1 Considering Disciplinary Approaches

A designer, an ecologist and an entrepreneur walk into a bar . . .

A joke that starts like this would later develop in ways that illustrate the different approaches the three protagonists take to the world around them. The joke and its punchline (normally at the expense of whoever is third in the list) hinge on these distinctive differences being understood by the audience. So, what sort of differences would be relevant to our three friends? Perhaps the designer sees everything as a creative challenge; perhaps the ecologist sees everything as a system of interacting parts; perhaps the entrepreneur sees everything as a match between changing opportunities and changing resources. Perhaps, and perhaps a joke of some sort can be structured around these supposed differences in outlook or mindset. However, note that for the joke to work, we must all implicitly understand that these individuals each have an approach that will influence not just their professional activities, but also their orientation to whatever scenario they are about to encounter in the bar they are walking into.

Is that true? Do practitioners from individual disciplines have distinctive approaches at such a general level? What kind of thing are these approaches, what are they composed of and how are they related to each other? Are they relevant even beyond the bounds of their originating disciplines? Can people be effectively trained in those 'disciplinary approaches' and then apply those approaches to other contexts? How would such people identify the approaches of most interest to them, either individually or in combination? These are the sorts of questions that I will address in this work, not for the purposes of joke construction – as entertaining as that might be – but to inform how we think about disciplinary approaches in general. This is important because these approaches are central to many of the decisions that we make within and across disciplines, including decisions about collaboration, education and training.

Many disciplines have already conducted and reported significant work in their efforts to characterise the distinctive features of their own approaches. For example, referring to our three friends again, the training and professional experiences they each have might mean they are skilled in or inclined toward what is sometimes called 'design thinking' (e.g. Kimbell, 2011), 'systems thinking' (e.g. M. C. Jackson, 2003) or 'entrepreneurial thinking' (e.g. Krueger, 2007). Each of these approaches has been promoted as important to the disciplines that they are most closely associated with, but also to many other domains and applications. In recent years, this has been especially true for management practices (e.g. Gharajedaghi, 2011; Liedtka & Ogilvie, 2011; McGrath & MacMillan, 2000), and therefore management education (e.g. see Dunne & Martin, 2006; Glen et al., 2014; Peschl et al., 2021; Seiler & Kowalsky, 2011).

Consequently, each of these approaches has been reported across the general business press, including in publications such as *BusinessWeek*, *Fast Company*, *Forbes*, *Fortune*, *Harvard Business Review* and the *Financial Times*.[1] These approaches have also been advocated by many local and national governments (e.g. Kavanagh, 2021; Liedtka et al., 2020; UK Government Office for Science, 2022), and also by inter-governmental organisations such as the United Nations, the World Bank and the World Health Organization (de Savigny & Taghreed, 2009; United Nations Development Programme, 2017; Valerio et al., 2014).[2] In all cases, these forms of thinking are promoted for their potential to encourage new perspectives, expand imagination and boost creativity.

Whilst design thinking, systems thinking and entrepreneurial thinking might have received the most attention from those promoting problem finding, problem framing and problem solving, these are not the only approaches that are relevant to how people understand, manage and change the world around them. If our joke instead started with a computer scientist, an engineer and a statistician walking into the same bar, then the generally applicable approaches they each would be expected to take might be referred to as 'computational thinking' (e.g. Wing, 2006), 'engineering thinking' (e.g. Waks et al., 2011) and 'statistical thinking' (e.g. Chance, 2002). Across a wide range of literatures, many such disciplinary approaches have been defined, debated, promoted, criticised and defended. A non-exhaustive list would include those already mentioned but also many other approaches, which can be usefully (but only approximately) grouped under conventional disciplinary categories:

- *The professions* – design thinking, entrepreneurial thinking and engineering thinking (all cited above), technological thinking (e.g. Gorman, 2006), architectural thinking (e.g. Frascari, 2009), systems-architectural thinking (e.g. Aier et al., 2015), policy thinking (Geva-May, 2005) and thinking like a doctor (e.g. Loftus, 2018), nurse (e.g. Tanner, 2006) or lawyer (e.g. Rapoport, 2002).
- *The sciences* – systems thinking, computational thinking and statistical thinking (all cited above), mathematical thinking (e.g. Burton, 1984), scientific thinking (e.g. Noll, 1935), physics thinking (e.g. Sayre & Irving, 2015), chemical thinking (e.g. Sevian & Talanquer, 2014), evolutionary thinking (e.g. Novick & Catley, 2016) and data-scientific thinking (e.g. Cao, 2018; Gould, 2021).

[1] For example, for design thinking, see work by Higgins (2020), Nussbaum (2004) and Speicher et al. (2022); for systems thinking see work by Praslova (2023) and Tank (2020); for entrepreneurial thinking, see work by Crudo (2020) and Hoberman (2015).

[2] More generally, design thinking has been promoted as the means by which governments or democratic systems could be developed (Saward, 2021).

- *The social sciences* – geographical thinking (e.g. P. Jackson, 2006), sociological thinking (e.g. Ruggiero, 1996), anthropological thinking (e.g. Tett, 2021, pp. xiv–xv) and economic thinking (e.g. Mankiw & Taylor, 2014, pp. 3–29).
- *The arts and humanities* – historical thinking (e.g. Andrews & Burke, 2007), craft thinking (e.g. Ings, 2015), literary thinking (e.g. Langer, 1998) and artistic thinking (e.g. Sullivan, 2001).

Despite all the work that has been done to describe many specific disciplinary approaches, they have not previously been drawn together for comparison and integration, which is what I aim to do here. But why draw them together at all? If these disciplines are independently going about the work of describing what constitutes their distinctive approaches, why not just leave them to it? Well, one reason is that if these approaches are distinctive to each discipline, then they are at least implicitly distinctive in relation to something else, such as other disciplines. For example, the individual approaches of our three friends entering the bar – whatever disciplines they are now drawn from – would, we hope, become better defined in contrast to each other as the joke unfolds: there is clarity in comparison.

Another reason to draw the approaches together is that disciplinary divisions are often rather arbitrary and can mask the similarities and overlaps between what different groups of people are doing and how they are doing it. Just as the disciplines are related to each other in interesting ways, so are their approaches. Because of this, anyone wanting to learn or apply a specific disciplinary approach (such as design thinking) would benefit from understanding how it relates to any approaches they are already familiar with, given their own disciplinary background. They would also benefit from understanding how it relates to other contrasting or complementary approaches, approaches that they might also want to discover. However, such understanding might be hard to arrive at because descriptions of these approaches are scattered through a large and confusing set of literatures that are barely connected by references that cut across disciplines. Furthermore, the courses that teach the approaches largely do so in mutual isolation (e.g. for reviews of design thinking syllabi, see Wiesche et al., 2018; Wrigley et al., 2018; Wrigley & Straker, 2017). The result is that individual disciplinary approaches are difficult to locate, and the relations between them are difficult to establish.

Fragmentation of the literatures, courses and communities related to disciplinary approaches acts as a barrier to innovation. For example, referring to the introduction of design thinking into management, Boland and Collopy (2004) explained that '[t]he more ways of thinking we have available to us, the better our problem-solving outcomes can be' (p. 11). However, as we have seen,

design thinking is only one of many 'ways of thinking' that we might wish to select and implement. If someone from management or elsewhere became interested in design thinking, how would they identify other approaches that might also be complementary, whether systems thinking, entrepreneurial thinking or something else? Alternatively, if someone recognised that empathising with users and customers was a valuable feature of both design thinking and entrepreneurial thinking, how would they become aware of the related features of anthropological thinking and economic thinking? Finally, if someone found that the application of systems thinking was a valuable way of expanding their understanding of the situations they were trying to intervene in, how would they come to recognise that evolutionary thinking and geographical thinking might also be useful for this? At present, the answer to all these questions would unfortunately be, 'with great difficulty!'

To address the problem of fragmentation, I here survey many of the disciplinary 'thinking' projects that have been conducted and are ongoing. This allows me to draw out the connections and contrasts between the projects, between the approaches they have defined, and between the components that they have used to build those definitions. To achieve this, I first offer a discussion of terminology and scope to allow disciplinary approaches to be described more clearly, both at the level of the individual disciplines and at the level of a more abstract unifying concept. I then focus on the overall descriptions of disciplinary approaches, investigating what kinds of things these approaches are, the extent to which they are agreed on and the motivations for describing them. This sets the context for presenting a collection of disciplinary approaches and the components they are made up of, tabulated for convenient comparison, both within and across disciplines. I then shift focus from individual descriptions of disciplinary approaches to the ways in which they overlap, and the gaps between them. I assess what the approaches are defined in contrast to, the extent to which they are discipline-specific, the ways in which they might be transferred to other contexts, and how sub-disciplines and inter-disciplines are handled. All this motivates calls for a more coordinated cross-cutting project to define disciplinary approaches. These calls are supported by a sketch of the limited kinds of comparison and consolidation that are possible at present, and suggestions for the kinds of work required to achieve greater coordination in future.

Overall, this work is aimed at supporting those who want to research, teach, learn or apply any particular disciplinary approach to also identify the complementary or contrasting approaches that other disciplines have to offer.[3]

[3] For example, the design research community have for many years talked about 'designerly ways of knowing' (Cross, 1982), but this is just one specific form of 'disciplinary ways of knowing' (Messer-Davidow et al., 1993).

More ambitiously, I also intend to stimulate interest in the general concept of disciplinary approaches, rather than just the specific approaches that have seemingly dominated people's attention so far. I hope that is useful, even if it is not very funny.

2 Establishing Terminology and Scope

As we'll see, it is characteristic of the projects that define disciplinary approaches that the same words are used to mean different things, and that different things are meant by the same words. These observations can be made not just across disciplines but also within them. While I aim to remain faithful to the intended meanings of the authors I cite, adhering to their terminology too closely would sometimes lead to a proliferation of distracting terms. Because a certain consistency is required here, I have tried to standardise the language used and apply that language across disciplines and authors, even if this sometimes requires deviating from the original terms. In addition, because we will be looking across multiple disciplines, connecting and comparing different bodies of work, it is necessary to have some new terminology for concepts that are more general than those that are required when only focussing on any single discipline. For example, the term 'disciplinary approach' is only necessary if one is interested in *the type of thing* that design thinking, systems thinking and entrepreneurial thinking are.

There are five key terms to focus on here:

- *Disciplines* – I'll use the terms 'disciplines' and 'disciplinary' to refer to forms of coordination and control related to knowledge and behaviour. This is very broad, but disciplines are most often exemplified by academic subjects (e.g. mathematics, history) and professional practices (e.g. design, entrepreneurship). In many cases, the boundaries between such subjects and practices are blurred, because those working within academic subjects are expert practitioners (e.g. mathematicians, historians), and professional practices are studied and taught academically (e.g. design research and entrepreneurship training).[4]
- *Approaches* – I'll use the general term 'approaches' to refer to how practitioners in a particular discipline see the world, orient toward it and act upon it. This includes how they think, but also what they think about, what they know, what skills they have, what they are inclined to do and the personal qualities they exhibit. This use of 'approach' is intended to be inclusive of terms like

[4] See Sections 6.2, 6.3 and 6.4 for a much more detailed discussion of disciplines, including consideration of sub-disciplines and inter-disciplines, and an examination of whether something like systems thinking should be regarded as a specific disciplinary approach or a general higher-order thinking skill.

disciplinary 'thinking', 'mindset' and 'habits of mind', without being restricted to only cognitive abilities or characteristics.

- *Components* – I'll use the term 'components' to refer to the different parts or ingredients that make up any disciplinary approach (e.g. a collection of different ways of thinking or different things to pay attention to). Lists of such components are often central to descriptions of what characterises the approaches. These lists are typically unstructured, but can also be presented in order of importance, arranged in a hierarchy or presented in some other diagrammatic form. Either way, components are here taken to collectively describe, define or represent the disciplinary approach. For example, some components of the disciplinary approach called 'design thinking' might include empathy, visualisation and creativity.
- *Variants* – I'll use the term 'variants' to refer to the different proposals that have been made for any particular discipline's approach. These variants are typically proposed by different authors focussing on the same discipline, and they are typically distinguished from each other by their differing lists of components. For example, in discussions of design thinking, two different authors (or sets of authors) might each propose their own variant of design thinking, with one of those variants emphasising empathy, and the other not.
- *Projects* – I'll use the term 'projects' to refer to the collected attempts that have been made to define specific disciplinary approaches, possibly including numerous variants. For example, I'll refer to the distributed efforts to define 'design thinking' as though they are a single project, even if the authors and communities engaged in this work have not seen it as such. To be clear, I am retrospectively grouping different authors' work together and referring to those works as a single project, without meaning to imply that there was necessarily a well-coordinated effort toward a common goal.[5] This has the benefit of allowing related literatures to be grouped together and easily referred to for comparison and analysis.

See Figure 1 for an illustration of how these terms relate to each other and are combined.

While projects aiming to describe individual disciplinary approaches need not use any of the terms I have defined here, there is one term that is nearly ubiquitous, and which also requires some care: '*thinking*'.[6] Many authors append that word to a (modified) discipline name to label a disciplinary

[5] It is a project in the same way we could talk of 'the project of science', even though not all scientist (across scientific disciplines) are acting in a coordinated manner (e.g. see Schroyer, 1984, p. 720; Tollefsen, 2020, p. 279).

[6] See Athreya and Mouza's (2017) work for a review of definitions of thinking (§3.1) and a discussion of types of thinking (§3.2).

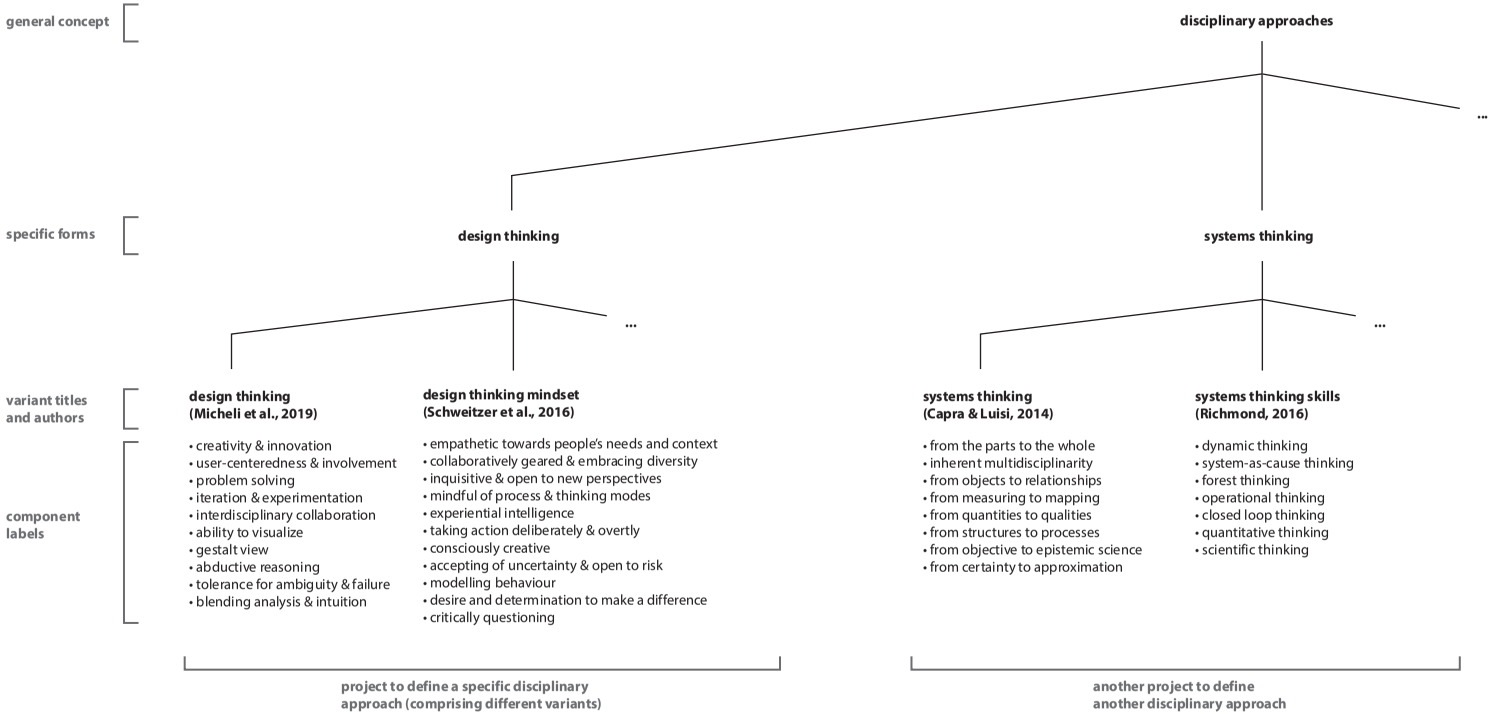

Figure 1 Diagram showing how the main concepts used in this work are related and combined. Starting at the top, there is a general concept of disciplinary approaches, which design thinking and systems thinking (etc.) are specific forms of. Each form of disciplinary approach is given different titles by different authors, and each author also typically lists a set of components that collectively make up the variant being described. These variants collectively make up the project that the discipline is undertaking to describe its approach.

approach, such as 'design thinking' or 'mathematical thinking'. This is the case even if those authors are not necessarily only discussing thinking, strictly considered (we'll return to this later). So, when I use terms like 'design thinking' and 'mathematical thinking', I am referring to the labels commonly applied to particular disciplinary approaches, rather than making a claim about the cognitive basis of that approach. Also, for consistency, I generally refer to specific disciplinary approaches in the form of '[discipline] thinking', such as 'geographical thinking' and 'anthropological thinking', even if some authors use alternative forms, such as 'thinking geographically' (P. Jackson, 2006) and 'think like an anthropologist' (Engelke, 2019). Furthermore, I use this standard form to include descriptions of disciplinary approaches that are not always labelled with the word 'thinking' at all, because other prefixes and suffixes are also prominent, but are used with similar meanings:

- *'mindset'* is used to characterise the approaches taken in entrepreneurship and design, as in 'entrepreneurial mindset' (e.g. Daspit et al., 2023; Haynie et al., 2010), 'design mindset' (Lavrsen et al., 2023) and 'design thinking mindset' (e.g. Schweitzer et al., 2016);
- *'habits of mind'* is used to characterise the approaches taken in engineering and mathematics, as in 'engineering habits of mind' (e.g. Lucas et al., 2014) and 'mathematical habits of mind' (e.g. Cuoco et al., 1996);
- *'attitude'* is used to characterise the approaches taken in science, as in 'scientific attitude' (e.g. Gardner, 1975; Gauld & Hukins, 1980; Noll, 1935)[7];
- *'logics'* is used to characterise the approaches taken in entrepreneurship, as in 'effectuation logics' (e.g. Sarasvathy, 2021).

Just as something needn't be called '[discipline] thinking' to be included in my analysis, it is also the case that something can be named in that way and still be excluded. The main reason for such exclusions is where a reference to '[discipline] thinking' is really a reference to a stage-based process, such as with a 'design thinking process' (e.g. see Razzouk & Shute, 2012).[8] Similar distinctions could be made between systems thinking and a systems modelling process (e.g. see Meadows, 2008) or between scientific thinking and the scientific

[7] Although they sound similar, I do not find work on 'styles of thinking' (Crombie, 1988) and 'styles of reasoning' (Hacking, 1994) directly relevant here. This is because those terms are being used to characterise different approaches taken in the history of science, rather than (for example) the different approaches of different sciences.

[8] Note that much of the confusion or disagreement in the design thinking discourse could be resolved, or at least reduced, by specifying whether any description of, or claim made about, design thinking is directed at a design thinking mindset, at a design thinking process or at design thinking tools (other similar distinctions are discussed later). The same can be said for discourse on the other disciplinary approaches.

method (Gauld & Hukins, 1980). Such process descriptions are excluded here even though disciplinary processes could influence disciplinary approaches, and even though disciplinary approaches could involve practitioners having the inclination to adopt certain processes. I still exclude such processes from my analysis because descriptions of the stages that a practitioner follows, and the activities performed at each stage, are quite different to descriptions of the components that make up a practitioner's thinking abilities, habits of mind, attitudes, and so on. Examining the relationships between processes and approaches is no doubt interesting, but I place that outside the scope of the present work.[9]

Even having placed certain topics out of bounds, it is probably clear that the scope of this work remains rather broad. This is because it is disciplinary approaches – *in general* – that are of interest, rather than any specific disciplinary approach. With so many disciplines to consider, it is difficult to know where to start one's investigations, and also difficult to know where to start in illustrating one's findings. However, I'll begin with design thinking because that might be expected to be of most interest to readers of this series, given that design is so closely associated with creativity and imagination. Design thinking is also, conveniently, one of the most prominent disciplinary approaches (see Figure 2), and so for many readers, it will provide an accessible route into the broad landscape of other approaches.

Having considered design thinking first, I'll then move onto the other disciplinary approaches that are most easily associated with it, or are thought to complement it, such as systems thinking and entrepreneurial thinking. Next, I'll progress onto a range of other disciplinary approaches, including computational thinking, engineering thinking, statistical thinking, scientific thinking, mathematical thinking, geographical thinking, historical thinking, anthropological thinking, and so on. Where possible, I'll loosely follow that general order with the aim of providing some consistency and permitting some anticipation of how and when disciplines will be referred to. However, this ordering is not intended to imply some hierarchy of importance or relevance, and I hope that readers who have interests in disciplines that appear later in the list – *or other disciplines altogether* – are able to read this work in a way that easily connects with their concerns. My intention is to emphasise the types of things that disciplinary approaches are, and the types of relationships they have to each other, irrespective of which particular disciplines are being considered.

[9] What is also out of scope is how disciplinary approaches are developed and applied. That might sound strange, but I take the phenomenon of interest here to be the emergence of discussions about disciplinary approaches in numerous disconnected literatures. It would be another study entirely to understand how a person or group develop and adopt a specific disciplinary approach.