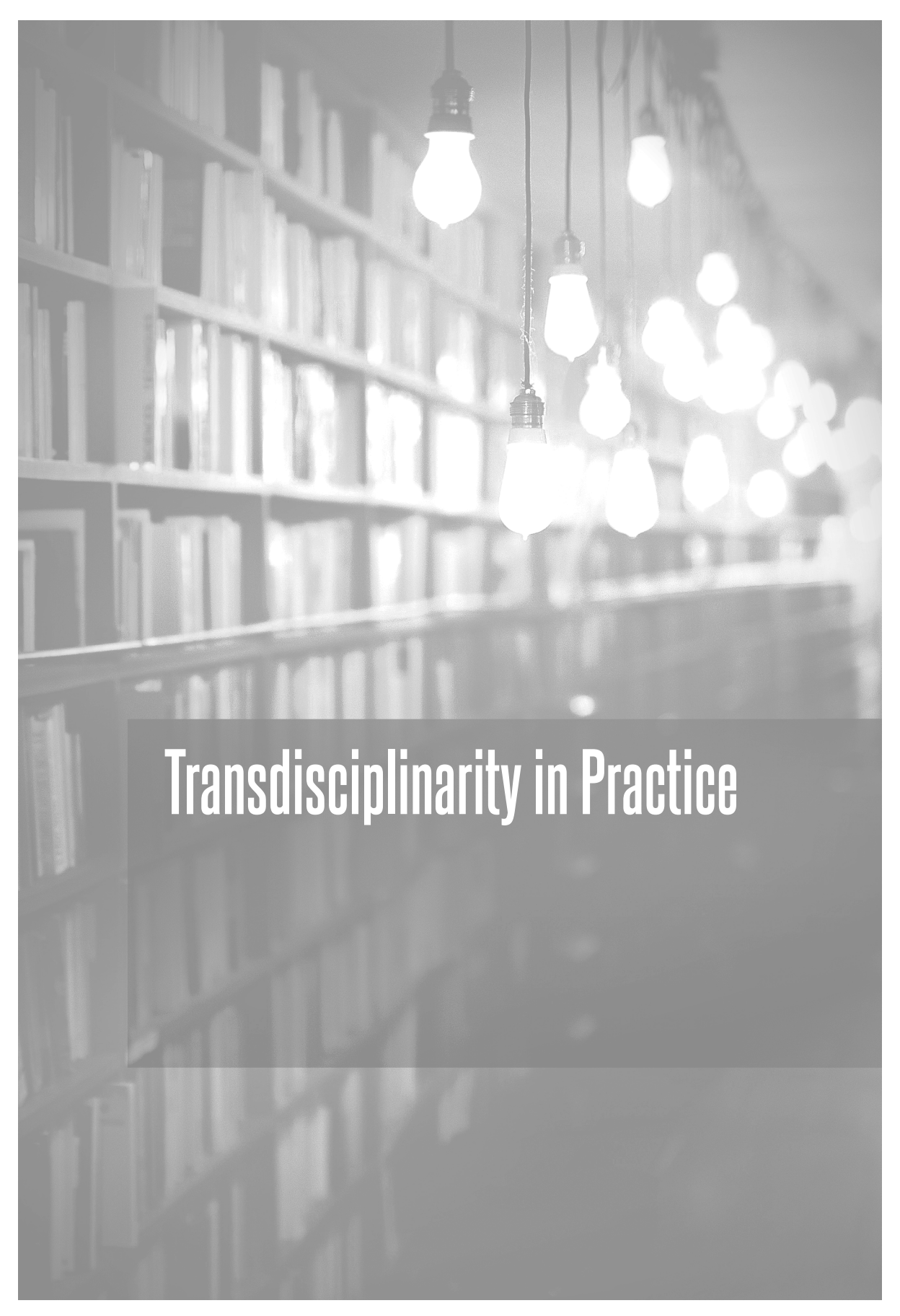


A black and white photograph of a library. In the foreground, several rows of bookshelves are visible, filled with books. The shelves recede into the background, creating a sense of depth. In the upper right portion of the image, several incandescent light bulbs are hanging from above by thin cords. Some bulbs are in sharp focus, while others in the background are blurred, creating a bokeh effect. The overall atmosphere is quiet and intellectual.

Transdisciplinarity in Practice

Transdisciplinarity in Practice

Capturing and Experiencing Knowledge
across Disciplinary Boundaries

Experience Bryon



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**Transdisciplinarity in Practice: Capturing and Experiencing
Knowledge across Disciplinary Boundaries**

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Transdisciplinarity in Practice critically examines how knowledge is produced, experienced, and captured across disciplinary boundaries. It offers a practice-based framework for transdisciplinary research that integrates embodied, performative, empirical, and conceptual methodologies. The book engages with two key traditions—the Nicolescuian and Zürich approaches—before drawing on philosophy, cognitive science, performance, and systems thinking to develop a dynamic practice of *knowledging*: a way of doing and experiencing knowledge that resists disciplinary closure. Tools such as the *active aesthetic* and *Integrative Performance Practice* support this rethinking of how knowledge operates in action.

Structured in two parts and joined by a conceptual Intermezzo, the book's first half maps core transdisciplinary traditions and critiques the historical formation of disciplinarity. A central chapter explores the politics of knowledge—power, value, failure, and collaboration—while surveying existing frameworks. The Intermezzo introduces non-linear perspectives, including systems thinking, rhizomes, and the holographic principle. Part II turns to embodied performance practice, establishing select aspects of creative process as a crucial contribution to serious epistemological practice. It incorporates enactivism to argue that knowledge is enacted through experience. Concepts such as *event(ing)* and the *middle field* offer tools for capturing knowledge in motion, supported by exercises and case studies.

- **Redefines Transdisciplinarity** as a practice-based methodology, moving beyond abstract definitions, supporting researchers in navigating the complexity of working across disciplines.
- **Synthesises key approaches**, including Nicolescuian and Zürich traditions, and traces the history and critique of disciplinarity and its influence on knowledge cultures from Ancient Greece to today.

- **Introduces original tools**—such as the active aesthetic and Integrative Performance Practice—to generate and capture emergent knowledge in action.
- **Designed for flexible use**, with diagrams, case studies, box-outs, glossary, exercises, and tools that support diverse reading paths.

**Dedicated
to
Tamsen and Ross**

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Experience Bryon

Introduction

If you are reading this book, you are interested in how knowledge works, how you work within it, and how you might help make it function better. Knowledge is simultaneously personal, local, and momentary, while also communal, global, and durational. Theories, histories, cultures, skills, vocabularies, needs, wants, and practices concurrently organise knowledge, constituting the unstable constructs we call disciplines. Each of us plays a role in determining what, in our time, is valued as usable knowledge. Those working across disciplinary boundaries practice at the very edges of specialisms where new knowledges have the potential to emerge. This book is for students, academics, and people working in creative industries, policy, education, and applied research across the humanities, social sciences, and STEM fields who are interested in the ways we determine, experience and capture knowledge in action at such sites of emergence.

Our world is marked by increasing complexity, uncertainty and rapid transformation. We face pressing global challenges in the guise of climate change, sustainability, public health crises, geopolitical instability and technological ethics—none of which neatly conform to the rules of any one existing discipline. Our models of expertise and the epistemological structures that foster them, while valuable in their specificity and depth, are often inadequate for the interconnected and emergent nature of today's issues. The solutions to our current problems will require not only the capacity to work across disciplinary boundaries but also an ability to recognise different *ways of practising* knowledge. At the centre of this book is a recognition that knowledge is not an object, nor is a discipline a custodian of knowledge, but rather that knowledge is an emergent property of *ways of practising*. Knowledge is only as rigorous, collaborative, transferable, applicable, relevant or expert as the ways it is practised at any one time, and further, it never sits still.

This contribution to the field of transdisciplinarity seeks to interrogate and engage with the dynamics of knowledge production across multiple epistemological and methodological terrains. It

does so not only by surveying existing frameworks but by offering a dynamic framework in which knowledge is experienced, enacted, and problematised.

A book is linear. However, the subject of transdisciplinarity is not, so the structure of this book encourages you to dip in and out wherever you think will be valuable. Throughout, page numbers are inserted into the text, offering places for you to jump forward or review back wherever you feel useful in your personal reading style. These page numbers signpost explanatory sections for those less familiar with certain terms and concepts and also serve to review or explore connections between interlinked aspects. You will notice that the use of block quotes is employed as a textual strategy. Rather than smoothing out disparate voices into a single, cohesive authorial tone, the intention here is to allow for moments of pause, resonance, and dissonance—inviting you to sit for a moment with different tones, architectures of thought, and vocabularies, rather than having these differences curated away. The practice of transdisciplinarity demands an attentiveness to multiple epistemic registers, and this textual structure aims to make room for those shifts, offering moments of encounter rather than absorption into a homogenised discourse. Boxouts contextualise or enrich the discussion and figures, either to instruct or to offer an alternative representation of complex ideas.

If we take seriously the idea that knowledge does not belong to a singular mode of articulation, then we must also take seriously the proposition that the act of reading is a kind of transdisciplinary practice in itself, one that requires movement, adaptation, and an openness to the multiplicity of voices that shape the discourse. In this way, the book resists linear progression in favour of a more dynamic, interwoven exploration of ideas.

The book is constructed in two parts joined by an Intermezzo. Part I begins by aiming to demystify transdisciplinarity's complex and sometimes contradictory history, introducing key thinkers and their competing interpretations. Chapter I, *Transdisciplinarity*, offers a mapping of transdisciplinary thought, tracing its origins from Kurt Gödel's mathematical breakthroughs to the work of Piaget, Jantsch, Nicolescu, and the Zürich tradition. It outlines the different genealogies of transdisciplinary thinking, distinguishing between those who see it as a means of producing new knowledge

beyond disciplines and those who frame it as a problem-solving methodology for real world issues. Rather than imposing a single definition, this chapter unpacks the ways transdisciplinarity has been shaped, contested, and redefined over time. It sets the stage for the book's broader inquiry into how knowledge can be experienced, captured, and mobilised beyond traditional disciplinary boundaries.

Before starting to explore ways to work across disciplines, in Chapter II *Knowledg(ing)*, we begin to interrogate what disciplinarity even is, how we got here, and how Western epistemological history has been formed with long-held prejudices and deep-seated assumptions that govern what we consider as knowledge. We investigate the ways we privilege certain forms of knowledge, and the reasons behind why some forms have been dismissed, marginalised, or ignored.

This chapter traces the historical roots of how we practice knowledge to their beginnings with Plato and Aristotle, whose early classifications of knowledge laid the groundwork for Western disciplinary structures. It explores how science became synonymous with knowledge itself, sometimes marginalising other modes of understanding, such as embodied, indigenous, and experiential knowledges. It also examines key philosophical and historical movements—from the Enlightenment's rationalist ideal to Kuhn's paradigms, from the postmodern critique of authority and objectivity to the emergence of Post-Normal Science—which have challenged, reinforced, or redefined our epistemological assumptions. Shifting from knowledge as a noun to *knowledging* as a verb, we begin to see knowledge not as something contained within the *object* of discipline, but as an active dynamic that we ultimately respond to and are responsible for.

Chapter III, *Problematics of Practice*, is where we will examine the tensions, challenges, and opportunities that arise when knowledge moves across disciplines, cultures, and epistemic traditions. We explore the politics of knowledge: how power shapes what is recognised as valid knowledge, who has access to decision-making, and how structures of authority reinforce disciplinary silos. Engaging with thinkers such as Habermas, Foucault, and Longino, this chapter unpacks the tensions between knowledge as a stable entity versus knowledge as an ongoing practice. Finally, we introduce existing approaches to transdisciplinary research—collaborative

models, reflexive methodologies, and alternative frameworks for capturing emergent knowledge—setting the stage for the critical methodological intervention that will be presented in Part II.

Before entering Part II, we move through the *Intermezzo*. The term ‘intermezzo’ originates from Italian and means ‘interval’ or ‘interlude’, historically referring to a short, often lighthearted performance inserted between the acts of a larger theatrical or operatic work. It signifies a pause, a moment of transition, or a shift in tone before the continuation of the main narrative.

In the context of this book, the Intermezzo serves as a conceptual pivot—a dynamic middle space that both reflects upon and disrupts the linear progression of ideas. It functions as a fulcrum, balancing between the theoretical groundwork established in Part I and the more applied, experiential explorations of knowledge in Part II. By tracing liminality, the agora, the included middle, systems thinking, rhizomes, and the holographic principle, this section provides a conceptual ‘romp’ through frameworks that resist binary thinking and challenge traditional epistemological hierarchies.

It is offered as a moment of conceptual play and, through the practice of reading it, aims to catalyse shifts in perspective, reinforcing one of the book’s central arguments: that knowledge is not a static entity but a practice in motion, emphasising that transdisciplinary research does not occur within clearly defined boundaries but in spaces of negotiation, emergence, and fluidity.

To begin Part II, Chapter IV, *The Arts Have a Seriousness Problem*, challenges the epistemological biases that have excluded artistic ways of knowing from serious research discourse and proposes that artistic practices offer valid epistemological frameworks that help confront embedded prejudices against *acts of practice* in the field of knowledge *generation*. It shows how artistic practice is not only relevant but essential to transdisciplinary inquiry, reframing artistic practice as an active *process of knowing* rather than merely a passive repository of meaning there to represent, depict, or make other types of knowledge approachable.

In Chapter V, *Knowledge Happens—But What’s Happening?*, we pivot towards the practice of knowledge itself—not as an artefact, but as something that happens in action, in the ways of its practice. The notion of the ‘middle field’ is introduced as a site of capture of the *way* knowledge is *generated* in *acts* of practice. The critical

framework of the *active aesthetic* is presented, a shifting template that can be applied to anything from discrete research moments to multi-step complex project plans. Deriving from performance and cognitive theories, it recognises knowledge as dynamic, enacted and embodied, while privileging process over resolution and interaction over interpretation. It is an approach that disrupts more conventional methodologies by including experiential, embodied, relational, non-hierarchical, technical, post/transhuman, and digital aspects of knowledging.

Chapter VI, *Detaching from Disciplinary Thinking to Witness Knowledging in Action*, draws from Integrative Performance Practice, embodied cognition, Neuro-Linguistic Programming's 'conscious competence', systems thinking, neuroplasticity and situated awareness to underscore the need for flexibility in thinking and practice, not as a rejection of expertise but as a way to remain open to emergent possibilities. Exercises within the chapter provide tools for working within and beyond one's discipline with greater clarity and adaptability, preparing the reader to engage with knowledge as an evolving and situated process.

The final chapter, VII, *Capturing Acts of Knowledging*, addresses the challenge of capturing and articulating acts of knowledging in a way that resists disciplinary fixity, paradigmatic bias, and the lure of interpretation. It offers a complementary practice to traditional modes of documentation such as statistical analysis, technical reports, posters, peer-reviewed articles and qualitative coding. It invites researcher-practitioners to witness and engage with knowledge as it is generated in action, making visible the ways knowledge emerges in and through the middle field by applying key performative concepts—event, action, obstacle, and happening—as dynamic, systematic tools for bracketing and observing how knowledge operates in the middle field of inter- and transdisciplinary research. The chapter concludes the book by offering a way to capture knowledge in motion, shifting the focus from outcomes to processes and making explicit the tensions, interactions, and emergences that characterise acts of knowledging in process. The approach is designed to be applied across disciplines and contexts, allowing for a plurality of epistemological standpoints. The chapter illustrates this through case studies spanning engineering, medicine, sociology, and the humanities, demonstrating how the critical

framework of the active aesthetic can be used to make disciplinary interactions, collaborations, and emergent knowledges visible. It also offers tools for individual researchers to refine their practices, interrogate their methodologies, and better understand their own modes of knowledging.

In framing research processes as ongoing negotiations of actions, obstacles, and emergent happenings, this chapter reinforces the book's argument that inter- and transdisciplinary knowledge production is not about synthesis or resolution, but about embracing crossings, collisions and intersections between practice and theory and among disciplines while attending to the dynamic interplay of forces at work. This approach provides a means of holding knowledge in motion, resisting premature closure, and allowing for more nuanced and responsive modes of research, priming the way for the possibility of emergent knowledges.

The book does not conclude with a resolution, but rather an invitation to an agora of sorts, an open space for further engagement, adaptation, and reflection. Since the active aesthetic as a critical methodology does not prescribe a fixed system or impose a definitive design but rather offers a way of working—a way of attending to the acts of knowledging that shape and are shaped by practice—the final pages leave the work to the reader. As a researcher/practitioner, you are invited to consider how these ideas, provocations, and methods might take root, evolve, and resonate within and beyond your disciplinary, multidisciplinary, interdisciplinary, and transdisciplinary engagements.

Part I

Chapter I

Transdisciplinarity

In this chapter, we will explore the complex terrain of transdisciplinarity. Its history is complex; however, by the end of this chapter, we will have a clear sense of who the key players are, why transdisciplinarity is important to contemporary practices of knowledge, and what transdisciplinarity has come to mean. Collaborations across disciplinary boundaries resulting in the emergence of new knowledge and practical innovation have been occurring for centuries, since way before the words ‘transdiscipline’ or ‘transdisciplinarity’ were ever uttered. However, in the 1970s, when the term first emerged, the world was undergoing a series of epistemological breaks and political shifts that necessitated a move away from siloed thinking and tunnel-vision policy decisions.

In Chapter II, *Knowledge(ing): What Lies Behind the Ways We Practice and Value Knowledge?*, we go into detail around historical contexts and specific events that underpin pivotal changes in the ways we practice knowledge (for a detailed account of the climate in which transdisciplinarity began, see pages 47–74). In short, the transdisciplinary project emerged within a hotpot of change in which the socio-cultural-epistemological implications of the ‘standard account of science’ had come under examination. The student unrest of the late 1960s in France had spread across the globe. The problems of ‘Big Science’ had begun to show themselves, bringing up questions related to ethics, economies, politics, policy, and global

impact. Military funding of science, big pharma, education, and developments in nuclear energy and agriculture were among the valid concerns.

By the 1990s, the concept had begun to find its legs and branch out into models of practice. The world had changed; we had a globalised economy and the internet in our homes. We had growing awareness of the fragility of our natural resources and the extinction of species. The results of climate change were becoming visible, along with an increased awareness of hunger and poverty. At this time, we were beginning to rethink everything from science to sex and from words to disciplines. Things we used to take for granted as set and certain were no longer perceived as steadfast objects of authority with unquestioned identities imbued with inherent, legitimate meanings; rather, pretty much everything was being reevaluated as parts of dynamic and socially constructed systems (see pages 50–51 on postmodernism). It was becoming evident that our disciplinary, siloed thinking was not going to incubate solutions to our world's complex issues, especially as any strategies developed were seemingly going to have to function across society, science, and evolving technologies. We entered an era, still ongoing, where the reconceptualisation of knowledge and how we practice it is a growing necessity.

We started to wonder: What do we consider valuable knowledge? How is expertise determined? Who decides the problems we choose to solve? Who writes the history of the advances in knowledge? Who's permitted into the conversation? Who gets the funding, the education, the benefits? Where does the power to determine all this derive from, and how is this power instituted? In Chapter III, *Problematics of Practice*, we go into depth with these questions; however, in this first chapter, we will contain the discussion, focusing on the origins, demystifying the underpinning philosophies, and becoming familiar with important distinctions and definitions of this fascinating and complex beast called transdisciplinarity.

Origins

Conceptually, the kernels of the very notion of transdisciplinarity can be plotted back to the work of mathematician Kurt Gödel

(1906–1978), a member of the Vienna Circle, interestingly, but working out of step with the logical positivists (for the Vienna Circle and the logical positivists, go to pages 44–45). In 1931, Gödel shook the world by calling into question the foundations of mathematics, which were assumed to be a ‘complete system’ in which all mathematical statements are either provable or refutable. His work on the Incompleteness Theorems, particularly the second theorem, led him to the conclusion ‘...that no consistent formal system can prove its own consistency. These results are unquestionably among the most philosophically important logic-mathematical discoveries ever made’ (Raatikainen, 2005: 513). His work demonstrated that a complete theory cannot be constructed from a single perspective.

Gödel concluded that any non-contradictory formal logic system (complex enough for arithmetic to be formalized in it) is incomplete (in the sense that it can rigorously build undecidable sentences), outlining as clear as possible the limits of the formalization of a logic-mathematical system. Here, as everywhere else, the principle of relativity of knowledge becomes valid. With all this, although the paradox seems to limit thought, it will open the way for the investigation of new realities, of multi-valued logic systems.

—Berian, 2007: III-5-5

Gödel’s work afforded a loosening of the premise that math is truth, and its place in science provides irrefutable knowledge. It opened the way to considering that any level of reality exists because all other levels exist at the same time and, importantly in setting the stage for the context from which transdisciplinarity would grow, the thinking that ‘a new principle of relativity emerges from the coexistence between complex plurality and open unity: no level of Reality constitutes a privileged place from which one is able to understand all other levels of Reality’ (Alvares and Freire, 2023: 8).

The Term Transdisciplinarity

Forty years later, and a little over fifty years ago, the term transdisciplinarity was introduced at a seminar at the University of Nice in France. The event, co-sponsored by the *Organisation of Economic Cooperation and Development* with the French Ministry of Education, was attended by Swiss psychologist Jean Piaget, Austrian

astrophysicist Erich Jantsch and French mathematician André Lichnerowicz. Piaget, known for his theory of cognitive development and epistemological views, in his contribution stated:

Finally, we hope to see succeeding to the stage of interdisciplinary relations a superior stage, which should be 'transdisciplinary', i.e., which will not be limited to recognize the interactions and or reciprocities between the specialized researches, but which will locate these links inside a total system without stable boundaries between the disciplines.

—Piaget: 1972

You will see as we explore the various breakouts of transdisciplinarity that the notion of a 'total system' and even the merits of 'stability' will be questioned in the development of practices for crossing disciplinary boundaries. However, the important aspect at this juncture is that we were looking for something that lay beyond multi- and interdisciplinarity, something that would allow for the emergence of new applicable knowledges which could transcend the sum of their parts with the possibility of new skillsets and vocabularies. The origins of the term in the 1970s, though, hardly offered a working definition. You will see that as the term was picked up and tried on in its infancy, it presented more like a utopian notion than a coherent, constructed idea.

Lichnerowicz, continuing the conversation begun by Piaget, advocated towards 'the Mathematic as a universal interlanguage' (Klein, 2021: 38). He drew on the term 'isomorphism' as it is used in mathematics to offer an analogy towards an explanation of transdisciplinarity. In this context, isomorphism 'comprises recognising the phenomena of one object in other objects, that is, if two objects are isomorphic, then any property that is preserved by one isomorphism is also true for the other object. This function can be used to investigate problems in one unknown field from another whose problems are clarified' (Alvares and Freire, 2023: 9). For Lichnerowicz, 'transdisciplinarity consists in treating by the same mathematical model (isomorphism) disciplines of a very different nature, but according to the same laws' (Lichnerowicz, 1980: 22).

Jantsch came from a very different perspective and responded to Piaget's ideas in relation to education and planning with social purpose. For Jantsch, 'the term referred to the targeted coordination

of a group of disciplines and interdisciplines, which together are involved in a complex scientific system, and which have a common purpose, with this coordination based on a general system of axioms that are considered binding on all concerned' (Jahn, 2008: 21).

During the same period, there was a PhD thesis by Jack Lee Mahan, who used the term in his title *Toward Transdisciplinary Inquiry in the Human Sciences*. His work aligns more with the ideas of Jantsch, and emphasised forefronting ethics by advocating for an 'attention to comprehensiveness, context and frame of reference of inquiry and knowledge; interpenetration of boundaries between concepts and disciplines; exposing disciplinary boundaries to facilitate understanding of implicit assumptions, processes of inquiry, and resulting knowledge; humanistic reverence for life and human dignity; desire to actively apply knowledge to the betterment of man and society' (Mahan, 1970: 194–195).

As we can see, at the initiation of the concept we call transdisciplinarity, it was clear that there were going to be various trajectories. Some were rooted in the philosophical and/or the mathematical, others in the socially conscious and/or ethical, with most crossing into pedagogy and/or policy. The strands that emerged were to breed different definitions, defining attributes, and structural designs and methodologies. The next section will aim to make sense of the broad trends before we pull out important distinctions and definitions for application in the final chapter.

Trajectories

When discussions around the notion of transdisciplinarity reemerged in the 1990s, they did so through multiple schools of thought. It can be a little confusing, partly because there are overlapping ways to plot the trajectory of the transdisciplinary project. For ease and clarity towards a workable set of definitions and distinctions, we will, in a few pages, settle on two strands, but first let's have a look at some of the other ways the various approaches to the transdisciplinary can be categorised.

As the focus of this book is to offer a productive practice towards transdisciplinarity rather than a forensic and comprehensive analysis of the literature, we will initially signpost scholars along with key texts (for those wishing to take a deeper dive). One way to break up the

key players is into groups, characterised by clusters of development and/or interrogations into the notions of transdisciplinarity. These categories are a little porous, as one can easily bleed into the other, but for the purposes of a start, they could be: *Forerunners*, *Education*, *Culture of Science and Knowledge Production*, *“Real World” Problems*, and *Nature of Knowledge and Philosophy*.

You will recognise some names from previous pages in the chart below, and others will show up throughout the book as we continue to map the terrain. Dates refer to key texts, which can be found in the bibliography and will also be cited within relevant sections as we progress.



Figure 1

This, however, is not the only way to categorise the scholarship and development of the concept. Peter Osborne contends that ‘we can trace three main and two secondary discourses about transdisciplinarity in the sciences’ (Osborne, 2015: 3–35).

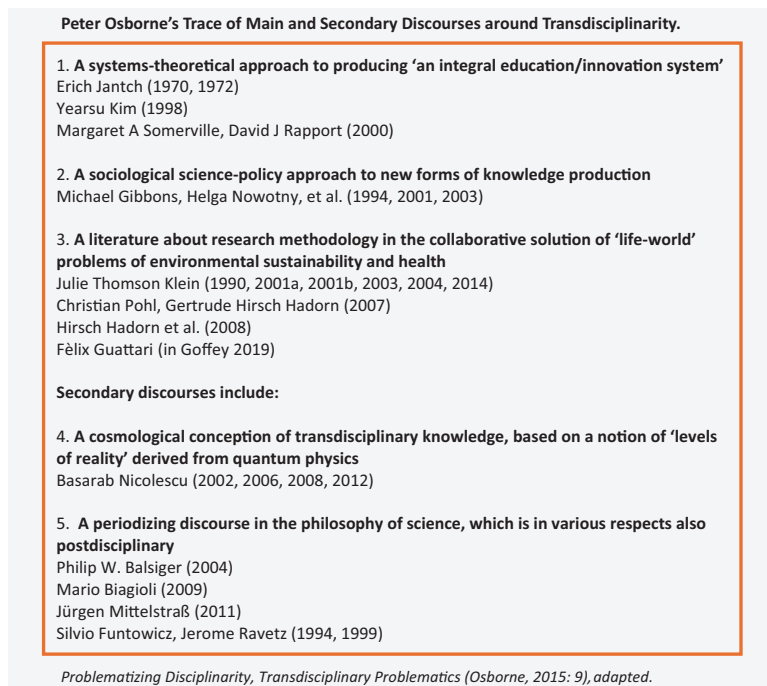


Figure 2

In examining Osborne’s breakdown, you will see some of the same names in different categories, and some that are part of the same category in Figure 1 are now in separate categories in Figure 2. If nothing else, this tells us that the terrain of scholarship and evolution in the transdisciplinary project can be perceived differently by people coming to the same canon from various critical and practical cultures. This, in and of itself, is part of what transdisciplinarity is all about, and we will learn as we progress that the differences don’t need to cause dissonance—but they should evoke a deep curiosity.

Perhaps one of the most interesting aspects of Osborne’s breakdown is the notion of ‘secondary discourses’. In this book, as

in much of the current literature, the work of Basarab Nicolescu is hardly considered 'secondary' and extends into the development of the transdisciplinary project beyond the scope of his most esoteric work, which could, understandably, be described as 'a cosmological conception of transdisciplinary knowledge, based on a notion of 'levels of reality' derived from quantum physics'(ibid.). However, Osborne's breakdown does offer a useful parallel lens through which to examine the ways different strands of thought can be perceived to perform within the transdisciplinary project.

Another way of categorising the branches of thought and their attributes comes from Mark G. Lawrence, Stephen Williams, Patrizia Nanz, and Ortwin Renn. Their breakdown aligns many of the same key players in the same ways, but here in line with working definitions explicit and implicit in the scholarship. 'To illustrate how transdisciplinarity is considered to be distinguished from other forms of research, [they] compiled 16 widely varying definitions from the literature of the last half-century' (Lawrence et al., 2022: 47) (see Figure 3, where explicit characteristics are represented as a darker shade and implicit characteristics in a lighter shade). They agree that the terrain is complex. 'Perusing these quickly makes it clear that it is not sensible to choose one or even a few 'representative' definitions, and that it can take considerable time to wade through them and form a clear understanding of what they encompass' (ibid.).

For them, there are two broad categories: Unity of Knowledge and Social Engagement. Lawrence et al.'s work is useful in its intricacy, as they have broken down attributes of the scholarship into further sections to further clarify the distinguishing characteristics found in the work of key players. These are:

- (1) A focus on theoretical unity of knowledge, in an effort to transcend disciplinary boundaries.
- (2) The inclusion of multidisciplinary and interdisciplinary academic research.
- (3) The involvement of (non-academic) societal actors as process participants.
- (4) A focus on specific, complex, societally relevant, real-world situations or problems.
- (5) Working in a transformative manner, i.e., going beyond the focus on real-world problems to proactively support action or intervention.

(6) An orientation toward the common good (including the betterment of society and a humanistic reverence for life and human dignity).

(7) Reflexivity, i.e., consciously contemplating the broader context and ensuring the compatibility of the project's components and tasks throughout the course of the project.

—Lawrence et al., 2022: 47

Key Characteristics of Transdisciplinarity.

	1. Unity of knowledge	2. Multi- and inter-disciplinary research	3. Involvement of societal actors	4. Complex realworld problems	5. Transformative	6. Common good orientation	7. Reflexive
Unity of Knowledge Transdisciplinarity							
Jantsch (1970, 1972)	■	■					
Mahan (1970)	■	■			■	■	
Piaget (1972)	■	■					
Nicolescu (2002)	■	■		■			
Max-Neef (2005)	■	■					
Mittelsraß (2011)	■	■		■			
Social Engagement Transdisciplinarity							
Scholz et al. (2000)		■	■	■	■	■	
Häberli et al. (2001)		■	■	■	■		
Klein (2001)		■	■	■	■	■	
Nowotny (2001)		■	■	■			
Bergmann et al. (2005)		■	■	■	■		■
Maasen and Lieven (2006)		■	■	■	■		
Pohl and Hirsch Hadorn (2007)			■	■	■	■	
Jahn et al. (2012) [+ Hummel et al. (2017)]	■	■	■	■	■		■
Lang et al. (2012)		■	■	■	■		■
Brandt et al. (2013)		■	■	■	■		
Thompson et al. (2017)		■	■	■	■		■

Characteristics, potentials, and challenges of transdisciplinary research (Lawrence et al., 2022: 48), adapted.

Figure 3

For the purposes of creating a foundation from which we can begin to establish a series of distinctions and definitions for the rest of this chapter, we will consider the evolution of the transdisciplinary project through two main approaches. In this way we join other scholars who have surveyed the landscape of transdisciplinarity in distinguishing between a Zürich tradition and a Nicolescuian approach (see Segalàs Coral, J. and Tejedor Papell, G., 2013; Augsburg, T., 2014; Bernstein, J. H., 2015; McGregor, S. L. T., 2015; Martin, V., 2017; Lawrence et al., 2022; Kaiser, M. and Gluckman P., 2023).

In 1994, quantum physicist Basarab Nicolescu, along with sociologist and philosopher Edgar Morin and artist Lima de Freitas, signed the *Charter of Transdisciplinarity* at the *First World Congress on Transdisciplinarity* in Convento da Arrábida, Portugal. There were just over 80 other participants, including academics, representatives from civil society, industry, and governments, and the President of Portugal. The work was valuable in distinguishing between cross- and interdisciplinary dynamics, drawing from the aforementioned insights of Kurt Gödel and also those of German theoretical physicist Werner Heisenberg. Nicolescu's work on transdisciplinarity predates the congress, most notably in the establishment of CIRET in Paris (the International Center for Transdisciplinary Research) in 1987. The congress was followed by Nicolescu's book *Manifesto of Transdisciplinarity* (2002), which sits among an influential canon of articles and other book contributions evolving and developing his bold conceptual framings of the notion of transdisciplinarity, which touch on the metaphysical, practical, philosophical and spiritual.

In the same year, Michael Gibbons, Camille Limoges, Helga Nowotny, Simon Schwartzma, Peter Scott and Martin Trow published *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*. This offered an introduction to the distinction between Mode 1 and Mode 2 science (for a more detailed account of the Modes, see pages 18, 67–69). Where Mode 1 represented the received understanding of knowledge practices under conventional models of science research, Mode 2 proposed a new mode for knowledge production that could extend past the boundaries of the 'institution' and be produced in a context of application. It featured heterogeneity and organisational diversity while remaining inclusive of enhanced social accountability and

reflexivity, and offered a more broadly based system of quality control. Towards this, an important characteristic of Mode 2 was the adoption of transdisciplinarity.

Taking Mode 2 firmly into the next century in the year 2000, the *International Transdisciplinarity Conference* was held in Zürich, Switzerland. Nearly 800 participants from about 50 countries attended the conference (see Klein et al., 2001a: 3). The emphasis here was on problem-oriented research towards 'real world' problems, research that would impact social and/or societal dilemmas while encouraging fluidity among science, society, and technology. This conference leaned profoundly on the work of Gibbons et al.'s Mode 2, and to a lesser extent on Silvio Funtowicz and Jerome R. Ravetz's notion of Post-Normal Science (for Mode 2, see pages 18, 67–69; for Post-Normal Science, see pages 69–73). The participants drew from these especially in relation to a widening recognition of knowledges that lay outside of the pure sciences, along with the importance of including multiple stakeholders and an encouragement to work across socio-cultural, policy-based, educational, science and indigenous sectors. Following the conference, the *Network for Transdisciplinarity Research* (known as td-net) was founded.

Distinctions and Definitions

Comparing the conference with the congress, the Zürich-based *International Transdisciplinarity Conference* could be said to have been more pragmatic, offering new forms of problem-solving. Conversely, the *First World Congress on Transdisciplinarity* could be seen as a more conceptual exercise, offering new critical methodologies. We will pull from both to draw out distinctions and definitions towards a productive practice of transdisciplinarity. However, as *conceptualising* (especially when offering original contributions to a field) is a radical practice, and in turn, the confrontation of the very nature of conventional scientific research with a view to a new epistemological framework requires a radical reconception, there will be no hierarchy of epistemological importance attributed to these two schools of thought within this text. One could argue that all transdisciplinary research has overflowing dynamics of both the conceptual and pragmatic.

Nicolescuian Approach

Nicolescu's conceptualisation of transdisciplinarity, while not explicitly defined by the function of its proposed methodologies in the solving of problems 'real world' or otherwise, has as its foundation an urgent recognition of our world's needs. In his *Manifesto of Transdisciplinarity*, he questioned:

How is it that we know more about what we do, and less about who we are? How is it that the accelerating proliferation of disciplines make the unity of knowledge more and more impossible to even imagine? How is it that as the exterior universe becomes more known, the meaning of our life and of our death declines into insignificance, even absurdity?... One hears tell that humanity has always been in crisis but that it has always found means to escape. Formerly, that affirmation was true. Today, it amounts to a lie, because for the first time in its history humanity has the possibility of complete self-destruction, with no possibility of survival... This potential self-destruction of our species has a triple dimension: material, biological, and spiritual. In the Age of Reason, the irrational is more active than ever.

—Nicolescu, 2002: 6–7

What Nicolescu's work offers is an approach that is non-linear and non-binary, that transcends the subject/object, cause/effect approaches to the experience and capture of knowledge(s). His conceptualisations, while not born of the social sciences but rather the tenets of metaphysics, quantum physics, systems theory and complexity science, are inherently about humanity and the lived experience.

Paradoxically, everything is in place for our self-destruction, but everything is also in place for positive change, just as there has been at other great turning points in history. The challenge of self-destruction has its counterpart in the hope of self-birth. The global challenge of death has its counterpart in a visionary, transpersonal, and planetary consciousness, which could be nourished by miraculous growth of knowledge.

—ibid.: 8

Importantly, transdisciplinarity was never intended to be seen as better than or to replace disciplinary, multidisciplinary, or interdisciplinary work; rather, they are 'like four arrows shot from

but a single bow: knowledge' (ibid.: 46). While there need not be any antagonistic relationship between them, transdisciplinarity does something that the others can't, because it does not have to adhere to the framework of disciplinary research. Much of this is in the prefix *trans*:

As the prefix *trans* indicates, transdisciplinarity concerns that which is at once between the disciplines, across the different disciplines, and beyond all discipline. Its goal is the understanding of the present world, of which one of the imperatives is the unity of knowledge.

—ibid.: 44

The role of complexity and emergence is an important one in all practice and research that crosses disciplines, and as Niculescu was drawing from chaos theory, adaptive system thinking and quantum physics, which allowed for multiple realities without the need for linear narratives, he was well placed to develop a framework that would challenge some of the received thinking around conventional disciplinary practice(s) that include an unravelling of complicated problems. '...There is a difference between a complicated situation and complex situation. A complicated problem is hard to solve because it is intricate and detailed. A complex problem has the additional feature of emergence, the process of deriving some new and coherent structures, patterns, and properties' (McGregor, 2004: 4).

To lead us to the conditions for which there is a possibility of *emergence*, he postulated three axioms. Here they are summarised by Sue L. T. McGregor, highly respected and widely published interlocutor of the Niculescuian approach (McGregor, 2015: 6/16):

- Axiom one: the existence of multiple levels of reality (ontology), with movement among them mediated by the Hidden Third (the quantum vacuum);
- Axiom two: the Logic of the Included Middle; and
- Axiom three: knowledge as complexity (epistemology); the Principle of Universal Interdependence.

Niculescu clarifies what is meant by Reality. 'By 'level of Reality' (With a capital R) we intend first of all to designate that which resists our experiences, representations, description, images or mathematical formulation' (speaking to Russ Volckmann in

Nicolescu, 2007: 80) (for more on Nicolescu's included middle, see pages 126–128). In Part II, the proposed approach to transdisciplinary practice will align with this resistance to representation. An anti-hermeneutic approach to practising knowledge across disciplinary boundaries will resist landing on a meaning, image or story, in the service of keeping acts of *knowledging* dynamic and live. This, in many ways, occurs through something akin to Nicolescu's second and third axioms. We will do this through an approach derived from embodied practice(s), informed by a performance practice as a research project. But at this juncture, as the axioms can be interpreted slightly differently across the literature and even shift within Nicolescu's own canon of work, we will leave the last word on these to the man himself:

If you take these three axioms, which parallel the three axioms of modern science, you get the definition of transdisciplinarity. But this means that we define transdisciplinarity not via a new discipline, but via a new methodology. In other words, we identify transdisciplinarity not with a new discipline, but with a new knowledge—knowledge about what is in between, across and beyond disciplines. For this new knowledge, you need these three axioms—perhaps you need more. I don't know but, for the moment, we need only three... If you take the three axioms, for the first time you can understand these realms of reality which involves the Subject and involves all of the different aspects of us. This means the individual level and also the social level. We talk about knowledge, which is not neutral. Disciplinary and academic knowledge is by definition neutral, with no values. You are not allowed to introduce values into scientific knowledge. However, transdisciplinarity is not neutral, and involves values, namely humanistic values, which are generated by the interaction of these three axioms.

—Nicolescu, 2007: 85

Perhaps the most important aspect of this work is that it offers a methodology (which is different from a method or mode of practice, more a critical lens) that allows for the possibility of emergence towards 'that which is at once between the disciplines, across the different disciplines, and *beyond* all discipline', his very definition of transdisciplinarity. In defining transdisciplinarity this way, it becomes evident that there are very clear distinctions between disciplinarity, multidisciplinarity, interdisciplinarity and transdisciplinarity.

For Nicolescu, disciplinarity can be defined as one practice concerned with itself, operating within its own reality; in the next chapter, we will explore how disciplinarity sometimes confirms its own framework and closes other disciplines out in doing so. It gets even more interesting when we leave disciplinarity and enter the realm of cross-disciplinary dynamics:

Nicolescu's Disciplinary Distinctions.

Multidisciplinarity concerns itself with studying a research topic in not just one discipline only, but in several at the same time. Any topic in question will ultimately be enriched by incorporating the perspectives of several disciplines. Multidisciplinarity brings a plus to the discipline in question, but this “plus” is always in the exclusive service of the home discipline. In other words, the multidisciplinary approach overflows disciplinary boundaries while its goal remains limited to the framework of disciplinary research.

Interdisciplinarity has a different goal than multidisciplinarity. It concerns the transfer of methods from one discipline to another. Like multidisciplinarity, interdisciplinarity overflows the disciplines, but its goal still remains within the framework of disciplinary research. Interdisciplinarity has even the capacity of generating new disciplines, like quantum cosmology and chaos theory.

Transdisciplinarity concerns that which is at once between the disciplines, across the different disciplines, and beyond all discipline. Its goal is the understanding of the present world, of which one of the imperatives is the unity of knowledge.

Transdisciplinarity: Past, present and future (Nicolescu, 2005: 144), adapted.

Figure 4

The Zürich Tradition

The Zürich conference, while speaking to growing concerns about the world's dilemmas, also sought to address a perceived solipsism of higher education. It challenged the idea that expertise is always academic and knowledge is substantiated by conventional science. It proposed that research should be contextual and sustainable, intertwining science, technology and society. Somehow, ‘real world’ came to mean that which resided outside of disciplinary constrictions and was applicable to pressing problems in the realm of social, health, and environmental issues. ‘Those in attendance believed that mutual learning is facilitated by building partnerships between academics and non-academics, leading to future transdisciplinary research. There was a distinct concern about the ideal focus of research, with the belief that it should be more oriented to stakeholders and end users in each of science (natural and social), the marketplace, and in government’ (McGregor, 2015: 6/16).

Distinct Features of Transdisciplinarity in Mode 2 Knowledge Production.

1. It develops a distinct but evolving framework to guide problem solving efforts. This is generated and sustained in the context of application, and not developed first and then applied to that context later by a different group of practitioners. The solution does not arise solely, or even mainly, from the application of knowledge that already exists. Although elements of existing knowledge must have entered into it, genuine creativity is involved and the theoretical consensus, once attained, cannot easily be reduced to disciplinary parts.
2. Because the transdisciplinary solution comprises both empirical and theoretical components, it is undeniably a contribution to knowledge, though not necessarily disciplinary knowledge. Though it has emerged from a particular context of application, transdisciplinary knowledge develops its own distinct theoretical structures, research methods and modes of practice, though they may not be located on the prevailing disciplinary map. The effort is cumulative, though the direction of accumulation may travel in a number of different directions after a major problem has been solved.
3. Unlike Mode 1, where results are communicated through institutional channels, Mode 2 results are communicated to those who have participated in the course of that participation and so, in a sense, the diffusion of the results is initially accomplished in the process of their production. Subsequent diffusion occurs primarily as the original practitioners move to new problem contexts rather than through reporting results in professional journals or at conferences. Even though problem contexts are transient, and problem solvers highly mobile, communication networks tend to persist, and the knowledge contained in them is available to enter into further configurations.
4. Transdisciplinarity is dynamic. It is problem solving capability on the move. A particular solution can become the cognitive site from which further advances can be made, but where this knowledge will be used next and how it will develop are as difficult to predict as are the possible applications that might arise from discipline-based research. Mode 2 is marked especially, but not exclusively, by the ever closer interaction of knowledge production with a succession of problem contexts. As with discoveries in Mode 1, one discovery may build upon another, but in Mode 2 the discoveries lie outside the confines of any particular discipline and practitioners need not return to it for validation. New knowledge produced in this way may not fit easily into any of the disciplines that contributed to the solution. Nor may it be easily referred to particular disciplinary institutions or recorded as disciplinary contributions. In Mode 2 communications in ever-new configurations are crucial. Communication links are maintained partly through formal and partly through informal channels.

The new production of knowledge: The dynamics of science and research in contemporary societies (Gibbon et al., 1994: 5), adapted.

Figure 5

For the Zürich contingent, the central ideas of transdisciplinarity and the forces behind them were not in service of creating a theoretical/critical methodology, as in the Nicolescu model, but rather in support of an epistemological shift through a set of values towards a production of knowledge dedicated to solving the world's most pressing problems. While this ongoing project does not have a unified definition of transdisciplinarity or an agreed-on critical methodology, it continues to produce valuable interlocutions around the challenges of collaborative projects, providing examples

of effective, socially robust research along with models of practice for discrete problematics in the process of research. The work is varied and published within journals such as *Research Policy*, *Environmental Science & Policy* and *Futures*. In Chapter III, we will review some of these practical models as we look at the challenges of transdisciplinary research.

As mentioned previously, the Zürich tradition leaned heavily on the work of Gibbons et al. and their articulations of a Mode 2 model of knowledge production. Although Mode 2 is often considered synonymous with transdisciplinarity, it is not; transdisciplinarity is only one of its five defining tenets (for more on Mode 2, see pages 18, 67–69). However, the way Gibbons et al. define transdisciplinarity, in four features, is characteristic of the Zürich tradition.

Post-Normal Science (see pages 69–73) is different from Mode 2, but has in common with the latter that it is primarily issue-driven. The Zürich strand pulls from both as it challenges the efficacy of conventional academic science research to solve urgent, risky, complex issues, ethically, with equity and social robustness. They also recognise the importance of values living in the same realm as facts and empirical data, along with the importance of the inclusion of indigenous knowledges and the integration of stakeholders as participants at all levels of the process.

A useful word for the nature of the types of issues that disciplinary, multidisciplinary and interdisciplinary practices are not ideally set up to solve was first coined by Horst Rittel and Mel Webber in their frequently cited paper ‘Dilemmas in a general theory of planning’ (Rittel and Webber, 1973: 155–169). They spoke of ‘wicked problems’, defined in part as ‘complex issue[s] that defy complete definition, for which there can be no final solution, since any resolution generates further issues, and where solutions are not true or false or good or bad, but the best that can be done at the time. Such problems are not morally wicked, but diabolical in that they resist all usual attempts to resolve them’ (Brown et al., 2010: 4) (for more on ‘wicked problems’, see pages 97–99).

It is important to note that it is in the recognition of complex issues that transdisciplinarity comes into its own, and in doing so has inherent challenges around joined problem-solving, productive collaborative practices, evaluation of data, the telling of the story of the

research, resourcing and power dynamics, translation of knowledge cultures, integrated methodologies, joined or negotiated values, reflexivity with regard to robustness and social accountability, and the delivery of and sustainability of ‘solutions’. In working towards a valuable, productive practice in Chapter III, *Problematics in Practice*, we will explore these challenges more fully.

Working to define and/or formulate some clarity on the dynamics of transdisciplinarity, Julie Thompson Klein, a highly respected and widely published interlocutor of the Zürich tradition and disciplinarity in general, summarises effectively. In reflecting on the proceedings of the *International Transdisciplinarity Conference* in 2000, she observed that the key words focused on the discussions of problem-solving included:

- problem- and solution-oriented
- complexity, heterogeneity
- participation of stakeholders, users, and decision makers
- collaboration, cooperation, partnership
- negotiation, mutual learning, joint problem-solving
- cross-disciplinarity, boundary crossing, integrative, holistic

—Klein, 2001a: 35

Thirteen years later, with many articles and research projects completed since that initial conference in Zürich, it became clear that this was going to be an evolving project:

In the current heightened momentum for [transdisciplinarity], the word is appearing in a widening range of contexts, as varied as learning assessment, arts education, mental health, sanitation, engineering, sustainability, ecological economics, human population biology, informatics, knowledge organization, team-based holistic approaches to health-care, and student-centered curriculum integration. Judging by patterns in the keyword clusters, imperatives will continue to differ. Moreover, even the same underlying principle may be framed differently. One strand of [transdisciplinary] problem-solving, for instance, centers on collaborations between academic researchers and industrial/private sectors for the purpose of product and technology development. It prioritizes design innovation and

involvement of stakeholders in product development. A different type of [transdisciplinary] problem-solving occurs when academic experts and social actors cooperate in the name of democratic solutions to controversial problems such as sustainability and the risks of technological modernizations such as nuclear power plants.

—Klein, 2013: 197

Distinctions

If we were to plot the main differences between the Nicolescuian approach and Zürich tradition, perhaps most telling would be the former's dedication to the notion of the emergence of new knowledges as something 'beyond disciplines' and the latter's adherence to 'real world' issues with intentional inclusion of stakeholders in the solving of problems.

Sue L. T. McGregor, offering what she calls a 'rudimentary analysis of the main differences between the two approaches', reveals important aspects in the development of and distinctions between the two branches of thought (McGregor, 2015).

What is important to consider is that the dynamics of transdisciplinarity, as defined by Nicolescu, while applicable in the service of 'real world' problems, also work in the service of issues perhaps not deemed 'real world'. The branch of cognitive science called *embodied cognition* (which we will draw on in Part II) could be considered, for instance, a transdiscipline. Its languages and skillsets, grounding concepts and models of practice go 'beyond' the disciplines that they were emergent from: psychology, biology, neuroscience, and philosophy (specifically phenomenology). Embodied cognition has its own critical methodology, vocabularies and skill sets now, and does not resemble any one of the 'home' disciplines that it emerged from as part of a transdisciplinary exercise. If there was a problem at the centre of its development, it was the need for a better understanding of our notions of self and consciousness; at the time, however, would this have been considered a 'real world' problem? The knowledges it offers, though, arguably enable us to engage in 'real world' problems in a more reflexive and whole way.

McGregor's Analysis of Main Differences between the Nicolescu and Zürich Approaches to Transdisciplinarity.

Nicolescuian Approach	Zürich Approach
Series of Meetings, conferences 1994–2005	One Conference, 2000
Definition of transdisciplinarity already existed before conferences	Mode 2 definition of transdisciplinarity existed before the conference but conference also generated a definition
Three books (1985, 2002, 2014)	One book (2001)
There is a <i>Charter of Transdisciplinarity</i>	No charter
Paris-based CIRET (<i>International Center for Transdisciplinary Research</i>) 1987	Swiss-based <i>Network for Transdisciplinarity Research</i> (known as <i>td-net</i>) developed in 2002 after conference
Main concern is human being as the center of civilized society (humans, science, and interactions between them)	Main concern is society, science and technology interface; especially wanted to tear down the barriers between sciences
Problems emerge in the life world	Problems emerge from the real world, not science or the academy
Normal science system is valid but too limited for complex problems; need a new methodology	The science system is the primary knowledge system in society; just need to <i>do science differently</i> so it can deal with complexity
Grounded in metaphysics (philosophy) and quantum physics	Grounded in Mode 2 knowledge production and, to a lesser extent, Post-Normal science; Mode 2 tried to account for changes in the world of science, policy, and the knowledge economy
Strives to <i>understand the world</i> requiring unity of knowledge (human science)	Strives to <i>do better science</i> so it can deal with the complexity of society
No distinct focus on research per se; this is a theoretical approach	Distinct focus on research, especially transdisciplinary research (a different way of doing science); this is a phenomenological approach, focused on application
Tight conceptualization of transdisciplinarity, distinguished from mono, multi and inter	Less inclined to clearly distinguish between transdisciplinarity, mono, multi and inter
At once between, across and beyond disciplines (transcends the academy and includes civil society and other sectors)	The interaction of disciplines <i>within</i> social constraints; want disciplines to work jointly with practitioners
Focus is on understanding the world and the coherence of the world through the <i>unity of knowledge</i> , but not just solving problems	Focus on joint problem-solving of problems pertaining to the science-technology-society triad
Unique approach to transdisciplinarity 'worked out' over decades	No unique approach; borrowed Gibbons et al.'s (1994) existing definition of Mode 2 transdisciplinarity
A new methodology (with three axioms) for creating knowledge	No unique methodology (no axioms)
New transdisciplinary knowledge cannot be reduced to the previous existing knowledge from which it came	Intent is to reconfigure and recontextualize <i>existing and available</i> knowledge, through synthesis
New knowledge is complex, emergent, embodied and cross-fertilized (Axiom of Complexity, epistemology)	Knowledge is socially robust, accountable. And reflexive; did refer to transdisciplinary epistemology
Reality occurs on many levels and movement between levels is mediated by the Hidden Third (where people do not resist each others' ideas)	No express concern with Reality (ontology)
Knowledge is created using the Logic of the Included Middle	No express concern for Logic

The Nicolescuian and Zürich Approaches to Transdisciplinarity (McGregor, 2015: 6/16), adapted.

Figure 6

Further, to solve 'real world' problems, even when requiring collaboration between science, technology and society, we will not always need or even be best served by transdisciplinary research. If mono-, inter- or multidisciplinary research works to solve the issue, it is no less robust, valuable or expedient for doing so. The nature of the problem does not make the research transdisciplinary. Nicolescu saw the issue:

It is difficult for us to understand why ‘joint problem-solving’ must be the unique aim of transdisciplinarity. It is certainly one of the important aims but not the only aim. The use of such a narrow characterization seems to us dangerous, as in religion, allowing unnecessary wars and unproductive dogmatism. Is transdisciplinarity concerning only society as a uniform whole, or, the human being who is (or has to be) in the center of any civilized society? Are we allowed to identify knowledge with production of knowledge? Why does the potential of transdisciplinarity have to be reduced to produce ‘better science’?

—Nicolescu, 2010a: 20

Finally, it seems a little counter to the democratic and socially robust nature of the Zürich tradition to determine for the world what is deemed a ‘real world’ problem, or even a ‘problem’ at all. Such value judgements are part of the socially constructed ‘truths’ that, as we will see in the next chapter, are central to the Zürich tradition’s own critiques of knowledge cultures that exclude voices. With that stated, of course, there are urgent, complex issues facing our world that will necessitate transdisciplinary dynamics to help find viable strategies. This was never contested by Nicolescu’s approach. In the following chapters, we will retain Nicolescu’s distinctions while drawing from the social values and select practices of the Zürich tradition, where applicable to social issues. We will, however, be inclusive of other transdisciplinary projects that might lie outside those currently deemed ‘real world’ within cultural contexts/constructs; as knowledge is knowledge and lives in the service of evolving knowledges in the transdisciplinary project, this should only enhance the practices going forward without diminishing the mission of any of them.

Conclusion

Within this section, we have explored the various definitions, characteristics and schools of thought around developing notions of transdisciplinarity. We have determined that there are various critical lenses and disciplinary cultures from which the challenges of working across disciplines are interrogated. We observed that

there are different values regarding what the defining purpose or characteristics of an enquiry should be if it is to be deemed transdisciplinary.

Working definitions, or at least guiding clarifications, are multiple. To illustrate just how diverse the perspectives are, below is a small capture of some of the working interpretations of the epistemological dynamic we have come to call transdisciplinarity:

[Transdisciplinarity is] 'scientific work done by a group of scientists... with the intention of systematically pursuing the problem of how the negative side effects of specialization can be overcome so as to make education (and research) more socially relevant' (Kockelmans, 1979: 128).

'Transdisciplinarity is, by orientation, an approach that recognizes a united and borderless intellectual initiative' (Du Plessis et al., 2014: 17).

'Transdisciplinarity is a new form of learning and problem-solving involving cooperation among different parts of society' (Häberli et al., in Klein, 2001a: 7).

'Transdisciplinarity concerns that which is at once between the disciplines, across the different disciplines, and beyond all disciplines' (Nicolescu, 2002: 1).

Transdisciplinary research: 'is needed when knowledge about societally relevant problem field is uncertain, when the concrete nature of problems is disputed, and when there is a great deal at stake for those concerned by problems and involved in dealing with them' (Pohl and Hadorn in Hadorn et al., 2008: 429).

Transdisciplinarity: 'a higher stage of interaction that entails an overarching framework that organises knowledge in a new way and, in a new discourse, cooperation of multiple sectors of society and stakeholders in addressing complex problems' (Klein, 2009: 65).

'Transdisciplinarity is about the relationship between inquiry and action in the world' (Montuori in Nicolescu, 2008: 10).

'Transdisciplinarity is a reflexive research approach that addresses societal problems by means of interdisciplinary collaboration as well as the collaboration between researchers and extra-scientific actors. Its aim is to enable mutual learning processes between science and society; integration is the main cognitive challenge of the research process' (Jahn et al., 2012: 4).

What the working definitions within these schools of thought generally have in common is that they speak to various ways knowledge categories can productively become more than the sum of their parts in one way or another, towards a purpose that can not solely be achieved by a home discipline. They all have in common a hope for humanistic, dynamic collaborative processes, and they all aim for the emergence of new, valuable and applicable knowledges. They also all hold a modicum of utopian thinking, through either design, inclusion, unity of knowledge and/or of righteous purpose. We will see in the final chapter of this book that integration and unity of thought are not necessarily the same as integrative processes of working, and that difference and dissonance between disciplines is better left unresolved sometimes, especially if we want to set the conditions for innovation and the emergence of new knowledges.

What we can see from this chapter is that different theorists/practitioners offer various philosophies about and approaches to how we can productively work across disciplines. In order to more fully move into a more productive account of transdisciplinarity, it will be crucial to really come to terms with what disciplines even are and what biases the centuries of development have left us with.

As the book progresses, we will explore what is still being grappled with as part of the difficulty in finding a common practice, one that allows for the inevitable heterogeneous nature of this type of research. In the next chapter, we work towards understanding the ways we practice the processes of *knowledging*. We will explore what is meant by the term knowledging and examine how, since the beginning of Western epistemology, there has been an embedded prejudice against the act of knowledge as practice and practice as knowledge, which has greatly influenced the ways we engage with knowledge, to the detriment of the advancement of the transdisciplinary project.

Chapter II

Knowledge(ing): What Lies Behind the Ways We Practice and Value Knowledge?

Having reviewed the current landscape of transdisciplinarity research and philosophy, in this chapter, we begin to examine the dynamics of knowledge. To fully understand our roles in working and facilitating across epistemological boundaries, it is important to reveal where and how many of our most deeply seated assumptions around the very practice of knowledge came to be. What happened? How did we get here? How did we get to the point where we privilege, develop and empower certain types of knowledge and degrade, prejudice and ignore others at our peril?

Perhaps the trapeze artist knows as much or more about physics as the aeronautics engineer who calculates that same formula day in and day out for 30 years. Perhaps the shaman knows as much or more about non-drug induced physiological responses in relation to the healing of trauma as that psychologist who works in private practice; perhaps that 18-year-old student who emigrated from a war-torn country and speaks four languages knows as much about logic and linguistics as the student whose parents invested hundreds of dollars preparing them to score highly on a university admissions test. The degree, the title, the test scores, the memberships to established societies—are they rigorous, transparent, strategic or even practical ways to determine knowledge?

Transdisciplinarity in Practice: Capturing and Experiencing Knowledge across Disciplinary Boundaries

Experience Bryon

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In the field of transdisciplinarity, we have many names for different types of knowledge.

- Indigenous knowledge
- Stakeholder knowledge
- Know-how
- Heuristic knowledge
- Tacit knowledge
- Embodied knowledge
- Empirical knowledge

With a quick glance at this list, we can see a pattern emerging. It might seem somewhat bizarre that experience and doing, embodied understanding and being locally engaged are outlying attributes requiring discrete knowledge designations. Part of the difficulty here is in the ways in which we have constructed and protected our practice(s) of knowledge. If we allow just anybody in now, who are the experts? How do we safeguard? Who decides where resources go? Who determines what problems we need to focus on? Who documents, contextualises and tells the story of the history of knowledge? We will consider all these questions in Chapter III, Problematics of Practice, but for now, let's begin by really understanding how we even got here. It's an important, revealing and perhaps uncomfortable space to sit with. It is the hope that while reading this chapter you don't simply clock the history and/or absorb the critical argument, but rather actively consider how this history has or has not become embedded in your consciousness, your evaluation of self and others, and further how it might have informed your own prejudices and privileges regarding rigour, practice, strategy and values in relation to humanity's most valuable commodity: knowledge and the participation, recognition and holding of it.

Our very notion of knowledge in Western culture can be traced back to the time of the early Greeks. With Plato, philosophy became a force for unifying knowledge and a synthesiser for all branches of learning. It was in the transition from Plato to Aristotle that disciplinarity was born. Aristotle was the first to classify knowledge into categories and—more significantly—hierarchies of importance. This took us down a profound path, one that could arguably be credited with what centuries later became a divide between the sciences and arts, the crafts and humanities, the power of the

bureaucrat/politician over the labourer/worker; the impression of men's objective, steady knowledge over women's unpredictable wiles and hysteria, a status divide between those who live off other people and those who live and work directly with the land. I have plotted this path in former publications, and this section draws from and adapts my earlier work, in this book specifically paving the way towards a productive practice of transdisciplinarity (Bryon, 2017: 1–20, 2018: 7–55).

It is not coincidental that the necessity to reconsider the ways we practice knowledge is coinciding with a dramatic upsurge of interest in Aristotle-inspired virtue ethics (Annas, 2011). Aristotle's three intellectual virtues—*phronesis*, *techne*, and *episteme*—prepared the ground for a string of divisions. While *episteme* refers to theory, reasoning, comprehension of a subject, or knowledge in general, *techne* is primarily focused on the practical, technical, and technological aspects of things, implying the act of creating, skill, and craftsmanship. *Episteme* is largely concerned with knowing why, while *techne* is more aligned with know-how. Beyond *episteme* and *techne*, *phronesis* is a concept that is difficult to categorise into a specific discipline or topic. It can be translated as 'practical wisdom' or 'prudence', and it has to do with what is best or worst for humanity. Danish economic geographer Bent Flyvbjerg summarises beautifully (see boxout).

Three Intellectual Virtues of Aristotle

Episteme

Scientific knowledge. Universal, invariable, context-independent. Based on general analytical rationality. The original concept is known today by the terms 'epistemology' and 'epistemic'.

Techne

Craft/art. Pragmatic, variable, context-dependent. Oriented toward production. Based on practical instrumental rationality governed by a conscious goal. The original concept appears today in terms such as 'technique,' 'technical,' and 'technology.'

Phronesis

Ethics. Deliberation about values with reference to praxis. Pragmatic, variable, context-dependent. Oriented toward action. Based on practical value-rationality. The original concept has no analogous contemporary term.

—Flyvbjerg, 2001: 57

Part of the recent upsurge of interest in Aristotle-inspired virtue ethics is a resurrection of the notion of *phronesis*, especially across interdisciplines of the social sciences, sustainability, business ethics and medical humanities. There appears to be an emerging (neo)-Aristotelian lean into the embracing of contextualism and situational ethics over a strict adherence to central sets of disciplinary values and/or applicable rules (see Flyvbjerg, B., Landman, T. and Schram, S., eds., 2012; Pickup, A., 2017; Tynjälä, P., Kallio, E. K. and Heikkinen, H. L., 2020; Kristjánsson, K., 2022; Caniglia, G. et al., 2023). Since the original concept of *phronesis* has ‘no analogous contemporary term’(see boxout), we will leave it for now, as it has not had a measurable effect on the formulation of Western knowledge distinctions. However, I include it at this point because its evolution in practice is worth watching, especially as it has the potential to disturb conventional disciplinary distinctions.

Discipline(ness)

The impact of the episteme and techne distinction can be experienced today in your own body as you move through the corridors of your library and as you walk among building clusters on a university campus, where sciences, arts and humanities are often territorially organised into geographical groupings, encouraging disparate cultures, and creating distinct characteristics in world views, thoughts and skills. Aristotle’s treatise on different knowledge states occurs in *Nicomachean Ethics*, in which, in book six, he determines that episteme represents a higher categorisation of subjects, with theology, mathematics, and physics more important than practical subjects such as ethics and politics, for instance. The lowest rung was occupied by the techne category, which included arts, poetics, and other activities of making, including engineering. He was somewhat conflicted, however, maintaining a Platonic meta-positioning of philosophy, which supported philosophy as a universal field of inquiry, while at the same time designating his virtues into these categories. It can be concluded that ‘Aristotle’s system makes clear, anxieties about the harmful specialisation of knowledge are as old as the scholarly disciplines themselves’ (Moran, 2010: 4).

‘If we are to begin to understand how to work across disciplines towards a productive practice of transdisciplinarity, it follows that

we need to more fully understand some of the baggage that we have brought with us through centuries of reconfigurations in knowledge production. If we are to truly work towards a productive practice of transdisciplinarity, it is time to understand not so much the *episteme* of the *techne*, how we know and label what we do and what happens, but rather the *techne* of *episteme*, how we engage in an act of *knowledging*' (Bryon, 2018). It is in the leaning into the idea of disciplinarity and knowledge as *active* and processual that we begin to understand the basis of knowledge not as an object of value, but rather as a *practice* born of ways of knowledging.

To fully consider a productive account of transdisciplinarity, we need to make visible the ways in which disciplinarity performs on our world, ourselves and our processes. With this, we begin to reveal what *disciplinary-ness* even is: some of the ways in which it is enacted, how it has acted upon us, and how we have acted upon it throughout the centuries. This section is not meant to provide a fresh interpretation or an exhaustive account of the complex notion we refer to as discipline, but rather to allow for moments of reflection into some of the ways disciplinarity has locked us into systems of thinking, doing and evaluating, some of which are clearly holding us back from the type of innovative knowledging which will invariably require crossing epistemological boundaries to deal with today's problems.

Disciplined by Our Disciplines

Socially and conceptually, we are disciplined by our disciplines. First, they help produce our world. They specify the objects we can study (genes, deviant persons, classic texts) and the relations that obtain among them (mutation, criminality, canonicity). They provide criteria for our knowledge (truth, significance, impact) and the methods (quantification, interpretation, analysis) that regulate our access to it.

—Messer-Davidow, Shumway and Sylvan, 1993: vii

Assuming Messer-Davidow's excellent definition as a starting point (see boxout), it makes sense that as we practice our disciplines, our disciplines practice on us and further constitute our world, that knowledge is a practice rather than an object. The idea that discipline is not the custodian of an object of knowledge, but rather a *practice* of *ways of doing* and knowing, further supports the notion of knowledging.

Here we evoke Foucault's famous comment (which we will return to in future chapters): 'The episteme is not a general developmental stage of reason, it is a complex relationship of successive displacements' (Foucault, 1991: 55). If, in our dance of knowledging, episteme is a complex relationship of successive displacements, it's not surprising that we struggle with its definition. The word discipline can mean 'a particular branch of learning or body of knowledge' (Moran, 2010: 2), perhaps delineated into 'Knowledge Territories' (Krishnan, 2009: 12), determined as 'a necessary evil of knowledge production...a function of institutionalization' (Fuller, 1991). It can be a 'division of knowledge into units' (Frodeman, 2014: 19), perhaps delineating 'generally accepted methods and truths' (Shumway and Messer-Davidow, 1991: 202). Regardless, it appears that it invariably gets 'caught up in questions about the relationship between knowledge and power' (Moran, 2010: 2). Foucault's perspective about discipline and power as a practised 'system of control in the production of discourse' (Foucault, 1972: 224), interpreted as a 'process aimed at limiting the freedom of individuals and as a way of constraining discourses' (Bridges, 2006: 268) is at the core of the problematics that occur in the crossing of disciplines.

The Stoic Egg

These problematics around inter- and transdisciplinarity are often expressed in metaphors of war, speaking of 'factions', 'territories', 'turf wars', and 'borders', with 'boundaries' upheld by people 'entrenched' in their own disciplinary 'silos' or 'fiefdoms', 'fortified' by knowledge inside their own epistemological frameworks. Additionally, there are 'migrations' and 'revolutions' in discipline. But how did we as humans begin to structure knowledge into this *thing* we call discipline, and how did all this aggression begin to occur?

The Stoics (c.300 BC), established by Zeno of Citium, an enthusiastic follower of Socrates, developed a philosophy not so much as an intellectual pastime but rather as a form of 'practice or an exercise (*askēsis*) in the expertise concerning what is beneficial' (Baltzly, 2014: 4).

The Stoic Egg

They (the Stoics) compare philosophy to a living being, likening logic to bones and sinews, ethics to the fleshier parts, and physics to the soul. They make a further comparison to an egg: logic is the outside, ethics what comes next, and physics the innermost parts; or to a fertile field: the surrounding wall corresponds to logic, its fruit to ethics, and its land or trees to physics.

—Diogenes Laertius in Durand: 2023

The orthodox Stoic position is that in order for a human to flourish, mastery of physics (*phusikê*), logic (*logikê*), and ethics (*êthikê*), constituting three parts of philosophy, is required. In the boxout, we see Aristotelian overlaps in the often-cited analogy of the egg to illustrate the separation and relationship between designations of knowledge. The analogy shows that the ‘purpose of philosophy, according to the Stoics, is to become virtuous, that is, to attain wisdom and thereby lead the good life, so that the overarching goal (the crop or the egg white, which the ancients assumed was nourished by the yolk) is ethical’ (Durand, 2023).

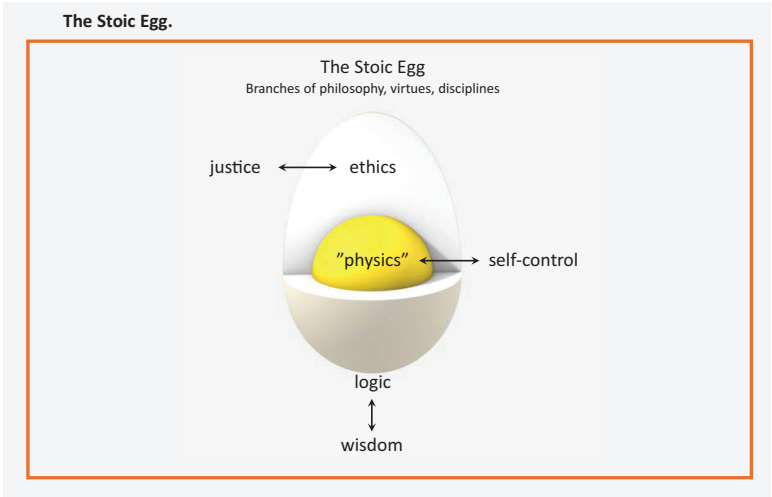


Figure 7

From this Stoic egg, we can see how the medieval *trivium* (grammar, rhetoric, and dialectic) and *quadrivium* (arithmetic, geometry, astronomy, and music) were developed and, subsequently, how the concept of the *artes liberales*, a system of knowledge that was thought to be the most comprehensive, was hatched.

From the first university structure of education (circa 1088, Bologna) up until the 18th century, there were ‘faculties’. They included the ‘higher’, comprised of medicine, theology, and law, and a ‘lower’, which included a combination of philosophy and humanities. However, as Frodeman reminds us, ‘...understanding ‘discipline’ as merely a taxonomic or analytic category neglects historical, institutional, and political elements that are central to the concept’ (2014: 19). When we think about how knowledge exchanges are enacted in practice, rather than situated as disciplines, we begin to reveal a history of knowledging. For instance, early professors would move from faculty to faculty during their careers, encouraging a rounded intellectual culture rather than specialisation.

The ways in which knowledge was captured and evaluated are also important. Unlike our current climate, where research is measured against citation accumulation, funding acquisition, and research outputs, all judged against mercurial definitions of ‘innovation’ and ‘impact’, in the earliest university structures:

Professors lectured (from the Latin *lectus*, past participle of *legere*, to read). This was in part a matter of technology: with books at a premium the oral transmission of knowledge was a necessity. The power of the church played an important role as well, in that professors were expected to promote a set of perennial truths—a *philosophia perennis*—rooted in religious orthodoxy.

—Frodeman, 2014: 20

From the notebook of an English student learning in the middle of the 17th century we get an inkling of the divisions of subjects and the experience of their values in practice:

The disciplines which dispose man toward understanding things are two-fold...directive and objective. The former was art and the latter, science. The arts were concerned with the ordering of activity,

or the right conception of things to be made, whether these were liberal, involving solely the mind, for example, logic, the 'making' of demonstrations, or the servile...which were...of two kinds: practical and fine, according as they were directed toward the production of the useful...or...the beautiful.

—Costello, 1958: 37–38

By this time, we begin to see the Aristotelian hierarchy of values firmly framed into education, an entrenchment of epistemological values that we still live with: the notion that the practice of arts is aligned with action (*techne*) and that sciences are concerned with knowledge (*episteme*), with the latter considered to be of a higher status. We will see that this idea soon becomes so powerful that science eventually becomes synonymous with knowledge itself.

As you will see in the following chapters of this book, aiming to value any of the evolutions of the Aristotelian distinctions over the others will be detrimental and perpetuate another set of prejudices and compromised practices that will work directly against any valuable account of transdisciplinary practice. Working towards a productive practice of transdisciplinarity, in the final chapter, we will completely leave the complicated world of dualisms and enter the complex world of systems of emergence. You will see that all actions, whether transparent, sibylline, or hidden in plain sight, in the many evolutions of the *techne* and *episteme* discussion are active parts of the gestalt of knowledging. Becoming cognizant of these and witnessing aspects not disciplinarily recognised as 'knowledge', especially by one's 'home' discipline, is a crucial part of the proposed practice. One can't fully respond and be responsible in the practice of knowledging without a wider perspective. However, knowing the ways in which we got here helps the practitioner/researcher to understand, and then to help unravel the many practices and prejudices that impede productively working across disciplines.

Before moving on to explore disciplinarity in the Renaissance, it is worth noting that from the 14th to the 18th centuries learning advanced outside of the academy. Surviving letters show vibrant cultures of knowledge production and exchange extending beyond learning institutions, taking place within the culture of the salon, in societies, and at coffee houses (Frodeman, 2014; Grafton, 2009).

Communication in the Republic of Letters was primarily carried out through letters, hundreds of thousands of which survive to this day. And while such letters would certainly announce the latest scientific discoveries in, for example, optics or mathematics, this system of communication was not constituted along disciplinary lines.

—Frodeman, 2014: 21

Lovers, Machines and War in the Renaissance

Although classical ideals fueled by the rediscovery of ancient Latin and Greek texts are a distinguishing feature of the Renaissance, epistemological practices were in some ways radically interdisciplinary. It is a time when the texture of early modern thought and representation was developing, where ‘early modern science is practised as an art and, at the same time, that imaginative literature provides a form for producing knowledge’ (Spiller, 2004: 2).

During the Renaissance, there was intense development in the areas of astronomy, physics, mathematics, geometry and the sciences, in line with the practical needs of society. At the beginning of the 13th century, we see organised mathematical education connecting to the social structure and the current economy in the *Scuole d’abaco* (Abacus schools). This helped foster innovators such as Luca Pacioli (1445–1517), who, in turn, had a fundamental role in Leonardo da Vinci’s (1452–1519) mathematical education (Pisano and Cappechi, 2016).

Scuole d’abaco

In the late Middle Ages until early modern age, another category of professionals—having contact with the humanist scholars but who cannot be identified with them—proposed a kind of education which was substantially different from the medieval scholastic one, emphasizing practical, pre-professional and scientific studies: these professionals were the so called maestri d’abaco. They taught mathematics in public or private schools. Most of these schools took place in Italy, but the phenomenon rapidly crossed the whole of Europe, introducing several concepts and methods both in advanced mathematics and, later one [sic], in the teaching practice. The role of the maestri d’abaco was soon significant for the improvements/development of scientific method, still though this remains, nowadays, a matter of controversy.

—Pisano and Bussotti, 2013: 91

In Leonardo da Vinci, the quintessential Renaissance man, we see that reason, calculation and creating were not separate thought concentrations organised into hierarchies, but rather mutually interdependent parts of a whole practice. To craft a machine, design and create calculations and draw up artistic renderings could be seen as acts of knowledging from the same source in the service of an integrated inquiry brought forth by need and desire.

It is unfortunate, and not for the first or last time in our history, that humanity became particularly innovative and collaborative in the service of its own destruction.

...a certain body of knowledge started to spread within early military handbooks (constructions and maintenance of war machines, mathematical and geometrical rules for weapons, battle projects, Pythagorean tables, fortifications projects, measurements and devices, etc.) in which a minimum of mathematical (calculus) basic education was required. For that reason, the scientific education of soldiers and gunners played an important role within the art of war.

—Pisano and Cappechi, 2016: xi

In this era, many of Aristotle's momentum-related doctrines were challenged in the development of measurements of calibres, land surveying and, importantly, the scientific foundations of ballistics. Aristotelian physics used terms like 'heavy', 'natural', and 'violent' to describe motion. These understandings were not particularly helpful in measuring projectile movement.

As Aristotle's more technical treatises were being appropriately superseded, others held strong. The theories and artistic innovations developed and debated by the Camerata, a Florentine group of scholars, scientists, and musicians, from which many letters and journals survive, are a prime example. Meetings were held at the home of Giovanni Bardi (1534–1612), and figures such as Vincenzo Galilei (1520–1591), father of the famous astronomer and physicist, Giulio Caccini (1545–1618) a well-known singer and composer, Jacopo Peri (1561–1633), credited by many with the composition of the first opera, Ottavio Rinuccini (1562–1621), and Jacopo Corsi (1561–1602) were among those who attended.

The group met to deal with a sense that music had lost its way in the layered polyphonic style of music of the time. They hoped to resurrect the written word in a position of primacy over what had become a cacophonous construction of technical musicality.

They also sought to rein in the supposed abuses of the singers, who through their performance practice (they asserted) had become unruly and egotistical, muddying the ‘purity’ of the poetry. They turned to Aristotle for their authority in such a matter.

I would advise you, therefore, to fix forever in your memory what Aristotle says, that in rhythms are images of fortitude and... above all else your principle objective should be not to spoil the verse in singing by making a long syllable short, or a short one long, as is habitually done every time; and what is worse, it is done by those who consider themselves great men in this art, with such poor grace and style that any connoisseur of good poetry reacts with great pain and distress, something unworthy of our century, surely.

—Palisca, 1989: 121

In performance history, there have been multiple instances where reforms were passionately justified as missions to resurrect a revered notion of classical purity. However, in each of these, there remains an important oversight: we have no records of the ways of practising from this era. Surviving documentation of antiquity includes descriptions, sculptures and paintings; however, there are no comprehensive accounts of performance *practices*.

With the Florentine Camerata, we have the beginnings of the interdisciplinary genre of opera. This is a genre whose history can be defined by a prejudice against the performer and the act of performance, where its momentum from one era to the next is marked by the favouring of the word, then the music, then the word, and then the music—and in more recent times the director’s and/or designer’s ‘concept’—each as the prime *custodians* of some supposed inherent meaning.

The performer and the act of performance, for centuries and arguably often still, is relegated to merely depicting the text or concept rather than embodying an *activation* of meaning in the way of *doing* during that *act of performance* (see Bryon, 2005: 287–294). From Monteverdi to Handel, from Mozart through Rossini to Wagner, reforms have been perpetrated by those who have never experienced or witnessed the classical practices. No operatic or theatre creator, composer, director, librettist or performer living or dead has been privy to Aristotle’s ideals. The classical foundation, which has been repeatedly invoked to resolve problems and to pursue deeper meaning and unity in theatre, can be seen as more mythical than

practical. What begins to emerge here is an assumption that ‘to know *about* a practice or *of* a practice as an aesthetic *object* of practice, rather than having knowledge of the actual practice *within* a practice, was sufficient—a type of ‘*episteme*’ about ‘*techne*’ perhaps’ (Bryon, 2018: 13).

The values that were born out of this dynamic, where a knowledge of practice was seemingly treated as an object rather than as an embodied understanding of practice from within processual workings, are to this day often considered a reasonable foundation for expertise and reform. The approach to transdisciplinary practice proposed in Part II asserts that we need to see all knowledge and all disciplines as practice if we want to understand the ways in which these disciplines cross and collide and intersect as action.

Performance is both a practice and a mode of analysis. It is a communicative behaviour for which there is no other name (that’s to say, if you can call it acting you treat it as acting). It is a mode of analysis that works by framing, thinking of, its material as if it were performed, which is to say as if it were a deliberate communicative practice.

—Shepherd, 2016: 222–223

If we add to Shepherd’s notion that type of practice that is also purposefully *not* communicating—that practice at the core of performance practice that must precede communication, the scales, the barre work, the *way* of being in the *doing* of the *doing* so that one is in the flow of *process*, the *act* of the *act*—we can also begin to tap into ways of knowing. The act of practising and training in high-end performance is one that requires a constant balance of non-linear reasoning, calculating, creating, witnessing, evaluating and enacting, all towards outcomes that must be exacting while flexible and repeatable. There is much to glean from these disciplines in working towards a productive practice of transdisciplinarity.

Bloody Reason in The Enlightenment

A defining factor of the Enlightenment is that the natural order established by the ancient Greeks met disturbances. This era overlapped with the *scientific revolution*, greatly influenced by scientists such as Galileo, Copernicus, Kepler, and Newton. The natural sciences proceeded on the foundational view that nature

was a 'well-ordered machine' and on the empirical method, which 'aimed to deal with problems within specific parameters, based on new methods of induction and deduction to test hypotheses and new experimental apparatus' such as the thermometer, microscope and telescope' (Moran, 2010: 5). These developments set the stage for science as we know it.

Ironically, although not the usual epistemological story told, belief systems were a little mercurial, and the epistemology of science evolved slowly. Newton's belief system, for instance, included a commitment to rules, which for him constituted the 'reason of God'. Famously, he was also obsessed with alchemy and wrote many mystical works about turning iron into gold. There is certainly a trace of theology, religion and even magic in the foundation of the scientific disciplines.

However, as the Enlightenment progressed, there was a significant shift towards theoretical knowledge. The first editions of the Encyclopedia were created, the best known of course being Diderot's *L'Encyclopédie* (1751–80). This represented a turning point where the codification, systemising and categorisation of knowledge developed along the lines of episteme, with the capture and accounting of knowledge being formed around models that reinforced the supremacy of know-that and know-why over know-how.

In the Enlightenment, religion went from being the queen of the sciences and the end of all knowledge to being one among many types of knowledge... The depersonalization of Knowledge was also necessary. Rather than knowledge being attached to the person and thus a matter of status or personal charisma, knowledge was increasingly grounded in data that the world gave up through empirical investigation.

—Frodeman, 2014: 22

Once again, it was largely in part due to the necessities of war that a gap was closed between *techne* and *episteme*, this time as a defining moment for the discipline of medicine. Before the 18th century, you would see surgical colleges and societies very separate from medical education. Surgeons dealt with the personal, the body; the work was physical, a craft requiring dexterity and the ability to perform in the flow of time under difficult conditions. Surgeons held an *artisan* status in line with the Aristotelian *techne*. They often travelled from town to town cutting hair, pulling toenails and teeth, dealing with deformities from syphilis and birth, and performing skin grafts and

other corrective surgeries.

Medical education at the time did not include this *crude* sort of practice. It was during the French Revolution and the creation of the modern hospital where the training of doctors for the army required that they practice surgery and medicine interchangeably due to the urgent and exacting needs of the field. This changed everything for medicine. Surgery became a science, and medicine became better.

Whereas physicians had traditionally been concerned with the whole body, with humors, spirits, or other generalist conceptions of disease, surgeons had always been confronted with the local: with abscesses, broken bones, specific abnormalities requiring definitive intervention at a particular site. With the rise of the French medical schools... physicians learned to think surgically, and the solid parts of the body came into their own within medicine.

—Bynum, 2008: 46

Where would we be if we had learned deeply from this and reconciled the antiquated divide between episteme and techne? What if science had developed as an investigation into the inclusion and integration of other practical and embodied modes of knowledge with the theoretical sciences as an obvious and evidenced way to advance the human condition and experience? Unfortunately, instead, we doubled down, and suspicions around anything spiritual, emotive, interpretive, bodily, artistic, subjective, and arguably feminine got couched as a threat to the advancement of knowledge as reason. It would appear also that the legitimisation of science coincided with a formal exclusion of women, despite their previous participation in intellectual life during the Renaissance courts and select aristocratic traditions.

Science as Quasi-Religious

With the dawning of the Enlightenment in the eighteenth century, science and religion began to part company. The West entered an age of dualism in which the physical and the spiritual were increasingly decoupled. Yet, in spite of the officially secular climate of modern science, physicists have continued to retain a quasi-religious attitude to their work. They have continued to comport themselves as a scientific priesthood and presented themselves to the public in that light.

—Wertheim, 1997: 12

When Wertheim writes of ‘quasi-religious’ aspects, she is speaking specifically about physics (see boxout), but the same could be said for all the sciences. She asserts that this quasi-religious culture, where particle accelerators are likened to cathedrals in Lederman’s 1993 book *The God Particle*, and funds are poured into the quest for a *Theory of Everything*, could have been slightly different if ‘women had a significant role in determining the directions and goals of science itself’ (Wertheim, 1997: 14). Some 30 years ago she asserted that ‘we need a new culture of physics, one that does not place so much value on quasi-religious, highly abstracted goals; a culture that is less obsessed with particles and forces, and more concerned with human beings and our needs’ (ibid.). Perhaps through the advancement of a productive transdisciplinary practice we can get there.

However, as history tells us, it would appear that science, while ready for its gods and priests, was resistant to its goddesses and priestesses. ‘The Royal Society, founded in 1662, did not admit a woman until 1945, and the Académie des Sciences, founded in 1666, did not admit women until 1979’ (Shumway and Messer-Davidow, 1991: 205). It took until the 1860s in Switzerland, the 1870s in England, the 1880s in France, and the 1900s in Germany for women to even be admitted into universities (ibid.).

Unless they were working quietly behind the scenes—taught by fathers, or assisting husbands—women were excluded. Tracing a clear and honest line of women’s influence in the production and shaping of knowledge is difficult, if not impossible. And, as most social epistemologists—and certainly feminist epistemologists—will tell you, this exclusion has deeply shaped the way we do knowledge. From the very beginning of the scientific enterprise, a stark divide was established, a divide that drew sharp boundaries between those who think and those who do; between theoretical and embodied knowledge; theory and practice; hard and soft; pure and applied; logical and emotional; expert and lay; order and chaos; and, of course, masculine and feminine.

Science Becomes Knowledge

It is at this point that knowledge becomes a system of values aligned with a series of dichotomised understandings built on the epistemological hierarchy discussed from the beginning of this chapter. The standard Enlightenment model of knowledge and belief brought clear rules around how, for knowledge to be validated as knowledge, it must consist of propositions that can be tested and evidenced, then substantiated by argument through objective means. To complete the process, these propositions would then be publicly disseminated and accepted by a set of peers playing by the same rules within the same knowledge cultures.

It is easy to see how this dance led to the categorisation and formation of knowledge clusters that became *subject disciplines*. This successful and sustaining project defines the parameters of our careers as practitioner/researchers to date. As Moran speculates, its success of the past few hundred years lies in ‘...that they [the sciences] are able to limit themselves to certain closely defined fields and controlled situations, and thus produce apparently clearer, more rigorous and effective examples of ‘useful knowledge’ (Moran, 2010: 7). As Klein points out, the fragmentation of knowledge did not happen without a certain uneasiness, often attributed to a lack of philosophical overview which was thought could provide a *unity of knowledge*. ‘A number of writers from the sixteenth through to the nineteenth centuries, including Francis Bacon, Descartes, the French Encyclopedists, Kant, Hegel, and Comte. Each of them expressed concern about the fragmentation of knowledge, and each, in his own way, articulated a vision of the unity of knowledge’ (Klein, 1990: 20–21). As we will see in the following chapters, this unity of knowledge is not what this book proposes, partly because the notion itself aligns with the quasi-religious (see boxout), but mostly because a central philosophy of this book is the leaning into a *productive tension* that can be messy and must be visible.

By the 1800s, subject specialisms began to appear through a culture of peer review, generated within academic associations,

journals, citations and research frameworks. These ordained some things as *useful knowledge* and others as not. The object of a discipline became self-identifying and sustained through a semi-incestuous practice.

As the communication turned inward and became self-referential the disciplinary community became the relevant public. At the same time this process generated a division between specialists and laypersons that has become increasingly pronounced since then. Popularization emerged as a separate activity not intended to contribute new knowledge but limited to the broader (educated) public.

—Weingart, 2010: 6

It is with the movement of logical positivism, a term first used by Auguste Comte (1798–1857), which took place in the 1920s and 1930s in Europe and the 1940s and 1950s in the US, that we begin to see the types of university structures that we now recognise, where the pure sciences are typically regarded as a separate faculty from the humanities and their interdisciplinary breakouts.

Logical Positivists rejected the category of knowledge Immanuel Kant identified as *synthetic a priori*, even though Kant's influence on their philosophy is woven throughout their project. Before Kant '[p]hilosophers typically understood the nature of knowledge and the nature of reality as two sides of the same coin' (Fuller, 2002: 40). Kant's work shifted philosophy from metaphysics towards a critique of knowledge, providing a jumping off point for a set of disparate groups of scholars who developed in various directions, not necessarily agreeing on any one crucial concept, but having in common a post-Kantian philosophical sensibility towards a field of epistemology.

Logical Positivism

'Logical Positivism' is a name for a method, not for a certain kind of result. A philosopher is a logical positivist if he holds that there is no special way of knowing that is peculiar to philosophy, but that questions of fact can only be decided by the empirical methods of science, while questions that can be decided without appeal to experience are either mathematical or linguistic.

—Russell, 1950: 3–19

The logical positivists, particularly the branch of philosophers in Europe coined 'the Vienna Circle', whose most influential members included Moritz Schlick, Hans Hahn, Philipp Frank, Otto Neurath, Olga Hahn-Neurath, Viktor Kraft, Theodor Radacovic, Gustav Bergmann and Rudolf Carnap, started with the notion of verification, which posited that '...a theory is proposed and the theory makes predictions that can be tested through observation. Scientists will sceptically adopt a theory and then test the theory by making observations. As the observations that confirm the theory accumulate, the theory achieves a scientific status' (Erickson, 2016: 56). Further, universal laws can only be obtained through logical and rational thinking on the objective data gathered through the senses, and any metaphysical supposition must be considered unscientific.

Karl Popper (1902–1994) exposed what he saw as profound failings in this theory, showing that it alone cannot distinguish between science and pseudoscience. He was critical of astrology, psychoanalysis, particularly the work of Freud, and Marxism. He observed that proponents of these 'theories' leaned on their 'apparent explanatory power'.

These theories appear to be able to explain practically everything that happened within the fields to which they referred. The study of any of them seemed to have the effect of an intellectual conversion or revelation, open your eyes to a new truth hidden from those not yet initiated. Once your eyes were thus opened you saw confirmed instances everywhere: the world was full of verifications of the theory.

—Popper, 1963: 33–39

For Popper, experiments and observations are not there to verify but rather to falsify theories, and that, if and until they are proved false, they are considered true. This arguably 'leaned more towards naturalism, ...the idea that all observable effects have natural causes, opposing the logical *a priori* claimed by the logical positivists' (Krishnan, 2009: 14).

Karl Popper's Conclusions

In the winter of 1919–1920 Karl Popper formulated these conclusions:

1. It is easy to obtain confirmations, or verifications, for nearly every theory—if we look for confirmations.
2. Confirmations should count only if they are the result of risky predictions; that is to say, if, unenlightened by the theory in question, we should have expected an event which was incompatible with the theory—an event which would have refuted the theory.
3. Every 'good' scientific theory is a prohibition: it forbids certain things to happen. The more a theory forbids, the better it is.
4. A theory which is not refutable by any conceivable event is non-scientific. Irrefutability is not a virtue of a theory (as people often think) but a vice.
5. Every genuine test of a theory is an attempt to falsify it, or to refute it. Testability is falsifiability; but there are degrees of testability: some theories are more testable, more exposed to refutation, than others; they take, as it were, greater risks.
6. Confirming evidence should not count except when it is the result of a genuine test of the theory; and this means that it can be presented as a serious but unsuccessful attempt to falsify the theory. (I now speak in such cases of 'corroborating evidence'.)
7. Some genuinely testable theories, when found to be false, are still upheld by their admirers—for example, by introducing ad hoc some auxiliary assumption, or by reinterpreting the theory ad hoc in such a way that it escapes refutation. Such a procedure is always possible, but it rescues the theory from refutation only at the price of destroying, or at least lowering, its scientific status. (I later described such a rescuing operation as a 'conventionalist twist' or a 'conventionalist stratagem'.)

—Popper, 1963: 33–39

From this point a *standard account of science* was born, where knowledge validation was determined by questions of proof, evidence, confirmation, demonstration, falsification, refutability and testability, all resting on the premise that 'science is a form of knowledge that produces facts and fact-like statements' (Erikson, 2016: 55), and with this, it was assumed that science and knowledge were to be considered one and the same.

Gulfs, Scrutinies, and Subversions of Authority

The 20th century brought the socio-cultural-epistemological implications of the 'standard account of science' under examination. Fresh queries regarding its true operation and our place within it were being raised. Hard and fast rules started to crumble, or at least come under scrutiny. Influenced by two world wars and the discovery of new science, a complicated power game played out, unravelling centuries of dualisms (and, arguably, creating new ones). The language of science itself, distinctions about what constituted 'real' knowledge and what did not, led to a number of epistemological displacements, especially in the context of new radical theories and sciences.

Developments in quantum physics and 'chaos theory' have even been taken to mark 'the death of materialism' that is, of the mechanistic model of the properties and behaviour of matter which had been dominant since Newton (a dramatisation of the implications of this work which many working in these fields would reject) ...the very nature of the revolutionary work in theoretical physics, astronomy, and cosmology has helped to challenge the model of scientific thinking which represented it as proceeding by a combination of rigorous deduction and controlled inferences from empirical observation.

—Collini, 1998: xlviii

This century brought an unprecedented number of people to the Western model of higher education from a more diverse set of classes and cultures than ever before. The fruits of the Industrial Revolution were making life arguably better in relation to domestic comforts, mobility and medicine. In the first half of the century, we learned about blood types, the theory of relativity, vitamins, that the Earth had a crust and mantle, and that atoms had nuclei. Galaxies and penicillin were discovered. We took to the skies, and the first transistor, the electron microscope, radiocarbon dating, and the Big Bang theory came to be. By the second half of the century we had the polio vaccine, the structure of DNA, deterministic chaos theory, genetic engineering techniques, the discovery of a cancer gene, superstring theory, identification of the AIDS virus, the discovery of the hole in the ozone, a high-temperature superconductor, a near-complete sequence of the human genome, and Dolly—a cloned sheep.

The Enlightenment ideal of science as a pure quest for knowledge was put to the test in a world where *Big Science* became a political and economic priority. Big Science, a term first coined by Alvin Martin Weinberg in 1962 (see boxout), pertains to largely government-funded projects such as the Manhattan Project, radar research, CERN, the Apollo program, high-energy physics, the Human Genome Project, and the Hubble Space Telescope. The ways of funding science, of gaining recognition, and execution changed. The fragmentation of tasks and overall practice of science were altered by the sheer scale of the ventures. The act of knowledging within these large-scope projects shifted the relationship between science and society. It is not surprising that the next evolutions in the ways we considered knowledge sprang from considerations around epistemology, philosophy, culture, and ethics.

Big Science

When history looks at the twentieth century, she will see science and technology as its theme; she will find in the monuments of Big Science—the huge rockets, the high-energy accelerators, the high-flux research reactors—symbols of our time just as surely as she finds in Notre Dame a symbol of the Middle Ages. She might even see analogies between our motivations for building these tools of giant science and the motivations of the church builders and the pyramid builders. We build our monuments in the name of scientific truth; they built theirs in the name of religious truth. We use our Big Science to add to our country's prestige; they used their churches for their cities' prestige.

—Weinberg, 1962: 3

The world has changed tremendously and continues to do so in our century with unrelenting speed. However, how we handled the recognition and organisation of what we valued as knowledge, in addition to what we deemed the burning issues, during all this inexorable change requires critical excavation, especially if we are to move towards a productive culture of transdisciplinary practice.

In the following sections, we will see how the discussions taking place during the 20th century delayed any resolution of the episteme/techne divide by turning the philosophical gaze towards another set of perceived conflicts that intersected but failed to resolve the antiquated dilemma—one that is crucial to confront, if we are serious about the transdisciplinary project within which disciplinarity is a practice.

Two Cultures

The Two Cultures and the Scientific Revolution was delivered as the Rede lecture at Cambridge University in May 1959 by C. P. Snow, a scientist by training and a novelist by vocation. He laid out a contentious narrative concerning the tensions between ‘literary intellectuals’ and ‘research scientists’. Distinctions between the humanities and the sciences had been articulated prior, as early as 1930 by George Sarton (who founded *the History of Science Society* and the journal *ISIS*) and 12 years prior, as suggested by historian Tore Frängsmyr tracing Sarton’s inspiration to a continental tradition, particularly that of Auguste Comte in 1924 (Cohen, 2001: 9).

The Two Cultures

The non-scientists have a rooted impression that the scientists are shallowly optimistic, unaware of man’s condition. On the other hand, the scientists believe that the literary intellectuals are totally lacking in foresight, peculiarly unconcerned with their brother men, in a deep sense anti-intellectual, anxious to restrict both art and thought to the existential moment.

—Snow, 2012: 5

Regardless, Snow highlighted something that had not been stated outright within the scholarly elite, the notion of ‘a gulf’ between science and other types of knowledge, articulated as ‘two cultures’, with science at the top of the epistemological hierarchy, and boy, did it set off ‘the mother of all academic shouting matches’ (Gould, 2011: 89). Snow was in part bemoaning the British education system and maintained that non-science-based Western intellectuals had completely misunderstood the advances of the Industrial Revolution, calling them ‘Luddites’.

In 1962, F. R. Leavis, noted English literary critic, set out to challenge Snow in the form of a Richmond lecture at Downing College, Cambridge. It was a fairly personal attack, stating that Snow was, among other things, ‘portentously ignorant’, and ‘casting him in the role of superficial philistine, and bumping up against the limits of what cultural criticism can do by way of presenting a more adequate picture of human fulfillment’ (Collini, 2013: 21). This generated a ‘small storm of correspondence and comment—dominating the letter pages of the *Spectator* for several weeks, as well as being the subject of editorials and analyses there and elsewhere’ (ibid.: 26).

We had entered the 1960s, a time of profound cultural shift. The student uprisings in France in 1968 turned modernist ideology on its head, confronting historic materialism, political doctrine, and social reality. Established hierarchies and recognised complex social networks started to break down. It was the beginning of the end of grand narratives. In the arts and architecture, there were blurrings of genre, often framed as a revolt against hierarchical underpinnings of modernism, discipline, and form. We had the collapse of old dualisms, spurred on by a curiosity around sociological, philosophical and epistemological between-spaces, passages and unstable meanings. Anthropologist Van Gennep noted three rites of passage: preliminal, liminal, and postliminal (Gennep: 1960). Taking this idea further, anthropologist Victor Turner referred to liminal as 'betwixt and between' (Turner: 2017), a field of 'anti-structure' where there is an innate possibility and becoming. These ideas spurred discourses around interdisciplinarity and brought on an interrogation of the supposed inherent authority of science as the custodian of truth and knowledge.

Literary theory came to the fore as part of everyday life. It consumed all performance, cultural, ritual, and sociological research and practice, putting forth the idea that writing's meaning was not in the authority of the word, but also in the act of writing and reading and the juxtaposing relationships between the texts. This notion was expanded to include all *prescriptions*, including Enlightenment rationality, ritual acts, social assumptions of gender and race, histories, and even notions of self. It introduced an intellectual mode of discourse where any reality is recognised as mediated and objectivity is a naive and possibly irresponsible notion, as its foundations are built on historically constructed truths. To continue to function with a lack of awareness of the operations that generate the frameworks and the architectures of constructed modes of perception was considered a form of naive realism: postmodernism had landed.

Although this era did not confront the *techne/episteme* divide head-on, you will see in the final chapter that it gave us a few very helpful tools in jiggling free some of the assumptions and set habits that have kept us from the kind of transdisciplinary research practices that we are in desperate need of. In Part II, select postmodern ideas around performativity, phenomenology, and *cognition* will be adapted to help navigate knowledge across disciplines by witnessing the dynamics *between* as doings, experiences and knowings.

Science as a Cultural System

Science must no longer give the impression it represents a faithful reflection of reality. What it is, rather, is a cultural system, and it exhibits to us an alienated interest-determined image of reality specific to a definite time and place.

—Lepenes, 1989: 64

In the second half of the century, postmodernism brought unrest, arguably because we as a culture were not yet prepared to sit with discomfort and harness its potential as an opportunity for the emergence of new knowledge; we resolved the discomfort with a new series of dualisms, which arguably exhausted us into the current era of post-truth. In Part II of this book, we will draw on the notion of discomfort to help bridge the *techne/episteme* divide and to offer a productive mode of transdisciplinary practice. The approach will embrace a practice of temporary destabilisation. However, understanding the resistance to destabilisation and the fervent historic commitment to an epistemological authority is important in order to fully understand the ways it has moulded how we value and practice our acts of knowledging.

The new set of dualisms can be partially understood through what became the Science Wars. Divides were sophisticated and charged, and lines were drawn between science and the humanities, 'with the scientists often regarded as positivists rather than relativists, naturalists rather than humanists, realists rather than constructivists, empirical thinkers relying on logic and evidence rather than interpreters valuing aesthetics, with proper science on the side of falsifiable truth and New Age pseudo-science on the other; and with this also a peculiar political penchant to label the humanities category as Leftist, with science on the Right' (Bryon, 2018: 5).

Normal Science, Puzzles and Paradigms

It is in this context that we enter a new historical era in the philosophy of science, which can be marked in part by Thomas Kuhn's work *The Structure of Scientific Revolutions*, first published in 1962 and one of the most quoted philosophical texts. Kuhn was never traditionally trained as a philosopher, even though he retired as a professor of

philosophy at MIT; his ideas grew across varied disciplinary realms. At Berkeley, when he published the pivotal book, he was a professor of the History of Science, a relatively new discipline at the time. His foundations, both undergraduate and graduate, were in physics.

The context of his work developed academically when logical empiricism was the dominant philosophy. During the time of Kuhn's development, various constructions of 'old rationalism' associated with Rudolph Carnap, Carl Hempel and Karl Popper held the high ground as the normative philosophy of science. Although not always in agreement, they held in common a 'rationalist' opinion 'that a central task of the philosophy of science is to say what scientific rationality consists in, to describe how scientists ought to make inferences from evidence or to choose between competing hypotheses' (Bird, 2001: 3–4).

In this section, we will see how Kuhn, in examining the history of science and its developmental patterns, revealed another take on the accumulation of scientific knowledge and challenged the nature of the scientific method. Kuhn's work aligns with philosophers such as Imre Lakatos, Paul Feyerabend, Larry Laudan and Michael Polanyi towards new anti-positivistic scholarship and the recognition of wider cultural influences in the formation of 'truths'.

When Kuhn's work first landed it received the most attention for positing that '...the idealised process of observation, experimentation, deduction and conclusion—on which much of science's claims to objectivity and universalism are based, turns out to be a mirage' (Sardar, 2000: 28). This particular aspect of Kuhn's work is central to the climate that set off the Science Wars, and is unfortunately a provocative and limiting reading of his work. For the purposes of this book, with its leaning into a productive practice of transdisciplinarity, other aspects of the thesis within *The Structure of Scientific Revolutions* are much more useful and will be drawn on in the following chapters to help bridge the very gaps that his work in the past has been weaponised to create. For transdisciplinary research and practice to function, all ways of knowledging need to be made *visible* to each other, with no need for 'wars' in the face of conflicts between ideas and methods. In fact, conflicts, collisions and intertwinings will be embraced as the very spaces through which new and innovative acts of knowledging might emerge.

Paradigms

Most of us have heard the term ‘paradigm’ or ‘paradigm shift’. The latter term is sometimes adopted as a catch-all for a change in systematic perspective and is often used in various contexts of personal psychology and by corporate gurus. However, the way Kuhn actually activated it is worth exploring, especially in how it pertains to the history of science, disciplinarity and its implications for acts of knowledging. Kuhn himself, in a 1969 postscript to the original publication, lamented the focus on ‘controversies and misunderstandings that the book has evoked, particularly for the charge that I make of science as a subjective and irrational enterprise’ (Kuhn, 1996: 175).

For Kuhn, the word paradigm crosses a few meanings, but in general it includes a ‘disciplinary matrix’ or ‘the sum of all the beliefs, values, techniques...shared by the members of a particular community’ (Kuhn, 1996). For the purposes of thinking across disciplines, this idea of a matrix is interesting. To clarify his position, he explains the use of the term disciplinary ‘because it refers to the common possession of the practitioners of a particular discipline; ‘matrix’ because it is composed of ordered elements of various sorts, each requiring further specification...they form a whole and function together’ (ibid.: 182).

A paradigm holds a collection of knowledge within a certain discipline, including the ideas of what is considered truth, enveloped in an accepted understanding of the big ways of explaining the world. It relies on a joint belief in the way in which the world is conceived and, as such, determines the questions that researchers ask on a regular basis. A paradigm further indicates an era’s universally recognised scientific accomplishments/discoveries that, within their time, provide models, problems, puzzles and solutions for a community of practitioners. Further, it contains a sort of finished set of ‘rules’ that is settled on for an area of knowledge.

If we take baking a cake, for instance (a useful analogy that we will see again in Part II), the tools we use, the methods of preparation, the modes of measuring, *that* we even measure, the environment of a kitchen or baking space, the rules of safety and etiquette and status behaviours in a kitchen culture, the idea that a cake has a role in a society as celebratory and/or a treat, the puzzles we construct

around this to do with making it lighter, higher, flourless, iced in decorative ways, the problems that need to be solved around taste and presentation: all these are part of a paradigm.

If we think of a pre-paradigmatic stage of baking, perhaps the idea of ‘making a treat’, perhaps there would not be a kitchen, perhaps even heat. We might not even know what was tasty or poisonous. Would there be tools? What would be the method? What would be constituted as correct, and what would the puzzle be in aiming towards success and betterment? Things could have developed in any direction towards a piece of confection that we share at weddings and birthdays—or perhaps in another paradigm, there would not be weddings and birthdays? For Kuhn, science is something that is done by humans in a human context, and it happens in stages:

- Pre-paradigmatic stage
- The emergence of normal science
- The emergence of an anomaly and a crisis
- Scientific revolution as a result of the birth and assimilation of a new paradigm

Normal science is what we become used to, what happens when the business of science is established. It occurs as an existing framework where the questions, the tools, the languages and skill sets are contained within set principles. When normal science is happening, we are not really asking the big questions about how the world functions; we are working within the structure to solve puzzles.

The Paradigmatic Loop

A paradigm can... even insulate the community from those socially important problems that are not reducible to the puzzle form, because they cannot be stated in terms of the conceptual and instrumental tools the paradigm supplies... One of the reasons why normal science seems to progress so rapidly is that its practitioners concentrate on problems that only their own lack of ingenuity should keep them from solving.

—Kuhn, 1996: 37

Normal science is problematic for Kuhn, as it ‘must continually strive to bring theory and fact into closer agreement, and that activity can easily be seen as testing or as a search for confirmation or

falsification. Instead, its object is to solve a puzzle for whose very existence the validity of the paradigm must be assumed' (ibid.: 80). He then evokes the old proverb 'It is a poor carpenter who blames his tools,' indicating that the responsibility does not lie in the theories imbued in normal science but rather in the practices of that science.

Science students accept theories on the authority of teacher and text, not because of evidence. What alternatives have they, or what competence? The applications given in texts are not there as evidence but because learning them is part of learning the paradigm at the base of current practice.

—ibid.: 80

Lessening the constraints of normal science on society is central to the transdisciplinary project. In the next chapter, the notion of *wicked problems* will be examined in relation to this failure. Kuhn, through his historiography of science, threw into doubt the notion that science is about progress, that it builds on discoveries of the past in objective measured and linear ways. Science is rather a messy journey of disjuncture, conflict and revolutions.

Normal science begins to break down when pieces of the puzzle go missing, or morph, or misbehave. Anomalies start to accumulate. Things become unstable. It is at this stage that scientists begin to question their basic assumptions and new paradigms emerge. It happens when old methods and intellectual frameworks fail to solve new problems. We are arguably at a time of such a crisis now, where a productive transdisciplinary paradigm might at least for a time help to address our current crises. For Kuhn, the ignoring of anomalies is an indication that scientific activities are not completely rational. Anomalies can happen when things emerge that are unexplainable within the current paradigm or when new technologies reveal outliers to the rules and/or discoveries are made. For Kuhn:

Discovery commences with the awareness of anomaly, i.e., with the recognition that nature has somehow violated the paradigm-induced expectations that govern normal science. It then continues with a more or less extended exploration of the area of anomaly. And it closes only when the paradigm theory has been adjusted so that the anomalous has become expected.

—ibid.: 52–53

Importantly, which paradigm emerges as the next is not always about what is good for the world. The best, most effective, most time sensitive, most economical, remotely fair, or universal—these are not, unfortunately, the determining factors for a place in the evolution of science. Like most things with any value for humans, the next paradigm is formed subject to power, politics, brute force, desire and luck.

Where anomalies override assumptions, *revolution* occurs before a new normal stage of science begins. Examples of this include the development of such tools as the telescope and microscope. Kuhn shows how the paradigms of Aristotle, Newton and Einstein were not clean accumulations of knowledge, but rather revolutions. So too was the replacement of the Ptolemaic version of the world, where everything was thought to revolve around the Earth, by the discoveries of Copernicus.

A last and important point on Kuhn is that new paradigms are *incommensurable* with the old. They play by different rules, they do not perceive or acknowledge observational data in the same ways; they ask different questions and resolve different problems, and their evaluation of what is adequate and legitimate differs.

If we take the notion of paradigm to not only include moments of ‘normal science’ but also to apply to disciplines, with their own rules, cultures, languages, skill sets, aesthetics and puzzles (whether history, dance, biology, ecology, anthropology, music, mathematics, engineering, acting, computer technology, naval architecture, or oil painting), this incommensurability issue opens the way towards a dynamic approach, enabling us to benefit from knowledge across these disciplinary matrices through a productive practice of transdisciplinarity. In Part II, this thinking will be central to the approach offered, initiating from the same sort of place Kuhn did, that science and disciplines are something that is *enacted* by humans in a human context, and that no discipline, not even science, is an *object* that *holds* knowledge.

Science Wars

The mid- to late 1990s were rife with a sort of ‘debunking culture’ within academic scholarship. This was not exclusively on the part of the scholars, but was also spurred on by publicists and journalists, fueling attention-getting scandals.

Challenges to science as a pure, rational and objective custodian of truth as knowledge were not new. We had Oswald Spengler's somewhat romantic view of objective science and the role of logical analysis in his *The Decline of the West* (1928). Friedrich Nietzsche was famous for his concerns around the 'role and purpose of philosophy in an age of rapid scientific progress' (Brobjer, 2017: 11). The idea that there was an 'identity crisis' afflicting the 19th century, where science was dominating, was articulated by Herbert Schnädelbach, and a rejection of 'the empirical study of the natural world in favour of deductive reasoning and the construction of metaphysical systems' held sway through Hegelianism in German universities long after the methods of 'exact science were being used in Paris and London' (ibid.).

However, the two-culture conflict articulated by Snow offered a generous scaffolding for provocative tit-for-tats (to review Snow, see pages 49–51). This particular conflict is historically important partly because its premise remains one of the great detours away from a productive practice of knowledging. One could argue that contemporary policies created on the notion that teaching/funding STEM subjects as exclusively valuable domains of knowledge, set in competition with subjects in the humanities and the arts that embody innovation, creativity, and critical thinking within social contexts, are built on remnants of this 'debunking culture', with its seductively conservative and simple dualisms.

It was in the mid- to late 1990s that the scientific conservatives rose in a newly invigorated way. The Science Wars got hostile and rife with misinterpretation. Writing in the late 1990s, Aronowitz posits that this might have occurred because though 'earlier criticism was consigned to the wilderness of 'provocative' but ultimately unrespectable thought and was sequestered within fairly narrow circles, today critical investigations of science and technology have won some academic legitimacy and, perhaps more to the point, have begun to influence some scientists and the public as well' (Aronowitz, 1996: 182). For social epistemologist Steve Fuller, the Science Wars were an 'outgrowth of specifically Western developments in the relationship between science, technology and society' that were largely instigated through two popular works, one by American Nobel Prize-winning physicist Steven Weinberg, *Dreams of a Final Theory* (1992), and the other by the British biologist Lewis Wolpert, *The Unnatural Nature of Science* (1992).

These books included extended critical discussions of a group of historians, philosophers, and sociologists of science who, over the past quarter-century, have been challenging many taken-for-granted views about the nature of science. Ironically, Weinberg and Wolpert provided the first exposure of these scholars' 'science studies' (or 'STS', for 'Science, Technology and Society') to the general public.

—Fuller, 1999: 243

Science Studies was part of an emergence of the interdisciplinary subjects that came from the blurring of boundaries intrinsic to the postmodern era. There was an increasing development of cross-disciplinary activity among the humanities and sciences that influenced the development of cultural studies and literary studies into performance studies, feminist studies, gender studies, urban studies, women's studies, American studies, and cognitive studies, along with the above-mentioned science and technology studies. The Science Wars fast characterised such crossovers as being part of an academic leftist conspiracy, grouped with feminism, multiculturalism, and a suspect postmodern agenda.

Biologist Paul R. Gross and mathematician Norman Levitt, self-proclaimed 'scientific realists', published *Higher Superstition* (1994), becoming aggressive defenders against any view of science that favoured social context over the pure logic of argument. For them, this was akin to an intellectual nihilism:

Many notable historians and sociologists of science have long held misgivings about intellectual nihilism that offers itself as 'cultural constructivism'; but they have been reluctant to challenge it for fear of gaining a reputation as sissies, too weak-kneed to play the exhilarating game of 'epistemological chicken'.

—Gross and Levitt, 1997: xiii

It was Alan Sokal who took this game of 'epistemological chicken' to an extreme. In line with Gross and Levitt's depiction of the academic left as being 'permeated by jargon, philosophical dogma, and political attitudes drawn from the world of postmodern literary criticism' (ibid.: 81) and their pointed statement:

The notion of ‘cultural critic,’ in its postmodern form, embraces a certain kind of sociologist as well as a certain kind of literary scholar. They publish in the same journals and appear at the same symposia, speaking the same language and sharing the same attitudes.

—ibid.

Sokal wrote a nonsensical article titled *Transgressing the Boundaries: Towards a Transformative Hermeneutics of Quantum Gravity*, positing that quantum gravity was a social and linguistic construct. It was published in the journal *Social Text* in its spring/summer edition in 1996. ‘By being accepted and published, it proved, for many, that the leftist, postmodern, subjective, and relativist humanities were an incestuous, non-rigorous melting pot of pretentious mumbo-jumbo. It exposed to others that *Social Text* had not yet put in place a proper peer review process, and as such, no physicist had read the paper prior to its acceptance’ (Bryon, 2014: 20).

I structured the article around the silliest quotes about mathematics and physics from the most prominent academics, and I invented an argument praising them and linking them together, [he said] All this was very easy to carry off because my argument wasn’t obliged to respect any standards of evidence or logic.

—Sokal, 1996: *New York Times* interview with Jenny Scott

Sokal’s hoax was effective on a few counts, perhaps most illuminatingly, as Steven Fuller posited, by its example. There is always a certain level of ‘trust’ needed for any form of organised construction of enquiry to occur, whether that be a publication, an agreed method of rigour, or modes of confirmation and evaluation. ‘Given the expense involved in reproducing most scientific experiments today, even the hardest of ‘hard’ scientists are forced to take most of what their colleagues say in print at face value. In other words, Sokal unwittingly found himself teaching science studies by example’ (Fuller, 1999: 244)!

Some couched the energy behind the charged nature of the debate as a perceived threat to an almost religious devotion to a scientific enterprise perceived to hold virtues, when done correctly, able to match nature with reality within an edict of rationality. Earlier, a link between physics and God had been analogised to include all science (see pages 40–42). When Steven Weinberg and his contemporaries

in the 1970s started talking about a 'Grand Unified Theory', followed by the adoption of the term 'Theory of Everything', we see a certain God-like affiliation. Then, of course, there was the aforementioned book by Leon Lederman, 'The God Particle' and that moment when Stephen Hawking famously posited that one day physicists would 'know the mind of God'.

Science Wars

...like other religious conflicts, the present one is less about what 'Science' is and more about who should control the portrayal of 'it'. Should the 'nature' of science be portrayed as 'unnatural' (and therefore accessible only to an elect few) or 'natural' (universally accessible, at least in principle); is this 'Science' a force of good or evil; is it male, female, or neuter; is it really objective or is it a grand illusion?

—Lynch, 1996: 238

Many argued that if science had become like a new religion, it was as dangerous as any religion when it becomes commodified and industrialised. Andrew Ross, writing in the aforementioned edition of *Social Text* 1996 Spring–Summer, stated that this type of religiosity was in line with the 'militant resurgence of belief in its pristine truth' and posited that 'the crusaders behind the Science Wars are not about to throw the moneylenders out of the temple. Their wrath is aimed, above all, at those who show how the temple was built and how rituals are maintained—the constructionist academic left' (Ross, 1996: 1–13). All this created considerable concern in the ranks of academics. 'Many of my colleagues in the social and cultural studies of science wish the whole debate would go away. Like agnostics in the middle of a religious war, they are inclined to see the debate about science 'as an empty exercise in hostility between factions they would prefer not to join' (Lynch, 1996: 254).

Steve Fuller, offering a form of mediation, summarises nicely: 'Just as sociology had contributed to the secularization of religion, science studies would contribute to the secularization of science' (Fuller, 1999: 246). And, in framing the entire kerfuffle, summarised '...the dispute has been over what it means for an activity to be 'scientific' and which activities should be counted as scientific. Generally speaking, professional scientists use the term 'scientific'

to capture certain ideals of inquiry, whereas science studies scholars aim to capture how science is actually practised, ‘warts and all’, as it were’ (ibid.: 245).

You will see how the proposed practice towards transdisciplinarity in the final chapter of this book embraces the notion of ‘warts and all’ as a more inclusive and robust capture of data towards a more rigorous and productive account of knowledging across, between and beyond disciplines through its way of *practice*. The move towards a productive practice of transdisciplinarity breaks from ideas of unity and *consilience* in that it is *not* reliant on the dreaming of some utopian notion of coherence. You will see that the practice proposed in this book adheres to the idea that ‘borders’ are never going to stop being there, and that to resolve them may be counter to innovation. Rather, it is proposed that it is in the practice of engaging with them that *knowledge* and *meaning* occur.

Consilience

Consilience is a term that pops up in discussing inter/transdisciplinarity, because, on the face of it, it looks like it offers ways of moving across disciplines with the coherent intent to share and evolve knowledges. However, considering the various ways the word has been explained in and as *practice* reveals important blind spots and biases.

The concept was first introduced by William Whewell in 1840, referring to a convergence of facts and theory to form a common network of explanation across scientific disciplines. The word has its roots in the Latin *con* ‘with, together’ and *salire* ‘to leap’: a jumping together. It was revived by American biologist, naturalist, ecologist, entomologist and Pulitzer Prize-winning writer E. O. Wilson in 1998 in his book *Consilience: The Unity of Knowledge*. This adoption of the word has drawn criticism, as Wilson’s reading of it and justification of his position shifted it in important ways. Wilson advocates a ‘deliberate, systematic linkage... across the disciplines’, whereas what Herschel and Whewell had in mind was the unexpected, serendipitous discovery of interconnections. It may create more confusion than clarity, then, to call Whewell’s concept and Wilson’s by the same name’ (Carey, 2013: 25).

This lack of serendipity, but also uncertainty and not-knowingness (see Chapter III, pages 99–103), is reconciled by an argument that posits that sociobiology can provide an overall framework of science to include most everything, including the arts, brains, ethics, reproductive cultural patterns, the Big Bang, and quarks. In order for this to work, Wilson proselytises an epistemologically empiricist and ontologically realist stance held together by a reductionist methodology.

Consilience

The explanatory network now touches the edge of culture itself. It has reached the boundary that separates the natural sciences on one side from the humanities and humanistic social sciences on the other. Granted, for most scholars the two domains, commonly called the scientific and literary cultures, still have a look of permanence about them. From Apollonian law to Dionysian spirit, prose to poetry, left cortical hemisphere to right, the line between the two domains can be easily crossed back and forth, but no one knows how to translate the tongue of one into that of the other. Should we even try? I believe so, and for the best of reasons: The goal is both important and attainable. The time has come to reassess the boundary.

—Wilson, 1999: 136

Wilson's text is seductive and rich with big ideas and fascinating historical readings. Despite the wish to join the sciences and the humanities, in the aligning of the 'two cultures' with 'Apollonian law' and 'Dionysian spirit' (see boxout), he harks back to Aristotle's separations of episteme and techne. Wilson, however, was not a philosopher, but rather a compelling storyteller and accomplished scientist. The book can be grouped into the aforementioned penchant towards 'theories of everything'. That Wilson was born into Christian fundamentalism as a Southern Baptist may have contributed to the swap of one unified theory for another.

Importantly, as this chapter is in part about revealing the ways the episteme and techne divide still lives as an obstacle to productive practices of transdisciplinarity, Wilson's notion of the arts is telling. He sees the arts as an interpretive *object*, with the artist as somehow biologically imbued with a magical talent. He states that '...the exclusive role of the arts is the transmission of the intricate details of human experience by artifice to intensify aesthetic and emotional

response' (Wilson, 1999: 238), and further that '[t]he arts are eternally discursive. They seek maximum effect with novel imagery. And imagery that burns itself into the memory, so that when recalled it retains some of its original impact' (ibid.: 242); 'Art is magic' (ibid.: 298); 'Works of art communicate feeling directly from mind to mind, with no intent to explain why the impact occurs. In this defining quality, the arts are the antithesis of science' (ibid. 238); and finally, 'Several special powers were granted the arts by the genetic evolution of the brain. First is the ability to generate metaphors with ease and move them fluidly from one context to another. Consider the technical language of the arts themselves' (ibid.: 239).

The approach proposed in Part II of this book originates in performance theory and the arts, but not in the type of romantic and mysterious notion shared here. What will be proposed is that to share and innovate across disciplines, we cannot speak of one discipline's practice with another's product: we must set all disciplines in *motion* as acts of knowledging, avoiding settling into *interpretation* for as long as possible. You will see that the *practice* of working across disciplines is in many ways an anti-hermeneutic exercise. This is not unlike the barre work of a dancer, the scales of a singer or the sensory work of an actor. It's the pre-practice of art, the *techne*, that will give us an exacting process by which to capture, record, witness and reflect on various *knowledges* as they cross, collide and intersect. The *techne* of the episteme is the dance from which new knowledge, innovation and serendipity emerge.

Wilson's book was widely read and had its devotees and its critics. Perhaps the most famous of the latter was American palaeontologist and evolutionary biologist Stephen Jay Gould, who dedicated seventy pages to a critique of Wilson in his book *The Hedgehog, the Fox, and the Magister's Pox: Mending the Gap Between Science and the Humanities*, published in 2003. Carey summarises the assault beautifully:

Gould particularly attacked what Wilson called his 'central idea', that 'all tangible phenomena, from the birth of stars to the workings of social institutions, are based on material processes that are ultimately reducible, however long and tortuous the sequences, to the laws of physics'. While acknowledging that reduction is 'a powerful method that should be used whenever appropriate', Gould argued that Wilson extends this method in a way that violates both Whewell's notion of consilience and his own.

—Carey, 2013: 26, referring to Gould: 2003

Like Wilson, Gould aimed to put an end to the aforementioned two-culture problem articulated by Snow between the sciences and the humanities (to review Snow, see pages 49–51). Unlike Wilson, who wished to reconcile this problem, Gould claimed it suggested false dualism. Gould's writing is also quite romantic and illustrated with cul-de-sacs of detail styled in a baroque manner. In essence, however, where Wilson posits that unity between the sciences and humanities can be attained by reducing everything to science, Gould ultimately argues that consilience is not about forced integration.

Consilience of Equal Regard

I too seek a consilience, a 'jumping together' of science and the humanities into far greater and more fruitful contact and coherence—but a consilience of equal regard that respects the inherent differences, acknowledges the comparable but distinct worthiness, understands the absolute necessity of both domains to any life deemed intellectually and spiritually 'full,' and seeks to emphasize and nurture the numerous regions of actual overlap and common concern.

—Gould, 2003: 259

Turns

A defining attribute of the epistemological dance was not in a 'jumping together' of consilience but rather a dizzying choreography of multiple *turns*. The first *turn* can be said to have initiated in the 1920s with the 'linguistic turn' framed by the ideas of Gustav Bergmann, Richard Rorty, Ludwig Wittgenstein, Ferdinand de Saussure and the Vienna Circle. The linguistic turn, among other things, was a recognition of linguistic utterances as architects of meaning. Importantly, it pointed towards a rejection of naturalism, logical positivism and metaphysics. Once something is spoken/written and also read/heard, there is no longer an *object* of meaning; rather, meaning is generated. Here, issues of truth and knowledge are superseded by issues of usage and meaning.

Notions of usage and meaning, when expanded to include gestures, gender, symbols, methods, spaces, races, classes and bodies, bring us to *cultures*. You will recall the section on postmodernism (see pages 50–51), where the notion of authority, authorship and grand

narratives of historical truth and hard facts were contested. From the 1970s, the *turns* proliferated, stemming largely from a 'cultural turn' that emerged out of social sciences and various breakout studies in the humanities. The writings of Clifford Geertz, Jefferey C. Alexander, and Neil Smelser were among the earliest framing the movement. What developed eventually was a series of discourses around the notion that language, cognition, bodies, etc., were seen as inextricably embedded in the activities of culture. Further, for these to be critiqued and witnessed in any rigorous and transparent way, a recognition of the power relations and interests that might underlie them was essential.

Each new *turn* offered a new set of interdisciplinary discourses that proposed specific critical framings, practices and theories around subject areas. *Turns* are interdisciplinary in nature, as most effective *turns* take journeys from their home disciplines, are adopted and critiqued across other disciplines, and return to the home discipline, altered. Turns present a dynamic that has, through critical momentum, gained validity by encompassing a new referentiality. Examples of such include the practice turn, interpretive turn, translational turn, spatial turn, iconic turn, postcolonial turn, ethical turn, epistemological turn, performative turn, and cognitive turn. These last three offer conceptual models that will prove useful in reconfiguring the continuing techne/episteme imbalance towards a productive practice of transdisciplinarity, revealed in the final chapter.

Uncertainty and Society à La Mode

At the turn of the century, with the internet in most households offering information on demand, easy cross-global communication, and breaking news arriving instantly in one's hands as it occurs, it becomes clear that no grand unified theory or utopian integration of knowledge was going to help us discover new knowledge, or manage ways of knowledging that could help us deal with the world's complex problems. The reason is that the pressing issues are of *nature*: climate change, food production, sustainability, health and poverty. Nature is not a unified nor an integrated *object* prime for reduction, but rather a series of dynamic processual relationships

with crossing, colliding and intersecting systems that work in and out of a semblance of balances. Nature is processual. What came next was a recognition that it would take multiple ways of knowing to fathom processes towards solutions in recognition of a myriad of ethical, material, moral, and philosophical complexities. Towards the end of the 1990s, there was a certain fatigue around the theory and debunking culture, which gave way to explorations around practical problem-solving, with considerations around how ‘science’ and other knowledges might *function* within, and for, the realms of society, policy, power and context.

Modes of Knowledge Production

In Chapter I, where we defined transdisciplinarity, highlighting the key players in its development, you may remember the definition offered by Michael Gibbons, Camille Limoges, Helga Nowotny, Simon Schwartzman, Peter Scott and Martin Trow (see page 18). Here we introduce the concept of ‘modes of knowledge production’, which was first published in *The New Production of Knowledge* (1994) and further elaborated in *Re-Thinking Science* (2001), ‘to answer the valid criticisms of [the argument in the first book] and partly to develop our broader thesis’ (Nowotny, Scott and Gibbons, 2006: 39). Their critical framing of modes is worthy of a discrete section in this chapter, as the modes of knowledge production offer an apt perspective on the directions that the act of knowledging was taking into the 21st century.

The notion of ‘knowledge production modes’ stems from the sociology of science, continuing a conversation that, from this chapter, you will have observed began decades prior with the advent of science studies and its examination of relationships between science and society. The impetus for this new framing of the query was ‘to create a new way of thinking about science’ (Gibbons and Nowotny, 2001: 68). The importance of this way of thinking lies in the witnessing of disciplinary cultures, recognising modes and models of dissemination, the determining what are important problems and whose knowledge is to be deemed valuable within an inquiry, and also offering ways of discussing productions of knowledge that do not sit exclusively with the culture of one discipline.

Disciplinary Structures of Mode 1

The disciplinary structure is the basic model of knowledge production in most universities. The disciplinary structure determines the important problems and how they should be dealt with and by whom. It also specifies what should be regarded as a good contribution to the field. The disciplinary structure has a social dimension, too. Accreditation of new researchers, selection of new university faculty, and criteria for their advancement in academic life are subject to this dimension. In brief, the disciplinary structure defines what shall count as 'good science'.

—Nowotny, Scott and Gibbons, 2003: 243–257

They identified their five characteristics of Mode 2 knowledge production as constituting 'another language...to describe what is happening in research' which they considered 'empirically evident... when they all appear together [and] are integral or coherent enough to constitute something new...a new form of production of knowledge' (Gibbons and Nowotny, 2001: 68). These characteristics are distinguished from Mode 1, which traditionally determines the received understanding of 'good science'.

...the whole epistemology that drives Mode-1 science is based on a very clear separation of science from society. Mode-1 epistemology is based on the idea of discrete areas of specialization structured on a model of communication that really has only two elements: the first one is that all research must be communicable in a form that can be understood by one's colleagues; and the second one is that it can attract a consensus, even if a limited one. Embedded in this model is a notion of reliable knowledge which comprises a whole series of relatively separate decisions about the integrity of a certain set of scientific findings, the limits of the integrity being dependent on the limits of the consensus achieved.

—ibid.: 77

To counter the limitations of Mode 1, five characteristics determining Mode 2 were developed. They are knowledge produced in the context of application, transdisciplinarity, heterogeneity, and organisational diversity, enhanced social accountability and reflexivity, as well

as a more broadly based system of quality control. To see the characteristics against each other, refer to Figure 8.

Importantly, although these are distinct modes of knowledge production, this exercise was never intended to serve as a paradigm shift demolishing Mode 1; rather, both modes were recognised as interacting with one another. ‘Specialists trained in the disciplinary sciences do enter Mode 2 knowledge production. While some may return to their original disciplinary base, others will choose to follow a trail of complex solving problems that are set by a sequence of application contexts’ (Gibbons et al., 1994: 9), and of course knowledge produced through transdisciplinary research practices, particularly in the development of new instruments ‘may enter into and fertilize any number of disciplinary sciences’ (ibid.).

Characteristics of Mode 1 and Mode 2.	
Mode 1	Mode 2
Knowledge is accumulated through the professionalization of specialization largely institutionalised in universities	Knowledge is accumulated through the repeated configuration of human resources in flexible, essentially transient forms of organisation
Problems are set and solved in a context governed by the largely academic interests of a specific community	Knowledge is carried out in a context of application
Disciplinary	Transdisciplinary
Characterised by homogeneity	Characterised by heterogeneity organizationally
Hierarchical and tends to preserve its form	More heterarchical and transient

The new production of knowledge (Gibbons et al., 1994: 3, 9), adapted.

Figure 8

Perhaps to accommodate a productive conceptual arena where Mode 1 continues to exist in a world with Mode 2, in the second book they introduced the concept of the *agora* from the ancient Greek as a model for a transdisciplinary forum, ‘a problem-generating and problem-solving environment in which the contextualisation of knowledge production takes place’ (Nowotny, Scott and Gibbons, 2006: 50).

It is populated not only by arrays of competing ‘experts’ and the organisations and institutions through which knowledge is generated and traded but also variously jostling ‘publics’. It is not simply a political or commercial arena in which research priorities are identified and funded, or an arena in which research findings are disseminated, traded and used. The agora is in its own right a domain of primary knowledge production—through which people enter the research process and where ‘Mode 2’ knowledge is embodied in people, processes and projects. The role of controversies in realising scientific potential is also played out in the *agora*.

—ibid.

In the upcoming *Intermezzo* we will explore the agora next to other middle and non-linear spaces in preparation for the introduction of a more embodied approach to transdisciplinary practice.

Post-Normal Science

Post-Normal Science, developed around the same time as the modes of knowledge production, has in common with them that it breaks from a linear, reductionist, mechanistic, stable, disciplinary, cause-and-effect ethos and enters into a fluid, systems thinking, inter/transdisciplinary, dynamic set of processes as an approach to method-driven inquiries. For Post-Normal Science, the fulcrum of the critical framework lies in the notion of uncertainty, something that Mode 1 has historically been seriously uncomfortable with, which I will argue in Part II leads us to blind spots in working across disciplines, impeding innovation and the emergence of new knowledges.

Post-Normal Science (PNS) was introduced at the inaugural conference of the *International Society for Ecological Economics* in 1990 by Silvio Funtowicz and Jerome Ravetz. The term ‘post-normal’ has two origins; firstly, Kuhn’s notion of ‘normal science’ with its closed puzzles, validation systems, skills and vocabularies (see pages 69–73), and secondly ‘the assumption that the policy environment is still ‘normal’, in that such routine puzzle-solving by experts provides an adequate knowledge base for policy decisions’ (Ravetz, 1999: 2). They developed their approach specifically for the types of problem-solving that normal science is not designed to handle within its epistemological and self-defining parameters.

The reductionist, analytical worldview that divides systems into ever smaller elements, studied by ever more esoteric specialties, is being replaced by a systemic, synthetic, and humanistic approach. Natural systems are recognized as complex and dynamic; this entails moving to a science based on unpredictability, incomplete control, and a plurality of legitimate perspectives.

—Funtowicz and Ravetz, 1994: 1

In the mechanistic view of the world, it can be seductive to think that with research, uncertainty decreases, and with knowledge, we come to the truth. However, it is also true that research can generate more uncertainty, especially in such areas as nuclear energy, climate change, big pharma, agriculture, the use of fossil fuels, and sustainability. All of these include multiple technical, methodological, and epistemological domains, and with different disciplinary mechanisms, we get different ways of measuring, capturing and evaluating risk, certainty and truth. In the advancement of knowledge, uncertainties will be created, not closed down.

PNS was developed in response to questions about science and its own ability to manage ‘risk’. It follows the work of Albert Weinberg, who coined the term ‘trans-science’ to elucidate the fact that just because we can express something scientifically, it does not mean we can solve it scientifically:

Scientific truth is established by the traditional methods of peer review: only what has value in the intellectual marketplace survives. By contrast, where trans-science is involved, wisdom (rather than truth) must be arrived at by some other mechanism.

—Weinberg, 1972: 1

The PNS scientific approach works to manage uncertainties and replaces formalised deduction with interactive dialogue where appropriate: ‘the task is to choose the appropriate kind of scientific problem-solving strategy for each particular issue’ (Funtowicz and Ravetz, 1994: 2). Important to the founders of PNS is the distinction that this is not a new paradigm or a substitution for normal science or expertise, but rather a way of considering problem-solving

under special conditions. Experts will always be needed. This is about policy; in circumstances where facts are uncertain, there is a plurality of value systems involved, stakes are high, and decisions are urgent, PNS is a useful tool.

For all inquiries that fit the four conditions, a search for ‘Truth’ is put aside, and quality and fitness for purpose become the priority. If we think of the COVID pandemic and the imminent need for treatment options and a vaccine, waiting for the usual robust processes of testing, peer review, and publication would have cost multiple lives, which would not equate to quality of processes or favourable outcomes. With PNS as a management of uncertainty, quality is understood as a contextual element within the application of scientific information.

A key component of this quality in issue-driven research is the inclusion of ‘extended peer communities’:

The contribution of all the stakeholders in cases of Post-Normal Science is not merely a matter of broader democratic participation. For these new problems are in many ways different from those of research science, professional practice, or industrial development. Each of those has its means for quality assurance of the products of the work, be they peer review, professional associations, or the market. For these new problems, quality depends on open dialogue between all those affected. This we call an ‘extended peer community’, consisting not merely of persons with some form or other of institutional accreditation (‘stakeholders’), but rather of all those with a desire to participate in the resolution of the issue.

—Ravetz, 1999: 5

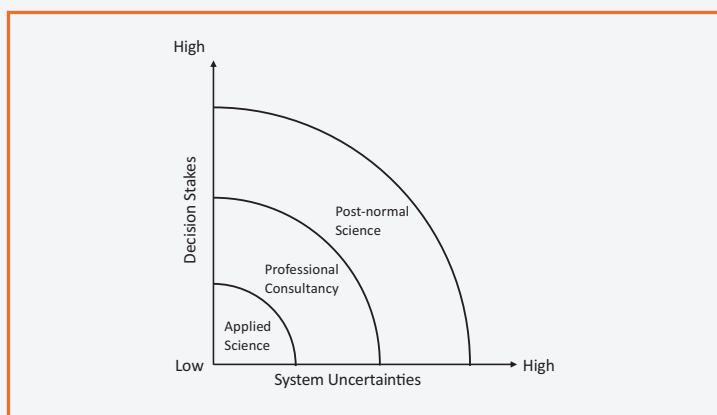
For PNS, a key component of quality assurance is the open dialogue between all those affected, extending beyond discrete disciplinary cultures, stakeholders, politicians and funders. Further, the ‘extended peer community’ may come with what they term as ‘extended facts’. These may not conform to the quality assurance of conventional research; however, they still, with proper interpretation, are sometimes important to include in the debate. Examples of extended facts ‘can range from ‘housewives’ epidemiology’, through pupils’ surveys, to investigative journalism and leaked secret documents’ (ibid.).

Quality in a Post-Normal Age

We now see that the complexity of policy problems corresponds to the complexity of the relevant knowledge. The maintenance and enhancement of quality, rather than the establishment of truth, is the key problem for science in the post-normal age. Accomplishing this requires the incorporation of several new features in the methodology of science, transcending the bounds of normal training and research. Another is mutual respect among participants in a dialogue, and a recognition that no side necessarily has a monopoly of truth or morality. And finally, there is the readiness of all sides to learn from their mutual contact. In this way, science can rejoin the polity.

—Ravetz, 1999: 7

Systems Uncertainty and Decision Stakes.



Uncertainty, complexity and post-normal science (Funtowicz & Ravetz, 1994: 1882), adapted.

Figure 9

The lower the decision stakes, the more appropriate applied science will be. Here, the system's uncertainties might include those at a technical level, such as the treatment of data, functionality of tools, or instruments acting reliably. Applied science in this context is that of the traditional kind, including 'pure', 'core', 'investigator-driven', and 'basic' science. When uncertainty cannot be managed at the technical level, we enter into 'professional consulting'. 'Professional consulting is different from applied science in

occasionally requiring creativity, as well as the readiness to grapple with new and unexpected situations, and (most important) to bear the responsibility for their outcome' (Funtowicz and Ravetz, 1994: 3). Examples might include engineering judgements, expert witnesses and expert readings of data for specific practical contexts. However, when system uncertainties or decision stakes (or both) are high, we enter the realm of PNS.

[P]ostnormal science occurs when uncertainties are either of the epistemological or the ethical kind, or when decision stakes reflect conflicting purposes among stakeholders. We call it 'post-normal' to indicate that the puzzle-solving exercises of normal science (in the Kuhnian sense), which were so successfully extended from the laboratory of core science to the conquest of nature through applied science, are no longer appropriate for the solution of global environmental problems.

—Funtowicz and Ravetz, 1994: 4

Here, the conventional hierarchy of 'hard facts' over 'soft values' becomes inverted. They cite 'the actions that will need to be taken in preparation for mitigating the effects of sea-level rise consequent on global climate change' (ibid.) as a prime example. In this example, the four elements apply: (1) facts are uncertain; (2) there is a plurality of value systems involved; (3) stakes are high, and (4) decisions are urgent. Further fitness for purpose will need to be the priority in all actions, and productive debate will require that we reach beyond discrete disciplinary cultures, stakeholders, politicians and funders to include the 'extended peer communities': those affected at local levels.

Conclusion

In plotting the path of ways of knowing from Aristotle through to the Enlightenment, from positivism to paradigms and from postmodernism to the post-normal, we still have a prejudice against validating as knowledge all that could be said to sit within a *practice of techné*. You will see in the following chapter, *Problematising Practices of knowing*, that every item to be negotiated in the practice of working across disciplines has in common *ways of doing*

that will determine the qualities of knowledge that will be emergent, often despite the *objects* of knowledge involved. These *ways of doing* are at the centre of this book, offering an approach to *practice(s)* of knowledging towards a productive account of transdisciplinarity.

We are at a juncture where the assumption of rationalism as a touchstone of valid truth or foundation of technical design is no longer a luxury. Since the questions around authorship of the postmodern era became radicalised and evolved into a lack of regard for *facts*, emerging as the highly politicised *post-truth* era, concurrently with the advent of artificial intelligence going mainstream, it would be valuable to look behind and among the objects of knowledge and technical production and fully consider the *ways of doing* from which these objects emerge. Knowledge, technology and methodologies are emergent products of *ways of doing*.

Chapter III

ProblematISING Practices of Knowledgeing

You may recall that at the end of Chapter I, we determined that there are various definitions, characteristics and schools of thought around the developing concept of transdisciplinarity. We learned that the myriad of working definitions generally have in common a wish to address the various ways that knowledge categories can productively become more than the sum of their parts, towards a purpose that cannot solely be achieved by a 'home' discipline. They also have in common a hope for humanistic, dynamic, collaborative processes, and they all aim for the emergence of new, valuable and applicable knowledges.

In the last chapter, we plotted a path of knowledge from the age of antiquity through the birth of disciplines and the establishment of the standard account of science into Mode 2 knowledge production, Post-Normal Science and transdisciplinarity. We witnessed a throughline of the Aristotelian virtues *techne* and *episteme* sustaining their relative statuses, holding theory, understanding, and the object of knowledge over making, skill and ways of practice.

As a quick aside, it is important to acknowledge that the *episteme/techne* divide (discussed throughout Chapter II) that has permeated the ways we practice the acts of knowledgeing in Western culture is also mirrored to various extents in other cultures and languages:

In Latin, a distinction was made between *scientia* (knowing that) and *ars* (knowing how), while *sapientia* (derived from *sapere*, to know) meant wisdom, and *experientia* referred to knowledge derived from experience. In Arabic, *episteme* was translated as *ilm* (plural '*ulum*', 'the sciences', so that scholars used to be known as the '*ulema*')... In China, *zhi* meant knowledge in general, while *shixue* referred to knowhow. In German, a distinction has developed between *Erkenntnis* (knowledge from experience, formerly *Kundschaft*) and *Wissenschaft* (academic knowledge).

—Burke, 2016: 8

These distinctions influence aspects of current knowledge cultures that contribute to many of the challenges for transdisciplinary research that we will continue to discuss in this chapter. The final chapters in Part II will propose a practice that refines the processual dynamics of transdisciplinary research, shifting the emphasis of many of the current research frameworks. We will consider what would occur if, rather than approach working across disciplines as an understanding or coordination of multiple knowledge(s) of disciplinary processes, we instead work to capture the processes and practices of knowledge(s) and understanding(s) in the flow of a practice *of* knowledgeing: a *techne* of the *episteme* rather than the *episteme* of the *techne*.

We will explore what happens when we consider transdisciplinary practice not as a synthesis or unity of knowledge, which we will see is something that has to be perceived as an object, but rather as what happens if we allow the knowledges to remain dynamic in process as practice (resisting the object of narrative) with a different manner of capturing, measuring and witnessing, one deriving from the arts, drawing on both performance theory and a branch of cognitive science called enactivism.

Before entering into Part II, it is worth looking at how the transdisciplinary project has already taken us much of the way towards this new approach, setting the stage by successfully shaking up, quite radically, what we have even come to deem as knowledge and foreshadowing the implications of the expansion of the concept of knowledge. In the previous chapter, we plotted a linear path exploring how knowledge has changed throughout history. Here we will pull from across history, selecting modes of thinking that have

been harnessed to and continue to influence the development of the transdisciplinary project. To find the historical context of these ideas, the reader can follow the dates of the citations and return to the previous chapter to situate the ideas within the historical timeline. In this chapter, however, ideas, concepts and practices will be shared not as part of the unfolding of a history but as a non-linear layering, revealing the transdisciplinary landscape.

Problematising Designations of Knowledge

We ended the last chapter by looking at how Post-Normal Science recognises the types of challenges poised for transdisciplinary solutions: those that have high stakes and a high level of uncertainty, such as pressing environmental concerns and pandemics, and require something less contained than the types of knowledge conventionally gleaned from applied science. In such instances, closed and often slow knowledge systems, including ‘pure’, ‘core’, ‘investigator-driven’, and ‘basic’ science, will not suffice alone. In high-risk and high-stakes situations, when uncertainty cannot be managed at the technical level, it was observed that we enter into ‘professional consulting’, which often requires a modicum of creativity ‘as well as the readiness to grapple with new and unexpected situations, and (most important) to bear the responsibility for [the] outcome’ (Funtowicz and Ravetz, 1994: 3). Practitioners of this sort of knowledge might include engineers, expert witnesses, and expert readers of data for specific practical contexts. In such instances, Post-Normal Science inverts the conventional hierarchy of ‘hard facts’ over ‘soft values’ (see pages 69–73).

In the last chapter, we also introduced Mode 2 knowledge production (review pages 18, 67–69), which, in Chapter I, we saw firmly attached to the Zürich tradition of transdisciplinarity (see page 12). Mode 2 has in common with Post-Normal Science the requirement that all debate in a research project extend beyond conventional discrete disciplinary cultures, stakeholders, politicians and funders and, importantly, expand the circle to include the ‘extended peer communities’: those affected at local levels. For Mode 2, this means explicitly that we include ‘a wider, more temporary

and heterogeneous set of practitioners, collaborating on a problem defined in a specific and localised context' (Gibbons et al., 1997: 3).

What we see here is that in order to do rigorous and robust research, we now need to transcend the old perceived dissonances between the science/non-science knowledge cultures, because the world's pressing problems necessitate that we now include and manage and measure and evaluate and institute and communicate and record plural understandings of knowledge *in action* in a timely, organised, applicable manner. However, this might not be so completely new.

From the earliest cultures, humans have learned, tested, accumulated and shared knowledge across generations. Art, song, stories, dance, ritual and various forms of writing not only served to pass on knowledge, but created meaning, determined value and declared status. Healing, birthing practices, creation of dwellings, embalming practices, tools for hunting and preparing food, all required ways of generating, capturing, and communicating knowledge.

Mythology, religion, magic, as well as natural causes were often the framework within which this knowledge was cast and developed. Even though modern scientists tend to draw strict boundaries in relation to religion and mythology, historically, these boundaries were mostly 'blurry' for a long time. Even 'Western' conceptual differentiation between knowledge and belief is blurry, and these terms do not always translate easily.

—Kaiser and Gluckman, 2023: 7

The science of the last few centuries, which was fiercely defended against anything non-science, was, if you recall, born of the scientific revolution (1550–1750) and is, in the greater scope of things, really quite a recent phenomenon. One could argue that our complete blind faith in it as representing fact, truth and rigorous knowledge, good for humankind, sitting apart from and in a higher status than subjective, experiential, embodied, and processual knowledges, could be where we went wrong. This is **not** to say that science and its practices of rigour, measurement and application need to be 'contaminated', 'diluted' or 'threatened' in any way by the inclusion of other knowledge cultures within a research project. Traditional scientific methods are the best at what they are the best at; however,

the false dualism between science and non-science may not be useful anymore. It is not as if 'scientific' progress was always dependent on its fierce protection against any knowledge that does not fit within its purview.

We are still literally uncovering evidence, through the discovery of tools, drawings, tombs and buried dwellings, of the existence of prehistoric cultures that domesticated crops and animals, lived in permanent settlements, and had canoes and tools, dating as far back as the Stone Age. We have found evidence of written records and a sophisticated use of metals, with trading and commerce clearly involved, dating from the Bronze Age. Following prehistoric times, there was substantial progress within the great ancient cultures that was 'scientific' in nature (see boxout).

Early Knowledge Cultures

The early Mesopotamians had impressive chemical knowledge of clay and other materials, which gave them the technology for pottery. Geometry in ancient Egypt was a tool to measure and reinstate land property after floodings of the Nile. Sometime between the first and fourth century, the Hindu–Arabic numeral system was introduced, including the base of zero. It travelled and was much later introduced in Europe via the Mesopotamic and especially the Islamic world. The influence of the Islamic world on the eventual growth of mathematical knowledge can hardly be overstated: algebra, trigonometry and mathematical improvements of (geocentric) astronomy were some of the contributions that set the scene for modern mathematics.

—Kaiser and Gluckman, 2023: 8

We are, of course, living in very different times. The knowledges developed in early cultures tended to be more localised than ours today, and the technologies were, for the most part, a little more transparent in scope and speed of acquisition. We have had different guises of science, arts, craft, and philosophies for centuries. Within the context of globalisation, technological advancements, world poverty, and the effects of climate change, the transdisciplinarity project is, among other things, a radical dedication to expanding what we consider valuable knowledge in the practice of dealing with today's complex issues.

Because transdisciplinary research crosses knowledge cultures that move between belief systems across conventional science

models, the humanities and the arts, it will be crucial to traverse various languages and skill sets and consider different modes of evaluation, models of rigour and systems of application and activation. To this purpose, the proposed practice in Part II will expand on the notion of knowledgeing introduced in Chapter II to make visible the ways knowledge within disciplines *does* things as a primary space in which integrative practices might occur.

There have been many contributions attempting to reconfigure the ways we think and value types of knowledge. In Chapter II, we learned of postmodernism, paradigms, consilience, Mode 2 and Post-Normal Science, and we will, in the *Intermezzo*, speak about systems, holographs, rhizomes, and middle fields. But first, some thinking around knowledge categories to help lay the groundwork.

For transdisciplinarity to work, one must be able to think and do across knowledge cultures. In Chapter II, we spoke about the various *turns* as interdisciplinary discourses which propose specific critical framings, practices and theories around subject areas. To recap, turns are interdisciplinary in nature, as most effective turns take journeys from their home disciplines, are adopted and critiqued across other disciplines and often return to the home discipline, altered (see pages 64–65).

Communicative Action

The initiator of what might be called the *communicative turn*, aligned with the *linguistic turn*, was Jürgen Habermas. The importance of his work cannot be overlooked in its influence on moving us towards notions of communicating across knowledge platforms. Habermas was a fervent critic of the importance that science holds in society and advocated for a different approach to considering what rational knowledge might be. His publications, *The Theory of Communicative Action* (1984) and *Philosophical Discourse of Modernity* (1987), catalysed changes in scientific thinking. ‘Habermas’s thesis of ‘uncoupling’ system and life-worlds, and his thesis on the colonisation of life-world...allow us to look at the differences between steering problems (disciplinary methods) and problems of mutual understanding (interdisciplinary and multidisciplinary methods)’ (Du Plessis et al., 2014: 33).

His work has provoked criticism around perceived ideals of a utopian social epistemology void of deeper considerations of ‘the patently biased and otherwise limited nature of participants’ avoiding changes within the systems of knowledge towards a ‘transcendental appeal to the nature of good society’ (Fuller, 2002: xix). To consider these valid concerns, the next section, on values and power, will address issues aligned with this perspective (see pages 90–96).

However, in relation to Habermas’ wish to shake up society’s reliance on scientific rational knowledge, he proposed the inclusion of different types of knowledge and the opening up of fragmented disciplinary thinking to the understanding of complex realities and more authentic communication. Després et al., writing on transdisciplinarity and intersubjectivity, drawing from Habermas, locate three types of knowledge to *include* with scientific knowledge.

Instrumental Knowledge refers to pragmatic knowledge, the knowledge of how to go about things. Experienced professionals, technicians or workers are generally the main channel for this knowledge.

Ethical Knowledge corresponds to customs, beliefs, values and past experiences which bring people to determine what is wrong and what is right on a specific issue. Citizens, elected officials are key sources for this type of knowledge.

Aesthetic Knowledge comprises images, and refers to aesthetic experiences, tastes, preferences and feelings that help define what is beautiful and what is ugly.

—Depres et al., 2004: 476

One can see how this aligns with the inclusion of the extended peer communities previously mentioned as part of the Mode 2 and Post-Normal Science structures. It also opens the way for considering the notion of the ‘expert’. ‘Although experts can express their ethical and aesthetic position, non-experts are as skillful to do the same because they too experience everyday life in ethical and aesthetic ways’ (ibid.: 477). Habermas’s communicative action crucially posits the idea that ‘actors in society seek to reach common understanding and to coordinate actions by reasoned argument, consensus, and cooperation rather than strategic action strictly in pursuit of their own goals’ (Habermas in Bolton, 2005: 1).

As much as Habermas' work helped reconsider exchanges between knowledge cultures and moved us in a direction of wider inclusivity in interdisciplinary exchanges across the sciences and other areas of knowledge, it leaves us with lots of questions about how we *do* the work of exchanging, coordination, and collaboration in the *act of practising* transdisciplinary inquiries. Prioritising the *way* of doing will be central to the final chapter of this book, as we introduce the critical framework of the active aesthetic to interrogate the practice of knowledge across disciplinary boundaries. It offers an approach for expressing the processes of *generating* knowledge in the *act* of practice.

Forms of Knowledge

Within the transdisciplinary project, there have been multiple approaches to creating categories and forms of knowledge in the service of better exchanges between disciplinary thinking and doing. Most of these approaches work to traverse disciplinary distinctions, break down the perceived walls around science, set up dynamic relationships between knowledges in the service of engaging in challenges or solving problems, incorporate an active inclusion of various actors and participants (i.e., local, indigenous, stakeholders and policy makers in addition to academics), manage power dynamics, open the way for mutual learning across different ways of being, and offer translational modes of communication, valuing, and practising knowledge(s) while holding space for practically and intellectually managing and contextualising possible emergent new knowledges. It is a big ask.

Qualities of thinking and doing are considered as a part of this challenge, especially with regard to different modes of inquiry within disciplinary cultures across the sciences, humanities and arts. 'Different qualities of thought may be distinguished in the complementarity between *intuitive* and *analytic* modes. For mutual interchange between theory and practice, though, both types of thought are considered opposite. Intuition is not regarded as inferior or superior to analysis, but considered as a complementary approach' (Scholz and Marks, 2001: 243).

In a few pages, we will address perceived dissonances between theory and practice through a set of knowledge categories not so

commonly adopted within the transdisciplinary project. However, the necessity to include both *intuitive* and *analytic* modes is recognised as imperative to fostering innovation and, as discussed in relation to Mode 2 and Post-Normal Science, also towards socially robust knowledge.

In Christian Pohl and Gertrude Hirsch Hadorn's *Principles for Designing Transdisciplinary Research* (2007), they distinguish between three forms of knowledge (see Figure 10). Julie Thompson Klein summarises:

Systems Knowledge confronts the challenge of how to deal with uncertainties that result from transferring abstract insights to a concrete case with specific conditions. Uncertainties also result from lack of empirical or theoretical knowledge about a problem, and depending on interpretation of a given problem, particular elements may be assigned different degrees of importance and thereby lead to diverging assessments of the need for action as well as target knowledge and transformation knowledge.

Target Knowledge addresses what the multiplicity of social goals for research means for practice-related problems, and for collaboration between science and stakeholders in society. Positions must be clarified and prioritized in the research process according to significance for developing knowledge and practices that promote the common good.

Transformation Knowledge takes established technologies, regulations, practices and power relations into consideration. In order to be effective, options for change have to rely on existing infrastructure, current laws, and current power relations and cultural preferences.

—Klein, 2013: 195

What is perhaps most interesting about these categories is the 'challenges' articulated in each box (see Figure 10). 'Learning', 'clarifying', 'prioritising', 'reflecting', and 'dealing' with uncertainties are all *practices* of knowledge making. It is in the *ways* we *do* these *practices* that the qualities of the knowledge are determined. It is the *act* of doing these practices that constitutes the *act* of knowledging.

Next, leaning into the idea of the *practice* of knowledge as acts of knowledging, it is worth looking at a critical methodology designed especially for rigorous practice-based research, offering a different way of looking at knowledge categories.

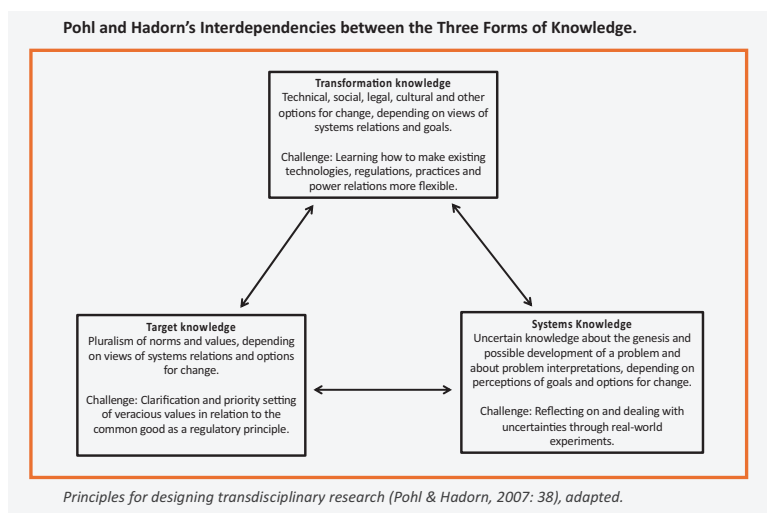


Figure 10

Practice as Research

Practice as Research is a critical methodology often neglected in the literature on transdisciplinarity. It is used widely across artistic and performance research, in part to assure rigour. Part of the overlooking of its epistemological possibilities for the practice of transdisciplinary research may be in ongoing misunderstandings about what knowledge production from the fields of the arts even is. Like Wilson in his discussion on consilience (see pages 61–64), many see the arts as interpretive *objects*, with the artist somehow biologically imbued with a magical talent. Recalling Chapter II, Wilson states that ‘...the exclusive role of the arts is the transmission of the intricate details of human experience by artifice to intensify aesthetic and emotional response’ (Wilson, 1999: 238), and further, ‘The arts are eternally discursive. They seek maximum effect with novel imagery. And imagery that burns itself into the memory, so that when recalled it retains some of its original impact’ (ibid.: 242)... ‘Art is magic’ (ibid.: 298). ‘Works of art communicate feeling directly from mind to mind, with no intent to explain why the impact occurs. In this defining quality, the arts are the antithesis of science’ (ibid.: 238). All of this is difficult. Such characterisations of the arts

are manifold in conversations about working across the arts and sciences, and they invariably come from people who may patronise the arts but are **not** practising artists themselves (for more on the arts and their ‘seriousness problem’, see pages 137–153).

Where Practice as Research is particularly helpful is for those aspects of the arts that can be said to be pre-hermeneutic: the acts of the *practices* of making, training, and creating, the *embodiments* of practice rather than the emergent *objects* of the practice, with meaning, metaphor, and depiction often attached to them as values of interpretation or experience. Why is this useful for all transdisciplinary work is that knowledge does not reside in a discipline as an object. It is dynamic and processual. It is in flow as an act of knowing—in practice. To explore across disciplines is not to reconcile *objects* of knowledge but to interrogate and collaborate through the *acts* of knowing while making connections across *ways of doing*. One could even argue that science, too, is an embodied practice. If we considered it as such, what might we learn and how might we capture data differently? The entirety of Part II sets us up for an approach to transdisciplinary research that activates exactly this question. For those wishing to explore practice as/-based/-led/ and research methodologies further, there are multiple sources that tend to lie outside of the current transdisciplinary discourse.

One can begin to trace the evolution of the research project ‘Practice—(as/based/led/and)—Research’ in the arts by looking at the working papers and documents published on the websites of PARIP (Practice as Research in Performance) and PALATINE (Performing Arts Learning and Teaching Innovation Network), as well as in the influential works of key advocates such as Smith and Dean (2009), Barrett and Bolt (2010), Biggs and Karlsson (2010), Kershaw and Nicholson (2011) and Nelson (2013, 2022). These scholars have been pivotal in championing research in the arts, bringing artistic practitioners into the sphere of rigorous academic inquiry. Through case studies drawn from studio-based practices, applied work, and intermedial performance, they have elaborated on methodologies, theoretical frameworks, and ways of framing processual outcomes. Their work offers both guidance and concrete examples on approaches to archiving and documenting for the practitioner-researcher, while also showing how research can actively and productively shape creative practice.

Robin Nelson, a widely cited champion of Practice as Research and author of *Practice as Research in the Arts: Principles, Protocols, Pedagogies, Resistances* (2013), offers another way of categorising knowledge that helps define the notion of *praxis*. Nelson interrogates issues to do with what knowledge is and how it is expressed across disciplines. Committed to ‘creative cross overs in an interconnected academy’ that includes arts research that ‘demonstrates a rigour equivalent to that of the sciences’, he argues for a ‘both-and’ type of epistemological space which includes “a more fluid ‘knowing’... which might be located on the spectrum between types of knowledge rather than on the reverse side of an impervious ‘knowledge/not knowledge binary’” (Nelson, 2013: 23/39).

He offers a way of considering ‘modes of knowing’ as a ‘multi-mode epistemological model’ for Practice as Research (2013: 37), triangulating a conceptual relationship between three categories:

- know-how (‘Insider’ close-up knowing)
- know-what (The tacit made explicit through critical reflection)
- know-that (‘Outsider’ distant knowledge)

At the centre of these is *Arts Praxis*, operating as a dynamic for the practitioner/researcher working within the current institutional, funding and scholarly paradigms. This is an interesting way to negotiate the episteme/techne tensions that we traced in Chapter II.

What is provided in this model is a triangle of knowing, illuminating a dialogical relationship among ‘doing-reflecting-reading-articulating-doing’ towards ‘praxis’, which he defines as ‘theory imbricated within practice’ (Nelson, 2013: 32–33). It also advocates for a recognition that knowledge can be situated in *acts of practice* and, as I will argue in the final chapter, for us to really harness and capture knowledges, especially across knowledge cultures, all knowledge *must* be revealed and mobilised as *acts of practice* in order to allow for optimal transdisciplinary exchanges.

As we begin to consider all research as practice and all knowledge as *acts of knowledgeing*, Habermas, Nelson, Pohl, and Hirsch Hadorn together supply knowledge categories that help expand what we consider as knowledge across the sciences, technology, humanities and the arts, inclusive of extended peer communities, stakeholders, and policy makers towards a more productive account of transdisciplinarity.

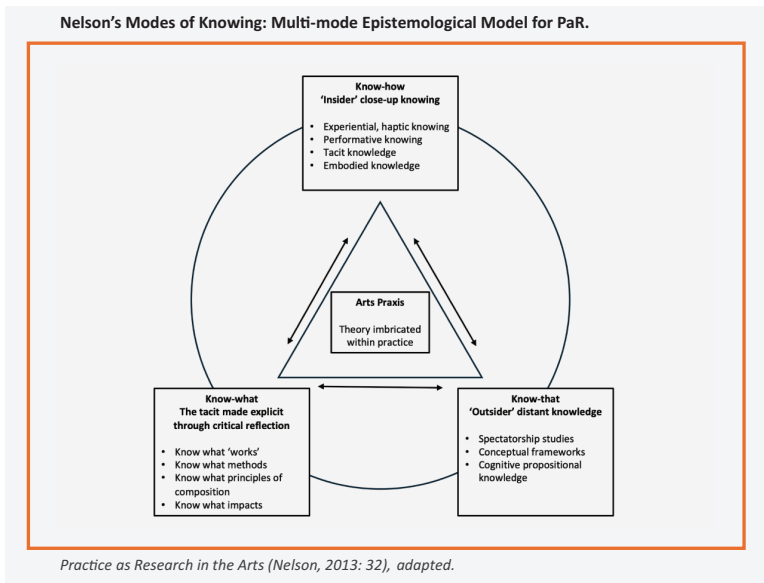


Figure 11

Problematising Values

In the previous chapter, we saw how the ‘standard account of science’, with its hold on society as the authoritative account of knowledge, was slowly questioned for its status as purely objective, transcending any contamination of a subjective empirical truth. We saw this through the interrogation of authority by the postmodernists (see pages 50–51), with the recognition of the shifting nature of these truths as ‘framed’ through Kuhn’s paradigms (see pages 53–56), and in the growing view that science is just another socially constructed critical framework—this last one fought out quite scrappily in the Science Wars (see pages 56–61).

At the centre of all these movements, what might be most important is how this tension plays out in relation to values and power. This is where the subject area of the *Philosophy of Science* becomes particularly helpful. Helen E. Longino sets up another approach to the discussion with regard to the nature of values in science:

I want to urge that philosophy of science include attention to the roles that values, interests, and relationships in the social and cultural context of science play in scientific judgement as well as attention to the impacts of science and science-based technologies on society. I am of the view, however, that in principle there is no way of guaranteeing the eliminability of such values from science. We should stop asking whether social values play a role in science and instead ask which values and whose values play a role and how.

—Longino, 2004: 127

Here we begin to align with the notion of knowledging in the former chapter while at the same time priming the ground for the introduction of the critical methodology of the active aesthetic in the next by way of thinking more about how the sciences (and all disciplines for that matter), in the actual *act of doing* them as *practice*, reveal, among other things, a web of complex connections and interactions among aspects of objectivity and values.

There is no denying that objectivity has been a defining attribute of science, placing it firmly in the episteme category and apart from disciplines in the *techne* more aligned with the heuristic and embodied practices. The ‘objectivity’ has been a defining badge of honour:

It expresses the idea that scientific claims, methods, results—and scientists themselves—are not, or should not be, influenced by particular perspectives, value judgments, community bias or personal interests, to name a few relevant factors. Objectivity is often considered to be an ideal for scientific inquiry, a good reason for valuing scientific knowledge, and the basis of the authority of science in society.

—Reiss and Sprenger, 2014

However, as long as the role of human experience and perspective is involved in the act of *doing* science (and again, all disciplines for that matter), it is inevitable that values and power will come into play. One might even say that objectivity *is* a value, and, like many values, in actual practice lives on a sliding scale. ‘To call a thing objective implies that it has a certain degree of importance to us and that we approve of it. Objectivity comes in degrees. Claims, methods and results can be more or less objective, and, other things being equal, the more objective, the better’ (ibid.).

Objectivity is terribly important to the processes and rigours of research and practice. However, a robust practice of witnessing the sliding scales which operate as part of what the self as practitioner brings to the process—the biases of the disciplinary cultures, the nature of the issues/problems being tackled, and the wider implications of the work on the surrounding cultures and communities—would be a *practice* of recognising inevitable subjective experience in the *act* of knowing in order to develop more objective results. This is one of the ways in which the critical framework of the active aesthetic will be brought to bear in the final chapter.

We see here that objectivity and values become inextricably linked. There is both the hope for neutrality in science and our wish to accept theories as ‘impartial and not a matter of wishful thinking’ (Longino, 2004: 128). Longino discusses the implications of considering science in terms of being *value-neutral* and examines the perceived virtue of science as being *value-free* in the first instance.

In a culture where so much rests on the sciences we fear that certain kinds of values will lead to acceptance of representations of the natural and social worlds in theories, hypotheses, and models that favor the interests of certain members of or (sic) groups in society over those of others.

—Ibid.

She goes further to connect this to the idea of an ‘ideal of universality’. This, of course, brings us back to the previously discussed ideas around the wish for unified truth, theories of everything, God particles and the like. In this instance the yearning is in the direction of integration: ‘what counts as a scientific truth of scientifically supported claim for one person or community should count as such for any other, no matter how different their cultural values’ (Longino, 2004: 128).

As this book is being written in 2025, I am grateful that we don’t need to list all the examples of how this idea has gone terribly wrong for so many. We, of course, know that this is where things break down, and where the supposed authority of any one set of

disciplinary *values* must never hold for all people, all cultures, all locations, across all challenges. There is a keen acknowledgement that we need science AND other modes of knowledge to work together, which is why this book and others in the same field even exist. No discipline can be value-neutral or devoid of its sliding scales of subjectivity and/or objectivity, because the agents of practice are either human or programmed by humans, working in human contexts for and among challenges that pertain to humanity. We are messy. Gloriously complex. And we **can** do this.

Problematizing Power

One cannot enter into a discussion about the relationship between knowledge and power without acknowledging the philosophical contributions of Michel Foucault. Directly opposed to quests for ‘synthesis’ such as those mentioned in the last section, he worked to expose their power dynamics through the production of an *Archaeology of Knowledge*. His observations revealed ‘the systems of thought that remain unconscious to scientists, scholars, and other people but still succeed in framing and limiting what they do’ (Moran, 2010: 121). Interdisciplinarity was inherent in his interrogations of power assumptions. He observed that, through disciplinarity, ‘knowledge closed in upon itself’ when we began to divide up and create ‘hierarchical relationships between teachers and students and systems and timetables and examinations, producing a surveillance that makes it possible to qualify, to classify and to punish’ (ibid.).

Foucault and Discipline

Michel Foucault has famously interpreted ‘discipline’ as a violent political force and practice that is brought to bear on individuals for producing ‘docile bodies’ and minds. In this process of disciplining for the general purpose of economic exploitation and political subjugation the ‘disciplines’ do not remain external to the subject, but become increasingly internalised. Although Foucault uses the term ‘discipline’ in a

very general and also fairly specific sense, it clearly includes the academic disciplines and their contributions to bringing about 'discipline' in society. The disciplined individual accepts the external rationality and values as one's own, which means open repression is no longer needed. For Foucault disciplining is thus a process aimed at limiting the freedom of individuals and as a way of constraining discourses. Disciplines then have to be considered to be considerable barriers to free thinking and an obstacle to more self-governed subjectivation, which became the focus of Foucault's later work.

—Krishnan, 2009: 9

Negotiating the dynamics of power is central to the entire process of the practice of transdisciplinary research, largely because the different cultures, languages, skillsets and contexts have different determinations around what matters and what is valued. As we have seen in previous chapters, implicit in the many definitions of transdisciplinarity is an interchange and collaboration in the co-production of knowledge(s) among policy makers, stakeholders, researchers and indigenous communities, each with their own perspectives, knowledges and experiences, and often coming to the work with different aims, practices and terminologies. Further, this often occurs without a set understanding of how outcomes may be recorded, attained, and/or applied. Again—it is a lot!

One strategy to 'flatten hierarchies of power' is the implementation of 'a neutral space that permits both formal and informal interactions for building trust, and for open and frank conversations between local community representatives, expert scientists and policy makers' (Kareem et al., 2022: 141). You may recall Nowotny's mention of the *agora* on (see pages 68–69, 125–126) as an inclusive gathering place that holds a space between practice and research; however, even in such a metaphorical and physical space, dynamics of power still operate.

Dealing with power dynamics will always be a movable feast, and it is likely that productive research can never come, and perhaps never should come from a place that is completely value-free and non-biased; however, Livia Fritz and Franziska Meinherz, guided by social theories of power, offer an approach that makes it possible to trace power throughout transdisciplinary processes.

Their ‘multidimensional analysis’ draws on and coordinates multiple theories of *power over*, *power to* and *power with* (Allen, 1998; Arendt, 1970; Foucault, 1997; Haugaard, 2012; Partzsch, 2015). ‘Combining them in one approach emphasises the fact that consensual forms of power or empowerment at the local scale are not free of macro-societal power over mechanisms, which shape individual actors’ ability to articulate themselves and lead to the marginalisation of certain groups, discourses or knowledge within a community’ (Fritz and Meinherz, 2020: 46).

Power over takes its cue from Foucault’s determination that knowledge, politics and power are mutually interdependent, and in bringing each other forth constitute a *power over*. It is sometimes hidden, as in within invitations or exclusion from moments of decision-making, participation, and/or access to resources. Sometimes, power is wielded by making things overcomplicated to access. On the other side, *power over* may frame contributions and offers from one with less power as over-complicated and in the margins. Many of us have been there and done the following: in order to become someone who has access to resources or be afforded a place at the table, we might start to take on the languages and behaviours of those who do in order to be included. *Power over* in this way presents a mode of manipulation. It can be wielded over structures and discourses in addition to over individual and collective actors.

Frits and Meinherz’s applications of *power with* and *power to* serve to act as disrupters to the dynamics of *power over*. Their derivations of these, as mentioned, are constructed from various sources.

Disrupters to Power

Power to

The notion of power to captures the individual actors’ capacity to form and shape processes despite resistance (Haugaard, 2012), and is roughly synonymous with empowerment (Allen, 1998). Allen (1998: 34f) defines power to as ‘the ability of an individual actor to attain an end’. Resistance is one possible manifestation of power to, just as domination is a manifestation of power over (Allen, 1998). The emphasis in this form of power lies on the individuals’ agency and their capacity to achieve their goals.

Power with

In power with, power appears as the capacity to collectively learn and act. Finding commonalities and developing collective strength are the core of power with. The notion refers to learning processes and the development of a new group or community consciousness (Partzsch, 2015). Power with is associated with Arendt's (1970: 44) view on power being 'the human ability not just to act but to act in concert'. Following this interpretation, Allen (1998: 35) defines power with as 'the ability of a collectivity to act together for the attainment of a common or shared end'. The emphasis in this form of power lies on the productive forces of power (Partzsch, 2015).

—Fritz and Meinherz, 2020: 45 (*adapted*)

Fritz and Meinherz's Empirical Questions for Multidimensional Analysis of Power in Transdisciplinary Sustainability Research.

FORM OF POWER	EMPIRICAL QUESTIONS	MAIN PROCESS PHASE
POWER OVER...		
...is wielded over actors, structures and discourses	Which actors from research and/or practice define the problem to be assessed, the sustainability approach adopted and the research design?	development phase
...is the capacity to overtly influence the decisions and action of others (first face)	Which actors from research and/or practice decide who is or is not invited to participate and set the terms and conditions for how participants in the TD process interact? Which criteria, norms or discourses orient these decisions?	development phase
...is the capacity to set the agenda and covertly influence decisions (second face)	How are the resources required to participate in the TD process and influence decisions/processes/outputs distributed among actors from research and/or practice?	all phases
...is the capacity to shape ideas, norms and intentions (third face)	For which tasks and in which situations throughout the TD process do researchers depend on practitioners and vice versa?	all phases
	In which ways do the funding conditions and other structural factors influence the set-up and evolution of the TD process?	all phases
...is the social constructedness of subjectivity in social and historical processes (fourth face)	In which ways does the process set-up influence the capacity of actors from research and/or practice to voice their concerns and contribute their expertise?	knowledge production phase
	In which ways do epistemological values and norms of what characterises valid knowledge and appropriate science-society relations shape the boundaries of participation in the TD process?	knowledge production phase
	To what extent does the TD process and the results it produces question established discourses, institutions and practices?	dissemination phase
POWER TO...		
...is the individual capacity to act	Which individual actors involved in the TD process achieve their goals?	all phases
	In which situations are actors from research and/or practice opposed to decisions or actions by other actors involved in the TD process?	all phases
	How does the TD process enhance the capacities of actors from research and/or practice to achieve their goals?	all phases
POWER WITH...		
...is the capacity to collectively learn and act	What new project goals and understanding of problems emerge in the TD process?	development phase
	Which new collectives, discourses or practices emerge through the TD process?	knowledge production/ dissemination phase
	How do actors from research and/or practice build bridges across different knowledge areas and collectively learn from the TD process?	all phases

Tracing power in transdisciplinary sustainability research (Fritz and Meinherz, 2020: 47), *adapted*.

Figure 12

They break the processes of transdisciplinary research into three useful categories: (1) Development phase: Designing the project and framing the research problem; (2) Knowledge production phase: Co-producing knowledge; (3) Dissemination phase: Bringing results to fruition (Fritz and Meinherz, 2020). Figure 12 lays out their empirical questions for multidimensional analysis of power in transdisciplinary research. Their particular area of research is sustainability; however, the information included is transferable to most transdisciplinary projects.

Examples of Manifestations of Power. The examples are taken from transdisciplinary case studies. For each power manifestation, the mechanism by which researchers (R), practitioners (P), or funding bodies (F) exercise power are identified.

	FORM	MANIFESTATION OF POWER	ACTOR	MECHANISM
DEVELOPMENT PHASE	power over	funding conditions shaped the design of the project and allocation of resources	F	resource allocation
		researchers determined formats, timing, agenda of interactions and selected participants	R	planning + agenda setting
		practitioners influenced the definition of the research problem and question	P	planning + agenda setting
		only researchers received funding, providing them the means to shape the process	R, F	resource allocation
	power to	taking project decisions, researchers “freed” from funding structures	R	planning + agenda setting
		researchers were legitimised by funding body to approach practitioners	R	empowerment
	power with	trust built as basis for further collaboration	R, P	trust building
		joint initiation of project based on previous collaboration	R, P	joint action
DEVELOPMENT PHASE	power over	researchers determined methods used for TD activities and knowledge integration	R	planning + agenda setting
		unequal distribution of resources reduced practitioners’ capacity to actively shape the process	R	resource allocation, knowledge constellation
		practitioners granted researchers access to the field; researchers depended on the support of practitioners	P	actor composition
		hierarchies outside TD process were transferred into the TD space and distorted group dynamics	P	actor composition
	power to	empowerment of practitioners through awareness raised	P	learning processes
		solutions developed legitimised researchers as experts in the field co-production of results, co-creation of management/action plans, visions, scenarios	R, P	empowerment joint action
	power with	practitioners developed capacities to act jointly despite different standpoints	R	joint action
		researchers determined methods used for TD activities and knowledge integration	R	planning + agenda setting
DISSEMINATION PHASE	power over	knowledge compilation by researchers only	R	agenda setting
		funding body and practitioners shaped dissemination and publication requirements	F, P	agenda setting
	power to	enhanced capacities to act on the basis of process results	P	empowerment
		researchers were endorsed by practitioners as valuable partners	R	trust building
	power with	co-validation of results	R, P	joint action
		joint development of follow-up projects	R, P	joint action
		development of networks and partnerships	R, P	trust building
		implementation of findings, acting upon the knowledge co-produced	P	joint action

Tracing power in transdisciplinary sustainability research (Fritz and Meinherz, 2020: 48), adapted.

Figure 13

Fritz and Meinherz put the questions in Figure 12 to seven transdisciplinary researchers in a workshop setting. The participants were asked to reflect on a project that they were closely involved in. 'Based on these real world situations in which power unfolded, the framework's analytical categories were refined, and mechanisms and sources of power were derived' (Fritz and Meinherz, 2020: 42). Figure 13 shows the collective observations to do with power dynamics within the various stages of a transdisciplinary research project.

It becomes clear in this study that there are very transparent and conscious ways that one can practice a disturbance to some of the embedded *power over* dynamics. This will not happen as an overarching wish, but rather as a *practice* systematically enacted within the various stages of the project. Witnessing one's own *power over* others can be a blind spot of privilege. Learning how it operates is helpful in making it visible. We will explore another method of making invisible processes (including power) visible in the final chapter through the Integrative Performance Practice. Fritz and Meinherz's work, specifically in the area of power dynamics in relation to co-creating knowledge, is an effective complementary approach to begin to reveal to ourselves as practitioners that there are, indeed, embedded systems of power even in the best-intentioned practice/research communities.

We will learn in Part II that confronting and harnessing 'power' begins with the self as practitioner/researcher, especially as the dynamics of power are shifting so radically in a world that is increasingly chaotic. Henry Timms and Jeremy Heiman, working to grasp the nature of power in our rapidly changing world, published a book, *New Power: Why Outsiders Are Winning, Institutions Are Failing, and How the Rest of Us Can Keep Up in the Age of Mass Participation*, 2018. They break power into two categories, New Power and Old Power. For them:

Old power works like a currency. It is held by few. Once gained, it is jealously guarded, and the powerful have a substantial store of it to spend. It is closed, inaccessible, and leader-driven. It downloads, and it captures.

New power operates differently, like a current. It is made by many. It is open, participatory, and peer-driven. It uploads, and it distributes. Like water or electricity, it's most forceful when it surges. The goal with new power is not to hoard it but to channel it.

—Heiman and Timms, 2018: 2

What is most telling in their study around different types of power and how these operate in today's 'hyperconnected world' with its rapidly developing technology is the recognition that we as humans are shifting and changing in our expectations, behaviours and values as the nature of power evolves. They explain this as a 'tale of two mindsets' doing 'battle in today's world' (ibid.: 18). In many ways, the transdisciplinary practitioner/researcher needs to work between both mindsets. We also need to have a heightened awareness of how we ourselves negotiate power as we activate our inquiries within the frameworks of our disciplines and while crossing into others.

Problematizing Problems

From the previous section, we see that power determines the quality and directions of pretty much everything, from the management of resources to energy and education, policy and politics; all of these determine the challenges and problems that we choose to attend to. We have discussed the history of knowledge and how it has come to require an adjustment to linear thinking/cause-and-effect approaches, as problems are now more often than not complex, requiring a greater degree of reflexivity and hybridity. We have discussed the value of extending what is considered knowledge beyond the empirical towards the heuristic, embodied and tacit, and the origins of a bias against these in the antiquated *techné/epistémè* divide. We have come to reason that transparency and intercommunication are going to be important in engaging in challenges within the global environment, where one action can affect many with exponential knock-on effects, effects not able to be determined or measured by a single discipline. We are likely going to have to reconsider our organising of knowledge practices (or ways of knowledgeing) around more heterogeneous and complex domains, shifting the ways we think about education, technology, and the organisation of knowledge away from discrete subject areas

and concentrated disciplines. If the recent global pandemic taught us anything, it taught us that uncertainty and urgency are likely to be our constant companions in a future of research engaging with more complex challenges. The world has shifted.

Before somewhere around the 1950s, our Earth was considered to be in what scientists called the Holocene epoch. It represented approximately 12,000 years of relatively stable climate following the last Ice Age. It was during the Holocene epoch that human civilisation developed. Most scientists now agree that we have entered a new epoch, that of the Anthropocene, and it's on us. Humanity's impact on our Earth has been profound.

The new epoch... was likely to be defined by the radioactive elements dispersed across the planet by nuclear bomb tests, although an array of other signals, including plastic pollution, soot from power stations, concrete, and even the bones left by the global proliferation of the domestic chicken were now under consideration.

—Carrington, 2016

Evidence of the Anthropocene includes extinction rates of animals and plants, increased levels of climate change exacerbated by increases in fossil-fuel burning, plastic in our waterways and our own bodies, and increased amounts of nitrogen and phosphorus in our soils (ibid.).

It is in this epoch where transdisciplinary approaches to the world's challenges are going to be crucial. It is also clear that the problems that have arisen as a result of our linear and tunnel-vision applications of scientific progress are going to need more sophisticated approaches to unravel and recalibrate towards sustainable ways of living on this planet.

We have already discussed the paradigms Mode 2 and Post-Normal Science (see Chapter II), which offer ways to begin to think about these challenges. Here, we look at Horst Rittel and Melvin Weber's term 'wicked problem'. They offered a way of defining certain types of complex problems in their 1973 paper *Dilemmas in a General Theory of Planning*, published by *Policy Sciences*. It remains the journal's most highly cited and downloaded paper (Crowley and Head, 2017: 540), and despite years of scrutiny and critique (see Lönngren and Van Poeck, 2021), the term 'wicked problem' elicits an enduring commitment, especially within the Zürich tradition of

transdisciplinary scholarship, largely due to the fact that problem-solving is central to their very definition of transdisciplinarity (see Chapter I).

The evocation of the term ‘wicked’ is not about morality; it is rather more in line with the notion of malignancy, as in: wicked problems are more tricky than benign problems. For instance, problems lacking clarity in both aims and solutions, that elude clear logic or even coherent articulation and are subject to risky outcomes, no matter which way things play out, are of the wicked variety. In distinguishing a category dedicated to such problems, Rittel and Weber sought to ‘reject both a systems-based, rational-scientific, grand theory of planning’ and the ‘classical paradigm of science and engineering’ as a basis for framing ‘social science’ and ‘modern professionalism’ (Crowley and Head, 2017: 542).

Some problems that require critical thinking and the consideration of soft data and human experience in order to even craft language and methods, and often draw from multiple methodologies to articulate their challenges, fall into the categories of wicked problems. Challenges related to global poverty, climate change, public health, equality, sustainability, or agriculture might fall into this category.

Key Characteristics of Wicked Problems

- (1) They do not have a definitive formulation.
- (2) They do not have a ‘stopping rule’. In other words, these problems lack an inherent logic that signals when they are solved.
- (3) Their solutions are not true or false, only good or bad.
- (4) There is no way to test the solution to a wicked problem.
- (5) They cannot be studied through trial and error. Their solutions are irreversible so, as Rittel and Webber put it, ‘every trial counts’.
- (6) There is no end to the number of solutions or approaches to a wicked problem.
- (7) All wicked problems are essentially unique.
- (8) Wicked problems can always be described as the symptom of other problems.
- (9) The way a wicked problem is described determines its possible solutions.

(10) Planners, that is those who present solutions to these problems, have no right to be wrong. Unlike mathematicians, 'planners are liable for the consequences of the solutions they generate; the effects can matter a great deal to the people who are touched by those actions.'

(Rittel and Webber, 1973: 4(2), 155–169)

In dealing with wicked problems (or even complex problems that do not fit into the wicked category), especially while working with high-risk and urgent issues, research practices might require an embrace of *failure* and *not knowing* that has traditionally been resisted within the conventions of fact-based empirical science. The subject area called the *history of science*, coupled with critical thinking from sociology, helps us to explore some of the ramifications of this.

Problematising Non-knowledge, Ignorance, and Failure

In Karin Knorr Cetina's 1999 book *Epistemic Cultures: How the Sciences Make Knowledge*, she questions the notion of a unity of science by considering scientific practices as not only simply the methods and tools of the work but as *epistemic cultures*, referring to 'the aggregate patterns and dynamics that are on display in expert practice and that vary in different settings of expertise' (Knorr Cetina, 1999: 8). For her, culture 'foregrounds the machineries of knowing composed of practices' (ibid.: 9). Cultures might include types of reasoning, modes of evidencing and articulating, and dynamics between theory, inquiry and practice(s). Importantly, even within the sciences, cultures are varied and diverse.

Böschen et al. draw from Knorr Cetina's contrasting examples to compare scientific cultures of *non-knowledge*:

High energy physics is described as being engaged in the production of "negative knowledge" that specifies the evidential limits of the produced data: "Negative knowledge is not non-knowledge, but knowledge of the limits of knowing, of the mistakes we make in trying to know, of the things that interfere with our knowing, of what we are not interested in and do not really want to know.

Molecular biologists, however, “in the face of open problems” adopt “a strategy of blind variation combined with a reliance on natural selection. They vary the procedure that produced the problem, and let something like its fitness—its success in yielding effective results—decide the fate of the experimental reaction.” In short, molecular biologists’ “blind variation” is based on an ongoing reorganization of the experimental settings until they “work.” In most cases, explanations of the initial experimental failure are not sought.

—Knorr-Cetina, 1999: 91 and Böschén et al., 2010: 788

In short, knowing and nonknowing play different roles in different cultures of scientific practice. Other examples might include quantum theory, which explores things and moves on, bouncing off discoveries that we cannot even prove yet, while the practice of medicine generally explores and evidences more concretely before implementing new actions built on discovery. However, even within medicine, as practised during the recent pandemic, uncertainty and urgency (as signposted in *Post-Normal Science*: see pages 69–73) can lead to our allowing a little more leniency in the traditional checks and balances.

All of this becomes terribly important for the practice of transdisciplinarity because *‘The ways of explicitly addressing non-knowledge and the limits of knowledge’* determine whether and how scientific non-knowledge is specified and communicated and can thus be taken into account later on, in other contexts or fields of expertise. Hereby, it is of relevance which kinds of non-knowledge are acknowledged explicitly (the not-yet-known, unknown unknowns, the unknowable, etc.)’ (Böschén et al., 2010: 789).

To illustrate, Böschén et al. identify different types of non-knowledge: ‘Control-oriented’, ‘complexity-oriented’ and ‘single case-oriented’, which operate differently across research cultures. They interviewed a molecular biologist, an ecologist and a clinician in practice for each (see Figure 14).

An important aspect of Böschén et al.’s study and the crafting of designations of non-knowledge is that it helps us to understand that we are dealing with cultures that all have strengths, weaknesses, blind spots, and, as Kuhn might have said, their own *puzzles* (see pages 51–56). We cannot simply decide that one approach is more rigorous, valid, or reliable than the other. They are diverse cultures of rigour and accountability. The science/non-science; practice/

theory; episteme/techne distinctions can all be seen as epistemic cultures in possession of knowledge and non-knowledge practices.

Three “Ideal” Types of Scientific Cultures of Nonknowledge.

Control-oriented	Complexity-oriented	Single case-oriented
The control-oriented scientific culture of nonknowledge... is characterized by an epistemic focus on the control of the experimental conditions and the avoidance of disruptive factors.	The complexity-oriented culture (under which ecology or epidemiology can be subsumed) is characterized by a high degree of openness toward unanticipated events as well as uncontrollable and context-sensitive setting.	Single case-oriented is based on professional expertise and concentrates on single case-based experience. The most eminent example here is the medical profession and the analysis of medical case histories. This cultural type is characterized by a very low degree of decontextualization but shows a tendency to define nonknowledge as a problem of the individual expert. The amount of available scientific knowledge contrasts heavily with the amount of knowledge possibly appropriated and applied by the individual practitioner. Moreover, the aptitude of scientific evidence for the practical context and the individual case is challenged. Similarly, clinical research is challenged by every-day professional experiences.
Molecular biologist	Ecologist	Clinician practitioner
<i>I have to define my system very precisely to get answers [at all]. If I have too many variables which aren't under my control, I usually can't interpret the results.</i>	<i>New research questions normally arise throughout the daily professional practice. A certain vaccination is administered and no one knows how it works. And then you start thinking and you try to see what happens: Is it really these specific cells? Do they accumulate? What I investigate currently in clinical research is mostly derived from this clinical approach. I notice that there is no evidence-based treatment available and if I am interested enough, I start looking for answers.</i>	<i>We often go out relatively unencumbered and just look: What is actually happening outside? And then we allow ourselves to be surprised by what we find: We observe this and then try to evaluate our findings without looking for a specific systematic condition that has to be achieved. (...) It is our recurrent finding that self-organised natural systems are highly resistant to our planning. This aspect of self-organisation is perceived not as a disturbing factor that has to be eliminated, but rather as an actual characteristic of the systems.</i>
The control-oriented approach is undoubtedly strong in producing “hard facts” (or reproducible knowledge) and functional technoscientific artifacts. Yet, it withdraws attention from contextual factors or persisting real-world uncertainties.	The complexity-oriented approach tries to avoid blind spots of perception but runs the risk of producing only “weak evidence” without any predictive power and is faced with the difficulty that any observation is dependent on a specified and necessarily restricted horizon of expectations.	The approach based on single cases can account for the observation of complex case histories over time and the case-specific application of therapeutic treatments.

Scientific nonknowledge and its political dynamics (Böschen et al., 2010: 790–792), adapted.

Figure 14

When working across disciplines, we should work to not only understand the knowledges within and across disciplinary boundaries, but also the practised and invested cultures of non-knowledge in our own disciplinary spheres and others’.

However, it is not always apparent where ignorance is situated, especially since it often sits in the blind spots. Jerome Ravetz (as you may recall, half of the team that coined the term ‘Post-Normal Science’) spoke of the ‘sin’ of science as an ignorance of ignorance in

science, or (for brevity) ‘ignorance-squared’ (Ravetz, 1993: 157). We have seen examples of this type of ignorance in the ‘risk analysis of chlorinated fluorocarbons (CFCs) in the 1930s (where we) had been completely unaware of the possibility of harm to the ozone layer caused by those substances’ or in the current social experiment we are undergoing in relation to possible ‘harms and hazards associated with new technologies’ (Böschén et al., 2010: 784). Many practices in agriculture, in addition to the sustained effects of social media and AI, are revealing themselves as possible advances made under the category that Ravetz termed ‘ignorance-squared’.

Training in science and scientific research systematically fosters ignorance of ignorance, in the way that pupils, students, and researchers are systematically shielded from any acquaintance with problems outside the domain of successful puzzle solving. When scientists restrict their discourse with others of the same or related specialties, their ignorance-squared can persist indefinitely. Traditionally, they have lived securely in their ‘ivory tower’, supported by society in their narrowly focused pursuit of specialized knowledge.

—Ravetz, 1993: 158

We will see in Part II an approach to research that is self-referential and that demands a *witnessing* of blind spots in the dynamic processes of practising both in a home discipline and across disciplines. It may not capture everything, but as a process of *knowledgeing* it values the *processual* rather than the *objects* of knowledge, and in doing so exposes the act of *knowledgeing in practice*, able to respond to and be more responsible for its production of knowledge.

Writing on both ignorance and failure, Stuart Firestein, research scientist and Dean of Biological Sciences at Columbia University, embraces both as essential aspects in the process of scientific practice. He questions the traditional narrative of viewing science as a series of successes and facts built on more successes and facts.

When most people think of science, I suspect they imagine the nearly 500-year-long systematic pursuit of knowledge that, over 14 or so generations, has uncovered more information about the universe and everything in it than all that was known in the first 5,000 years of recorded human history. They imagine a brotherhood tied together by its golden rule, the Scientific Method, an immutable set of precepts

for devising experiments that churn out the cold, hard facts. And these solid facts form the edifice of science, an unbroken record of advances and insights embodied in our modern views and unprecedented standard of living. Science, with a capital S. That's all very nice, but I'm afraid it's mostly a tale woven by newspaper reports, television documentaries, and high school lesson plans.

—Firestein, 2012: 1

He evokes Samuel Beckett in a notion of 'failing better' where he says the playwright, in coining this phrase, 'enlarged his sphere rather than shrink it'. For Firestein, 'Failing better means looking beyond the obvious, beyond what you know and beyond what you know how to do. Failing better happens when we ask questions, when we doubt results, when we allow ourselves to be immersed in uncertainty' (Firestein, 2015: 27). He questions the wisdom of scientific education and research cultures evaluated on moments of successes and sharpening of techniques, honing strategy and narrowing on a problem to find a solutions; he says this is of course a 'recipe for accomplishment—if by that you mean publishing papers and getting grants' (ibid.: 28) and concedes that this is pragmatic but problematic:

...this process is driving science into a corner, separating it from the wider culture, failing to engage generations of students, turning it into a giant maw for facts and balkanizing the effort into smaller and smaller specialties, none of which have any idea what the others are about. We all recognize that there is something wrong with this. We can't keep up with the exponentially expanding literature of ever narrower details, we can't agree on what the right spending priorities are, we can't seem to affect public policy with our knowledge. We scientists are more and more a secret society of oddballs and geeks, tolerated because now and again some gadget or cure drops out of the otherwise impenetrable machinery we are supposed to be controlling.

—Firestein, 2015: 29

All this can feel daunting. It raises the question: which of us is ready or has the gumption to work against the grain of years of disciplinary silo thinking, with its pull of conventional measures of success, to enter the often unknown, little-held sphere of an uncertain but increasingly necessary terrain of transdisciplinary research?

Problematising People

Since the beginning of the project in the 1970s, the traits and characteristics of people initiating and working within inter- and transdisciplinary research have garnered interest. Much of what we read in this section, while important to perception and received thinking within the academy, will be approached differently in Part II, where perceived traits will be considered *emergent properties* of the *practice* of the self/researcher rather than inherent attributes of an *object* of self. However, it is important to understand the landscape within which one is being educated and working.

A thread that weaves throughout all the literature is the importance of one's ability to thrive in *complexity* and to employ *systems thinking*. Here, one focuses not primarily on elements of a problem but rather on the ways things interact, relate, differ and weave, often all at once.

Complexity thinkers... appreciate that the triadic construct known-known unknowns-unknown unknowns heightens the link between uncertainty and knowledge creation to address complex wicked problems. When nonlinearity is present in complex thinking scenarios, the dynamic can become chaotic (unpredictable) requiring a unique logic to reason through it—the logic of complexity.

—McGregor, 2020: 7/31

This type of thinking contrasts directly with the linear, sequential, cause-and-effect, dualistic, classical model of reasoning discussed in Chapter II. In Part II, the critical methodology of the active aesthetic will be introduced to allow for the ability to witness and account for the local and global at once. In the *Intermezzo*, various models of *middle spaces* will be surveyed, offering places where many things can be true at once: where knowledge is not compound and simplistic but rather dynamic and relational (see *Intermezzo* on pages 123–134). Examples of these include Nicolescu's Axioms and *hidden third* (2002, 2014), *yes-and* models from improvisation and devising practices in the performing arts, and Nelson's notion of *both-and* from the aforementioned research model, Practice as Research.

It is not a matter of a binary choice between deconstruction and communicative rationality: a both-and thinking things together, approach allows for both, but contingently perhaps, according to the appropriateness of different regimes under varying circumstances.

—Nelson, 2022: 66

Being able to navigate this fairly new epistemological culture, especially when much of Western education still teaches counter to this way of thinking, testing and valuing, takes people willing to think of knowledge not so much as an *object* or *custodian* of information but as a dynamic, processual series of interlinking *practices*. In doing this, we overturn the long-held Aristotelian hierarchy of episteme over techne (see Chapter II). When we begin to think like this, we can see that no one discipline, epistemological culture or *self* can really be in *possession* of an *object* of knowledge. Power becomes a marker not of erudition, but rather of adroitness, if of anything.

In transdisciplinary practices where *collective learning* is an inherent aspect, the emergence of a ‘collective mind’ is evoked (Brown and Harris, 2015: 179–195). Valerie A. Brown and John A. Harris observed, while conducting a Local Sustainability Project in partnership with local communities, that a significant transformational change involved two separate learning spirals: ‘collective learning within *individuals* and collective learning among a *group*’. Along with this, they found that ‘the recognition of the need to welcome paradox, examples of two things that cannot both be true, rather than to try to resolve them...moving a paradox from its basis in opposing positions to a dynamic relationship facilitated transformational change’ (ibid.: 184). For them, ‘collective thinking’ moves beyond transdisciplinary thinking, because it leaves the domain of the university research tradition with its formal administration and its inheritance of the scientific enlightenment and empirical thought.

Collective thinking offers the opportunity to access the full potential of human thought, no longer restricted to fragmented constructions of knowledge and the limitations of purely quantitative evidence...at the personal and at the group level [it] asks for reframing opposites as dynamic relationships and moving from the limited access to understanding offered by empirical evidence to include asking introspective, physical, social, ethical, aesthetic, sympathetic, and reflective questions.

—ibid.: 192

This moving *beyond* is the essence of transdisciplinary thinking in the Nicolescu tradition. In the late 90s, at a Symposium on overcoming the underdevelopment of learning at the annual meeting of the American Educational Research Association in Montreal, Canada, he stated:

Transdisciplinarity is globally open. Transdisciplinarity entails both a new vision and a lived experience. It is a way of self-transformation oriented towards knowledge of the self, the unity of knowledge, and the creation of a new art of living in the society..... Universal sharing of knowledge cannot take place without the emergence of a new tolerance, based on the *transdisciplinary attitude*, one which implies putting into practice the transcultural, transreligious, transpolitical, and transnational vision; whence the direct and indisputable relation between peace and transdisciplinarity.

—Nicolescu, 1999: 3/7; emphasis added

Tanya Augsburg, drawing directly from Nicolescu's articulation of a *transdisciplinary attitude*, brings the notion into the twenty-first century, examining traits of individuals involved in transdisciplinary projects, and gleans from the literature and case studies the main 'traits entailed in becoming and being a transdisciplinary individual'.

In casting a wider net inquiring into *who is doing inter- and trans-disciplinary research, and why*, Maria Helena Guimarães et al. expand on Augsburg's work towards an empirical study of motivations, attitudes, skills, and behaviours. They distinguish between extrinsic and intrinsic motivations in inter- and transdisciplinary researchers, with the former including 'possible rewards or anticipated benefits; the latter... on the desire to engage with issues in the non-academic world that do not seem to lend themselves to easy solutions using traditional approaches' (Guimarães et al., 2019: 3).

Their study draws from across the literature, including familiar scholars in the field (many previously mentioned): de Freitas et al. (1994), Nicolescu (1999), Gibbons and Nowotny (2001), Giri (2002), Bruce et al. (2004), Klein (2004), Godemann (2008), Robinson (2008), Wall and Shankar (2008), Jacobs and Nienaber (2011), Montuori (2012, 2013), Augsburg (2014), Fam et al. (2017), Hoffmann et al. (2017a, 2017b), von Wehrden et al. (2019). They find that motivation is, for the most part, not of the extrinsic kind.

Factors Contributing to Transdisciplinary Individuals.

Transdisciplinary Skills and Traits:

Mutuality, necessity and trust
 Ability to build networks within realm of unfamiliarity
 Capacity to engage in meaningful dialogue, suspending one's point of view
 A societal conscience and awareness
 Able to think in a complex, interlinked manner
 Able to relate to logic of complexity
 Have a modest positionality

Intellectual Risk Takers and Institutional Transgressors:

Intellectual risk taker
 Adopt a humble attitude towards the immensity of knowledge
 Engage in new modes of thinking and of taking action
 Inwardly felt need for others' points of view
 Appreciate importance of readiness, resources, relationships
 Appreciate importance of intellectual freedom, a collaborative spirit and networking that enables relationships
 Confident in professional and self-identity
 Able and willing to share responsibilities, knowledge and autonomy
 Able to transgress disciplinary borders and reach across disciplines for a particular purpose
 Issue-driven
 Co-producer of hybrid knowledge

Transdisciplinary Practices and Virtues:

Respect the practice of interspectivity
 Able to see community of perspectives (not collection of people)
 Authentic embeddedness
 Courage to abandon one's home discipline
 Cultivation of the art of abandonment
 Ability to acknowledge the pain inherent in abandoning ones' intellectual comfort zone
 Ability to acknowledge dependence

Creative Inquiry and Cultural Relativism:

Inquiry-based
 Trans-paradigmatic
 Integration of inquirer into inquiry process
 Creative inquiry and complex thinking
 Cultural relativism and cultural diversity
 Goes beyond limitations of traditional disciplinary approaches and established ways of thinking
 Avoids solipsistic and narcissistic traps

Becoming transdisciplinary: The emergence of the transdisciplinary individual (Augsburg, 2014: 240), adapted.

Figure 15

In contrast to Augsburg's (2014) findings, none of the participants indicates the existence of extrinsic motivations, such as rewards and/or anticipated benefits. In fact, the discourse presented shows that extrinsic motivation (Robinson, 2008) is not common in the context of the present study. Even those participants in high-level academic positions express challenges linked to professional progression that are caused by their engagement in [inter- and transdisciplinary research]. Therefore, although the interviewees do not explicitly describe perseverance and commitment, as described by Fam et al. (2017), the overall trajectories of the participants in academia suggest that these two traits might have played a crucial role in attaining their academic positions.

—Guimarães et al., 2019: 10

They speak of characteristic traits of inter- and transdisciplinary researchers, which include finding personal fulfillment in responding to the ‘social responsibility of science’ with a ‘problem-solving urge (including going beyond disciplines), which often requires the capacity to work together and use knowledge in an operationalized manner, and being reflexive’ (ibid.: 13). Somewhat disturbing but understandable within the current institutional environment, which is not yet set up to foster and value plural epistemologies in action, they find that ‘the pursuit of [inter- and transdisciplinary] research tends to coincide with the lack of aspiration to build a career in academia. Most of the interviewees do not aspire for a standard academic career due to a general sense that an academic career path based on [inter- and transdisciplinarity] is unavailable to these researchers, although the majority were working in academia when interviewed’ (ibid.: 13–14).

With this in mind, it is not surprising that their review of behaviours and the challenges of inter- and transdisciplinary individuals includes the below:

Behaviours and Challenges of Inter- and Transdisciplinary Individuals.			
Topics	Title	Details	References
Behaviours	RISKTAKERS	Intellectual risktakers, confident enough in their own roles and professional identities to respect one another as equals and to share responsibilities, knowledge, and autonomy with others	Augsburg (2014), Fam et al. (2017), Gibbons and Nowotny (2001), Jacobs and Nienaber(2011), Klein et al.(2008), Nicolescu (1999), Robinson (2008), Stokols (2014), Wall and Shankar (2008)
	TRANSGRESSION	Transgressive approach to knowledge and particularly to knowledge institutions, especially the university, since transdisciplinarity challenges the university modus operandi of disciplinarity. Engagement in new modes of thinking and taking action	
	PRACTICAL	Co-producers of new hybrid forms of knowledge, issue driven, and prefer practice over theoretical or epistemological claims	
Challenges	SOLID DISCIPLINARY BACKGROUND	Need to have a qualification in a discipline or a profession to acquire a solid background before crossing boundaries between disciplines	
	RECOGNITION FIRST	Pursue ITD when well-grounded in a discipline/field/topic	

Who is doing inter- and transdisciplinary research, and why? An empirical study of motivations, attitudes, skills, and behaviours (Guimaraes et al., 2019: 102441), adapted.

Figure 16

From all the research, one can glean the recommendation that having a solid grounding in the skillsets and vocabularies of at least one established field, and further being recognised as a rigorous practitioner/researcher in that field *before* crossing disciplinary boundaries, is seriously helpful. However, if you want to travel this route, you must not get too attached to any accolades or to the critical and practical epistemological frameworks of your home discipline. You will want to be reflexive, flexible, inclusive, and tolerant of ideas that seem counter to the frameworks of your home disciplines. According to the research, you will need to be brave and slightly rebellious as you navigate institutional *modus operandi*, while at the same time remaining creative in the engagement of transgressive modes of thinking and doing. There is risk involved. However, nothing new has ever been discovered without a certain amount of risk. Seems like a lot!

In Part II, we will take a slightly different perspective on one's relationship with *self* as a researcher/practitioner engaging across disciplinary boundaries. Through a combination of performance theory and cognitive science, we will dissolve the subject-expert-self and the object-knowledge-research/practice dynamic. We will explore an approach to the *ways* in which the *self practices*. Drawing from a branch of embodied cognition called enactivism, we will see what happens when we leave the notion that we are experts and think more along the lines that expertise is an emergent property of a *practice of self*.

With the application of the critical methodology of the active aesthetic, practised through the methods in *Integrative Performance Practice*, Part II will provide a way to work that might take some of the personal risk out of the equation, while at the same time revealing information hidden in the blind spots inevitably maintained while acting as a subject and still maintaining the rigour of capturing knowledges across disciplinary boundaries. However, let's first review a few of the valuable approaches to ways of practising transdisciplinarity that exist presently.

Problematising Approaches and Practices

The final section of this chapter requires that we once again examine the differences between the two historical paths of transdisciplinarity. In Chapter I, we reviewed the history and

trajectories of the transdisciplinary project through two main tracks, the Zürich tradition and the Nicolescuian approach. The former tended to define itself by its commitment to problem-oriented research towards ‘real world’ problems, those that would impact social and/or societal dilemmas, while encouraging fluidity among science, society, and technology.

The latter drew on Basarab Nicolescu’s work, offering an approach that is non-linear, non-binary, and that transcends the subject/object and cause-and-effect approaches to the experience and capture of knowledge(s). While not born of the social sciences (like the Zürich tradition) but rather the tenets of metaphysics, quantum physics, systems theory and complexity science, it shares with that tradition an inherent commitment to humanity and the lived experience.

Chapter I called into question that a defining characteristic of transdisciplinarity needs to be that it is an act of problem-solving in the context of real world issues characterised by social and/or societal dilemmas (see pages 7–25). Nicolescu questioned this narrow interpretation, asking why ‘joint problem-solving’ must be the unique aim of transdisciplinarity (Nicolescu, 2010: 20). Joint problem-solving can happen very effectively within discrete disciplines and even in multidisciplinary dynamics, and if this can occur it might be even more rigorous and practical. Transdisciplinarity is not better than or counter to disciplinary research/practice.

Some transdisciplinary developments have occurred because of *complex inquiries* (rather than problem-solving). Further, some transdisciplinary developments occur as part of *disciplinary evolutions* spurred on by new technologies and cultural shifts. There are multiple emergences of new skill sets and vocabularies, now stabilised, that were born of dynamic past crossings of disciplines, no longer resembling parts of the discrete disciplines they emerged from.

Practitioner/researchers sometimes encourage disciplines to cross, collide and intersect towards new understandings within an *area of inquiry* that lies outside of the *problem-solving* parameters of the Zürich tradition’s definition of transdisciplinary research. The example of consciousness and an aspect of cognitive science called embodied cognition was brought up as one example in Chapter I. I

think we can agree that consciousness would not be considered an urgent real world problem in the sense that Mode 2 or Post-Normal Science would describe them. Cognitive science's field of embodied cognition can, however, be seen as a transdisciplinary inquiry born of inquiries that cross the disciplines of linguistics, anthropology, biology, philosophy, psychology, neuroscience, and, increasingly, artificial intelligence. Nanotechnology is another example of this type of dynamic (see Messler, 2004: 44–7).

Such disciplines are on paths in their evolution through transdisciplinarity towards the possibility of landing as temporarily stabilised disciplines, perhaps only to be destabilised again as the world and its technologies develop. They may set off again into a new journey through another transdisciplinarity dynamic, all part of the dance of knowledging (you will recall that the central premise of Chapter II was the upending of the Aristotelian hierarchy of episteme over techne, and with this the notion that discipline is not a stable object that holds knowledge, but that knowledge is intrinsically a practice of knowledging). Disciplines enter into a fluid dynamic, if only for a short time, when engaging in transdisciplinary research. Most current approaches aim to navigate this dynamic, albeit from different perspectives and to resolve different issues.

Within the boundaries of transdisciplinary developments, the individual disciplines do not remain what they were, at least, they change their methodical and theoretical perspectives. Not just the theories in the narrow sense, also the disciplines themselves get pulled into the process of research and science—in a *systematic manner*. Precisely this is what is meant with methodical transdisciplinarity.

—Mittelstrass, 2011: 338; emphasis added

Harnessing and/or capturing this 'systematic manner' is not a straightforward task and is the focus of this section. In collecting and interrogating various articulations of the complex journey from disciplinary through interdisciplinary to transdisciplinary research practices, Klein tracks word clusters of meanings, revealing similarities and differences across designations of key words. She notes that 'understanding core distinctions in that typology is a necessary first step towards understanding the meanings of [transdisciplinarity]' (Klein, 2013: 190). She observes that the *inter* in interdisciplinarity was 'conventionally taken to exist **between**

existing approaches, while ‘trans’ moves **beyond** them’ (ibid.) and, further, that this ‘beyond’ is transcendent, implying an overarching synthesis (This notion of *beyond* was first introduced in Chapter I with the work of Nicolescu Basarab, see pages 14–17).

Even at a quick glance, Klein’s word clusters offer a solid sense of the landscape, setting the context for the various approaches and practices of transdisciplinary research that will be introduced in the following pages.

Klein’s Keyword Clusters in Discourses Around Transdisciplinarity.	
Cluster#1 - Traits associated with Interdisciplinarity	• interdisciplinarity • integration, synthesis, interaction, holistic thinking • boundary crossing, boundary blurring, transcendence
Cluster#2 - Change in thinking about the thematic of unity	• interdisciplinarity • integration, synthesis, interaction, holistic thinking • boundary crossing, boundary blurring, transcendence
Cluster#3 - Highlights a broad shift associated with the first three features	• participation, cooperation, collaboration, partnering, networking, mutual learning • postnormal science
Cluster#4 - Keywords that highlight forms of knowledge	• system knowledge, target knowledge, and transformation knowledge • socially robust knowledge, contextualization, new social distribution of knowledge, science in society, co-production of knowledge • local, indigenous, people’s, traditional forms of knowledge
Cluster#5 - The alignment of transdisciplinarity with the transgressive imperative	• interrogation, critique, transgression, transformation • reconfiguring, reformulating, resituating

The transdisciplinary moment (um) (Klein, 2013: 189–199), adapted.

Figure 17

In problematising practical approaches, it is in the Zürich tradition, working across different knowledge cultures, across disciplines, with indigenous communities, academics, stakeholders, policy makers, and civic partners in the service of solving complex problems, that we see the most transparent attempts at coherent practical structures drawn from various conceptual models. Not surprisingly, these are invariably linked to managing dynamics around collaboration, knowledge capture, and dissemination. The relationships among collaboration, knowledge capture, and dissemination are not simple because they are embedded within the very issues that we have thus far problematised within this chapter. These include what we designate as knowledge; what communication looks like; what forms of knowledge are considered valid; how value is determined; in which ways power is enacted; who decides how we determine problems; what is the place of non-knowledge, ignorance and failure; who is expert; and what are the

favourable personal attributes of someone engaged in this work?

Even within the Zürich tradition, there are no agreed-upon vocabularies or steps within transdisciplinary research processes, and this is somewhat appropriate, because every project must be attentive to the particular cultural, social, epistemological, political, and ideological origins of one's own and others' perspectives, concurrently, throughout and at different points along the way.

Due to the wide variety of definitions and varying emphasis on the characteristics of transdisciplinarity... there is no clear, widely accepted 'cookbook recipe' for setting up and running real-world [transdisciplinary research] processes (continuing to focus specifically on the social engagement school of transdisciplinarity). However, considerable work has gone into developing conceptual models of the phases and components that are frequently involved in [transdisciplinary research] processes.

—Lawrence et al., 2022: 51

Because this work is invariably about the emergence of new knowledge and, as Nicolescu writes often, *beyond* knowledge, each process, if done properly, redefines the process. However, there are a few common considerations. This section will not offer an exhaustive account of transdisciplinary practices and approaches, but will rather speak to four select approaches that tend to intersect most of the concerns central to the problematics articulated throughout the Zürich tradition.

Collaboration

As previously mentioned, collaboration sits at the heart of much of the work. McGregor, following a comprehensive review of the literature around this element, offers an excellent breakdown of the key challenges articulated around the notion of collaboration in transdisciplinary research. Her findings sit at the heart of most of the practices and are consolidated in Figure 18.

You will see in Part II that this notion of synthesis and integration will be made distinct from an Integrative Practice where, even though the practice may be integrative, it will not be in the service of integrated or synthesised outcomes. The embrace of difference, conflict, discomfort and distinction will be central to the practice

proposed. But for now, you will see that integration, synthesis and a sense of communion are emphasised in the practices emergent from the Zürich distinction, often in the service of collaboration. Strengths of thinking this way include the fostering of an environment of tolerance and curiosity among different knowledge cultures, a commitment to finding shared heuristics and understandings towards emergent meanings brought forth from the group, and support for an ability to adapt and reflect on common learnings, releasing old views and processes, in an environment of group reflexivity towards the possibility of shared knowledge. However, in the act of synthesising, the sharp edges of interrelations can sometimes be smoothed over. It is often in the barbs and things that don't fit where some of the riches of knowledge can be found.

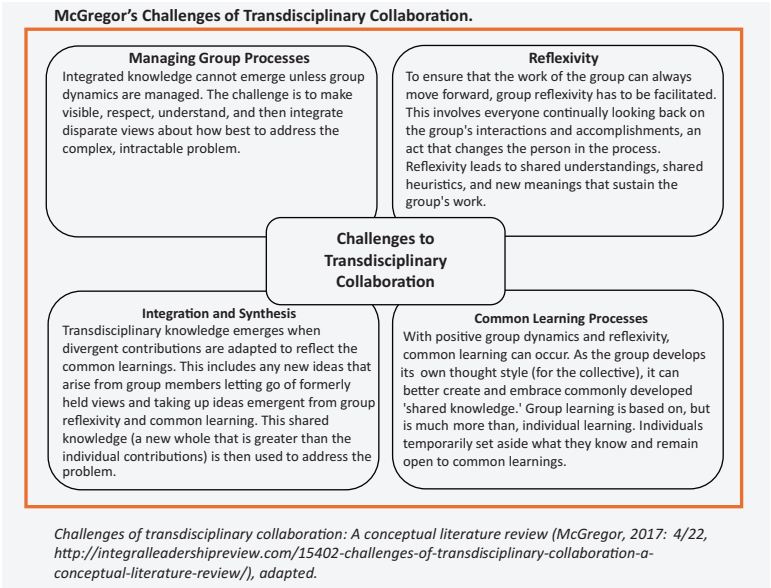


Figure 18

Modes of Access

Thomas Jahn approaches the challenges of collaboration by exposing issues around *modes of access* with regard to *the problem*. This speaks to the aforementioned issues to do with *power* and *problems* (see pages 90–96) and also relates to collaboration. He distinguishes between three modes of access:

- a mode of access oriented towards everyday life (everyday life mode of access)
- a mode of access oriented towards science (scientific mode of access)
- an integrative mode of access.

—Jahn, 2008: 26

The first mode represents issues that start from ‘pressing societal problems...pushed to the fore by recognised societal actors...in need of practical solutions’. As the emphasis is on solving a problem, the knowledge may or may not feed back as transferable research towards further interdisciplinary domains:

The sciences accept, so to speak, an order from society (political sphere, economic sphere) to produce practical solutions to these problems; translate this then into a set of research questions; work on these normally in a multidisciplinary manner; and then present society or its representatives with the results of their research in the form of a set of proposed solutions. Research here aims primarily to generate applied, useful knowledge and presents its results to the ‘user’ for evaluation.

—Jahn, 2008: 26

In the second mode, the starting point is a ‘complex problem internal to science’, following ‘an epistemological approach’. In this mode, results are ‘intended to enhance scientific understanding and lead to the development of new methods, models, concepts, general conceptions and, above all, new questions for research’ (ibid.). Here, we get the transferable knowledge, largely because this is partly how science tests and defends its rigour. However, this knowledge is not designed or packaged to be actively applied to any particular societal problem, especially as it is articulated as an ‘outcome’, packaged often in an academic article and shaped for a closed knowledge culture.

The third, *integrative mode of access* is inclusive of both scientific and societal problems and concerns itself with the transferability of disciplinary knowledge(s). It aims to reconcile research processes, recognises a similar set of concerns to those around collaboration offered by McGregor, and looks to create inclusive *problem framing*, with research results articulated as practically and theoretically rigorous, valid across knowledge cultures, requirements and platforms.

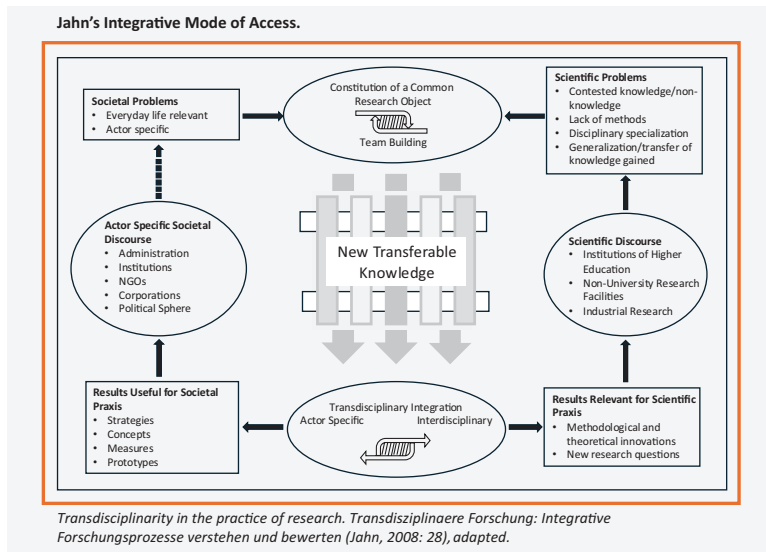


Figure 19

What is most interesting here in relation to practice is all that needs to occur in Jahn's middle column (see Figure 19). It is in this column that we see how transdisciplinary research is often a praxis, living in a mutually interdependent relationship between society and science (and/or technology).

First, societal actors who are affected by a problem must be drawn into the research process. And second, the problem must be turned into a scientifically valid question in the course of an exchange between concerned societal actors and scientific actors. Here the clarification of interpretive claims and claims of validity, and of conflicts of interests, play a decisive role. This translation of a problem from its meaning in an everyday context into a scientifically valid research question means defining the goals of research in such a way that their contribution to practical solutions of a societal problem is narrow enough to be useful. At the same time, this process of defining research goals in a manner useful for everyday life points to the structures deemed essential that need to be examined, thus providing researchers with their object of scientific investigation in the first place. In this way, transdisciplinary research conceives and organises research as a common learning process involving both society and science, a process that proceeds reflexively.

—Jahn, 2008: 15

TD Wheel

Another approach can be found in Anna L. Carew and Fern Wickson's 'TD Wheel' (Carew, 2010: 1146–1155). The approach here could be seen to assist in much of what Jahn identified in his middle column (see Figure 19) in recognition of many of the issues brought out in McGregor's literature review on collaboration (see Figure 18). Carew and Wickson offer 'a heuristic or thinking tool to assist researchers in overcoming some of the problems associated with current or proposed evaluative frameworks for [transdisciplinary research]' (ibid.: 1149), emphasising that transdisciplinary research is a 'coalescence between three key elements of context, process and product' (ibid.: 1154).

The wheel is a tool intended to assist in formative phases or stages in the transdisciplinary research process, which they identify as:

- **Shaping:** planning and proposing research
- **Supporting:** guiding research in-train
- **Evaluating:** planning for evaluation, periodically documenting/checking progress, and reporting on outcomes

In the following figure, they use the term *process* to mean 'the actions that [transdisciplinary] researcher/s take in managing and conducting their research', which is influenced by one's responsibilities, pragmatism, values and beliefs, capacities and intentions. *Product* here includes 'outcomes of the researcher/s actions', including 'peer approval, problem-solving, mutual learning' (ibid.: 1152/1154).

The TD Wheel can be applied in different ways across three broad research phases: at project initiation; when the project is in-train; and as a prompt for evaluation at project completion. In an initiation phase, the model could play a shaping role as a guide to project design. At this stage, the heuristic would support analysis of what processes and products are desirable, as well as how these might be approached within the given problem, research and researcher/s context... At the close of a TD research project, the model has application for evaluating quality. It emphasizes, for example, that research products must be judged in light of the shifting opportunities and constraints afforded by the various elements of context, over the life of the project.

—Carew and Wickson, 2010: 1154

The tool encourages discussion, ways to envision across epistemological cultures, and planning the project in line with crafting the articulation of products across various contexts. It is designed to ‘offer a supporting role by guiding researcher/s’ critical reflection, and assisting in the identification of potential hindrances, obstacles and opportunities’. This is all towards quality transdisciplinary research, which for them ‘needs to be judged in relation to the interplay between context, process and product’ (ibid.: 1154).

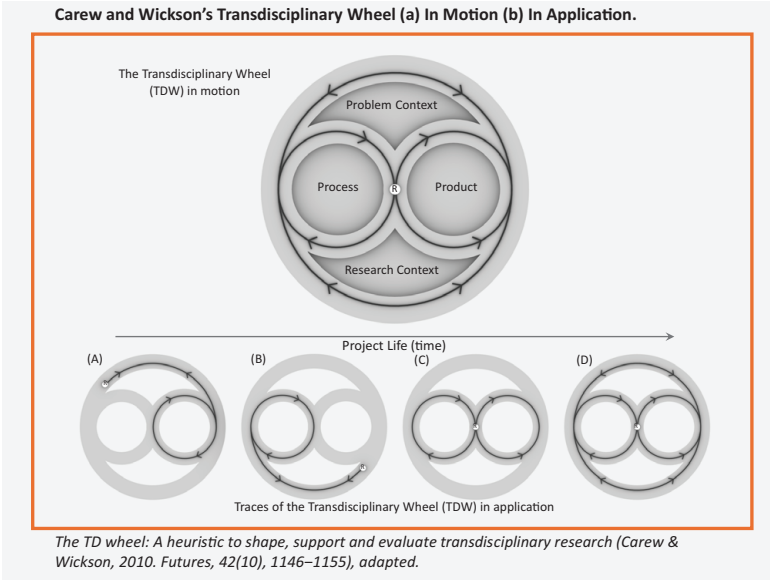


Figure 20

This is a useful model as a processual check-in and reflective tool, to assist researchers in not getting stuck in their own perspectives/ epistemological cultures, but rather continue to make the work inclusive, valid, and applicable for all intended contexts while encouraging shared learning. How one gets unstuck, or negotiates what to do when the wheel gets caught up, is not clear, in this or any of the other approaches that we have yet to encounter. However, this will be an important aspect of the approach introduced in Part II.

Outcome Spaces Framework

Another approach, highly indebted to the work of Erich Jantsch (see pages 6–7, 119–122) and drawing directly from Julie Thompson Klein’s ‘keyword spectrum analysis’ (see pages 111–112), can be found in the work of Cynthia Mitchell, Dana Cordell, and Dena Fam: *Beginning at the end: The outcome spaces framework* (Mitchell et al., 2015: 86–96). They propose a framework ‘to guide purposive (after Jantsch, 1972) transdisciplinary research (i.e., research that seeks to create change)’ and have as a core value the idea that the research process must be ‘explicit about revealing conceptual, ontological, and epistemological positions’ (ibid.: 87–88).

Their structure is based on the idea that working backwards by declaring ‘normative intent’ and articulating ‘desired outcomes’ at the start of a project allows for greater effectiveness. They posit that ‘defining upfront the desired improvements has profound implications for how transdisciplinary research is conceived, designed, implemented and evaluated’ (ibid.: 86).

Towards this, they define three *outcome spaces*, defined as:

1. An improvement in the **situation** or field of inquiry.
2. The generation of relevant stocks and flows of **knowledge**.
3. Mutual and transformational **learning** by the researcher/s and involved participants.

You will note that these categories of *outcome spaces* overlap but also differentiate from categories found in the aforementioned approaches. The working towards productive approaches to transdisciplinary research practices has, in part, been a history of shifting categories of and emphases on dynamic relationships among concerns present within a research project.

Here, their use of the term *situation* is distinct from but inclusive of a designated ‘problem’:

It recognises the inadequacy of the idea of ‘solving a problem’. Early articulations of the outcome spaces framework instead proposed ‘problem re-resolution’, a deliberate wordplay intended to acknowledge that messy or wicked problems are rarely ‘solved’ once only, and that as research proceeds, clarity improves... The situation may be dynamic and change over the course of the project. Therefore the situation includes current influential triggers, drivers, players, and trends, as well as project participants and changes in their perceived area of control and influence.

—ibid.: 90–91

Their use of *knowledge flows* relates to ‘how knowledge moves: between disciplines; between theory and practice; between academic and professional practice; from within to outside the project; up and down Jantsch’s (1972) empirical, pragmatic, normative and purposive strata, etc’ (ibid.: 92). It has to do with the ways knowledge is transferred, shared and experienced and validated across different world views, thought styles or, as Nicolescu might have said, *realities*.

Finally, by *mutual and transformational learning*, they refer to a key function of transdisciplinarity:

For transdisciplinary research intending to create change, extending impact beyond the life of a project is essential. Therefore, collaborators should come away with new perspectives, new orientations, new strategies, and new tools—seeing and doing things differently as a result of their experience of transdisciplinary research. That means the process has to value and trigger learning for researchers and for those engaged in projects, and to provide just the right amount of the right kind of cognitive dissonance to facilitate a transformational learning experience.

—Mitchell et al., 2015: 92

Important to this approach is that it is designed not to reconcile the general nature of transdisciplinary research, but rather as a tool to be used project by project, as it has been by research staff and students at The Institute for Sustainable Futures at the University of Technology Sydney. Like *Practice as Research* (see pages 84–87), in this framework, practice and theory are mutually interdependent. These *outcome spaces* represent a conceptual framework designed ‘to guide the conception, design, conduct, and evaluation of purposive transdisciplinary research projects’ through a ‘backcasting’ or ‘backward planning’ approach (ibid.: 90). In some ways, this turning away from the strict *problem-oriented* approach in favour of working backwards from outcomes, which might lead to the area of inquiry being perceived differently, presents a welcome systematic expansion away from some of the constricting Zürich distinctions.

They offer a conceptual map (see Figure 21) that shows their *three outcome spaces* (situation, knowledge, learning), ‘indicating a transdisciplinary project within [one’s] field of vision, that is itself embedded in the broader landscape’ (ibid. Figure 2: 91).

The conceptual map of outcome spaces in [Figure 21] indicates the transdisciplinary project embedded in a broader context of the situation, knowledge and learning spheres within a field of vision. The field of vision is limited to the experiences, knowledge and worldviews of the research team. It represents the ‘messy situation’ (Checkland, 2000) as seen by researchers and participants.

—ibid.: 90

Beyond the ‘field of vision’, the conceptual map includes things we do not yet know that we do not know; it is inclusive of uncertainties and ignorance that can show up as ‘future shocks’ (recall *Problematising Problems: Non-knowledge, Ignorance and Failure*, see pages 96–99). The *project boundary*, represented as a dotted, undefined shape ‘... acknowledges that project resources also bound research in time and space, requiring strategic thinking about realistic spheres of influence, and how contained research projects can leave a wider positive legacy. Positioning the framework in relation to transdisciplinary research projects in particular, rather than transdisciplinary research in general, is deliberate and significant’ (ibid.: 90).

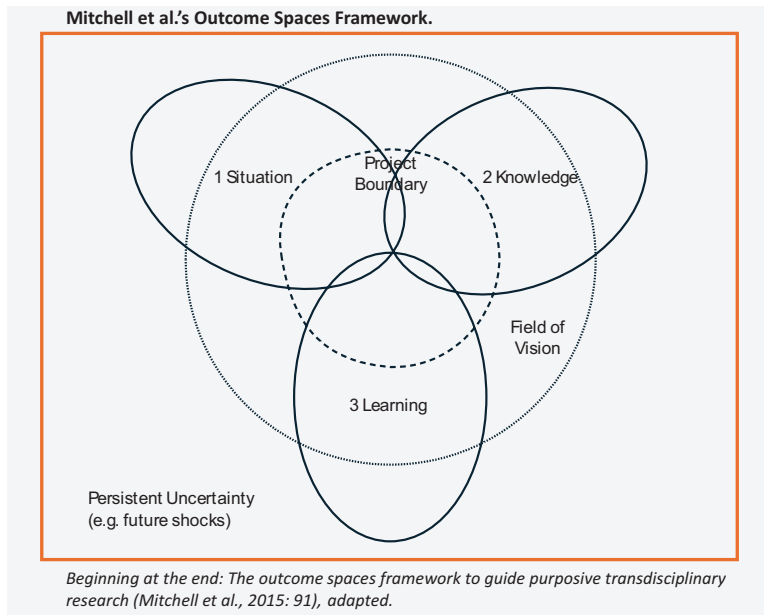


Figure 21

This shift of focus from ‘problem-solving’ to *beginning at the end* offers the potential for more transparent and explicit reflexivity and communications across different knowledge cultures. It also allows for more realistic check-ins about what is possible and how the shared learning is being activated as possible usable outcomes across different epistemological and ontological orientations. ‘Improving our capacity to be explicit about these orientations and their implications for our processes will improve our capacity to communicate across the divides and diversity within the transdisciplinary research community and beyond’ (ibid.: 95).

I chose this example partly because of its move away from a hard and fast commitment to problem-oriented research. It offers a softening, through an evolution of practice, of the lines previously drawn between the Zürich and Nicolescu traditions, a softening that will be essential if we are to grasp the approach proposed in Part II.

Conclusion

In this chapter, the examples of practices and approaches were selected specifically because they have inherent intentions to productively engage with the key issues expressed throughout the entirety of Part I. These include reflexivity; collaborative processes; recognitions of power dynamics and the unknowns; and the recognition of different modes of knowledge, along with approaches to complex problem-solving with a commitment to inclusivity across knowledge cultures. In this section we have discussed current discourses around challenges in *collaboration*, issues to do with *modes of access* in the solving of problems, *prioritising active reflexivity* to keep the integrity of a project, and, telescoping out, expanding the field of vision by *working backwards in awareness of intended outcomes*, in part to include epistemological and ontological, and for the purposes of moving forward we will add hermeneutic orientations.

Intermezzo: A Romp Through ‘Middle Spaces’ and ‘Non-Linear Dynamics’

As transdisciplinary researchers, we know that to work between disciplines is to embrace an often elusive middle space. A quick review of most of the diagrams in Part I of this book shows how we literally map middle spaces into our conceptual frameworks (review Figures 7, 9–11, and 18–22). What is fascinating is that the activities and ways of practising in these spaces are not clearly defined. Regardless, these middle spaces are defining attributes of transdisciplinary work.

It is often intimated that these middle spaces and the practices of the knowledging that occur within them provide an antidote to the inadequacy of classical linear, dualistic, cause-and-effect logic. These places between disciplinary boundaries are often articulated as complex, systems-oriented, and non-linear.

Before we move on to interrogate in what ways knowledge operates within these middle spaces, as a doable practice, we pause for a short intermezzo, a romp through a selection of conceptual understandings around middle spaces and non-linear dynamics as they pertain to the act of knowledging. These are important to all that was discussed in the previous chapter—reflexivity, inclusion of various knowledge cultures, articulation and dissemination of findings, collaboration, awarenesses of power dynamics, synthesis and integration of knowledges, determining of ‘the problem’, the handling of non-knowledge, failure and ignorance, and the many other keenly observed dynamics within the myriad of discourses surveyed within the first half of this book—because it is in these middle spaces, and through the non-linear dynamics within transdisciplinary dynamics, where all of these problematics actually operate.

Of course, each of these nuggets could be, and many are, the subjects of entire books and journal volumes, so this ‘romp’ through

key concepts is in no way exhaustive, but rather offers a quick overview to help situate select ideas around these discourses and approaches.

Middles

Liminal Spaces

Liminality is an important concept originating from anthropology and widely adopted as a notion central to the interdisciplinary field of performance studies.

Anthropologist Arnold Van Gennep distinguished three rituals of passage in the latter part of the 20th century: preliminary, liminal, and postliminal, originating from the Latin *limen*, which means threshold. The idea that transdisciplinarity is a transgressive act coincides with the notion of thresholds and liminal space(s). The term could be conceptualised as a 'between' state, a state of becoming. A frequently cited example is that of the adolescent, one who has transitioned from childhood (preliminal) to adulthood (postliminal), but has not yet reached adult status. In this sense, adolescence is a transitional stage in the process of maturing.

Victor Turner, influenced by Van Gennep, expanded the term's usage beyond anthropology to include modern politics, society, and culture, all of which were impacted by the counterculture movements (see pages 49–56) of the 1960s (Van Gennep, 1960). The liminal space could be perceived as a kind of theatre, a performative space, an active area generating meaning—a space of knowledging.

For Turner, liminality was less about an intermediate stage of transition and more about a lived experience. 'Liminal entities are neither here nor there; they are betwixt and between the positions assigned and arrayed by law, custom, convention, and ceremonial. As such, their ambiguous and indeterminate attributes are expressed by a rich variety of symbols in the many societies that ritualise social and cultural transitions' (Turner, 1969: 95).

Terms like 'liminal spaces', 'the liminal body', and 'liminal performance' are now commonplace in the theorisation of contemporary theatre, dance and voice. The term has served a central purpose in critical discourses and openings of practice between and

among the disciplines of performance. Much of this is because, with the application of liminal theory, boundaries could be seen in terms of a play between, with a sense of becoming, as oscillation, and in flow. Recalling the discourses on transdisciplinary research and the liminal spaces envisioned between different knowledge cultures, practice and research and science and the humanities, there are many similar problematics, and perhaps things to be learned from the ways performance practice and theory have negotiated across emerging technologies and disciplinary boundaries.

‘For theater makers, liminal thinking brought an intervention to the boundaries that previously helped structure the making of work. It is often no longer clear who or what generates meaning, who or what creates the work, and what dictates the making: is it the director, the performer, the producer, the media designers, the set designers, the media itself, the space, the costumes, the props’ (Bryon, 2014: 48). This has undoubtedly shaped the diverse ways in which we create work and given rise to new forms, including, but not limited to, multi-modal, intermedial, multidisciplinary, hybrid, site-specific, and physically-based theatre, devised rather than text-based theatre, and performance art.

The final chapter, introducing Integrative Performance Practice, will draw directly from epistemological practices deriving from performance to reveal possible blind spots in the practice of knowledging within transdisciplinary research.

Agora

An agora, from the Greek *gathering place*, was a large square, often situated in the centre of a city. ‘It served early as a meeting place for political assemblies, and was later bordered by buildings to house civic administration and courts of law. The open area served as a market place at all times; permanent shops came to be erected on its periphery’ (Thompson, 1954: 9). It also had temples at the edges, with open-air altars, and at certain points athletic events and dramatic contests took place there. It was also the space where Zeno and Socrates conducted their teachings. The term’s adoption to mean a middle space with regard to knowledge is based on the fact that it was a point of convergence.

In the conversations around knowledge production, the agora is a space of public debate and a place where knowledge extends beyond the academic. It is inclusive of indigenous and lay expertise—in the agora, knowledge is *socially robust*. Mode 2 and Post-Normal Science have in common the requirement that all debate in a research project extend beyond conventional discrete disciplinary cultures, to stakeholders, politicians and funders, and expand the circle to include the 'extended peer communities', those affected at local levels. In Mode 2, the agora was evoked as the conceptual space within which a heterogeneous set of practitioners would collaborate.

The agora is the problem-generating and problem solving environment in which the contextualisation of knowledge production takes place. It is populated not only by arrays of competing 'experts' and the organisations and institutions through which knowledge is generated and traded but also variously jostling 'publics'. It is not simply a political or commercial arena in which research priorities are identified and funded, or an arena in which research findings are disseminated, traded and used. The agora is in its own right a domain of primary knowledge production—through which people enter the research process and where 'Mode 2' knowledge is embodied in people, processes and projects. The role of controversies in realising scientific potential is also played out in the agora.

—Nowotny et al., 2006: 14

To review the previous sections on Mode 2 knowledge production, see pages 18, 67–69.

Included Middle (Nicolescu)

Basarab Nicolescu's approach to the concept of transdisciplinarity serves as one of the defining trajectories of the epistemological project (see pages 14–17). For him, the way new sciences shake up conventional thinking radically alters what we recognise as knowledge and reality under the classical model. (This section only scratches the surface of Nicolescu's work as part of the 'romp' through middles. A deeper dive into the primary sources in the bibliography is highly recommended for those particularly interested in this approach.)

Nicolescu speaks of 'levels of reality' and draws from quantum physics, evoking the idea that we can have multiple levels of

reality that have their own distinct fundamental logics, structures, phenomena, and laws. Further, each level can only be approached and explained and perceived through its own distinct fundamental logics, structures, phenomena, and laws. However—and importantly—for one level to exist, the others need to also: they are connected (see page 6 to review Lichnerowicz’s notion of isomorphism and Gödel’s Incompleteness Theorem, which opened the way for the perception of new realities and multi-valued logic systems).

The idea of two realities that cannot be thought of as the same but have coherence between them can be found in the natural world.

...an immense self-consistency—a cosmic boot-strap—seems to govern the evolution of the universe, from the infinitely small to the infinitely large, from the infinitely brief to the infinitely long. A flow of information is transmitted in a coherent manner from one level of Reality to another in our physical universe.

—Nicolescu, 2008: 8

A reality in which two realities coexist could be thought of as a sort of dynamic transreality. Nicolescu explains this through a diagram which shows the symbolic representation of the action of ‘the included middle’.

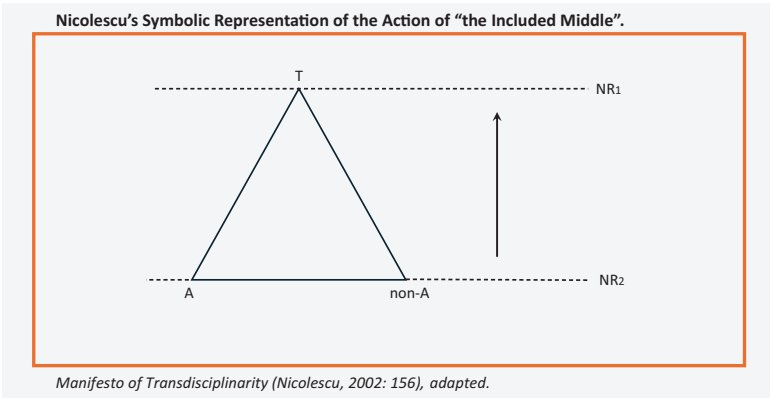


Figure 22

- 1. The axiom of identity: A is A.
- 2. The axiom of non-contradiction: A is not non-A.

3. The axiom of the excluded middle: There exists no third term T ('T' from 'third') which is at the same time A and non-A.

The place of non-resistance to these contradictions, the third space, allows for the 'included middle'. It resonates between the subject and object (to be discussed in the next chapter in the context of phenomenology). It preserves difference while allowing unification.

In order to obtain a clear image of the meaning of the included middle, let us represent the three terms of the new logic—A, non-A, and T—and the dynamics associated with them by a triangle in which one of the vertices is situated at one level of Reality and the two other vertices at another level of Reality. The included middle is in fact an included third.

—Nicolescu, 2010a: 26

This is aligned to the concept of knowledging introduced in Chapter II and in support of the perception of knowledge as an ever-active set of dynamic exchanges:

...the action of the logic of the included middle on the different levels of Reality induces an open structure of the unity of levels of Reality. This structure has considerable consequences for the theory of knowledge because it implies the impossibility of a self-enclosed complete theory. Knowledge is forever open.

—ibid.: 27

How one actually practices and engages and captures, measures, articulates and shares the knowledge born from a dynamic emergence of the included middle is not where this approach takes us, however. In the final chapter, we will explore the ways to practice in this context.

Non-Linear Dynamics

Systems Approach

When dealing with multiple 'levels of Reality' in the sense of Nicolescu's included middle and across the dynamics of disciplinary structures bound by their disparate vocabularies, values, and skill sets, and also working across various communities, stakeholders,

and policy makers, things clearly enter the realm of complexity. In order to grasp the complexities of the transdisciplinary landscape, a reductionist, positivist, linear, causal approach will not suffice. For this, we need to move towards connectivity, dynamism, and nonlinearity, with an opening up to the possibility of emergence. This is where systems approaches come in. However, as Wolfgang Hofkirchner points out, this does not exclude traditional science and its methodologies:

The systemist conception of sciences assumes semi-permeable boundaries and upward and downward interactions across the levels between all science. This is substantiated through defining any science in the context of discovery, describing and dealing with an overall systematic interconnectedness. Accordingly, formal sciences become part of a systems methodology that embraces formal and non-formal methods to understand systems features; real-world sciences turn into a science of different real-world systems that can be categorised as material systems, living (material) systems and social (living) systems, and applied sciences turn out to be a science of the artificial design of those systems. Any science is open to further specifications of subsystems, sub-subsystems and so on.

—Hofkirchner, 2017: 3

But what do we mean by a system? According to French philosopher and sociologist Edgar Morin, 'System is not a master-word for totality; rather, it is a root-word for complexity' (Morin, 1992: 382). It is not a utopian 'holism', as this would represent a new form of reductionism. In keeping with the work in the final chapter, systems approaches recognise conflict, contrast and complexity and do not aim to resolve, nor do they wish to create any sort of 'Theory of Everything'. 'Complexity cannot be simplified—that is the moral of the system paradigm. It is complex because it forces us to unite ideas which are mutually exclusive within the framework of the principle of simplification/reduction' (ibid.: 381).

Systems approaches do explore wholes and wholeness, however, from a perspective of dynamic interconnectivity. Systems thinking is a system of thinking about systems where any whole is recognised as something much more than the sum of its parts.

As opposed to reductionism and theories declaring that reality is 'nothing but' (a heap of physical particles, genes, reflexes, drives, or whatever the case may be), we see science as one of the 'perspectives'

that man, with his biological, cultural, and linguistic endowment and bondage, has created to deal with the universe into which he is 'thrown', or rather to which he is adapted owing to evolution and history.

—Von Bertalanffy, 1972: 423

Although systems approaches sit in this little intermezzo in the section on *non-linear dynamics*, one can see how they constitute a fierce recognition of *middles*. This is the reason why the final chapter proposes a new type of middle space that is situated in a doable practice (techne) before any task, a systematic *way of witnessing self* in the act of knowledging within and across one's *home* discipline. We as practitioners are systems too, engaging with systems and then being defined by systems and also redefining systems. This is a profound aspect of transdisciplinary exchanges.

Rhizomes

In Deleuze and Guattari's *A Thousand Plateaus*, they offered a delicious post-structural riddle for the landscape of non-linear thinking (Deleuze, G., and Guattari, F., 1988). Evoking the metaphor of the rhizome, they challenged systems thinking, psychoanalysis, notions of standard usage of language, origins in general and particular, linear journeys, epistemological hierarchies, history as representation, and so much more beyond the scope of this mere 'romp'. However, for this section and towards the notion of transdisciplinarity, within which this concept has been adopted to great effect (see Collett et al., 2020), the concept of the rhizome offers a unique approach to reconsidering the act of knowledging.

Firstly, rhizomes are found in nature. Consider the vast network of roots interlinking beneath the surface of a forest, or think about the construction of ginger, which branches off into all directions with no beginning or end. Both examples grow in myriad directions at once. In rhizomes, we find lots of interconnecting and perpetually changing multiplicities, a biological example of dynamic connectivity in action where any point can be connected to any other. There is no one originating system or final resting place or defining structure in a rhizome.

Deleuze and Guattari distinguish the notion of the rhizome from that of the *arborescent* (like a tree). We think of trees as moving in

a direction: upwards. They have a certain order; they come from seeds, and then from roots, and from the ground, and there are clear perceived causes and effects in their journeys, and we determine this ordering of tree-ness—*after the fact*.

A rhizome has no beginning or end; it is always in the middle, between things, interbeing, intermezzo. The tree is filiation, but the rhizome is alliance, uniquely alliance. The tree imposes the verb 'to be' but the fabric of the rhizome is the conjunction, 'and... and... and...' This conjunction carries enough force to shake and uproot the verb 'to be.' Where are you going? Where are you coming from? What are you heading for? These are totally useless questions.

—Deleuze and Guattari, 1988: 25

Because there is no beginning or end in a rhizome, the middle is not to be conceived the same way as in the notion of the *liminal* presented earlier in this section. Because there is no set structure within which the dynamics of activity occur, the *systems approach* will not apply here either.

In writing about education for sustainable development, Tanja Tillmann et al. explain this concept beautifully as it pertains to education and knowledge:

The rhizomatic perception of reality elucidated by Deleuze and Guattari is offered as a viable alternative to more traditional, arborescent modes of conceiving and understanding our world. The arborescent or tree-like view of reality tends to rely on hierarchical understandings of our world. Such hierarchical understandings are characterized by a universal acceptance of the processes of segmenting our world into discrete entities, to which fixed meanings are attributed. The rhizome offers a means to move away from traditional and hierarchical frames of thinking as it promotes multi-perspectivity of 'being and becoming'. The rhizome captures complexity and generates a fluidity that facilitates re-orientation of mindsets towards greater sustainability and harmony with the world we live in.

—Tillmanns et al., 2014: 6

The notion of *becoming* will prove important in the practice of knowledging proposed in the final chapter. In this context, becoming is dynamic, in process, with both the particular and the whole happening simultaneously in a live web. Knowledge in practice does

not *land*. Deleuze might say that one does not conceive of knowledge and then act, articulate or evaluate it, but rather that all of these are constituted simultaneously. These are not binaries or stages but rather pluralisms. 'You begin with the distinction between rhizomatic and arborescent only to see that all distinctions and hierarchies are active creations, which are in turn capable of further distinctions and articulations' (Colebrook, 2020: xxvii).

Holographic Principle

Another way of conceiving of non-linear realities, reminiscent of Nicolescu's included middle, is in the holographic principle. In the early 1900s, it was proposed by Leonard Susskind, the same physicist who co-invented string theory, that the very universe might actually operate much like a hologram. The holographic principle entered the public discourse at the end of the last century when it was picked up by physicist David Bohm, who used it to propose new levels of reality in his 1983 book *Wholeness and the Implicate Order*, and brain scientist Karl Pribram in his 1991 *Brain and perception: Holonomy and structure in figural processing*, where he drew on the principle to reconsider the ways the information occurs throughout the nervous system.

For our purposes, the principle offers a metaphor for reconsidering the structures of knowledge across knowledge cultures away from the local, linear, mechanistic, component and analytic and towards multidimensionality. It is a sister concept to non-linear dynamics, systems theory, chaos theory and complexity theory. It helps us to rethink the part, the bit and the local in terms of connectivity.

Most of us will be familiar with the idea that a hologram projects a three-dimensional image and is created by way of splitting laser beams. It works this way: one beam is bounced off the object to be photographed, and a second is bounced off a reflection, colliding with the reflected light of the first beam on its way to the film. The way a holographic film or plate looks to the eye is nothing like the picture of what it will project; instead, it looks like a bunch of irregular ripples, reflecting the collision of and crossing between the two split beams, like the ripples made by two separate stones being

thrown into a pond. The crisscrossing of these ‘ripples’ is called the interference pattern, and this is what creates the hologram.

Where this gets really interesting is that if you hold a holographic film or plate projecting an image of, say, a hat in your hand and then drop it to the ground, shattering it into pieces, not all is lost. With a hologram, if you were to project a portion of the film, you would not see a small part of the hat but rather the entire hat, just faded. The crux here is that all the information from the interference pattern is distributed evenly across the surface, offering a record of the entire image even from a small portion of the film/plate. In essence, *the part is in the whole and the whole is in the part*.

Sociologist and philosopher Edgar Morin, original signatory (with Nicolescu) of *The Charter of Transdisciplinarity* at the *First World Congress on Transdisciplinarity* in Convento da Arrábida, Portugal, writes about the holographic principle and evokes the wisdom of Blaise Pascal.

The idea of the hologram surpasses both reductionism, which can only see the parts, and holism, which only sees the whole. It is a bit like the idea formulated by Pascal: ‘I cannot conceive the whole without conceiving the parts and I cannot conceive the parts without conceiving the whole.’ This apparently paradoxical idea immobilizes the linear mind. But, in recursive logic, we know very well that what we acquire in terms of knowledge about the parts feeds back on the whole. What we learn about the emerging properties of the whole, a whole that cannot exist without organization, feeds back on the parts. So we can enrich knowledge of the parts through knowledge of the whole and knowledge of the whole through knowledge of the parts, in a single productive movement of knowledge.

—Morin, 2008: 50

The holographic principle offers an explanation that leads us to reconsider realities built on sectional thinking and dualities such as the brain/body, subject/object, local/global, bit/whole and part/entire. It opens up the possibility of an approach to perceiving and connecting phenomena not as linear or constructed like blocks, but rather brought forth from a place of attunement with a sense of connectivity. It is not about analysing by breaking things into parts, but making/sensing connections among underlying symmetries or occurrences.

Conclusion

Of course, there are other middles and other non-linear dynamic conceptual frameworks; however, those included here seem to recur in the discourses around transdisciplinarity. Liminality, the agora, the included middle (Nicolescu), systems approaches, rhizomes, and the holographic principle could be described as epistemological stirrings, perhaps? They are non-reductionist, and they encourage connections and an opening towards the possibility of emergence. They are all slightly different and are all useful as tools to help reveal blind spots in our practices of knowing.

Part II

In Chapter I, we examined the historic premises, complex definitions and key players in the development of the transdisciplinarity project. In Chapter II, we plotted a path through the history of disciplinarity, introducing the notion of *knowledging* (a term that in this section will be fully activated). We observed the enduring hierarchical supremacy of Aristotle's episteme over techne, which arguably has supported a sustained set of perceived dualisms in relation to practice/theory, science/humanities, subjectivity/objectivity, reductionism/holism and mind/body. In Chapter III we problematised issues to do with power, non-knowledge, values, people, and current approaches to transdisciplinarity. Finally, as an *Intermezzo*, we took a romp through non-linear thinking and middle spaces, setting the stage for the introduction of an approach that is designed to enhance both the Zürich tradition and work in keeping with philosophies of the Nicolescuian approach. The approach offered in Part II starts at a point *before* the practices that have been shared from existing traditions, moving through the entire process of transdisciplinary practice/research, allowing the option of using other approaches concurrently as desired.

In the proposed approach, we start with the *self* of the practitioner/researcher, making evident how we as *selves* are activated by and also activate our disciplines. From here, we begin to understand disciplinarity as a dynamic of knowledging, a process, rather than an *object* or *custodian* of knowledge. We will learn through this approach how to capture the exchanges of these dynamics as they reveal what disciplines actually *do* as they *cross*, *collide* and *exchange* towards the emergence of new knowledge or, as Nicolescu posited, *beyond* disciplinarity. To do this, we will draw from aspects of the arts, specifically the performing arts, but before we do, it is worth noting why this has not yet occurred.

Chapter IV

The Arts Have a Seriousness Problem

The way we have come to think about the arts and artistic practice in Western culture hardly resembles how it was considered centuries ago. As explored in Chapter II, the evolution of the *techne*/episteme relationship has had a complex journey across many acts of knowledging. As a quick review: in ancient Greece, arts and crafts were synonymous, encompassing a wide range of enterprises that included spiritual connections to practice and methods of fabrication along with appreciations of the symbolic implications of works. Aristotle, even as he categorised *techne* as a lower form of knowledge than episteme, wrote, “The nature of all *techne* is to research the technique and theory behind it, to find its principles in the person who gave birth to it, and not in the creation itself” (Aristotle in Strosberg, 2014: 26). Around the same time, the Roman equivalent of *ars* included medicine, sculpture, and carpentry. In the Middle Ages, mechanical arts found a firm place, including such practitioners as Leonardo da Vinci, and artisans gained recognition and independence with the building of cathedrals and the growth of cities. In the Renaissance scientists and artists had common concerns, and developments occurred in parallel. Artists gained personal reputations and considerable influence. As the Enlightenment got underway, aristocratic funding for the arts started to disappear. The scientific revolution had been a catalyst, and all things mechanical and reductive began to be favoured, with

the emotional and contemplative deemed less serious. From here on out, it was from science and its emergent technologies that the public would get its sense of what it means to be human and to live in, and of, the world. Before the Enlightenment it was largely the arts that served this role.

...since artists were no longer needed to represent reality, many took upon themselves the challenge of interpreting that reality. In so doing, they unwittingly reestablished conceptual links with science. Despite their role as 'society's conscience', few artists today have attained the social status of scientists. For example, there is no Nobel prize in the visual arts.

—Strosberg, 2014: 29

Bit by bit, and not without witness (and in some cases, resistance) from such luminaries as Francis Bacon, Ephraim Chambers, Denis Diderot and Jean Le Rond d'Alembert (as historian of the sociology of science and technology Eric Schatzberg discusses), the arts and the artisan became separated, and the fine arts as we know it emerged. Artisanhip became 'craft', aligned to skill, the mechanistic and imitative. When most valued, this became aligned with technology and applied science, and at its least valued, became a mere imitation of art. These evaluations had predictable correlations to do with power, class and agency.

'Technology' rose to the status of a keyword only in the 1930s. By then, it expressed the idea of both applied science and industrial arts. It also inherited the effacement of human agency that occurred in the nineteenth century, when middle-class theorists denied the creative role of skilled artisans in modern industry. In addition to obscuring agency, 'technology' also embodied a class relationship, with working-class skills subordinate to middle-class knowledge.

—Schatzberg, 2012: 563

In Chapter II, we plotted the path of the development of knowledge in more historic detail, but for the purposes of this chapter, we recall that science and the arts increasingly came to occupy incredibly different cultural worlds, with different languages and skill sets. Science in many ways became the antithesis of art, and in schools, many were guided to choose between the two as if they were incompatible life journeys. Although what we have come to know as 'art' is different

from that in the age of antiquity, Aristotle's hierarchical positioning of episteme over techne continues in relation to what is deemed valuable as research in knowledge production.

In Chapter II, we also learned how, in the last century, ways to advance knowledge and reconcile questions of objectivity, truth, value and rigour within and across disciplines have been approached and instigated from and against various tensions around the empirical sciences and social sciences. We learned of the Science Wars (see pages 56–61) and how social constructivism, a subject area from the humanities, questioned the hold science had as the custodian of knowledge. Within all of these debates and tensions, one area of knowledge less often tapped for its epistemological value has been that of the arts. This is largely because of somewhat romantic ideals, still in play, that keep artistic practice from being seen as *robust* in relation to serious and *impactful* research.

In discussing the notion of 'robustness', philosopher of science Léna Soler expresses that even though the term robust seems to be 'intuitively' clear as a concept, there are major fluctuations and vagaries to its meaning (Soler et al., 2012: 1). Thomas Nickles laments the lax use of the term in determining value in today's research:

In recent years the term 'robustness', its cognates and neighbors (solidity, persistence, hardiness, reliability, resilience, viability, flexibility, healthiness, etc.) have been applied to just about everything. In fact, 'robust' has become a buzzword in popular culture that can be applied to anything that exhibits strength of some sort. Indeed, the word is commonly applied, in addition to achievements in the scientific field (scientific propositions, scientific theories, experimental devices, experimental results and the like), also to complex technological systems beyond the scientific field (aircraft, electrical grids, nuclear plants, the internet and the like), as well as to biological organisms and to social networks. So there is a need for both substantive investigation and terminological clarification.

—Thomas Nickles in Solar et al., 2012: 1

One can see how the arts might have difficulty easily fitting into conventional attributes of robustness, especially with its connotation of *solidity*. Much artistic practice, when operating at the edges of its specialism, has a quality of flow, and is thus far from solid. In fact, attributes of rigorous and effective art include the incongruous,

discordant, and inconsistent, purposely instigating *against* proven/solid results, with a tendency to be reflexive, present and flexible. These are all attributes that, while offering the possibility of valuable practices towards innovation and new knowledges, do not, as a way of knowledging, fit easily into the uses of the term 'robust' in relation to conventional evaluations of research.

The arts have a *seriousness problem*, and this affects their role within multi-, inter- and transdisciplinary research and practices. Some of this is due to the de-emphasised manner in which artists have to represent their work in order to be included in research that is deemed robust, especially under the current imposed criteria of *impact*. In recent years, within inter- and transdisciplinary exchanges between the arts and sciences, the arts tend to sit at the periphery in relation to knowledge production. This is partly due to the ways that the value of knowledge has been institutionalised within research effectiveness exercises such as the REF in the UK. The impact of artistic practice is hard to measure unless it is contextualised as *applied*, absorbed or reframed as part of socio-cultural studies, or included in therapeutic environments. In all these cases, the value of the artistic aspect of a study is often measured through critical methodologies that lie *outside* those of art and/or artistic practice.

In discussing 'Art-Science' in the UK, Georgina Born and Andrew Barry illuminate another contributing factor to this *seriousness problem*. A common way that the arts participate in research is in the service of the *impact* of science research:

In these developments, art that is in dialogue with science is understood as a means by which the (absent) public for science can be assembled or interpellated. Here science is conceived as finished or complete, and as needing only to be communicated, understood or applied, while art provides the means through which the public is mobilised or stimulated on behalf of science.

—Born and Barry, 2009: 2

Siân Ede, arts director of the UK branch of the Calouste Gulbenkian Foundation and author of *Art and Science*, examines the dynamics among contemporary artists, science and technological advances. In doing so, she champions the notion that art need not be limited to the production of beautiful artefacts. She argues that the arts have established their role as a legitimate form of knowledge

production in their own right, and in doing so, help to reveal their epistemological value:

Visualising, abstracting, imagining, inventing, pretending, storytelling, re-presenting, and ceaselessly reinterpreting things are as important as indications of the human achievement as communication as rational discourse and the presentation of empirical evidence. We may be afraid of the uncertainty and chaos that this implies, but we should be able to acknowledge our susceptibility to seeing things from a range of view points and be confident in the value of such approaches. We probably have survived as a species as a consequence.

—Ede, 2010: 1

Note that all of Ede's characteristics listed are verbs, practices, and doings. So often the arts are considered in their artefact form, after the act of making and practising, somehow imbued with *meaning*. We don't tend to view the petri dish or a newfound drug and decide that it has *meaning* as an object. We tend to look at the discoveries and objects of science with a fierce curiosity about how we got to the exact elements in them. We need to know the steps, the chemical composition of the substance, the technologies involved, the possible implications of a discovery forward and the backstory of how we got to the results. It is within these aspects that we find the knowledge, not in the object in that petri dish, or the chemical composition of that drug. The science is in the *act* of the experiment. It is in the researching, the failing and the discovering. Too often, art, when crossing disciplines, is perceived as an object, next to science as a process. When we plop a sculpture next to a clinical practice of medicine, a finished play next to the socio-cultural practices around neurodiversity, or a piece of music inside the environment of a working MRI machine, these act as artefacts/objects next to the processes and practices of science and technology.

When we do this, we have not moved too far from E. O. Wilson's position (see pages 61–64) that '...the exclusive role of the arts is the transmission of the intricate details of human experience by artifice to intensify aesthetic and emotional response' (Wilson, 1999: 238) and 'Works of art communicate feeling directly from mind to mind, with no intent to explain why the impact occurs. In this defining quality, the arts are the antithesis of science' (ibid.: 238). And all this said in a supposed intention to, among other things, reconcile the

knowledges of arts and sciences! When looking into the possibility of an integrative process in the practice of epistemological pluralism, Miller et al. observe a dynamic much like those described in the section on problematising power in Chapter III (see pages 90–96).

The object of inquiry is often defined by one discipline, thereby entitling their methodological approach and epistemology, imposing a particular set of values—epistemological sovereignty.

—Miller et al., 2008: 46

This chapter will argue that when any sense of ‘epistemological sovereignty’ takes hold, the process of transdisciplinarity has stopped (or perhaps never started).

In recalling Nicolescu’s definitions of multi-, inter- and transdisciplinarity (see Figure 4 on page 17), examples such as those discussed in the previous pages in relation to applied arts, or art in the service of science, would most likely fall into the multidisciplinary category.

Multidisciplinarity concerns itself with studying a research topic in not just one discipline only, but in several at the same time. Any topic in question will ultimately be enriched by incorporating the perspectives of several disciplines. Multidisciplinarity brings a plus to the discipline in question, but this ‘plus’ is always in the exclusive service of the home discipline. In other words, the multidisciplinary approach overflows disciplinary boundaries while its goal remains limited to the framework of disciplinary research.

—Nicolescu, 2005: 144

If there happens to be a mutual exchange between the practices of an artistic discipline and another discipline, the project may manage to fall into the interdisciplinary category. However, this would only be possible if the artistic practice in question has, in the *process* of the research, an *explicit* role in the *activation* of the inquiry. Recall:

Interdisciplinarity has a different goal than multidisciplinary. It concerns the transfer of methods from one discipline to another. Like multidisciplinary, interdisciplinarity overflows the disciplines, but its goal still remains within the framework of disciplinary research. Interdisciplinarity has even the capacity of generating new disciplines, like quantum cosmology and chaos theory.

—ibid.

It is quite rare to find an actual transdisciplinary project that includes the arts with a discipline that lies outside the arts in the sense that Nicolescu describes. Recall:

Transdisciplinarity concerns that which is at once between the disciplines, across the different disciplines, and beyond all discipline. Its goal is the understanding of the present world, of which one of the imperatives is the unity of knowledge.

—ibid.

In the Nicolescuian sense, a multidisciplinary relationship is akin to one discipline sitting next to the other for a time. A useful analogy is opera, as it is generally understood to encompass multiple disciplines that most of us can understand as *practices*. In a production of Bizet's *Carmen*, which includes dancing, operatic singing, and scenography/design, perhaps a media artist creates background images to be projected during a dramatic aria. That media artist's work and the singer occupy the same space for a time. The media artist's work lives in the service of the performance of the aria. We might think of this as *1 next to 1*. In this example, neither the singer nor the media artist's actual practice of their discipline has influenced or affected the other's actual practice of their discipline.

If we bring in a ballet company to perform alongside the opera singing ensemble for the famous quintet, with the singers working next to the ballet dancers, all playing as gypsies, things shift to interdisciplinarity. As a director, I might ask the opera singers to move their bodies in ways that mirror the dancers; they might need to learn to contract and extend their limbs from a designated point of physical centre. I might ask the dancers to breathe with the musical phrase; to allow for a sense of cohesion with the singers, the dancers might need to watch the conductor for a cue. They would rehearse together and occupy the same space, but the difference here is that the dancers and the singers would be affected in a disciplinary way. Their practices would alter. Their bodies would have to leave their comfort zone for a moment; perhaps they would get an embodied experience of the difference between their disciplinary cultures. They would learn new terminologies and even have to apply them. This would be akin to $1 + 1 = 2$, with 2 being the temporary relationship, inclusive of embodied and theoretical knowledge exchanges within the disciplinary dynamics, in *action*.

This, however, would not be considered a transdisciplinary exchange, because after this performance those dancers would go back to their dance studios and their barre routines, and the singers would go back to practising in front of their pianos, vocalising their scales and working out their cadenzas with their disciplinary, embodied and theoretical practices unchanged. Transdisciplinarity would be a different sort of animal. It is akin to $1+1=...$ pomegranates? We arrive at something that lies outside the languages and skillsets of either discipline. There is an emergence of something new. There is the possibility of a *beyond*, as Nicolescu would say. The arts are rarely taken seriously enough to enter into an epistemological relationship like this, and because of this, we are missing important opportunities. This is exactly where this book will take you: into the practice of the practice of knowledge, and, in doing so, into the ways we function within and across disciplines. We will explore an approach that examines the *performance* of science and art, revealing them as *acts* of knowledging to allow for richer exchanges.

A Quick Dip Back into Two Cultures, Studies, and Turns

You will see as we progress that the practice proposed in this book offers an anti-hermeneutic approach drawn from performance, which is ironic, as the practice of performance is often perceived as being in the exclusive service of *meaning* (depicting texts faithfully and enabling the telling of stories, for instance). To briefly reexamine how we have become caught in this type of received thinking, let's hark back for a moment to the middle of the last century. Recall C. P. Snow's *The Two Cultures and the Scientific Revolution* and F. R. Leavis' cutting response, leading to the *Science Wars* and spurring on a newly minted separation between 'literary intellectuals' and 'research scientists' (see pages 49–51). Here, we had a perceived divide between the seemingly rational, empirical sciences and the humanities, which were supposedly subsumed by socio-cultural constructionism. On its tail came the 1968 student uprisings, catalysing the rise of postmodernism, with its roots in literary theory and anthropology, energising discursive criss-crossings in areas concerned with meaning, language, ritual, identity, society, behaviour and culture. This was a time ripe for the birth of interdisciplinary

scholarship, in the guise of an explosion of *studies* and theoretical discourses framed as *turns* (see pages 64–65).

Cultural studies, performance studies and science and technology studies were developed in this era. In this environment, anthropologist and cultural critic Clifford Geertz shared his perspectives on social theories of behaviour in his frequently referenced article *Blurred Genres: The Refiguration of Social Thought* in *American Scholar*, Spring 1980. Geertz's concepts of 'game', 'drama', and 'text' in relation to ritual and human behaviour are recognised by critical theorist Shannon Jackson as a stabilising influence. The field of performance studies gained institutional traction because Geertz 'came to symbolize 'anthropology' for a generation of non-anthropologists, wax[ing] eloquent about the blurring, particularizing, and analogizing of social thought' (Jackson, 2004: 147).

The 'turns' wove their ways through the 'studies', and for the purpose of understanding the act of knowledging across disciplinary boundaries, a familiarization with the 'practice' turn is helpful. Because 'turns' are more movements than doctrines, and in some cases are still in development, there are no ruling positions that define them; however, we can say that the practice turn was a response in part to logical empiricism and is built, like the performative turn, on the linguistic turn. A large part of what the practice turn is about is thinking of language, agency, power, knowledge, ethics, culture, and science as practice(s) that practice against, with and are always mediated in relation to other practices, rather than in relation to objects and bound by any authorising aspect, essence, or order.

The Practice Turn

...[though] practice theorists would agree that activity is embodied and that nexuses of practices are mediated by artifacts, hybrids, and natural objects, disagreements reign about the nature of embodiment, the pertinence of thematizing it when analyzing practices, the sorts of entities that mediate activity, and whether these entities are relevant to practices as more than mere intermediaries among humans...practice accounts are joined in the belief that such phenomena as knowledge, meaning, human activity, science, power, language, social institutions, and historical transformation occur within and are aspects or components of the field of practices. The field of practices is the total nexus of interconnected human practices.

—Schatzki, 2005: 11

Despite the expansive advances in theoretical thinking incubated in the various *studies* and teased out through the multiple *turns*, the discourses within them work quite effectively towards maintaining an ongoing assumption that science lives more properly on the side of *epistemology*, with the humanities (inclusive of the arts) on the side of *hermeneutics*. In such assumptions, the sciences can still claim to serve verifiable objective truths, where the humanities are seen to hold the space for diversity in meaning-making, giving agency for multiple cultures of difference, and allowing for shifting perspectives in a variety of contexts. Science, in this sense, is more easily perceived as robust and repeatable and therefore more fundable and more highly valued as research.

We can see in this context how the fine arts and literature came to have a seriousness problem, and if this is the case, then the performance artist is in real trouble. The *actual* work and the epistemological value of the performing artist's *practice* are largely rendered invisible, in part thanks to embedded historic prejudices, and sadly invisible even to the very turns and studies aligned with the concept of *performance*.

Performance Practice, a Function of Hermeneutics in Servitude?

Before the studies and the turns, the performing artist's low status in any area of epistemological seriousness was well established. The act of performance was rendered as a function of hermeneutical servitude. As I have written in previous publications, a prime example of this can be found in the history of opera, which can be seen as a 'history of a prejudice against the performer and the act of performance' (Bryon, 2005: 287–295). As previously mentioned, in speaking about the interdisciplinary nature of knowledge in the Renaissance, the birth of opera can be credited to a group of scholars, scientists, and musicians called the Florentine Camerata (see pages 37–39). We learned how they lamented the unruly nature of the performer and sought to resurrect an immaculate essence embedded in the text, evoking a supposed classical purity thought to reign during antiquity.

I would advise you, therefore, to fix forever in your memory what Aristotle says, that in rhythms are images of fortitude and... above all else your principle objective should be not to spoil the verse in singing by making a long syllable short, or a short one long, as is habitually done every time; and what is worse, it is done by those who consider themselves great men in this art, with such poor grace and style that any connoisseur of good poetry reacts with great pain and distress, something unworthy of our century, surely.

—Bardi, 1578: 121

The performer, when deviating from some supposed inherent meaning held fast in the text, was considered to have supremely ‘poor grace and style’ (Palisca, 1989: 121). As opera progressed through the centuries from Monteverdi to Handel, from Mozart through Rossini to Wagner, reforms evolved around notions that the custodian of meaning was either the word/libretto or the music/score. Into the 20th and 21st centuries, things got a little more flexible, but one could argue that the performer in contemporary times works largely in the service of a *pre-determined* design or concept dreamed up by the director. In fact, the notable time when the act of performance came to the forefront was in the Bel Canto era, typified by the works of Gioachino Rossini (1792–1868), Vincenzo Bellini (1801–1835) and Gaetano Donizetti (1797–1848), when extravagant vocalism and the ‘mad’ aria became a virtuosic vehicle. This resembled the earlier Baroque era of the Castrati, where melismatic writing and the singer’s reaching extravagant heights was an evocative and often grotesque attraction in its own right.

There are two primary ways in which the performer has been positioned throughout the history of opera. The first is as a vehicle for a pure realisation of the text: a figure tasked with embodying the composer’s and librettist’s vision. In these cases, the performer becomes a vessel, even a puppet, serving the intentions of the composer and librettist, or, in more contemporary settings, the director. ‘The second role of the performer is similar to an attraction in a circus show. In this role, the performer defies gravity with feats of high notes or clever ornamentation; the meaning is in the very novelty of the act. In these eras, the critics traditionally blame the singer for becoming unruly and ruining the sacred drama’ (Bryon, 1998).

Why this matters to us as inter- and transdisciplinary research/practitioners is that, if the text, design, or concept is not the custodian of the meaning—where is the meaning? Can we take this further and posit that disciplines are not the custodians of knowledge? This is *exactly* what I will argue in a few sections. We will come to see the words, choreography, blocking, score, set design, the disciplinary rules, recipes, and methods of science as all *pre-scribed*, akin to the aforementioned artefact, and thus unstable as custodians, since the *ways* in which they are enacted and/or encountered shift meaning and therefore the generation of knowledge in action as well. If the exchange of knowledges in the crossing of disciplines is at the core of our work, then where those knowledges occur and/or reside is going to be important. One discipline that has mastered the *acts* of *process* in the *practice* of training, conditioning towards excellence in both unstable and pre-scribed spaces, is that of performance training. The critical framework of the active aesthetic will help capture and witness acts of knowledging within our own and across other disciplines to reveal blind spots and complex connections, in a bracketed middle space that occurs *before* things land as artifacts, texts, or concepts.

Roland Barthes (1915–1980), literary theorist, essayist, philosopher and a central figure in advancing this concept, refers to a notion of text that is not an *object*, such as a musical score, but rather as a dynamic *event* that ‘exists in movement, of a discourse’ and is ‘experienced only in the activity of production.’ It lives as a ‘network’ in such non-linear and middle spaces as discussed in the Intermezzo section of this book (see pages 123–134). He most famously stated that ‘...the birth of the reader must be at the cost of the death of the author’ (Barthes, 1977: 148) and that ‘It is not that the author may not ‘come back’ to the text, in his text, but he then does so as a guest’ (ibid.: 161).

This thinking helped to jiggle us out of the idea that there is an inherent meaning in the text or score toward the idea that acts such as reading generate meaning that may or may not align with the author’s text. This goes for almost anything pre-scribed: the way of watching a performance, the way of repeating an experiment, or the way of following a recipe, for instance. We will explore how knowledge and meaning occur in the *ways* of doing an act.

Performance studies grew out of the postmodern landscape on the heels of the practice turn. It was closely aligned with the interdisciplinary cultural studies that grew alongside a blurring of boundaries, with an augmented interest in cross-disciplinary activity among the humanities and sciences. That its defining roots are found in the social sciences and literary theory is a large part of the problem in relation to its lack of advocacy for how knowledge is *generated* in the *practice* of performance. For scholars in performance studies, the term 'performance' serves to examine theories of reception and repetition over a wide range of events, texts, and/or identities. One might utilise 'performance' as a means of contextualising hermeneutic readings and representations. Performance is defined as anything that does, or is done to, and/or generates meaning. One of the founders of performance studies explains:

One cannot determine what 'is' a performance without referring to specific cultural circumstances. There is nothing inherent in an action in itself that makes it a performance or disqualifies it from being a performance...every action is a performance... What 'is' or 'is not' performance does not depend on an event in itself but on how that event is received and placed.

—Schechner, 2002: 30–31

Where performance practice as a valued epistemology comes into difficulty is in observing how practice is frequently separated from nuanced understandings of the *processes* of that practice, and instead classified as a performative object that is positioned or incorporated in the creation of a performance. For instance, when Schechner looks at modes of performance that take years of training, such as ballet, Western opera, Chinese opera, and Noh, he calls these 'codified acting', because such disciplines are for him 'based on semiotically constructed gestures and movements, songs, costumes, and makeup set by tradition and passed down from teacher to student by means of rigorous training' (Schechner, 2002: 156). He says that in order for codified acting to be mastered, one needs to 'begin very young when both mind and body are flexible' (ibid.: 158). Somehow, Western acting training, no matter how rigorous, is excluded because 'one can begin to learn realistic or Brechtian acting relatively late in life because people have 'practised' daily behaviour all their lives' (ibid.: 158). As I have argued in previous publications:

...on a most basic level, is it not true that in actuality, codified or not, the years of training needed are not about the learning of positions and sequences of dance, or the memorising of notes and phrasing of music, but rather the *way* in which to do these anew each time? It is not the signs and signifiers or the codes of performance that render the learning of these disciplines time-consuming, but rather the *act* of doing, the *way* of practice. ‘The codified performance emerges out of this way of doing, an active aesthetic, not as the performative object of an ‘actor’ activating codes. It is this *way* of doing, the *practice* of the practice that is passed down from teacher to student. It is this that takes the time and requires exactitude: not the learning of codes’ (see Bryon, 2014: 49–50).

The Arts Justify and Diminish Themselves

As this book is being written, arts education is under assault within Western culture. Music, drama and arts programs in schools are being cut, and scholarships and government funding for creative practices are being passed over for STEM subjects in the assumption that these will provide a better workforce for society in preparation for an unknown future. If it were indeed the ‘codes’ that were to be lost, or even artefacts on the walls, dancers on stages, actors in houses, and musicians in pits, that would be sad and certainly the entering of an aesthetic dark age, but this is not the worst of it. The *ways* in which we train, practice, teach, and endeavour to improve and create have informed the development of human minds and bodies for centuries. The ability to stick to something and fail and try again, to commit to a hunch, to follow a sense of intuition and to risk physically to endure and push through the edges of physical pain and mental exhaustion to attain something that is revered as coming from before us and respected as a tradition bigger than one’s self: the ways of practising in the arts have informed and transformed humanity for centuries. The reading and playing of music is something that was once considered part of general literacy. Many of the scientists in the previous chapters would have grown up knowing and participating in fine and musical arts. Lawrence Scripp’s meta-analysis in the field strongly suggests that ‘Research now offers a theoretical basis for, and growing evidence of, the significant effects

of learning shared between music and other measures of academic achievement' (Scripp, 2002: 135). These include:

- spatial-temporal reasoning (Hetland, 2000a and b),
- achievement in math (Vaughn, 2000),
- achievement in reading (Butzlaff, 2000),
- the reinforcement of social-emotional or behavioural objectives (Standley, 1996) (in Scripp, 2002: 135).

In studies involving fine arts education, results show it 'provides opportunities for the interplay between expression and reflection, bringing about meaningful and measurable benefits in domains outside of those found currently in most academic achievement tests' (Roage and Kim, 2013: 126), with measurable enhancement in the areas of academic achievement, mental health, creativity and attendance.

Movement and dance training has been known to promote synaptic smoothness (promoting neurological connections throughout the body), a realistic and accurate understanding of what the body is doing (making movement conscious and developing internal awareness), eye-motor coordination (enhancing accuracy in observation and perception of movement for recognition and repetition), awareness and understanding of spatial relationships (involving bodily movement in space and time) and hemispheric transmission (helping coordinate brain function through the corpus callosum, the network of fibers that facilitates communication between the right and left hemispheres of the brain), among other things (Faber, 2016: 174).

In looking particularly at the development of body, mind and emotions, 'recent neuroscientific research corroborates the notion that drama and performance techniques have the potential to be an effective tool in educating the whole child...' (Van de Water, 2021: 1). Benefits were found through embodied and contextualised learning, especially in the areas of inclusion, diversity, and social awareness. Further, early training in performance is known to enhance crucial interaction skills. 'Training can be done through activities that develop teaching skills, new ideas and thoughts about teaching and deeper interaction skills and that are pleasurable. By training our interaction skills we have new experiences using our sense organs.

These can reshape our mental pictures and representations of reality—often in a creative way’ (Toivanen et al., 2011: 60–69).

Most of these studies, often cited and commissioned in defence of the arts, couch the benefits as therapeutic, good for mental health, valuable in the creation of cohesive communities, enhancing physical coordination, contributing to complex thinking, and even good for general health. This may all be true, and these studies can sometimes be helpful in getting grants and justifying the keeping of crucial programs in education and communities. However, they yet again, more often than not, relegate the arts to the service of other disciplines.

When we emphasise that the arts benefit the human condition in a way that needs to be immediately measured within the tools and timelines of another discipline, those very arts cease to resemble their own practices, as their effectiveness is now measured not by the excellence of their own traditions but rather by their effects in another. When we take component parts of an artistic practice and put them in the service of the practice of pedagogy, therapy and community-making, this is lovely, but let’s not measure or justify art within this model without clarity.

Even with our best intentions, working with materials, tools, techniques, and processes used by artists in therapy, pedagogy or community-making exercises, *this does not make the object produced art*. In these instances, the intention of the work is not to create art but to engage in a therapeutic or pedagogical or community-making process. The intention of the creator of art in a cultural and societal context is to create art, which is very often *anything but* therapeutic, instructional, or cooperative.

Chapter V

Knowledge Happens: But What's Happening?

If we continue disturbing the epistemological hierarchies of antiquity by considering the *techne* of *episteme* rather than the inverse (the premise of this book), we can begin to wonder about the ways knowledge *happens*, how it is *activated*, and what *occurs* in the crossing, colliding and interchanges *between* knowledge cultures. With this, we lean directly into the notion of *knowledging*, which is built on the idea that knowledge is activated through different natures of exchange. This aligns with Foucault's famous statement: 'The episteme is not a general developmental stage of reason, it is a complex relationship of successive displacements' (Foucault, 1991: 55). In embracing a notion of knowledging we accept that knowledge does not *reside* in a discipline as an object. Knowledge is a *process*, *active* and *dynamic*. When we take this further, we begin to consider the idea that neither the practitioner nor the discipline is the custodian of knowledge either.

Knowledge is unstable, and although this can feel uncomfortable, it is exactly within the unstable spaces where innovation, new knowledge and Nicolescu's notion of *beyond* are incubated. The practice of working in this sort of dynamic space, however, is not the conventional training of the inter- or transdisciplinary researcher (see pages 104–109). We will explore in the next sections how

Transdisciplinarity in Practice: Capturing and Experiencing Knowledge across Disciplinary Boundaries

Experience Bryon

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knowledge happens in the ways we do things and that what we actually practice is what actually informs the development of our minds and bodies, and therefore the scope of knowledges we are capable of receiving, mapping, articulating, conceiving and perceiving.

In the *Intermezzo*, we explored the idea of non-linear thinking and middle spaces. In discussing inter- and transdisciplinarity, there is a tendency to evoke the application of middle spaces along with models of between-ness. This is largely because much of the exercise is that of witnessing the spaces between as the disciplines practice across and among each other. A common theme is the embracing of the uncomfortable spaces of disciplinary exchanges. As Moran summarises, it's inherent in the terminology:

As Geoffrey Bennington points out, 'inter' is an ambiguous prefix, which can mean forming a communication between and joining together, as in 'international' and 'intercourse', or separating and keeping apart, as in 'interval' and 'intercalate' (Bennington, 1999: 104). This ambiguity is partly reflected in the forging connections across the different disciplines; but it can also mean establishing a kind of *undisciplined space in the interstices between disciplines*, or even attempting to transcend disciplinary boundaries altogether.

—Moran, 2010: 14; emphasis added

This idea of an *undisciplined space* is perhaps seen as such because the workings within it cannot be labelled, landed, measured, repeated, or evaluated within the rules, frameworks, languages, and paradigms of any of the disciplines it lies among. It may be in a *liminal space*, part of the dynamics of an *agora*; the exchanges might be resisting the *arborescent* and living in a more *rhizomatic* state. We may be entering a realm where our own discipline and another exist together in an '*included middle*', and/or we may be experiencing knowledge concurrently as both sectional and integrative in line with the *holographic principle* (to review these terms and concepts, see pages 123–134). To think more explicitly about how we as research practitioners activate knowledge in engagement with our own, and across other disciplines, we turn to performance theory and practice.

We will examine the problematic nature of knowledge as an act of knowledging through the critical methodology of the active

aesthetic. The active aesthetic has to date been used in a variety of settings (Bryon et al., 2018; Campos, 2013; Scott, 2016; Moran, 2017; Kaufman, 2017; Tunprasert-Ahrens, 2018; Skelton, 2024) as a critical methodology helping to interrogate, witness and capture aspects of experience, exchange, process and practice in the generation of knowledge. This approach is designed to help capture and witness acts of knowledging within our own and across other disciplines, to reveal blind spots and complex connections, in a bracketed middle field that occurs *before* things land as artifacts, texts, or concepts.

The Middle Field of the Active Aesthetic

In this model, the middle field can be considered as a field of ‘performing’, which lives *between* a ‘performer’ and the ‘performance’; it is an *active* field. It functions to help us discern the *ways* knowledge, information and meaning *occur* in *ways* of doing—in the *practice* of a practice. You will see that it is a matter of *manner* rather than of method where the nature of knowledge occurs. The critical framework of the active aesthetic offers a way to ‘witness or evaluate the *way* of *doing* in process, the qualities within the *activation* of generating a process’ (Bryon, 2014: 61).

This model helps to reveal how the knowledge of any discipline does not reside in the object of that discipline, nor does it reside in its crafts/faculties/texts/departments/methods/techniques/evaluations, but rather in the practices of its practice(s). We will see that the traits and rigour of a discipline at any one time are primarily determined by the ways or manner in which people practice within that discipline, and, in turn, that this *way* is what we *actually* become proficient at when we master a discipline. In this sense, the rigour of any field exists inside the dynamic of an active aesthetic as it engages through its knowledge. Knowledge happens in the ways of doing, not the whats of doing. To return to a metaphor from many pages ago: the quality of the cake is in the way of making, not the object of the printed recipe, and aspects of this *way* that are not in the recipe will have a marked effect on an outcome, such as the type of spoon, one’s emotional attachment to the recipe and the care one puts in, the weather, the stove, or the soil from which the grain to make the flour was grown.

It works like this. A performer does not *do* performance, but rather *does something* (performing) from which the performer and the performance emerge. A dancer does not dance. A singer does not sing. A researcher does not research. Rather, all engage in a middle field of dancing, singing and researching from which the singer/song, dancer/dance, and researcher/research emerge, often simultaneously. In collapsing the dichotomy of subject/self and object/discipline (see Figure 23), we disturb the notion that the aesthetic of an artefact or performance *holds* meaning and that any discipline, text, recipe, or plan is a *custodian* of knowledge. Importantly, this 'middle' thrusts all included elements into a field that is more systems-oriented and anti-hermeneutic than reductionist, linear, and dualistic.

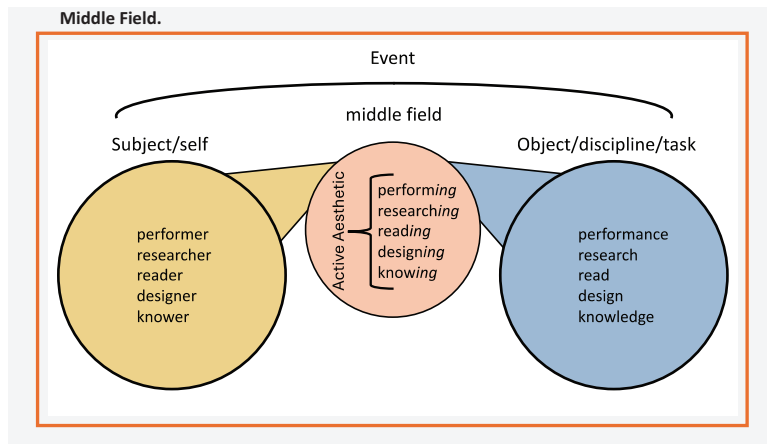


Figure 23

The term was coined *active aesthetic* in relation to performance practice (Bryon: 1998), to reveal how it is not the aesthetic of the artefact or of the text where meaning happens in performance, but rather that of the practice of performing as it collides with the acts of engagement, experience and witness. Singing the same song, the same notes, let's even add the same family: Judy Garland's 'Over the Rainbow' and Liza Minnelli's will be different. It is in the *ways* of singing that both the song and the singer emerge. This could be said of an experimenter doing an experiment, too. It would be in the details of the middle field, the ways of doing the practice of

experimenting, that all this would be more comprehensively able to be witnessed and then captured as a record and/or data (to be explored in the next sections).

The Doing of the Doing

When we say ‘the doing of the doing’ or ‘the practice of the practice’, it is not meant to be an annoying tautology. It is key to discerning what the stuff of the middle field is. Highly trained performers know well that what we actually do is not what we appear to do. An actor does not do emotions; neither does a dancer do choreography, nor does a singer do notes. There is a whole series of actions/intentions, tensions/obstacles and happenings, internally, externally, and experientially, that must occur *before* any emotion, move, or utterance emerges. Some of these lie in emotive and/or physio-vocal conditioning, some happen as creative choices in the moment, and others as choices made in text analysis, carefully crafted and conditioned into embodied acts. In fact, any performance practitioner of voice, acting and movement will tell you that for the most part, by the time a pirouette, a high C, or a dramatic line is executed, it is too late to do anything about it. Its quality and rigour are determined in the work before the word, move or sound, and must be re-practised anew each time. It happens as a practice prior to any pre-scription. It’s this pre-hermeneutic process that takes years to master and is sometimes ineffable and not always linear. It encompasses some things that are not of our bodies and some things that are, and includes aspects that are not of the realm of representation. It is within the dynamics of the middle field where knowledge can be found and rigour determined.

We start by beginning to ask ourselves, what am I doing when I do ____? As a thought exercise: as you are reading this page, there is you, the reader, and the book to be *read*. The active aesthetic lives in a space between this: the *act of reading*. And, moreover, your *way of doing* the *act* of reading. I posit that it is through the *way* of doing the act of *reading* that the *reader* and the *read* will emerge.

As you are *doing* the *act of reading*, what is involved in your *way* of doing? Are you *skimming* the pages to get the basic idea? Are you *searching* for things that apply to you? Are you *connecting* the

ideas on this page to your own knowledge base? Are you *trying* to make sense of the ideas? Are you *criticising* the text as it unfolds? Are you *thinking* about what you might have for dinner tonight? Are you *trying* to focus as there are kids screaming in the background? What do you bring to the act of reading as far as attitude? Are you suspicious, eager, dispassionate, or interested? How does the environment play into the act? What is involved in the *way* of doing?

In this exercise, you might ask what is the *doing* of your reading, the *doing* of your doing, the *practice* of your practice in this event of reading? What is involved in your *way* of reading? This is the stuff of the *middle field*. You are not simply reading, but rather you are engaged in a *way* of reading. Any knowledge gained or lost will be an emergent property not of the book, or of you, but activated in your *way* of the *act* of reading.

For instance, if while you were engaging in the practice of reading, the light was flickering, you were thirsty, the air pressure was shifting, and your left shoe was tight, this would all fall into the middle field. The room, the floor, the nervous system, one's history, the day of the week, muscle and emotional memory, felt senses, highly technical physical patterns of learned behaviour, involuntary muscle groups firing in precise ways, productive tensions, conscious acts, unconscious actions, and so much more can all be found within this middle field and will, as an emergent property, determine the reader and the read.

Further, what we actually do (as a doing of the doing) is what we actually get good at. And as there is no such thing as not doing, it is prudent to witness doings in this way so that we can bring awareness to what we are conditioning in, creating, and activating. Performance artists know this, since as an occupational hazard all their doings, mistakes, and/or techniques are very exposed. Importantly, one can only make choices about activities/doings that one is aware of. As an exercise, I ask my students when finishing the first term of their BA degree in acting, for instance, to explore what the doing of their doing and the practice of their learning is. Many start by saying that it is to master the craft of acting; however, when we drill down (a term we will use to effect in the following sections) by asking ourselves, what is the doing of my 'mastering', and continue to drill down, what is the doing of (the answer to that question), and so on, we find that many were doing the doings of '*pleasing* the teacher' or

'*trying* to get a good grade' or '*competing* to be the best'—all sorts of things that have very little to do with the discipline of acting. If they did not self-witness their own engagement with the practice of their discipline of learning, they might have ended up getting good at *pleasing*, *trying* and *competing*, because we get good at what we *actually* practice. This would be the knowledge acquired, and all the texts, methods, plans, techniques, curriculum, data, of the discipline would become complicit in that doing of the doing. This is not as dire as it might sound. Especially when we remember that *we* do our disciplines, they do *not* do us, the fact that what we get good at is what we practice becomes a matter of one's own agency (but more on that in the following sections).

Thinking briefly about applying this conceptual framework to more meta questions, we might begin to wonder about the active aesthetic of learning and education in Western culture and find that much of the stuff of its middle field (regardless of all the advances in the sciences, philosophy, pedagogy and arts) bears surprising results. If you speak to educators, they will often tell you that the middle field between teaching and being taught these days has become largely about preparing students to take tests. Where this is the case, we will have a generation of the taught patterned into an understanding that knowledge consists of attributing values to answers, with all that entails, both when it works and when it does not. Here, the emergent properties of the 'learning' will not necessarily be those of thinking critically, risking failure, or valuing exploration in the ways that it would be if the middle field contained such things as holding the space for and encouraging inquiry, recovering from mistakes, engaging in complex thinking and making connections. It is important, however, and we will explore this in greater detail when we learn how to analyse and capture the stuff of the middle field, that observations such as these should happen without judgment as much as possible. Observation and witnessing will be key to minimising the 'noise' in the data prior to evaluation.

Another meta inquiry might be around how we connect in the modern world: if we look at the ways humans now actually engage and connect as communities, we might observe that in the middle field of this practice, much of this occurs while we sit alone. Often, even when others are in proximity, our field of awareness tends to be focused on a lit-up rectangular device as we curve our spines

to meet it and often respond internally to reward signals coming from this device. This is the stuff of the middle field and is what we are becoming excellent at in a world of phones and tablets. What happens in the active middle field is what we get good at and determines the knowledge (embodied and intellectual) that is conditioned in and acquired. There is no robust thing called learning or connecting. The learner does not learn, the teacher does not teach, the connector does not connect. Rather, we engage in a middle field of learning, teaching and connecting from which the learner, teacher, and connector learn, teach and connect. Practices and disciplines alter over time as they rub up against the world in an ever-changing dynamic of knowledging.

Sometimes, what we call ourselves within a discipline does not directly and grammatically align with what we do. For instance, what is the doing of the doing of a doctor? It does a discipline and a practitioner a disservice to consider it all of a piece, even if we are speaking in a career-focused context. Let's look at a general practitioner. If you are a doctor, what do you do when you doctor; what is the doing of doctoring? Does a GP heal, diagnose, comfort, prescribe, get through the day, manage a complicated schedule, get through as many people as possible, negotiate insurance policies? What is the practice of the practice(s), and what happens when we drill down through the doings of healing, diagnosing, prescribing, and negotiating?

It is crucial for us to understand our own disciplines, but also important to consider the middle fields in relation to the disciplines we plan to work in, especially as we wish to create interdisciplinary connections with new emergent active properties. It will be the middle fields across disciplines that intermingle and generate meaning and knowledge, whether we are aware of them or not.

Reproducibility and the Middle Field

The middle field is dynamic, and might temporarily take the form of an 'undisciplined space'. However, there are ways to map it, or at least witness its dynamics (We will go into detail about models of capture in a few sections.). One can think of the middle field as a shifting template that serves as a temporary, contained space of flow.

It is moving, unstable and highly subjective, and as conventional research models are so often bound by the robust, stable, and objective, one might have trouble conceiving it as rigorous or even repeatable. However, this is exactly where drawing from the epistemology embedded in embodied performance practices has the potential to serve inter- and transdisciplinary researchers.

In the standard account of science, repeatability is part of what gives science its robustness. However, the scientific method is also subject to the stuff of the middle field. The process of verifying a study and/or the results of an experiment as fact and therefore as knowledge has, in the last 20 years, come into question. Arthur Nosek, an American social-cognitive psychologist, launched the Reproducibility Project, including 270 scientists repeating 100 published psychological experiments. The results were surprising, with only about a third of the experiments able to be repeated effectively:

There exists very little evidence to provide reproducibility estimates for scientific fields, though some empirically informed estimates are disquieting (Ioannidis, 2005). When independent researchers tried to replicate dozens of important independent studies on cancer, women's health, and cardiovascular disease, only 25% of their replication studies confirmed the original result (Prinz, Schlange and Asadullah, 2011). In a similar investigation, Begley and Ellis (2012) reported a meager 11% replication rate.

—Nosek, 2012: 657

That this occurs is not so surprising. As many in the field of research know, there are few funds set aside for the validation of old ideas in the replication of experiments. Professional progression, funding and publications tend to favour innovation and new ideas with potential 'impact'. Rather than anything sinister like outright fraud, the most likely causes are 'publication bias', the fact that journals prefer to report positive results, and, of course, the fact that funding is not generally given to prove something wrong, especially when the positive result serves pharmaceutical companies and institutional research profiles.

Rather than any debunking or casting of aspersions on research practices, what is more interesting for our purposes is how the failure to repeat happens, and what exactly occurs to confound the

replication when attempted. If all of the *pre-scriptions* that are part of the discipline of scientific experimental practice are present and all data and methods transparently accounted for, then what happens in the instance of a 'fail'? It may not be an issue of bad research practice or corrupted data, but more about the *ways* of doing the *practice* of the experiment: the stuff of the middle field.

Paola Bressan, a research scientist in experimental psychology, took a closer look at a Reproducibility Project in Psychology (Open Science Collaboration: 2015). She examined four separate 'failed' replications that one would assume maintained the integrity of *pre-scribed* disciplinary methods and data retrieval processes. However, what contributed to unforeseen confounds was interesting:

Twelve color photographs of faces of men of various degrees of attractiveness were presented in an album, one per page. Each photo was accompanied by one of four labels: 'this person is single,' 'this person is in love,' 'this person has a girlfriend,' and 'this person is married.' Four parallel albums were prepared so that each of the 12 faces could be paired, between subjects, with all four labels. Stimuli and albums were the same across the original and replication studies (see Data Availability). *Stimuli were presented on paper in the original and lab replication studies, on a computer screen in the online replication study.*

—Bressan, 2019: 4; emphasis added

In the discipline of performance-making, where 'experience' is a large part of the currency we deal in, the difference between a live and mediated encounter would be seen as a profound shift, setting off all sorts of adjustments to do with the reception of meaning and consideration around received knowledge, inclusive of shifts in perceived risk and evaluations of the audience's and participants' investment and levels of felt intimacy. All of these would be accounted for in the *ways* of doing the practice.

There were other differences, too. Some studies had originally been done in Italian, with the replicated study in a translation into English. Some studies were repeated online when the original happened in person. One study experienced what is called 'random noise in the replication dataset', which included: participants arriving late/early, not following instructions, having previous knowledge of the study, forgetting to read labels, misreading labels, giving ratings before reading labels, questioning labels, and asking explicitly

whether the label should affect their rating. Some participants were not paying attention, or going through the tasks very rapidly, or using their phones (all documented in the data).

None of these participants (89 overall, because a few fell in more than one category) had been excluded from the analyses run by the replication team. These sources of noise in the data (absent in the original study) were indeed hard to remove, because the study's statistical power would decrease substantially by dropping these participants en masse.

—Bressan, 2019: 6

An experimenter does not do the experiment, but rather enters a middle field of experimenting, and all of this might be useful to think about in terms of how we engage in the acts of knowing. In agreement with Bressan, 'if we are really curious about the truth—as opposed to just craving to prove a point—it might be best to have a good look at the data; yes, to examine them (in full public view) from every angle' (Bressan, 2019: 11). Those wishing to remain curious rather than simply debunk, make points, or create scandal, see all this as a signal to deepen the practices of scientific inquiry. As transdisciplinary practitioners/researchers, we need to be able to see as much of the picture as possible in order to make connections and offer transparent choices. Reproducibility and replication are becoming less stuck and possibly ready for ideas like 'repeated presence' or 'shifting templates', which will be explored in the following pages.

The problem is this definition's emphasis on repetition of the technical methods—the procedure, protocol, or manipulated and measured events. Why is that a problem? Imagine an original behavioral study was conducted in the United States in English. What if the replication is to be done in the Philippines with a Tagalog-speaking sample? To be a replication, must the materials be administered in English? With no revisions for the cultural context? If minor changes are allowed, then what counts as minor to still qualify as repeating the procedure? More broadly, it is not possible to recreate an earthquake, a supernova, the Pleistocene, or an election. If replication requires repeating the manipulated or measured events of the study, then it is not possible to conduct replications in observational research or research on past events.

—Nosek and Errington, 2020: 2

When a visual artist does a series in the same style, one work rarely duplicates the exact steps of the last, as in a recipe. It might be the brush strokes that repeat, the scale, the environmental impetus behind the work, sometimes a colour palette, or the type of materials. The space in which they complete the work may or may not necessarily matter to the aesthetic; the year they complete it may or may not matter. When working with practices across disciplines, there always need to be some flexible, subjective, experiential and durational 'moving parts', as well as some that are 'stationary'. Everything can't be moving to allow for a capture or knowledge, or repeatability. This was arguably one of the pushbacks against poststructuralism: everything seemed to be set in motion, leaving nothing to hang our epistemological hats on, so to speak, no scaffolding, seemingly no rules. The middle field will allow a temporary, conscious and transparent 'bracketing' of movement. However, it is not the aesthetic/stationary aspects that we tend to have difficulty with, but rather the dynamic, subjective, moving and active. For this, let's return briefly to those disciplines that have centuries of history of practice, pedagogy and rigour in working in this way.

In the discipline of performance, repeating is not what occurs even when an artist performs six days a week and twice on Wednesdays and Saturdays, as on Broadway. A performer does the doing anew each time. An actor, for instance, trains for years to have the physical control and resilience to be able to experience the intentions and actions, emotions and sensory perceptions of a character living within the given circumstances of the play. They do this while hitting certain points on the stage in concert with lighting and other technical effects connected to certain moments. They execute complex fight choreography and negotiate props and set pieces, all in a flow of presence as if it were the first time. No one goes to the theatre to watch someone repeat. They expect something extraordinary to unfold as if they were the only person to witness and as if it were the first time. This is the rigour of repetition. It is exact. It needs to be risk-assessed when weapons and complex choreography or elaborate set pieces are involved. It is different each time and must also remain the same. There is a live, dynamic stability to it. The elements of these aspects are pre-interpretation or pre-hermeneutic, and, one could argue, might even offer a certain robustness.

Experiencing as Knowledge

The phenomenon of experience and the standard account of science have had a very complicated relationship. It's been fraught with both distrust and idealisation. As the social constructivists of the last century pressed, science is indeed a human activity, embroiled with all that this entails. Both *experiencing* and the practice of *experimentation* have been interlinked since antiquity. Aristotle stressed the importance of the senses in observing and positing reliable knowledge by understanding causes and phenomena in the natural world (see boxout).

The Meaning of Experience

The categories of 'experience' and 'experiment' lay at the heart of the conceptions of natural knowledge that dominated European learning at both the beginning and the end of the Scientific Revolution. The Latin words generally used to denote 'experience' in both the medieval and early modern periods, *experientia* and *experimentum*, were generally interchangeable, with no systematic distinction between them except in particular contexts...both are related to the word *peritus*, meaning skilled or experienced. Besides these terms and their vernacular cognates, another related Latin term, *periculum* ('trial' or 'test'), began to be used in the late sixteenth century to designate the deliberate carrying out of an experiment (*periculum facere*), initially in the mathematical sciences. By the end of the seventeenth century, the construal of experience as 'experiment' in this sense had acquired a wide and influential currency.

—Dear and Park, 2006: 335–58

Sir Francis Bacon (1561–1626), often regarded as the father of empiricism, emphasised inductive reasoning and experimentation, laying the groundwork for the scientific method. It was at this point that controlled experiments to test hypotheses took hold, along with the practised importance of eliminating biases and preconceived notions. Much of Bacon's work was based on a criticism that the 'Aristotelian approach subordinated experience to abstract reasoning, using experience only as a means of confirming preconceptions' (Dear, 2006: 107).

René Descartes (1596–1650), considered by many the father of modern philosophy, although he worked mainly in the field of

mathematics, connecting geometry and algebra in the development of analytic geometry, is best known for his statement 'cogito, ergo sum' (I think, therefore I am), to be found in his *Discourse on the Method* (1637) and *Principles of Philosophy* (1644). Many people interpret his work as supporting the idea that knowledge and self are best understood by separating the mind from the body. One might argue that this stark division has been misinterpreted and is currently in a slow dissolve. Another reading would be that, according to Descartes, the act of questioning one's own existence itself is, at the very least, evidence of the actuality of one's own mind; a thought cannot exist unless there is a thinking entity, in this case, the self. A clarity of inquiry relies on this framework, on the perception of one's thought and a practice of radical doubt towards experience. Senses, such as colours, sounds, and tastes, present as ideas that draw from the mind itself. Without this, experience alone can be deceiving, for instance, in the example of a phantom limb.

Descartes put forward the idea that the rational mind, rooted in the brain, was separate from the sensory world of the body, a world shaped by emotion and often unreliable. At the heart of his project was the drive to establish a method of inquiry that was measurable and precise, untouched by the authority of the Church. He was aiming for something rigorous and dependable—a system he could trust to reveal a more objective truth. 'What happened was that in the adoption and adaptation of his ideas over the years, intuition, felt senses, emotional experience, memory, and arguably feminine-anything and embodied knowledge got thrown in the same suspicious bucket as the irrational and non-rigorous, because not being of the 'objective' mind made it slippery, immeasurable, non-reducible, and therefore unscientific and, even worse, subjective' (Byron, 2014: 17).

In more recent years, subjectivity and experience are being recognised as important to include within data and in designs of inquiry (recall pages 160–164 on reproducibility). For the practice proposed in this book, the subjective and the objective are all considered aspects of the middle field, and need not live in dissonance or duality, but rather can simply be witnessed for the roles they play within the critical framework of the active aesthetic. To exclude experience and anything that might be deemed subjective is incomplete at best, arguably a mode of interpretation at the least, and a playing of God at its most problematic.

Adam Frank (American physicist and astronomer), Marcelo Gleiser (Brazilian physicist and astronomer) and Evan Thomson (Canadian philosopher of mind and cognitive science), in their recent book *The Blind Spot: Why Science Cannot Ignore Human Experience* (Frank et al., 2024), bemoan the fact that ‘We have lost sight of the lived experience that underpins the scientific concept and think that the concept refers to something more fundamental than our bodily sensations’ (ibid.: xii). They evidence convincingly how when we do ignore human experience, we not only lose rigour but are less able to conceive of solutions to the Earth’s current pressing issues within the Anthropocene, ‘a massive manifestation of the Blind Spot’ (ibid.: 226). Climate change and other wicked problems discussed in prior chapters (see pages 97–99), all defining inquiries of the Zürich tradition of transdisciplinary research, fall into the issues created by an adherence to upholding the value of abstraction over direct experience.

To illustrate how we have been conditioned into perceiving abstract ideas in place of experience, Frank, Gleiser and Thomson offer the example of temperature. Humans began to measure temperature with our felt sense of hot and cold. We then correlated this with changes in the volume of fluids as they expand with heat. The tools scientists used were sealed glass tubes filled partway with liquid. With these, they could determine a boiling point, and made this a fixed point for building thermometers and numerical scales. However, once they established these modes of measurement and therefore the concept of temperature, ‘scientists discovered that the boiling and freezing points of water weren’t as precisely fixed in the natural world as they initially thought. High on a mountain, for example, water boils at a lower temperature than at sea level’ (ibid.: xii). To stabilise aspects of the inquiry of measuring temperature, they had to create a controlled setting referred to as ‘the workshop’, ‘the communal scientific infrastructure required for creating new precise experiences along with the tools for manipulating, investigating and communicating them’ (ibid.). This, in effect, became such a refined way to measure the phenomena that it increasingly became removed from direct experience. The formulation of the theory known as classical thermodynamics was born, and this led to temperature being defined in increasingly abstract ways. ‘Now, temperature could be defined without referring to the properties

of any particular substance. Thermodynamics even allowed for a definition of something physically impossible—absolute zero, the ideal limit of temperature at which a thermodynamic system has no energy' (ibid.: xiii). By the late nineteenth century, thermodynamic temperature was measured by the average motion of molecules at a microphysical level.

The Blind Spot arrives when we think that thermodynamic temperature is more fundamental than the bodily experience of hot and cold. This happens when we get so caught up in the ascending spiral of abstraction and idealization that we lose sight of the concrete, bodily experiences that anchor the abstractions and remain necessary for them to be meaningful. The advance and success of science convinced us to downplay experience and give pride of place to mathematical physics. From the perspective of the scientific worldview, the abstract, mathematically expressed concepts of space, time, and motion in physics are truly fundamental, whereas our concrete bodily experience are derivative, and indeed are often relegated to the status of an illusion, a phantom of the computations happening in our brains... The failure to see direct experience as the irreducible wellspring of knowledge is precisely the Blind Spot

—Ibid.: xiii/xiv

In the analytic model embedded in the critical framework of the active aesthetic, the middle field includes elements of direct experience. Where the self (agent) is the researcher and the discipline (task) is research, both emerge from all that lies in a middle field of *researching* (review Figure 26), and experiencing is included in this middle field. To explore the dynamics of direct experience, we will draw from *embodied cognition*, a field of study that in itself emerged from a transdisciplinary research exercise among psychology, neuroscience, phenomenology, and biology. Practitioners and theorists in performance have employed the frameworks of embodied cognition to interrogate the dynamic relationships among meaning, action, environment and knowledge, partly as an alternative to hermeneutic perspectives invariably caught up in representation and also as an alternative to any lingering Cartesian mind/body dualisms (see McConachie, 2006; Zarrilli, 2007; Kemp, 2012; Shaughnessy, 2012; Bryon et al., 2017; Kemp and McConachie, 2018; McLaughlin, 2019).

Embodied approaches to cognition propose that ‘thinking and behavior are properties of the whole human organism, not the brain alone, and that body, brain and cognition are ‘situated’—engaged with the surrounding environment’ (Kemp, 2017: 95). When the brain, body and world are viewed as interdependent and often even as constituting each other, the term ‘situated’ can be ‘used to draw attention to the fact that the body is embedded in and dynamically interacting with an environment’ (Shapiro, 2010: 124). Francisco Varela (Chilean biologist, philosopher, cybernetician and neuroscientist), Humberto Maturana (Chilean biologist and philosopher), and Evan Thomson (mentioned above as co-author of *The Blind Spot*) were pioneers of the theory, emphasizing ‘the growing conviction that cognition is not the representation of a pre-given world by a pre-given mind but is rather the enactment of a world and a mind on the basis of a history of the variety of actions that a being in the world performs’ (Varela et al., 1991: 9). A branch of the embodied cognition research program closely aligned with the concept of the middle field is *enactivism*, an approach to cognition framed as a sense-making activity whereby a self/agent does not passively receive information from its environments, translating it into internal representations, but rather participates in the generation of interactions that might include meaning, sensing, and experiencing as the self/agent *enacts* its world:

The agent is embodied and dynamically-coupled to the world in which she is embedded; thus, agent, world and action are necessarily intricately interwoven, and the agent’s body, experience, action, and world shape the way in which she deals with her everyday pragmatic concerns. There is an inseparability of mind and world, and it is embodied practice rather than cognitive deliberation that marks the agent’s engagement with its world.

—Stuart, 2008: 256

That experiencing includes a play among the mind, body, and environment goes to the stuff of the middle field, allowing us to look more closely at the dynamics of direct experience as a system. We will consider how it is not so much subjective experience that has traditionally hijacked the event of knowledge, but rather the stories we tell about experiences (which, we will see in the next section, shift the experience to one of telling stories). In looking to a practice of

experience, embodied epistemologies situated within the discipline of performance, specifically acting, can be particularly helpful, especially when examining them from inside the phenomenon of the doing of the practice:

In contrast to representational and/or mimetic meta-theories of acting, which construct their views of action from a position as an outside observer to the process/phenomenon of acting, an enactive view provides an account of acting from 'inside' the process itself—that is, from the perspective of the actor as enactor/doer. Acting is not to be viewed as embodying a representation of a role or a character, but rather should be understood as a dynamic, lived experience in which the actor is responsive to the demands of the particular moment within a specific (theatrical) environment.

—Zarilli, 2007: 635

We will learn that acts of experiencing, both when working within one's own and across disciplines, take a rigorous practice of concurrent modes of awareness, inclusive of self as researcher/practitioner, the ways of operating in one's home discipline, and the dynamics in the operations of the other. This is a particular skill and an exacting way of knowledging. Trained actors master the craft of witnessing multiple things at once in a flow of presence as multiple consciousnesses of perception. An actor, for instance, experiences the senses, feelings, urges of the character in the given circumstances of a play in the flow of a performance at the same time as experiencing themselves as the artist executing technical (sensory, physical, vocal) choices in real time, evaluating the moment to adjust for variables in partners' engagement, props, scenery, and audience behaviours.

....experiencing for the actor is a form of metacognition, a process of 'experiencing experience' and as such, it draws upon the actor's awareness and higher order thinking and processing skills... For the actor to undertake these processes within an interconnected and dynamic system... it is imperative to reframe the actor's 'dual consciousness' within an understanding of intersubjectivity as an embodied phenomenon.

—McLaughlin, 2019: 231

It is from the embodied practices within the performance arts that we get some of the most clearly articulated ways to enhance and train

one's ability to maintain a rigorous awareness of experience in the act of experiencing. An actor needs to become excellent at witnessing multiple things at once in a flow of presence without attaching extra *stories* or *noise* to the information/knowledge. It is this skill that will become useful in the next sections as we explore the middle field of disciplinarity and how we as researchers/practitioners *activate* our disciplines as we engage across disciplinary boundaries.

Autopoiesis ∞ Posthuman ∞ Transhuman

As we progress, the middle field will become a temporary bracket for the dynamic systems from which the doer/agent and the discipline/task emerge. The middle field includes some things of our bodies and some things that are not. It also encompasses technologies, and thus takes into account the ways we receive, perceive and enact acts mediated through direct embodied experience and/or through technologies that become agents of knowing, mediated for and through us—and perhaps even becoming us. This is all crucial to the ways of knowledging mentioned in previous sections.

The recognition of direct experience in the previous section is not there to privilege the biological over the mechanical or the live over the digital, but rather to account for the ways each might mediate acts of knowledging through their processes of generating knowledge. Recalling Paola Bressan's look at the study involving labelled images (see pages 162–163), it is not that the repeated experiment was executed remotely via digital means that caused the problem, but rather that this was not deemed active as a *way* of doing, included in what would be the middle field of this particular event of experimenting. It was *overlooked* as the knowledge and meaning-making generator that it is. No element, aspect, avenue, or mode of reception is considered better or more authentic or 'pure' in this approach. This is not what it is about. Rather, the point is to make the dynamics of the middle field transparent so that we can then be responsible for and able to respond to these as acts of knowledging.

We have touched on enactivism in the section on experience. *Autopoiesis* is a concept that corresponds with enactivism and includes the idea of *structural coupling*. Autopoiesis (from Greek *autos*, self, and *poiein*, to do), meaning a living system or network

that produces self from within self, was first articulated by Humberto Maturana and Francisco Varela in the 1960s. Fritjof Capra (American author, physicist, systems theorist and deep ecologist) summarises:

According to the theory of autopoiesis, a living system couples to its environment structurally, i.e., through recurrent interactions, each of which triggers structural changes in the system. For example, a cell membrane continually incorporates substances from its environment into the cell's metabolic processes. An organism's nervous system changes its connectivity with every sense perception. These living systems are autonomous, however. The environment only triggers the structural changes; it does not specify or direct them.

—Capra, 2003: 30

What is important here is that even though there are 'structural changes' in the system of the cell, the cell remains autonomous. It both changes and is the same. It is interesting to consider this in relation to how we might 'structurally couple' to the practices or methods in our disciplines. Do they change us? Two researchers may learn from the same professors, have the same supervisor, study at the same institution, use the same critical methodologies, and have access to the same technologies; why do they come out as completely different researchers? What determines the *knowing of our knowing*, and how does this determine us as a self/researcher? Many of you will remember those 'aha' moments where something you read or engaged with, or some piece of technology, or something a teacher said, shifted your very perspective and in some way profoundly redirected your journey and the manner in which you navigated through your practices and disciplines from that moment on. You remained you; however, from that moment on, you were also changed. This is part of the evolution of learning. Those disturbances to your habitual patterning, those 'aha' moments, are indicative of a 'perturbation' in the theory of autopoiesis. You are different from that other person who went through the same schooling with the same teachers using the same technologies. What might constitute a perturbation for you may just skim past another person, and what might be a perturbation for somebody else might be something you absorb without any shift. The day of the week, what you're wearing, what you ate for breakfast, your health, or your sexual orientation or gender (for instance) might also contribute to what becomes a

perturbation in the flow of your training and the practice of learning your discipline.

According in the concept of autopoiesis, we are encountering and changing in relation to environment, but we are also autonomous. It may seem contradictory, but that is exactly the point. The most striking feature of an autopoietic system is that it pulls itself up by its bootstraps and becomes distinct from its environment through its own dynamics, in such a way that both things are inseparable.

—Maturana, 1992: 46

Can something that is not made of cells, that is not a biological living system, bring forth its own knowing as an autonomous being through the rubbing up against perturbations? Can other types of systems constitute an *identity* and, in doing so, bring forth a sort of *selfhood*? Can a discipline, for instance, structurally couple? Disciplines, perhaps not unlike cells and people, are systems, and become what they are through perturbations that act as disturbances, catalysing adaptations and evolutions. We can look at the discipline of archaeology, for instance, and consider it a system whose ‘internal’ processes have adapted to ‘external’ perturbations, yet archaeology preserves itself as a core ‘organisation’. Through the centuries, changes in its theoretical methodologies and scientific approaches have occurred. Technological advances have been introduced, such as photography, radiocarbon dating, geospatial technology, Lidar and remote sensing tools (towards less invasive techniques), and DNA and isotopic analysis (to better understand the diets and migrations of cultures). It has sustained a distinct identity across sweeping political landscapes, including those entailed by the nationalism of the 19th and 20th centuries, through attempts at decolonisation and also in today’s climate of globalisation. The discipline of anthropology has also been affected by interdisciplinary dynamics, sitting between empirical sciences and the humanities. It is open to perturbations deriving from theories of culture, environmental sciences, history, and art and design practices, to name a few, yet it remains distinctive as a discipline. Anthropology’s evolution may include the incorporation of new methods, new technologies and evolving critical lenses, but it retains a practice of stratigraphic analysis with a focus on revealing the materials of human culture through the ages. Capra points out:

According to Maturana and Varela, 'you can never direct a living system; you can only disturb it' and summarizes that 'a living system maintains the freedom to decide what to notice and what will disturb it... Cognition, then is not a representation of an independently existing world, but rather a continual bringing forth of a world through the process of living'.

—Capra, 2003: 32

With this noted, can we say that a discipline thinks? It clearly changes and grows and never settles. As an autopoietic system (a system or network that produces self from within self), it is a living entity of sorts. A discipline is not organic; however, it is executed by humans and technologies and tools, enacting itself through activating and receiving, producing knowledge and making meaning.

Enter Posthumanism. It's a tricky idea, and its definitions and uses are still being determined. '...There is not a single posthuman, but many of them, wearing different costumes and presenting different appeals to varying audiences. This constitutes a problem that needs more consideration than it has gotten' (Ivakhiv, 2020: 44). For the purposes of interrogating how knowledge happens, posthumanism is essential, and these next paragraphs will unapologetically pick and choose from across the literature of this emergent theoretical framework/philosophical movement/turn/conceptual understanding (it goes by many scholarly forms) to consider what it might mean for the practitioner/researcher working across disciplines.

The *post* in posthumanism, for some, equates to after the human, boasting a lineage to as far back as the 1960s, when Foucault mused, 'As the archaeology of our thought easily shows, man is an invention of recent date. And one perhaps nearing its end' at the conclusion of his *The Order of Things: An Archaeology of the Human Sciences* (Foucault, 1970). This take is often articulated as a sort of dystopianism, where non-human entities ultimately take the place of the human subject (Braidotti, 2017; Colebrook, 2014; Wolfe, 1995, 2010). However, as Clair Colebrook points out, this is not so simple:

Such posthumanisms are...ultimately ultra-humanisms insofar as they attribute all the qualities once assigned to man—qualities such as mindfulness, connectedness, self-organizing dynamism—to some supposedly benevolent life in general that needs to be saved from the death of merely calculative systems.

—Colebrook, 2014: 164

A different way the *post* in posthuman operates is as movement directly in opposition to the solipsism and arrogance of *humanism*, as in post the *age* of humanism (another term that is hard to pin down). In the conclusion of his book dedicated to the complexities of defining humanism, and after stating that he has ‘throughout resisted the temptation to offer anything as straightforwardly helpful as a definition of the word, choosing instead to stress the plurality, complexity and fluidity of meanings it has been able to deploy or suggest’ (Davies, 2008: 125), Tony Davies offers:

[T]he problem of humanism remains, for the present, an inescapable horizon within which all attempts to think about the ways in which human beings have, do, might live together in and on the world are contained... Certainly it should no longer be possible to formulate phrases like ‘the destiny of man’ or ‘the triumph of human reason’ without an instant consciousness of the folly and brutality they drag behind them... It is almost impossible to think of a crime that has not been committed in the name of humanity. At the same time, though it is clear that the master narrative of transcendental man has outlasted its usefulness, it would be unwise simply to abandon the ground occupied by the historical humanisms. For one thing, some variety of humanism remains, on many occasions, the only available alternative to bigotry and persecution. The freedom to speak and write, to organize and campaign in defence of individual or collective interests, to protest and disobey: all these, and the prospect of a world in which they will be secured, can only be articulated in humanist terms.

—ibid.: 131 and 132

When posthumanism signifies a movement after humanism, it sits against a prevailing *anthropocentrism*, the notion that humans are at the centre of everything. According to environmental philosopher Baird Callicott, the term equates to the notion that ‘only humans are worthy of ethical considerations’ and ‘other things are mere means to human ends. The terms ‘human chauvinism’ and ‘speciesism’ are closely related to anthropocentrism’ (Callicott in Kopnina, 2019: 1).

This ‘decentring of the human’ is where it gets interesting in relation to the notions of autopoiesis mentioned above, leading to the proposition of non-human systems, as in the example of an autonomous discipline that ‘thinks’ expressed earlier in this section. Posthumanism around the 1990s was increasingly employed by

cultural criticism, identity theory, and literary theory. As a critical discourse, it opens up and the same time, implodes the very ways we have engaged and valued and framed thinking itself. Cary Wolfe plots this path:

As Foucault puts it, 'In this connection I believe that this thematic which so often recurs and which always depends on humanism can be opposed by the principle of a critique and a permanent creation of ourselves in our autonomy: that is a principle that is at the heart of the historical consciousness that the Enlightenment has of itself. From this standpoint I am inclined to see Enlightenment and humanism in a state of tension rather than identity... even if we admire humanism's suspicion toward 'revelation and religious authority' (whose stakes are all the more pitched at the current geopolitical moment), and even if we take the additional posthumanist step of rejecting the various anthropological, political, and scientific dogmas of the human that Foucault insists are in tension with Enlightenment per se, we must take yet another step, another post-, and realize that the nature of thought itself must change if it is to be posthumanist.

—Wolfe, 2009: xvi

For the purposes of this work, these changes of thought might begin by distinctly disrupting the linearity of the idea that a subject/agent does an object/discipline and that either holds meaning or knowledge by way of anthropocentric intent, authority or history. To begin to think of knowledge as dynamic and unstable can be confronting, but this might be an aspect of the change in the 'nature of thought' that Wolfe refers to.

The other strand of thinking around posthumanism correlates with the Macy conferences on cybernetics, which took place from 1946 to 1953. It intersects with cultural critiques and identity theories, along with science fiction and pop culture. In looking at technologies that can enhance the human condition, such as assistive technologies, biohacking, and prosthetics, we enter the realm of the 'transhuman', another term that is in the flow of development:

Transhumanism has a 'big tent' kind of problem. While in general, transhumanism can be defined as a philosophy that seeks to transcend the natural state of being human with technology to improve performance, avoid suffering and cheat death, the philosophers within

this tent are performing a variety of acts. From libertarians to socialists, entrepreneurs to anarchists, feminists to autocrats... Transhumanists can espouse a range of philosophical and political positions that affect their conception of transhumanism and transhuman/posthuman futures. Whether transhumanism is seen as a way to improve equity and social justice or the ability for individuals to pursue personal goals, it all, at its core includes the connection of the human with the technological in ways that are thought to deeply change what it means to be human.

—Tumilty, 2022: 3

Actors and performers have for centuries practised a sense of communion (or co-knowledging) with objects, artefacts and other beings, from the mask to the sword and even the animal ('animal work' here is distinguished from the philosophies of the animal adopted as part of post/transhumanism scholarship). Animal work is an important part of training in acting conservatories worldwide. Professional actors use the techniques to create inner and outer lives of characters that are very different from their own habitual nature. This practice can include weeks or months of observation, with the performer learning everything from an animal's physical point of centre, their behaviours when hungry, their power and mating rituals, their internal and external rhythms, what occurs when they are scared or at rest, to ineffable imaginings born of observations, experiment and improvisation that are then made real as artistic practice. All this happens prior to any utterance of text or blocking by a director. It is the pre-work of embodied practice, which is often invisible, and where these acts of knowledging in the discipline of performance occur. You might recognise the animal work of Marlon Brando in *The Godfather* (evoking a bulldog who has been shot in the throat) or Al Pacino as Sonny Wortzik in *Dog Day Afternoon* internalising the life of a mutt; perhaps you might recognise Tom Cruise's animal work as a fox in *Magnolia*, or Juliette Binoche's cat as Rose in *Jet Lag*. As highly respected veteran acting coach Susan Batson says, 'When you successfully internalise animal behaviour, your audience doesn't necessarily realise it. Animal Work creates a tangible physical reality underneath the character's words and movement that, though clearly present, remains almost indefinable' (Batson, 2007: 160). Why this matters here is its place in revealing

where knowledge *happens* in relation to the middle field. It is the work that occurs in the middle field where knowledge happens, not in the product or the agent who enacts it. It is the doing of the doing, the ways of generating knowledge in practice, the *active* part of the aesthetic, whose dynamic relationships can be found in the middle field.

This gets interesting when we decentralise the human. When an actor embodies the animal, the animal no longer sits in the middle field between the actor and the act. When this is done properly, the actor becomes *animalness*, and the animal is integrated into the dynamics of the self/agent/actor. The actor does not play an animal, but rather incorporates the animal into self to play the character. What occurs in the middle field (the way of doing this *acting*) determines the actor/self/animal and the act/discipline/character as emergent.

When we pull together the aspects of posthumanism and transhumanism that intersect with notions around a decentering of the human, we get to a place where embodied performance has been practising its acts of knowledging for centuries. We could easily perceive a mask as a type of cyborgian extension. It is an artefact, an object and a technology, but it also becomes the actor and the actor becomes it. It is granted power by the audience. The biological being behind it structurally couples with it and how it is received, perceived and engaged with in the environment/event of the theatre. This re-renders the self/subject/mask during this performative *event*, emergent with the discipline/task/act from a middle field of acting/self-ing/mask-ing. We will have more to say on how the *event* as a term will help us bracket the dynamic of the middle field in the last chapter on capture; for now, however, it's important to see how the mask becomes a self/agent that does the task/discipline.

Ellie Nixon, writing on the intersection between posthumanism and embodied practices in performance, joins those who have been proposing practices that resist fixity, demonstrating 'through instances of creative practice and performer training exercises that imagination is inseparable from our lived embodied engagement of attending to and resonating with the world' (Nixon, 2024: 173). She offers a beautiful analogy in the practice of sailing:

...from an anthropocentric position, I am at the centre of this reality. I make it happen. However, from a position of material engagement, I am decentred. The material world (the hull, the sheets, the sail, the tiller, the crew and the elements) is not passive in the act of sailing, but rather intimately entwined. The elements are fellow travelers, and for the boat to sail with ease, imagination as an embodied experience is essential.

—ibid: 173

The idea of ‘fellow travellers’ included in the systems of embodied practice extends beyond disciplines of performance. As advances in 3D printing, AI and robotics, along with new composite materials harnessing nanotechnologies and smart applications, are put in the ‘hands’ of engineers, teachers and surgeons, their work will arguably be embodied, and these elements will become part of the system of the agent/practitioner. The analytical model of the middle field within the critical framework of the active aesthetic becomes useful to help us understand where the acts of knowing sit within these disciplines. If we can no longer assume that a discipline is the custodian of knowledge, and we can no longer assume that an agent is the pure ‘actor’ of a discipline, the need to reveal the acts of knowledging becomes more crucial to help us ascertain and keep track of how knowledge is occurring, first in our home disciplines and then across disciplinary boundaries.

Effective Action and Blind Spots

Effective action leads to effective action: it is the cognitive circle that characterizes our becoming, as an expression of manner of being autonomous living systems... The business of living keeps no records concerning origins. All we can do is generate explanations, through language, that reveal the mechanism of bringing forth a world. By existing, we generate cognitive ‘blind spots’ that can be cleared only through generating new blind spots in another domain. We do not see what we do not see, and what we do not see does not exist. Only when some interaction dislodges us—such as being suddenly relocated to a different cultural environment—and we reflect upon it, do we bring forth new constellations of relation that we explain by saying that we were not aware of them, or that we took them for granted.

—Maturana and Varela, 1992: 242

There is no denying that the ways we experience, receive, perceive and generate meaning and knowledge require a close and constantly updated connection with the *techne* of episteme in the Anthropocene. Ongoing debates around the usefulness of theories of cognition in relation to posthumanism and transhumanism are current and rich. However, at the time of publication for this text, and towards the sustaining purpose of the proposed practice for researching across disciplinary boundaries, we recognise that posthumanism and transhumanism share important principles with enactive cognitive science and the autopoietic theory that align with the analytic model of the active aesthetic. All embrace a relational ontology. They reject dualisms such as mind/body, human/non-human, and self/other and embrace the idea that meaning and knowledge are not pre-given but arise dynamically through interaction.

Chapter VI

Detaching from Disciplinary Thinking to Witness *Knowledgeing* in Action

The final two chapters of this book are about you and your practice. You will begin to situate your work within the landscape of the transdisciplinary project introduced in Chapter I, and contextualise your practice of knowledgeing against the historical landscape of epistemology explored in Chapter II. You will reflect on your ability to reveal and respond to the problematics outlined in Chapter III within the middle field as part of the critical framework of the active aesthetic in relation to your own ways of practice. You will draw from a systems approach as part of the middle field, in tune with the conceptual frameworks introduced in the Intermezzo. We start with you, the researcher/practitioner interested in working across disciplines towards the emergence of new knowledge(s). They might lie ‘beyond’ (in the Nicolescuian sense) and/or towards the solving of ‘real world’ problems in line with the Zürich tradition. Regardless of where you sit—it all starts with you.

Working with the critical framework of the active aesthetic and its middle field, we observe that it is in the doing of the doing or the practice of a doing that knowledge happens. We have explored how it is not the *things* that you do when you practice a discipline that determines knowledge, but the ways in which you do the doing. We have learned that the *ways* of the middle field include subjective

experience, technologies, internal and external influences, rules, methods, power dynamics, and politics. Recall the aforementioned examples of a doctor and a teacher. Here we look at aspects of self, the *who* that is doing the doings.

In the next sections, we will explore ways to witness the dynamics of the middle field between self/agent and task/discipline. What we will find will influence responsibility, as we explore the principle that our discipline does not do us, but rather we do our disciplines, and in doing so, shift the events of knowledge. In this work, the responsibility of this kind directly correlates to the ability to respond within and across disciplinary boundaries.

We turn first to the ways we engage with our own disciplines, to understand both what the doings of our doings are and how to recapture and/or expand what we include in our middle field of knowledgeing by enhancing our situated awareness.

Parisian Plastic Researchers

Your enquiring ways and awareness of the pleasure of inquiry likely started when you were a child, before you attained any formal education or disciplinary expertise. Babies make connections, solve problems, and draw inferences from internal and external stimuli (before perceiving any difference between the two). They innovate, test, explore and theorise, adjusting practice to work out solutions. Babies would make supreme inter- or transdisciplinary researchers. The rapid and flexible remapping of their minds as they make connections enacts their world through the neural networks in their brains, interdependent with their sensory experiences and their environments, all in a constant unfolding self-ness. It is extraordinary, and perhaps as sophisticated as we ever get, all prior to shutting things out and locking things down into rules, categories, labels and values.

If you look at a map of a baby's brain it would look like old Paris, with a lot of winding, interconnected little streets. In the adult brain those little streets are replaced by fewer but more efficient neural boulevards, capable of much more traffic. Young brains are also much more plastic and flexible—they change more easily.

—Gopnik, 2009: 12

Child psychologist Alison Gopnik, challenging the long-held belief that infants are somehow ‘defective adults’, contends that children are in fact the human species’ research and development division. She posits that the way a baby’s brain works, with its heightened learning capacity and knack for experimentation, ‘will put the most productive scientist to shame—when it comes to imagination and learning, prefrontal immaturity allows children to be super adults’ (Gopnik, 2009: 91–13). The development of the prefrontal cortex has a lot to teach us about the ways we make connections, integrate and categorise.

In many respects, our engagement with institutions of teaching and learning has impeded many of the traits that are attributed to successful inter- and transdisciplinary researchers/practitioners. In Chapter III, we dedicated an entire section to their attributes, citing studies around what it takes to be successful in our field (recall pages 104–109). Findings included that being reflexive, flexible, inclusive, and tolerant of ideas that seem counter to the frameworks of one’s home discipline is helpful. We need to be brave and slightly rebellious as we navigate institutional ‘modus operandi’, while at the same time remaining creative in the engagement of transgressive modes of thinking and doing. Maybe a slight return of that Parisian neuro-mapping that Gopnik speaks of would suit the practitioner/researcher working across disciplinary boundaries?

The prefrontal cortex sits at the front of our brains. It is, in psychological terms, considered the seat of executive function in that it is associated with the way we moderate our behaviour, decision-making, and planning. It is also the very last part of our brain to develop, usually in early adulthood. ‘Through repetition, learning, environment and all the other things that make our world what it is, the brain starts to make connections that get established, the way a river etches out channels in the land. As we etch in the patterns, our mind is made up—literally—and with it the more random, often expansive, and also less effectual neural pathways get weaker and disappear. In many ways, the sophistication of adulthood is also a necessary form of disintegration’ (Bryon, 2014: 15).

Interestingly, ‘High IQ is correlated with later maturing and more plastic frontal lobes. Keeping your mind open longer may be a part of what makes you smarter’ (Gopnik, 2009: 14). Many of us grew up in learning cultures where children who mastered conventions quickly,

did what was asked, often without questioning, and abided by rules, tended to be rewarded for their ‘maturity’ and ‘good’ behaviour. What was admired on our report cards may not have been conducive to the very attributes required for the type of researcher needed to help solve the issues within the Anthropocene; in fact, these knowledge values may have even contributed to many of the world’s current issues. However, there is a balancing game to be played. Recall the section *Problematising People* in Chapter III, where Augsburg sets out *Factors Contributing to Transdisciplinary Individuals* (Augsburg, 2014: 240), which include such attributes as:

- ability to build networks within the realm of unfamiliarity
- ability to relate to the logic of complexity, modest positionality
- ability to transgress disciplinary borders, courage to abandon one’s home discipline
- cultivation of the art of abandonment, the ability to acknowledge the pain inherent in abandoning one’s intellectual comfort zone
- avoidance of solipsistic and narcissistic traps

(Review Figure 15 for the entire set of factors.)

These are clearly not the only types of cognitive space to hold as a productive practitioner/researcher. As Guimarães, M. H. et al.’s meta-study determined, transdisciplinary research is best engaged in *after* one is ‘well-grounded in a discipline/field/topic’ (Guimarães et al., 2019: 102441) (review Figure 16 for the entire set of factors). It would appear that a practice of dual consciousness is required, including concurrent attributes of both expertise and naiveté. As the section on dual consciousness of experiencing in the discipline of performance illustrates, this is absolutely trainable as a practice. However, this is not currently how we tend to educate our innovators and future practitioners/researchers.

How do we harness our innate plasticity, cultivating a new connectivity, curiosity and innovation, while maintaining the integrity of our home disciplines? Fortunately, we are not fixed, and further specific types of intention, attention, and perception will actually change our brains. Norman Doidge, a Canadian psychiatrist and psychoanalyst working in Neurology, has some good news (see boxout).

The Plastic Paradox

The plastic paradox is that the same neuroplastic properties that allow us to change our brains and produce more flexible behaviours can also allow us to produce more rigid ones. All people start out with plastic potential. Some of us develop into increasingly flexible children and stay that way throughout our adult lives. For others of us, the spontaneity, creativity, and unpredictability of childhood gives way to a routinized existence that repeats the same behaviour and turns us into rigid caricatures of ourselves. Anything that involves unvaried repetition—our careers, cultural activities, skills, and neuroses—can lead to rigidity.

—Doidge, 2007: 242

Next, we will explore ways to honour the rigour of our disciplines while allowing ourselves to venture into the unknown. We will start by making explicit the porosity between our disciplines and the world, and ourselves and our disciplines.

Conscious Competence

In order to make visible the dynamics of our practices and reset them in motion, we need to recognise the things we have made automatic, the stuck and sedentary aspects we are no longer present with. Being set in your ways and moving in set patterns, protecting yourself from change, is fine if you intend to proceed without a sense of curiosity or the type of critical engagement that puts you at the forefront of your discipline, ready to respond to new technologies and knowledges. It is my guess that if you are reading this book, this is not you. Regardless, an ironic aspect of getting very good at a discipline is that we begin to embed things in as we gain ease, and with this embedding comes the type of set behaviours with fixed neuro-mapping we discussed in the previous section. As inter/transdisciplinary researchers working at the edges of our specialisms, expertise practised in this way is like walking through research blindfolded. As so much of the work of an inter/transdisciplinary practitioner/researcher is making connections, often among things that others have missed, to have heightened awareness of the operations of disciplinary activities around a research event could make the difference between world-changing progress and the status quo.

To illustrate how we can get set in our ways (literally, in the pathways of our neuro-mapping), we adopt for a brief moment a page out of Neuro-linguistic programming to illustrate a specific aspect of the dynamics of learning to highlight the need for a more present way of practising our disciplines. In this framework, there are four stages of learning:

1. Unconscious Incompetence
2. Conscious Incompetence
3. Conscious Competence
4. Unconscious Competence

When we are one year old, sitting in the back of a car, drooling on the car seat, we are likely to be (1) unconsciously incompetent at the act of driving. We are not aware that we don't know how to drive. When we get to age 12, we are very aware that driving is going on. It might look like fun; we might even be curious. We are very aware that we don't know how to drive—we are (2) consciously incompetent. When we are 17 and have just gotten our license, we remind ourselves to look in the rear-view mirror and also over our shoulders before pulling out into traffic. We are diligent, ready for surprises and in a present state in the flow of learning: we are (3) consciously competent. When we have been driving for 20 years and there are kids screaming in the back of the car, we have a much-needed coffee in the console. We are straining to hear the traffic report on the radio. The driving of the car, the looking over the shoulder, the checking the rear view mirror—they just happen, and we barely attend to them or any dynamics that may be occurring around these acts. We are now (4) unconsciously competent.

Unconscious competence is not where we want to be as researchers/practitioners, and if we are really honest with ourselves in the witness of our practice, the doing of our doing, our ways of doing—there are parts of our work that have gotten there. These parts are not in motion; they are stuck and invisible. We cannot capture in the middle field what is not in motion or visible. If you are working with another researcher in another discipline who is operating in (4), you need to attend even more diligently to observe what is actually occurring in their discipline, in the doing of their doing. The good news is that (and this is something that comes from performance practice) conscious practice is contagious. When you

work with people who are present and attend to the task, others tend to join this way of working. But this might need to start with you. The inverse is contagious, too.

Returning to a way of conscious competence without the angst of that 17-year-old new driver is the goal. An easy, open, present, intelligent practice, open to receiving information without forcing it into stories or having it land as labels or get *reframed* through the filters of our home disciplines, is the key. Next, we learn to set and keep things in motion (for as long as possible or agreed) so that we can observe the dynamics of the middle field, the space of knowledging (from which the researcher and research, the experimenter and experiment, the practice and practitioner all emerge).

Integrative Performance Practice

For tools to help us practice in this way, we turn to a mode of performance practice designed specifically for cross-disciplinary exchanges. The practice employs the active aesthetic as its critical methodology and was born of a transdisciplinary exercise across performance disciplines. Integrative performance practice (IPP) began as an inquiry around how to reconcile the very different trainings of the embodied practices of dance, voice and acting. Despite all being performance practices, over hundreds of years they have become very different in their most expert forms, and to practice two or three together without compromise to the excellence of any of them has been a challenge without the use of technologies or adjustments to technique, which tend to reconfigure embodied parameters, often watering down line, tone, and/or emotional expression. Each discipline has different breathing methods, different physical points of centre, different ways of approaching a task, different ways of executing gesture and expression, different modes of managing emotion, different notations and different 'text' analysis methods. The details of this research can be found in multiple publications, including *From Walking and Talking to Cartwheels and High Cs: An Examination of Practice-based Laboratory Work Into Physio-vocal Integration* (Bryon, 2012), and *Integrative Performance: Practice and Theory for the Interdisciplinary Performer* (Bryon, 2014). Select aspects of the practice have been used in application

to *situated awareness* to aid in the enhancement of protocols for emergency responders in *Awareness Performing: Practice to Protocol*, *Routledge Companion to Theatre, Performance and Cognitive Science* (Bryon, 2018) and also featured at the *Mayo Clinic Humanities in Medicine Symposium* on the subject of performance, medicine and transdisciplinarity (May, 2021). Here, we look specifically at transferable applications for inter/transdisciplinary research and practice within and across the sciences and humanities.

What we will draw from in the next pages are transferable foundations of the practice that best enabled the subjects of the original research to cross disciplines without being too encumbered by the assumptions and conditioning of their home disciplines. Most participants in the original project had practised their disciplines for many years. As these included the embodied disciplines of dance, opera singing, and acting, all of which take years to master, the crossing of disciplinary boundaries was not only an intellectual endeavour but one of coordination of both voluntary and involuntary muscles, patterns of attention, ways of initiating psycho-physio-vocal tasks, evaluations of knowing when something is working or not, and negotiating those spaces between transitions from one phrase/task to another, whether physical, musical, or emotive. When training is of the embodied kind, shifting across disciplinary boundaries is not easy and often uncomfortable. When we come to think of it, however, is there such a thing as a disembodied practice? Isn't all practice embodied when executed by or through a body? Don't all researchers/practitioners, to some degree, deal with similar types of challenges and discomfort when working across disciplines? As there is really no such thing as a disembodied practice, we proceed further with the understanding that all practice brings with it the complexities and challenges of embodiment: experiencing, structural coupling, neural mapping, paradigmatic biases, and everything else laid out in the pages prior to this chapter.

Certain practices within the IPP are designed to promote a readiness to receive, perceive and have agency in the light of new incoming data, unfamiliar ideas, serendipitous moments, foreign vocabularies and skillsets, all without compromise to the expertise and excellence of your home discipline. Recall the boxout (page 31) summarised here: 'Socially and conceptually, we are disciplined by our disciplines. First, they help produce our world. They specify the

objects we can study—and the relations that obtain among them... They provide criteria for our knowledge...and the methods...that regulate our access to it' (Messer-Davidow, Shumway and Sylvan, 1993: vii).

Recall the notions of structural coupling (pages 171–174) and neuro-mapping (page 183). We don't only do our disciplines. They do us too, and in so doing bring forth our *self-ness*, the agent who does the tasks of our disciplines and also the task of perceiving and observing the tasks of others. There is a certain energy, a certain attitude, a certain way of holding oneself and meeting the world that gets attached to people who practice certain disciplines for years. We surround ourselves with others from our disciplines, are affected by our environments, and are physically patterned through conditioning inherent in the nature of our work. We are also affected by the cultures of our disciplines, the ways they enact competition, discourse, inclusion and rewards. In the development of the IPP, we noticed this 'certain something' in the studio as we worked across embodied disciplines. It's a quality that exists both *before* and during any challenge or task. It goes to the way one meets a task, the way one dresses, one's inner and outer rhythms, the way one positions oneself in the environment, the way of engaging with a challenge and preparing for encounters. It is learned, and is often a marker of expertise, but it can also become automatic, an 'unconscious competence', closing one off to being able to even see the fruits of other modes of knowing that lie outside our own culturally embedded values and attributes. Its dynamic is holographic (see pages 132–134) in that it lives in the moment and also the entire. Just as many of us would be able to tell an expert ballet dancer from a celebrated actor from a master opera singer by the way they walk into a room, one might say the same about the difference between an expert architect, a famous anthropologist, and a Nobel Prize-winning chemist. It starts before the task, and it's hard to describe, but it is real and goes to the ways we filter, encounter and engage in acts of knowing. Before you enter into an inter/transdisciplinary encounter, what do you bring?

The German word *Haltung*, which has no true equivalent in English, feels especially fitting here. Though often translated as 'attitude', *Haltung* also carries meanings like posture, position, stance, manner, bearing, and composure. It can be shaped by cultural conditioning or teachings, and it inevitably influences your sense

of commitment—even what you define as discipline in the service of your craft. Haltung holds within it behavioural, emotional, and physical patterns, family history and the like. It's the whole gestalt you bring with you to the work.

There is nothing wrong with what we bring. It's the not being aware of how it performs within and across inter/transdisciplinary exchanges that could contribute to the problematics laid out in Chapter III (review pages 75–122). For now, however, the way our focus as embodied beings can literally narrow our own practice of crossing to others' disciplines is where we will continue to explore. In the study of situated awareness (SA), this type of closing or filtering to the detriment of being able to both see things that lie outside the habitual and also be present enough to respond with all one's faculties can kill. Think of the police force, fighter pilots and emergency responders. Theories of perception under stress in relation to 'cognitive architectures' suggest that stress induces 'perceptual tunneling' and 'cognitive tunneling' (Ritter, Reifers, Klein, and Schoelles, 2017), as well as 'perceptual distortions and biases, an inability to process symbolic information, and altered motor abilities' (Rahman, Balakristan, and Bergin, 2012: 358). While performers and researchers do not typically operate in emergency situations, they share with emergency workers the need for precision under stress while multitasking and managing both external and internal stimuli. The following practices from IPP are designed to enhance the ability to work with excellence from one's home discipline while being responsive and open to other stimuli, while engaging across disciplinary boundaries. This need for these skills need not be in an immediate emergency. They can be extremely beneficial at the meeting table, in the lab, in clinical settings, in the studio and in the field.

As Andy Clark's work on predictive processing suggests, brains like ours function as predictive engines, continuously attempting to anticipate the structure and pattern of incoming sensory input. Rather than passively receiving data, our brains are highly proactive, actively generating sensory experiences and using external signals primarily to verify and refine their top-down predictions—an approach that challenges traditional views (Clark, 2016: 3). Clark highlights that this process involves learning to predict our evolving sensory states, which are shaped by both bodily actions and

interactions with the world (ibid.: xv). This raises questions about how reception, perception, reflection, and action operate in practice. As practitioner/researchers venturing into lesser-known territories across disciplinary boundaries in the hopes of harnessing the conditions of emergence towards innovation and the possibility of new knowledges, it is important to work to maintain the rigour and excellence of our own practice/research while encountering others' with a critical openness and reflexivity.

Awareness and Witness in Research Practice

We start with ourselves and our own practice. In order to own the ways of practising your discipline, the doing of the doing, in line with the notion of 'conscious competence', it matters that you become aware of which aspects of yourself are doing the task of the discipline. Refer to the earlier discussion of those students who, once we drilled down to what the actual doing of the doing was when they thought they were engaging in *learning* a craft, found instead that they were *pleasing*, *competing* and *trying*, all things that have little to do with the task of *learning* their disciplines (pages 158–159). What is important here is that one gets good at *exactly* what one practices. The discipline does not do you as you sit and passively go for the ride. Further, there is NO SUCH THING AS NOT DOING. *Something* is being conditioned in, learned, mastered and practised. The ways of doing the practice of the discipline are what determine the emergent practitioner and practice. So what is the stuff of this way? Who is doing the practice?

To start to begin to even notice this is a practice in and of itself. Learning to observe things without putting them into boxes or labelling them is really useful, and the longer you can observe and/or experience something simply as a phenomenon, the more open you will be to its possibilities. This is what we mean by keeping it live before it lands. This live space is open, in motion, perhaps even a space of wonder and curiosity. It occurs prior to describing or diagnosing. We attempt to keep the disciplinary filters at bay and experience the phenomenon for what it is, in the hopes that it might reveal something new. We let it teach *us* for a moment.

One helpful distinction here is that between witnessing and judging or diagnosing. In this instance, positive, negative, and

neutral variations of judgement and diagnosis are equally limiting. It is the *way* of encounter that is important here, not what you might glean from such encounters. In this context, one witnesses the *ways* of doing in process, the qualities within the *activation* of *generating* a process. As a research practice, witnessing allows us to attend to the experience of doing the task, whether that task is executing an experiment, observing a study, reviewing data, or engaging in collaborative work. Witnessing is simply that, a noticing. Let go of any sticky impulses to tell a story, to attach to a feeling, to justify a position, to go down a track of thoughts, to go into any 'zone'. Go into the doing of the doing as it unfolds in the present moment, with a commitment to the task and a curiosity that only goes as far as 'Isn't that interesting'. To witness is to notice. When we witness, we take gentle note of what is happening as it happens. It is light and peripheral in character, but keenly present.

Thoughts and Feelings: Awareness and Focus

Now that we have explored what it means to work from awareness, we fine-tune this a little more. We distinguish between focus and awareness, and further between awareness and thought and feelings. We ask: who is doing the doing? We (the agent) *have* feelings and *have* thoughts, but we are *not* those thoughts or feelings. The very fact that you can notice thoughts and notice feelings means that you are not them. To practice from awareness as opposed to from one's thoughts or feelings *is* the practice. It is open, non-verbal, not trancy, can be uncomfortable, can be easeful, is in a poise of readiness. It is work, a rigorous practice, and is ultimately productive.

Those familiar with Buddhist teachings or 'mindfulness' practices will find some of the language familiar. However, in IPP, the goal is NOT peace or therapy but rather the harnessing of a productive tension supporting an exactitude of action and rigour in research. In IPP, awareness is active, and includes exteroceptive, proprioceptive and interoceptive sensory dynamics. In a practice of *witnessing* thoughts and feelings rather than judging, diagnosing, boxing, or acting on them, practitioners render them less 'sticky' and less able to influence or hijack a task. O'Regan, Myin and Noë's articulation

of the phenomenon of grabbiness correlates nicely: ‘Grabbiness is the fact that sensory stimulation can grab your attention away from what you were previously doing’ (O’Regan et al., 2004: 103).

Filtering also corresponds to the notion of grabbiness. Trying to work out how something fits into the solution you are working on or trying to understand something from the perspective of your home discipline is also a way of working from thoughts and/or feelings. Many of the problematics discussed in Chapter III will be made transparent and addressed if moments of pause are created in the practice/research to inquire who is doing the work (thoughts, feeling or awareness), what is the doing of the doing, and what is the practice of this practice. Issues around values, power, identification of research problems, dynamics around failure and issues embedded in collaborative relationships can all be made transparent and then available to make choices around. There is *no such thing as not doing*, and everything is *active*—however, the ways of doing(s) determine the emergence of the doer(s) and the done. There will always be time for compiling, categorising and crafting, and capturing, but if the filters of thoughts and feelings run the show, one is likely to get caught in a predictable loop of concluding the same nature of things in the same ways and bring to the work the same set of problematics. The research trajectory will get stuck in the same grabby play, perhaps with a few different props. Opportunities will be missed, to say the least, and knowledge will be lost.

A common characteristic of those at the top of their fields is an ability to enter a sort of tunnel-vision quality of sustained focus. Being able to commit to an inquiry and to spend hours at the library, in the lab, hours in meetings or in the field, directing our very beings towards the solution of a problem, is in many ways a definition of the job. Performers and emergency responders face something similar, but need to adjust slightly and constantly, because with some types of focus, they can lose proprioceptive range, integrative reflex coordination and diminished emotional availability. To help with this, we learn to work from awareness rather than focus. For an illustration of how this works and a demonstration of why this is important, explore Figure 24.

Awareness and Focus.

In a moment you will do the task of *focusing* on your big toe. (If you are left-handed, focus on your left big toe; if you are right-handed, focus on your right big toe.) Here focus is not a visual instruction, meaning it is not necessarily important to look directly at your big toe. Now for half a minute

focus focus focus on your big toe. Take the time and do it now...

Focus.

Continue to focus.

Now let that go – and notice when focusing were there any tensions, physical sensations, inner rhythms, breathing patterns...

For most, what can be observed in the focusing is that their breath has stopped and they lose awareness of the rest of their body and the space around them, including things behind them. Often the tongue gets rooted at the top of the upper palate, and all thoughts and feelings are directed to one place in a sort of tunnel vision. Often people find they need to look at an object of focus. With all of this going on, we will not be in readiness to do anything other than focus on the big toe. I have done this little experiment in auditoriums and in workshops in many countries and, strangely, regardless of cultural differences, the effects are the same. If we instead draw our awareness to that same toe (and this does not mean to “think” toe toe toe, or “feel” the toe, but to go there, to allow your awareness to go to the toe), something else occurs. Explore for about a half a minute what it is to bring your awareness to your left big toe. Do it now...

Allow you awareness to go to your big toe.

When a half minute is up, let it go.

Okay. For most, this is quite a different experience. We breathe; we have a body, arms, legs AND a toe. There is an environment in which we are working. We are more open and receptive. Awareness does not disintegrate, hone in, or separate the task from the self or the space within which we are working.

Integrative Performance: Practice and Theory for the Interdisciplinary Performer (Byron, 2014. Routledge: pp. 70–71), adapted.

Figure 24

Working in Presence, Conscious Practice, and Company

In the work of the IPP, there is no such thing as a ‘good habit’, but rather a continuous process of engaging with each action anew. Repetitive exercises and drills, sequences in SA, musical scales, or barre work in performance are never performed mechanically. Rather than being passively shaped by a drill or exercise, the practitioner actively engages with it—consciously and from awareness. This approach helps prevent a narrow, dissociative focus in which tasks become overtaken by distracting thoughts or emotions and knowledge is missed. A ‘zone’ or ‘trancey’ felt sense is the antithesis of what this is about; it is more of a ‘crispy presence’.

Presence in this context is *not* a state of being aligned to devotion or sacrifice but a way of doing that includes the *doer* and the *doing* as one system available to itself in the unfolding present moment. It invites one to be both responsible and able to respond to the external and internal stimuli as one. This work is about the performer *in the act of* performance, on their own terms, in and of the world. As a result, we are NOT aiming for the being-in-the-flow sort of feeling that invariably gets a little bliss-like or zone-y. 'In discussing presence in relation to this work, we never speak about optimum, heightened, or focused states, as we cannot *do* states (states, like emotions, are emergent); rather, presence here is spoken about in the service of the way we do a task from awareness in the unfolding and constantly developing present moment' (Bryon, 2014: 75).

It is here that it becomes very transparent that what we truly practice is what we become proficient in. When we practice 'trying to do something,' 'blocking out,' 'serving a collective,' 'repeating,' or 'trying *not* to do something,' we will inevitably master those tasks. These also create a sort of double tasking (as they are rarely the objective) that makes noise while closing down the space for open receptiveness with the possibility of experiencing new knowledge and/or the serendipitous happy accidents that are so often those eureka moments of impactful research or valuable creativity. When presence becomes a verb—a *presencing*, so to speak—as a constant companion to research practice, we are simultaneously more receptive and perceptive to things that live outside our habitual boundaries.

In IPP, this *presencing* is called *conscious practice*. While we do it, we recognise that no one is completely still of mind or clear of purpose, but rather that we are complex systems engaging with other complex systems, and it is a constant returning to presence in the witness of thoughts and feelings and all the *company* we bring to a task that allows us to remain responsible for and responsive to the many acts of knowledging occurring. When we don't *witness* the company, the agent/doer of the task can get hijacked, and invariably it becomes the company that's doing the work. The subtleties of this are best expressed in the original text:

What things accompany or disrupt a task? — and I choose the terms “accompany” and “disrupt”, rather than “get in the way of”, “hurt”, or “contaminate” because there is no pure product that we are aiming for, but rather a clarity in the way of doing the task. It is through this clarity that the active aesthetic, our way of doing, will be determined... Sometimes it helps to make apparent some of our company, but without shame and blame, and with a healthy sense of “isn’t that interesting” — witnessing vs judging and diagnosing, sitting with it, perhaps, in the discomfort and letting it be. By making the invisible visible, the unconscious conscious, the unfelt experienced, we can then begin to make choices about what we bring to a task and what the task is.

—Bryon, 2014: 76/79

To hone the skill of working in conscious practice, the IPP employs a modified version of the Vipassana Walking Meditation (see Figure 25). In the IPP, this is a gentle practice and a rigorous way to take personal inventory (agential inventory) of the ways in which, of a given day, we might be allowing thoughts, feelings, or company to do the task of something as simple as ‘walking’. It is a way to practice *witnessing* as an antidote to grabbiness or allowing the task of crossing disciplines to get hijacked by a siloed self. It’s a way to prepare to be and stay a research/practitioner fit to engage within and across disciplinary boundaries, primed for the emergence of new acts of knowledgeing.

Again, in the IPP, the practice of awareness and presence is not about any enlightenment or spiritual agenda, but about being in readiness to respond to and able to perceive a wide array of dynamic connections within the middle field that those with disciplinary blinkers on might miss. The ‘attentional blink study’, a seminal study published in the *Journal of Experimental Psychology: Human Perception and Performance* (Raymond et al., 1992: 849–860), is a still widely cited project known for findings explored in the development of cognitive psychology, neuroscience, and human-computer interaction. In short, it speaks to a phenomenon in which our brains can become blind to a ‘second target’ when it appears shortly after the ‘first target’ during a sequence of stimuli. This reveals limits in our ability to process multiple pieces of information when ‘focused’ or caught up in ‘company’ in the ways described above. It’s often

described as a 'brain glitch' that makes us unconscious of things happening right before our eyes.

Vipassana Walking Meditation.

In the Vipassana walking meditation we will practice attending to the doing of walking, which helps to discipline the mind and the body, connecting to awareness in action. We will draw awareness to the action of the feet and attend to the moment-by-moment experience of movement that will be broken down into deliberate steps as you execute the task of walking. Here you will allow your inner talk to connect directly to the doing of walking. If you witness that you are drifting away from the task of walking, you will acknowledge and return to the doing of walking. This can feel silly at first, but trust the process and it will provide new insights into the nature of your doing while engendering a deeper sense of presence within the flow of the task.

We are not aiming to achieve any heightened state.

This is likely to be slow — very slow — and often people manage only a few steps their first time.

Preparation: This is best done in bare feet in a space that will allow you to walk a little distance. The fewer visual and auditory distractions, the better.

Step 1. Begin by standing, breathing, and standing, simply standing. Let your arms rest by your sides, your face be soft and your gaze gentle and straight ahead throughout. Note that you are "standing", "breathing", "standing".

Step 2. Before moving, and while noting "standing", observe your readiness to walk, noting the acting of intention: "intending to walk".

Step 3. At the same time as you do the action, very slowly and deliberately, silently note the action.

"Lifting" as your heel leaves the floor.

"Leaving" as your foot releases contact with the floor.

"Moving" as your foot moves through the space.

"Placing" as your foot makes contact with the floor.

Step 4. "Pausing" — and then repeat step 3 with the other foot.

Tip: You may find that there are days when other things cloud the task. This is a wonderful opportunity to understand your process in the doing of a task. If, for instance, you find your attention leaves the act of lifting the foot, but rather goes to checking on yourself, simply pause and note "checking" and return to "breathing" and "standing" and start at step 1 again. You may find you go to "sensing frustration"; return to "breathing" and "standing" and continue from awareness rather than from thoughts or feelings. There are times an outside stimulus distracts us; note this too — "hearing clock", "pausing", "standing", "breathing", "lifting" ... "thinking about lunch", return to "standing", "breathing"...

Step 5. When you are ready to turn and walk back, remember to note "intending to turn", "pivot", "turning", "turning", "turning", "standing", "breathing", and "lifting"... and then back to steps 1-5.

Lifting - Leaving - Moving - Placing

Variations: The basic premise of this meditation can be used in any action. Cleaning up the studio or sweeping the floor in preparation to work is useful, as it helps to prepare the space and the artist for work at the same time. If there is a particularly challenging task within a work, be it vocal, physical, or emotive, the basic attending to the doing of the task in this way can help to integrate the task with the doer and the doer with themselves through an attending to the task in the present, with all that is available through the action.

Integrative Performance: Practice and Theory for the Interdisciplinary Performer (Bryon, 2014. Routledge: p. 77), adapted.

Figure 25

In the work of researcher/practitioners working across disciplinary boundaries, it's not just about the eyes, of course. It is about experience (in the manner discussed on pages 165–171) and what we filter out and allow and/or include. It's about the ways of working and the attentional biases that determine the awareness of what is occurring in the middle field between the research and the researcher, the space where the acts of knowledgeing occur.

Evan Thompson, working from a combination of meditation, neurobiology, and phenomenology, reveals the benefits of the practice of the Vipassana walking meditation. He shares that, within his own study, in relation to the attentional blink study, after three months of intensive Vipassana practice:

...there was less mental 'clinging' or 'sticking' to the first target, so that attention was open and ready for the second target, making it easier to detect. This reduction in mental clinging or stickiness was reflected in the EEG brain waves, which showed that fewer attentional processes were devoted to the first target after intensive meditation training, making more attentional processes available for the second target. Furthermore, the individuals who showed the largest decrease over time in the neural activity they required to detect the first target also showed the greatest improvement in detecting the second target. Thus, a more efficient neural response to the first target seems to facilitate detecting the second one.

—Thompson, 2015: 53

One could say that in the work of inter/transdisciplinary practitioners, it is not only the first or second 'target' that matters most. It's the possibility of the emergence of a third that is most interesting, especially in the service of tackling wicked problems where solutions will invariably lie beyond (in the Nicolescuian sense) or in an integration of interdisciplinary knowledges. All this works to better activate the tenets of Mode 2 knowledge and the ability to extend beyond our own paradigmatic thinking.

Working with Others

Central to most definitions of transdisciplinarity is collaboration in the co-production of knowledge(s) (see Chapter I). In the section titled *Collaboration* (Chapter III), we saw different approaches to collaborative practices, including Thomas Jahn's *modes of access*,

Anna L. Carew and Fern Wickson's *TD Wheel* and Eric Jantsch's *Outcome Spaces Framework*. Julie Klein's tracking of *word clusters* from discourses across inter/transdisciplinarity scholarship reveals the complexities of collaborative practice across knowledge cultures. Sue McGregor's *conceptual literature review* provides an excellent breakdown of the key challenges articulated around various notions of collaboration within the transdisciplinary project.

The architectures and structures concerning plans of collaboration are multiple, and will invariably need to be crafted from within the centre of the work, across the epistemological cultures included. There is no recipe. What the critical framework of the active aesthetic offers is an approach to engaging with these challenges that operates *before* and *throughout* the aforementioned or newly designed methods, to help ensure that we continue to think and practice along the lines of the *techne* of the episteme, interrogating acts of knowledging from inside the practice of the practice of research.

Synthesis and integration are distinct from an Integrative Practice, in which even though the practice may be integrative, it is not necessarily in the service of integrated or synthesised outcomes. Instead, this practice embraces difference, conflict, discomfort, and distinction. We saw in Chapters I and III that most of the practices emerging from the Zürich tradition emphasise integration, synthesis, and a sense of communion, serving collaborative purposes. Viewing integration in this way can support fostering an environment of tolerance and curiosity across different knowledge cultures, encouraging shared heuristics and understandings, and supporting adaptability and reflection within group learning. It can help participants release outdated views and processes while engaging in group reflexivity to create shared knowledge. However, in the process of synthesis, the sharp edges of interrelations can sometimes be softened, potentially overlooking valuable insights. Often, the richest knowledge emerges from the tensions, inconsistencies, and unresolved elements that do not neatly fit together. The IPP is at its core about supporting a productive tension. Incorporating an approach to knowledging as a conscious practice of *presenceing*, working from awareness in action, assists the agent/practitioner/researcher to remain *adaptive* and at the same time more discerning of the stimuli that they allow to influence a task.

Performers in the act of performing and emergency responders employing SA experience a sort of double consciousness. Productive, rigorous and safe group dynamics are not cultivated through positivity or team-building exercises alone (or at all). An ensemble, group or team, rigorous in its acts of knowledging, engages in tasks with integrity from agential awareness, and in cooperation with others engaging in tasks with integrity from agential awareness.

Awareness must be both individual and collective in an ambulance rushing to a hospital in heavy traffic with a cardiac arrest in process. A team with a combination of collective and individual awareness monitors the patient's vitals, administers medication, and deals with the moving vehicle (which requires keen road and traffic awareness), while physically and technically negotiating medical equipment in space constraints, navigating and communicating with each other and the hospital and making split-second decisions based on their shifting internal and external (integrative) environment. For members of a string quartet to account for a missed entrance due to an unforeseen muffed page turn may require them to reconnect on the next bar while working out shifts in stress, flow, and the arc of a musical phrase. Such a shared coordination of the playing while making everything appear seamless to a paying audience requires concurrent individual and collective consciousness, a dynamic system of synchronous 'I' and 'we' agency. Choruses, orchestras, ensembles, companies, organisations, and troupes all participate in self-awareness dynamics. Terms like 'we-agency', 'plural self-awareness', 'collective agency', 'we intentionality', and 'ensemble cohesion' are not uncommon concepts as invoked in investigations into group dynamics and performance, particularly those of musicians, placing the phenomenon at the level of pre-reflexive embodiment (Høffding, 2015; Schiavio and Høffding, 2015; Salice, Høffding and Gallagher, 2017).

In both SA and performance practice, agents are operating locally and globally at the same time. The dynamic is systems-oriented and non-linear, remaining open to stimuli while in pursuit of a goal, open to being changed while remaining the same and maintaining the rigour of technical exactitude while allowing the experience of experiencing to guide choices that may contradict or make adjustments to this exactitude. It is complex (there is no space for complicated), and there is always the possibility of emergence.

These examples of modes of practising have things to offer in the ways we practice the acts of collaboration in the generating and measuring of knowledge across disciplinary boundaries.

Reflexivity in the Critical Framework of the Active Aesthetic

- Are we perceiving all practices of all parties involved as processes, or are we positioning some as objects or custodians of power and knowledge?
- Are we observing our own and every partner's practice of a discipline as in motion, so that we are able to respond to and open the way for agents (including ourselves) to be responsible for the practice(s) occurring in and across acts of knowing? (This will include all agents: policy makers, stakeholders, indigenous and local participants, academics, and others.)
- Have we endeavoured to understand the practice(s) of the 'other' discipline(s) from the inside? Have we considered the experience and ways of knowing from inside the processes of the other, their ways of generating knowledge in the act of their practices?
- Are we working from a place of witnessing (rather than focus, judgement, diagnosis, thoughts or feelings), and if not, what are we actually practising?
- Are we aware of our company as we cross to other disciplines? Are we noticing how the doing of our own doings are shifting?
- Are we getting comfortable and in a 'flow state', leaning into the habitual, or are we maintaining the internal and external conditions that cultivate an environment of productive tension, a 'crispy presence'?
- Before we enter the space of interchange (and at regular intervals), have we individually prepared ourselves to practice our own work with integrity, before crossing to others?
- And repeat...

Transdisciplinarity, according to this approach, is not solely dedicated to all things equal, homogeneous or integrated, because in this work we no longer subscribe to the notion of a utopian meta-knowledge or meta-epistemology or, as our ancestors hoped, a unity of knowledge. The reason for this is simple and a central argument

of Chapter II. Such thinking invariably propagates the antiquated episteme over the techne dynamic. It perpetuates privileges of 'old power' and a blindness around difference, pluralism and fluidity and is unstrategic when working within today's shifting landscapes of power (review *Problematizing Power* on pages 90–96).

Belgian political theorist Chantelle Mouffe's idea of agonistic pluralism is apt. It challenges the idea that consensus is preferable, especially in a political space, which transdisciplinarity spaces arguably ultimately become. She posits a space of contestation. This contesting, however, is not one of antagonism, where sides are drawn and enemies are made and destruction becomes the practice. Adverse ideas and their communities are there to be encountered in a practice of deep engagement, rather than being eliminated. Tambakaki summarises:

Working from a post-structuralist and, crucially a postmarxist perspective, endearing (or not) to an interdisciplinary Left, Mouffe's work has been key to electing debates about other ways of doing politics. Agonism lies at the centre of such debates. Balancing (the need for) unity with (the need for) plurality; (the defense of) democracy with (the inescapability of) conflict; and (the mobilisation of) dissensus with (the construction of discourses and projects that encourage) democratic renewal, Mouffe's account of agonism sketches out the tasks of politics and, in so doing, it stirs interdisciplinary discussions over their contours.

—Tambakaki, 2014: 1

Inter/transdisciplinary practice and research have always been largely about an opportunity for embracing the uncomfortable intersecting of different dominions of knowing and being. As practitioners, we need to learn not only to be okay with perturbations, surprises, and opposition, but to embrace them and witness them as the pivotal acts of knowing that they are. As we move forward into the final chapter, we witness the dynamics within the middle spaces of inter/transdisciplinary exchanges to allow for a greater capture of knowledge, generated through the crossing, colliding and intersecting of disciplinary boundaries.

Chapter VII

Capturing Acts of Knowledgeing

There are many ways to capture, gather, measure and interpret qualitative and quantitative information and knowledge. Multi-modal documentation is common in practice/and/or based research projects, as some types of multi/inter/transdisciplinary knowledge, especially those including experiential and/or phenomenological aspects, are hard to capture with rigour. The use of the critical framework of the active aesthetic to capture the activities that occur in the middle field is not a substitute for traditional modes of capture such as multi-modal documentation, statistical analysis, data collection and analysis, mathematical modeling, graphs, charts, lab notebooks, digital models of logging, technical reports, and/or peer-reviewed articles/posters/papers. It rather offers a complementary practice, a way to pause and draw into awareness what it is that you might wish to document, record or capture. It reveals to us what is happening at any chosen point. It captures what is occurring in the middle field in a way that resists intention, paradigmatic bias or storytelling. At its core, it is about conflict and systems, and is self-reflective. The application of the critical methodology of the active aesthetic helps us capture happenings, the workings of knowledge, the techne of the episteme—*before* the acts of constructing, ordering, collating, categorising, labelling, determining, or evaluating elements

Transdisciplinarity in Practice: Capturing and Experiencing Knowledge across Disciplinary Boundaries

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within a chosen moment. This final section will show how to work with this approach as a means of awareness before and perhaps during modes of recording or reporting.

This approach provides an active architecture deriving from dramatic text analysis methods from performance that have been adjusted through the critical lens of the active aesthetic to be applied across disciplinary boundaries. It was first conceived to work across lighting, music, writing, acting, sound engineering, set design, dance and production (Bryon, 1998, 2014) and then further developed across performance and social geography, pedagogy, cognitive science, psychology, activism and forensics (Bryon, 2018). In this book, the approach is developed to work within and across any disciplinary practice as a contribution to the transdisciplinary project, applicable to both the Nicolescuian approach and the Zürich tradition.

Dramatic text analysis is often about finding meaning through character-based intentions; however, this approach leans into the anti-hermeneutic. It might have stemmed from naturalistic text-based theatre; however, when expanded to work across the performance disciplines in opera, inclusive of production and technical practices, in the early days of the Integrative Performance Theory (Bryon, 1998), adjustments were made that made it also applicable to non-narrative based performance work such as performance art, inter- and multimedial performance and post-dramatic work. We retain select terms derived from Konstantine Stanislavski's 'method of physical actions'. These are *events*, *actions*, *obstacles*, and *happenings*. Here, key terms are activated as a system, or working template, in an active architecture bracketing different types of knowledge in action.

Key Terms: Event, Actions, Obstacles and Happenings

The moments that we choose to capture and witness in the middle field are called *events*. They are temporarily bracketed moments of engagement, held for a time to allow for the witnessing of what is occurring within the middle field. In this context, the notion of an event is not a 'story' serving a narrative, but rather a temporary

framework encapsulating a shifting template, enabling the observation of dynamics within the middle field. Each event is unique and subjective, creating an opportunity to examine the directions of knowledge and their included ways of practice(s).

Event As a Concept

To use the term *event* as a way to resist narrative, interpretation, and meaning has its history in the works of Derrida, Barthes and Deleuze (review pages 50–51, 146–150 on poststructuralism and pages 123–134 in the *Intermezzo*), who laid the groundwork for a reversal in the order of aesthetic interpretation at the end of the last century. A little insight into the conceptual underpinnings of the term is useful, since leaning into narrative and meaning is too often our default mechanism when observing and capturing ways of knowledge, which was the main point of the previous chapter.

In the deauthorizing project of poststructuralism as laid out by Derrida and Barthes, we begin to see ‘text’ not as the custodian of meaning or its agent/author as an authority, but rather both as living in a realm of *process*. Recall the exercise on reading on pages 157–158, where it was the engagement with the act of reading and moreover the ways of the act of reading that brought forth the meaning(s) of words. The object of the word held no authority by virtue of its essence. The word as an object is not the custodian of meaning, but rather the ways of engagement with the word create aspects of meaning as a system of emergent properties. These ways of generating knowledge in the act of practice are the purview of the middle field.

When Jacques Derrida characterised the history of Western philosophy as ‘logocentrism’—the assumption that truth, meaning, or sense exist prior to their specific textual incarnations—he challenged core assumptions that presume meaning is inherent within the text itself. As we move forward, our working definition of ‘text’ will be shaped by the insights of both Derrida and Barthes. ‘In Derrida’s arguments ‘text’ refers to all those pre-semantic features that make meaning possible, including inscription, tone, rhythm, or syntax. His evoking of ‘the event’ helped to confront this aspect of Western thought’ (Bryon, 2014: 43).

For Roland Barthes, ‘text’ is ‘not a co-existence of meanings but a passage, an overcrossing; thus it answers not to an interpretation,

even a liberal one, but to an explosion, a dissemination' (Barthes, 1977: 159). In this sense, the text functions as an 'interconnected network extending itself as a result of a combinatory systematic (an image, moreover, close to current biological conception of the living being)' (Barthes, 1977: 161).

It is at this point that we recall that the middle field includes some things of our bodies and some things that are not. It encompasses technologies, and thus takes into account the ways we receive, perceive and enact acts mediated through direct embodied experience and/or through technologies that become agents of knowing, mediated for and through us. This will all become 'text' to be captured in the middle field. In exploring a broader understanding of what we mean by text, we as researchers may discover a newfound freedom. However, within this freedom also lies responsibility. Derrida argues in *Signature Event Context* that the inherent undecidability of a text heightens the responsibility of interpretation (Derrida, 1988: 1–21). No reading or analysis can rely on a context as a fixed foundation, since context itself is always subject to interpretation. As researchers, we continuously analyze and reanalyze our sources, theories, methodologies, and data, whether engaging with historical texts, empirical findings, or theoretical frameworks. Each interpretation or analysis is, therefore, a decision. If texts are fundamentally undecidable, and if each reading constitutes an event rather than merely reproducing a pre-determined meaning, then this significantly raises the stakes of interpretation. This is why, within the critical framework of the active aesthetic, the idea of responsibility is crucial. There can be no hiding behind the objects of disciplinarity (except as part of a transparent experimental design or creative choice) when one considers the *way* of doing as the *dynamic* from which knowledge emerges.

While Derrida and Barthes were literary theorists, Deleuze was a transcendental philosopher, approaching the concept of the event from a different perspective. Like Derrida and Barthes, he argued that there is no fixed grounding or authoritative foundation for action, performance, or perception; rather, meaning is continuously created and generated within an in-between space (review the section on Rhizomes in the Intermezzo section). Claire Colebrook summarises:

'We can select and assess our values, not by giving them some ultimate meaning, or foundation but by looking at what they do. Ask, he insisted, not what a text means but how it works'. She further explains that 'Art, Deleuze argued, is not just a set of representations; it is through art that we can see the force and creation of representations, how they work to produce connections and 'styles' of thinking'.

—Colebrook, 2002: xxxii; emphasis added

Deleuze's take on the event is that it is fundamentally about *becoming*. It is dynamic and always in process, simultaneously engaging both the particular and the whole within a *live web* of connections. Becoming, in Deleuze's view, is not a matter of transitioning from one state to another but is instead an inherent quality of every element within an event. For Deleuze, it is not about measuring events by the change that happens from one state to another, but rather that we live in a sort of constant production of *change-ness*, or in a flow of *becoming*. Events are what they are because they exist within this ongoing transformation, constantly generating within the movement of becoming. From this perspective 'we could conceive that everything is a series of *ways* of doing; *middle fields* to *middle fields* to *middle fields*, with constant emergences of subjects and objects becoming determined as the subjects and objects of disciplinarity—and further that that event of *becoming determined* also has a *way* of doing, a *middle field*' (Bryon, 2018: 47).

Action as a Concept

Some are surprised to learn that in the craft of acting, no one *does* an emotion. To even try is an act of pretending, indicating, depicting, and/or faking, unless to do these things is a conscious creative choice and part of a non-realistic genre. Stanislavsky's reforms around acting training were a revolt against the melodramatic, gesture-ridden styles of his time towards something more truthful and naturalistic, imbuing performances with the inner lives of characters moment to moment within the given circumstances of a script. One could say 'there is no acting in acting'. Renowned acting teacher Sanford Meisner, who developed his methods from Stanislavskian roots, is often quoted: acting is 'living truthfully under imaginary circumstances' (Meisner and Longwell, 1987: 63).

Acting training is largely about attending to the presence and quality of doing through a finely tuned psycho-physio-vocal self. When an actor begins to work on a character, or a director begins to consider the things that will occur in the play, they think in terms of *actions*. These actions are not those of ‘pretending’. They are as unfiltered as possible; they are immediate, able to be executed in the present. Why is this important for transdisciplinary work? As we begin to think of what you, the subject/agent, do in the ways of doing an object/task, it is the doing of the doing we consider, not the operations that you might connect to disciplinary procedures. These ‘actions’, moreover, will not only be physical but also might include internal objectives. They can be vocal, emotional, or actions of thought. The throw of a light might have an action, as might the response generated from AI used as a digital partner in the research. Simply: **actions are doings**. They will always be verbs. They are the doings that sit inside the bracket of the chosen *event*.

Obstacles as a Concept

Obstacles are things that get in the way of, slow down, create resistance, stop, break, or inhibit doings or actions. In acting, an obstacle is anything that stands in the way of a character achieving their intention, and importantly includes internal aspects such as emotional struggles, fears, and doubts in addition to external physical barriers, political forces and societal conventions. In applying this notion to transdisciplinary work, it could also include technical difficulties, lack of resources, natural phenomena (gravity, for instance), anomalies, knowledge gaps, and/or conceptual and methodological barriers. Obstacles actively shape the way knowledge emerges. Anything that creates resistance in the momentum of a doing and catalyses a change or shift is an obstacle.

Happenings as a Concept

Aspects that emerge through these resistances/obstacles are called *happenings*. Happenings include shifts in actions, feelings or states and reactions. They include effects, outcomes, discoveries, and failures. *Happenings are the emergent property of an action against an obstacle*. Happenings are also little events. It takes many happenings

to make an event. You will see in the following pages that with this approach, we can telescope out to observe a larger event and also zoom in to observe a happening as an event (see Figure 26), which will have all its own actions and obstacles and happenings within its own middle field. There will always be larger events and there will always be smaller happenings, right down to a molecular level. Whichever happening or event you bracket with your attention sits temporarily amid both smaller and larger webs of activity. Nothing lands; the bracketing is always in relation to and in motion against other series of happenings and events.

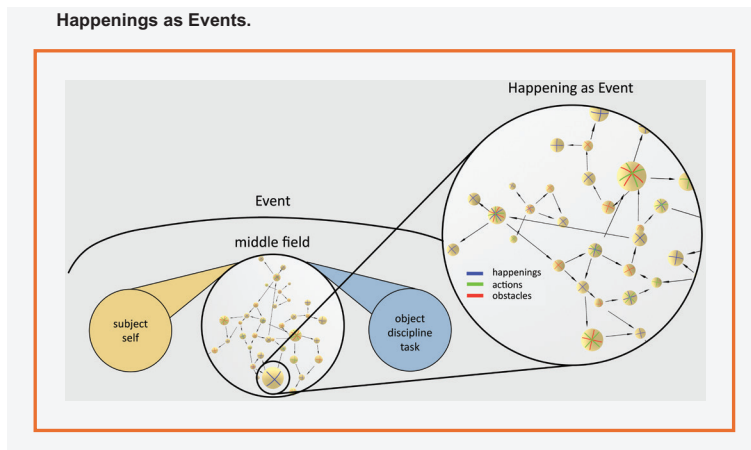


Figure 26

Actions Against Obstacles Create the Emergence of Happenings

Actors do not do 'emotions'. Rather, an actor gives themselves a character's intention (a want, or even better, a need) and activates that intention towards truthful *actions*. Let's say a character's intention is to **find the car keys**. An actor's actions might be to **check** behind the hat on the hook by the door (obstacle: not there), then to **mentally track back** in their mind, working out where they had them last (obstacle: fuzzy mind—came home drunk), and to **search** through pockets (obstacle: lots of things in the pockets, but no keys!). If actors are smart, they will raise the stakes of this intention

(if the script has not already). Not only can they not find the keys, but they woke up late and have a life-changing appointment which is 20 minutes away—and there is traffic. Now the obstacle of not finding the keys might result in the emergent happenings of rapid movement, raised heart rate, panic, anger, raised voice, and clumsy mishaps. Seasoned actors do the doings of the actions *against* the obstacle anew each time. This *againstness* is where the conflict and real work is created (the actor's middle field, so to speak). Repeatability is not in redoing the happenings, but rather in redoing the actions *against the* obstacles so that the happenings may *emerge* anew each time. A trained actor in this scene would not do empty gestures of moving fast, raising voice, panicking, or being clumsy: none of these things help one find keys. But it's what the audience will often think they are experiencing. The work, the knowledging is in the doings of the doings (which always have a rub of *againstness* about them, referred to earlier as 'productive tension'), not in the *objects* of the task.

Many traditional modes of capture across disciplines document the *objects* of the task (which is precisely how the repetition study on pages 160–165 hit anomalies). This is also central to the arguments about the exclusion of 'experience' in the standard accounts of science (discussed on pages 165–171). If we begin to capture the doings of the doings and their happenings, many of the issues in Chapter III (on problematising) will be made visible in the act of generating knowledge. To create the conditions for an active architecture that can work properly across disciplinary boundaries, we expand this concept beyond meaning-making and the performative to include mechanistic and contingent knowledges.

Applying an anti-hermeneutic lens to this idea, we no longer require the idea of intention, want or need to generate the movement of an action. The force of gravity can create the action **to fall**, the ground can be the obstacle, and the sound of the plop as the object hits the ground can be the emergent happening. An extension against contraction might create the emergence of a gesture; wind hitting the vocal folds might create the emergence of a sung note. Collaborating against a power grab will result in a shift of strategy. 'Action against obstacles emerging as happenings' is the beginning of a dynamic analytical system of temporary capture. Action against obstacles emerging as happenings can be chemical, political, technical, behavioural, social, physical, rhetorical, and/or any combination of them all.

Earlier, we discussed the doing of the doing, or the practice of the practice, in relation to reading: the fact that a reader does not read but rather enters into a middle field of read(ing) from which both the read and the reader emerge simultaneously (recall pages 157–160). Here we expand the example to show how the doing of one's doing sits within the wider bracket of the event 'scholar reads' and how the event includes the middle field, the subject and the object together in a dynamic framework inclusive of actions, obstacles and happenings (see boxout).

Event 'Scholar Reads'

Everything within this event—from the comfort or discomfort of the clothing the reader is wearing, to the noise or quiet of the library they sit in, to the content of the paragraph they are reading, to the familiarity or unfamiliarity of the terms within the text, to the flickering light overhead, to the company they keep—will, at any given moment, function as an action, obstacle, and/or or happening. The flickering of the light, for instance, might be a happening produced by the action of electricity encountering the obstacle of an electrical short within the library's walls; that flickering (happening) might simultaneously serve as an obstacle for the reader as she attempts the action of comprehending the text, giving rise to the happening of heightened concentration; which, in turn, might become an obstacle for her friend, engaged in the action of trying to get her attention, thus generating the happening of frustration—all within the event of Scholar Reads. This middle field operates like a shifting template, able to be zoomed out of or drilled down into: what appears as a minor happening within a larger event—a day of study—could also be zoomed in on, revealing itself as a more specific event, such as library lighting fails.

—Bryon, 2018: 47

If the scholar stops participating in the event of reading for any reason, the event has changed into another one. This can happen when the web of actions against the obstacles and their emergent happenings no longer support a tension that constitutes the event. A new event might emerge.

Entire disciplines have had event changes; this is what Kuhn spoke about with regard to anomalies and paradigm shifts (see

pages 51–56). This is not always a bad thing. Roland Barthes posited that interdisciplinarity is ‘not the calm of an easy security; it begins effectively (as opposed to a mere expression of a pious wish) when solidarity of the old disciplines breaks down.’ He referred to this as an ‘epistemological slide’, and opposed it to an all-important ‘break’ (Barthes, 1977: 155). Barthes did not want to suggest some conscious decision to re-ground theory on a new foundation. He was instead challenging the very notion of foundation through the event of structure. ‘Once one takes the idea of structure seriously, one has to recognise that knowledge and learning are the effects of movements that are not within the realms of decision and knowledge’ (Bryon, 2009: 139–140).

Event(ing) as a Transgressive Act

To appreciate the application of the *event* and to ensure that we understand how it operates beyond the scope of intentions and objectives, feelings and thoughts, let’s turn to something most of us know.

Romeo and Juliet, Shakespeare’s classic tragedy of the ‘star-crossed lovers’, is a text, a pre-script (it comes to us pre-written, like a recipe, operational plan, research strategy, or experimental method). This pre-script, the play text, has proven highly adaptable across disciplinary contexts: Berlioz transformed it into a *symphonie dramatique*, Prokofiev a ballet, and Tchaikovsky an *overture-fantasia*. Bellini’s and Gounod’s operas remain in regular performance, as does the Bernstein/Sondheim/Laurents musical adaptation *West Side Story*. The story has also been reimaged in film, influenced pop and jazz music, and even taken shape as an interactive Twitter-based performance, *Such Tweet Sorrow*, produced as a collaboration by the Royal Shakespeare Company and The Mudlark Production Company. Within each of these, the events and the intentions of the characters will differ, even when elements of the pre-script remain the same, whether they be plot, word, theme or characters. We will see in future pages how this is analogous to any inter/transdisciplinarity research event, and further that it is not in the objectives, intentions, or ‘texts’ within which a project is enacted where knowledge occurs, but rather between these, in a dynamic middle space.

At its core, the 'star-crossed lovers' narrative is rich with actions against obstacles creating happenings, centring on the *theme* of love. Theme is often considered the constant across disciplines and genres, serving as a unifying thread that connects different interpretations; but an *event transgresses theme*. This is important because the transdisciplinary project has always pinned itself on select themes that weave through the discourse, such as 'cooperation', 'problem-solving' and 'collaboration'. Regardless, events that arise could disrupt these themes despite all the best intentions by way of the actual *acts* of knowledging that occur.

In this approach, just as it is argued that one does not simply 'do' emotions or 'do' performance, one does not simply 'do' a theme or do 'research' or 'do' collaboration. Instead, themes (as in all these examples) emerge through actions, gestures, movements, sound, obstacles, and technologies. Themes only become fully realised within the dynamic interactions of the dramatic event. Even within the overarching theme of 'star-crossed lovers', the event of *Romeo and Juliet* remains fluid and adaptable. What unfolds on the stage, in the performance space, through the use of technologies, or within a chosen environment, constitutes the event in the act of performance.

Possible events within the love theme of *Romeo and Juliet* could include:

- A. Family feud comes to a bitter end
- B. Manipulation of church officials results in the youths' demise
- C. Society drives teenage lovers to suicide
- D. Love prevails over prejudice

Here we see that the event is not something that is written into the pre-scribed text, design, or even technology, but rather is a choice of how one activates this text in the act of performance (as expressed in a previous publication describing this process in relation to Integrative Performance Analysis (Bryon, 2014: 197)). Context may influence it, but it does not determine it. Events help us to determine what happens between the texts, performance, design, technology, concept, and disciplines of performing. The event in this instance helps bracket the crossings, collisions and intertwining of the dynamic operations within it. As a first step, an event is used as an active framework for the purpose of making choices.

In picking any one of these events in advance, a director, designer, or performer would be making creative and technical choices to ensure that all action, obstacles and happenings were activated within the chosen event. Anything that lay outside the chosen event would not read well in the performance, as it would not work towards believability or the journey of the characters in this dynamic. A costume design might be completely different for each of these events (the promotional poster would be different for sure). Set design and lighting design would also be shifted, as would the very last touch between the lovers; the way of encounter would be completely executed differently within each of these events. *The event is holographic* in that the tiniest moment reflects the entire bracket. The bit is in the whole, and the whole is in the bit. It is systematic (review the Intermezzo pages 123–134).

The point here is that the event is not the same as the pre-scribed text (a recipe, operational plan, research strategy, or experimental method) or their themes. It is rather the ways in which these are played out. The many happenings within an event arise from the dynamic tension between action and obstacle, whether in a physical process, a biological system, a political strategy, a technological experiment or in performance.

Working with the Critical Framework of the Active Aesthetic in Application

You can enter into the shifting template of this dynamic from a myriad of directions, and each will reveal different things to you about the ways in which knowledge is *performing*. You can engage with the process as a way of witnessing, refining, capturing and/or processing. You can also practice it in retrospect as a way of determining future strategies. What's more, the act of employing this approach can be its own event. *In this way, it is always self-reflective*. This works in much the same way as the process of mind mapping does: it encourages presence, reveals new ideas and cultivates innovation, or does things not yet dreamed of in the emergence of the *beyond* (in the Nicolescuian sense).

Do note that the events in the example of *Romeo and Juliet* are **not** *wants, wishes, intentions, or objectives*. Events and happenings are somewhat dispassionate in their reporting, as in *Romeo and*

Juliet examples A–D on the previous page. They can read like a non-editorial news headline. Events in transdisciplinary research processes might be ‘workshop session establishes shared learning’, ‘team designs inclusive research plan’, ‘language around the problem is crafted’, ‘ethical considerations are considered’, ‘data is evaluated and coordinated’, ‘scope of project is determined’, ‘framework is designed to synthesise literature’, ‘community relationships are established’, ‘a pause is taken for reflexivity around shared heuristics’, ‘series of communications links abstract and case-specific knowledge’, ‘findings are disseminated’, ‘frustration explodes’, ‘workshop to address complex problem attended by stakeholders and researchers’, ‘strategy meeting attended to determine the extension of impact beyond the life of the project’, or ‘breakthrough happens’. Importantly, under the umbrella of any of these events are multiple agents/subjects (doing) tasks/objects. The doings are not expressed simply as the tasks/objects, but rather as the doing of the doing, the way of doing the tasks/objects. This is how the information in the middle field allows us to witness or evaluate the *way of doing* in process, the qualities within the *activation* of generating a process: knowledging in action. Remember that the agent/subject and the task/object are emergent properties of the middle field.

Because transdisciplinary research (even without this level of detail) is supremely context-specific, with different projects using different evaluation frameworks, valuing different impacts, having different combinations of disciplinary cultures with distinct skill sets, with narrative, contingent and/or mechanistic vocabularies, there will be no attempt to dictate a series of events that constitute good transdisciplinary research. Rather, we will explore learning how to apply this tool as an approach across a few contexts to enable you to make it your own in the service of your practice/research, within its own knowledge culture, evaluation frameworks, critical methodologies and practical methods. This approach allows epistemological plurality in the witness of knowledge in the act of being generated.

Within the boundaries of transdisciplinary developments, the individual disciplines do not remain what they were, at least, they change their methodical and theoretical perspectives. Not just the theories in the narrow sense, also the disciplines.

—Mittelstrass, 2011: 337

In keeping with Mittelstrass’ observation, one of the most exciting things about the middle field, and key to how it captures cross-disciplinary knowledging in action, is that what might be a *happening* for one aspect can at the same time be an *obstacle* for another (see Figure 27). An action of one agent could constitute an obstacle for another, at the same time as it hits its own obstacle, emerging in a happy accident, violent break and/or minor occurrence as a happening. It’s a multidimensional active capture of crosses, collisions and intertwinings, bracketed within an event. The materials and phenomena in the middle field do not adhere directly to a linear or intent-based organisation; there will not (necessarily) be a clear line from an action against an obstacle towards an event. Working in this way is a practice. It is holographic, systems-oriented, at times rhizomatic, and can make visible the dynamics of Nicolescu’s included middle (review the Intermezzo pages 123–134).

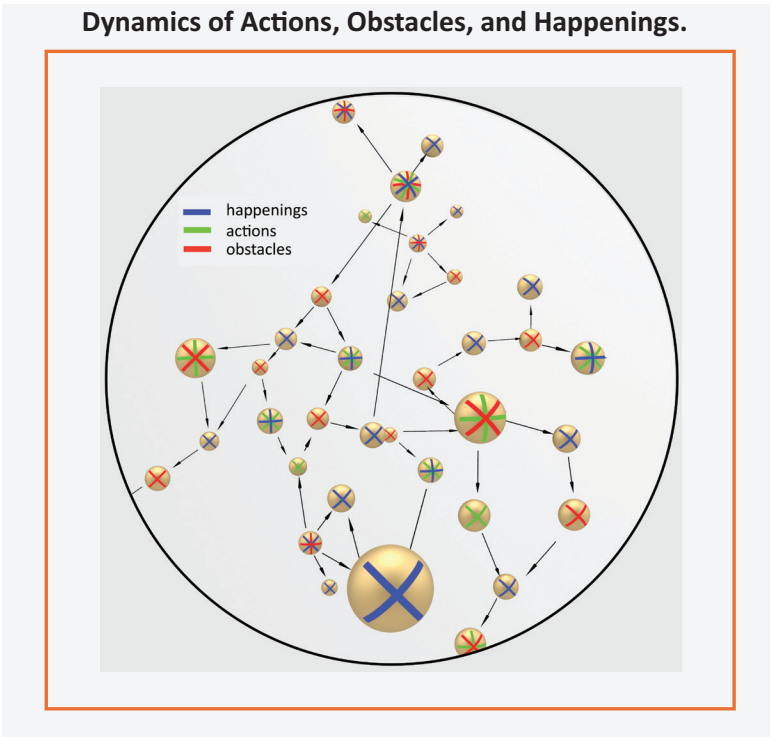


Figure 27

A Little Note on 'Capture'

I am resistant to offering the following case studies, since as soon as one writes in words in a linear way, one makes meaning (of course). This is not an anti-hermeneutic act. The practice of applying the critical framework of the active aesthetic does not conceive of 'capture' as a model of recording and reporting, but rather as a mode of awareness in motion, prior to and possibly during the acts of recording and reporting.

Philosophically, one could argue that the notion of something non-hermeneutic is an impossibility, since once we perceive, receive, and/or conceive of something, we make *sense* of it to some degree. That sense-making is a meaning-making of sorts.

This is why *anti*- rather than *non*- is used. The anti- is a leaning into working from a place that resists construction, interpretation, and reason-finding, and rather comes from a place of unravelling, witness, and the embrace of the type of discomfort that comes before justification and reason. This, of course, will start with the individual pausing regularly to check in on the doing of their practice in the application of this framework. It's a resistance to defence, labelling, and habitual positioning of power or expertise. It is a temporary space of witness, and comes with a certain risk in working from the sort of vulnerability that embraces the uncomfortable space that precedes meaning-making—for as long as we are able, and/or as long as agreed.

Rather than a practice about making meaning, this is a practice about being present as meaning and knowledge emerge. The dynamic that one witnesses as the middle field before reporting or recording is a presence of the tensions in motion between the actions and the obstacles. One of the things that determines how long we are able to do this is our ability to embrace the discomfort of the obstacle, akin to Mouffe's notion of agonism. The merits of this include the embracing of conscious competence, more optimal situated awareness, and a 'crispy' presence in which we are more able to respond to and be responsible for our part in engagement across disciplinary dynamics.

Some inter/transdisciplinary work happens as solitary practice/research, sitting with collections in libraries and in discourse with practitioners long deceased. Sometimes the work occurs in the field, with constant contact among the participants; sometimes it

happens spanning the globe, where the bulk of the communications are in writing, via email and in translation. The active aesthetic of ‘collaboration’, ‘integration’ and all the other terms introduced in Chapters I and III in relation to the practice of inter/transdisciplinary work emerges from the action, obstacles and happenings in the bespoke events brought forth by the nature of the work, its participants, and the method and critical methodologies included.

So in the next section please note that the mode of expression, the order of things, the use of tables, the entering into the system through the forefronting of disciplinary roles, the use of the English language, and the use of language at all, are not to be read as a set of pre-scriptions, but as only one discrete expression of the process.

Project: Development of Assistive Exoskeletons for Stroke Rehabilitation

Here we explore a hypothetical scenario in which agents from the disciplines of engineering, medicine and sociology, along with a stakeholder, work together to create a wearable robotic exoskeleton for post-stroke mobility recovery as an intervention for stroke victims that is not only technologically sound but also socially accepted and clinically effective. Each agent has a task in line with their discipline. These might look like:

Agent/Subject	Task/Object
Neurologist	Ensures exoskeleton aligns with rehabilitation principles; evaluates patient response.
Biomedical engineer	Designs and refines the exoskeleton’s mechanical and electronic systems.
Human–computer interaction specialist	Develops the interface that allows the patient and therapist to adjust settings.
Physical therapist	Guides patient use, providing feedback on movement and usability.
Sociologist	Observes how patients, families, and clinicians interact with the technology; assesses ethical concerns.
Stroke survivor	Tests the exoskeleton, reacting to its constraints, and adapting to its use.
Family caregiver	Provides insight into how the technology fits within daily life and long-term rehabilitation.

However, it will be in the *ways of doing* tasks of the middle field, such as ensur(ing), design(ing), refin(ing), develop(ing), guid(ing), test(ing), that the agent and the task will emerge: the doing of their doings. This might become apparent in the details of a ‘trial session’, for instance:

Agent/Subject	Task/Object
Neurologist	Checking for unintended compensatory movements (checking is a particular way of ‘ensuring’).
Biomedical engineer	Modifying responsiveness (modifying is a particular way of ‘designing’).
Human–computer interaction specialist	Simplifying the control settings based on patient feedback (simplifying is a particular way of ‘developing’).
Physical therapist	Noticing that the device’s stiffness is preventing natural movement (noticing is a particular way of ‘guiding’).
Sociologist	Noting signs of discomfort or frustration (noting is a particular way of ‘observing’).
Stroke survivor	Attempting to take steps using the exoskeleton (attempting is a particular way of ‘testing’).
Family caregiver	Observing, questioning whether the device is realistic for home use (observing and questioning are particular ways of ‘providing insight’).

If we employ the practice of drilling down in relation to the doing of the doing or the practice of the practice, the neurologist might ask themselves: what is my practice of doing when I **ensure**? I am actually **checking**. What am I doing when I practice **checking**? I am actually **defending** myself from possible blame. They might notice that the tensions in their body and the internal rhythm of their mood (both happenings) when ensuring fit those of defending, with its physiological actions and obstacles. In performance practice,

actors are encouraged to pause and witness breathing, thoughts, and feelings regularly, and to then notice if they are aware of the event they are in. Actors can't put their instrument back in the case and in the closet at the end of the day; their being is the instrument of reception, expression and quality of presence. This goes to the idea from Chapter VI that what we *actually* practice (as in the doing of our doings) is what we *actually* get good at. In reality, all of this is also true for the research/practitioner working across disciplines.

Let's return to that neurologist, who, when we drilled down through the doings of the doing, we found was actually *defending*. This action of *defending* and its implied obstacle (which is likely personal and informed by another event) can take the neurologist away from the types of productive tension conducive to the event of **development of assistive exoskeletons for stroke rehabilitation**. When this happens, the agent is also less able to capture, receive and perceive acts of knowledging occurring within the agreed event. For more on how to deal with this when it occurs, return to the sections:

- *Awareness and Witness in Research Practice*: pages 191–192.
- *Working in Presence, Conscious Practice, and Company*: pages 192–202.
- *Reflexivity in the Critical Framework of the Active Aesthetic* (boxout): page 201.

Importantly, there are not only human agents in this event. The **clinical environment** of the hospital setting becomes an agent. It *influences* interactions, spatial constraints, institutional protocols, embodied experience, and rhythms. Other agents/subjects include the **exoskeleton hardware** and **AI software**, which *react* to movement patterns, *generate* data, and *introduce* possibilities and limitations in rehabilitation. Further, non-human agents generate *ways* of 'influencing', 'introducing' and 'reacting' and are *active* participants in the production of knowledge.

Remaining in this scenario to explore the notion of obstacle, some that might be witnessed include:

Technical obstacles	The exoskeleton's motion prediction algorithm fails to anticipate patient movements, causing delayed responses. The device is too heavy, making prolonged use impractical. Sensors misinterpret involuntary muscle spasms as intentional movement, leading to unsafe actions.
Clinical obstacles	The therapist notices that the patient relies on the exoskeleton too much, reducing natural muscle engagement. Insurance policies do not cover exoskeleton-assisted therapy, limiting real world implementation.
Social obstacles	The patient feels self-conscious wearing the device in public, affecting motivation to use it long-term. Caregivers express concerns about long-term maintenance and affordability.
Agent-oriented embodied / environmental/ situational obstacles	An agent might be working against period cramps. There is construction in a wing of the hospital, creating a distraction. Another agent might feel the need to impress, or have feelings of frustration or impatience, or thoughts (positive or negative), taking them out of the field of the event.

Actions against obstacles will emerge as happenings. Multiple happenings will create an event (recall: not necessarily in a linear way, as actions from one agent can become an obstacle for another while being at the same time a happening for yet a third).

Possible events that might emerge could include:

- The physical therapist's observation that the patient is over-relying on the device leads to a new adaptive mode that gradually reduces assistance as strength improves.
- The sociologist's interview reveals cultural resistance to robotic assistance in certain communities, leading to a redesign that emphasises human control over automation.
- A family caregiver suggests a voice-activated control system, which improves usability for patients with limited hand mobility.
- The neurologist and engineer debate the role of AI, realising that rather than making the exoskeleton fully autonomous,

giving patients more control over settings increases confidence and engagement.

- A meeting is called between research leads and stakeholders to navigate clinical, technical, and social challenges.

One might observe, applying the tenets of the critical methodology of the active aesthetic, that the exoskeleton is not just an engineered device; it is an emergent entity shaped by human and non-human interactions. One might observe that obstacles are not setbacks, but generative forces that refine both the technology and the research questions and that transdisciplinarity is about the emergence of knowledge through practice—an act of knowledgeing.

And, of course, we can zoom out to see all of the above as concurrently a happening of the event **program initiated to connect technology and medicine to enable the geriatric population to rejoin the workforce**. Conversely, we could zoom in on one of the happenings from the above list, say, a meeting **between research leads and stakeholders to navigate clinical, technical, and social challenges**. Here, new participants would be introduced, and different agendas and perspectives would be activated through the doing of doings against obstacles emerging in new happenings. It might begin like this:

Agent/Subject	Task/Role
Neurologist	Emphasises the need for clinical validation and safety, ensuring the device aligns with rehabilitation science.
Biochemical engineer	Focuses on technical feasibility, iteration on mechanical and software improvements.
Sociologist	Brings insights into patient experience, social acceptance, and long-term adoption.
Stroke survivor	Shares first-hand experiences , describing challenges in real-life use.
Healthcare administrator	Evaluates integration into clinical settings, considering training, workflow, and budget.
Insurance representative	Determines whether the device qualifies for coverage, emphasising cost-benefit analysis. Examines regulatory challenges, funding opportunities and public health implications.
Government policy adviser	Examines regulatory challenges, funding opportunities, and public health implications.
Patient advocate	Represents broader community concerns, ensuring equitable access and usability.

...and one might repeat, as in the prior example, by drilling down through the doings of the doing. Or a happening might emerge during such an event, such as ‘tension in the room’, and the participants could witness from the happening *back* to investigate what doings against which actions might be creating the conditions for this emergence. One could start by purposefully guiding actions against obstacles to hold a space for an optimal happening, and then adjust when doings of doing and/or the happening don’t bracket the productive tensions for the emergence of the event. The application of the active aesthetic as a critical concept can be simply a personal practice and/or a diagnostic tool, or an agreed-on model of reflexivity, or a mode of interrogating the rigour of a report.

The above example would most likely be deemed a transdisciplinary research project within the criteria of the Zürich tradition due to the fact that it is geared towards a ‘real world’ problem and includes a variety of stakeholders, including people from the community, and aims to integrate diverse knowledge cultures towards solving of a problem. It might also be considered transdisciplinary through a Nicolescuian lens; this project could possibly take us *beyond* the included disciplines, creating new languages, skillsets and cultures, especially if a new discipline emerges in the guise of a type of integrated prosthetic therapy, for instance, that transcends the biological and incorporates AI and extended notions of embodiment in keeping with theories of transhumanism. What is often misunderstood is that a project’s being transdisciplinary does not make it more advanced, rigorous or even more fit for purpose than if it were disciplinary or multi- or interdisciplinary. Solving a problem, or finding an answer, is sometimes best accomplished in simple ways. However, the complex issues we are dealing with in today’s climate are becoming more likely to need an approach that lives outside of the paradigms that fostered an environment enabling the issues to occur in the first place.

Refining a Research Project

Our last example is where we often start as researchers/practitioners. As mentioned earlier, inter and transdisciplinary work often starts as a solitary practice. Many students embarking on a PhD will

begin in this manner. The application of the critical framework of the active aesthetic is particularly useful in this instance, since part of the defining of a research project that crosses many disciplines is in determining what takes the lead, what supports, what is the context, what is the language of interrogation and capture, what is the methodology, and what are the methods.

There will be lots of elements collected in an area of inquiry. It often starts with 'what I am interested in is...'; however, the rest of that sentence does not necessarily constitute a research project. If the area of inquiry is in practice/research, a conversation might go like:

PhD Candidate: What I am interested in is film and intimacy.

Supervisor: Ok, that's great, but what role does *intimacy* play here, and what role does the act of filming play here? What is the doing of the doing of these in this area of inquiry?

At this point, one would expect that the researcher would know that 'methods' are modes of practice or procedure. They should know that the empirical method, editing, experimental protocols, and rehearsal practices are all methods and that they differ from methodologies, which are critical lenses, ways of discussing methods or philosophical frameworks.

With any practice that is embedded within research (and this practice can also be that of conventional science), one must make sure that the practice is not there to merely illustrate, depict, parallel, or offer accompanying aesthetics. Rather, one asks: how is this practice *activating* the inquiry? What is it *doing* that is intrinsic to the activation of the inquiry? What is the doing of its practice?

Upon further inquiry, if the doing of the doing of filming was to function as an invasive gaze, one might not need the camera or film at all. A person standing there watching could do that. If it were to include the experience of the person behind the camera and the relationship of film and all a camera means to social media and privacy, things would function differently. Working to drill down in the same way about the role and function of the term *intimacy* will also be important.

In working all this out and in finding one's vocabulary, one might read and watch a lot and thus begin to situate the practice and inquiry within a heritage of other practices and theoretical

discourses. This would be the beginning of a literature review or an annotated bibliography. From there, methodologies might appear. Feminism around the gaze, or phenomenology around the embodied experience, or performativity around how the camera performs and we perform with it, would all be among the options. The type of camera, the scenario of the film, and ethical concerns around the filming would all be a part of the mix.

What often occurs for early researchers is that all that reading, all those methods and methodologies and aesthetic and technical properties accumulate and end up on the same level, with the same status, and it gets like a Rubik's cube; when you move one thing or introduce another thing, it can shift the entire order, and it all gets very overwhelming.

This is where employing the critical framework of the active aesthetic can help to clarify a research project. There are many ways to employ this approach, starting with considering how you in yourself practice your doing of researching. It is helpful to clarify the myriad of elements within a research project as it develops, rendering all aspects active (not objects or custodians of knowledge) by inquiring what the doing of their doings are in relation to the event of your inquiry. Again, you can start with an event, or with happenings, actions or obstacles. You can drill down or telescope out. You can do a version of the following exercise, *Casting the Play* (see Figure 28). The metaphor of *Casting the Play*, in this instance the use of paper, mind mapping, and coloured pens, is just one option of exploring how to render all aspects or participants in a web of knowledging, in the active template of the middle field, within the bracketing of an event. The exercise is not a prescription. The critical framework of the active aesthetic works like a shifting template that can be placed in a myriad of ways to reveal the generation of knowledge in action.

In working with *Casting the Play*, the roles may change as you redo the exercise from week to week. Even if you don't do all the steps of the exercise exactly as suggested, you can see how it at least helps to make apparent the elements within an inquiry for consideration regarding their functions within a developing research project. The point of such exercises is to open a way to interrogate, witness and capture aspects of experience, exchange, process and practice in the generation of knowledge. When working across disciplines as a solitary research/practitioner, this regular conversation between self and disciplinarity is important.

Casting the Play.

Casting the play can be helpful at various junctures in the process of developing a research project.

Find a large, blank piece of paper and various coloured pens (partly because, for some, getting off the computer and shifting the habitual mode of inscription helps shift things). Prepare by breathing and perhaps doing the Vipassana walking meditation to cultivate a 'crispy presence' in preparation to engage in this task from awareness rather than from thoughts or feelings. (Review Figures 24 & 25)

As you progress, do not worry if you repeat words, or do not write full sentences, but rather words or phrases.

- We begin by jotting down (in no order, anywhere on the paper) all key words that surround this enquiry (going forward, remember you may repeat).
- Get another colour and write down key players/authors/scholars.
- Get another colour and jot down objects or pieces of work, prior experiments or methods.
- Get another colour and write down philosophies and methodologies that are informing the thinking and doing of the enquiry.
- Get another colour and write down any other words or phrases remaining.

And now we have the cast. Now, not everyone on stage can be a soloist: there is a chorus, a leading man/woman, supporting roles, and ensemble members. There are also the set, and props, and sconces on the walls. Triangles around words/phrases can indicate leading role, squares supporting roles, circles ensemble cast, ovals chorus, and so on. What becomes interesting is the ways the colours and shapes intersect and differ.

Figure 28

In engaging in such an exercise you might begin to work out whether phenomenology, for instance, is a supporting character to the leading role of intimacy, or if it's just part of the chorus to contextualise the experience of the gaze and in fact feminism is the supporting role to a lead role of sensuality (a word you just found on your sheet of paper while *Casting the Play*). Maybe David Lynch's work becomes the set, or maybe his work and ten others' become the chorus, holding the space for your own practice that troubles their work through a critical lens of feminism. It could go many ways, but here the discussion works with what you have, to help you make your work responsible and able to respond to your inquiry and, most importantly, for you, the researcher/practitioner, to have agency over your personal ways of knowing. What is the doing of the doing of all the elements on the paper? Which of these elements provoke, instigate or interrogate? Are there any obstacles that you can press against to explore the emergent possibilities of new or original knowledges? What is the event of the inquiry? And this might change from week to week.

For many, the experience of doing an inventory, whether through *Casting the Play* or another exercise of your own design, allows things to stay in motion and work from a place of witness and awareness. It is much like tuning up an instrument. Researchers often sense when the tensions are in a productive place. Writing up can even become pleasurable. Regardless, such exercises offer an alternative non-linear bouncing off place for discussion that helps one witness the work and themselves in the act of *knowledging*. One also learns about their own process and what the doing of their own doing in research/practice is as they work within and across disciplines.

Conclusion by Way of Thinking Forward

We conclude this book by leaving the acts of *knowledging* with you, the reader/researcher/practitioner, as you explore the *techné* of the *episteme* within your own knowledge culture(s) and across disciplinary boundaries. Thinking forward, some things one might consider in relation to the application of the *active aesthetic*:

What is your relationship to recognition and belonging, and how might this influence your doing of the doing?

What do the 'values' in the room do to the ways in which we engage in practice?

What if we stopped asking what things mean and rather asked how they work, and further considered their place(s) in an event as action, obstacle and/or happening?

What would it look like if there were a planned set of pauses for all included in a research project, designed to create moments to take an inventory of the obstacles present and the happenings occurring, with consideration of the event emerging?

How might one begin by crafting an intended event, considering what obstacles might be in place or could emerge, and consider a way of engaging in actions that consciously and clearly work in a way of practice that has integrity towards the desired outcome?

How might one set up the conditions for all involved to feel comfortable and safe to disclose their doings of the doings, making the invisible visible and, as such, allowing for the making of new choices?

What if collaboration embraced discomfort and dissonance and all involved were empowered to bring a range of factors to the field, setting the stage for interaction and witness rather than categorisation, judgement, and diagnosis?

What if every research project had embedded within it a recognition of experience?

What if we were taught from the beginning that a literacy of knowledge production included a balance of arts, sciences and philosophy, inclusive of embodied practices?

How might you begin to practice ways of knowing that include regular moments of reflexivity around the practices of your doings and the doings of your practices?

How might you pause and consider what your contribution is (action, obstacle and/or happening) to any event (global, local, personal, cultural)?

If you are even able to perceive of an event, are you a part of that event in some way?

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Glossary of Terms

Agency: The capacity of an individual, group, or entity to act independently, make choices, and exert influence over their environment. In performance studies, agency often refers to the ability of performers, characters, or audiences to actively shape meaning, identity, and experience within or beyond prescribed structures, conventions, or power relations. It is critically explored through various frameworks, including performativity, phenomenology, psychoanalysis, intermediality, and posthumanism.

Agora: An open space where people can meet or, by analogy, a place on the internet for free exchange of ideas. In ancient Greece, an agora was a central public space serving as a marketplace, a place for assembly, and a hub for civic, political, and social life.

Anthropocene epoch: A period of time during which human activities have impacted the environment enough to constitute a distinct geological change.

Anthropocentrism: The viewpoint that humans are the central or most significant entities in the world, viewing other entities as resources that may justifiably be exploited for the benefit of humankind.

Autopoiesis: From Greek *αὐτο* (*auto*) 'self' and *ποίησις* (*poiesis*), the capacity of a system to self-create and self-maintain its own components and structures, forming a closed, self-organising loop.

Consilience: The unification of knowledge across disciplines, allowing for an integrative approach to understanding complex phenomena (the ways the definition is contested are discussed in Chapter II in the section, *Consilience*).

Constructivism: A theory of knowledge emphasising that meaning and reality are actively constructed rather than passively absorbed. As people experience the world and reflect upon those experiences,

they build their own representations and incorporate new information into their pre-existing knowledge (schemata).

Cybernetics: The science of communication and control theory that is concerned especially with the comparative study of automatic control systems (such as the nervous system and brain, and mechanical-electrical communication systems).

Deconstruction: A critical methodology of philosophical and literary language which emphasises the internal workings of language and conceptual systems, the relational quality of meaning, and the assumptions implicit in forms of expression.

Dialectic: A method of argument that explores contradictions and their resolutions, often applied in philosophical and theoretical discourses.

Dynamism: The quality of being characterised by continuous change, activity, or progress. In various disciplines, it refers to the forces or principles driving movement, growth, or transformation within systems, whether social, artistic, technological, or philosophical.

Emergence: The process by which complex systems or patterns arise from the interaction of simpler elements. It describes how new properties, structures, or behaviours spontaneously form that cannot be fully explained by characteristics of the individual parts.

Epistemology: The branch of philosophy that studies the nature, origin, and limits of knowledge. It explores how knowledge is acquired, justified, and validated, as well as the distinction between belief and true understanding.

Exteroceptive: Relating to or involving the perception of external stimuli from the environment through the body's sensory organs. Exteroceptive senses, such as sight, hearing, touch, taste, and smell, provide information about the outside world, enabling an organism to navigate, interact with, and respond to its surroundings. It contrasts with interoceptive (relating to internal bodily sensations) and proprioceptive (relating to the sense of body position and movement).

Gestalt: A pattern or structure perceived as a unified whole rather than merely a collection of individual parts. Used in psychology and philosophy, the word emphasises that the whole is greater than the sum of its parts, with meaning emerging from the overall configuration.

Hermeneutics: The theory and methodology of interpretation, particularly of texts, language, and symbols. It involves uncovering meaning through contextual analysis and is commonly applied in fields such as philosophy, literature, religion, arts and the social sciences.

Heterogeneity: The quality or state of being diverse, varied, or composed of different elements. In various contexts, it refers to the presence of distinct or contrasting components within a system, group, or phenomenon.

Heuristic: A problem-solving approach or learning method that employs practical, experience-based techniques, often relying on trial and error, intuition, self-educating techniques and/or educated guesses.

Isomorphism: A correspondence or similarity in structure or form between two systems, entities, or concepts, where relationships and patterns are preserved despite differences in content or nature. In mathematics and logic, it refers to a one-to-one mapping between sets that maintains structural integrity.

Liminality: A transitional or in-between state or phase where usual boundaries, structures, or identities are suspended or blurred. It often signifies a period of ambiguity, transformation, or potential existing between established conditions or stages.

Logical empiricism: A philosophical movement that emerged in the early 20th century, combining empiricism (the idea that knowledge is derived from sensory experience) with formal logic. It emphasises the verification principle, asserting that meaningful statements must be either empirically verifiable or logically provable, while dismissing metaphysical or speculative claims as nonsensical.

Logical Positivism: A philosophical movement that emerged from the Vienna Circle in the early 20th century, advocating that meaningful statements are only those that can be empirically verified or logically deduced. It rejects metaphysics, ethics, and theology as meaningless if they cannot be tested or proven through observation or formal logic.

Metacognition: The awareness and understanding of one's own thought processes. It involves the ability to monitor, control, and reflect on how knowledge is acquired, used, and assessed, often enhancing learning, problem-solving, and decision-making.

Metaphysics: A branch of philosophy that explores the fundamental nature of reality, existence, and the relationships between objects, properties, space, time, causality, and possibility. It addresses questions about what exists beyond the physical world and the nature of being itself.

Ontology: A branch of metaphysics that studies the nature of being, existence, and reality. It examines categories of existence and how entities, concepts, or phenomena relate to one another within a structured framework.

Paradigm: A distinct set of concepts, theories, methods, and standards that define and guide research and practice within a particular field or discipline. Paradigms shape how problems are understood, approached, and solved, often evolving or shifting through revolutionary changes in thought.

Performativity: The concept that language, actions, or behaviours do not merely describe reality but actively shape or produce it. Originating from J. L. Austin's speech act theory and expanded by Judith Butler, it often refers to how identities, norms, and social realities are constituted through repeated, embodied practices.

Phenomenology: A philosophical approach that focuses on the direct investigation and description of lived experience as it is perceived, without recourse to theories, assumptions, or preconceived notions. Founded by Edmund Husserl, it aims to reveal the essential structures of consciousness and how meaning is constructed through subjective experience. Maurice Merleau-Ponty expanded phenomenology by emphasising the embodied nature of perception and experience, arguing that consciousness is fundamentally rooted in the body's interaction with the world, making perception a primary source of meaning-making.

Posthumanism: A philosophical and cultural framework that challenges anthropocentric perspectives by questioning the boundaries between humans, animals, technology, and the environment. It critiques Enlightenment notions of human exceptionalism and explores how identity, agency, and ethics are reshaped in the context of technological advancements, ecological concerns, and non-human forms of life.

Postmodernism: The intellectual and cultural movement that emerged in the mid-20th century, challenging established narratives, structures, and truths associated with modernism. It emphasises relativity, fragmentation, pluralism, and scepticism towards grand narratives and absolute truths. In various fields, including art, literature, architecture, and philosophy, postmodernism celebrates diversity, intertextuality, and the blurring of boundaries between high and low culture.

Poststructuralism: A theoretical movement that emerged in the mid-to-late 20th century as a reaction against structuralism, challenging the idea that language, culture, and meaning can be understood through fixed structures or universal systems. It emphasises ambiguity, instability, and the fluidity of meaning, arguing that meaning is always contingent and shaped by power dynamics.

Praxis: The intersection of theory and practice, emphasising the integration of reflection and practice, often with the aim of transforming or improving social, political, or cultural realities. In performance studies, it sits within models of 'Practice as Research' (PaR), involving a cyclical process of doing, reflecting, and articulating knowledge that emerges from embodied creative practices.

Proprioceptive: Relating to proprioception, the body's ability to sense its own position, movement, and orientation in space. This internal awareness arises from signals received by muscles, joints, and tendons, enabling coordinated movement and balance. In performance and phenomenology, proprioception is often explored as a fundamental aspect of embodied experience and perception.

Rhizomatic: A non-hierarchical, interconnected network with multiple entry and exit points, a concept derived from Gilles Deleuze and Félix Guattari's work, particularly *A Thousand Plateaus* (1980). Unlike linear or tree-like structures, a rhizome is decentralised, fluid, and continually evolving, making it a useful metaphor for understanding complex systems, knowledge production, and identity formations that resist fixed or singular meanings. It emphasises multiplicity, heterogeneity, and connectivity. In nature, a rhizome is an underground stem that grows continuously and produces roots and shoots from its nodes, allowing plants like ginger, bamboo, and ferns to spread and propagate.

Socio-cultural: Relating to the interaction between social and cultural factors that influence behaviours, practices, beliefs, and identities within a particular context, and the ways in which individuals and groups are shaped by and actively shape the norms, values, languages, and practices of their society. In fields like anthropology, psychology, and education, the socio-cultural approach considers how knowledge, learning, and development are mediated through social interaction and cultural tools.

Solipsism: A theory holding that the self can know nothing but its own modifications and that the self is the only existent thing. 'Solipsistic' describes behaviour from those who are overly focused on their own needs and desires to the point of neglecting or disregarding others, or who believe that only their own existence is real.

Structuralism: An intellectual movement that emerged in the early 20th century, primarily in linguistics, anthropology, psychology, and literary theory. It emphasises that elements of human culture, thought, and behaviour must be understood as part of broader, underlying structures—systems of relationships rather than isolated entities. Structuralism analyses how these structures shape meaning and experience by examining the contrasts and relationships between elements within a given system. Key figures include Ferdinand de Saussure (linguistics), Claude Lévi-Strauss (anthropology), and Roland Barthes (literary theory). Structuralism's influence extends across disciplines, providing foundational methods for analysing language, myths, social practices, and texts.

Subjectivation: The process by which individuals become subjects through social, cultural, discursive, and power-related mechanisms. It involves the formation of identity, agency, and consciousness as shaped by external forces such as language, ideology, institutions, and disciplinary practices.

Synthetic *a priori*: Refers to a category of knowledge identified by Immanuel Kant that is both *synthetic* (extending knowledge beyond definitions) and *a priori* (known independently of particular experiences). Unlike analytic *a priori* judgements, which are true by definition, synthetic *a priori* judgements connect concepts in ways that are necessarily and universally true, but not self-evident. Kant argued that such judgements are foundational to knowledge

in mathematics, natural science, and metaphysics (e.g., '7 + 5 = 12' or 'Every event has a cause'). Central to his *Critique of Pure Reason*, this concept explains how objective knowledge is possible through innate structures of human cognition that organise all experience.

Transhumanism: A movement that advocates for the enhancement of human capabilities through advanced technology. It seeks to overcome biological limitations such as ageing, disease, and even mortality, aiming for improved cognitive, physical, and psychological abilities. Transhumanism explores the ethical, social, and philosophical implications of merging humans with technology, including artificial intelligence, genetic engineering, cybernetics, and nanotechnology.

Vienna Circle: A group of philosophers and scientists in Vienna during the 1920s and 1930s, led by Moritz Schlick, dedicated to developing a scientific worldview grounded in logical positivism. They emphasised the verification principle, holding that meaningful statements must be empirically verifiable or logically coherent, and rejected metaphysical claims as meaningless. Advocating for the unity of science, they aimed to integrate all knowledge through a common logical language. The group's influence spread internationally after members fled Austria due to the rise of Nazism, shaping analytical philosophy and philosophy of science. However, their strict adherence to verificationism faced criticism and eventual decline as philosophers like W. V. O. Quine and Thomas Kuhn exposed its limitations.

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