Chapter 1

Contexts of Transdisciplinarity: Drivers, Discourses & Process

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Introduction

In a classic episode of the UK Channel Four situation comedy caricaturing Irish Catholicism, *Father Ted*, two Irish Catholic priests – Ted Crilly and Dougal Maguire – are sent by their superior, Bishop Brennan, to protest against the screening of the The Passion of St Tibulus, a film which the Vatican perceives as morally objectionable, even heretical. All of the elements of the narrative are highly abstracted versions of 'real world' events; though fictionalised they correspond to a particular contextual reality. The hapless and unconvinced duo handcuff themselves to the railings outside the cinema bearing placards with vague non-committal slogans of condemnation and caution: 'Down with this sort of thing!' and 'Careful now!' Instead of persuading the previously disinterested islanders to boycott the film, they draw attention to it ensuring almost unparalleled success. Struck by the fact that nobody wants to hear what they have to say, they decide to concede defeat and return to their parochial house, but still chained to the railings by the handcuffs they had placed on themselves. Having lost the key to their cuffs, their escape was only possible by uprooting the railings and bringing them home.

The story is set on 'Craggy Island', a fictional island located somewhere *beyond* the island of Ireland, where misfits, deviants and the unorthodox are deposited by the Catholic Church away from the mainland and the mainstream, but still forced to deal with the problems of everyday life with all its ambiguity, ambivalence and unpredictability. Ultimately their sanction for the failure to sustain the Church's orthodoxy, the threat of disciplinary action, is banishment to somewhere *worse* than Craggy Island! While this vignette could be regarded as quintessentially Irish, and parochial, the priests' placard slogans have subsequently appeared in protests against fracking and austerity (the Occupy movement), have been referenced in *Grand Theft Auto V* and appeared globally *via* internet streaming. On another level, our example is, well, exemplary. *Fr. Ted*, though written by Irish writers and performed by a predominantly Irish cast, was only made possible by exile, a phenomenon not unfamiliar to previous generations of artists (Wilde, Shaw and Joyce). The series could not be made *at home* because it transgressed received wisdoms and orthodoxies, defiling totems of authority and devotion along the way. Once it had 'broken through', it became hugely popular in Ireland, providing an endless source of quotable aphorisms, including those referenced here.

There is, it seems, some concordance between the caricature of contemporary Catholicism and the sentiments expressed in relation to the social role of the University (and the claims to universality that inhere in both institutions) by researchers promoting transdisciplinarity in pursuit of sustainability. Despite their respective claims to universality, both are under intense pressure to establish relevance in the context of a changing world:

> Society is constantly in motion, and citizens are facing problems and challenges for which there are no ready-made solutions available. Past solutions no longer offer guarantees of adequate results, either now or in the future. For higher education to play a meaningful role in the risk society, with its sustainability challenges, a major

> reorientation of teaching, learning, research, and university-community relationships will be required   (Peters and Wals, 2013, p.6)

In a somewhat playful manner we wish to contend that the '*Passion of St Tibulus*' might serve as a useful metaphor for considering the challenges of transdisciplinary research in an Irish context. We do so with particular interest in exploring the space across, between and *beyond* the apocryphal warning slogans of the main protagonists, and consider whether they possess broader significance. In what follows (here and in Chapter 2), we draw extensively from the literature in order to review the possibilities and potential, but also the challenges and constraints, of a transdisciplinary approach. Appropriately we begin by noting how Alfonso Montuori (2013, p.212), admittedly in a convenient and perhaps contrived correspondence to our argument, speaks about a '*passion for transdisciplinarity*'. From his personal (autobiographical) perspective this passion stems from 'a felt need to go beyond some of the limitations of more traditional disciplinary academic approaches, and certain established ways of thinking' (2013, p.212); as well as from a professional (pedagogical) perspective that enables researchers to explore their 'passion' or 'intrinsic motivations' and which 'integrate the inquirer into the inquiry because it grounds one's work in one's experience' (Montuori, 2010, p.115-6). In the same vein, Shrivastava and Ivanaj (2012, p.119) similarly talk of a *passion for sustainability*. Radkau's exploration of the 'disciplined transdisciplinarity' of Max Weber suggests that far from being a recent concern, the importance of passion pervaded Weber's work, not least his famous *Science as Vocation* where he states that 'nothing is worthy of man as man unless he can pursue it with passionate devotion' (Radkau 2008, p.28). The relevant passage counsels caution against the temptation to hubris, instead encouraging the cultivation of humility when crossing boundaries:

> All work that overlaps neighbouring fields, such as we occasionally undertake and which the sociologists must necessarily undertake again and again, is burdened with the resigned realization that at best one provides the specialist with useful questions upon which he would not so easily hit from his own specialised point of view. One's own work must inevitably remain highly imperfect.   (Weber, 1978 [1918], p.5)

About this book

As the preceding suggests, this volume is a result of some very particular motivations that have brought us together as collaborators. We share a spirit of enquiry that has led each of us to venture well beyond our normal disciplinary boundaries, exploring new collaborative possibilities in other academic departments, research centres and civic initiatives outside the walls of the university. We have done so with growing concern at the prevailing mood of techno-scientific rationality that has increasingly prevailed throughout Irish higher education, particularly since 2008 and the ensuing financial crisis. Such a mood has served to intensify our need to find ways of developing genuinely interdisciplinary cooperation within our institution; searching out others who share our anxieties about the need for a concerted effort to work on some of the profound and inter-connected challenges that we face not just here in Ireland, but across Europe and the wider world. However, our mode of working has been at marked variance with some of the *braggadocio* found in mainstream and more narrowly conceived problem-solving science. In this we follow Cilliers who notes that 'in order to open

up the possibility of a better future we need to resist the arrogance of certainty and self-sufficient knowledge. Modesty should not be a capitulation; it should serve as a challenge – but always first as a challenge to ourselves' (Cilliers, 2005, p.265). Maintaining humility in the face of such enormous social and environmental challenges as well as a hypertrophic growth in knowledge has led us to proceed discreetly in developing this volume. Perhaps it is appropriate to say something briefly of its genesis here.

Early in 2011 the Irish Government science and enterprise policy advisory board (FORFAS) initiated a review across the higher education sector requiring institutions to identify their key research priority areas (RPAs). It was clearly part of an exercise in ensuring universities became more attuned to the needs of the economy which, it has to be said, in Ireland at that time was in a precarious state. Characteristically top-down and within an unnecessarily tight time-frame, the four constituent colleges of University College Cork (UCC) were asked to identify their RPAs. For some, these were already well developed; but for the College of Arts, Celtic Studies and Social Sciences (CACSSS) with its especially broad constituency of departments, this was a fairly unsatisfactory process given the limited consultation. Nevertheless, from this process *Environmental Citizenship* was born as a RPA, though without a clearly identifiable 'membership' of potentially interested researchers. A few months later a workshop was convened which brought together 25 researchers from across the university and featured a series of 'lightening talks' designed to help stimulate some conversations across disciplinary boundaries. It was envisaged that the *Environmental Citizenship* RPA might serve as a collaborative platform on which a variety of different initiatives could be launched. One of the first initiatives was an evening seminar series, *Sustainability and Modern Society*[1] that, in keeping with a spirit of engagement beyond the university, was made open to the public. This rather experimental gathering ultimately included some twenty presentations from 17 presenters between October and November 2012, with contributors typically operating in pairs, and representing a diverse range of disciplines – from physics and chemical engineering to sociology and philosophy. We believe that such a discursive, exploratory and reflective seminar series addressing issues concerning (un)sustainability and modern society and offered entirely without cost was the first of its kind in our university. The editors of this book were involved in leading these initiatives while many of the authors took part. The *Environmental Citizenship* RPA and its activities also spawned a corresponding repository website under the heading '*Sustainability in Society*'[2].

Earlier opportunities for cross disciplinary interaction and dialogue were vitally important too in bringing together (and literally facilitating the meeting of) like-minded colleagues who were asking similar questions, albeit from different disciplinary perspectives. These offered a 'safe' space which legitimised the sharing of ideas around common themes among disciplinarians from across the university. These included a two day event on *Communicating Climate Change* run in December 2010 by *The Public Academy*, an initiative by the School of Sociology & Philosophy at UCC in conjunction with the Royal Irish Academy as well as an annual Colloquium Series on *Environment, Planning and Sustainability*, which was run jointly by four units within UCC: the School of Biological, Earth and Environmental Sciences, the Environmental Research Institute, the Programme in Planning and Sustainable Development and the School of Sociology and Philosophy. Other developments of relevance within the university at that time included the setting up of the *Green Campus* project (see Maier, Narodoslawsky and Mullally, Chapter 13) and the creation of a university-wide module on global climate change, each of which influenced the direction of sustainability-

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[1] http://www.ucc.ie/sustainabilityinsociety/events/sustainability/ [Accessed 1 October 2015]
[2] http://www.ucc.ie/sustainabilityinsociety/

transdisciplinary narratives across the university, while also reflecting the influence of the *Environmental Citizenship* platform.

Attempting to build coherence and momentum around the platform presented particular challenges and frustrations. Establishing regular meetings of interested researchers proved immensely difficult: the departmental demands on staff to teach large and many classes, to undertake administration and to perform their disciplinary roles invariably resulted in more expressions of apology than attendance at meetings. Yet we embarked on organizing a conference working on the assumption that researchers are generally happier to find time to attend 'set-piece' events than they are attending run-of-the-mill meetings and so an open invitation was extended across the entire university. We were conscious of the need to find a language and framing that was inclusionary and not overly social-scientific in order to avoid self-filtering opt-out by colleagues from STEM disciplines. We arrived at the compromise title of *'Transdisciplinary conversations on transitions to sustainability'* which allowed us to identify sustainability as a core theme while encouraging a diversity of perspectives and disciplinary strengths. Inelegant and inexact as our framing might have been the outcome and experience suggests that there may be something to Wellbery's idea that 'semantic opacity triggers a peculiar sort of intellectual productivity' (Wellbery, 2009, p.988).

In September 2013, with financial support provided by the University's Strategic Research Fund, we convened the two day conference at which twenty papers were presented by researchers from all four colleges of the University, together with three keynote interventions provided by Prof Andrew Stirling (University of Sussex), Prof Michael Narodoslawsky (Technical University of Graz), and Prof John Barry (Queen's University Belfast). The very rich discussions that took place around those presentations, framed by an orientation paper which opened the conference (reproduced in the Appendix), compelled us to capture as much as we were able and bring it to publication. The papers that have found their way into this volume, however, are significantly different to those initial presentations for, in the spirit of fostering transdisciplinary conversations in a collegiate, open and trust building manner, each has been reviewed by at least two other contributors in addition to the editors, whereupon authors were encouraged to re-write in light of feedback comments. This process has been demanding on the contributors and we again acknowledge their patience and fortitude. We might say that this book has been something of a calvary for us all (Merriam Webster definition: an experience of intense mental suffering) and even, given its institutionally rather unorthodox approach, a parallel with *The Passion of St Tibulus* itself!

This brief account of the genesis to the volume – the chapters that follow are summarised at the end of this chapter, while we reflect on what our initiative represents for research practice in the university more generally in the final chapter – will hopefully make clear that our adoption of transdisciplinarity as a frame emerged from a process that was influenced by contextual circumstances that required struggling against the explicit *disciplining* of our increasingly isolated intellectual pursuits and their undeclared assumptions about how things are or should be (Jansen, 2009). Above all, it seemed to offer a way forward in our shared concern for sustainability. Transdisciplinarity, in some accounts, is borne out of a critique or disaffection with the capacity of disciplinary knowledge to cope with the complex and often intractable nature of 'wicked problems' (Rittel and Webber, 1973) in contemporary life and attempts to promote alternative 'ways of knowing' (Peters and Wals, 2013). Sustainability is often represented as the archetypical problem: 'steering socio-ecological systems towards a more sustainable path is an inherently transdisciplinary problem, requiring cooperation between different scientific domains and society at large' (Brandt, et al., 2013, p.1). Nevertheless, it is often precipitated by frustration with the ineffectual reach of silo-ised

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disciplinary research, thus eliciting a condemnatory stance: 'the simplistic, reductive and linear logic behind disciplinary knowledge production is portrayed as helpless in addressing wicked problems that are beyond its scope and methods – or even as guilty of the misguided belief that all problems can eventually be solved' (Huutoniemi, 2014, p.3). As the priests on Craggy Island might have said: 'Down with this sort of thing!'

Increasingly, authors concerned with interdisciplinarity and transdisciplinarity introduce their own precautionary principle to the debate to warn against 'throwing the baby out with the bathwater' (Bursztyn, 2008; Darbellay, 2015; Fuchsman, 2009; Nicolescu, 2010; Ramadier, 2004; Stock and Burton, 2011). Indeed, Nicolescu (2010, p.22) provides us with a slogan worthy of its own placard: 'no transdisciplinarity without disciplinarity'! Fuchsman (2009, p.72) draws on Toulmin to point out that 'only within a world of disciplines can one be interdisciplinary'. Robinson's reflection on 'becoming undisciplined' notes that much of the discussion often takes as given the root word and focuses upon the prefixes (multi-, inter-, trans-), highlighting how research or teaching that is not disciplinary is 'typically described in terms of how it differs from, adds to, or even works against, disciplinary work' (Robinson, 2008, p.70). However, many authors (Cooper, 2013; Fuchsman, 2009; Horlick-Jones and Sime, 2004; Ramadier, 2004) draw attention to the fact that disciplines are increasingly characterised by fragmentation into sub-disciplines and warn against assuming a false unity within separate disciplinary containers. To complicate matters still further, Repko (2012, p.6) points out that 'today's discipline may well have been yesterday's sub-discipline'. Careful Now!

The Handbook of Transdisciplinary research concludes:

> Transdisciplinary research is not meaningful without sound disciplinary contributions and it has the potential to stimulate innovation in participating disciplines. Bringing this potential to fruition requires an emerging college of peers able to bridge disciplinary and transdisciplinary specialisation   (Wiesmann, et al., 2008, p.436)

Nevertheless, the 'transdisciplinary moment(um)' (Klein, 2013) in universities is not divorced from wider social processes: rather it is necessitated by them. Hershock argues that:

> addressing the crises of 21st-century higher education is not separable from addressing the wider crises associated with contemporary globalization processes and the aporia of difference (an impasse or paradox centred on the means-to and meaning-of difference) with which they compel confrontation   (Hershock, 2010, p.37)

Caraça (2012, p.51), in considering the convergent crises of the 21st century, argues that we are living in 'a deep crisis that originates in the conjugation of different processes: geo-political, techno-economic, cognitive'. The separation of cultures has led us here and we have let these crises entangle with one another like school children. He goes on to say that the aftermath of these crises 'must therefore initiate a new culture of integration' (2012, p.54). This, in his view, will necessitate the 'redirection of higher education, creating a fully autonomous network of institutes of advanced study and reflection, to function as beacons of this new navigation towards the future' (2012, p.55). This of course, is only one, and not

necessarily the most desirable, of many possible institutional formations for transdisciplinarity. Equally, several writers drawing upon Luhmanns' social systems theory (Cooper, 2013; Webb, 2006; Wellbery, 2009) have pointed to the resilience and adaptability of disciplines. Rather than integration, further adaptation and fragmentation might also be likely.

Clearly, the dynamics that serve to drive these processes are likely to be heavily shaped by national policies and institutionally-contingent variables. We reflect on how these processes are being played out in our context in the final chapter of this volume. Meanwhile, in Chapter 2 we draw upon a reading of the literature to offer an explanation of terminology and, for the reader unfamiliar with the differences, and trace the distinctions between modes of disciplinary cooperation (intra-, inter-, multi-, trans-). Here, however, we want first to review the drivers and discourses of transdisciplinarity; to explore the promise and prospects that this approach presents particularly as we engage with the challenges of sustainability. We will then introduce the chapters in this volume, offering some thoughts on the ways they contribute insights to this field.

Drivers of transdisciplinarity

Three contextual drivers for transdisciplinarity in the contemporary world have been identified: economics (specifically the idea of the knowledge economy); sustainability; and societal demands for meaningful engagement in decision-making. However, it is the contemporary emphasis on building knowledge economies that drives the demand for 'knowledge aimed at solving consequential problems' (Wickson, Carew and Russell, 2006, p.1047). The emphasis on the knowledge economy crystallised in the 1990s across the globe as nation states, supra-national organisations, universities and businesses began instigating and refining approaches based on the idea that the successful exploitation of knowledge is the key to socio-economic development (Thompson 2007). Although Thompson traces multiple contributions to this particular discussion, two key ideas are highlighted as seminal: the *triple helix* model developed by Etzkowitz and Leydesdorff (2000) and the *'new production of knowledge'* of Gibbons, et al. (1994). As a result, knowledge has increasingly been repositioned as a form of capital.

In the case of the triple-helix model, the analogy of DNA is employed to highlight the complex and intertwined nature of the relationship between universities, businesses and governments in national innovation systems. Recent extensions of this model (Carayannis, Barth and Campbell, 2012), the *quintuple helix*, stress the necessity of the socio-ecological transition of society and economy in the 21st century. In the case of the 'new production of knowledge' idea, the argument is that universities are evolving from traditional models of knowledge production (Mode 1) to more socially accountable research entities encompassing actors from inside and outside universities and different disciplinary backgrounds (Mode 2): that is, from first principles to contextualised results. Nevertheless, Thompson (2007) points out that while many research funders have increasingly placed an emphasis on Mode 2 approaches, for many universities this is still a more idealised than realised position. Moreover, more critical evaluations, like that of Mokyr (2002, p.285), have argued that useful knowledge has become reduced to technology and basic science as the basis of technological development, or 'equipment we use in our game against nature'.

This brings us to the second contemporary, contextual driver for transdisciplinarity, the growing socio-political and cognitive significance of sustainability in the 21st century. In an exploration of the cultural logic of sustainability, Yates (2012, p.23) suggests that while the 'expectations of the old terms of modern progress [development, improvement, growth] are

still valid for us, and still legitimating our leading institutions, the terms themselves no longer have the force of historical inevitability'. In this context, 'sustainability, is for the moment, a word that gives voice to our present fears and uncertainties about whether we live in a world of scarcity and abundance, just as it augurs and upholds our hopes for thriving in a decidedly uncertain future'. The same author also points to developments in the higher education sector to demonstrate the continuing significance of sustainability noting that 'as early as 1990…a group of 31 university leaders representing 15 nations signed the Talloires Declaration – the first official commitment to environmental sustainability on the part of university administrators' (Yates, 2012, p.11). He also notes that two decades later institutions of higher education across the world have made sustainability a core organisational concern. As of March 11, 2015 this has grown to 497 signatory institutions in 54 countries worldwide.[3]

Voβ and Bornemann (2011) suggest that sustainability demands research that takes account of complex contexts and interactions between natural and social systems. They insist that we must abandon the assumption of a singular problem framing, a solitary prognosis of consequences, and one 'best' way to respond in an 'objective' manner that adopts a detached and 'supervisory' outlook on the socio-ecological system as a whole. Instead, sustainability research must integrate a diversity of perspectives, expectations and strategies in a complex understanding of societal change and acknowledge that such change results from a multiplicity of distributed efforts at shaping it. In short, the challenges of sustainable development require that we retain an appreciation of the multi-dimensionality of problems and, in order to keep open options for the future, sustain for as long as is feasible a diversity of potential solutions.

However, we must acknowledge that this is easier said than done. Rau and Fahy (2013) suggest that a commitment to interdisciplinarity is often seen as a necessary precondition to successful sustainability research: it is much less clear what this type of research is supposed to look like and what ontological, epistemological and methodological foundations it is supposed to rest upon. While adopting a complexity perspective means the active embrace of emergence, contingency, inherent uncertainty, irreducibility and 'surprise', it does not lessen the very real challenges that this connotes in practice. Nevertheless, these challenges have to be increasingly engaged at the interface of science and policy. Luks and Siebenhüner point out that sustainability:

> entails highly complex challenges that include multiple problem dimensions starting from poverty eradication to safeguarding of ecosystem services and to economic development to feed the entirety of humankind. This complexity and the multi-layered scales of the problem render the relationship between governmental regulation and scientific information even more difficult than in more conventional problem arenas
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> (Luks and Siebenhüner, 2007, p.419)

The third key driver for transdisciplinarity in the modern world concerns the way that societal developments and demands are pushing research in more participatory, consultative and deliberative directions. In the case of the latter, the sociological conception of 'knowledge societies' might be a useful touchstone. Stehr reasons that, 'if knowledge is not just a constitutive feature of our modern economy but also a basic organisational principle of the way

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[3] http://www.ulsf.org/programs_talloires_signatories.html

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we run our lives, then it is justifiable to speak about our living in a knowledge society'. All of which together stimulate demand for knowledge production that attempts to solve real world problems through a 'context specific negotiation of knowledge' (Stehr, 2007, p.147). Nowotny points out that 'society has an expanding educational system and the pervasiveness of societal and information and communication technologies on its side'. Far from being a temporary condition she stresses that 'once society has begun to "speak back to science", it is likely to continue doing so' (Nowotny, 2005, p.25). Furthermore, Delanty's reflection on *The University in the Knowledge Society* remarks that the identity of the university:

> is determined neither by technocratic managerial strategies nor by pure academic pursuits: in the knowledge society knowledge cannot be reduced to its uses or to itself because it is embedded in the deeper cognitive complexities of society, in conceptual structures and in the epistemic structures of power and interests
>
> (Delanty, 2001, p.151)

Rather than decrying the demise of the university as a result of postmodern fragmentation of knowledge, pluralization and ever greater differentiation, Delanty suggests that the university today is 'more reflexively connected with society' (2001, p.152). This is an *interconnective* reflexivity in the sense of multiple, reciprocal links between the university and society through the dynamics identified by Nowotny, as well as through new links between the sciences. For Hershock, a shift from 'higher education organised around disciplinary silos and independent "bodies of knowledge" to organizational dynamics that support the emergence of "ecologies of knowledge" and hence from satisfaction with epistemic variety to the pursuit of epistemic diversity' is a very positive development (Hershock, 2010, p.39). Moreover, 'since reflection constitutes the primary activity of the development of the "ecology of knowledge" … thinking is not *automatically* reflexive regarding the needs of the wider world but stays within its socio-disciplinary relations' (Du Plessis, Sehume and Martin, 2014, p.59). If there is any truth in the well-worn aphorism that encapsulates the challenge of transdisciplinarity - that 'the world has problems, but universities have departments' (Brewer, 1999, cited in Pohl, 2008) - perhaps the key is to create spaces in universities for transdisciplinary thinking free from the conventional boundaries and standards of disciplines:

> Space for alternative paths of development. Space for new ways of thinking, valuing and doing. Space for participation minimally distorted by power relations. Space for pluralism, diversity and minority perspectives. Space for deep consensus, but also for respectful dissensus. Space for autonomous and deviant thinking. Space for self-determination. And, finally, space for contextual differences and space for allowing the life world of the learner to enter the educational process
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> (Wals and Jickling, 2002, p.230)

Discourses of transdisciplinarity

Klein (2014) has identified three major discourses in the 21st century that are central to the debate on transdisciplinarity: *transcendence, problem solving and transgression.*

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Transcendence is seen as an essential quality of transdisciplinarity, 'a creative process whereby a framework for characterizing larger level processes transcends frameworks used to characterise the parts' (Stock and Burton 2011, p.1099). Nicolescu's *Manifesto of Transdisciplinarity* conceives of a 'transdisciplinary model of Reality' that both transgresses and transcends:

> The words *three* (from the Latin *tres*) and *trans* have the same etymological root: three signifies "the transgression of the two, that which goes beyond the two". Transdisciplinarity transgresses the duality of opposing binary pairs: subject/object, subjectivity/objectivity, matter/consciousness, nature/divine, simplicity/complexity, reductionism/holism, diversity/unity. This duality is transgressed by the open unity that encompasses both the universe and the human being.   (Nicolescu, 2002, p.56)

Montuori (2013, p.221) agrees, citing the above while suggesting 'to this we should add, female/male', as he reflects on a personal intellectual journey reading through 'a variety of disciplines … [in particular those concerned with] exploring the creativity of women', which revealed 'glimpses into a different world' from which he 'began to see not only the nature of fragmentation, but also the way in which our dualistic thinking, driven by binary oppositions, was profoundly limiting.' This leads him to conclude that while 'the implications of Transdisciplinarity are revolutionary', that 'fortunately they are beginning to be explored' (p.222) since 'Transdisciplinarity and Complexity are ideas whose time has come.' (p.226). Strydom's (2011) exploration of immanent transcendence, specifically in the work by James Bohman on 'plurality and unity', provides a key to linking different levels of reflexivity. Strydom characterises the relationship as follows: 'what has been disclosed by critique in a first reflexive turn, has to pass through a "second reflexive turn" by being tested, confirmed and appropriated by the audience, or more generally, the public...not merely interpreting the world, but actually contributing to changing it' (2011, p.85). For Strydom, this allows 'not just the observance of both the "plurality" of perspectives immanent in social reality and the possible "unity" of perspectives pointing beyond a given situation, but also critical inquiry into the "ongoing tension" as it is being worked through by "reflective and self-critical practices"' (Strydom 2011, p.86). This resonates with Montuori's suggestion that transdisciplinarity is *inquiry* based (starting with the phenomenon in question) rather than discipline based, allowing complexity to combine with contextual knowledge, integrating the observer into the observed (Montuori, 2010).

Transdisciplinarity as *'problem solving'* attracts a great deal of attention in the literature and is frequently linked to sustainability or sustainable development. It has been suggested that transdisciplinary research is 'performed with the explicit intent to solve problems that are complex and multidimensional, particularly problems (such as those related to sustainability) that involve an interface of human and natural systems' (Wickson, Carew and Russell, 2006, p.1048). Elsewhere it is understood as 'an extended knowledge production process including a variety of actors and with an open perception of the relevance of different forms of information produced by the scientific and lay community' that is needed for 'future orientated issues that include a notion of the common good, such as sustainable development' (Mobjörk, 2010, p.866). The problem solving approach responds to demands for research that is scientifically robust, but also socially relevant and embedded within the perspectives of policy and local actors. The prefix 'inter' in this case, most often refers to the *inter*face or zone of *inter*action

between different systems (e.g. society and nature, science and policy, system and life-world etc.) (Harris and Lyons, 2013).

Zierhofer and Burger (2007) understand the problem orientation of transdisciplinarity as 'knowledge for action' and identify three main types of knowledge integration. The first they class as *thematic integration*: the elementary form of building stocks of knowledge; the coherent and systematic ordering of knowledge. The second is *problem or product* oriented integration; that while most competent social actors have an *implicit* understanding of the structure of action an *explicit* understanding is necessary to approach problems in a rational and methodical way. The third element of integration is *social integration* referring to the knowledge of a variety of social actors (Zierhofer and Burger, 2007, p.66-7). Social integration is particularly challenging because it deals with a diversity of knowledge with different 'qualities of validity' e.g. 'local'/experiential knowledge versus 'generalised'/scientific knowledge; factual versus evaluative; individual interests of those affected versus ethical maxims, etc.

The third major discourse of transdisciplinarity identified by Klein is that of transgression. She argues that there is a long history of transgression in social theory in attempts to provide overarching frameworks including the work of Durkheim, Simmel, Weber, Park and Parsons. She also identifies a similar dynamic at play in Gidden's work on 'structuration', Habermas's theory of communicative action and Luhmann's social systems theory. Equally, she points out that towards the latter part of the 20th century, the intersection of problem solving discourse and transgressions began to gain traction through the linkages between Funtowitz and Ravetz's ideas of 'post-normal science' (Funtowicz and Ravetz, 1993) and Rittel and Webber's 'wicked problems' (Rittel and Webber, 1973), supplemented by the work of Gibbons and later Nowotny on the 'new production of knowledge' or 'Mode 2 Science' (Klein, 2014).

Transgression is not just a function of space, but of time too. The original conversations in the 1970s, occurred at a time of the collapse of grand narratives, but as Elzinga (2008) suggests, in the 1990's, research in an academic setting was replaced by research in the context of application. We might posit that the increased attention to transdisciplinarity in the first two decades of the 21st century has created a somewhat more permissive environment for transgression in the language and demands of research funding bodies nationally (e.g. in Ireland and elsewhere), at EU level (Horizon 2020) and beyond.

A Return to Craggy Island: The Limits and Possibilities of Transdisciplinarity in Context
While the tenor of this chapter undoubtedly seeks the positive (perhaps warm) embrace of transdisciplinarity, we are awake to the risk of normative naivety, what psychologists term the 'Polyanna principle'. While we have some sympathy for Nicolesceau's characterisation of those engaged in transdisciplinary inquiry as 'incurable knights errant, re-kindlers of hope' (Klein, 2012), we are also acutely aware of the seductions and frustrations of the Quixotian zeal of the complex systems approaches intrinsic to transdisciplinarity (Cundill, Fabricius and Marit, 2005).

Careful Now?
Klein (2013, p.189) has long since described transdisciplinarity as a 'word *a la mode*', in essence a response to the *Zeitgeist* of convergent crises in the 21st century. Yet, it is not only opportune, but also opportunistic. The demand for transdisciplinarity is indeed normative, but not neutral, its desires simultaneously suggest both openness and closure and imply unequally distributed risks. A 'reality check' is warranted here, as Lawrence reminds us, while

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transdisciplinarity is known and referenced in all regions of the world, it is still not mainstream, 'rarely recognised by professional institutions', 'taught in higher education programmes' or 'supported by funders of research' (Lawrence 2015, p.1). Moreover, while detecting a change in the register and an expanded lexicon of research funders, Stock and Burton fear that: 'neither research councils, academia, nor the government appear to clearly understand what is being sought in integrated research and why – leading to an indiscriminate, almost random use of referential terminology' (Stock and Burton 2011, p.1093). Nevertheless, as we have demonstrated, while the impetus towards transdisciplinarity is not new, the fact that it now increasingly appears as a *sine qua non* of research funding has given it a new significance for researchers. Nicolescu, however, offers a cautionary warning against the 'marketing of transdisciplinarity... (as) an ideal means for bestowing a new legitimacy on decision-makers in distress without doing anything to change' (Nicolescu 2002, p.115).

On the other hand Bursztyn (2008) highlights the difficulties faced by transdisciplinarity in establishing its place in the modern university that is struggling with an ontological dilemma: between the pressure for increasing specialization on the one hand, and a mission for relevance on the other. This can sharpen divisions in practice as the gathering of knowledge within given paradigms and for which there are established metrics and rewards, is increasingly confronted by the need for innovation and renewal led by newcomers. Institutional conservatism tends to place value on what is older; besides, established disciplines are invariably resistant to perceived interlopers and competitors for increasingly restricted research resources. For Bursztyn this makes transdisciplinary research vulnerable to charges of: 'generality' (as opposed to 'expertise' or 'depth'); 'heresy', in the sense of responding to market demands or fashions (the lure of filthy lucre); 'parasitic' (in the sense of diverting resources from 'real research'); illegitimate (in Bursztyn's terms 'the syndrome of the bastard' (Bursztyn, 2008, p.9), or in Montuori's fashion 'a mutt, and proud of it' (Montuori, 2013, p.225)), which reflects the temporal gap between the adaptation of existing disciplinary structures and external recognition by funders or evaluation bodies; 'non-peer evaluation' where evaluation committees are not more than the sum of their parts (inter- and trandisciplinarity are judged on disciplinary terms); and the related problem of 'external metrics' where proposals are evaluated 'not according to what they aim to be but according to what they are not'. Finally, transdisciplinary research risks being 'Balkanised' both in the sense of providing a container for misfits and in bracketing off research that does not fit conventional containers – closing down instead of opening up debate (Bursztyn, 2008).

To this we might add an additional risk of a Balkanisation of transdisciplinarity itself, into divisions between the so-called 'theoretical' and 'phenomenological' strains of transdisciplinarity ((Nicolescu, 2008, p.12; see also Chapter 2 of this volume for a more detailed exploration), or as Max-Neef (2005) puts it, its respective strong and weak versions. One bone of contention between the two strands might be what Hukkinen and Huutoniemi (2014, p.178) describe as the potential 'God trap', that is, the claim that 'any novel way of explaining the world within a higher level explanatory framework than the existing ones can itself be criticised as just another explanation within yet another higher-level explanatory framework'. While those with a largely phenomenological bent may concur with this, proponents of theoretical transdisciplinarity would counter that this in fact coheres precisely with the multi-level nature of reality as revealed by 20th century science, for example as demonstrated by Heisenberg's uncertainty principle or by Gödelian logic, whereby in any formal closed system of axioms, there will always be at least one axiom known to be true but which cannot be proven (Gödel, 1931; see also discussion in Chapter 3). Thus the ontological presence and requirement for unknown unknowns, ineliminable uncertainty and irreducible

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complexity will inevitably facilitate emergent creativity, novelty and evolutionary progress which are ultimately reflected in Nicolescu's three transdisciplinary axioms (Nicolescu, 2006, p.154) – recognising different levels of reality, the logic of the included middle and the totality of levels (see also Chapter 2). Indeed, by this rationale, the 'God trap' would reveal itself as being not so much problematic, but as an inherent facet of reality and part of a worldview which would go beyond reductionism in embracing self-organised emergence – thus even dissolving the necessity for bones of contention about the use of the 'God' word itself, at least if conceived of in a traditional linear causal fashion (Kauffman, 2010; see also Byrne, Chapter 4).

Just as movements move, disciplines evolve, but this represents a dynamic, relational, contextual and contingent evolution 'between disciplinary order and undisciplined chaos' (Darbelley 2015, p.172; see also Byrne, Chapter 3), whereby a state of contingent balance 'arises at all levels of university life: it grapples between the institutional structures and reciprocal positions of disciplinary communities with their epistemological prejudices and their theoretical and methodological *a priori*'. Or, at least, a 'state of equilibrium' is sought. But this is just an illusionary mirage in the face of complex reality. As Webb (2006, p.103) points out, the in-between 'thus leaves an opening, or the possibility of an opening within every system that appears closed; it leaves systems open to the play of chance and uncertainty and, despite the constant striving for equilibrium, makes homeostasis within the system finally impossible'.

Down with this Sort of Thing?

The contested nature and inherent diversity (and normativity) associated with conceptions, values and assumed significance of inter-and transdisciplinarity facilitates a situation whereby such concepts can be 'constructed in different ways for different purposes' (Cooper, 2013, p.79). For instance, a pragmatic conception of transdisciplinarity which would focus on 'innovation' and 'problem solving' may lead it to be construed in a manner which can be 'articulated within a market-derived discourse of production' so that it 'represents a turn away from disciplinary knowledge' (Cooper, 2013, p.79). Thus the transdisciplinary appeal that 'next to scientists, non-science should also have a voice' (Nowotny and Leroy, 2009, p.60), is employed not so much to embrace the experiential knowledge that wider society can offer in framing and addressing broader societal problems such as those around sustainability and human flourishing, but rather to empower a narrower section of society, specifically business and economic interests in the process of knowledge (and product) production and growth. Inter-and transdisciplinarity, framed in this way, would be singularly conceived and directed as a utilitarian tool to 'solve' market defined societal problems or develop processes, systems and technologies which, citing the work of Nowotny (2006), in the wake of an ever more complex and reflexive society would seek 'to control rather than simply anticipate' (Cooper, 2013, p.79). Accordingly, a number of authors have begun to reflect on some potentially negative external drivers that foster transdisciplinary momentum, such as the idea inter-and transdisciplinarity can be employed as governance tools which would serve as a kind of 'Trojan Horse' for increased institutional control (Cooper, 2013; Frodeman, 2014; Garforth and Kerr, 2011; Sabharwala and Hub, 2013).

These threats however, whether perceived or real, should not be allowed to dissuade would-be practitioners from seeking a view and practice of transdisciplinarity which envisages an altogether broader more encompassing scope, one which would both draw from and transcend the scientific and the ethical in a coherent and unifying manner, so as to envision transdisciplinarity as 'a different manner of seeing the world, more systemic and more holistic', and 'as a project destined to improve our understanding of the social world and Nature' with the realisation that 'if such an effort is not undertaken, we will continue generating ever greater harms to Society and to Nature, because of our partial, fragmented and limited visions and

assumptions.' (Max-Neef, 2005, p.15). Thus, citing the vision of Morin (1992), we require the development of a recursive way of thinking 'capable of establishing feedback loops in terms of concepts such as whole/part, order/disorder, observer/observed, system/ecosystem, in such a way that they remain simultaneously complementary and antagonistic.' (Max-Neef, 2005, p.14)

Transitions to sustainability – disciplinary to transdisciplinary perspectives
The chapters contained within this book offer quite a range of different perspectives on the challenges of transitions to sustainability. While the authors emanate from a variety of disciplinary backgrounds the resultant chapters cannot be said to be methodologically integrated around transdisciplinarity in a strict sense. Indeed, and to varying degrees, while the chapters might at times be said to reach transdisciplinarity either only momentarily or tangentially, there is among this collective a common ambition to look outward and openly, coupled with a disciplinary humility which is a necessary prerequisite to and basis for authentic transdisciplinary conversations and transcendent knowledge generation. It was based on such an ethos that this collaboration proceeded, framed by the original conference at University College Cork in September 2013 *'Environmental Citizenship: Trans-disciplinary conversations on transitions to sustainability'* and its accompanying orientation paper 'New Paradigm Thinking' (see Appendix).

The first section of the book *'Setting the Scene'*, offers an opening two chapters from the book's editors which focus on a number of pertinent aspects of the nature of transdisciplinarity, particularly in the context of sustainability. This is followed by a chapter by Byrne which examines some models of sustainability, which are based on a *process, relational, dialectical* and *integrative* view of complex reality, and which relate to broader ontological, historical, social and scientific contexts. This facilitates an uncovering of transdisciplinary thinking – a framework which is both involved in the realisation of, and is required to underpin the abovementioned understandings. In this context it is shown how such a (transdisciplinary aligned) paradigm and ethos can contribute to a reorientation of the dominant conception of progress, away from the monist ideal and towards one which would envisage it in a dialectical and contingent sense, so as to promote integrative (ecological-, social-, techno-economic-) system 'sustainability-as-flourishing'.

This is followed by the principal section of the book on *'Transdisciplinary Conversations and Conceptions'*. Byrne opens it, following on from his preceding chapter with a look across four disparate disciplinary areas in order to demonstrate how such a new and emergent paradigm, one based on the transdisciplinary concept of 'complex thought', is manifesting itself in quite different but coherent ways, right across disciplinary conceptions of reality.

Mullally then picks up the reins with a chapter which encapsulates the distinctiveness of the book, reflecting as it does some broader issues (in this instance, narratives around anthropogenic climate change), though as they are reflected through the more localised lens of Irish media reportage. The subject is playfully approached by drawing from some literary constructs while using the 'structuring metaphors' of somnium, soma and somnambulism, which in effect act as 'shorthand for arguments that focus on calls to collective action, an identification of societal mechanisms of stability and inertia preventing collective action and change, and the idea that society needs to wake up and face reality.' The result of this investigation reveals an interesting array of interspersed and overlaying narratives, typically

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utilised in order to help support and promote dominant political and ideological perspectives, while oftentimes bestrewn with religious metaphors.

Barry then takes up the baton to offer a coherent though devastating critique of techno-optimism. He makes a plea for a transdisciplinary approach in order to realise 'better', that is, 'legitimised and publicly debated and agreed' technologies. Such an approach would at once recognise knowledge generation both within and without the academy (drawing on both the expert and the experiential) while rejecting linear 'disciplinary silo thinking and "problem-solution" call and response perspectives' to societal meta-problems of unsustainability. To reinforce his point, Barry highlights the inherently normative, political and ethical nature of technology (and its use), thus undermining protestations which would hide behind a view of technology as a wholly unproblematic and apolitical tool emanating from an exclusive faith in the application of (what is conceived as 'value free') science.

Simultaneously, Barry would reject the other extreme: an 'anarcho-primitivist' critique which would have humanity revert to 'a pre-modern, pre-industrial past'. In attempting to 'tread a path between these two extremes', through for example, invoking the precautionary principle, he echoes the dialectical and process conceptions of progress as advocated by Byrne in chapters 3 and 4. The result therefore is far from a rejection of technology, but a clear eyed realisation that it is a double edged sword, which if handled carefully and wisely, can play an important and indeed highly innovative role once aligned with broader ethical, political, philosophical and socio-economic imperatives to address contemporary nexus issues around unsustainability. In this context, he envisages a transdisciplinary and post normal approach as a necessary basis for progress and human flourishing.

McIntyre and O'Halloran embody much of the ethos of this collaborative endeavour along a path of transdisciplinary conversations as they seek to 'walk the walk' with their joint offering emanating from respective fields of law and ecology. They carefully examine respective legal and scientific conceptions of ecological 'integrity' and find considerable dissonance between ecological and legal understandings of the concept. Indeed, while 'integrity' is a cornerstone legal concept in European nature conservation law and corresponding frameworks, it is nevertheless found to be lacking in legal definition, being 'somewhat vague and flexible'. This is problematic as it allows considerable room for interpretation, including lack of agreement on whether or how to have regard for best available scientific knowledge and conceptions around integrity. The result, as is highlighted in the chapter, is a range or different ways of interpreting 'integrity', including having regard for the precautionary principle in light of inherent scientific uncertainty. The chapter goes on to consider scientific markers for ecological integrity, highlighting a number of methods that are used despite the 'multi-dimensional nature and complexity' of natural ecosystems, and concludes that the current dissonance provides an exemplary case study in demonstrating how and why best legal practice could be enhanced by taking greater account of scientific knowledge and insights.

Chapter 8 continues with the theme of how law takes account of science, while reflecting on how classical philosophical and theological wisdom can help provide useful guiding principles in the realm of environmental law. In particular Sage-Fuller considers the legal concept of the precautionary principle and argues that when it is employed (in light of scientific uncertainty), it is done so through a heuristic of fear. She proposes that this approach is both largely deficient and unrealistic, while it is based on a totalizing reductionism which would annihilate individual human responsibility and autonomy. Sage-Fuller thus argues that the application of an alternative heuristic, one informed by an alternative positively framed

principle of prudence ('based on looking for what is good'), informed by a heuristic of love, would lead to enhanced wisdom and more integral approaches to ecology and human development. This approach is inspired by classical Aristotelian-Thomistic philosophy, and is built on in the chapter by some contemporary insights drawn principally from the Catholic philosophical tradition, making the case that a 'principle of prudence' is an altogether more realistic basis for sound decision making in a contemporary society characterised by serious environmental degradation amid inherent uncertainty.

Keohane leads the following chapter with the cry that if we are to authentically generate sustainable futures, we need to envision 'sacred symbols, sublime objects and charismatic leaders'. This is in order 'to stand against the profanity of the present .. a post-modern age of de-symbolization wherein all meta-narratives are discredited', and where 'all bar one: the divine Market' is profaned. Taking a broadly based and light hearted sociological perspective, he describes how a postmodern globalised neoliberal individualistic consumerism cannot ultimately meet 'the deep human need for continuity', which manifests itself in the form of isolists who would seek such continuity through technologically aided extended lifetimes. He concludes with an offer of hope though; for within humanity's inherent desire for connection and continuity could lie the hope and inspiration for a future characterised by intergenerational sustainability.

Futures are also on the agenda for the authors of Chapter 10, in which Ó Gallachóir, Deane and Chiodi consider how modelling respective energy futures scenarios can help develop policy choices. The chapter presents some modelled scenarios for energy mix in the Republic of Ireland in light of reducing carbon emissions targets over the coming decades. The work helps reveal the scale of the challenge that presents; the scenarios presented, which include both 80% and 95% reductions in Carbon Dioxide emissions levels, require not just very significant switches to renewables, but in addition quite significant *reductions* in overall energy *consumption*. Such changes will clearly require a lot more than technological change, a fact that the authors recognise alongside other limitations of the model, which ultimately leads them to conclude that a necessary if challenging next step to deepen the learning would be not just to engage with a range of other disciplines, but in a spirit of transdisciplinarity, to also engage with society more broadly.

In their chapter O'Shaughnessy and Sage address how transdisciplinary thinking in the realm of governance presumes a search for policy coherence across horizontal domains. Yet in their analysis of the Irish agricultural sector they observe a powerful commitment to *productivism* seemingly untroubled by the way this has resulted in a deepening bifurcation of the farming sector. Noting how adherence to the EU's Common Agricultural Policy had strongly shaped a strategy of specialisation and intensification, the authors observe how, despite the emergence of a rural development agenda and its accompanying environmental measures, Irish farming industry sets ever more ambitious output targets seemingly oblivious to the consequences. The chapter highlights how the imperative of economic growth can effectively 'silo' and isolate contingent policy considerations and effectively derail transitions to sustainability in preference to claims for 'national economic recovery'.

The final chapter in the section highlights the need for transdisciplinary approaches in the domain of technological innovation, in particular in the rapidly emerging science of nanomaterials. Sheehan brings the reader on a journey through a vast and growing range of nanoparticle applications. He also highlights a range of potentially highly problematic health and environmental issues associated with nanomaterials and in doing so reveals a gaping chasm between the breakneck speed of scientific developments and innovations and a range of trailing

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associated nexus spheres including ethical, environmental, societal, health, political, legal and economic. He also highlights the scientific uncertainty around health and environmental aspects of this nascent technology which may echo earlier discourses around the precautionary principle, techno-optimism, sublime objects and indeed wisdom.

The third and final section of the book is devoted to '*Conclusions*'. Maier, Narodoslawsky and Mullally reflect on the nature of their experiences of transdisciplinarity, not just within the university, but, in the case of the first two authors, as visitors to Cork from TU Graz (as researchers, collaborators and, in the case of Narodoslawsky, as conference speaker for the symposium which preceded this book), from which they provide an external assessment and some insights on the nature of transdisciplinary collaborations.

Another succinct but delightful external assessment is provided in the penultimate chapter by John Barry, another conference contributor, and one who is both an external authority and fellow traveller as we considered the tentative (and oftentimes tangled) pathways on a transdisciplinary journey from unsustainability.

The final chapter is a reflective piece from the book's three authors which considers the journey thus far and focuses on some emergent possibilities (and challenges) around the application of transdisciplinary approaches within, without and across the university.

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