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A Rich Mosaic of Impact: Julie Thompson Klein's Scholarly Influence in Australia and New Zealand

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Abstract: Ten Australians and one New Zealander provide reflections on the influence of Julie Thompson Klein's work on and in inter- and trans- disciplinarity. Even taking into account that this article is based on a small number of contributions from only one corner of the world, the reflections demonstrate the influence of a diverse array of Klein's academic work, the ground-breaking nature of her book *Interdisciplinarity: History, Theory, and Practice*, the meticulousness of her scholarship that makes her voice authoritative, and the added benefits of personal connections. The contributions also demonstrate the value of reflective narratives in providing a more rounded and richer picture of an academic's influence than traditional metrics, including – in Julie Thompson Klein's case – non-citable enhancement of thinking and orientation, catalytic effects when her ideas are combined with others, and practical value in making sense of events and circumstances. Most importantly, assembling reflective narratives provides a window onto the unique attributes and contributions of individual researchers, educators and practitioners, illustrating and affirming the richness of differences and the importance of valuing and capitalising on them. Recognition of such diversity is not only essential to help individuals identify the strongest contributions they can make, but also critical for good inter- and trans- disciplinary research, education and practice.

Keywords: diversity, interdisciplinarity, Julie Thompson Klein, reflective narratives, research impact, transdisciplinarity

Introduction

There is growing demand on the academic community to demonstrate that its work has impact. In addition to citations of publications, academics are increasingly required to show that specific projects and programs have made a difference: enhancing public debate, changing government policy, improving professional practice, producing new commercial products and so on. Here we approach the assessment of impact in a different way, by reflecting on how we and – through us – research, education and practice have been (and continue to be) influenced by the academic work of Julie Thompson Klein.

Our focus is especially, but not exclusively, on her impact in Australia and New Zealand. Klein has only visited this part of the world twice. In 1995 she was a Foundation Visitor at the University of Auckland in New Zealand, combining that with a tourist trip to Australia. In 2004 she was a keynote speaker at the Australian Academy of Science Fenner Conference on “Bridging Disciplinary Divides: Understanding the Population/Environmental Debate” (Klein, personal communication, May 2018).

The ten reflections in this article all demonstrate the influence of her writing. Some reflections also reveal impacts resulting from personal connections made on Klein's 2004 Australian trip as well as at meetings in other parts of the world. The reflections establish the power not only of her own ideas, but also of the ideas of others that she has promoted. The diversity of Klein's impact is striking. A major advantage of the process we have used is that it allows this diversity to be made evident and captured. As we show, she has influenced interdisciplinarity and transdisciplinarity in research, education and evaluation, and she has also helped make sense of institutional responses to these research approaches.

Our reflections are couched in the syntax, spelling and grammar used in Australia and New Zealand to highlight the special flavour of Klein's impact in our part of the world. The collection is structured as follows:

- One reflection on how Klein's work fostered a deeper understanding of the challenges of interdisciplinarity, as well as ways of accepting them (Lorrae van Kerkhoff).
- Three reflections that draw on the link between interdisciplinarity and complexity, first articulated by Klein in 1990: 1) how one of her articles joining these two ideas helped a doctorate make a difference (Wendy Elford), 2) how her work impacted on a teaching

program (Chris Browne and Louise Blessington) and 3) how her views had a permeating influence on university-based research and government work (Virginia Kaufman Hall).

- Two reflections on Klein’s thinking about how organisations have approached transdisciplinarity: 1) one on how it provided the justification for the focus at a self-funded university institute (Cynthia Mitchell) and 2) one on how it influenced evaluation at a New Zealand Crown Research Institute (Bruce Small).
- One reflection on making sense of a negative university response to interdisciplinarity and transdisciplinarity, using ideas of others promoted by Klein as well as her own work. This contribution could be subtitled *Singing Old Songs, Tussock Jumping and the Glass Bead Game: Environmental Transdisciplinary Practice at the Australian National University* (David Dumaresq).
- One reflection on how Klein influenced the choices made during an intentionally integrative career, which involved unearthing layers of memory as well as correspondence with other authors of this article (Stefan Kaufman).
- Two reflections on the importance of personal interactions with Klein: 1) one addressing her tact and strategic sense (Valerie Brown) and 2) one dealing with her intellectual generosity (Gabriele Bammer).

Lorrae van Kerkhoff, Fenner School of Environment and Society, The Australian National University

For many scholars working in problem-oriented fields such as sustainability, environmental management, public health, and social policy in Australia, the idea of interdisciplinarity is something of a no-brainer. “Of course” academic disciplines are artificial constructs of limited use in tackling complex problems; “of course” disciplinary understandings are partial and insufficient to really understand and effectively intervene in those problems. But (at least in the late 1990s when I became interested in such things) beyond the seemingly obvious shortcomings of disciplines, there seemed to sit a large void. If not disciplines, then what?

Klein’s work shone a light into this void in ways that allowed us to start to see some shape and contours there, and to develop some orientation. I have framed my reflection of her influence in terms of both understanding and accepting the interdisciplinary challenges that are presented to scholars, researchers, educators and practitioners. Have we conquered these chal-

lenges? No. But Klein's contributions to defining interdisciplinary work as a field of scholarship in its own right have done much to enable us to recognise these challenges, see them in a broader context, and deal with them.

*Understanding academic work beyond disciplines is a minefield of tricky definitions, long-winded debates, and often tedious contestation. While it was tempting as a younger scholar to simply dismiss versions of these definitions that I did not subscribe to, Klein offered a subtler approach. Impatiently seeking a quick, 25-words-or-less definition of interdisciplinarity that I could brandish in triumph over other, less well-read conversation partners, I turned to Klein's 1990 work, *Interdisciplinarity: History, Theory, and Practice*. Instead of finding my verbal weapon of choice, I found a rich and nuanced discussion over several chapters that outlined the various, diverse and situated understandings of interdisciplinarity. I learnt that while some definitions may be more suited to particular contexts than others, there are no universally applicable right or wrong ways to think about interdisciplinary work.*

With hindsight perhaps the multiplicity of possible definitions is obvious, and as Klein and others have observed, it should be expected that an interdisciplinary field would maintain a range of interpretations (Huutoniemi, Klein, Bruun, & Hukkinen, 2010). Ontological and epistemological differences in philosophical frames are apparent not only in the diverse content, theoretical perspectives or methods attached to each discipline that might be involved in an interdisciplinary enterprise; they are also manifested in how people see interdisciplinarity itself. Granted the Australian appetite for interdisciplinary work during the 1990s was largely (not exclusively) driven by practical concerns: How can we become more effective at solving complex problems? Klein's research and writing challenged me, and I believe assisted others around me, to understand the philosophical dimensions of crossing disciplinary boundaries and how doing so might have practical implications. Such understanding establishes a more robust foundation from which to explore similarity and difference, and the strengths and limitations unique to each disciplinary perspective. Without being able to delve into the depths of underlying thought and find common ground enough to enable agreement and action, interdisciplinary conversations can become circular and repetitive, reinventing the same misinterpretations and repeating them over and over.

The second part of my reflection focuses on not just understanding, but also accepting – by which I mean taking on – the challenge(s) of interdisciplinarity. Importantly, Klein's work pointed to the institutional dimensions of this challenge, reminding us that disciplines are not only cognitive, but

also organisational, and structure much formal recognition and esteem in universities (Klein, 2010; Klein & Falk-Krzesinski, 2017a). Consequently the challenges include recognising and preparing for the institutional difficulties faced by those involved in interdisciplinary endeavour in a university context, such as often being the first whose programs are cut when financial or socio-political forces push “back to basics” (Klein & Newell, 1996). In discussing institutional context and outlining its features, Klein not only reminded interdisciplinary scholars that these challenges exist, but also created a sense of solidarity, that we are not alone in confronting institutional barriers. Klein was also intent on celebrating the successes amongst the challenges; successes such as women’s studies, environmental and urban studies and integrative and innovative curriculum, highlighting the benefits that can come from questioning and crossing disciplinary boundaries, taking complexity seriously, and experimenting with alternative ways of understanding and dealing with complexity (Klein, 2010). While Australian academic institutions have not, generally speaking, followed the U.S. path of liberal education that encourages interdisciplinarity, we have developed strong academic programs in interdisciplinary areas, and supported substantial and long-term collaborative funding models to take a problem-focused approach to complex issues. Klein’s contribution to the debates about and evolution of interdisciplinarity in this part of the world has been to underpin the arguments of those advocating for interdisciplinary and transdisciplinary work, to ensure we don’t lose sight of the deeper philosophical dimensions of this endeavour while we pursue its practical benefits, and to inspire innovation and bravery in the face of conservative institutions that deny those benefits.

Wendy Elford, Now to Next Pty Ltd.

To reflect on Julie Thompson Klein’s work is to acknowledge the power of a single article, one that acts as a type of punctuation mark in the deep thinking that is required for a doctorate. For me, such an article has driven the transition from being a professional feeling stuck dealing with an intractable problem to an international collaborator shaping the changing setting in which the problem occurs. I am a human factors and ergonomics professional. I use narrative – the stories and reflections that people share about their day to day experiences – as data to improve the design of work systems and workplaces. I apply knowledge gained from physiotherapy, psychology, neuroscience, architecture, organisational design and more. My interpretations and interventions place my practice between, within and across mul-

tiple professions and disciplines, which makes it complex; adding the human element to any problem almost always adds complexity. I always pick the most complex of problems to deal with and expect to make a difference in people's wellbeing and safety, in their ability to work effectively and to lead productive and satisfying lives.

The article concerned was entitled "Interdisciplinarity and Complexity: An Evolving Relationship" (Klein, 2004a). Armed with Klein's words and analysis, I finally felt I had the permission needed to think, write and work well outside of my professional box and in the end, my personal comfort zone. As a doctoral student, I had naïvely started off wanting "the answer" to a problem and all the facts to go with that quest. Perhaps receiving a diagnosis of Asberger's Syndrome a decade or more later would partly explain my desire for certainty; discovering Klein's work marked a useful early turning point towards a new way of thinking that could accommodate the power of ignorance; accepting your ignorance is humbling. This opened up a new way to resolve the differences I experienced between disciplines as a child growing up, between my mother the artist and my father the engineer, and as an academic later on. Reflecting on this now, I can see the links Klein made between interdisciplinarity and complexity were what I needed to respond to my instinctual and growing discomfort with the challenge of forcing the evolution of my career to match the evolution of my thinking, for one to keep pace with the other.

On an academic note and as a writer and student, I was also grateful for Klein's article as an exemplar of how to combine excellent use of sources with quotable thinking on a challenging topic. Beginning doctoral students need such articles to inspire them to reach beyond their current professional boundaries. These articles are written by academics with great courage and expertise. Klein has both qualities, yet she is not alone; the compliment to her can be extended to others who have provided a solid argument by bringing two big ideas together. Such articles give less experienced academics, researchers and thinkers a way to move quickly forward to their own new ground. For me, Klein's article on interdisciplinarity and complexity acted like a bridge; it helped me feel safe as I considered the landscape of ideas from a new position. Klein reminds us that "A significant number of new specialities have a hybrid character. They constitute a second form of specialization focused on areas missed or only partially examined by traditional disciplinary specialities" (Klein, 2004a, p. 3). Through Klein's work, I discovered how one article can forever change the academic landscape by creating a new structure for thinking based on what has been left out of the discussion. One article can act as scaffolding for new concepts and new

specialties to come.

Finally, Klein's article finishes with a cloaked warning. Academia is not immune to the same complexity it references and explores. Klein names some of the ways in which past ways of thinking still influence innovators who think deeply for a living: "Contests of legitimacy over jurisdiction, systems of demarcation, and regulative and sanctioning mechanisms continue, and perceptions of academic reality are still shaped by older forms and images" (Klein, 2004a, p. 10). My conclusion is that my identity as a professional, whether as a solo researcher or as part of collaborative praxis within an interdisciplinary endeavour (Elford, 2011; Elford, 2012), must become even more fluid if I am to become increasingly useful in dealing with complexity. Working out how to "know fallibly" yet be effective in continuing partnership with others is an essential part of knowing anything at all.

Chris Browne, Science Teaching and Learning Centre, and Louise Blessington, Fenner School of Environment and Society, The Australian National University

The most significant influence that Julie Thompson Klein has had on what has become our shared teaching practice came through her argument that engaging meaningfully in interdisciplinary studies requires a different set of classroom metaphors (Klein, 1999). This realisation early in our teaching careers gave us "permission" to develop and align our philosophy of teaching and learning in an interdisciplinary context to focus on process through the journey metaphor.

We guide, probably more from behind than in front, students through an interdisciplinary capstone course "Unravelling Complexity," where students are challenged to become "bold in unravelling" (Boulton & Lucas, 2008, p. 9) complexity. They learn to become comfortable in navigating the uncertainty of complex problems rather than becoming paralysed by complexity itself or – worse – remaining ignorant of it. We focus our practice in the 12-week journey through a range of perspectives, with the goal of helping students to realise for themselves how to see the world anew through an interdisciplinary lens.

The link between learning about the nature of complexity and the need for an appreciation of interdisciplinarity is clear. Complex problems are characterised by deep uncertainty and multiple, conflicting world views (Head & Alford, 2008). Through a series of course seminars, a range of invited academics provide their opinions on how their discipline handles the nature of complexity and complex problems. Our role on this journey is to help stu-

dents to integrate these ideas, so that they can make sense of these perspectives through later discussion and reflection.

The intellectual journey of the course moves through three phases. The first is a collated "primer" on complexity, where each student reviews relevant articles on a concept related to complexity from outside their discipline and writes a 500-word piece for their peers explaining their articles' take on the topic. Students prepare a draft for peer review, before submitting a final for collation into the primer. The resulting artefact becomes a resource for students to share disciplinary perspectives that allows students to, as Klein describes, "cross the boundaries" of inquiry (Klein, 1999, p. 3).

The second phase of our journey promotes integration of disciplines around complex problems. Invited experts delve deep into "grand challenges," such as migration, energy security, food production, gender inequality, truth and justice, and the fourth industrial revolution. Groups of students take turns each week to plan and lead a discussion on their assigned topic after the presentation and develop a co-authored proposal on how they might address the challenge described by the invited expert. These activities highlight the great complexity of such topics and the need for the integration of insights drawn from the perspectives of many disciplines to deal with those complexities.

The third phase of our journey involves the composition of an individual portfolio. Students unravel a complex problem of their choosing, typically arising from their discipline, through drawing connections to insights from other disciplines. Students create "a critical or creative piece that can be consumed in 10 minutes" and are encouraged and supported to present their work in any medium they wish. During this phase, our guidance helps students tether their exploration to the course themes of complexity.

The portfolio encourages students to synthesise the knowledge they have gained during the course in a process that, for many students, is a transformative experience. Submissions span many themes and media; recent examples include a sculpture of Aphrodite commenting on gender equity, embroidery embodying human-nature relationships, an essay on sexual assault law reform, a slam poem on emergence, a board game about climate change, and a podcast on the nature of complexity itself.

What these diverse artefacts have in common is an understanding of the "evolving relationship" between complexity and interdisciplinarity that Klein (2004a) addresses in her work. Shaping our course to elicit this understanding shows how we have been influenced by, and responded to, Klein's work, by working to integrate these ideas within tertiary-level education.

Virginia Kaufman Hall, Retired

I appreciate Klein's articulation of the usefulness of interdisciplinarity. Upon reflection upon my working life in academia, government, education and community development, I realise how much I enjoyed discovering through my doctorate studies (including exposure to Klein's work) that theory is useful not only in unpacking multiple influences within a complex situation, but also in offering multiple "tools" to apply. For example, in my Australian government work facilitating ongoing and participatory research and evaluation of indigenous programs, I analysed wicked problems in attempts to shape policy. I was strengthened and informed by an integrative pragmatism that, for me, traces back to Klein.

Cynthia Mitchell, Institute for Sustainable Futures, University of Technology Sydney

For me, transdisciplinarity is a means to the end of improving planetary outcomes in ecological, social, and economic terms. My engagement with the concept has therefore always been from a practitioner standpoint, initially as an engineering educator in the 1990s, and since 2001 as a researcher at a self-funding institute whose mission is to create change towards sustainable futures. For us as researchers with a normative stance, the relevance of our work was always clear. My enduring interest was and remains in ensuring that the quality of our research (doctoral theses plus reports for government and industry) is equally clear. Boyer's scholarship model served me well in this regard for many years (Glassick, Huber, & Maeroff, 1997), including our translation of his assessment criteria into a transdisciplinary realm, but in thinking about quality criteria for transdisciplinary theses, more richness and nuance were needed. This was the context for my first encounters with Klein's superlative capacity for search and synthesis. My national teaching and learning fellowship in 2006 concerning quality criteria for transdisciplinary doctorates set out from the platform created by her closing reflections in special journal editions on transdisciplinarity in both Futures (Klein, 2004b) and Research Evaluation (Klein, 2006).

Firstly, in Klein's work, I found what felt like a rare space of resonance with our strong praxis orientation. For example, the richness of her conceptualisation of transdisciplinarity, in her piece in Futures, integrating as it did across the many "schools" of transdisciplinarity, provided multiple touchstones for our institute's work. Furthermore, her statement that "transdisciplinarity is simultaneously an attitude and a form of action" (p. 521) helped legitimise our normative stance. Her comments were significant be-

cause at the time, our change creation orientation had a powerful marginalising effect in academia.

Secondly, in Klein's (2006) work I found guideposts for how to strengthen our praxis. Here again, the strength for me lay in Klein's breadth of coverage and sharpness of synthesis, with themes like "the expanded meaning of quality," "the centrality of integration," "the interaction of social and cognitive factors," and the "the need for change in peer review." These themes spurred me on to collaboratively explore, define (Mitchell & Willetts, 2009), and recently revise (Willetts & Mitchell, 2017) new criteria and processes for the evaluation of transdisciplinary doctorates.

Our institute is now 21 years old, with more than a hundred staff and research students, and is globally sought after for its practice orientation to transdisciplinarity. We cemented that position in 2017 with a Routledge publication entitled Transdisciplinary Research and Practice for Sustainability Outcomes, in which, most appropriately, Klein sets the scene (Klein, 2017).

Bruce Small, AgResearch

Crown Research Institutes (CRIs) are major suppliers of research to the New Zealand Government. Much of the research conducted by CRIs focuses on applied, real world research problems. Frequently these problems are urgent, and have elements of scientific uncertainty, and both the problem issues and potential solutions impact various stakeholders in different ways (with potential winners and losers). Additionally, impacted stakeholders may have different values and legitimate end-goals with respect to the problem and solutions. These types of research problems are sometimes called "wicked problems," and for both ethical and pragmatic reasons, transdisciplinary research processes are currently viewed as the most appropriate approach for creating long-term desired societal impact (increasingly a requirement demanded by the government research funders).

One New Zealand CRI, AgResearch, has embraced the concept of transdisciplinary research through its Adoption and Practice Change programme (A&PC). The programme has much benefitted from comments Klein offered in 2008, in her article "Evaluation of Interdisciplinary and Transdisciplinary Research: A Literature Review." Her discussion about evaluation as being one of the least understood aspects of transdisciplinary research resonated with those involved in the AgResearch's A&PC programme, and also with the government funders, keen to be able to demonstrate the societal impact of the research they fund. Consequently, the A&PC programme has focused on creating, and adapting existing, tools and other resources

that are enabling AgResearch to develop evaluation capacity for reviewing transdisciplinary research programmes. These tools and other resources are currently being introduced to AgResearch scientists, so that they may be utilised at all research phases from planning to review. Currently, this is being done through a website called “Beyond Results” (<http://www.beyondresults.co.nz/>). AgResearch and other New Zealand CRIs have been in discussion about how an “evaluative culture” and “evaluative capacity” can be built into the CRIs with respect to transdisciplinary research.

David Dumaresq, Fenner School of Environment and Society, The Australian National University

I first read Julie Thompson Klein’s Interdisciplinarity: History, Theory, and Practice (Klein, 1990) sometime in the mid-1990s. I was immediately struck as to how useful Chapter 3, “An Interdisciplinary Lexicon,” could be in dealing with two concerns (among many others) within the Australian National University (ANU) in its long and convoluted path towards establishing a multidisciplinary (even interdisciplinary, and potentially transdisciplinary), robust, coherent, and rigorous academic entity dedicated to detailing the problems of, and pursuing solutions for, environmental literacy and social and ecological sustainability. Firstly, Klein’s work could help describe to ourselves, our immediate colleagues and the wider university what it was we were trying to do, and secondly, it would help reveal why there had been and would be so many missteps along the way.

In particular Klein’s typification of “the kinds of interaction that have constituted ‘interdisciplinary’ interaction in actual practice” provides an excellent and revealing starting point for addressing these concerns. These four basic kinds of interaction are “(1) borrowing, (2) solving problems, (3) increased consistency of subjects or methods, and (4) the emergence of an interdiscipline” (Klein, 1990, p. 64).

These interactions provide a neat summary of the safe ground that many if not most disciplinary based researchers use to extend their own field and engage with the “other.” Interactions within the ANU up until the mid-1980s could best be described in this way, even if some wished to push much further. What happens when we push further into the “gaps” and on into the transdisciplinary?

Again, Klein provides a useful succinct map. Here Klein borrowed from a Scandinavian colleague adapting Sverre Sjölander’s ten stages of development in interdisciplinary activity. Although the original stages were developed for group work, Klein points out that they work just as well for the

individual and individual interactions with others. These ten stages are:

1. *Singing the old songs;*
2. *Everyone on the other side is an idiot;*
3. *Retreating into abstractions;*
4. *The definition sickness;*
5. *Jumping the tussocks;*
6. *The glass bead game;*
7. *The great failure;*
8. *What's happening to me?;*
9. *Getting to know the enemy;*
10. *The real beginning. (for details see Klein 1990, pp. 71-73)*

So how have these ten stages played out at the ANU across the years from the 1970s to the early 2000s and what can their application to actions at the ANU tell us? In the 1970s the ANU created two small units to focus on trans-disciplinary academic activities in teaching and research designed to bridge the social and biophysical sciences centred around the problematique of environment and sustainability. The Human Sciences Program was established in 1974 to bridge the Arts–Science “gap” in undergraduate teaching, and the Centre for Resource and Environmental Studies (CRES) in 1975 to carry out research and provide postgraduate studies. Both entities were multidisciplinary in the staff they engaged and did not operate within the traditions of disciplinary based academic departments. Among other objectives, they were founded with the imperative to “get to know the enemy” in Klein’s terms. Both units constantly struggled to gain legitimacy among the strongly disciplinary based departments and schools of the wider university.

In 1987 the university declared a “great failure” and disbanded the Human Sciences Program against the strong opposition of students and staff. In defiance of this higher edict, most of the academic and intellectual activity and purpose was retained and further developed in a renamed Human Ecology Program housed within a strongly single discipline teaching department along with some of the original program staff. This “housing” was intended as an interim step pending the creation of a range of larger academic multidisciplinary entities. A School of Resource and Environmental Management (SREM) was proposed but was stillborn in 1990 with those disciplinary voices still “singing the old songs” being the loudest. Even so a virtual SREM existed across the relevant disciplinary based departments for the next ten years with much jostling among staff across Klein’s first four stages, with “the definition sickness” taking hold.

Multiple pressures from budgetary constraints, rising managerialism, and administrative consolidation for institutional survival in the early 2000s

gave rise among several disciplinary departments for the need to re-engage in creating an interdisciplinary school concerned with society and environment. Very quickly the strategy of “tussock jumping,” moving fast from one known and agreed on position to the next, emerged allowing for the formation of a School of Resources, Environment and Society (SRES) in 2001.

Within SRES, the “glass bead games” rapidly developed, each with its own rules, arenas, officials and participants including their own Joseph Knechts (Hesse, 1943, 2000). “Glass bead games” are opaque to outsiders, the rules are vague, undefined, even unknowable except to a few adepts, entry is limited to a chosen few, and years may be spent learning the game and gaining entry. Those who wish further familiarity with the “glass bead game” are referred to Hesse’s book. Interestingly at this time of the early 2000s, many “glass bead games” concerning society, environment and sustainability sprang up across the whole university, not just within SRES.

Perhaps in order to avoid another Stage 7, “a great failure,” SRES engaged in a rather bewildered “What’s happening to me?” Stage 8 with the research entity CRES to form the Fenner School of Environment and Society (FSES) in 2007. FSES’s creation and early activities re-engaged with the ANU’s 1970s Stage 9 vision of “getting to know the enemy.” Despite this, many old and new “glass bead games” remain being played and interactions between these games within FSES seem reduced to “tussock jumping” at best. A fully developed Stage 10 of “getting a new beginning” remains in the future.

Klein’s work provides a many layered, nuanced approach to understanding where we stand as individuals, as research groups, or as more formal institutions in our engagement with inter-, multi-, and trans- disciplinary activities. The above brief account of one strand of such activity at the ANU gives us an insight into just how difficult extended and re-iterative working outside accepted intellectual disciplines can be.

Stefan Kaufman, BehaviourWorks Australia, Monash Sustainable Development Institute, Monash University

I was both pleased and a little bit disconcerted when I first received Gabriele Bammer’s request for contributions to this article for the special issue celebrating the work of Julie Thompson Klein. I certainly remembered who Klein is, and felt familiar with some of her perspectives. In particular, and in my own scholarship and practice, I identify with her recognition of, and sense-making of, the impacts of complexity, hybridity, non-linearity, and the subsequent necessity of embracing heterogeneity (Klein, 1998). I can lay

some reasonable claim to be working in a transdisciplinary way throughout a chequered but entertaining (thus far) career bridging disciplines and contexts in academia, policy and practice. I think that this is, at least partly, because of insights from her work. But I was in an initial panic at the thought of trying to identify exactly where, how and when I first encountered it, which seemed to me a necessary step in tracking her influence in my context. Nevertheless, I wrote back to Gabriele saying "Funny, it's been so much of the water I've been swimming in I think it will take some reflection and rereading, but I like the idea of participating."

Further investigation revealed two illuminating perspectives. One was the refreshingly acerbic and astute recollection of David Dumaresq when I asked him about Klein's influence in my education and research training. David was the convenor of the Human Ecology Program throughout my own 1997-2000 undergraduate studies and was the supervisor of my honours (1st class). He was also the convenor of the Human Ecology Seminar series I participated in from 2001-2007 and the PhD program I started in 2004 and submitted in 2009, after leaving the campus to work in government in 2007 (I'm now back in the university sector). My primary supervisor for the PhD, Valerie Brown, is also contributing to this article. David wrote:

I would be interested in your recollection in this period Stefan, because to the best of my knowledge (and for the record), the program never explicitly used JTK's work in any of its formal teaching activities.... This is of itself remarkable.

He said he believed he would have referred to her work in passing in lectures, tutorials and workshops.

Human Ecology forum discussions and presentations certainly referred explicitly to JTK around 2003-4 when Jacqui Russell and I were writing a piece on the philosophical and methodological basis for transdisciplinary human ecology and a program based within it for the 2004 Society of Human Ecology Conference in Utah.

He also wrote that he would expand on this in his own contribution to this article:

What I explicitly used JTK's work for was to help me situate and defend Human Ecology's place in ANU as a transdisciplinary teaching and research program that bridged the social and the biophysical sciences, focused around the problematique of environment and sustainability.

Intrigued now, I had to dig deeper to find the aforementioned second perspective, because I definitely recalled talking and thinking about Klein's

ideas during my undergraduate studies and honours year (1997-2002). Despite that, as David reminded me, Human Ecology Program colleagues only began sharing work influenced by Klein's thinking from 2003-4. So I asked my mum if she remembered anything about Klein's work. Dr Virginia Kaufman Hall was the first PhD graduate of the University of Western Sydney's Social Ecology Program, under Professor Stuart Hill, in 1996. Her research explored the transformational impacts on organisations of women joining the workforce. Both my father, Byron Kaufman, a US advertiser expatriate from Boston, Massachusetts, and my mother (Australian born) had two simple but non-negotiable pieces of "advice" for my undergraduate course choices: 1) don't study anything you are not interested in just to get a job and 2) follow your interests and passion. A third element that Byron in particular was adamant about was that, regardless of what I studied, I understand the value of having qualifications from a respected university, an a-disciplinary pragmatism and reflexivity of knowledge in context that I suspect Klein would appreciate. Their advice aligned well with that of Professor Stephen Boyden (a seminal contributor to Human Ecology at ANU and globally). His advice to Human Ecology honours students, via Louis Pasteur, was "chance favours the prepared mind."

But back to Klein. Virginia commented:

What I love about Klein's work and what I wanted you to be exposed to at the time of your studies in the early 2000s is that we were living through a fundamental change in the ways that knowledge was becoming more accessible through the Internet and changes in education.

She saw an opportunity in Klein's recognition of a new definition of interdisciplinarity for her doctorate studies and teaching in social ecology, saying "Klein offered a way to reframe problem contexts and bring in opportunistic approaches, to shift the old stuck thinking."

Problem contexts are transient and problem solvers mobile. Emerging out of wider societal and cognitive pressures, knowledge is dynamic. It is stimulated by continuous linking and relinking of influences across a dense communication network with feedback loops. As a result, new configurations are continuously generated. (Klein, 1998. p. 26)

Virginia noted that:

Klein's thinking, research and development activities were to me social ecology in action. I was excited that you leant towards the disciplines within Human Ecology and could learn in action with people like Val Brown et al.

So in an important sense, via my teachers and mentors, Klein was there at key points in my undergraduate studies, honours year, work for the ANU's cross-institute environment institute (Dyball, Beavis & Kaufman, 2005), establishment of "GreenSteps" at ANU (Kaufman, Symons & Bachar, 2006), PhD research, and later knowledge broker role in state government environmental protection (Curtis et al., 2017; Faulkner & Kaufman, 2017; Kaufman, 2010).

Thanks in part to Klein's influence, I have always sought to locate myself at intersecting boundaries, with a prepared, open, but critical mind. And her influence is there not least now, when I'm working to bridge sectors and disciplines in a multi-agency collaboration on behaviour change campaigns in waste and the circular economy, towards sustainability transitions, back home in Australia and, at the time of writing, undertaking a fellowship at the Institute of Advanced Sustainability Studies, Potsdam, Germany, exploring the potential of "rigorous storytelling" and extended peer review for evaluating the societal impact of transitions research (Davies & Dart, 2005; Funtowicz, 2001). Now, too, I find her work a useful guide (Klein, 2008).

In summary, although diffuse and multi-threaded, I can identify at least some exposure to and engagement with Klein's ideas in this personal history of choices in study, research and work. Through my account of this experience, I offer evidence of some of her contribution to transdisciplinary scholarship and practice in Australia in at least three university programs, as well as government policy and practice.

Klein's primary contribution for me personally is the attitude that pervades her writing: a calm, constructive certainty that, to the careful (and prepared) participant's mind, underneath the prickly edges of disciplinary and sectoral boundaries and barriers to entry, emergent order and structure are potentially discernible, if always evolving. For those of us compelled to work across and around boundaries, she offers the faith that transdisciplinary sense-making is possible and desirable. Despite substantial challenges to traditional knowledge generating (and using) institutions in adapting to transdisciplinarity, she offers good reason to believe that we can transcend and synthesise situated perspectives in order to tackle complex, pressing problems. And that we can, and must, do so without being trapped in any one perspective on these complex, unfolding situations we create, exist in and navigate.

Valerie Brown, Fenner School of Environment and Society, The Australian National University

I have met Julie Thompson Klein three times while I have read her articles often. The first time we met, Julie was on the planning committee for a multi-disciplinary conference on integrated approaches to environmental issues. Other members of the committee were mono-disciplinary researchers. With great tact, Julie managed to convince the committee that integrated approaches might need more than a short summing up of individual papers. The second time we met was at the end of the conference where our job was to sum up the conference for the participants. Here Julie's strategic sense again came into play. She summed up the presentations perfectly, with due recognition of their contributions to integration, and with a twist that recognised the (large) number of times a paper was a specialised piece of work with a preliminary bow to the ideal of integration.

Our third meeting was by a video-link in which Julie made an appearance for an Integration and Implementation Sciences (i2S) conference. Julie, as so often in her publications, gave us all a clear understanding of the uses of inter-, multi- and trans- disciplinary in research and practice (<https://www.youtube.com/watch?v=pKTi3ZPHEE0>). The clarity of her review was a joy to hear. It has been the touchstone for my own work in the transdisciplinary field of practice ever since.

Gabriele Bammer, Research School of Population Health, The Australian National University

*Validation of budding ideas about interdisciplinarity was one of Julie Thompson Klein's earliest and greatest contributions to my work. I remember the excitement with which I discovered her book *Interdisciplinarity: History, Theory, and Practice* (Klein, 1990) and the legitimacy it gave to my thinking. My copy of her book still bears post-it flags from my first reading, marking key ideas including:*

- *the tension between interdisciplinarity as a “philosophically conceived synopsis” and as a practical concept (p. 42);*
- *the four kinds of interaction that constitute interdisciplinarity (p. 64);*
- *the importance of defining disciplines as well as interdisciplinarity (p. 104);*
- *thoughts on interdisciplinary teams (especially pp. 127 and 129).*

*These are all ideas that informed the development of *Integration and Imple-**

mentation Sciences (*i2S*; Bammer, 2013), although this was not always a conscious process.

A second influence is intellectual generosity and is a key quality that I associate with Julie Thompson Klein. She is a strong advocate of the work of others and her writing and presentations are densely infused with the breadth of scholarship on inter- and trans- disciplinary. (She quite rightly admonishes – mostly gently, but not always – those who are ignorant of the wheels they are reinventing.) Further, she seems tireless in responding to invitations to contribute to books, papers and conferences. I have valued her intellectual generosity in helping inform others of my work, as well as in contributing to writing projects and conferences that I have led. Her invited commentary on *i2S* (Klein, 2013) provided both an affirmation and a critique of the *i2S* ideas and extended them in a helpful way by introducing the notion of “the network as platform” (p. 429).

Third, Julie Thompson Klein does not just write about the network as platform, but is a strong supporter of, and participant in, initiatives that strengthen links among interdisciplinarity, transdisciplinarity and team science. In 2013 she provided an online opening keynote for the First Global Conference on Research Integration and Implementation, which is preserved on Youtube (<https://www.youtube.com/watch?v=pKTi3ZPHEE0>), and is also referred to in Valerie Brown's contribution above. Klein has also been a leading player in the development of various communities of practice, including the International Network of the Science of Team Science (INSciTS) and, most recently, the Inter- and Trans- disciplinary Alliance (ITD-Alliance). Further, she has provided valuable and well-cited blog posts (Klein 2016a, 2016b; Klein and Falk-Krzesinski, 2017b) for the Integration and Implementation Insights blog (<http://i2Insights.org>), which aims to connect a wide range of communities of practice. The reach of Klein's contributions in supporting INSciTS, ITD-Alliance and *i2S* is international rather than regionally confined. This automatically benefits researchers and educators in Australia and New Zealand who generally take a strong international perspective.

Conclusions

Two major conclusions can be drawn from the reflections presented above. The first is the striking diversity of Klein's influence on our work. The second is the value of the open qualitative process we have used to assess any researcher's (not just Klein's) impact.

Four key observations can be made about Julie Thompson Klein's contri-

butions, even from such a small number of reflections. First, the breadth of Klein's work that has been influential is noteworthy, with only a few overlaps cited among the different contributors to this article. Second, one overlap in particular warrants discussion, namely the common lessons drawn from Klein's ground-breaking 1990 book, *Interdisciplinarity: History, Theory, and Practice*. All three contributors who cited this work were struck by the richness of her depiction of interdisciplinarity and found this a useful platform for their own thinking.

Third, Klein's voice is authoritative because of her meticulous inclusion of the wide range of work on inter- and trans- disciplinarity and her ability to weave it into coherent narratives suitable for different audiences and contexts. This depth of scholarship provides comfort and legitimacy, especially to neophytes in search of a lexicon and scaffolding for bridging disciplinary divides. Finally, personal connection is not critical for Klein's influence to be felt but adds to it.

Regarding the second conclusion about the value of reflective narratives, they provide a rich picture of influence that cannot be gained from calculation of H factors and journal article citations. Allowing those reflecting to focus as they see fit on a particular person's contributions can uncover dimensions of influence that might otherwise remain hidden. In Julie Thompson Klein's case, the reflections demonstrate an influence on thinking and orientation that has been fundamental, but not easily citable, as shown in the contributions of Lorrae van Kerkhoff, Virginia Kaufman Hall, Cynthia Mitchell, Bruce Small, Stefan Kaufman and Gabriele Bammer. The reflections illustrate catalytic effects when Klein's ideas are combined with the ideas of others in particular educational and research settings, as described by Wendy Elford, as well as Chris Browne and Louise Blessington. They also show the practical value of her ideas in making sense of and/or shaping events and circumstances, highlighted by David Dumaresq and Valerie Brown.

It is also useful to see our reflections as recollections of particular learning moments prompted and/or supported by Klein's scholarship and practice. These learning moments can be linked to Bawden's (2000) three levels of critical learning systems that have the capacity to be self-reflective and adaptive: 1) learning about the situation at hand, 2) learning about how to learn, and 3) learning about the paradigmatic and worldview assumptions that frame the previous two levels, and exploring our own responses to these. We can see all three at play in our reflections: 1) using Klein's definitions and descriptions to learn about the situation at hand (van Kerkoff, Kaufman Hall, Small, Dumaresq, Kaufman and Bammer), 2) using Klein's scholar-

ship on crossing boundaries, integration, and synthesis to provide prompts and guidance (van Kerkhoff, Browne and Blessington, Mitchell, Dumaresq and Bammer) and 3) using Klein's work as permission to transcend one's own paradigms, as with van Kerkhoff's strategies for making sense of and responding to institutional challenges, Elford becoming "fluid," Browne and Blessington seeking to enable transformation in their students, and Kaufman adopting Klein's models to open the door to transformation.

As a group of authors we were surprised – pleasantly so – by the greater whole that emerged from the sum of our individual written parts, especially as some of us were not sure we had anything worthwhile to contribute when agreeing to participate. The result reminded us of assembling shards of glazed pottery into a mosaic.

Reflective narratives, of course, also have shortcomings, with biases resulting from the selection of contributors and the vagaries of memory being two that are immediately obvious. A few words about the selection of contributors to this article may be in order. There is no organised inter- or trans- disciplinary community in Australia or New Zealand and no one employed in Australia or New Zealand is currently a member of the Association for Interdisciplinary Studies (James Welch, personal communication, July 2018). The Australian Academy of Science was unable to provide a list of attendees at the 2004 Fenner Conference, at which Julie Thompson Klein was a keynote speaker. Instead two other participant lists were used: the participants at a 2004 Integration Symposium hosted by the now-defunct Land & Water Australia and the Australian and New Zealand participants at the 2013 First Global Conference on Research Integration and Implementation. Personal connections were a third source of invitees. The second list and personal connections yielded contributors. Of those approached, some did not respond, some said they did not know who Julie Thompson Klein is (with many adding that they would now look up her work), some could not identify strong influences based on her work and some were not able to contribute in the time available. In terms of a selection process for contributors of reflective narratives, this illustrates the challenges of attempting to draw a representative sample. But perhaps ensuring that the sample is representative is less important than ensuring that there are enough pieces to assemble a mosaic, recognising that such a mosaic is not only a product of the individuals involved, but also of the moment of writing. The same person writing at a different time, in a different context, may well contribute different shards to the mosaic.

As an aside, noting the non-respondents who were not aware of Klein's research led us to conclude that there is work to be done in strengthening

inter- and trans- disciplinary scholarship in Australia and New Zealand. Further the challenge of identifying likely contributors to reflect on Klein's influence demonstrates that the community of researchers and educators in inter- and trans- disciplinarity needs to be organised through a professional association or network. These were unexpected lessons from reflecting on Klein's contributions in Australia and New Zealand.

Additional lessons stem from the reflective narratives. Despite their limitations, reflective narratives provide an important complement to metrics measuring influence. Simple comparators based on limited dimensions (such as the number of publications in high impact factor journals) do not illustrate the unique strengths that each academic can contribute based on their specific attributes or the value of that diversity among researchers, educators and practitioners. Each of us brings a different set of knowledge, skills and personal qualities to our academic work. For some it is deep knowledge about particular methods, for others the focus is on concepts, still others can extrapolate from myriad cases, and so on. Some are qualitatively skilled, others are outstanding wordsmiths, others are expert at project design and more. Some are skilled in nurturing up-and-coming talent, others in working with senior leaders; some are good at starting projects, others at finishing them; some bring creative thinking, others attention to detail; and the list could go on. Metrics tend to focus on targets to reach or exceed, rather than affirming, valuing and capitalising on the wide range of individual differences that exist. And it is differences that are critical for good inter- and trans- disciplinary research, education and practice. It is combining differences that makes for richer understandings of problems and that yields new, creative insights for tackling them. This is the most important lesson that we have drawn from reflecting on Julie Thompson Klein's unique contributions.

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