

# On Connection and Community

## TRANSDISCIPLINARITY AND THE ARTS

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It is not surprising in a postmodern world struggling with commercial imperatives such as economic globalization and morally questionable realities such as Western cultural imperialism, that there is a growing interest in and understanding of the idea of transdisciplinarity. A few years ago a highly placed colleague told me that my interest in this idea (it goes against its ethos somewhat to call it a "subject") was highly suspect and rather "New Age." The latter term is not one that I would choose, but he was right in attributing transdisciplinary paradigms to a new intellectual age, which is not only rethinking, reconceptualizing, and reassessing educational practices, but the very nature of education itself.

I want to make two points at the outset. First, there is confusion and diminution of purpose when the terms *transdisciplinarity*, *multidisciplinarity*, and *interdisciplinarity* are used interchangeably: they are different in thrust, and there are evolutionary distinctions that are significant in terms of both process and content. Second, whereas some research in this area appears to have been conducted in more scientific areas, and with a pragmatic view towards joint problem solving, I am proposing that the arts not only provide an exemplar of what transdisciplinarity actually is, but demonstrate the scope and potential of how transdisciplinary thinking contributes to both knowledge production and current intellectual debates.

## DEFINING THE ARTS

To take the second point first. I define the arts in a very generous way, a generosity possibly encouraged by the fact that the Centre for Research and Education in the Arts (CREA) in which I work emerges out of a university of technology (University of Technology, Sydney, Australia). As Ihde notes, technology, "anthropologically and philosophically, revolves around human beings relating to their environment."<sup>1</sup> The arts also, of course, relate to environment, both subjectively and intersubjectively; this is true not only of the creative arts (dance, design, drama, literature, music, and visual arts) but also of the broader field of liberal arts, which have their historical roots in the *quadrivium* and *trivium*. In the *quadrivium* ("four ways"), geometry, astronomy, arithmetic, and harmonics were studied. In the *trivium* ("three ways"), students studied grammar, logic, and rhetoric. In more recent times, liberal arts has focused on languages, history, philosophy, pure science, and literature. The arts focus of CREA is based on a concept of "many ways" (*multivium*), on the conscious premise of many perspectives, possibilities and probabilities of conceptual and practical relationships.

## DEFINING TRANSDISCIPLINARITY

The aim of transdisciplinary research is not contained within a disciplinary framework, and in the production of transdisciplinary knowledge, "*the intellectual agenda is not set within a particular discipline.*"<sup>2</sup> This is one of the most common confusions and why it is significant to note the differences between interdisciplinarity, multidisciplinary and transdisciplinary. If I am teaching mathematics and I use poetry or poetic concepts, that's great, but it is not transdisciplinary, because my primary aim is to teach math; I am anchored in my discipline, seeking to achieve its objectives. When an art lecturer and an English lecturer come together in a teaching episode, that is not transdisciplinary, unless they seek outcomes that go beyond both their own disciplines and subsequently make significant changes in what they do. Nicolescu notes that *interdisciplinarity* is concerned with the transfer of methods from one discipline to another.<sup>3</sup> *Multidisciplinarity* or *pluridisciplinarity* are interchangeable terms defined by Jantsch (1972) as characterized by the continuing autonomy of the various disciplines without leading to changes in existing disciplinary and theoretical structures. The philosophy of transdisciplinarity is characterized by the potential for change in such structures and the imperative for thinking in different ways about curricula, teaching, scholarship. It has particular impli-

cations for research, which has tended to become highly specialized and discipline-contained; "[t]he upshot of discipline-driven research," writes Barnett, "is that researchers talk mainly to themselves, and even then, the so-called peers cannot always understand one another."<sup>4</sup> Transdisciplinarity is more than Klein's (1996) "productive tension"; rather it is a dynamic that encourages movement *between, across, and beyond* structures. If we imagine the disciplines as branches of a tree (of knowledge, say), then transdisciplinary thinking is the trunk (or even, perhaps, the sap); the roots are the epistemologies connecting the tree to universe. At a profound level, transdisciplinarity is connection and connectedness.

We live in a disconnected time, and a time of minimum accountability to make connections. Postmodernism has set us free from the old master narratives (of binary oppositions, good and bad, high and low, true and false, local and universal). Postmodernism, however, is a master narrative in itself—a very pervasive, even insidious master narrative (rather like a computer virus) that insinuates and worms itself into worldwide webs of communicative spaces, from architecture to literary theory. It has collapsed boundaries, disrupted past ownerships, and created an increasingly abstract world, freeing it from old configurations but reconfiguring it in a curiously limited way (for a more comprehensive discussion of this, see Johnston, 2001-2). This presents challenges in finding moral and intellectual benchmarks, but it has also opened up an era in world history that is liberated from previous cultural occupations and autocracies.

## WHAT IS EDUCATION?

At the beginning of the 21st century, transdisciplinary thinking urges us to avail ourselves of this freedom and to rethink intellectual agendas. It forces us back to that most basic question, what is education? Literacy and numeracy, say the press. And so of course it is, in part at least. Yet despite the concentration on these areas, many countries, including those in the educationally progressive West, are reporting worryingly low levels of literacy and numeracy skills. The reality is that "education" it is so much more than skills; it is so much more than curricula crammed with an increasing diversity of subjects. Education is *educatio*, bringing out, leading out, encouraging the development of physical and intellectual and spiritual potential; equipping with life skills; inspiring creative propinquities of thinking; setting up multiple ways of connecting with environment. It is connecting individuals to community, to *past* community, to *present* community, and to *future* community. It is also providing the means whereby individuals can connect with themselves, in both a linear historical sense and a horizontal

geographical sense. It is process and content. The *Delors Report* to UNESCO (1996) met with a mixed response, but it got this right: it sets in place four pillars as its foundations of education:

1. Learning to know
2. Learning to do
3. Learning to live together, learning to live with others
4. Learning to be.

### LEARNING TO BE

Many teaching/learning experiences address these foundations in various ways, but not all of them, and *not as their core business*. We assume that children will pick up *learning to be* along the way. Yet there are tragically high figures of disenchanting youth in so many countries, tragically high figures of youth suicide (Australia has one of the highest rates of male youth suicide in the world). It is simplistic to blame all social ills on education systems, but the reality is that education systems reflect sociocultural ideologies and expectations, how and what a society considers important about itself, how and what it thinks its children should be.

The West has become coy and reticent about overtly teaching what it is to learn to *be*; it is a difficult charge in a multicultural, multifaith community. This is also partially true about teaching *learning to live together*, in community and with others, and learning how to contribute to that community. It is odd that in an increasingly environmentally conscious world, fiercely proud and protective of its World Heritage wilderness areas, we have shied away from any conceptualization of World Heritage knowledge. The ideas and intellectual strivings of the past, the thinkers who articulated those struggles, who gave them imaginative life in artistic forms, play little part in the lives of the majority of young people, whose learning to be is individually-centered, generally uninformed by that significant factor of educational success, "prior knowledge." In the increasingly specialized world of the twenty first century, something of the wholeness of what it means to *be* and to *belong* was lost. Paradoxically, in elevating the importance of the individual, who "has to be me, who will survive" and so on, and in overtly and covertly selling them their rights "to do it their way," and in challenging the rights of parents and limiting the role of teachers, Western culture has helped to make the individual a potentially fragile and vulnerable figure. Postmodernism refutes any idea of truth or meaning as a constant, and so individuals have to make their own meanings on an increasingly underinformed base, with less "prior knowledge." Western humankind needs to find new ways to inform newcomers (its children) of the evolutionary his-

tory of human intellects down through the ages, to tell stories about their different ways of engaging with being human. I'm generalizing here, but I believe that we have allowed our tap roots to be cut away—the ones that went down to the deepest part of ourselves—and that now we have to scurry around with lots of little surface roots going everywhere, but rarely reaching anything deep and rich and fertile enough to truly sustain. So we dry out very quickly. The 1990 report, *Priorities in Higher Education*, identified the problem of "cultural illiterates" as Fitzgerald notes, "culture" is "critical to our future."<sup>5</sup> Culture is not just the province of intellectuals, it is not just "high" art and music and literature. *Culture is a living transdisciplinary concept*, a dynamic of what it is to be and what it is to live together, a continual vibrant tension of living past and living present: multiple versions of what Merleau-Ponty called "the world contracted into a comprehensive grasp."<sup>6</sup> Culture is what gives us a sense of human history and human geography, a sense of a *landscape of being*, a topography out of which, as a life-long project, individuals create and cultivate their own intimate, subjective mindscapes.

### TRANSDISCIPLINARY LANDSCAPES

Transdisciplinarity addresses, as its core business, landscape: that which is between, across, and beyond the disciplines. Its concern is to connect and to make connections. It engages with both what the landscape looks like (content) and the thinking processes that enable it to be fully perceived. This landscape is inclusive of non-Western ideas and attitudes towards education, moving beyond actual subject matter and disciplinary boundaries to underpinning ideologies and assumptions. It emerges not only from ethical concerns but also from a rapidly changing global society that recognizes the importance of difference in educational practice. This can already be seen in such technologies as hypertext, which implies abandoning conceptual systems founded upon traditional Western notions of hierarchy and linearity and replacing them with systems of nonlinearity, nodes, links, and networks.<sup>7</sup> The wider role of technology is, in fact, to create networks of connectedness.<sup>8</sup> As Barnett notes, "In the end, all knowledge is connected, and anything that we do in our educational transactions to convey a different picture is damaging."<sup>9</sup> Knowledge production must be epistemologically, ontologically, and phenomenologically conceptualized as part of an *ecology* of knowledge and of an infinite network of ecological knowledge relationships. Transdisciplinary landscapes overtly trace these points of relationship and connection, expecting, however, that they are likely to be transient and heterogeneous.

## TRANSDISCIPLINARITY AND THE DISCIPLINES

Transdisciplinarity carries a political freight because it challenges what Hoskin calls the "continually expanding power" of disciplinarity,<sup>10</sup> threatening disciplinarity's "coherence."<sup>11</sup> Like hypertext, it implies a new conceptualization of linkages and interrogates disciplinary traditions of center and margin. It has particular relevance in the tertiary sector where the need is for transdisciplinary paradigms to initiate meaningful dialogue, a new mapping in disciplinary relationships, and a new coherence for the university experience of students. Universities need to acknowledge that in the main they only accidentally contribute towards the following:

1. a totality of university experience that is across, between, and beyond specialized disciplinary knowledge;
2. the development of such generic attributes of graduates described in graduate profiles as the capacity for:
  - critical and imaginative thinking,
  - creative problem solving
  - intercultural understandings;
3. the preparation of *citizens*, and *citizen scholars*<sup>12</sup> as well as *professionals*.

Learning theorists such as Gibbons and others point out two modes of knowledge production: *Mode 1*, which is traditional, disciplinary, homogeneous, organizationally formulated and preserved; and *Mode 2*, which is transdisciplinary, heterogeneous, heterarchical, and organizationally transient.<sup>13</sup> Gardner proposes the idea of multiple intelligences: verbal/linguistic, logical/mathematical, natural, bodily/kinaesthetic, visual/spatial, musical/rhythmic, interpersonal, and intrapersonal.<sup>14</sup> Transdisciplinary teaching, in both process and content, exercises intelligence in multiple ways. It specifically works to provoke new ways of conceptualizing knowledge structures and engages with ideas of interpreting and understanding the world in different ways, what Saljo conceived as comprehending the world by reinterpreting existing knowledge.<sup>15</sup> It is related to Barnett's concept of *critical interdisciplinarity*, which recognizes the large element of "sheer convention"<sup>16</sup> that is a part of traditional disciplinary paradigms, and stresses the "emancipatory" potential of moving students beyond these.<sup>17</sup> This emancipation relates to ideas of the totality of university experience; it also relates to Palous' idea of the changing university: "The drama of our times is the exodus from particularity and the advent of universal community. . . . Leaving egoistic cells and prisons and entering worldwide openness can be

called education (from the Latin *educatio*, "to take out, to bring out, to lead out."<sup>18</sup>)

There is an increasing discourse of dissatisfaction with traditional educational practices. Employers are asking for knowledges beyond subject field, and for employee attributes beyond subject-specific knowledge and skills. Growing numbers of school students are joining with employers in claiming that traditional platforms of study are less appropriate to their work demands than, for example, the International Baccalaureate, in which students study subjects such as "Theory of Knowledge." Controversial writers such as John Ralston Saul (*The Unconscious Civilisation*) and Edward O. Wilson (*Consilience*) are popularizing, in international best-sellers, not only dissatisfaction but different ideas about education and educational practices. Sociological and demographic studies reveal that students are no longer likely to be employed in only one area over a working lifetime. Universities are acknowledging this by offering growing numbers of combined degrees; these are not transdisciplinary, but do represent a significant shift in ideas about breadth of knowledge. Yet despite all the rhetoric there has been little real application of transdisciplinary theory, little work on new methods. In its final report, the Commonwealth of Virginia's Commission on the University of the Twenty-first Century found, as Klein notes, that "the disciplines are no longer adequate to what we know and the problems we must solve" and called for "a basic transformation in the way Virginia thinks about higher education, the way colleges and universities think about their responsibilities, and the way faculties think about knowledge and their disciplines."<sup>19</sup> Educators must either:

1. explore ways of using transdisciplinarity as an underpinning approach to curriculum design, or
2. develop and implement a pilot transdisciplinary "subject" (see my earlier reservation), premised on the notion of the significance of "prior knowledge," and specifically encouraging transdisciplinary thinking processes and knowledge production.

The essence of transdisciplinary thinking is that it is flexible and dynamic; like the arts, it continuously creates new stages, new characters, new "language-ings"; in Gibbons' words, it "consists in a continuous linking and relinking, in specific clusterings and configurations of knowledge which is brought together on a temporary basis in specific contexts of application."<sup>20</sup> It seeks to avoid the conventional interpretative frameworks of Western educational tradition. It seeks to make connections, stimulate creativity and develop ideas of intellectual community and intellectual citizenship. It aims to encourage a unifying but not restricted perspective across knowledge and across cultures. It overtly seeks ways to open up thinking to "maps of unlimited possibilities." It seeks to create mindscapes that are unfettered by

traditional patterns and procedures. It develops kinds of thought that are common to a number of fields, and gives a central place to the imagination. It acknowledges also the central significance of imagery and metaphor—for example, saying “the brain is a muscle” opens up useful discourses of likeness and unlikeness.<sup>21</sup> It encourages speculation and contemplation, which Northrop Frye, the literary scholar, noted as the position of the mind where the arts and sciences begin. It reflects practices, ideas and beliefs from Western, non-Western, and indigenous cultures.

### A “COLLECTIVE CONSCIOUS”

In describing the characteristics of narrative, Wolfgang Iser notes that each character and viewpoint in a text become the “theme” of the reader’s attention, viewed against the “horizon” of what has gone before.<sup>22</sup> Knowledge is not a single act of cognition but cumulative. Jung spoke of the notion of a *collective unconscious*, a deep level of unconsciousness that members of every culture share and that includes patterns of thought (“archetypes”) and wisdom. My idea of the university is as a *collective conscious*—students exposed to wide horizons of “prior knowledges” and entering into diverse patterns of imaginative thought that reach between, across, and beyond the conventions and traditional boundaries of actual subject field. This is not liberal arts, nor Great Books, although it may engage with both and share similar purposes. It is not concerned with hierarchies, or canons, although it may agree with some of the thoughts and the cultural ideas out of which hierarchies and canons emerge. It is not a weak hybrid, although it may be hybridized. It does not detract from the significance of specializations but encourages creativity within them. It *is* collective in the sense of a gathered-together, huge, fertile ocean of resources, full, diverse, with many currents. It is *not* collective in the sense of being owned or restrictive, nor is it a closed, reductive, monolithic system.

### TRANSDISCIPLINARITY AND THE ARTS

The arts, for all their distinctiveness and difference, are part of an artistic and creative landscape, or an *ecology*, and a network of ecological relationships that reach beyond their own discipline; they share common sources (creativity and the need to represent it in imaginative, diverse, ever-changing ways). The arts are not primarily concerned with their discipline; the primary concern of drama, poetry, and music is not drama, poetry, and music per se, but

what they express *beyond* the disciplinary constraints of their form and structures: ideas about critical beingness—versions of what it is to *be*. This is why they have so much to offer in the learning environment, especially in tertiary education, about which Barnett writes: “What has to be faced is that a higher education anchored in a discipline, in which *critical being* [my italics] is restricted to the domain of formal knowledge *and* is restricted in its scope to technical operations within a single field, cannot supply critical persons for the new millennium.”<sup>23</sup> The arts offer powerful, transformational, experiential ways of learning; as well as separate subjects (literature, art, drama, music), they are a plurality of *transdisciplinary, core-disciplinary, artistic practices, processes, and paradigms* that spill over, usually at the deepest point, into all disciplines. A scientist’s discussion of string theory and superstrings describes the dimensions of the universe as being “tightly curled up in the folded fabric of the cosmos”; the same scientist notes that the microscopic particles within protons and neutrons are called “quarks” after a passage in Joyce’s *Finnegan’s Wake*.<sup>24</sup> Edward O. Wilson refers to science as a “culture of illuminations”;<sup>25</sup> discussing contemporary society, Geoff Mulgan writes that democracy “can become more of a permanent conversation.”<sup>26</sup> Hågerstrand develops a metaphor of “time geography” that conceives of individual biographies as “life paths in space” and describes daily routines of movement in terms of geographical “stations” and “domains.” Language is the primary technology of communication, again transdisciplinary and core-disciplinary (part of what transdisciplinarity addresses is the core of the disciplines). Language is also an artistic tool that opens up new ways of thinking through metaphor, imageries, representations of subjectivities, and metacognitive *arts of knowing* that allow us to “know” at the deepest level—to perceive, receive, become aware of, think about, learn about, interpret, remember, imagine, sense. It is these metacognitive arts of knowing that give “researchers-as-artists”<sup>27</sup> the languages to describe their “knowing” to others. In a so-called knowledge society, where knowledge seems to be increasingly situated as an autonomous commodity, it is this creative artistry that provides personal, relational, handholds, that gives scope for what Gardner calls intrapersonal intelligence—“*the ability to access one’s own feeling life.*”<sup>28</sup>

### TRANSDISCIPLINARITY AND RESEARCH

Research methodologies have become more transdisciplinary, less limited by discipline-specific qualitative/quantitative paradigms; this has been helped, for example, by Einstein’s theory of relativity (which changed Newtonian absolutes of space and time into subjective entities that depend on the

motion of the observer); and by the uncertainty principle of quantum mechanics (any information that can be obtained about any system in nature is limited by the unavoidable disturbance introduced into the system by our measurement of it). Even exact sciences such as cartography require subjective decisions about centers and polarities; as Jeremy Black points out in *Maps and Politics*, any map is imperfect and asks us as its central premise to accept the basic set of assumptions it constructs.

Transdisciplinary thinking provides a revealing optic for considering the nature of research. First, research is looking again (it is derived from the Middle French *recherche*, from the Old French *rechercher*, to search again). Research, deeply, is ontological. It is concerned with an immense diversity of "first principles" and principles of being; it seeks to find out about what already exists, what already is. It is looking again, continuously arming with new knowledges, new tools of thinking, new technologies, new sets of assumptions. It is a gathering together of a particular situation, place-specific, time-specific, condition-specific, and looking at it in a new way. It does not actually discover new facts—the fact already was, what is new is the human knowledge of it. Hawking's (1993) quest for the secrets of black holes, and a "theory of everything," is not a quest for new facts; it is a quest to discover the "facts" and principles that already exist and to bring these into the knowledge arena of the world in which we *are*. "Discoveries" and "new products" and "new cures" are discovery of the links that can be made between certain conditions and certain substances, of what can be manufactured by putting one substance with another in a particular way using a particular process and perhaps a particular technology. The potential of the new product or process or cure or technology was always there because of what already is.

Second, research is obviously concerned with knowledge, but the crucial aspect of this knowledge is that it *re-interprets* existing knowledge and ideas, and this re-interpretation in some way changes understanding. The arts construct and bring together (as a novel, as a painting, as a piece of music, as theatre) multiple sites of looking again, multiple sites of reinterpretation, and multiple ways of comprehending the world. They are an example in practice of a transdisciplinary research approach, a type of what Denzin and Lincoln refer to as *bricolage*, "that is, a pieced-together, close-knit set of practices that provide solutions to a problem in a concrete situation."<sup>29</sup> Traditional research focuses on a "real" question; the arts set up their own question and explore it creatively, not from authentic observations of a specific situation being extended into a universal "truth," but from what the writers/composers/artists perceive as a universal (or possible) "truth" being given imaginative specificity. Transdisciplinarity, like the arts, gives a central place to the imagination, acknowledges the significance of imagery and metaphor, speculation and contemplation; we need to learn more about

how it facilitates neural plasticity, perception, motor control, memory, attention, consciousness, and emotion.

## POSSIBLE EXAMPLES OF CONCEPTS TO BE STUDIED WITHIN A TRANSDISCIPLINARY ETHOS

### The Concept of Space

Subject content will include: *What is space?* World Heritage Knowledge of space; how others have written, portrayed, talked, and dreamed about space; space in mathematics, science, drama, history, geography, philosophy, art, dance; Cartesian coordinates positioning a point in space; Hilbert space; music as the space between the notes; tropic space and space as metaphor; space as symbol; Asian-Pacific ideas of space; Inuit space.

### The Concept of Symmetry

Ideas to be opened up include: Self similarity, the unifying concept underlying fractals, chaos, and power laws; Invariance against changes in scale and size; Schroeder:<sup>30</sup> "Symmetry is one of the most fundamental and fruitful concepts in human thought"; the Mandelbrot Set: engage with its symmetry geographically, mathematically; engage with its principles in discussions of art, music and the environment. The poetic carriage of symmetry: linguistic, visual, aural, intellectual, metaphorical, symbolical, philosophical, semiotic, semantic: *Tyger, Tyger burning bright/In the forests of the night/What immortal hand or eye/Could frame thy fearful symmetry?*

### Principles of Repetition and Recurrence

An "ancient theme"; related to the idea of a collective unconscious: themes which persist amid variation from age to age and which correspond to a pattern or a configuration of emotional tendencies in the minds of those who are stirred by the theme; symbols and recurrence.

## CONCLUSIONS

I am holding up a simple picture. It is attractive in itself. But when I tell you that there is something more, that this is a 3D picture, you look at it differently. You look for something else, something beyond what appears on the

surface. And looking across and between and beyond its shapes and patterns, you suddenly see another completely different picture, clear and bright, hovering in a delicate suspension, floating free from its horizon, like magic. Without consciously looking for the something more, without my prior knowledge that tells you that there *is* something more to a picture that looks quite complete the way it is, and without your prior knowledge about what 3D is, you would never see that other image. Transdisciplinarity alerts us to this something more—it invites us to comprehend the world by looking again, and reinterpreting existing knowledge. Those four pillars of the Delors Report make an appropriate image for the old Sanskrit saying that seems so pertinent for concluding a discussion such as this: “*The strength of all things comes from the in-between.*”

## NOTES

1. Ihde, 1993, p.51.
2. Gibbons et al, 1994, p. 27.
3. Nicolescu, 2002. This transfer may take place firstly as application (for example, transferring the methods of nuclear physics to medicine results in a new treatment for cancer), secondly as epistemology (for example, transferring methods of formal logic to areas of general law proposes constructive analyses), or thirdly as the generation of new disciplines (for example, methods of mathematics applied to physics create mathematical physics, methods of mathematics applied to meteorological phenomena create chaos theory, methods of particle physics applied to astrophysics create quantum cosmology).
4. Barnett, 1990, p. 176.
5. Fitzgerald, 1997, p. 85.
6. Merleau-Ponty, 1962, p. 408.
7. Barthes (1979) describes an ideal textuality that matches hypertext and which is interesting in this discussion: “In this ideal text the networks are many and interact, without anyone of them being able to surpass the rest; this text is a galaxy of signifiers, not a structure of signifieds; it has no beginning, it is reversible; we gain access to it by several entrances, none of which can be authoritatively called the main one; the codes it mobilises extend as far as the eye can reach, they are indeterminable . . . ; the systems of meaning can take over this absolutely plural text, but their number is never closed, based as it is on the infinity of language.”
8. MacFarlane, 1995, p. 52.
9. Barnett, 1990, p. 176.
10. Hoskin, 1993.
11. Messer-Davidow et al; 1993.
12. Coffield and Williamson, 1997.
13. Gibbons, 1994, p. 3.
14. Gardner, 1983.
15. Saljo, 1979, p.76.

16. Barnett, 1990, p. 177.
17. Ibid., p. 187.
18. Schuller, 1995, p. 176.
19. Klein, 1996, p. 235.
20. Gibbons, 1994, p. 29.
21. Ricoeur notes that metaphor both “specifies and liberates”—it challenges thinking about likeness and unlikeness.
22. Martin, 1986, p. 162.
23. Barnett, 1990, p. 109.
24. Greene, 1999, pp. 6, 7.
25. Wilson, 1998, p. 45.
26. Mulgan, 1997, p. 16.
27. Hägerstrand, 1970, pp. 7-21.
28. See Johnston 2002.
29. Gardner, *Frames of Mind*.
30. Schroeder, 1998, p. 3-5.

## REFERENCES

- Barnett, Ronald. *The Idea of Higher Education*. Buckingham: The Society for Research into Higher Education and Open University Press, 1990.
- Barthes, Roland, S.F. New York: Hill and Wang, 1974. Translated from French by Richard Miller.
- Black, Jeremy. *Maps and Politics*. Chicago: University of Chicago Press, 1998.
- Coffield, Frank; and Williamson, Bill (eds). *Repositioning Higher Education*. Buckingham: Society for Research into Higher Education and Open University Press, 1997.
- Delors, Jacques. *Report to UNESCO of the International Commission on Education for the Twenty-First Century*. UNESCO Publishing/The Australian National Commission for UNESCO, 1996.
- Denzin, Norman K.; and Lincoln, Yvonna S. (eds). *The Landscape of Qualitative Research*. Thousand Oaks, CA: Sage, 1998.
- Fitzgerald, Stephen. *Is Australia an Asian Country?* St Leonards, Sydney: Allen & Unwin, 1997.
- Gardner, Howard. *Frames of Mind: The Theory of Multiple Intelligences*. London: Fontana, 1983.
- Gibbons, Michael; Limoges, Camille; Nowotny, Helga; Schwartzman, Simon; Scott, Peter; and Trow, Martin. *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*. London: Sage, 1994.
- Greene, Brian. *The Elegant Universe*. London: Vintage, 1999.
- Hägerstrand, Torsten. *What about People in Regional Science?* Papers of the Regional Science Association, vol. 24, 1970.
- Hawking, Stephen. *Black Holes and Baby Universes and Other Essays*. London: Bantam Books, 1993.

- Hoskin, Kenneth W. 'Education and the Genesis of Disciplinarity: The Unexpected Reversal.' In Messer-Davidow, E.; Shumway, D. R.; and Sylvan, D. J. (eds) *Knowledges: Historical and Critical Studies*. Charlottesville, VA: University Press of Virginia, 1993.
- Ihde, Don. *Philosophy of Technology*. New York: Paragon, 1993.
- Jantsch, Erich. *Technological Planning and Social Futures*. London: Cassell, 1972.
- Johnston, Rosemary R. 'Teacher-as-Artist, Researcher-as-Artist: Creating Structures for Success.' Anstey, M.; and Bull, G. (eds), *Crossing the Boundaries*. Sydney: Pearson International Australia, 2002.
- Johnston, Rosemary R. 'Beyond Postmodernism: Spatialism and the Representation of the Infinite.' *CREArT* (2) (2001-2), pp. 3-13.
- Klein, Julie T. *Crossing Boundaries: Knowledge, Disciplinarity and Interdisciplinarity*. Charlottesville, VA: University Press of Virginia, 1996.
- MacFarlane, Alistair. 'Future Patterns in Teaching and Learning.' In Schuller, T. (ed) *The Changing University*. Buckingham: The Society for Research into Higher Education and Open University Press, 1995.
- Martin, Wallace. *Recent Theories of Narrative*. Ithaca and London: Cornell University Press, 1986.
- Merleau-Ponty, Maurice. *Phenomenology of Perception*. London: Routledge & Kegan Paul, 1962.
- Messer-Davidow, Ellen; Shumway, David R.; and Sylvan, David J. (eds). *Knowledges: Historical and Critical Studies in Disciplinarity*. Charlottesville, VA: University Press of Virginia, 1993.
- Mulgan, Geoff. *Connexity: How to Live in a Connected World*. London: Chatto & Windus, 1997.
- Nicolescu, Basarab. *Manifesto of Transdisciplinarity*. Albany: SUNY Press, 2002. Translated from French by Karen-Claire Voss.
- Priorities in Higher Education—A Report by the Senate Standing Committee on Employment, Education and Training*. Canberra: AGPS, 1990.
- Saljo, Ronald. In Marton, F.; Hounsel, D.; and Entwistle, N. (eds.) *The Experience of Learning*. Edinburgh: Scottish University Press, 1979.
- Saul, John Ralston. *The Unconscious Civilisation*. Ringwood, Victoria: Penguin, 1997.
- Schroeder, Manfred. *Fractals, Chaos and Power Laws: Minutes from an Infinite Paradise*. New York: W. H. Freeman, 1991.
- Schuller, Tom. (ed). *The Changing University?* Buckingham: Open University Press, 1995.
- Wilson, Edward O. *Consilience: The Unity of Knowledge*. New York: Alfred A. Knopf, 1998.