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FOUR
THE POLITICS OF WORKING COSMOLOGIES TOGETHER
WHILE KEEPING THEM SEPARATE

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Indigenous cosmopolitics? In a rather straightforward way, in this chapter the phrase refers to the politics of working indigenous and other cosmologies together and separately in a particular time and place. Cosmology as I use it here is the anthropologists' cosmology, effected as relativizing. It is not the philosophers' nor the theoretical physicists' cosmology, which, as I tell things, are accomplished as absolutes. Here I am concerned with the working together/keeping distinct of a Yolngu Aboriginal Australian cosmology and the Western cosmology that is expressed in a modern mathematics curriculum. Cosmologies know partially, and they know parts of the multiverse. Note that I am using "multiverse" differently than James, who invented the term (as a synonym for pluriverse). James was pointing to the many moral worlds that could be constructed by humans necessarily living in nature—nature is a multiverse for James.¹ In contrast, the multiverse, whose variable boundaries I negotiate, refers to multiple possible forms of human and nonhuman collective being: multiple forms of life. My multiverse renders James's as parochial. For me, concepts (and I have already introduced quite a few in my first paragraph) are the achieved working units of cosmologies, clotted as routine sets of practices, necessarily in the workings of a particular cosmology. Concepts can be made to cohere well enough in such working and, importantly, they can also be made to cohere well enough between cosmologies. Concepts are a means to negotiate the flimsy boundaries of the multiverse.

In 2006, the famous anthropologist Mary Douglas suggested that it was now too late for anthropologists to study cosmologies. Modernity had become too pervasive. She felt that other cosmologies no longer wait out there for anthropologists to happen upon.² The several claims implicit in her assessment would have been vehemently opposed by the Yolngu elders and teachers I worked with in the 1980s and 1990s, and they would still be disputed today. First, the idea that cosmologies have ever been somehow hermetically sealed from each other and so could be something anthropologists found as whole and pure worlds would have been hotly disputed. And second, the idea that an indigenous cosmology is somehow inevitably weakened by a modern Western cosmology would likely have been met by invitation to participate in a ceremony—a funeral, or a boys' initiation, or even a workshop held as part of mathematics education. Yolngu cosmology is alive and well and actively inventing new forms of cosmopolitics as it does the multiverse through its concepts.³

This chapter is about mathematics education in a small group of Yolngu schools in Australia's Northern Territory. Across the period 1987–96, a curriculum came to life that, as a cosmopolitics, strategically worked cosmologies together while simultaneously assiduously keeping them separate. As I experienced and puzzled about the working together and separately of these two cosmologies, a third minimalist translating cosmology began to emerge, and this chapter tells of an episode in that process of emergence.

Ethical and Political Practices Entailed
in Indigenous Cosmopolitics

The translating cosmology I have begun to outline here is better named as a methodology. Here I mobilize and to some extent develop this as an analytic in telling of the working together/keeping distinct of a Yolngu Aboriginal Australian cosmology and the cosmology embedded in a modern mathematics curriculum. As a cosmology, my translating framing is minimalist, concerned solely with epistemic practices and epistemology; what it values is limited to knowledge making. While I recognize that I do need to fully specify what it offers in this regard, that must wait for a different occasion. Since I write here under the topic of indigenous cosmopolitics, what I specify prior to telling my stories is the ethos that is entailed for a collective that mobilizes such a methodology (cosmology) in doing

cosmopolitics as analysis, that is, in explicitly negotiating the boundaries of the multiverse. I offer consideration of this ethos as a means to partially specify ethical and political practices entailed when analysts participate in indigenous cosmopolitics.

Cosmopolitics is necessarily a collective matter and requires nurturing a collective ethos committed to respectfully enacting dissensus that goes along with active accord making. In rhetorics, ethos defines a relation between a giver and a receiver of news, of information, of knowledge, of advice, of exhortation, and the rest. This relation is necessarily nurtured in a working cosmology through situated, cultural, and epistemic encounters and engagements. The forms of such relations are often implicit in shared histories, but, albeit less comfortably, they can and must be explicitly articulated when contesting histories encounter and engage. In cosmopolitics, all participants are both givers and receivers.

Ethos concerns the credibility, in a particular situation, of givers' characteristic modes of giving information or knowledge, which includes explanations given, for example, by teachers. Ethical practice, expression of the ethos in cosmopolitics, requires good faith and bad will of givers when it comes to epistemics. Dissensus arising in expressions of epistemic bad will and good faith is the ethical order of the day. Epistemic bad will is required since participants must refuse to go along with the various common senses that are, inevitably, at play; refusing to go along with what everyone knows is mandatory, since in cosmopolitics there are no everyone's who know, and there is nothing given to be known. Yet at the same time, epistemic good faith is required. Principled refusal to go along with what everyone knows requires givers to know what they know (as knowers of a parochial cosmology), to know how they know it, and to have a developed capacity to articulate it. Knowing what I know and how, and trusting others to know what they know and how, leads to possibilities of active accord making while respecting dissensus. It makes it possible to go along doing our differences together in the light of freely given assent to particular agreed matters in the here and now.

Dissensus and active accord making and keeping (or not keeping— withdrawing assent) is the default ethos of a collective engaging in cosmopolitics. Enacting this default ethics explicitly is one element of political practice in working cosmologies together while keeping them separate—of cosmopolitics. Let us imagine political practices as managing the going on together along three axes, three power-laced continua of collective

action. One axis stretches between persuasion and coercion, another between cooperation and competition, and a third between dissensus and consensus. An ethos that cultivates dissensus—imposed in the epistemics of the methodology (my minimalist translating cosmology)—necessarily also cultivates persuasion and cooperation. Political practices of cosmopolitics are by derivation, those which cultivate dissensus and yet require continuous active assent to particulars. This in turn requires cooperation and persuasion. Cosmopolitics is a particular enactment of political possibilities.

Mutual Encounter and Engagement in Developing a Novel Mathematics Curriculum

Here I re-present an account of mutual encounter and engagement between members of the Yolngu Aboriginal Australian community at Yirrkala, and the Northern Territory state Department of Education. I use both “encounter” and “engagement” here, for I want both the “contra” (against) that lurks within “encounter,” and also the links back to “gage”—pledging oneself, of engaging. Both are required in order to go on together doing difference. I write as a partial participant in the action, one who was a member on the modern education side—a teacher and researcher of mathematics education.

First, I relate the encounter and engagement of the curriculum in a general way, attending in particular to the concepts that the curriculum entailed. Then I tell of an episode where I became aware in a new way of the cosmopolitical significance of some epistemic aspects of an ethos committed to dissensus and active assent to particular epistemic accords. The story tells of my coming to recognize that as a teacher educator of the emerging curriculum, I was (mis)using my authority as a mathematics educator in proposing something that was not assented to. In performing myself as a giver of knowledge in the collective, my practice of the required ethos was wanting. My practice was both ethically wrong and bad cosmopolitics. As a knower of the cosmology embedded in the modern mathematics curriculum, at the time I experienced this episode as the falling to bits of the ontic and epistemic commitments that had enabled me as a teacher of science and mathematics for many years. This experience precipitated the puzzling that would eventually enable me to articulate what here I name as a minimalist translating cosmology—a methodology for indigenous cosmopolitics.

In the late 1980s, the Australian polity quite uncharacteristically engaged explicitly with political change. Environmental policy, workplace

relations, political rights of Australia's indigenous peoples, gender equality, and multiculturalism—all became important political issues, and administrative change followed. Difference was not only recognized, but policies were formulated to support and even foster different development trajectories for indigenous institutions, among others.

For nearly a decade, indigenous educational institutions expanded, and innovation thrived. Bilingual education had been growing in Northern Territory schools since the 1970s and by the mid-1980s was well funded and confidently extending to more and more schools. The particular project I describe here grew out of this bilingual curriculum and pedagogy and culminated in what became known as the Garma Maths Curriculum. This curriculum, with its associated syllabi, was officially recognized as a state-endorsed curriculum by the Northern Territory Department of Education Board of Studies in 1992. The children learning through this curriculum showed improved achievement in standard mathematics tests. But by 1996, almost all trace of this curriculum had vanished from the small group of schools in which it had been established, along with the bilingual program, which was abolished. New public management policies struck, and radical cost cutting became the order of the day. Indigenous languages and bilingual education are still largely absent from Northern Territory state schools.

In the particular group of schools where I found myself working in the late 1980s and early 1990s, an Action Group of Aboriginal teachers was formed to administer the school on a week-to-week basis, working in close collaboration with a school principal appointed by the Department of Education. Both of these administrative arms were subject to governance by a devolved school council of elders, a group whose work was funded by the state and supported by government officers under a policy of local control of schools. The project to develop a radically new mathematics curriculum and pedagogy was initiated in recognition of the failure of conventional mathematics education to promote effective learning in the school. So inadequate and indeed counterproductive was conventional mathematics education judged to be that in beginning the work of imagining a new mathematics curriculum the School Council banned mathematics teaching for a year.

In 1992 our curriculum was described this way:

GARMA MATHS: "BOTH WAYS" MATHS CURRICULUM
FOR YIRRKALA AND LAYNHA SCHOOLS

In the 1980s, after Yirrkala school introduced a program of Aboriginalization, Yolngu community elders were asked to come to the school to help develop a "both-ways" curriculum for the schools at Yirrkala and the Laynha Homelands.

The community elders came to meetings at the school to tell the Yolngu teachers in the Action Group what their school curriculum should be like.

The first thing these elders did was to give us several Yolngu words to guide the development of the maths curriculum. These words, or metaphors, reflect the knowledge of the Yolngu elders, about how maths in the Yolngu world and maths in the Balanda world can be taught side by side, so that one does not crowd out the other. Three of the metaphors through which curriculum planners have learnt to understand "both ways" mathematics are Garma, Ganma, and Galtha. . . .⁴

Garma is a place, a ceremonial area, but not for secret ceremonies. It is for open ceremonies that everyone can participate in. . . . If a ceremony has been properly negotiated and produced in full view of everyone, it will be performed in the Garma ceremonial area. Yolngu can sit and watch a Garma ceremony and read from it the network of connections between people, places, songs and totems that make up this particular ceremony. Garma is an open forum where people can talk . . . ideas, differences, agreement. The old people who supervised the making of the curriculum told the Action Group that the School should be like this Garma area.

. . . Where might a Garma Maths curriculum start? . . . The recursive systematic kinship system [which all Yolngu children know and use before they come to school] by which the Yolngu world is routinely given order and value can be placed alongside the recursive system of English numbers [which equally Yolngu children can recite and sometimes use before they come to school]. In Garma Maths students spend as much time extending their knowledge in exploring ways of representing and interpreting their own Yolngu systems on paper, as they do exploring the ways in which Western maths is used to give order and value in white Australian life.⁵

The new curriculum had four elements, and over the years a full syllabus for all the school years of the primary school and the lower years of secondary schooling were laid out. In articulating the theory of the curriculum, we used the term “mathetics” (rather than mathematics).⁶ Using the everyday term “maths” in the curriculum title might look like a colloquialism, but for us it expressed a serious challenge to the epistemic hegemony of mathematics. The four areas of the curriculum were named Djalkiri, the footsteps of the ancestors; Gurrutu, the Yolngu kinship system; Space Grid, Cartesian grid and navigation; and Tallying Number, arithmetic, measurement, and calculus. Mathetically, Gurrutu and Tallying Number were understood as analogous, as were Djalkiri and Space Grid; culturally, Gurrutu and Djalkiri belonged together on the Yolngu side and Tallying Number and Space Grid worked together on the modern mathematics side.

It is self-evident that, experientially, Gurrutu and its practices are profoundly different from Tallying Number and its practices: the worlds they order as routine sets of practices feel incommensurable. As elements of disparate cosmologies in commonsense terms, it is not obvious how they might be connected. Similarly, Djalkiri, committed as it is to physical orientation of embodied (and other) humans (and nonhumans) and places through stories of spirit ancestors, differs from physical orientation achieved through the technologies of Cartesian coordinates as theorized and practiced in Space Grid. The differences were and are so obvious that in the emerging Garma Maths Curriculum difference looked after itself. The mathetic concepts we devised as connections in the curriculum—recursion and positionality—name a family likeness respectively between the kin relations of Gurrutu and the numbers of arithmetic, and positional relations systematically coded in Djalkiri on the one hand and modern navigation on the other.

The core concepts in each of these curriculum areas are best understood as relations. In one mathetical domain of the curriculum, relational concepts are effected in practices of doing recursive series of names, as numbers, and on the one side as reciprocal kin names. In the other mathetical domain, practices of positioning as conceptual point-field relations are enacted in the grid-tracking technologies of modernity and in the doings of people-places as routinely enacted in Yolngu life. Mathetically, the curriculum as a whole effects a variable set of relations of relations. The core logic of the curriculum mobilizes a Wittgensteinian relational logic of family likenesses.⁷

The Garma Maths Curriculum inducted children into mathetical thinking, without always obliging them to think modern, which is not to say that modern thinking was not being taught in Garma Maths. In thinking modern, we are working with a set of figurations that are usually invisibly imposed on modern thinkers. In this the modern order of things systematically and invisibly enacts our obligations to a particular past then-there. This is actually a then-there quite far away from the here-now of 1980s Yolngu Aboriginal Australia. The conceptual figurations of modern thinking clotted in the fury of the competing knowledge authorities of Europe's seventeenth century, as feudalism faded as a form of governance and Christendom tore itself apart. Not surprisingly, the cosmology of modern-era institutions—which the mathematics curricula of modern primary schools faithfully express—was instituted through achieved formulations that, among other things, separated off knowledge and politics, and knowledge and gods. Neither of these separations feature in Yolngu cosmology.

I have given a brief account of the working imaginary of our Garma curriculum and in concluding, as an aside, I alert readers to an element in the historical situation of the curriculum that I have missed in my telling so far. Unlikely though it seems, this curriculum initiative in northern Australia had one of its beginnings in some primary school classrooms of Yoruba land in southwestern Nigeria, where I had worked earlier in the 1980s. Yoruba teachers had demonstrated that there is a difference between Yoruba numbers and the numbers of the primary school curriculum and simultaneously shown that these disparate numbers could be connected.⁸ In articulating what I had been shown, it took me some time to recognize that I did not know how to articulate that difference-sameness as generative. As I am about to reveal, I experienced a similar blindness when I began working with Yolngu teachers and their advisors. It was not until I was stopped in my tracks by the dead of a colonial massacre that I saw that cosmopolitics requires a more sophisticated doing of difference-sameness than what I have just proposed in describing the curriculum. What I have just offered is a particular description of what was known in the epistemic practices of the Garma Maths Curriculum—a relatively uncontroversial account of the curriculum's working ontology. As you are about to see, while that might have been adequate for the mathematics curriculum authorities who viewed the curriculum as cross-cultural mathematics education, it is not sufficient when the curriculum is more properly understood as cosmopolitics. To get at the epistemic requirements that recognizing the curriculum

as cosmopolitics entails, we need to go further and problematize both the configurations of the entities known in the curriculum and the figure of the knower.

Learning from Disconcertment

I am taking cosmopolitics as the politics of collectively doing cosmologies together and separately. In working my way toward articulating some practices entailed in partially participating in cosmopolitics as an analyst, I began by considering the ethos of such a collective. I proposed that what is required is the nurturing of a collective ethos committed to respectfully enacting dissensus that goes along with active accord making. Ethos is tied up with the epistemic demeanor of participants as knowers, especially those who participate as analysts, and by extension also what they know, and how, and how they know they know, and why they value that particular knowing.

In this section, I turn my attention to beginning consideration of the epistemic demeanor that goes along with engagement in a cosmopolitics. I propose that epistemic demeanor is something that can be cultivated, although it usually is not. In describing the Garma Maths Curriculum in the previous section, I adopted an epistemic demeanor appropriate for conducting an argument in mathematics education. In concluding that section I proposed that, as such, it was inadequate for participating in Garma Maths when more properly understood as cosmopolitics. Here, in working toward articulating what is an appropriate epistemic demeanor in participating in cosmopolitics as an analyst, I tell of meeting the dead of Gängan, a small Yolngu homeland settlement. Meeting these dead came to pose the problem of how these dead, as expressions of Gurruṯu, were to participate in our maths teaching and learning. How to carry the dead of Gängan along in the Garma Maths Curriculum? My story centers on the configuration of what is known and on the figure of the knower in the curriculum. It punctures the comfortable epistemic assumptions of the mathematics teacher-educator working as a curriculum development advisor—the author-in-the-text of the previous section. My story tells of what for me became a continuing, profoundly uncomfortable moment of the curriculum work.

A Story

Southwest from Yirrkala, a small town in Australia's northeastern Arnhem Land, it takes about half an hour in a light plane to get to the Yolngu homeland settlement of Gängan. For me, adopted into the Marika clan, Gängan is in the homeland of my mother's clan. On this visit I was to feel shame that in the past my lot, Australians of Anglo descent, had taken a fatal interest in this adoptive family of mine. Somewhat at odds with this shame, simultaneously I felt a strong professional concern over what Yolngu adults consider proper as the content of a junior primary school reading primer. The disconcerting mutual interruption of those two judging figures, plural versions of the modern knower as removed, judging observer, is my main focus in this telling. My story of learning to work a disconcertment elicited by a story of the dead of Gängan led me to recognize the inadequacy of some ontological assumptions I had not previously concerned myself with. I recognized that my epistemic practice as a participant in the Garma Maths Curriculum cosmopolitical collective was flawed.

I arrived in Gängan along with Yolngu *yapa*, teachers who are sisters for me. We had come, together with other teachers, both Balanda and Yolngu, for a workshop in the recursion strand of the curriculum. The curriculum was developing well. In the recently established statewide tests, the students of this region had performed better than expected; the children were learning. This is not to say the curriculum was uncontroversial—it remained contested by members of the wider Yolngu world, in particular senior clan members there at Gängan, who justifiably feared the betrayal of the sacred meanings of Gurruṯu and Djalkiri by the explicit analogizing with tally number and the cartographic grid. In this workshop, we were to consider the syllabus for the older children, and explicitly how to develop ideas of quantifying valuation in the tallying number strand of the curriculum. Working with the children and teachers of this very small outstation school, we rehearsed the teaching of the practices of the base ten pattern using boxfuls of straws. But the main focus was linguistic. What are the English and Yolngu terms that should be engaged to teach quantifying valuation, and how can we specify with enough precision how these terms should be introduced and expressed in pedagogical practices?

Buildings of corrugated iron sheets held up with bush timber flank the airstrip. A teacher from the school meets the plane, and, accompanying us on the walk to the school, he tells us that these old buildings were retrieved

from the first Gangan settlement established in 1970, over there to the west, closer to the river. They were moved when the airstrip was built, east-west across a small rise. Houses with sand verandas face outward from the communal shower and telephone box. The Telecom logo seems oddly out of place—so orange. Set on a small hummock over to our right and behind us as we walk, screened by bushes, are a steel tower with its dish and an array of solar panels. The light green Colorbond school buildings face each other across a wide connecting veranda where we'll sleep. It funnels the breeze into the classrooms through open louvers. Wurrán, the black-legged crane, is painted on the outer east-facing wall of the school building here at Gangan. Its wings are outspread, its head atop the long neck turned to one side, dancing. Many of the children who learn in this building are Wurrán, or maybe their mother identifies as Wurrán. As we muddle about selecting our sleeping positions, in openly acknowledging my adoptive position, a young woman, mother for me, promises that tomorrow she will show me the country.

The next day, our morning work goes smoothly, and after lunch as a group we visit the lagoon, seemingly the center of life in Gangan, a wide deep waterhole where the sweet-fleshed baypinnga, lungfish, and large barramundi live. We strangers all wade in along with the children. Our hosts do not, and we are teased. When our sweat, the sweat of strangers, is carried downstream, a tremendous storm will blow in, we are told—this place is cared for in that way. We impetuous visitors retreat back to the edge, and to no one's surprise a storm does blow in later in the afternoon, whipping the sheets of butcher paper on and through which our negotiations are being conducted off the wall where they've been secured with masking tape.

Later in the afternoon, as she promised, my young plump mother shows me the country. The *yati* (ritual ground) with its huge tree, the river that feeds the lagoon. About halfway along the lagoon we visited at lunchtime, we stop at a sandy spot, naturally clear of bush, dominated by a large, shady fruiting tree. "It was through there," my mother indicates, "along that rise you see there across on the other side of the lagoon, that Bilarni [Bill Harney] and his men rode." She points back toward the *yati*. "All the men were doing men's [sacred] business, way back there."

This is the story of a 1920s massacre in which the Dhalwangu clan was very nearly wiped out, from which today it still struggles to recover. As she goes on, tears begin to stream down my cheeks, quite unbidden. The place

becomes its history. My young mother gestures, making a map of the horror, pointing out the landscape features that had their place in the killing, the dying, the surviving. The hollow water lily stems through which some of those who take to the water breathe; the huge rotting log behind which the rifle shooters kneel; the trees behind which the Dhalwangu men stand as they prepare to throw their spears. The shots crack noiselessly around me. Invisible children fling themselves into the water as it remains undisturbed. The young woman, member of my adoptive mother clan, becomes a distressed crane, dragging her broken legs, frowning the sand we stand on.

Later, back at the schoolrooms, my guide goes into the teachers' store-room and brings me a small green booklet. The story she has told me has been written down in both Gumatj and English. Gruesome amateurish line drawings illustrate it.⁹

All the men were at a private ceremony site in the bush nearby. The children and women were at the camp. The other women and children had gone gathering yams, berries, goannas, and freshwater turtles.

None of them knew that a party of men with guns were riding towards the camp on horses. They were led by Bill Harney, a yellafella from the Roper River area. The armed band of men rode into the camp and shot the older women. The men heard the shot[s] from their gathering spot and ran to see what was happening at the camp. There they saw their wives being shot dead so they attacked the killers with their spears. The rifles were too much for the spears and they were driven back to a large lagoon nearby. Some of the men who went in the water were shot and killed.

Meanwhile other women were shot and killed at the camp. While some escaped with their children, where they were joined by the men who escaped. The other young women, children and men were captured by [the] men. Bodies were lying everywhere. Those in the bushes watched as Bill Harney and his men started their journey back, taking with them the captives, back the way they had come from.

That was not the end of the story though, Bill Harney returned the next year and collected the skulls of the people he had murdered. And later sold them to a museum in southern cities and made a lot of money.

When I finish reading this small book, my young mother, a teacher at Gangan school, comments that even though they, as a homelands school,

do not have an official bilingual program, among the children it is one of their most popular reading primers. "They read it again and again," she says proudly. "It's taught so many children to read English!" The odd bodily feeling of profound wrongness which that remark evokes in me is certainly the most vivid memory I retain of that Garma Maths Curriculum workshop.

Making Something of the Story

The story with its dual performances, as narrated enactment in place and as enthused-over reading primer, continued to haunt me. For me it brought to the fore two sets of tensions in the collective epistemic work of the Garma Maths Curriculum. One concerned the entity known and taught in the various elements of the curriculum; the other concerned the figure of the knower. These tensions were embedded in a politics that was the world known in a cosmopolitical Garma Maths Curriculum—its dual cosmologies.

The story of the dead of Gängan doing work in helping their young lively kin to learn to read reminds me that these dead I have just shed tears over are Gurrutu. Every one of the dead is related in a particular nameable way to all those who are embodied as a Gurrutu position, and a learner in the Garma curriculum, even I, partial though my Gurrutu embodiment might be. The dead as a whole are a part of the vague Yolngu whole, one of many such parts, although of manifestly different provenance than most of the Yolngu world's identifiable parts. This is how the logic of Yolngu life works—every individual and every place are uniquely nameable as a Gurrutu position by every Yolngu person and are set in a complex reciprocal relation with every place. (Of course, that semiotic logic also attaches to the much less institutionally formalized working of kin positions in mainstream Australia—I am my mother's daughter, but, in modernity, application of that logic is severely constrained, very patchy and partial in its coverage.)

Garma Maths is a curriculum in which names of reciprocating Gurrutu positions and names of numbers conjure up concepts that are rendered equal through a focus on the material practices of recursion; both numbers and Gurrutu positions become as mathematical objects. In the practical here and now of classroom life, this holds well enough as a connection for the curriculum to work. Yet perhaps we should not be surprised that inevitably, despite attempts to keep things separate, numbers begin to work

with the material semiotic logic of Gurrutu positions, and vice versa. We find that the dead of Gängan can and clearly do become in the present as a number in Yolngu life (albeit never a precise number). The dead of Gängan are present in the curriculum as a number of people; in fact, if the story told in the reading primer is to be believed, as several numbers: shooters, dead, survivors, and money are all numbers that continue to have life in Gängan (albeit rarely named as numerals). In a form of restorative justice in Gängan, the Garma curriculum must recognize number as the dead of Gängan, and their killers, and the supposed rewards they got. Each of these is necessarily a singular number, unlike every other number, but one that, willy-nilly, is always present. The curriculum must carry along these ontologically singular numbers with it—as numbers. Number as enacted in other aspects of Australian life (including the conventional mathematics curriculum) has enumeration as representing the dead and the shooters, rendering them as safely in the past, and as not inhabiting the present.¹⁰ Yet in our ontologically dangerous curriculum, numbers that are taken for granted as indexes and taught as such must sometimes become something else—icons.

And of course it works in the other direction too. When it comes to the curriculum, what the elders of Gängan worry about is that Gurrutu positions might be taken to be mere indexes. Gurrutu position as an entity known in the Garma Maths Curriculum might be taken solely as a sign, leaving bodies, places, and here and nows out of contention. For the elders, what is important about Gurrutu is that the names are the thing named—Gurrutu positions are icons. For most of those people who are Gurrutu as well as numbered (indexed) modern Australian citizens, to render Gurrutu positions as indexes is profoundly wrong. And I could make analogous arguments for the Djalkiri and Space Grid domains of the curriculum. Carrying along the dead of Gängan in our curriculum is important in all four of its mathematical domains. These ontological challenges around the configurations of entities known in the Garma Maths Curriculum are where dangers need to be continually actively managed as a politics between cosmologies in the present.

In continuing to make something of this story, I turn now to an ontological issue that is prior to the politics over what is known—the topic that has concerned me in the previous paragraphs. Shifting to what many might see as subjective aspects, here I am concerned with questions of how knowers are configured. I begin by noting that, predictably, I had cried when faced with the place of a massacre. I was strongly affected by words uttered

and gestures enacted in a place where years ago entire families had been mercilessly slain. It was around the time my mother was born as the very first Australian in my family, setting her apart from her Scottish brother, so clearly my family was not involved. So why should I feel shame? And should one be skeptical about the veracity of reports of skulls being sold to museums after a massacre in the twentieth century? Such questions of individual and institutional responsibility are not what concerns me here.

After the workshop, I would moil around in conflicting emotions for days. The precisely imagined horror of the story set against the idyll of Yolngu family life in a homeland that I had briefly experienced held me in its thrall in one moment, and then suddenly I was plunged into paroxysms of worry about whether children should be exposed to such horror stories as part of the effort of learning to read. I found myself inhabiting simultaneously two intensely felt, but somewhat contradictory, modern knowing figures—an extreme form of disconcertment. I felt judgment was needed in both cases but was unable to formulate such a judgment because I did not know which figure to prioritize or how such a decision could be made. It took some time for me to see that it was the generic figure of the modern knower that was the problem here. In seeing that, I recognized that the form of conceptual knowing required in the Garma Maths Curriculum requires that the figure of the knower be dissolved into practices in the here and now, no less than the entity known.

The story of the dead of Gāngan, in both its enacted form by the lagoon and its enthused-over reading primer, was not presented in the time and place of the Gāngan workshop all those years ago with the intention of producing disconcertment. It was not that the young narrator felt I needed reminding of the horrors perpetrated by my mob who had arrived unbidden and taken over as the colonizing frontier progressed with considerable violence and bloodshed across lands known and owned by others. The story of Gāngan's dead is a story of that place, one of many, and the story can be told in infinitely many ways, with many morals, we might say. The moral I foreground is not the usual demand for restorative justice; rather, it is tensions associated with epistemic assumptions. A set of easy assumptions about universally configured knowers and what they know began to dissolve, to fall into their constituent bits, as I stood there on the veranda of a school building, transfixed by a small reading primer whose lime-green cover featured an amateurish drawing of crossed spear and rifle. The story

as I tell it here, as packing a double punch, took some time and much puzzling over before its lines became clear. While it had been clear to me for some time that in the Garma Maths Curriculum we were working prior to the tense mathematical objects of the curriculum clotting as concepts, as tense mathematical relational entities, I had up to that point failed to see that knowing subjects were likewise dissolved in the curriculum to become as bundles of practices and ephemerally clotted as cosmopolitical knowers in particular moments of learning and teaching. The form of disconcertment I experienced in Gāngan, a discomfort born as a knower configured as a modern removed judging observer was forced to simultaneously inhabit an interrupting personae, was revelatory.

Conclusion: Cosmopolitical Epistemic Practices

Engaging in cosmopolitics entails cultivating an ethos that in turn is expressed in the epistemic demeanor of participants as knowers. Recognizing this is especially important for those who participate in cosmopolitics as analysts. What is epistemic demeanor, and what is an appropriate demeanor for engaging in cosmopolitics as an analyst? An epistemic demeanor may be assertive, dogmatic, or tentative. It might be confidently tentative or timidly tentative. It can be cultivated, as it sometimes is when someone giving or receiving in communicative interaction aims to misinform or prevaricate. Much of the time, however, epistemic demeanor is not knowingly cultivated. Demeanor arises in the word "mien"—the form in which something is expressed. In writing of epistemic demeanor, I propose that form of expression and epistemic practice are intimately connected. If we wish to ask about collective epistemic practices, we must ask about the figure of the knower, about what they know and how, and how they know they know, and why they value that particular knowing.

If we could imagine the unlikely event that the questions articulated in such a typology were to be answerable in empirical description, we would have met an empirical account of a cosmology.¹¹ But the actuality is that such empirical questions one might ask of a working cosmology—"What is known?" (ontology); "How is it known?" (methodology); "Who knows?" (how the knower is configured); "How is it known to be known?" (epistemology); "Why is this knowing valued?" (axiology)—are only ever answered partially in collective enactment. Cosmopolitics is no different: there as

everywhere enacted answers are the collective, partial emergent and contingent epistemic practices that eventuate.

Nevertheless, claiming the modest privilege that arises in her skills as analyst, which carry with them special response-abilities and responsibilities, a participant analyst in cosmopolitics, in wearing her minimalist translating cosmology on her sleeve, might, in assuming a confidently tentative epistemic demeanor, propose an answer to the final question: Why, in cosmopolitics, is it appropriate to adopt the demeanor that goes along with claiming that the epistemic practices appropriate in cosmopolitics are collective, partial, emergent, and contingent? Why is that knowing valued in cosmopolitics? The answer is circular and takes you back to the beginning of my chapter. Yet in that claim lies hope, hope that an ethos that is generative of dissensus might be nurtured again, and again.

NOTES

1. "Visible nature is all plasticity and indifference, a multiverse as one might call it, not a universe." William James, "Is Life Worth Living?," *International Journal of Ethics* 6, no. 1 (1895): 10.
2. See Allen Abramson and Martin Holbraad, "Introduction: The Cosmological Frame in Anthropology," in *Framing Cosmologies: The Anthropology of Worlds*, ed. Allen Abramson and Martin Holbraad, 1–28 (Manchester: Manchester University Press, 2014), 5.
3. Endre Dányi and Michaela Spencer, "Common Ground: Centres, Scales and the Politics of Difference," paper presented at the 4S/EASST Conference BCN-16: Science + Technology by Other Means, Barcelona, August 31–September 3, 2016.
4. See Michael Christie and Helen Verran, "Digital Lives in Postcolonial Aboriginal Australia," *Journal of Material Culture* 18, no. 3 (2013): 299–317, for a treatment of all three metaphors.
5. Michael Christie and Yirrkala School Action Group, *Garma Maths* (Yirrkala, Australia: Yirrkala Literature Production Centre, 1992). In addition to a series of curriculum documents and explanatory pamphlets published by the Yirrkala Literature Production Centre, a set of videos edited from the amateur video footage generated by Yolngu teachers recording various workshops and events was produced by feminist documentary film maker Merle Thornton in the 1990s. Papers on this curriculum include Helen Watson (Verran), "The Politics of Knowing and Being Known," *Arena: A Marxist Journal of Criticism and Discussion*, no. 92 (1990): 125–38; Helen Verran-Watson, "We've Heard You Teach Mathematics through Kinship? Mathematics Curriculum Development in the Laynhapuy Schools," in *Kauna Public Lecture Series 1991*, 53–76 (Adelaide: Aboriginal Research Institute, 1991); Helen Verran, "Logics and Mathematics: Challenges Arising in Working across Cultures," in *Mathematics across Cultures: The History of Non-Western Mathematics*, ed. Helaine Selin and

Ubiritan D'Ambrosio, 55–78 (Dordrecht: Kluwer Academic, 2000). The work was funded by research grants from the Australian Institute of Aboriginal and Torres Strait Islands Studies, University of Melbourne Research Office, and the Australian Research Council, with ongoing funding from the Northern Territory Department of Education

6. The term "mathesis" currently features in theorizing of mathematics education that draws on Deleuze for inspiration. For example, Holdsworth offers an account of mathematics education informed by "Deleuze's general views about . . . the *mathesis universalis*." He proposes that the experience of mathematics education can be "an encounter with complexity that takes us . . . to a political space in which we encounter the forces of creative intensity." He sees Deleuze as "reinforcing the view that despite the *univocity of being*, mathematical and scientific practices are actualised *plurivocally*." David Holdsworth, "Philosophical Problematisation and Mathematical Solution," in *Deleuze and Education*, ed. Ina Semetsky and Diana Masny, 137–54 (Edinburgh: Edinburgh University Press, 2013), 138.

7. This logic is argued in Helen Watson (Verran), "A Wittgensteinian View of Mathematics: Implications for Teachers of Mathematics," in *School Mathematics: The Challenge to Change*, ed. Nerida Ellerton and Ken Clements, 17–30 (Geelong, Australia: Deakin University Press, 1989).

8. As I was beginning the work with Yolngu teachers, their elders, and Department of Education advisors in the late 1980s, the book I had been assembling for some time about my experience with different numbers in Yoruba classrooms, provisionally titled *Numbers and Things*, was disintegrating. See Helen Verran, *Science and an African Logic* (Chicago: University of Chicago Press, 2001); Helen Verran, "Comparative Philosophy and 'I,'" *Confluence: Online Journal of World Philosophies* 3 (2015): 171–88.

9. Bronwyn Wuyuwu Yunupingu, *A True, Bad Story*, ed. Brian Devlin (Yirrkala: Yirrkala Literature Production Center, 1981). See the *Living Archive of Aboriginal Languages*, <http://laal.cdu.edu.au/record/cdu:34418/info/>.

10. Numbers constituted in such a semiotic logic are of course quite common in mainstream Australian life—they constitute the life of the Australian Stock Exchange, for example.

11. This is a teaching typology. I developed it as a pedagogical trick to alert listeners to the actuality that although rarely articulated as questions, these questions are answered all the time in our collective going on. Note the author in the text of Latour's *An Inquiry into Modes of Existence* sets off on a quest to do just this for the cosmology collectively enacted by the moderns. Bruno Latour, *An Inquiry into Modes of Existence* (Cambridge, MA: Harvard University Press, 2013).

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FIVE

DENATURALIZING NATURE

John Law and Marianne Lien

If we talk only of singular Man and singular Nature we can compose a general history, but at the cost of concealing the real and altering social relations.

—RAYMOND WILLIAMS, *Problems in Materialism and Culture*

What if there are Nature-wholes made real, and what if these "Natures-made-real-as wholes" matter? What if there are Nature-wholes made real in relation to, as well as a consequence of, other practices, wholes and entities?

—KRISTIN ASDAL, "Enacting Things through Numbers:
Taking Nature into Account/ing"

It is important to understand how what we sometimes call the modern makes itself smooth, singular, and overwhelming, but it is also a mistake to take this at face value. Instead, its crevices and cracks deserve exploration, both because they are crucial to its techniques of power and because they suggest strategies of resistance.¹ In short, so-called modernity is both coherent and not coherent at all.²

In this chapter, we develop this argument in one particular context by exploring how a set of contemporary northern practices naturalize nature. Our answer, inflected by science and technology studies (STS), is that this happens in an intricate play within and between practices. On the one hand, these work on the assumption that nature is a single reality separate from culture and that nature is given. On the other hand, they simultaneously operate to generate natures in multiple and divergent forms. In