Numbers in Arnhem Land

value and difference in a postcolonial mathematic

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Declaration

This is to certify that:

i. the thesis comprises only my original work towards the PhD except where indicated in the Preface,
ii. due acknowledgement has been made in the text to all other material used,
iii. the thesis is less than 100,000 words in length, exclusive of tables, maps, bibliographies and appendices or the thesis is 69,190 as approved by the RHD Committee.

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Christian James Clark
Summary

In conventional accounts of mathematics and number there is nothing new to learn: difference and value always arrive internal to the accounts. Is there potential for alternative forms of mathematics, the potential for number to do more than name value? How might we learn to work with numbers that perform multiple valuations and how might we learn from number in situations that are constituted through difference? Can difference become more than what is left in the aftermath of 'our' values, and become a positive potential for learning new ways to value? These questions can only be understood and addressed through an empirical and philosophical re-conceptualisation of number, value and difference in situations constituted by difference.

*Numbers in Arnhem Land* investigates the role of number and the ways in which it promotes a quality of oscillating value. Through an empirical investigation, number is understood as an event, an active and embodied relation or comparison done through and as difference. Numbers as event differentiate specific relations in collective life. Learning how number does value demands learning how number can articulate itself as relations that are multiple and open. The notion of oscillating value has value not as an abstract property of number, but a virtual quality. Valuations are the limits number approaches within the event. Understanding value as limits in this way allows numbers to play a full role in constituting collective life.

Learning the potential of number through value demands an understanding of empiricism and ethnography that is also committed to difference as primary and irreducible in the encounter. Relational empiricism, as developed through this thesis, is not the measuring and valuing of worlds already ordered and valued (the forms of empiricism offered by both universal and relativist critiques), but the work of resonating differences, becoming sensitive to more tones, the audible and inaudible, through which new forms of collecting living and harmony may grow. Relational empiricism is an empiricism which is thoroughly experimental.

*Numbers in Arnhem Land* is a post-colonial encounter. The analysis is located in between the Yolŋu ways of living in North East Arnhem Land and the dominant modes of living in Australia. It operates in between European thought and Yolŋu thought and in between the intellectual traditions of the academy and those of Aboriginal Australia. The problem for which this thesis works solutions is a problem of the postcolonial situation in contemporary Australia. Through engaging in an encounter through living 'in between', this project is itself performing and enacting relations. These relations are comparisons, the active
holding together of difference in ways that sustain learning and participate in collective life in ways that are open and hopeful.

In articulating number through difference, and feeling for ways into the resonances through which number operates as difference and through oscillating value, this thesis demonstrates a mode of learning value through a respect for difference. This thesis claims that caring for difference in such a way opens the way for a renewed and revived study of number and empiricism in the social sciences.
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'I spy with my two little eyes something beginning with bee.' 'Banana!' 'Bottle! 'Biskit!' We are driving home from a fishing trip and devouring the last of the snacks. 'I spy' has become a popular game. It is both wildly fun, beginning with someone singing the lively tune 'I spy with my two little eyes something beginning with …', and quite serious, clearly evident in the precision of Yolŋu children who always spy with their two little eyes ...

'Balanda!' The word seems to have shot out of the mouth of one of the Yolŋu children before she has thought. As equally involuntary as her interjection, Balanda, she looks at me confirming the presence of a pale-skinned European, then immediately looks away in a wave of acute embarrassment. Laughter bursts in filling our bodies and the car.

She has just called me, her dad, a Balanda – a name from Macassar, meaning Hollander or European. My partner and I had been adopted into a local Yolŋu family, many of whom were presently tightly squeezed into our car. Everything within the Yolŋu world is related through kinship: people, places, animals, cars, plants, songs and
languages and so on. My partner and I became embedded in these relations. Every weekend our family took us to visit various places pointing to and naming trees, waterways, and car wrecks and introducing us to campsites, people, winds and fish. Like the game 'I spy', being a Balanda adopted into a Yolŋu family and their kinship system is a lot of fun and quite serious. This moment in the car, one of discomfort for both the child and myself, is the sudden visibility of contradiction which is at the very heart of being an adopted Balanda. That's what precipitated the laughter. More than taking us fishing, teaching us Yolŋu languages, introducing us to people and making us welcome, our adoptive family generously lived this contradiction, together with us.

As a researcher and ethnographer, kinship is the medium through which you are introduced into and belong within the Yolŋu world. The people you spend time with, the places you visit, the languages you learn are all mediated through kinship. It is an ethics of both knowing your place and your relations. You are at once a newcomer and a junior member, learning how to respect these relations and how to behave within the respect that you are granted by virtue of your relatedness: to people, clans and places. This Yolŋu system of relations, Gurruṯu, is an arithmetic: a system of determining who and what counts and in which ways. As one counts in say years and kilometres (one year of living in Arnhem Land, 600 kilometres from the nearest city of Darwin) so in gurruṯu: a time and place through which things become located can be plotted. Counting in gurruṯu is determining your position within the relations of people and place. When a Western mathematic of number and a Yolŋu mathematic of gurruṯu come together, when your 'dad' is simultaneously 'malu' and 'Balanda' there is both great discomfort and great laughter. Squeezed into a car, driving down a dusty road, sharing drinks and snacks while playing I spy is just one way this sameness and difference is done and redone, all the while negotiating what sameness and difference is (at least for the time being).
‘Nhä, English-gurr or Yolŋu wurr.’ Through English or through Yolŋu language one of the older children asks. ‘English-gurr’. The siblings revel in the challenge of the game, testing and demonstrating each others intellect. Playing the game in English both allows for the fun as nothing too insulting or dangerous can be said, but also allows the children to demonstrate their skill in a third or fourth language. ‘Book!’ ‘Yaka.’ ‘Seat Belt!’ ‘Yaka.’ ‘Boot!’ ‘Yaka.’ We are all thinking and the car falls silent. ‘Give up-na?’ she says excitedly. ‘Bark!’ ‘Yaka!’ ‘Berries!’ ‘Bee!’ ‘Starting with bee muka.’ ‘Nhi [yeah]… Bee. Gukuwuy [from honey]’ ‘Barge!’ ‘Wanha barge? [where's the barge?]… Bāyŋu barge [there is no barge].’ The barge, which brings food and other supplies, visits once a week, coming up the river in the few hours during the high tide … We are all thinking again. Stumped. ‘Bilinydjjan! [kinship name]’ ‘Yaka Bilinydjjan. English-gurr.’ ‘Buffalo!’ This time we look more carefully out the windows. ‘Wanha?’ ‘Where?’ ‘Bāyŋu.’ ‘Bush!’ She smiles. ‘Nhe right [you're right], Bush.’ ‘Darra turn [my turn]’ says the guesser of ‘Bush’ and she starts it off again. ‘I spy with my two little eyes something beginning with …’

Half an hour later our convoy has stopped in town giving some fish to the old ladies who had not come and replaying any news from the day. I had run the car into a tree, providing much amusement in its retelling. While this goes on outside, inside we are all trying to thinking of something starting with ‘Tee’. Tree! Track! Truck! T-shirt! Dog! Yaka dog. Tee muka, yaka dee. ‘Tricky Dog!’ ‘Teacher’, I look at my partner who frowns back: this is a weekend, the two days of the week she enjoys not confined to the school in which she works, a place where contradictions are not generously lived.
triumphantly. 'Wanha?' 'Ŋunha [over there]. Seven ga four ga two' she says reading the
tumber plate of the car parked over the road. 'Thirteen.'

My adoption into *gurrutu* was perhaps unconventional. I had not spent long
periods of time with any Yolŋu people to necessitate any real existence (the guy with the
truck, the woman at the council) nor had I any strong relationship with Yolŋu to warrant
my existence. I had nevertheless got to know many Yolŋu who worked from time to
time as consultants at Charles Darwin University. Darwin is the capital city of
Australia's Northern Territory, and in part to fill the time while my partner spent a few
days in 'remote teacher orientation' within the air conditioned conference rooms of
Darwin's most expensive hotel, I went to the University to catch up with some
colleagues and friends.

*Gapuwiyak*. That was the name of the settlement in which my partner had
accepted a teaching position, a position which granted permission to live in the
community and a government house: the best possibility I had for undertaking extended
fieldwork. 'Gapuwiyak', said my friend and colleague as we sat in his office. He
explained to me that the brother of Mark, one of the Yolŋu consultants I had come to
know through the university, lived on land owned by his family from time immemorial,
his *homeland*, which was near the settlement of Gapuwiyak, whose history in
comparison was almost insignificant. 'They are a kind and very generous family' he
said. 'Good people … and if this brother agrees to adopt you, you will be well connected
across Arnhem Land through Mark, and here at the university.' Once adopted, he
explained, upon meeting any Yolŋu, I will be able to tell them Mark is my brother.
People will know him and their relation to him, and be able to work out their
relationship to you.

I was beginning to see how being counted in Yolŋu kinship was being given a position. Being adopted as a brother by the man living on his homeland would make me brother also to Mark. I would become related and recognisable to Yolŋu all over Arnhem Land, brother to all their brothers, father to all their children, a son to all their parents. But already the English kin terms are struggling to grasp gurruṯu: 'a son to all their parents'? Isn't there only two, a mother and a father? Gurruṯu can be thought as a system of relations: mother-child, father-son and so on. The terms of these relations are not individual people, but positions inhabited by people of the same heritage. Just as a man and his brothers are all brothers and in doing so occupy the same kin position of brother, having many people in a kin position holds other relations. These men are also all fathers to all of their collective children, and all sons to all of their collective parents. Hence, someone has many mothers and many fathers. I am using English versions of the gurruṯu relations because they are literally familiar to English readers. There are Yolŋu names of course, and these can be written in an orthography developed in the last fifty years. These will be used and they too will become familiar as we go, but standing in an office, with my friend about to pick up the phone, gurruṯu is still strange and impossible to grasp.

'Yo! Hello.' The phone call is happening. We have caught the brother by ringing the municipal motor mechanics workshop where he works. The conversation is in Yolŋu matha and undecipherable to me. The intonation suggests a question. 'Will you adopt a Balanda you have not met on my trust?' A pause, the conversation resumes briefly then ends. 'So, he will adopt you as his brother. That is good. The only thing is that your partner will probably become my mother-in-law, but we can work that out.' I knew that
certain kin relationships were ones of such great respect that general avoidance is the appropriate practice, including not looking at, speaking to, speaking the name of, or giving any direct indication toward these people. As to the relationship between my partner and friend, both Balanda and whom until recently were strangers to one-another, being mother and son-in-law in gurrwę … it was another contradiction to be worked through in the interface of two radically different ways of working who counts and in what ways.

Would I ever find numbers 'at home' in North East Arnhem Land, living with Yolŋu and not simply in addition to them? I was sitting at home at the start of another day, beginning to worry I would not. There is money at the shop of course, maths lessons at the school, the accounts in the local council. But these numbers seem too sheltered within settler institutions, working in air-conditioned rooms, stopping at five in the afternoon, yet never out fishing or at a fireside. Numbers seem to be thoroughly embedded in the division between Balanda and Yolŋu. My one hope is the high school maths teacher and two young women in their final year of school. The teacher is planning a project using Global Position Systems and Geographical Information Systems software to map the local area. I keenly offered to be involved, to drive the group around and help in the organising of the various trips out to 'places of interest'. So, this morning I set off to the school with a little more confidence in meeting some numbers which might venture outside of rigid divisions.

Walking towards the Men's Clinic, I see the old man sitting in the morning sun. 'Nhämır rhé? [how are you?]’ I say. I had been told that this man was my older brother, but I had never spoken to him directly other than our occasional 'how are you?’ He was
often at the men's clinic which is on the way from my house to both the shop and the
school. 'Manymak [good]' he replies, and then adds 'räli gu' motioning for me to come
and sit. I sit down next to him on the concrete veranda. He asks what I call Daniel, the
man who adopted me. 'Đarraku wäwa'mirrinŋu [for me, brother]' I say. He says that we
are brothers and begins telling me about the homeland at the Barge Landing and the
many names for all the different places. His hand motions to the places as he names
them.

In the last few months Daniel and I have been talking about producing a video
about the homeland. In part it is to explore the use of video and digital technologies at
the homeland, and this may produce problems and question for my research. It may also
become a way to inform non-Yolŋu of the ownership of the area, a need created by a
group of newly stationed policemen who are going off hunting in the area without
seeking permission. Daniel has mentioned that he will need my two older brothers to
speak for the homeland, and perhaps it is this story that has the older brother sitting with
me now, telling me these place names. Or perhaps he is simply informing me of the
wäŋa, the homeland or people-place, into which I have been adopted. I tell him what I
have been talking to Daniel about and he replies he is busy this weekend because he
will be going to a dhäpi, a boys initiation ceremony, at a related homeland. I mention I
might be going too and he bursts into a smile and pats me on the shoulder.

'Nhälil marrtji ga? [where are you going now]' he asks. 'School lil.' 'Ma', he says
indicating that we are finished and that I can go, but I take the opportunity to ask him
about the project at the school. The most detailed map the teacher has with him is a
water resources map. He is using this to bring together the GPS work and a
sustainability course on water. The teacher has mentioned to me that he wants the
project to visit a fresh water spring, which is within the homeland of this old man. I tell the old man this. He asks who the students are who would be going. I know only their Balanda names. He knows only their Yolŋu names. I tell him how I am related to them and point to the houses they live in. Having thus established the relations of the two young women, the old man sits motionless and looks to the ground, clearly not impressed at the plan. 'Ŋunhi wāŋa Dhuwa, maṉḏa Yirritja [That place is Dhuwa and those two are Yirritja']. He neither refuses nor grants permission, but kindly informs me that we need to talk to another brother.

Yirritja and Dhuwa: the two moieties which divide the Yolŋu universe. The most basic way anything counts in the Yolŋu world is either as one or the other. Holding this difference together as difference is also very important. Dhuwa clans are caretakers for Yirritja clans land and religious knowledge, and vice versa. Yirritja men marry Dhuwa women, and vice versa. A child is always the opposite moiety of its mother. These are foundational laws and deeply embedded in gurrutu and Yolŋu life. In following the teacher and two young women as they mucked around with handheld GPS devices in studying environmental water, I was hoping the project might try to manage difference in knowing and caring for place: one known by coordinates and cared for through proper management of the division between society and environment, the other known through ancestral journeys and cared for through the proper management of the division between Dhuwa and Yirritja. Perhaps I might witness a kind of comparative mathematics emerge after all!

At school and I tell the woman working in reception my problem, 'where these two students should and should not go', trying to make it an issue for consideration and potential negotiation. She suggests a place which is nearby. It is a Yirritja place. It is
also a popular and common swimming place for the community, including Balanda. Anyone can go to without seeking permission in advance. I ask the Principal and she is happy with this place for these students. She briefly considers it and says 'ma', Okay. Outside the office I see my sister-in-law and tell her what I am doing and of the decision just made. 'Yol ɲalapal ɲuruki wâŋawu? [Who are the old people for that place?]’ she asks herself out loud. She gives me a woman's name and tells me she is living in the green house or yellow house. The woman is also the mother of a student in the same class as the students doing the GPS project. This is all going well I think, relieved. I go and tell the teacher what has happened. He says he will ask his student to take him to her mother to ask for permission after school. Hopefully the trip will happen the next day.

One the way home the old man is still sitting at the men's clinic. 'Biliŋ?’ he says. Done? 'Yow’. Nhāpurru dhu marrtjin Baralmanhalil [We will go to Baralmanha], I say. He begins to laugh 'Manymak wâŋa' he says. 'The right place?’ I ask, 'Yo!’

The next day I drive to school. Students are coming in from morning break. The teacher is busy filling out the Department Movement Requisition Form: departure time, return time, car registration plate, places to be visited. Soon he is ready with the two women, and a young man who is coming for the ride. 'Do you know what we are doing?’ he asks the students. No reply. We get in the car and start driving. We have no map as I roughly know the way. The students talk in the back, the teacher and I unable to understand them. Soon I am asking directions of the students, and in response the young man gives little gestures with his hand indicating which track to take, left or right, as track begins to folk more and more as we approach the river.

We arrive at the swimming place. Peter gives a GPS to the two women as they
are doing the project and a digital camera to the young man who starts looking through
the photos stored on the camera, then starts taking pictures of his two friends. 'Take
photos of the place, or nature', the teachers gently instructs. 'Of the water.' We stand in a
loose group waiting for the two GPS to find the satellites. Soon the screen shows twelve
satellites on a background of nested circles, each one numbered: 1, 2, 3 … up to 12. The
teachers demonstrates on one GPS while one of the students follows: push one button
once and then another button twice. This records a 'waypoint'. Done. The students are
now free to take pictures of each other, while the teacher jots down on a clipboard the
road condition, a numeral for the distance from Gapwiwik and a numeral for the time it
took to drive here. 'Can you drive here all year round?' he asks. 'Bäyŋu. It's a dry season
swimming place' one of the students replies. 'And what's the name of the place?'
'Baralmanha.' He writes it down 'place name: Baralmana'. 'And what's the name of the
river?' 'Baralmanha.' 'The same?' 'Yeah, same.' The teacher leaves it blank 'river name:
…' The works feels trivial, a public place within which the Yolŋu systems of relations
remains stabled and backgrounded, a few clicks of a button for which Western space-
time remains stable and backgrounded. We jump back in the car and drive back to the
school for lunch.

The pilot is shaking his head. 'No I won't be able to do that' he says as he forces
the clip on his clip board wide, sliding the bank notes I have just paid him underneath.
One thousand four hundred and fifty dollars, in $100 and $50 notes. The charter plane
had been hired by my adoptive Yolŋu family to fly some relatives from a community
600 kilometres away to Gapuwiwik for the funeral of one the family's oldest women. It
is March, only months after the monsoon and most of the roads were still cut off by
flooding rivers. This time of the year is the most profitable time for the few private
charter companies in the region. My sister-in-law and her children were at the airport to greet those arriving. I was there as I had been holding onto the money and had also helped organise the charter. My sister-in-law asked me to ask the pilot if he could fly to another community twenty minutes away (by air) to pick up one of her daughters and bring her back for the funeral. This flight cost two hundred and eighty dollars each way, five hundred and sixty dollars to pick up her daughter.

There was no way the family could get together that much cash to pay him on the spot. It was a Saturday and the banks were closed, but all their accounts were almost empty anyway. After a series of phone calls to the daughter they had organised a way to pay him. They explained to me that waiting for the pilot with the daughter was a EFTPOS card. Money would come into the attached account on Monday, two days from now. They would give the pilot the card and its PIN number and he could withdraw the money on Monday. This is what he was refusing to do. I thought of charging the flight to my credit card. No. I had already contributed five hundred towards the charter, and this extra money would be considered lent from me and my sister-in-law, which would only continue this already stressful episode which had begun three days prior.

I had first become aware of the problem on Wednesday. At the Barge Landing I had seen a piece of paper that had clearly originated in the school. On one side was some work one of the children had brought home from school. On the other, someone had written out names with numerals for money next to them. This list on the cast off piece of paper had caught my eye. Four names, four sets of numerals. The numerals were the fortnightly pay that each person would receive the next day. They were all on the Community Development Employment Programme: a Federal Government program to undertake community based projects and services to employ Indigenous people living
in places where there were few other jobs. Each payment was just less than four hundred dollars, and adding it up would maybe make around fifteen hundred dollars. Next to them was written 1450, which I was soon to learn was the price of the charter to fly in their daughter and sister.

The next day, when their payments came in they bought a small amount of food, not enough to last them a week let alone the two weeks until the next pay day. With the inevitable demand on food due to the influx of visitors for the funeral, the food was going to last even shorter. My partner and I were asked to help pay and had committed to giving five hundred dollars: my partner's government salary and our rent-free house were generous and we tried to extend this generosity when and where we could. At our house, we laid out the notes the family has collected so far. I put them in piles of two hundred dollars. Nearly all the notes were fifty dollar notes. Mavis looked at the array, pushed it into one pile and counted it again saying she was counting it 'Yolŋumirri', with people. She put out four fifty dollars notes in piles of two, 'Darra [me]', she said. Then she said her daughters name and put out six fifties. This included her son-in-law's contribution to whom she would not refer. Bianca she said, and put out four fifties and then 'yapa', her sister, and place the rest of the notes out, combining them with Bianca's and announced 'three hundred ga fifty'. The amount was still one hundred short. I called the charter company to book the plane. They could fly on Saturday and they accepted the booking held against my credit card.

The next morning Daniel and Mavis arrived at our house. They needed to use our phone to call their daughter and tell her about the charter. In the careful and anxious working out of money yesterday they had not included the cost of a second phone card which they need to make calls from the homeland's public phone. The night before they
had run out of phone credit. They make the necessary calls and go to leave. 'Where are you off to now?' I ask. 'Maybe we'll go fishing', my brother says with a wry smile. 'Fishing' I say in response to the smile, a little surprised they would go fishing in the hottest part of the day. 'Yeah, and maybe we'll catch you that hundred dollars we need for the charter. Where's a good spot to fish, do you think?' An hour or so later they return with a 'second hand lunch', some bread and tinned meat given to them by some relatives, and two fifty dollar notes. I add it to the collection, which now included my ten fifty dollar notes, and then count it out on the table, this time in piles of two notes. As I do it their ten year old daughter leans over the table, 'one hundred, two hundred, three hundred, four hundred' she is saying pointing to each pile of two fifty dollar notes, 'five hundred, six hundred, seven hundred, eight hundred ...' She takes a breath, 'Nine hundred, ten hundred, eleven hundred, twelve hundred, thirteen hundred, fourteen hundred … and fifty.' It is a lot of cash, difficult to amass, an effort even to count.

The sticks are making the officer nervous. The dancers, all young men, are holding foot long sticks above their shoulders like spears. The sticks are all pointed at a door, in front of which the new police officer is standing, hands held behind his waist, widening his chest. I imagine the dancers with real spears as they would usually use in this ceremony which is often performed to 'open something up'. The young dancers have slowly led a large group of people including the older men who are singing, beating clap sticks and leading the ceremony, two other police officers, the Chief Minister for the Northern Territory, a few journalists who came in on his plane, local government bureaucrats and a few members of clans performing the ceremony, some of who are recording the ceremony on mobile phones.
Prologue

‘One!’ shouts a ceremony leader. The dancers have retreated a little into a tight group. A single line of song is sung, then suddenly the dancers almost run towards the officer and door, stick/spears held chest height also rushing at the door/officer. The dancers retreat only slightly, slowly drawing the whole gathering further within the police compound, squeezing bodies closer together, and building the intensity of the ceremony. ‘Two!’ A line of song is sung twice and the group rushes again at the door. The officer flinches and the dancers retreat. ‘Three!’ The line is sung once, twice, thrice, the officer braces himself, holding his breath. The dancers rush at him. The young men are fit and putting all the energy into the dance. They are wearing only shorts, with white ceremonial paint smeared on their faces, torsos, arms and legs. The officer breathes out as the group recedes, perhaps hoping that ceremoniousness is a universal character of the number three. ‘Four!’ They rush in again, getting so close to the door the officer steps aside. A final call and the door is pieced open by the dancers.

The door is opened both ceremonially and literally. The young men are given cool drinks, and put on T-shirts over their painted bodies. The police station is officially open and it is time for speeches. For the first time in the community's forty year history it has a police station. The station is part of the Northern Territory Emergency Response, a Federal Government take over of remote communities in the Northern Territory. In the minds of a few ministers in the incumbent government, nine months earlier, these communities became understood as being 'in crisis'. A Major in the Australian Defence Force has been given the task to stabilise, normalise and then exit these remote Indigenous communities. The police station has been hurriedly assembled: a large barbed wire fence surrounds the site, shipping containers from China are fitted out as offices, sleeping quarters and holding cells, a portable pool and barbecue is set up under a shade sail, and police are seconded from other State jurisdictions.
Gapuwiyak is the only police station to be opened by the Chief Minister. The school is closed after ensuring all the children have bright new uniforms and the teachers are ushering the students to sit on the grass in front of where the speeches are to be made. I am standing with a few high school boys at the back. I have been given a job managing the enrolment system at the school. School attendance has become a hot issue and soon the police will offer to bring kids into school who they see out and about during school hours. The school itself has insufficient classrooms and teachers if even eight in ten of the school age kids turned up. But the students recorded 'P' for present in the School Administration and Management System, and uploaded the central Education Department server each Friday at 3pm, are of great importance. 'Numbers, numbers numbers' the school Principal told me. A primary school class performs actions to a book being read to them by their teacher. Afterwards, two Yolŋu kids sit with the Chief Minister who holds the book, one child on his left knee, one on his right. A photo is taken, he is happy and a trinity is restored.

'Take fifty dollar to the shop and buy us all a drink!' All of us smile, and a few men start laughing. Sitting cross legged, a man leans forward and picks up a small, droopy eared, black and white puppy. 'So who's going to get this drink then!' The laughter spreads. 'Hey, pass that yellow one [referring to a fifty dollar note by its colour] here and I'll put 'im in my pocket!' The joke becomes fully accomplished, everyone is laughing. The puppy is affectionately roughed around the ears by one man. Other men start calling, 'fifty dollar', 'fifty dollar', petting the ground to attract the puppy's attention. The puppy seems to respond to the calls and a young boy, furious, throws his empty drink bottle at his father and storms off.
The men are sitting in a small group, in a rough circle on some cotton sheets. We are sitting next to a house which is the focal site of the funeral my mukul bäpa, my father's sister. My brother introduces me to the men I do not know as relations: ɲapipi [my mother's brother] märi [my mother's mother and her brother], guṟruŋ [my sister's daughter's husband] and so on. I follow this simple Yolŋu matha and greet them by their kin name. Most of the men are visiting. They arrived yesterday and have begun singing through the places, plants, animals, clans and stories which define the identity of the person who has passed away. One man plays the yiḏaki [digeridoo], two the bilma [clapstick], two sing and the rest of us sit quietly. In the middle of the sheet is a tape recorder. Between songs, there is light conversation, catching up on news and gossip.

During one break, someone inquires into the name of the puppy which has been playing with us. One man smiles and says 'Pipty dola' speaking in creole. 'Pipty dola?' There's general surprise. The man explains that his son, who is sitting on his knee, was given a fifty dollar note some weeks ago. Someone had taken the note and when his son had demanded it be returned, he was given the dog. The son was told the dog had been bought with the fifty dollar. The son's face was beginning to screw as we all relived the experience. His dad continued. His son was so angry he wanted to kill the puppy, and kept asking where his real 'pipty dola' was. His family had tried to convince him that the dog was the fifty dollar note and called it so. The son was clearly still upset, understanding that despite the name of the dog being pipty dola it was not pipty dola. And so for quite some time between ceremonial singing, the group indulged in the literalism of the dog that was its name, pipty dola, the comedy of the black and white dog being a yellow one, and the tragedy of the exchange being experienced by the son.

* These stories are compositions. Some are more or less narrations of actual occasions while others are composites of several occasions. All the empirical stories in this thesis are of this same nature, which is considered in Chapter One in the section "Empiricism and Multiplicity".
Part One
Beginning with Difference: number, empiricism and the postcolonial

Problems of Number, Problems for Postcolonialism

And so we have arrived. Perhaps a little disconcerted, but here all the same. Differences abound: differences in arithmetics, differences in ways of counting and being counted, differences in people, differences in language, differences in place, differences in number. Sometimes these differences become important, sometimes they become trivial, some take much effect to achieve, and others seem unyielding and stubborn. And these differences have feeling: they are joyful, I spy thirteen, painful, we don't accept EFTPOS cards, familiar, the Trinity and surprising, four! Sometimes numbers work easily as symbols, for example when we have '12' satellites on the screen of a GPS. Sometimes they are iconic, for example fifty dollars is fifty dollars, but other
times they are not when $1450 in bank notes today is not the same as $280 on a bank card on Monday. So number itself is multiple. Yet sometimes number seems absent all together, completely separated out from others ways of counting and relating the world. When numbers do emerge, however, they are always in rituals of negotiation, routine acts that establish ways of living together in better or worse ways. What to do with all this difference? What to do with number?

This introduction is in four parts. The first follows number studies in the social sciences, considering their approaches to number and the methodological and philosophical demands made by number as a researched entity – the 'hardest case' of Western science and thought. These questions are then dealt with explicitly in the second section which develops an account of relational empiricism as a way of sustaining research on number in productive ways. The third section gives an overview of number in Yolŋu life, and how it has behaved in sustaining or undermining life in Arnhem Land for Yolŋu and others. The fourth section brings all three threads together under the notion of postcolonialism. Postcolonialism is situation and sensibility constituted through irreducible difference. This offers a wider framing for this study of number which becomes postcolonial in the sense that it sustains and is sustained by an account constituted by difference. In maintaining difference as always immanent in postcolonial places we can begin to sense the new within the present and begin to grasp opportunities to make our collective future different from our pasts.

**Number Studies in the Social Sciences**

Number and mathematics have become topics of sustained interest in the social sciences over the past three decades. At present, number is enjoying a revival in interest in science studies and sociology, in the social studies of finance and accounting, and in
anthropology. The field of science studies has perhaps made the most significant contribution to the study of number for which it has established a variety of approaches and methodologies. This variety is perhaps characteristic of a research field that has never had clear disciplinary boundaries and one which is nourished by this diversity. For all these approaches, which I will outline shortly, mathematics and number are considered 'hardest cases' for they epitomise the tightly bound tropes of modernity: objectivity, rationality, rigour, universality and abstraction.

Studies of number have also been at the forefront of methodological insights and innovations, perhaps because processes of generalisation and equivalence are considered central to the very possibility of research and knowledge. This section presents a potted history of number as it has been studied in the social sciences. Threaded through this story of the problem of number is its embeddedness in the problem of empiricism. The most recent conceptualisation of number as embodied assemblage marks an important philosophical development both for number studies (and conceptions of number more generally) and empirical research.

Conventional understandings of number, enumeration and quantification consider them as abstract and universal; true everywhere and grasped inside people's heads. As such, studies of number have remained for the most part, closeted in mathematics and philosophy departments. In the late nineteenth century, however, studies of numbers began to emerge within the new social sciences, albeit by simply borrowing the universal number of science. For Adolphus Mann and the Royal Anthropological Institute of Great Britain and Ireland, and Levi Conant in the US numbers were universal abstract objects in the world (Conant, 2009; Mann, 1887). The identification and knowledge of these universal numbers were understood to
Chapter One

demonstrate a measure of the development of a people's thought and civilisation, with English number names and Western science demonstrating the pinnacle of human progress. Evidence of number knowledge was primarily produced as tables of number names for different languages, which were then used to demonstrate the hierarchy of 'races' for whom the languages were a native tongue (Toy, 1878). In this early research, number was an indicator of civilisational progress and a legitimator of the expanding colonial empires.

It was almost a century later that anthropology again produced major works on number with Mimica's *Intimations of infinity: the mythopoeia of the Iqwaye counting system and number* (Mimica, 1988) and Crump's *The Anthropology of Numbers* (Crump, 1992). These works consider number as symbols, divorcing number names and numerical systems from any singular 'reality' of number. In doing so, differences in number names and numerical systems were prevented from reifying into differences of the civilised and the primitive. In being merely symbols, number could now accommodate variation across cultures and languages. However, as symbols, numbers were understood by both Mimica and Crump to be given within a universal human cognition. Numbers, therefore, do not necessarily exist within a mathematics, understood as logics and practices of manipulating number, which Mimica considers 'a specific form of Occidental cultural knowledge' (Mimica, 1988: 6).

Around the same time, Sal Restivo outlined the importance and potential of a sociology of mathematics and number. Restivo argued that such an analysis would relativise number through understanding that 'number worlds are embedded in and reflect world views' (Restivo, 1982: 138). These world-views, however, were not fixed or hardwired into different cultures (that is not a set of parallel universals), but were the
outcomes of specific places and histories, organisational resources and civilisational processes (Restivo, Collins, 1982; Collins, Restivo, 1983). As a product of specific social realities, Restivo's 'relativised number' became an object of research situated in the variety of social realities and demonstrating a variety of types of numbers. This research of studying particular social realities from which mathematics and number emerge continues today (Restivo, Bauchspies, 2006; Lampland, 2010; Stafford, 2010).

The possibilities that this relativised number opened up and the unsettling of universal mathematics it afforded has developed in three specific programs in the area of science studies: the ethnomethodological, the genealogical and the postcolonial. In *The Ethnomethodological Foundations of Mathematics* (Livingston, 1986), Livingston argued for an account of mathematics and mathematical objects grounded in the local, practical and embodied work of mathematicians. In his account, the properties of objects such as circles, triangles and proofs emerged through local work and were considered as 'intrinsically social objects' (Livingston, 2006: 41). This ethnomethodological approach has also been pursued by Bloor. Bloor was initially concerned with the inability of Livingston's strictly local analysis to deal with social and natural processes outside the immediacy of a local setting, including one's own theorising (Bloor, 1987). In Bloor's more recent work he employs Barnes' distinction between natural and social process and entities, and argues that their interaction in particular social and historical moments produce different forms of mathematics, the uses it is put to and the authority it is granted (Vincenti, Bloor, 2003). This typology of social (S-type) and natural (N-type) processes and entities has most recently employed by Mackenzie in his study of number in finance and markets.

MacKenzie's work continues the ethnomethodological approach, researching
the practices that bankers and accountants perform in their everyday work. MacKenzie uses the social/natural typology to emphasise the difference between entities which are more or less stable and defined by fixed properties, his examples are numbers in physics, and those which are emergent and changing, in his words 'performative', which is more characteristic of numbers in economics and finance (MacKenzie, 2001). He argues that in contemporary economies and markets, including emerging markets such as carbon markets, numbers such as the London Interbank Offered Rate or 'LIBOR' and the Global Warming Potential or 'GWP' are performative: they are in constant production, sometimes daily, and are therefore always in constant reproduction within collective practice which is inherently unstable and subject to change (MacKenzie, 2007, 2009). According to MacKenzie, understanding these performative entities, and most importantly performative numbers in markets, is a central task in contemporary social science:

>'if science studies is to fulfil its promise, it must grapple with the myriad ways in which high modernity is a scientific and a technological society: finance theory and its practical applications to the financial markets are among the most important such ways.' (MacKenzie, 2001: 119)

In addition to these recent and not so recent ethnomethodological studies of market number and finance number, there has also been important research into the genealogies of these numbers. In her book, A History of the Modern Fact: Problems of Knowledge in the Sciences of Wealth and Society, Mary Poovey's describes modern facts as entities which 'simultaneously describe discrete particulars and contribute to systematic knowledge' (Poovey, 1998: xii). For Poovey, number as numerical representation epitomises the modern fact. Hence, the question of what numbers are, is also an epistemological question of 'how knowledge was understood so that it seemed to consist of both apparently noninterprative (numerical) descriptions of particulars and
systematic claims that were somehow derived from those particularized descriptions' (Poovey, 1998: xii). Hence, for Poovey, the modern fact and number become her analytic tools with which to unravel the formation of a particular form of knowledge for which observed objects are simultaneously particular and general.

Poovey is therefore presenting numbers as inhabiting a form of empiricism in which different objects are unique yet always already 'generalised' in that they are given as self-evidently measurable against or comparable with other entities and scales. Number as a modern fact resolves the problem of induction, a problem first posed philosophically by Hume. Kant resolves Hume's empiricism through performatively and invisibly positing thought as universal ideas and concepts internal to minds and the worlds as discrete things knowable through such ideas and concepts (Waxman, 2005). Poovey's own analytic frame (Poovey, 1998: 20) is inspired by Bruno Latour's alternative to Kantian metaphysics developed in We Have Never Been Modern (Latour, 1993), and her work was heralded as a unique contribution to science studies (Brantlinger, 2000).

The emergence of number and numerical work in economics, accounting and administration is also the puzzle of Theodore Porter's Trust in Numbers (1996). Through predominantly historical episodes, Porter argues that the ubiquitousness of number and quantification in modern societies has come predominantly from the social sciences rather than the natural sciences. That is, the numbers that inhabit contemporary life are more often those which have emerged as objects of problems in the social sciences, compared to those numbers which have emerged as objects of problems in the natural sciences, especially those of mathematics and physics. For Porter, 'quantification is a technology of distance' (Porter, 1996: xi), and concerns the control and trade of absent
entities, either elsewhere in place, for example trading commodities in central trading houses, or elsewhere in time, such as futures trading.

While Poovey's *History of the Modern Fact* was perhaps a more surprising contribution to science studies, Porter's work was considered a 'paradigmatic' work for science studies (Hagendijk, 1999). In his review of Porter's book and the enormous response it received (over forty reviews in the twelve months after its publication) Hagendijk argues that Porter's work,

> 'raises fundamental questions, and discusses them in a creative way. It indicates research directions and suggests further studies and intriguing comparisons that could be made. As such, it is a very important contribution to the research agenda for STS' (Hagendijk, 1999: 636).

These 'fundamental questions' Porter's work raises relate to questions regarding the empirical and theoretical contributions of the work and the tensions that arise when such a grand investigation is attempted. Did Porter use enough historical episodes for his argument that numbers operate in processes which generate standardisation and trust, or did his selection of empirical cases constrain the analytic value of this work on number to situations of standardisation and trust? What of the empirical material contributes to the analysis itself: merely the quantity of data, the diversity/quality of date or something else?

Michel Callon offers a way these questions can continue to inform a research agenda, not in the form of post-hoc evaluations of research such as Porter's, but as ways to generate on going research and new accounts of number. Callon argues that in presenting numbers and quantification as always directed towards standardisation and expansions in trust, differences in number and quantification practices, and differences between these practices and practices which do not quantify, are absent in Porter's work
Beginning with Difference

(Hagendijk, 1999: 634). This is both an empirical problem and an analytic problem. Numbers are not simply empirical objects of research for Porter, but become his analytic tool to investigate standardisation and trust in social worlds. Hence, as a tool, Porter's number cannot interrogate numbers which do not effect greater standardisation and greater trust. Perhaps Porter's number itself is a 'modern fact' which works both as particulars in the book's empirical case studies and a general in that they contribute to the understanding of standardisation and trust as social processes. As an analytic tool therefore, this number is unable to interrogate other forms of social or collective practice which may or may not be done with numbers, nor the way numbers participates in generating new forms of social processes.

Perhaps it is no surprise, then, that the most unique study of number and earliest conceptualisation of number as performative began in postcolonial times and places. Postcolonial situations are constituted through difference, which forces modernity to confront itself in novel ways. It was this force of the postcolonial which initiated Bruno Latour as a social scientist cum philosopher. Latour was trained as a social scientist during his appointment at a French institute for education and development in the Ivory Coast in the 1980s. Reflecting on his career, Latour writes that 'ever since I discovered in Africa the ambiguous effect of the modernization frontier, I have been convinced that the moderns deserve a full-scale positive and constructive anthropology' (Latour, 2010: 8). From this moment, Latour's work has been bringing to attention the unexamined and othered practices of modernity. Latour has followed the heterogenous, relational, embodied and collective work of mediation that is constitutive of the purified entities such as society, objectivity and number, which enabling us to realise that 'we have never been modern' and that the difference between the West and other collectives might not be such a definitive divide as assumed.
The first empirical investigations of number in postcolonial situations is in the work of Helen Verran. Working in Yorubaland, Nigeria and then Arnhem Land, Australia, Verran argued that in these places 'a cross cultural tension enables us to see number and quantification as the "clotted assemblage"' (Turnbull, Verran, 1994: 130) of practices or rituals. As a teacher educator within Nigeria's developing modern education system, Verran experienced this tension within mathematics. Despite some of her student teachers following the prescribed routines which were to demonstrate the objects of learning such as number and volume, these objects failed to 'clot' as an activity. The objects of the lessons failed to become evident in the activity and educate the children. In other classrooms however, in which hybrid and often messy practices appeared to abandon the carefully prepared lesson plans and routines, objects recognisable as numbers but also unfamiliar, emerged with the power and charisma to interpellate children as learners, their bodies as objects of length and centimetres as units of enumerated measure. Once sensitised to these numbers which were simultaneously both Western and Nigerian, and neither Western nor Nigerian, Verran witnessed them operating elsewhere such as within market transactions.

What was this postcolonial tension within which these new numbers emerged? In her work, Verran specifies two forms of enumeration, one-many enumeration – in which a specific unit, such as centimetres, enumerates a many, such as a length of one hundred centimetres, and whole-part – in which a vague whole, such as a class of children, is decomposed into parts, such as dividing the class into boys and girls or lining them up shortest to tallest. Enumeration therefore is a form of generalising, or working the relation unit-plurality. It is understanding this generalising, not as abstract work in people's heads, but embodied practices done in classrooms and markets that has Verran calling numbers 'clotted assemblages'. In specifying different ways
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generalisation is done and accounted for however, Verran was confronted by the form of
generalising within her own work. In specifying a cross cultural difference in the world,
which one could understand Verran to be revealing, this relativist researcher is working
within a one-many form of generalising; cultures are specific units that are produced as
a many, or diversity of cultures. Within this generalising, difference in numbers
becomes relative to different cultures.

Becoming aware of this generalising in her own work allowed Verran to understand how her analysis was unable to empirically account for the workings of the strange yet familiar numbers in classrooms and markets that animated everyday life. In contrast to understanding these empirical situations as units of a particular 'culture' (which could be deemed sufficient or not, accurate or not) Verran began to work with these situations as events within which Western and Nigerian parts are decomposed and recomposed as a vague whole of a postcolonial situation. Conceptualising these situations of enumeration as on going events of composition/decomposition, events that are performative and embodied, and always incomplete, her analysis avoided the immediate fracturing of her empirical work into an inescapable cultural division at the heart of a relativist critique. In contrast, Verran's work opened up possibilities for new practices of enumeration to be done and thought, and for new numbers to emerge. This is a metaphysical point and also a political one.

'This choosing to arrange things for a going-on together, or a going-on only in this way, is a politics. It is a politics built either on trust and commitment to a community here and now, or a politics of imposition, a commitment to a knowledge community that is not here and now. This latter strategy amounts to an intimate form of colonizing' (Verran, 2001: 106-7).

*Science and an African Logic* demonstrates the magnitude of the philosophical task required to hold onto difference as an irreducible tension and the forms of
collective life which become possible if this tension is never removed or abstracted from the community in which it lives. Even though we might experience entities such as number as one-many, as things we can add up and share out, they are always embedded in orders of collective life which constitute 'things' as addable and sharable. The immense difficulty in studying number is that number is often experienced in its very thingness, as and through a definitiveness of such power, we can only imagine it as emanating from some real, universal number. As Verran writes,

'The ritual of doing "things" are so routine that they are accomplished without seeming to be. So used are we to going on with them that we are prone to make a metaphysical mistake; taking an understandable shortcut, we take objects like things as givens' (Verran, 2001: 162).

Maintaining that things are always rituals, that entities are always already clotted assemblages, dynamic, incomplete and requiring on going work, helps us avoid the 'metaphysical mistake' of accepting 'objects like things as givens'. It resists the temptation of the related mistake, of claiming that the definitiveness of our research, in the task at hand our knowledge of number, is only possible due to the definitiveness of things such as number, culture and other modern 'facts' which are knowable to social science. Hence, in developing this research trajectory within science studies that I am calling number studies, and demonstrating its re-conceptualisation of number as performative and multiple, I am not arguing that this offers a more accurate or truthful account of some singular entity, number. If we are to truly accept that numbers are inherently performative and multiple, then knowledge can not be definitive nor conclusive in any way. What this approach to number does contribute is an increasing sensitivity toward and familiarity with number as performative and multiple, and embedded within all forms of practice (Verran, 2011) including those which are transformative in the here and now of research in contemporary times and places.
Number has also re-emerged more recently as a 'new frontier' for research in anthropology. As the contributors to a special issue on number in *Anthropological Theory* argue, contemporary studies of number present a 'confluence of classic ethnographic and theoretical issues with the contemporary wave of novelty in the world' (Guyer et al., 2010: 36). Central to addressing this novelty is understanding number not as an abstract entity in people's heads nor within a culture's symbolic language or conceptual systems but as an entity in practice. And again, in anthropology, understanding number as performative in collective practices is invigorating research practice itself: the 'complexity of numbers-in-practice' the authors argue, presents 'an extraordinarily difficult challenge to meet ethnographically' (Guyer et al., 2010: 38).

Bill Maurer's work *Mutual Life, Limited: Islamic banking, alternative currencies, lateral reason* is an important work in anthropology's re-engagement with number. Maurer set out to study 'alternative currencies' but found, as did Verran, that the empirical investigation of number demanded a re-thinking of empiricism and knowledge itself. The 'problem of adequation' between money and thing, for which Maurer wanted to be able to demonstrate many solutions (mainstream capitalism, Islamic banking, Ithaca HOURS), could not generate any truly unique solutions nor recognise any real difference unless the homologous problem of adequation between knowledge and object in research was opened up also. Working with a 'traditional view of difference, of alternative currencies, for example,' argues Maurer,

>'posits a sort of numerical multiplicity in the objective world … Yet "alternative" in this sense is difference of one kind: infinite multiplicity of the same: many cultures, many moneys … Data [that] exists in the world to be counted, classified and sorted'. (Maurer, 2005: 12)

Even when naïve 'abstraction as representation' was replaced by more complex
Chaper One

The notion of 'circulation', Maurer again found his accounts collapsing back into representations of circulation. His attempts at novel research generated by the novel concept of circulation seemed to become yet another reproduction of some universal 'market' which was always already doing circulation. He writes,

>'No matter how implicated we are in the worlds we analyse, no matter what the objective limits of objectivism or the complicity between ourselves and our subjects, the empirical impulse absorbs the reflexive one by means of a perspectivalism that is additive to, not transformative of, the empirical project.' (Maurer, 2005: 5)

In working the empirical project as transformative, Maurer works difference, or 'the alternative', as a dynamic oscillation rather than a fixed division. He considers his work as performative within which a 'lateral reason' develops and has the effect of an 'oscillation (alternāre) between adequation and other modes of praxis' (Maurer, 2005: 17). Maurer is using a framing from the philosopher Gilles Deleuze (which will be expanded upon very shortly) to put into tension the 'additive empirical' project with a 'lateral virtual' project. Importantly, as Maurer points out, this emergent lateral reason which is performed and achieved in his work is as much ethnographic as it is theoretical (Maurer, 2005: xv). Hence, although Maurer's 'virtualism' can be read as being in contrast to what he is calling 'empiricism', his project as a whole is transformative of how 'the empirical' is worked and understood within anthropological research.

Within sociology, a 'new empiricism' is emerging which is also inspired by the metaphysics developed by philosopher Gilles Deleuze. This new empiricism is experimental. It is directed toward not only what is, but what is immanent in socio-material worlds, the 'yet to come' (Adkins, Lury, 2009: 8). Researching brands and their measures, Celia Lury argues that entities which were once considered symbolic, now need to be analysed as entities participating in a 'surface co-ordinization' (2011), in
Beginning with Difference

which measures are continually changing situated within a field of relations. This surface is expanding the 'organising and intensive powers' (Lury, 2011) of number which are no longer limited to representing the value of some external thing (the value of a brand) but toward enacting particular relations and orders of collective life (markets themselves) within which more values can emerge. In taking Verran's work as a springboard, Lury writes,

'... the indexical capacities of numbers to order and value are brought together without references to an external measure, but rather - or in - relations in which performative capacities of number are extended. In these uses, numbers open up new kinds of relations between the sensible and the knowable.'(Lury, 2011)

Here again, a direct and profound connection between the problem of studying number and the problem of research method, knowledge and in particular empiricism emerge together. Lury introduces the term 'device', through which she explores Verran's number as an indexing capacity, as a hinge, or the in between, within the relations of research practice which open up 'new kinds of relations between the sensible and the knowable'.

The question of a new empiricism is one that philosophers of the natural and social sciences have been working with for some time. Deleuze stands in a long but perhaps minor tradition in Euro-American philosophy, which includes Gottfried Leibniz, Henri Bergson, and Alfred North Whitehead. Contemporary thinkers within this ancestry are Isabelle Stengers and Bruno Latour. For Latour and Stengers, 'the basic question [for a second empiricism] is to decide whether or not empiricism can be renewed so that "what is given in experience" is not simplified too much' (Latour, 2005: 226). And, in accepting the demand of number as a researched entity to re-think empiricism, it is to this concern that we will now turn.
Empiricism and Multiplicity: metaphysics for different differences

How can we understand the relation between the sensible and the knowable in postcolonial places? How do we avoid collapsing differences into instances of the same "thing": numbers into Language, mathematics into Culture, postcolonial relations into Colonialism, pluralities into Unity? How do we avoid accepting that which is familiar as grounded in an external truth? These are some of the philosophical questions raised in number studies and addressed in this thesis. How might we avoid treating numbers in postcolonial places as constitutive of only colonial power? How might we avoid being blind towards ways in which numbers come to constitute postcolonial possibilities, and come to understand to these possibilities not as floating in some abstract destination, but as immanent in the on goings of everyday life? These are all fundamental questions of how sameness and difference is done and understood in empirical inquiry. Since, Kant the humming and happening world of experience has been limited by the universal categories of a presupposed knowing subject. While objects float somewhere 'out there', we only know them in here, in our heads. This informs an empiricism which is foundational, in that it presupposes both a universal subject and a universal form of being. There is a thread in Western philosophy, however, which resists this constant impetus to reduce difference to instances of the same, that is to reduce the real to experiences of the universal subject. Gilles Deleuze is its most recent proponent. This section brings Deleuze's metaphysics to a post-colonial encounter and in doing so articulates an alternative empiricism named by Verran as 'relational empiricism' (Verran, 2007).

Deleuze worked in the history of philosophy at first, becoming a philosopher proper in the works *Difference and Repetition* (1994) and *Logic of Sense* (1990), in
which he developes his own novel metaphysics and creates concepts through which it is articulated. Difference, for Deleuze, is not splits nor divides ordering a foundational metaphysic (subject/object, epistemology/ontology, concrete/abstract, real/ideal), but an irreducible difference, the unequal itself, animating a relational metaphysic of encounters and events. In *Difference and Repetition*, Deleuze turns Western philosophy inside out, showing its conceptualisation of repetition and difference to be ultimately restrictive of thought and fundamentally negative within inquiry. In the introduction he outlines his proposed metaphysics arguing that,

>'In every case, repetition is difference without concept. But in one case, the difference is taken to be only external to the concept; it is a difference between objects represented by the same concept; falling into the indifference of space and time. In the other case difference is internal … One is negative, occurring by default in the concept; the other is affirmative, occurring by excess … One is static, the other dynamic … One is extensive, the other intensive' (Deleuze, 1994: 23-4).

Repetition in every case is created within pure difference. That is difference without concept, the very in between or relation which constitutes or is internal to the repetition. Deleuze calls this difference intensive. In a limited case of repetition however, difference becomes extensive. In this case, repetition achieves a concept which is taken to be external to the difference constituting all repetition. As an external concept, 'the same' within which repetition appears, difference is treated as a property internal to the concept, an internal property of extent. Hence, repetition is not repetition of the Same. Repetition does not proceed through an external concept within which difference is merely that between extensive values of an internal property. Rather, in every case, repetition is the repetition of difference itself, an irreducible intensive difference. In offering an expression of these different differences, extensive and intensive, I offer a cup of tea. Now, making tea may at first appear to be an example
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taken from the musings of a solitary arm-chair philosopher, but it is also a common occurrence in contemporary remote Australia. So let us consider making our tea one warm tropical afternoon on the coals of a fire.

As people begin to gather and sit down in the shade, one of the younger women pours some water in a pannikin, or any kind of tin bucket, and places it on the fire. As we wait for the water to boil, some more people arrive. They are greeted and extra water is added to the pannikin. Once the water boils a handful of tea bags are tossed in and after a short time tea is ready. The tea is strong and we all pass around the sugar and powered milk, making our drinks steaming cups of sweet, milky tea.

This little collective practice of people and pannikin, tea bags and water, wood and fire, works through intensive difference and extensive difference. The difference between the water originally poured into the pannikin and the extra water poured in upon the arrival of more people can be understood as a difference between volumes. This is an extensive difference within the concept of volume. Volume is the concept within which the multiple waters can be considered separate. But the concept volume itself 'falls into the indifference of space and time' and is indifferent to the fire heating the water and the people drinking the tea. In understanding the difference in water as two different amounts of water-as-volume, these entities themselves fall out of the situation of the group of people around a fire being joined by some visitors, into an abstract space-time. Extensive differences are always within the Same given by internal properties of a concept; water added to water given as volume added to volume. Hence, extensive difference increases and decreases without altering the form of difference: the original volume of water plus the extra volume of water produces another volume of water, different only in extent, not in kind.
Is an extensive account any more gracious towards people than the indifference extensive concepts have in relations to things like water in pannikins? Not necessarily. When the visitors arrive we may treat them as creating an extensive difference in the amount of people gathered, and a corresponding extension is made to the water in the pannikin by increasing its volume. People, community and society can be extensive things and similarly fall out of the specific situation. When the people begin to talk, asking for the milk and sugar to be passed around, we might tend to think the difference between Yolŋu Matha and English in a similar way: difference is understood within the concept of language. This difference could be increased by the addition of another language, for example two of the English speakers might begin speaking German, or difference might be reduced by everyone speaking English. Extensive difference is therefore a difference in the extent of particulars of a general class; distinct volumes or distinct languages. Extensive difference only changes through the addition or subtraction of particulars of the same kind. Extensive difference therefore, is no more than a *repetition of a general kind*. For Deleuze, this is a negative difference as it occurs 'by default in the concept'. Extensive difference is limited to working through and as analogy, identification, similarity or opposition (Deleuze, 1994: 24). While extensive differences might measure up a situation; a quantity of people, an amount of water, a number of languages, a number of tea bags, they clearly do a bad job of telling about the making of the tea. For this, we need to appreciate intensive difference.

Intensive difference which produces the tea are the heating of the water and the steeping of the tea bags. Intensive difference does not emerge with the addition nor subtraction of objects of the same kind nor the increase or decrease in extent of particular properties. Intensive difference emerges as an *irreducible differential*, as a relation, which is transformative. To heat water the pannikin is placed on the fire
beginning to heat the water at the bottom of the pannikin which creates a differential of hot water at the bottom and cooler water at the top. Heating water is dynamic and transforms the water, first very slightly by making it circulate, but potentially radically when it transforms the water into steam. Intensive difference are dynamic and can affect transforms in kind.

Taste is also an intensive difference. Putting tea bags into boiling water produces a taste to inhere in the water. This transformation is not easy to reverse. Both the water and the tea bags are changed in becoming tea, and the tea itself is something entirely new, something not the same kind as either water nor tea leaves. Whereas extensive difference was produced between discrete things or units of the same kind, intensive difference is the in between, the dynamic relation, of a transformation itself – the moment of being both tea and not tea, the moment of steeping, or becoming tea. Whereas extensive difference operated with a concept which falls out of the situation, intensive difference required a constant attending to within the situation: is the water boiling yet, who just arrived, do they want tea, is the tea strong enough, I think I might add some more sugar. The accounts become more interesting by remaining located in the situation, teasing out the ways intensive difference emerges and reconfigures the situation itself.

And what about people? Perhaps at the beginning one family group is making tea on its homeland. Perhaps the visitors are a family from adjoining lands. Do we understand their arrival as effecting an identification? Perhaps the visitors are from a mining company. Do we understand their arrival as effecting an opposition? Yes and no. Similarity or opposition may be effected, tea may or may not be offered, a familiar gathering may or may not be interrupted, the situation is the new group here and now,
and the arrival itself has affected a re-ordering of kind. Kinship is often understood as relational and it is therefore easier to hold onto these moments of re-ordering. Perhaps the people making the tea are a clan group. They are already ordered with relations. The woman who made the tea is daughter to her mother, mother to her own daughter, wife to her husband and sister to her brother. Each person is multiple and irreducibly related, but no less embodied and located. Perhaps the visitors are from her husband's family and the arrival effects a re-ordered set of relations, between the families and within the families literally as the relations (relationships) which constitute the situation alter.

Perhaps during all this philosophising our tea goes cold and we want to heat it up. We pour our tea back into the pot. While the volume of the tea increases, many small volumes (cups) making a larger volume (pannikin), neither temperature nor the taste increases (nor decreases) in such a simple linear change in extent. Intensive differences interfere and become something new as the differentials, that is hotness-coldness and sweetness-bitterness, effect a whole from within. In some cases differentials dissipate, with the differently hot teas once poured together creating differentials of motion (convection) which slowly smooths out the differentials of temperature, slowing the tea into a more or less homogenous and steady state. In some cases this can be understood as extensive, with the steady state at some 'average' temperature. And sometimes it is not so obvious: do the combined teas create an 'average' taste?

Lightning is another of Deleuze's intensities which is appropriate for tropical Northern Australia. During the monsoon season, at about tea time, clouds build on the horizon. An electromagnetic differential, a 'potential', develops between the land and the clouds, increasing as the hot air from the land drives the clouds higher. Then suddenly,
the 'potential' is realised in a crashing cascade that sounds like the air itself is tearing. Differentials do not always resolve through homogenisation, but can effect radical transformations. Whereas within extensive difference the possible is merely an unrealised particular of an already existing concept, within intensive difference potential is a differential which is actualised in forms that do not resemble its cause. Lightning is always a little unexpected, as is this lightning. The lightning that strikes during afternoon tea in Yolŋu places is related to the maypin' tree which grows there. It is related within the Yolŋu kinship system as mother-in-law/son-in-law, a relation of greatest respect and avoidance. So before we take our tea under cover we put some maypin' leaves on the fire. Hopefully, the smoke which is produced warns of the presence of this relation that should become reduced to a particular instance of recognition, and no lightning will strike close by.

Until now we have been working with this distinction between the intensive and the extensive through some mundane empirical routines. We are therefore in danger of moving too quickly from these all to familiar 'facts' to naïve understandings of philosophy and empiricism. Deleuze warns against any philosophising which bases its 'supposed principle upon the extrapolation from certain facts, particularly insignificant facts such as Recognition, everyday banality in person [Look! Lightning!], 'The tea is ready']; as though thought should not seek its models among stranger and more compromising adventures' (this is Deleuze's charge against Kant (Deleuze, 1994: 135)).

Although this little adventure started with a friendly cup of philosophical tea, it very quickly became strange – water boiled on a fire? powdered milk? kinship between clans? a tree and lightning related as in-laws? and compromising – shouldn't mining companies always be opposed, will you the reader take my Yolŋu friends seriously in
managing lightning, should I keep it simple and avoid the lightning strike in the text at all? What to do with all this difference! In this strange and compromising adventure Deleuze is my companion, and so is Verran. They have joined us for tea, and are enjoying the discomfort which irreducible difference brings. Verran is patient, drinking her tea and sitting with me as I learn to trust myself and the situation. Deleuze is talking excitedly, incessantly, almost incomprehensibly. Over and over (and over) again he is saying, a strange and compromising adventure indeed, now for the model of thought.

We began with Deleuze arguing that in every case difference is without concept, but in one case becomes external to the concept. In terms of the distinction intensive/extensive I am slowly working up through the postcolonial situation of tea, in every case difference is intensive, but in one limited case (literally at the limits of intensive difference) difference becomes extensive. However, when we take extensive differences as the limits of our accounts, such as that of making tea, and only attend to extensive differences, the account our research generates is a bad one. The metaphysics of extensive difference only recognises particular cases of a general kind (either through similarity or opposition) and cannot account for transformation. Moreover, in attending to difference as extensive, the difference falls out of the situation into abstract concepts in space-time. This was Verran's conclusion in *Science and an African Logic*: that in taking things as givens we make a metaphysical mistake of limiting our analysis to extensive difference and in doing so necessarily perform an 'intimate form of colonizing' by imposing external concepts on the situation of research.

Deleuze's argument against an image of thought limited to operating with extensive difference is that it is negative, in that it necessarily presupposes that which is seeks. The dominant image of thought in the West has limited itself by accepting that
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thinking is an act of Recognition, initiated by an individual Self toward an independent Object. Caught in the act of Recognition as the very condition of its possibility, philosophy is forced to presuppose the Self as one who has both a common sense; that is a presupposed common faculty of a general category of being, and a good sense; that is a particular form of being for whom all one's senses are directed toward an unspecified object. Hence, in trying to generate an understanding of thought and being, a philosophy caught in Recognition presupposes both a form of thought; the individual with good common sense, and a form of being; a being recognisable to the thinker. In presupposing what it set out to discover this vicious circle immobilises thought itself and all we are left with is an ability to recognise the True and the inevitable. The alternative approach proposed by Deleuze, is not to find a better model of thought to presuppose, and continue presupposing that thinking comes from thinking, but rather to appreciate that what forces thinking is an encounter in the world. And it is here, in the empirical encounter, that we can begin articulating new models of thought.

'Do not count upon thought to ensure the relative necessity of what it thinks. Rather, count upon the contingency of an encounter with that which forces thought to raise up and educate the absolute necessity of an act of thought or a passion to think ...

Something in the world forces us to think. This something is an object not of recognition but of fundamental encounter. What is encountered may be Socrates, a temple, a demon. It may be grasped in a range of affective tones: wonder, love, hatred, suffering. In whichever tone, its primary characteristic is that it can only be sensed. In this sense it is opposed to recognition …

The object of the encounter … is not a sensible being but the being of the sensible. It is not the given but that by which the given is given. It is therefore in a certain sense the imperceptible.' (Deleuze 1994: 139)

Unlike the object of Recognition, a sensible being for Deleuze, the figure
matter set in space time for Verran (2001: 150) or the object of an encounter is intensive. It is the becoming of the encounter, of how the given is given. The tea is not given in a volume, it is given through its steeping, its tasting, its becoming. The situation is relational and does not reduce. Yes, one can treat tea as a volume, but this is simply a limit of the process of making tea. It is an outcome or remainder of the process. Yet it is this remainder which is the world (Deleuze, 1994: 222) It is this that we as researchers have: a cup of tea, some friends, hair smelling of smoke, a few more pages of notes. What do we do with such experience? Drink the tea, thank the friends, wash the hair, and write up the notes? Tidy up our encounter so it is familiar again and can travel back home? It can be tempting, sometimes necessary, but always violent.

During this research I lived, with my partner, in a remote community in North East Arnhem Land for fourteen months. When I arrived back to write this thesis the most common questions regarding my research were these: 'Did you get enough data?' 'Did you stay long enough?' 'Will you need to go back?' 'Do you have enough?' It is a serious question, to which I usually answered, 'No, but I have enough for a thesis'. And every time I heard it, I could not help being reminded of a radio comedy sketch in the Goon Show. In it, World War One has broken out, and the British chiefs have called a meeting. They are, it is no surprise here, drinking tea, but the Major has decided that enough is enough and that it is time to get down to business. Coming home, I had certainly had many cups of tea, but was I ready to get down to business. Desperate to find a way out of this predicament another Goon, ranked only a Captain, protests, ‘No, no! I haven't had enough. I haven't had enough.’ The Major replies coolly, 'Oh, haven't you … Well swallow this obstacle.' The Captain gulps it down, 'Oh! Oh, delicious! What was it, eh?’ It is explained to him that what he just ate was enough, 'It was marked on the tin "A N-U-double-F. Nett weight four ounces." So you've just eaten a four ounce
nuff.’ Becoming aware that he may have consumed the entire obstacle in one go (that is arrived at the conclusion all too soon), the Captain cleverly retorts, ‘Well, if that was a four ounce nuff, I haven't had enough nuff!’ Infuriated, the Major shoots the Captain whose departing words are 'I'm dying. At last, I've had enough!' 

So, did I get enough during fieldwork? Once you have enough/a nuff, is it a matter of picking your battles and calling in the allies? Aren't we rapidly falling back in similarity and opposition. Let's expand this episode as a response to problem or too many wars (Latour, 2004). While the Captain was enjoying himself drinking tea, it had become apparent to the Major that some unspecified thing had reached its full extent or value. It was enough! Was this thing a volume (enough tea), a quantity (enough people), a duration (enough time chattering) and had it been fully valued, the tea fully tasted, the meeting participants fully cohered, the gossip fully dispersed? Is the something sensed in the encounter extensive or intensive? The Captain was quick to exploit this obstacle of an irreducible difference, and makes the question explicit: this it is not enough. The Major makes the obstacle a medium sized thing that can be passed from man to man, which the Captain accepts, only to realise that this thing has become a nuff, a specific thing of measurable extent (ounces). Accepting the thing as extensive, the Captain tries to keep the obstacle generating value (tea, chattering etc), but now the problem of the obstacle is no longer what the unspecified thing is, but what amount of this thing is to be sufficient. The answer is neither here nor there, it is unimportant, and in the manner most arguments of this type are resolved, knowledge is reduced to power: the Major shoots the Captain. The extensive thing, a nuff, emerges with greatest effect at the limits of intensive orders: in the moment of the Captains dying the meeting continues. They have enough nuff. It is not only Captains who accept things as being medium in size and defined by extensive properties and in doing so learn the power of imposed orders. My
answer to 'did I get enough in fieldwork' was, 'No, but enough to write a thesis.'

So what is this nuff of the empirical that is both enough and not enough, both an obstacle and a problem? If I were a romantic I might say ‘No my dear, I didn’t get enough (of worldly experience). But, I have enough nuff to make me a man.’ If I were a mercenary I might say, ‘Boss, as I have learnt, one can never have enough (money)! But, I have enough nuff to make me an entrepreneur.’ If I were a positivist social scientists I might say ‘One can never know enough, that is every little feature of a particular social milieu. But, I have discerned enough, my earnest colleagues, that that society is full of nuffs.’ If I were a relativist my answer would be ‘Um… I think I got a nuff, though I’m not sure it is really a nuff. Is it enough to be a nuff from my perspective, or is it not? What do your nuffs look like? Oh … if everyone’s nuffs are different we’ll never have enough nuff! Or is there too much nuff?’

The nuff of the empirical encounter is *difference*. Romantics absorb it, entrepreneurs add it to the bottom line, positivists treat it as a lack and while relativists do grasp difference, it immediately fractures into divisions. For all of these research figures, albeit cartoon-like, the empirical is taken as extensive. Problems are solved once enough is enough and this is worked out case by case, order by order, ethnography by ethnography. But I like to work as an empirical philosopher, and instead do fieldwork to interrogate the very nature of nuff – that strange event that is both enough and not enough. Assuming that the empirical is extensive things cannot not help think the problem of the empirical. I am concerned with the problem of ethnography as such – the problem of ethnography as a practice generative of research or knowledge (I hesitate to call it a research method). What is it about ethnography such that it generates research? And this is where I am inspired by Deleuze's *encounter* as that which
Encounters for Deleuze are problems or events. In understanding an encounter as a problem, it is important to distinguish between problems in the world and problems of the world. There are many problems in doing empirical research: the straining of eyes and ears, especially when you are not competent at the languages spoken, the hours of writing notes when you feel you should be out there being involved, keeping your notes safe and organised, ensuring people understand and know what you are doing, and making yourself available as a public access phone and computer for electronic banking. All this and more is given in the situation of research and does need to be worked out. But they are not problems of empirical research. The problem of the empirical is how does it contribute to knowledge, how is empirical research as such possible?

Deleuze is inspired by differential calculus and differential geometry, species of mathematics concerned with rates of change and non-linearity. It is through the language of this maths that Deleuze articulates his novel approach to problems. Problems, for Deleuze, do not resemble their solutions. It is through encountering problems that solutions emerge, but while the solutions are clear and distinct (points on a curve), the problems are sets of multiplicities, or sets of tensors and attractors which are the limits towards which solutions asymptote, but never achieve. These problems or multiplicities therefore, are distinct but obscure. They are suggested in the ways solutions change. What is important to understanding a problem is not only the solutions, but how the solutions are given by differentials. Differential is an important concept as it is a relation of intensive difference. Understanding the empirical as the outcome of differentials helps the familiar forms of solutions we need to work through
not fall back into general concepts which then come to define the problem itself. Differentials are not in the actual stuff of the empirical, they are not the object or problem in the encounter. They cannot be known. The object or problem of the encounter is only sensed, or is sense itself: 'The object of the encounter … is not a sensible being but the being of the sensible.'

As differentials are intensive they are therefore dynamic. They are always within the relations or processes of differentiation. As these differentials and the process of differentiation are sensible but unknowable, Deleuze calls them the virtual. However, the virtual differentiations cause differentiation in actual occurrences. Differentiations produce both intensive difference and extensive difference. However, as actual occurrences are caused by irreducible difference, that is virtual differentiations, they do not resemble the nature of their causes. Nevertheless they are related. We can understand the relation virtual/actual as intensive. This relation is the relation problem-solution. Hence, Deleuze comes to refer to this as the 'complex notion of differentiation:

'Whereas differentiation determines the virtual content of the Idea as problem, differentiation expresses the actualisation of this virtual and the constitution of solutions (by local integrations). Differentiation is like the second part of difference, and in order to designate the integrity or the integrality of the objects we require the complex notion of differentiation … Every object is double without it being the case that the two halves resemble one another.' (Deleuze, 1994: 209)

Hence, in order to understand the problem of the empirical through the local integrations of a situation, the object of the empirical, we require a notion of relation as an intensive double, an irreducible difference.

Deleuze's other inspiration is the concept event. He says 'I've tried in all
my books to discover the nature of events; it's a philosophical concept, the only one capable of ousting the verb "to be" and attributes' (Deleuze, 1995: 141). The event has a long but small history in Western philosophy with its most famous proponent being Alfred North Whitehead. In The Fold: Leibniz and the Baroque (1993), Deleuze considers the event through the work of Whitehead and Leibniz. He writes,

'What are the conditions that make an event possible? Events are produced in a chaos, in a chaotic multiplicity, but only under the condition that a sort of screen intervenes.

Chaos does not exist; it is an abstraction because it is inseparable from a screen that makes something – something rather than nothing – emerge from it. Chaos would be pure Many, a purely disjunctive diversity, while the something is a One, not a pregiven unity, but instead the indefinite article that designates a certain insularity. How can the Many become the One? A great screen has to be placed in between them. Like a formless elastic membrane … the screen makes something issue from the chaos, even if this something differs only slightly' (Deleuze, 1993: 186).

The screen for Deleuze is the complex notion of different/ciation. It is the intensive relation virtual/actual or problem/solution. It intervenes in making virtual differentiations differenciate the actual into new orders of collective life. It intervenes in the problem in making solutions emerge. The event has three dimensions: percepts, affects and concepts. Percepts are the actual, the packages of relations, affects are the becomings that are never realised, but only further differentiated, and concepts are on the screen, nodes or regions of differentiation which only differenciate at their limits (Deleuze, 1995: 137). Hence, working with concepts is working on the screen or in the plane of immanence. As Deleuze writes, 'However one sees it, we're on the plane of immanence; but should we go around erecting vertical axes and trying to stand up straight or, rather, stretch out, run out along the horizon, keep pushing the plane further out?' (Deleuze, 1994: 148).
We began this section with a cup of tea. A small region emerged and clotted, a situation or a local integration, around the boiling water. There we noticed both the intensive difference and extensive difference making processes in the actual. We noticed the objects and subjects emerging as outcomes of relations and how these relations transform. As we sat patiently, we notice the difference was internal to the event, producing the tea, producing the people, and in paying attention to this internal difference we could begin to learn a way to go on without imposing external concepts. This cup of tea is an event. It is always transforming. The tea is drunk, the conversation ends and we ask 'what to do now'? We felt an urge to clean ourselves up, write more notes, come home, make hasty conclusions, but realised that this only made an external difference, severing the event from any relations and casting it into the indifference of space and time of 'fieldwork'.

We got slightly diverted by a question of enough. But we learned the dangers of accepting enough as 'a nuff', as things located in some external time-place we might nonetheless gather or return to. We understood that 'enough' is the sense of a situation. It is something within a situation to attend to more carefully and go on with. So we have arrived back at our tea as a concept within the event. We have managed to remain attentive to processes generating intensive difference through which events continue a certain becoming. We have not represented the event but continued it, becoming enveloped by it and shifting it a little. Once we appreciate the intensive differences which produce tea we are not limited to contain it. Rather we can let it flow out, here in the text, gathering a new set of affects, percepts and concepts, and continue. And we have arrived at a form of empirical inquiry which has not lost difference and is able to hold together different differences. We have not left the actual, but we have located its extensive limits within the intensive encounter. We are differrencitinating along with it.
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We have not risen into a transcendence, nor imposed a presupposed one. We have sustained a relation, a differential, an irreducible difference.

'This is the secret of empiricism. Empiricism is by no means a reaction against concepts, nor a simple appeal to lived experience. On the contrary, it undertakes the most insane creation of concepts ever seen or heard. Empiricism is a mysticism and a mathematicism of concepts, but precisely one which treats the concepts as object of encounter, as a here-and-now ... which emerge inexhaustibly ever new, differently distributed 'heres' and 'nows'. Only an empiricist could say; concepts are indeed things, but things in their free and wild state, beyond 'anthropological predicates.' I make, remake and unmake my concepts along a moving horizon, from an always decentred centre, from a aways displaced periphery which repeats and differentiates them' (Deleuze, 1994: xx).

So, let us locate research upon this moving horizon, within the plane of immanence, this screen. We are within an intensive surface and constituted by it as researchers. We must catch ourselves when we say surface. It is not a surface of extensive difference, known through concepts such as width and length. We have no external co-ordinates, such as when we plot a two dimensional surface within a three dimension space. It is a surface of intensive differences which creates its own co-ordinization. On one side of this surface is the actual; actual occurrences and happenings. This side is populated by a game of I spy, an adoption over the phone, visiting a place, a police man, a ceremonial act, a sentence. We participate in these episodes, filling the screen, parts differentiating and become other parts, and perhaps we form some trajectories: a ceremony, a period of fieldwork, a sub-heading, a narrative, a theme. These are all standardisations. Is a thesis just this, a crafting of trajectories, linking them in better or worse ways, giving them more or less means for extrapolating their histories and their futures? Yes, but let's not move too fast. This is only the introduction. These trajectories do not fall out of the surface as representations of some
real world, and indicating some possible world. They are not better or worse in their description of the surface, though they are descriptions. They are better or worse at the way they operate in the surface, extending it and changing it. They operate not through addition nor multiplication of data, but through the differenciation of events. These trajectories are important in that they show how orders change, value emerges and dies in re-orderings. They are trajectories between vectors, not lines connecting points. As vectors we feel for where they are going, where they are pushing, how they are folding the surface itself. In trying to mime this movement we turn away from the face of the actual toward the other face of the screen: the chaos of the virtual, the irreducible difference of multiplicities. Concepts do not operate to resemble the virtual, but simply to inhabit the surface (another account of this is given by De Landa in his articulation of the manifold (De Landa, 2005: 28)). This work of Deleuze moved Foucault to encourage researchers to accept Deleuze's empiricism, writing that one

'must persist in the confrontation with stupidity, to remain motionless to the point of stupefaction in order to approach it successfully and mime it, to let it slowly grow within himself (this is probably what we politely refer to as being absorbed in one's thoughts), and to await, in the always unpredictable conclusion to the elaborate preparation, the shock of difference' (Foucault, 1970: 190).

This shock of difference is only possible when research understands itself as located within intensive difference. The shock is the new, the lightning which does not resemble the differential it realises. And like those who are keen to see lightning and to drink tea in strange places one must be patient. This 'elaborate preparation' is hard work, this inhabiting the screen and hanging in there. Perhaps it might be easier if we put a name to this work by way of summing up, reducing the elaborate preparation into a tonic called relational empiricism.

Relational empiricism attends to the 'the multiple and specific orders by which
a vague whole … is composed' (Verran, 2007: 179). As a form of knowledge production empiricism generates generalisations (or repetitions to continue using the Deleuzian framing) which envelope a plurality of encounters into a composite unity. As a mode of generalising, relational empiricism, does not enclose its encounters within abstract concepts as foundational empiricism does, but understands generalisation as a transition, a generative moment of decomposition and composition. Relational empiricism is situated; always attending to the relations which constitute it, embodied; as relations are at once material and semiotic, interested; always seeking ways to go on, instrumental; as it seeks to create from within what is at hand, and collective; what is achieved is not any transcendence from relatedness but the collective achievements of the ordering and re-ordering of relations.

The instrumental character of relational empiricism has been highlighted by Verran and Winthereik (2010). Empirical data, in their case ethnographic stories, have their own agency to interpolate readers as Deleuze's 'new idiot' – the figure akin to the Foucault's subject above who dares to turn the incommensurable, the paradoxical and the absurd 'into the highest powers of thought – in other words to create' (Deleuze, Guattari, 1994: 62-3). However, is it the figure of Madame A, a petrol station owner during Nigeria's petrol shortage who exemplifies the situated, embodied, interested, instrumental and collective work of relation empiricism.

Madame A comes to us through the Jane Guyer's story 'waiting for petrol' in Nigeria in *Marginal Gains: monetary transactions in Atlantic Africa* (Guyer, 2004), which Verran then develops in her commentary on Guyer's work in which she coins the term 'relational empiricism.' During a petrol shortage in 1997, Madame A procures and transports a tanker of fuel from Lagos to her station in Nigeria. This in itself is no
simple task. The tanker breaks down and needs repair, the fuel itself is volatile, as are
groups of taxi drivers and others for whom the shortage is causing immense suffering
and who might steal the fuel by force or even set it alight. Once at her station, the fuel is
far some being simplified into a product. Some police and a few inexperienced soldiers
are present to ensure the Government mandated price for fuel of N11 per litre is adhered
to. The crowd of those seeking fuel occasionally erupts into violence, often exacerbated
by the armed soldiers, and on a number of occasions scatters the plastic kegs which are
lined up to be filled. Those with sufficient fuel have driven their cars to the station,
many now reliant on buying fuel in order to drive their cars any further. In the middle of
all this, next to the pump with a bag full of money at her side is Madame A.

On the face of it the problem Madame faces is just a particular case of the
general fuel shortage: there is not enough fuel. The limits imposed on the situation are
serious matters, and mismanaging them could lead to her death. The size of the tanker
has set limits on the amount of fuel: not enough to fill all the plastic kegs which are
lined up but enough to cause a devastating explosion, the government has set limits on
the price: not enough for Madame A to make a living when the time until her next fuel
sale is indefinite, the distribution of notes in pockets limits people's capacity to buy the
fuel: not enough for many of the desperate gathered around, and a commonly
understood moral register has set limits on the add-on costs possible: too much and the
price will become 'ajeju' and the seller will be accused of exploitation and witchcraft.
What is Madame A to do? During the next day, Madame A orchestrates an extraordinary
connecting and separating of relations, creating new orders which performed
collectively negotiated transitions or 'sales' transforming this singular tanker of petrol
into a plurality of petros in cars and kegs and transforming an anxious crown to an
appeased one. As Guyer writes,
'It was largely the quiet and methodical work of the station owner, who supervised the entire distribution, that kept the situation orderly. In the end there was no serious fighting, due to at least in part the skill with which she worked the repertoires for differential access throughout the whole day and night that it took, over several opening and closings, to sell the entire tanker load to the assembled clientele.' (Guyer, 2004: 109)

Rather then accepting fuel and its access as given by imposed limits such as litres, dollars, and social status, Madame A treated fuel as emerging in these orders which were themselves dynamic, relational and embodied in the here and now of the situation. First, in relation to the long line of plastic kegs, fuel was not to be given in litres but literally in kegs. One large keg cost N1,700. While the police could have re-made this relation of fuel-to-kegs back to litre-to-N, the large keg was fifty litres, they did not. This is because the re-ordering of things was done simultaneously with a reordering of people. Police and military orders are hard to change, and they are paid for helping and their temporary separation from the situation. Madame A also made her exchange of notes very public, ensuring witness to her observance of the nominal price. The station opened then closed four times, each selling period cohering a group of people and things. The first, actual car tanks were filled. The second, access money was quietly sort and higher ranking members, including the police, were sold kegs of fuel at the nominal price. Not all highly ranked people were served, and some lower ranked citizens were, ensuring that this social group did not become fixed and too obviously exclusionary.

On the third opening, buyers 'paid' a little extra in their waiting, but could reduce this by paying other businesses and officials. A not diligent enough handing of this order, meant not all your kegs would be filled. In the fourth opening, the taxi drivers and the others more lowly ranked bought fuel at the nominal prices, paying the 'extra' in
waiting all day in the sun. Hence, the concept of 'price' was not determined and imposed by some invisible hand, nor some very visible soldiers, nor once and for all at the start by the station owner. Rather, the 'price' emerged again and again as a moment of transitional a filling of a keg, a moving in the queue, a handing over of notes. Each moment determined a new publicly and collectively negotiated set of relations between people and things. The price was stable enough to be acceptable as equal and fair, but flexible enough to ensure that the entire routine could continue until all the fuel was sold without causing conflict.

I tell this story in detail because despite the perhaps ethereal philosophical development of relational empiricism in this introduction, it is done in every day routines, some significant other not so, some in research and others not. In telling this story of Madame A creating new limits or values by negotiating relations and effecting new transition at these limits, Guyer herself had to do the same, in person and in the text. As Verran writes,

"both Madam A and Jane Guyer are interested in the particulars of the many ways petrol can be qualified as an economic good in becoming many diverse products, and the characteristics of the mediators (human and non-human) that participate in those translations. For both women those particulars contribute to a general picture—the multiple and specific orders by which a vague whole, the economy of qualities of petrol during a shortage in Nigeria, is done' (Verran, 2007)."

In recognising both intensive orderings and their extensive limits, relational empiricism attempts to align itself more fully and in more subtle ways to the everyday goings on of collective life. In recognising its situatedness in collective life, it takes both limits and potentials seriously and recognises that others in the collective, human and non-human together, are are doing the same. A relational empiricism of number,
therefore, might begin attending to 'the multiple and specific orders by which number as a vague whole is composed'. This task is as much metaphysical as it is historical, and appreciating some of the ways number has come to life in Arnhem Land is crucial in cultivating an ability to be sensitive towards the ways in which number orders and is ordered by contemporary Yolŋu livelihoods in Arnhem Land.

**Number coming to life in Arnhem Land**

In 1995, in the main courtyard of Yirrkala Community Education Centre, a conference was opened to celebrate the on-going life of the Garma Living Maths Curriculum. It was a birthday of sorts, held in one of the former missions now settlements of North East Arnhem Land. On posters pinned up outside and inside the classrooms which encircled the courtyard the Garma Living Maths Curriculum demonstrated the number that it had given birth to: a number that would live as an in between, within and outside both Yolŋu knowledge and Balanda knowledge. It was hoped that this number would become a familiar companion for children growing up and living in this in between. While this was an occasion for celebration, it was important to recall a number which had emerged in Yolŋu lives previously, a number which was not so tolerant of difference. 'When we were going to school it was a mission school' Wäli Wunuŋmurra reminded the gathering. 'The school I went to. They had strict rules in the mission school and we were not allowed to miss school. If we [did] not turn up at school, we weren't allowed to eat and our families would not get their ration. That was how strict it was' (Wäli Wunuŋmurra quoted in Nambara Schools, 1995: 10). Number did not arrive in Arnhem land. It was born, through strict and often painful discipline, through engagements with orders of Yolŋu life and through the ingenuity of Yolŋu people.
The first numbers to try to live in Arnhem land counted heads of cattle and rows of pineapples and Chinese lettuce at stations that were established the late nineteenth century. The station workers protected these numbers, and had a policy of 'shoot on site' for any Yolŋu seen in the vicinity. When Yolŋu tampered with these staggering numbers (two thousand head of cattle) and continued hunting on the plains as they had done for generations, retribution parties exacted deadly revenge (McMillan, 2007). In the early twentieth century, mission settlements began to be established across Arnhem Land: Goulburn Island in 1916 and gradually moving East to Milingimbi in 1927, Yirrkala in 1935, and Elcho Island in 1945. In his history of the Church Mission Society, *We Wish We'd Done More*, John Harris writes that the Society's understandings was that the Yolŋu people had to be 'civilised' before they could become Christians (Harris, 1998: 204). Of highest priority was food production, and gardens were considered essential parts of the Christian 'family unit' (1998: 210). The spread of the missions was predominantly determined by the discovery of locations in which the soil was appropriate for agriculture (McKenzie, 1976). As the women learnt to 'stitch in time', the planting of sweet potatoes in rows was demonstrated to the men, the children were taught to read, write and count in the small mission schools. Using little pieces of asbestolite as slates, children began inscribing numerals and naming them: wan, du, dirri, bo, bayip, djik, djapin, ayit, ŋayin, diyin. These routines, English numbers names said with Yolŋu mouths and through familiar Yolŋu sounds, would sometimes pass as 'numbers' and in doing so would pass a Yolŋu child as 'more civilised'. If these names were inaudible as numerals, and considered sounds from the child's 'primitive' language, they would be severely punished, as languages other than English were not permitted to be spoken in schools (Dhaykamalu, 1999). In recognising numbers names, teachers also had to recognise the child saying them. Hence, at school Dhaykamalu became Valerie,
Yinjya became Mark and Gurruwikpik became Daniel. Rations of tobacco and flour, and occasionally of produce from the gardens were given to families if they had worked and had their children attend school.

By the middle of the twentieth century, however, the Church's own rations were drying up. The missions accepted capital grants from the Australian Federal Government on the condition that the missions enact the newly developed policy of assimilation. According to the policy,

'Work should be provided for them [Aboriginal Australians], realistic wages paid, and shops should be opened at the Missions so that they might be given the opportunity of running their own lives and those of their own communities within the framework of the Missions.' (Cole, 1971: 26)

Despite this policy beginning in 1947, Australian currency was not used in the mission economies until the mid-1960s. Instead, token money made from cardboard and washers were used. This had been attempted previously. In 1930, the aptly named George Goldsmith had attempted to stop the provision of food and tobacco rations for labour in favour of a form of wages. He cut round disks of four different sizes from cardboard and inscribed numerals on them. The size/numeral combinations matched the Australian coins of the time: the shilling, sixpence, threepence, and penny. One young Yolŋu boy however, worked out that such a process of producing money value did not end at the fingers of Mr Goldsmith. He could take a penny coin, cut it down to a smaller size and modify its inscription from a '1' to a '6', an in doing so end up with a sixpence. Much like the disciplined work of planting sweet potatoes in order to multiply them, this young boy had found a way to cultivate money value itself: beginning with one penny he produced a coin of six times the value. The Groote Eylandt mission was established for Aboriginal Australians with some European ancestry, or 'half castes' as
they were called. Being further along the scale of assimilation than the other missions in Arnhem Land, this mission had real pennies, but as with the people the coins were also caste, this time with a 'Y' such that they could not be used off the island.

In her book *Two Laws: Managing Disputes in a Contemporary Aboriginal Community*, Nancy Williams argues that European orders became more embedded in the orders of North East Arnhem Land than such missionary experiences and histories describe.² In relation to housing, the spatial layout of missions were straight roads with more or less perpendicular intersections, creating rectangular house blocks and gardens (Williams, 1987: 19). Within such a grid, a mission resident could visit their brother-in-law by taking the first left and stopping at the third house on the right. Although mission houses were given by the head of the mission to identified 'nuclear' families, and only after they had demonstrated they could keep a transitional house, this rarely occurred. Yolŋu lived in houses, as they lived in the land. Those from inland areas lived in top camp, away from the beach. Those from salt water country and the lower reaches of water ways lived at beach camp. The distribution of families and clans re-embedded the mission and its houses within the order of Yolŋu land ownership. Moreover, Williams argues that as the missionaries themselves were adopted in gurruṯu, and

> 'since all kin-defined roles specify some conditions for reciprocal "help" and "work", the Yolngu tended to judge missionaries on the basis of the "work" they did to "help" Yolngu and, consequently, whether missionaries justified their presence on the station or earned their "wages".' (Williams, 1987: 24)

Hence, not only were the houses of the mission embedded into Yolŋu relations in the land, the missionaries and their behaviours were also embedded in these connections and were understood as situated in Yolŋu landscapes, and were continually

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² Nancy Williams analysis concerns the Yirrkala Mission. However, same metric layout exists in other missions, as does the spatial distributions of Yolŋu clans and families in which the missions and their houses become embedded.
judged as maintaining a justification for this presence or not.

The knowledge taught in schools, however, remained within the rigid European curriculum and discipline of missionary schools and divorced from Yolŋu life and Yolŋu worlds. Mathematics was taught by rote and repetition and despite keeping pressure upon families to have their children attend school, the lack of ground work in contextualising mathematics into Yolŋu life meant that maths education and the numbers it tried to bring to life were rarely successful partners in learning for many Yolŋu (see for example testimonies in the Maths as a Cultural Practice Workshop in (Charles Darwin University, 2007)). When the missions became government settlements in the 1960s and the schools government schools, little changed. The commonly held view at the time was that Aboriginal Australian societies in general had no words for numbers greater than three, and this was evidence for Aboriginal Australian being devoid of any mathematics at all (Harris, 1982). Implicit in this approach was that Western numbers were universal and had not yet been recognised by Aboriginal Australians. In 1975, however, a survey by the Australian Council of Educational Research found that these numbers, even when repetitively demonstrated by Western trained teachers, were not having a universal impact in educating children. Aboriginal children in the Northern Territory were failing to recognise number and failing to grasp mathematics (Keeves, Bourke, 1976).

This large scale failure of Aboriginal children living in the northern Territory at basic numeracy tests came three years after a newly elected Australian Government had made it legal to teach in languages other than English and bi-lingual education was emerging in many school in remote Northern Territory settlements. The failure of students to recognise the difference between '75' and '62' was now understood to be a
failure of the curriculum to recognise the difference between Yiŋiya and Mark. The research impetus at the time was towards how to recognise and understand Aboriginal mathematics as different. Exemplary of this approach is the work of Michael Cooke. In *Seeing Yolŋu, Seeing Mathematics* (1990), Cooke argues that efforts which seek to see a narrow Western mathematics in Yolŋu thought should be abandoned, and that

'a far broader way of defining mathematics is to view it as a society's system of encoding, interpreting and organising the patterns and relationships emerging from the human experience of the physical and social phenomena. The emergence of a cultural schema is then a manifestation of the continual negotiation and refinement within a society of a framework for discerning patterns and for describing/defining their governing rules and interrelationships a coherent, ordered system of meaning. Whilst this process is common to all cultures, the resulting schemata can be fundamentally different.' (Cooke, 1990: 5)

For Cooke, 'an investigation of Yolŋu mathematics becomes a study of gurruṯu' (1990: 5). This relativist move on behalf of settler Australian educators and researchers occurred concurrently with the political movement of self determination. In the Northern Territory the movement to 'Aboriginalise schools' emerged and Aboriginal communities took up the challenge to control their schools, employ Aboriginal teachers and develop a curriculum respectful of Aboriginal knowledge and learning. In 1987, Hon Member for Arnhem Land, Wes Lanhupuy gave the occasional address at the graduation ceremony for some of the first of these Aboriginal teachers who were going to lead the Aboriginalisation of schooling in the Northern Territory. He said,

'Schools have been part of the process of colonisation of Australian and its original inhabitants. Schools were introduced and imposed on Aborigines following the fierce struggle between Aborigines and the new white settlers ...

To the credit of Aboriginal people much has still been retained in the face of continual pressures to undermine and undervalue the intellectual traditions of
Aboriginal Australians ...

Aboriginal people now understand that if schools are to serve the political, social and economic purposes of their own people, the school, as an institution, needs to be accommodated within the Aboriginal society itself.

Only when the cultural orientation of the school becomes Yolŋu, will schools become integral to the movement of Aborigines towards self-determination.' (Lanhupuy, 1987: 31-2).

This speech is quoted at similar length by Raymattja Marika, Dayngawa Ngurruwuthun and Leon White in their article 'Always Together, Yaka Gäna: participatory research at Yirrkala as part of the development of Yolŋu education' (Marika et al., 1990). For Marika and her colleagues, the challenge of developing a Yolŋu oriented schooling begins with a public articulation of Yolŋu intellectual traditions (1990: 3). These intellectual traditions had sustained and developed Yolŋu life for generations immemorial. One way they could continue was to provide the foundations for Yolŋu within the national framing of Aboriginal self-determination in the 1980s. Self-determination meant embedding education within Yolŋu society. After decades of failure, the hope for Western mathematics and number to emerge as successful in remote schools in North East Arnhem Land meant articulating them within Yolŋu intellectual traditions.

During the development of Yolŋu oriented education, Gaŋma became an important metaphor for Yolŋu in theorising of contemporary education (Marika et al., 1990: 19). It was first introduced during a workshop that was developing connections between gurruṯu and number (Nambara Schools, 1995: 21). Number and gurruṯu were similar in that they had particular patterns with specific names. It was this similarity that was being understood through gaŋma:
'In terms of the Gaṉma Project, gaṉma is taken as describing the situation where a river from the sea (in this case Balanda knowledge) and a river of water from the land (Yolŋu knowledge) mutually engulf each other on flowing into a common lagoon and becoming one.

In coming together the streams of water mix across the interface of the two currents and foam is created at the surface so that the process of gaṉma is marked by lines of foam along the interface of the two currents. In the terms of the metaphor then the line of foam, that is formed by the interaction of the two currents, marks the interface between the current of Yolngu life and the current of Balanda life. Both Yolngu and Balanda can benefit from theorising over the interaction between the two streams of life.' (Marika et al., 1990: 13-14)

Hence, by understanding number and gurruṯu through gaṉma meant the similarities – routines of patterning and specific naming – were made, created out of the interaction, like the foam. This marks not only an important difference in concepts such as number and gurruṯu, but also a different way of understanding concepts. Number became useful and knowable not through identification but through the production of negotiated analogies and working similarities. Bringing number into Yolŋu schools therefore meant keeping the two different knowledges interacting, and following and theorising the lines of foam that appeared at the surface. For this, another Yolŋu metaphor was used: galtha.

'Galtha in this sense is a place where people assemble, arriving from their different territories to sit for some time with related groups of people, but galtha is more than this. It is a place at which agreements are made and plans formulated. More importantly, it refers to the whole process of meeting, discussion, negotiation, planning, agreement and action. Galtha marks the nexus between plan and action, between theory and practice.' (Marika, 1999: 6)

For Yolŋu self-determination meant leaving the settlements and re-establishing the relations of people-place that constitute Yolŋu society. These relations, people-places or clan-lands, enacted as people living in place came to be known as homelands. Many of
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the homelands started their own schools. In the most Eastern region of North East Arnhem Land, within which the Yirrkala community is on the Eastern most coast, these homelands and their Homeland Learning Centres formed the Laynhapuy Homeland Schools. Hence, creating schooling through gaṉma meant doing it in and through all these different homelands, and for this galtha rom, or galtha law, was used. Galtha was the process through which the new schooling curriculum was generated, understood and agreed upon, in each place.

Where Western number emerged, it emerged within a Yolŋu orientation. On Thursday February 9, 1989 in Yirrkala Community School, the morning was spent with elders drawing lists of the formal names of gurruṯu: ɲaŋdi, waku, bāpa, gāthu, māri, gutharra, momu, marratja and so on, after which a Balanda teacher drew up a list of the formal numbers names: tens, hundreds and thousands and so on. Each one was done as a recursion, going from one relation to another: from ɲaŋdi-waku through mukul bāpa-gāthu gets you momu-gaminyarr, from nine-groups-of-one though one-group-of-one, gets you one-group-of-ten. In June, 1991 in Biranybirany Homeland, the participants were introduced to the place through the ancestral journey of the Djan'kawu sisters and the relations it established for the clans and lands. Then, separating out all the students into clans, they were counted and this number was drawn as a column graph. In November 1991, at Yāŋunbi elder Larrtjanŋa led a galtha rom workshop through the place, telling the story in place, showing the names and relations that were created. The students and teachers who were from many different clans 'found themselves where they stood in this country and why … they found themselves as one with everything around them' (Yirrkala School Literature Production Centre, 1992: 17). They then re-performed this making of a unity out of differences by mapping all the places on the metric space of rectangular sheets of paper. Back at Yirrkala in November 1992, the workshop caught
and prepared maranydjalk (stingray) that had become fat at that time of year. Once the
meat of all the maranydjalk was prepared together it was shared out as small balls of
meat. This sharing was done by matching a quantity of people getting meat to a quantity
of balls to be made through the one-to-one matching routines of Western number. In
each case, located in Yolŋu places, under the instruction of Yolŋu knowledge authorities,
Western ways of doing patterning and naming were generated together with Yolŋu ways
of doing patterning and naming. The public articulation of these Yolŋu intellectual
traditions in the context of developing Yolŋu education however required more work.
And for this, a final metaphor was given: garma.

'Garma is also a place [as was gaṉma]. It is an open area that everyone can
participate in and enjoy. If a ceremony is negotiated and produced in full view of
everybody, it will be performed in the garma ceremonial area. Yolŋu can sit and
watch a garma ceremony and read from it the network of connections between
people, places, songs and totems that make up these particular ceremonies at a
certain time. Garma also means an open forum where people can shared ideas
and everyone can work hard to reach agreement. The old people told us the
school should be like a garma setting.' (Marika, 1999: 8)

In Yirrkala a Yolŋu oriented education was to become a setting for garma.
Western mathematics and number was to find its home in the first strand of the
emerging curriculum: the Garma Living Maths Curriculum. The Garma Living Maths
Curriculum holds together number tally with gurruṯu as analogous routines of recursion,
while Western space is held as analogous to djalkiri, the footsteps made during the
journeys of ancestral beings which create places and their relations in Yolŋu world
(Thornton, 1996). Through metaphors of gaṉma, galtha, and garma, Western number
had finally been given ŭuku and luṉdu, its feet/foundations and friends, in the Yirrkala
School. What had been an infant, just born into the world in the mid-1980s was being
'grown up' though great effort and support and was becoming an energetic young child,
still young but more active. It was an achievement deserving of the tenth birthday celebration held on the grassed courtyard of Yirrkala Community Education Centre in 1995. It is fitting that such a number is given a ceremonial tenth birthday. The birthday is literally an occasion of both counting and being counted. Yolŋu students now literally count for number and number was now counting for Yolŋu students.

The Garma Living Maths Curriculum is a public expression of Yolŋu intellectual traditions made for the purpose of embedding an education in both Yolŋu and Balanda knowledge within a Yolŋu orientation. Framing this expression within its own terms, the Garma Living Maths Curriculum is a line of form being produced at the interfaces of the stream of Yolŋu knowledge and the stream of Balanda knowledge, which are constantly mixing but never becoming homogenised (gaŋma), that is then negotiated and decided upon group by group, place by place, homeland by homeland (galtha) and integrating this into a singular outcome to be presented at an open forum (garma). It is in this sense that the curriculum is named Garma Living Maths. Nevertheless, as a singular public expression there is the risk of it falling out of the processes in which it lives and being taken as a thing to be inserted into a more general framing. While the Garma Living Maths Curriculum is a great achievement for the Yirrkala Community School, the Laynhapuy Homelands, their students and communities, this achievement, treated as an exemplar of doing 'both ways' or cross-cultural education and research more generally has also spread to higher education institutions and their projects, Government environmental reports and international ethnomathematics databases. In most cases, Garma Maths is reframed as the successful discovery of a correspondence between Western Number and Indigenous knowledge or vice versa, which holds, unlike the foam, outside of the specific negotiations from which it is produced.
In other schools in North East Arnhem Land, Western mathematics and Western number remained as self-evident parts of school knowledge. In Yirrkala and the Laynhapuy Homelands, maintaining the Maths curriculum alive continues to be extremely difficult. In 1998, the Northern Territory threatened to withdraw support from bi-lingual education programs through which Garma maths emerged, and more recently in 2008 imposed a mandatory four hours English instruction per day, effectively destroying any possibility for a sustained Yolŋu orientation for education. In the same year, government support for homelands was drastically reduced as they were deemed non-viable settlements. Number still lives on in North East Arnhem Land, and perhaps more so with a cash economy, mainly supported by social security payments, and other routines of contemporary settlement life: mobile phones, digital clocks, bank accounts, cups of detergent, and litres of fuel. On a few occasions these numbers 'marry' Yolŋu ways of working but more often than not they become 'divorced'. They are worked out or not here and there but are generally not interrogated nor actively pursued as a opportunity for post-colonial learning and living.

**Postcolonial Potentials in indigenous Australian Philosophy**

This fourth and final section considers the potential for what might be called postcolonial philosophising: a form of knowledge work in the social sciences emerging from within colonial encounters with a sensitivity toward their transformative dynamics. This thesis contributes to postcolonial philosophising in developing an understanding of number and objects as irreducibly multiple relations and hence potential participants in the creative and political endeavours of postcolonialism. It also contributes to increasing efforts to displace Deleuzian thought into Australia through its engagement with Australia's postcolonial concerns and possibilities. The majority of this work, and
postcolonial studies elsewhere, understand relations as human (or social) relations and processes as those which produce (human) subjectivities. One unfortunate consequence of this focus on the subjective within postcolonial theory is that the work of Deleuze has largely been ignored or dismissed on the grounds that Deleuze-as-a-subject himself is neither concerned with postcolonial politics nor respectful of postcolonial 'voices' (Bignall, Patton, 2010). The unique contribution of this thesis in postcolonial philosophising is that it takes relations as assemblages of both human and non-human participants, with a focus on an entity which in some cases is even considered so objective as to transcend both a world of people and a world of things. Not only does this understanding of assemblage complement and expand the current work on Deleuze and the postcolonial, but is also helps expand the interface of positive engagement between Deleuze and the postcolonial.

So, what does a Deleuzian framing offer postcolonial places, practices and understandings? Simone Bignall proposes that Deleuzian thinking provides an articulation of a 'permanent and primary ontological difference' which is essential to 'post-colonial thinking' (Bignall, 2010a: 89). More importantly, this difference is positive, an affirmative impetus within transformations of colonial orders. Bignall argues that much postcolonial thinking and writing treats difference as negative, as difference between identities or societies. Her work recognises that such a treatment of difference is exclusively extensive. Differences in identities and societies are the given of the postcolonial encounter and agency, therefore, can only be understood and practiced as efforts at mastery over this difference, or merely as the skill of recognising how absolute and foundational division is in the world (Bignall, 2010b: 94). Making difference ontologically primary and intensive in the way Deleuze does (rather than epistemologically primary and extensive) offers Bignall a frame to move beyond a rigid
diversity of identities and societies to considering postcolonial encounters as affective and transformative assemblages.

As mentioned above, Deleuzian thinking has been considered ill-equipped for postcolonial encounters. For the most part this has been because his notion of assemblage flattened too many of the sharp differences of colonialism. Charges that Deleuze (the subject) and his work did not 'see' these differences were only accentuated by an absence of explicit work on colonialism and the apparent indifference this created for his coining of terms such 'nomadology' (Bignall, Patton, 2010: 2). Deleuze, as we have seen, does make difference ontologically primary, however it is as an intensive difference not an extensive difference. Politics, understood as the negotiation and transformation of actual extensive inequalities, for example in power, land ownership, human and political rights, and compensation, is in a sense secondary for Deleuze not because it is less important, but because extensive difference is always the outcome of intensive processes of becoming. The politics of extensive values – rights, wealth, freedoms, are secondary in an ordinal sense, emerging from within the negotiations which establish what 'rights', 'wealth' and 'freedoms' are. Politics therefore, is not secondary in a cardinal sense, of being of less value or less important to some independent 'philosophy'. As Bignal argues, a politics based on rights (understood as the internal properties of humans or human groups) requires an outside legislator with the power judge the correct recognition of these rights (Bignal, 2010a: 82). Politics as recognition operates in the same mode as knowledge as recognition. That is, through a presupposed observer with a good common sense, which Bignal sees in both liberalism and communitarianism.

Bignal argues that the recognition of rights does not do enough as a
postcolonial politics. That is, working with extensive difference cannot bring to life the full potential of the postcolonial encounter. Bignall's work brings into the clear relief the challenge for a Deleuzian framing of postcolonial philosophy: if rights are 'a minimum protection we simply cannot do without' (Bignall, 2010a: 96) how do we go on without imposing the mode of politics enacted through rights at the outset? Is the risk of undertaking the Deleuzian move in postcolonial places – that is of treating repetition as within a primary difference, rather than placing difference within a primary repetition, say rights or politics, simply too great? In resisting any totalising move in answering these question, Bignall argues that extensive differences must be worked out case by case through an affective politics of 'comportment' or living well together. This does not however, eliminate the risk of cases being folded back into relations of colonizing as witnessed when the Garma Living Maths was resolved as an official school curriculum.

Bignall does some important work in re-articulating the positive work a Deleuzian framing can do within postcolonialism. The full potential of the primary difference within the postcolonial, argues Biganll, is its transformational agency (Bignall, 2010b) which cannot be fully realised as a right based politics. Rather, this 'postcolonial agency' is transformational through becoming realised in multiple series (case by case) of becomings. In becoming sensitive to this agency as Biganll's work does, enlivens and expands the possibility for postcolonial philosophy. This thesis continues to enliven and expand postcolonial possibilities and hope. In working in social theory, Bignall reads Deleuzian bodies as social bodies. Bignall never explicitly equates bodies with humans, and Deleuze certainly does not, but is it important that we continue to expansion of difference as on going differenciations of both people and things, without making any distinction between participants.
A brief consideration of land rights can sketch the importance of making no distinction between human and non-human participants in post-colonial encounters. Bignall's critique of 'land rights' for Indigenous Australian's is that as 'rights' internal to communal indigenous bodies they must remain within the 'mediating body of the State' (Bignall, 2010a: 82). I agree. But its goes further. Implicit in Bignall's State is its 'thing', land, footprints, tracks, trees, roads, iron ore, gold, fire places, water springs and more which has fallen into the indifference of space and time – the very framing within which the State 'claims' and 'owns' territory. Hence, the mediating body of the State is only part of the foundational metaphysics which mediates Western politics and knowledge. If we are to refuse the imposition of State knowledge, and negotiate it case by case, we need to refuse that objects such as land are out there and given to 'us', recognisable and measurable by abstract concepts such as number. Politics and negotiations must be treated as collective, participated in by humans and non-humans, and constitutive of the world, both human and non-human (Latour, 2004).

Deleuzian thought has assisted in rethinking Australian 'Nature' and environmental politics. Environmental politics in Australia is usually understood in the terms of categorical accounts, from the oppositional conflicts of forest blockades to the sustainable management practices which in Australian go under the banner Natural Resource Management or NRM: What constitutes 'forest'? What constitutes 'resource'? What is 'ecological asset value' and how to measure its units? What is loss? What is damage? What acts are crimes? (Halsey, 2006).

Mark Halsey argues that Deleuzian framing offers a problematic account as an alternative to this categorical account, in his case of the Goolengook forests in South Eastern Australia. For Halsey, problematic accounts hold these categories as the limits
of Australian Nature emergent from conflict events. Most accounts of environmental politics focus on solutions to conflict (this is a forest and this is loss) and in accepting these limits as the limits for the account they treat conflict itself as that between different categories rather than an event in which difference is immanent in generation of these categories (Halsey, 2006: 5). While Halsey works from texts, showing the necessary violence they do the the life of the conflict itself in the place 'becoming-known' and 'becoming-contested' within a colonial Australia his framing demonstrates the potential of locating Deleuzian thought in novel places.

Stephen Muecke's *Ancient & Modern: time, culture and indigenous philosophy* (2004) is another work which displaces Deleuzian thought into Australia. For Muecke, as for Deleuze, philosophy is the work of actively generating concepts, 'ways of practicing knowledge repetitively, keeping it alive' (2004: 27). One becomes sensitive to this vital energy or potential for living and more able to engage with it as thinking when difference is understood as intensive or constitutive of an encounter. It is this Deleuzian move which Muecke directs toward the postcolonial encounter of Australia.

Muecke's work performs two generative differences in the place of old dichotomies: ancient & modern and body & country. For Muecke, Australia and a philosophy indigenous to Australia (which he calls 'indigenous philosophy') is both 'ancient & modern'. Indeed, modern Australia is enacted and narrated through a notion of the ancient. Hence, indigenous philosophy is not concerned with purifying the ancient and modern (nor recognising them as purified), and working them as foundations experienced within the linear temporalities of progress or civilisation. Rather indigenous philosophy is concerned with asking the questions: whose modern? whose ancient? and which connects do we make? (Muecke, 2004: 10) He writes,
'While the anthropological vision generally labours to clarify the differences between two sets of cultures and to describe each culture separately, I want to set up a mode of relating the can, rather, go to and fro on equal terms.' (Muecke, 2004: 10)

Here and elsewhere in *Ancient & Modern* (2004: 68), Muecke makes a distinction between the work of the social sciences and the work of philosophy, the former collecting data and purifying its objects and later seeking a metaphysics of relations which can constitute an on going collective life. His notion of place, however, works to caution against any fixed separation of the two endeavours and provides an inspiration for an empirically emergent philosophy within Australia. Muecke argues that indigenous philosophy means that 'place has to do the thinking and feeling for us' (2004: 90). The most important practice for Muecke is not a placeless ritual between 'society' and the 'word' but a located ritual between country and body (Muecke, 2004: 66). Philosophy becomes about the embodied cultivation of concepts in place. Muecke's move to make place primary in Australian indigenous philosophy resonates with Bignall's move to make difference ontologically primary for the postcolonial. The concept of place problematises practices of moving, displacing and relating. Places are not known as the particulars of a general concept 'place' nor as points within some abstract space (this is not a ritual between society and the word, but between body and country), but known through movements which connect places and create relations. Hence, indigenous or postcolonial philosophy in Australia emerges through movements *between* places and generative of new *relations*, rather than practices which are additive of places and generative of territories.

**Doing relational empiricism as performing a screening**

The movements which have so far relocated Deleuzian thought within
Australian postcolonialism recognise the performativity of knowing and living. Standardisations - rights, categories, and dichotomies, are the achieved limits within the actual here and now of living. They are not the limits of living, and are not be recognised as such. All work is necessarily performative, including this thesis. This thesis performs a certain displacement. In the second section of this introduction I understood this work of displacement as operating within the intensive screen of differentiation. As an intensive screen, research is not finding and knowing its place through extensive properties (length and width, \( x \) and \( y \)) but pushing out through displacements generated by intensive difference. Each displacement generates regions of coordination within the surface, and in doing so, simultaneously coordinates the research and the writing. We could say research is a process of becoming coordinated. So far, this thesis has created a region on the surface, not from nothing, but through progressive displacements: number studies, Deleuzian framings, genealogies of number in Arnhem Land and postcolonial reworkings of Deleuze. In working relationally, each displacement has effected an in between, a moment of regionalisation on the surface.

Performative texts, such as this one, therefore, are attempts to effect a unity. This unity is an assemblage of relations that can continue articulating a problem, an event in better or worse ways, both in actualising solutions and making more kinds of solutions immanent in the event: solutions in potentia. This vague whole continues to specify its parts in various forms – the text, the writer, the reader, the topic, in ways that might continue further displacements in thinking and living. Hence, the writer of this text and reader of this text, do not precede the text. They are performative also in the sense that they come to inhabit the region on the screen, they come to participate in specific screenings from which something new emerges. This is what Foucault referred to as 'persisting in the confrontation with stupidity' and awaiting the always
unpredictable 'shock of difference'. That this text might not be very effective, it might not affect you the reader enough, it might not affect the author enough, is always a risk. It is a risk that I want to mitigate against without further hesitation by accelerating this thesis-event to its limits and demonstrate the displacements in thinking that it can produce.

The next chapter therefore is not 'the next' proposition in an argument, it is not what 'happened next' after I read the relevant literature, it is not 'the next' point on some linear progression, but an exemplar of the encounter of Deleuzian thought and number Arnhem Land. It operates as a screening, a particular enacting of the region that constitutes this thesis. In screening this region it takes samplers from Deleuzian thought and ethnographic samplers and stitches them together. To paraphrase Latour, what matters is how such a screening can hold samplers together without crushing them and keep them apart with scattering them (Latour, 2004: 150). It is simultaneously a solution to the here and now problem of what comes next in the text, and a solution to the problem of number in Arnhem Land. Specifically, it continues to repeat or differenciate solutions to the problem of difference and value in Arnhem Land. As a repetition it seeks to amplify the inaudible and to harmonise with minor intensities such they might become more audible. The task is to amplify potentials more fully and expand the politics and ethics within which postcolonial futures can be continue to be born.
Chapter One
Chapter Two

Intensive Enumeration: a screening of the problem of value

This chapter is a *screening* in which assembled ethnographic samplers and samplers of Deleuzian concepts effect a generative account of number, value and difference. It provides an exemplar of relational empiricism; the novel empirical analytic in the social sciences that this thesis develops. The chapter provides an account of the enumeration of value as an intensive process. It interrogates the enumeration of value through a mutual juxtaposition of the Deleuzian concepts of control societies and the event, and episodes from Australia's recent dramatic overhaul of governance in Aboriginal communities called the Northern Territory Emergency Response. Of interest here is Income Management, a measure which effects multiple registers of money value in many remote and Aboriginal communities. Income Management is presented through understanding number as an event through which multiple registers of value, or
valuations, become differenciated. In doing so, the routines of enumerating value also differenciate new types of customer, new types of business and new types of product, each of which are considered here as a moment or fold in the event. In being a performative account, itself generative of difference, this research becomes another form of modulation and recoding, raising the question of politics and resistance within relational empiricism and the emerging forms of empirical research inspired by Deleuze and others.

The New Empirical: from Discipline Societies to Control Societies

The social, according to Latour, is 'not a special domain, a specific realm, or a particular sort of thing, but only as a very particular movement of re-association and reassembling' (Latour, 2005: 7). Within this analytic framing, developed under the names sociology of translations (Callon, 1986), Actor-Network Theory (Latour, 2003) and material-semiotics (Law, 2004), social science is not concerned with the description of a thing, but the dynamic processes through and as which the world is assembled and reassembled as a collective of humans and non-humans. The distinction between a colonial society and a postcolonial society is therefore a comparison of two modes of 're-association and reassembling’. They are not separate things, but differenciating movements. The potential for postcolonial relations are always immanent within the practices of the colonial. The question of postcolonialism therefore, is the capacity for these potentials to reconfigure the way collective life is lived and do so in a sustained way. Deleuze's distinction between control societies and discipline societies is also a typology for sensitising us to modes of practice which sustain and transform collective life. In cutting across the colonial/postcolonial comparison, the control/discipline typology allows us to problematise the relationship between the colonial and the
postcolonial and reconsider and reconfigure the potential for real postcolonial relations to emerge and be sustained.

In one of his last interviews Deleuze proposes that we are 'definitely moving toward "control" societies that are no longer exactly disciplinary' (Deleuze, 1995: 174). Here, and in his "Postscript on Control Societies" (Deleuze, 1995: 177-182), Deleuze extends the work of Foucault, outlining the distinction between discipline societies and control societies, the transformation of capitalism within control societies and some of its emerging forms of subjectification and resistance. In making the comparison between discipline societies and control societies, Deleuze uses a comparison of figures which enact the relations which constitute collective life. To begin connecting up these figures to an interrogation of number, I call these figures which effect a collective, *modes of enumeration*.

Deleuze contrasts the figures of signature and number (note that Deleuze's number here is extensive and *not* analogous to the number that is the concern of this chapter) which work to constitute discipline societies to the figures of password and code which work to constitute in control societies (1995). Hence, discipline societies emerge through an assembling of relations which simultaneously effect individuals (signature) and a population (number). Hence, we might understand *disciplining enumeration* as a form of tallying which simultaneously effects discrete units and a collection. Passwords, however, are not enumerated through tallying, but through arranging. *Controlling enumeration* could be considered as routines which through assembling relations simultaneously effect passwords and their assemblage as code. Code is not simply a list or register of passwords, but an arrangement. Passwords connect up in a network of dynamic relations with constantly changing combinations of
permissions, denials and re-directions. Control becomes 'short-term and rapidly shifting, but at the same time continuous and unbounded, whereas discipline was long-term, infinite, and discontinuous' (Deleuze, 1995: 181).

Within a control society, capitalism is much less directed toward the concentration of resources and labour, but more toward the distribution and character of products and markets. Products become simultaneously finished and incomplete, constantly being modified and recombined for markets (Deleuze, 1995: 181). The new objects that emerge therefore are no longer concentrative, either in terms of populations, wealth or resources, but dissipative in terms of effecting what Deleuze refers to as 'samples, data, markets or "banks"' (emphasis original, 1995: 180). The concern of a control society is failing products and markets, not failing production and factories. Processes of subjectification also change. Individuals no longer gather in number, neither inside nor outside the factory walls, but rather 'dividuals' are decomposed from 'samples' and 'markets', only to recreate new samples and markets. Resistance to this universalising of coded and coding markets must be sought outside these forms, that is, outside of these modes of circulation and communication (Deleuze, 1995: 175).

Does the distinction between discipline and control societies map onto the distinction between colonial and postcolonial societies? Are colonial societies related to discipline societies in their concentration of people, land and things as imperium, whereas postcolonial societies are more like control societies, working with dissipative and multiple languages and codes? In Australia is it the other way: assimilation and the forced removal of indigenous children from their families enacting dissipative and modulating 'communities of care' in which the State, churches and European families all participated, with a postcolonial Australia establishing more fixed forms of rights and
their recognition for the country's indigenous peoples? Such questions mistake these typologies for categories, and in doing so search for a hierarchy; postcolonial within control, or control within the postcolonial. There is no given relation between colonial/postcolonial and discipline/control. Relations, however, can be made. But this takes work, itself an act of connecting and separating which may or may not allow relations to be re-worked and our sensibilities for change to become re-tuned.

The distinction between discipline and control societies can be read as analogous to Deleuze's more theoretical project of developing analyses of worlds which are not exclusively extensive, but are intensive. In relation to things, the ontology of intensive worlds is concerned with non-metric objects rather than metric objects (De Landa, 2005). The defining process of disciplinary societies, confinement, is fundamentally extensive and metric: it creates distinct enclosures within cartographic space defined by boundaries which are of measurable extent (prison walls, school rolls). A defining process of control societies is modulation, which regulates flows and differentials, all of which are distinct but obscure in that they are intensive and dynamic (community correction, continuous learning). The central concept Deleuze uses in analysing an intensive reality is the event. 'I've tried in all my books', he says, 'to discover the nature of events; it's a philosophical concept, the only one capable of ousting the verb "to be" and attributes' (1995: 141).

As Chapter One made clear, studies of number to date have predominantly understood number as operating in an extensive or one-many relation. Research has focussed on the way number 'clots', 'stabilises', 'standardises' or 'makes sameness' in practice. Here, enumeration is predominantly disciplinary. Analyses of number as doing disciplinary enumeration, as working to effect objects as metric, does show some of the
critical workings of knowledge and power: the census and its people, the State and its territory, a currency its internal exchanges. However if these extensive limits are taken as given, the sensitivity of research toward change and novel re-configurations becomes both metaphysical and politically impoverished. In accepting that these limits are real, but are only the limits of intensive processes, we can begin to think and work number as not exclusively extensive and continue the development of conceptualisations of enumeration as intensive and modulating. The chapter claims that number, understood as a relation, has the character of an event, and participates not only within processes of confinement and measurement (as the figure of number does in Deleuze's writings) but also participates within processes of modulation.

This demands not only further empirical studies of number but also new understandings of objects. The conceptualisation of number and enumeration as intensive processes within a control society which I develop through this screening contributes to this empirical and methodological task. This chapter develops an account of number as an object generative of difference and multiplicity. While this re-conceptualisation of number and enumeration is novel in the broad sense of giving an intensive account, it shares a commitment with previous analyses to an understanding of number as performative and material, and a sensitivity to the generative nature of practice. I use the event as a framing concept to operationalise this sensitivity.

This chapter develops an account of number as affecting intensive processes within what I suggest is an emerging control society in remote Australia. It does so through the telling of three moments of the event number-as-enumerated-value which is realised in the Northern Territory Emergency Response in the region of North East Arnhem Land. The constituents of a control society are seen to emerge in several
folding moments of the event. These moments are told here as new customer, new product, and new business, each being born within in the re-qualification of money within multiple registers of value. I understand the telling of these moments as a screening of the Northern Territory Emergency Response as a control society – an intervention in a multiplicity, which by extracting differentials, presents and orders samplers into felicitous accounts. We will begin with the Northern Territory Emergency Response and its measure of Income Management.

Controlled Communities: Income Management and the Northern Territory Emergency Response

In June 2007, Australia was five months way from a Federal election. In the Northern Territory, Australia's 'outback', a report was released documenting some shocking cases of child abuse in remote settlements and recommending immediate consultations concerning the improvement of health and education services in the Northern Territory (Anderson, Wild, 2007). The findings and recommendations of the report were not surprising: they were consistent with a number of reports completed in the previous decade (Wild, 2007). Neither were the TV images of Aboriginal children playing in red dirt out the front of derelict houses. What happened next, however, was surprising. On June 21, the Federal Government announced an emergency takeover of remote settlements in the Northern Territory. It did so swiftly, without consultation, and by taking full advantage of its Federal powers to make legislation for the country's largest Territory (Australia's other seven regions are the Capital Territory and six self-governing States). The Northern Territory Emergency Response (abbreviated to NTER but more commonly known as 'the Intervention') was to apply within 'prescribed areas' which were designated at the discretion of the Minister for Indigenous Affairs, and most
Chapter Two

of these became circles of a five kilometre radius centred on remote settlements. As the residents of these remote settlements were predominantly Aboriginal Australians, the legislation explicitly enacted itself as a 'special measure' of exemption in relation to the *Racial Discrimination Act 1975* and its obligation to the United Nations (Law Council of Australia, 2010). The NTER has been investigated on three occasions by the United Nations, each time being publicly criticised as discriminatory and detrimental to people's well being in prescribed areas.

Seventy three settlements were 'prescribed' and became subject to the punitive measures of the NTER. By September 2007, Major General David Chambers was appointed in charge and uniformed Australian Defence Force personnel began to arrive in settlements and establish self contained living quarters and medical centres in which they were to conduct mandatory child health checks (which were quickly ruled illegal). As the unprecedented scale of the legislative overhaul began to be understood and challenged in courts and the public commentary, their severity was being realised in prescribed areas. All public assets were seized, police stations and holding cells were built, the sale of alcohol and pornography was banned (even though it was illegal by local by-law in many settlements already), child health checks (now illegal to enforce as mandatory) were vigorously encouraged, and all adults receiving social security had half of their payments controlled by the national welfare agency Centrelink under an measure called 'Income Management' (Commonwealth of Australia, 2009 a). The motivation for controlling half of people's social security was to prevent them from spending this money on alcohol, cigarettes, pornography and gambling, and therefore hopefully on food, clothes and medicines. While the governance by containment of land, assets and children through the enclosures prescribed and patrolled areas, and medical registries appear to be strictly disciplinary measures, it is the measure of
Intensive Enumeration

Income Management which has become one of most enduring and significant aspects of the NTER. Moreover, after its implementation in the Northern Territory, Income Management is now being proposed as a general feature of Australia's social security system (Commonwealth of Australia, 2009 b).

Income Management did and continues to not only apply to people who are living in prescribed communities (as the current prohibition on the sale of alcohol and pornography does), but to anyone who visits prescribed areas for services such as schooling, medical treatment, shopping, banking, visiting family and friends or simply passing through. Hence it was not seventy three 'areas' that became subject to Income Management but in becoming nodes these 'prescribed areas' designated seventy three markets, encompassing not only the activities of tens of thousands of people living within the prescribed communities, but also those living in most of the five hundred or more remote outstations and many living in larger regional centres. The work of prescribed areas to operate as nodes in effecting Income Management resonated with the new 'hub and spoke' model of governance and service provision proposed for the Northern Territory (Northern Territory Government, 2009).

The juxtaposition of Income Management and control societies that constitutes this paper is divided into six sections. In the first section, I introduce Income Management as three folds or moments in number as event and then in the second section go onto decompose the first fold: that of registering a managed customer. Here we see number working as relation, flipping between two modes of enumeration and in doing so creating two different registers of money and aligning two very different political orders. The third section looks at the second and third fold - managed business and managed product, and demonstrates how both of these are engaged in an economy
of qualities driven by constantly changing and modulating products. The differenciation of managed and unmanaged products is again done as enumerating value, which only momentarily determines products for exchange. The question of what products are therefore, if they are never fully exhausted or fixed as managed or unmanaged product in exchange, is answered: they are the latency and potentially grasped by this intensive account of enumeration. In the fourth section, the chapter turns slightly from number and the practices of enumeration to how value might be understood. Value is presented as an eternal object, a capacity always in material routines but always able to transform them through intensive processes. Such an intervention of number and value as generating difference raises the question of what interventions social science might make in a world in which performing multiplicity is becoming a *modus operandi*. The fifth section articulates what I have understood to be a screening and the sixth section considers what this offers as an account of research practice within intensive and dynamic societies.

**Income Management: folds in the Event of Enumerating Value**

The three moments through which Income Management is effected are customer management, business management, and product management. These moments are not distinct, they are more like moments of force, or torque, than sequential moments of specific duration. Each of these moments is mediated by managed money and are outcomes or folds of the successful enumeration of value as multiple registers. Let us begin with the orders of money within Australia's social security system and their reordering as managed and unmanaged monies. The Commonwealth Service Delivery Agency provides financial benefits to citizens who can be classified as being in need of financial support such as being unemployed, a
parent or carer, a low income family, a widow, having a disability, and running agricultural land which is suffering from drought amongst others. The trading name for the Commonwealth Service Delivery Agency is Centrelink. To receive social security benefits therefore, one must apply to become a customer of Centrelink. Centrelink also manages both the order and extent of need: which combination of benefits a customer is defined by and what the contribution of each individual payment should be depending on for example, the number of children in one's care, the degree of one's disability, one's partner's or one's own other income et cetera. Hence, on becoming a customer one may be entitled to and receive a combination of payments, with each of these payments varying in amount. Income Management applied to twenty nine different types of social security payments; parental payment, disability payment, bereavement payment, widow payment to name a few (Commonwealth of Australia, 2010a). Recently however, this was reduced to the primarily benefits for those under twenty five years of age, who are unemployed and who are parents (Commonwealth of Australia, 2010b).

The fold of managed customer begins with this already ordered 'customer' and the legislated quarantining of fifty percent of each total payment for all recipients. These quarantined fifty percents are held within internal Centrelink accounts and are not accessible by the persons for whom they are intended. All Centrelink customers who at any moment enter a prescribed area are required to have a meeting at which the method by which their quarantined money would be spent was determined: a redistribution which is far from straight forward. If a person receiving social security has school age children in their care, fifty dollars for each child from each fortnightly payment is sent to the school canteen, subsidising the provision of breakfast and lunch for all attending students. This redirection is effected regardless of whether the child attends school and during holidays when the school canteen is closed. After this, the remainder of the
Chapter Two

payment is distributed between direct debit payments for services such as rent or to other regular authorised retailers, payments onto a card or other system for purchasing at stores registered by Centrelink, the purchase of store cards issued by businesses registered by Centrelink or remaining in the internal Centrelink account. As the Centrelink Information Statements states, 'Half of your regular fortnightly payments will be managed until you talk to Centrelink about how to use it to pay for the things you need' (Commonwealth of Australia, 2010a: 1). This moment initiates Income Management as managed customer, and is the first fold of the event of enumerating value. This is how such a registration might actualise.

Outside the council buildings in a small remote settlement, three Centrelink employees sit at a large fold-out table. Each of them are operating a laptop which is connected to the Centrelink database via the mobile phone network. An Aboriginal woman (I will call her Mary) sits with one of the Centrelink employers (whom I will call Barb). On the table between them is an A4 sheet of paper. Printed on it are a list of 'equations' which read left to right: clipart picture (of food, a building or some other icon) equals, blank space inviting inscription. For example "@ = $ ______" might be the equation relating money for the school. A mock-up of this sheet is right.

<table>
<thead>
<tr>
<th>Income Management</th>
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<tbody>
<tr>
<td>Name: ..................</td>
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<td>Total = $ ......</td>
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It is being explained to Mary that her total payment is five hundred and sixty eight dollars per fortnight, and so two hundred and eighty four will be quarantined from this. For each of her children fifty dollars per fortnight will go to the school for their meals. This totals one hundred dollars for Mary who is a mother of two school aged
children, and ‘100’ is written: \( \$ = 100 \). Barb moves on. ‘So you have one hundred and eighty four dollars left over for the shop or saving. Maybe you can send one hundred dollars to the shop and save eighty four?’ Mary replies softly, ‘one hundred fifty.’ ‘That means you are only saving thirty four dollars!’ exclaims Barb. There is a pause. ‘There is a phone call for me in ten minutes,’ Mary says, and stands up and walks away.

Perhaps, despite Mary's departure and refusal to participate her registration for Income Management, Barb completes the form distributing Mary's managed money into acceptable institutions (school, store, Centrelink saving account). If this occurs, in two weeks Mary can spend her one hundred and fifty dollars at the shop and the school canteen will receive her funding. Perhaps the abrupt ending of the meeting is too soon and Barb files the incomplete forms away leaving the redistribution incomplete. If this occurs, in two weeks none of Mary's quarantined money will be accessible to her and the school canteen. Mary's 'dividuation' as a managed customer within the new order of social security and within a market of managed income is incomplete. In either case, Mary is unable to remain a customer within the previous ordering of benefits and their monetary payments. This new market of managed money, however, is not solely constituted by the quarantining and redistribution of social security payments. Managed money needs to be spent at particular shops on particular items. And this requires the creation of managed businesses and managed products. Before we consider these two moments however, let us pause to examine in more detail the emergence of managed money in the first fold of managed customer, by juxtaposing it with a Deleuzian event.

**Number as relation: the intensive enumeration of money value**

In the chapter 'What is an Event?' in *The Fold: Leibniz and the Baroque*
(Deleuze, 1993), Deleuze outlines four components of an event: extensive series, intensities, prehensions and eternal objects (1993: 86-93). Extensive series are characterised by an enveloping, a containing of many elements within one element. Income Management as an event envelopes the elements managed customer, managed product, managed business and managed money. These extensive series have intrinsic properties, called *intensities*, which also enter into series. Rather than enveloping however, intensities as series converge toward limits producing differences (Deleuze offers a grammatical simile: extensive series are an indefinite article, a something rather than nothing, intensities produce a demonstrative pronoun, a this rather than that).

In considering number, we could suggest that difference in value in this moment becomes not the difference between two enumerated extents of the same entity (more or less money), but an intensive enumeration which is generative of new entities and orders of entities. To begin to understand how number could have intensive properties we need to leave behind the notion of number as an abstract object, and relocate it within material practices of enumerating. Helen Verran's work on number does this move. In *Science and an African Logic* (2001), Verran meticulously works number to become understood as multiple. She does so by understanding number as a relation, as a 'generalising transition', which performs on going collective life. While numbers are materially embedded routines, they are specific in that they always participate in routines as the relation unity/plurality (2001: 99). In some times-places, the relation that is number is done as one-many, where the plurality is a collection of a particular unit. At other times-places, number is done as whole/part, where parts are variously decomposed from wholes. In her more recent work, Verran shows that number, as living in between these two forms, is always therefore incomplete, and that during actual happenings number can switch between these two doings of
unity/plurality and re-arrange and re-constitute political orders (Verran, 2010). This switching Verran calls 'holographic', and makes me think of the little cards of carton characters found in crisps' packets which feature a 'hologram' of two images. The cards are fiddly and unstable, switching from one image to the other with the slightest of movements, each time never fully eclipsing the alternative, and even when you find that precarious and perfect aspect it never ceases to be hologram. So, with number as a holographic relation, which is always multiple and always incomplete, let us return to the registration meeting.

As Barb and Mary sit down, their meeting connects up with all other registration meetings via the mobile network and Centrelink's database. Mary is recognised in the database by her Customer Reference Number, and revealed to herself: resident of community A, mother of two, recipient of social security, customer of Centrelink. Mary as a whole sitting at the table is decomposed as these various parts. Mary's payment is also a whole with various parts – the possible twenty nine different payments she might be receiving. Treating the payment as a vague whole makes conceivable the quarantining of 'fifty percent' of Mary's payment, without specifying in advance what the extent of fifty percent is. The ability of specifying fifty percent of a vague whole is crucial for the Income Management policy to remain flexible and potentially applicable to any recipient of social security. In Mary's case, this whole is enumerated first as 'five hundred and sixty eight' then again as two amounts of 'two hundred and eight four'. These two amounts are treated once again as wholes, to be redistributed as various parts: school, shop, and saving. In this brief enumeration of money value two very different orders are aligned. The parts which initially constituted the payment were within an order of 'need', whereas the parts as which the managed payment was decomposed are in an order of 'responsibility'. We could also characterise
these two orders as an order of receiving money and an order of spending money.

This aligning of very different orders occurred almost imperceptibly, and it occurred by a momentary switching between how number does the relation plurality/unity. Initially the value of the payment is enumerated as the relation whole-part. However, once enumerated as such it then became the relation one-many, in that the many, 'five hundred and sixty eight', was constituted by ones, Australian Dollars. As a one-many it can be halved and produce two separate but equal amounts, which are then treated as wholes and decomposed into parts. This 'holographic' switching between one-many and whole-part, which Verran has identified, is an intensity in the enumeration of value, in this case of money value. This holographic switching of the unity/plurality relation converges towards limits (one-many orderings, whole-part orderings). However, as an intensive series it is always converging toward limits, but never fully achieving them. These intensities precipitate realisation or actualisation only in the material routines of the here and now. Ethnographic accounts of number are so revealing, because they can show both number's inherent incompleteness and instability and its momentary achievements of completeness and stability.

The managed customer is affected in the above moment not by merely locating her as a Centerlink customer through a Customer Reference Number, but by the intensive enumeration of two orders of money: managed money and unmanaged money. Managed customer and managed money are co-constituted, a feature of Deleuze's third component of the event: prehensions. In the Deleuzian terminology I am using here,

'If we call an element everything that has parts and is a part [an extensive series], but also has intrinsic features [intensities], we say that the individual is a 'concrescence' of elements. This is something other than a connection or conjunction. It is, rather, a prehension: an element is the given, the 'datum', of
another element that prehends it.’ (emphasis original, 1993: 88)

The managed customer becomes data for the managed money. As managed money is effected it is not simply a scalar sum of money, but a vector towards the managed customer, effecting the woman as managed customer. Simultaneously, the customer prehends managed money as a new given in the reality of the Northern Territory Emergency Response. We can understand these prehensions as the effects of the modulations of a control society which are open and dispersive. When Mary stands up and walks away, the possibility of this mutual prehension remains a question. Her actions are an embodied refusal to become data, to allow managed money to become managed money through her. Perhaps the realities of these meetings are largely inconsequential in the fold of customer management. The moment might be achievable without the embodied Mary sitting uncomfortably at a table. Working Mary's Customer Reference Number as code, rather than signature, she might still be reassembled as managed customer. If Mary's resistance works, she remains outside the market of managed money, and her ability to participate in the market of unmanaged value changes too, in that she will receive a smaller payment. In North East Arnhem Land, the consequences of living outside the market of managed money is becoming known as retailers begin to modify their goods to become sellable in this new market.

**Economies of qualities: new businesses and products in the market of managed money**

Across the Northern Territory various retailers participated in Income Management through effecting a market for managed money. To do so, they needed to have both a process for enabling the receipt of managed money direct from Centrelink, and a process enabling the modification of products such that the proscribed items
(cigarettes, alcohol, pornography and gambling) which could not be purchased with managed money. Initially, large chain retailers such as Coles-Myer, Woolworths, Kmart and Big-W in regional towns were significant recipients of managed income. These stores had at hand their own currency embodied in store cards or 'voucher' cards. As some of these stores did not stock the proscribed items, their store cards could be simply exchanged for managed money. Other stores had to change the conditions of use on existing store cards to prohibit the purchase of managed items. The refund policies of these stores, however, enable the return of purchased items for a cash refund, and many televisions were simply carried from sales counter to returns counter effecting an substitution of managed money back to cash. This shows that the modulation of orders of money value is never total nor complete, but on going in specific transacting routines.

In more remote areas however, no such assemblage of retailers, store cards, and refund policies were present, and retailers had to develop a variety of strategies, from index cards, to improvised vouchers systems, to electronic cards. In North East Arnhem Land all the remote stores are operated by the Arnhem Land Progress Aboriginal Corporation (ALPA). ALPA defines itself as a 'Aboriginal-owned benevolent organisation which provides benefits to its members from the successful operation of community retail stores', with its board constituted by two members of each of the five settlements in Arnhem Land (Arnhem Land Progress Aboriginal Corporation, 2010).

When Income Management was proposed, ALPA had recently developed a new comprehensive nutrition policy (Arnhem Land Progress Aboriginal Corporation, 2009). The policy outlines a number of actions, which work to effect two classes of products. First, the policy distinguishes between items which are nutritious and those that are not,
and places a higher mark-up on the non-nutritious items than on the nutritious ones. The policy requires non-nutritious-more-marked-up items to be identified with with a yellow price tag and the nutritious-less-marked-up items with a green price tag. As part of the implementation of the policy, ALPA developed a proposal from a community women's centre for a smart card which could receive money value, but could then only use it to purchase nutritious-less-marked-up-green-tagged items. Transferring money onto this smart card was to be voluntary.

The Foodcard, as it was called, and its infrastructure was developed with funding from the Federal Government and logistical support from the international services company Deloitte. The Foodcard could be considered exemplary of a self imposed control society. It was proposed by a group of local Indigenous women, developed by the State government and multi-national services firm, brokered by a community owned retailer and its stores, and implemented through the most up-to-date information and communication technology and electronic finance. This Foodcard however, was never implemented. Rather, it became an astonishingly apparent purpose built solution for Centrelink’s managed customers in North East Arnhem Land to access their managed money. In 2008, community meetings for each ALPA store decided that these Foodcards would be used to receive managed income, and in doing so extended the set of managed items to include all non-nutritious-more-marked-up-yellow-tagged items. For social security recipients who successfully registered as Centrelink managed customers, a Foodcard was produced by ALPA being simultaneously nominated as the recipient of their managed income.

The nutrition policy of ALPA signals a shift from a retailer selling goods in remote Indigenous settlements (flour, tea, sugar, meat, Coca-Cola, bananas, eggs) to a
business delivering services in remote Indigenous communities (nutritious-less-marked-up-green-tagged items subsidised by non-nutritious-more-marked-up-yellow-tagged items). We can understand ALPA participating in what Michel Callon, Cecile Meadel and Vololona Rabeharisoa call the 'economy of qualities' (Callon et al., 2002), in which doing businesses is the constant modification and re-qualifying of products. In an economy of qualities 'business is structured around this qualification process made possible by the establishment of the device and by the right granted to the customer to use it' (2002: 210). We can understand the Foodcard as such a device, mediating both the re-qualification of products and the permissions to enter into an exchange with these products. The Foodcards therefore, behave like a element of code. The process through which Foodcards figure the relations of exchange are always materially embedded and stabilising only momentarily. Let us consider what these relations might be in the actualisation of the Foodcard as the enumeration of managed money.

A woman and her young child take two cold drinks from a fridge, one a carton of orange juice, the other a bottle of Orangeade. She adds them to her basket of shopping which includes a baby bottle, some eggs, bread, tea and other items. She walks to the counter where she is asked if she is buying with her FoodCard. She hands over her Foodcard which is inserted into the register, and its value is displayed on the screen as numerals. When the eggs, bread and orange juice are scanned, each item effects a registration of value, displayed as numerals, which is then costed against the Foodcard, reducing its value. Orange juices costs three dollars and fifty seven cents, displayed as $3.57, and the value of the Foodcard is reduced by the extent of three dollars and fifty seven cents. The women working the register tells the customer the remaining value on the Foodcard and a few more items are added to exhaust this value. However, when the Orangeade is scanned, its cost, displayed as the numeral $2.40, does
Intensive Enumeration

not reduce the value on the Foodcard. The cost of the baby bottle is also kept separate from green tagged costs. The woman is asked to pay cash for the Orangeade and the baby bottle. She says she does not want them, they are de-registered and an exchange of managed items and managed value is done.

**Intensive enumeration: the actualisation of potentials as prehensions**

During the moment of managed customer considered earlier in this paper, a woman being registered for Income Management, becoming a managed customer, stands up and leaves a meeting. I considered this a possible resistance toward becoming a managed customer, and framed it by saying that the money was prehending the woman as data in its own becoming. In the above narrative, within a moment of managed product, another woman while doing her shopping, actively asks for unmanaged products to be de-registered. In doing so she keeps her unmanaged cash separate from the exchange and participates somewhat by choice with managed money in a strictly managed exchanged. Here, the woman is prehending the items, and they are become data for her. Deleuze writes that prehension is always a passage toward further prehensions (1993: 89), and here the prehension of managed product is on the way to become a cool refreshing drink, or a warm cup of tea. Prehensions, moreover, are always already prehensions for other entities – juice, for example, is the concresences of plant, fruit, factory, bottle, label, fridge *et cetera*.

In order to purchase these products, to effect the exchange, products must prehend, or become passage for, managed money. The product had to be the data, the unfinished thing, ready to become momentarily completed by managed money as a product in the exchange. Hence, while prehensions are individuals, they are not self...
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evident, not always existing things. Rather, they only become individuals, strictly speaking 'dividuals', through intensive processes, the momentary mutual prehension of subject and object, all of which is continually becoming something else: in this case a cool drink, a cup of tea, the satisfying of child demands, a discerning customer at a remote store, a statistic of increased sales of nutritional products. Hence, rather than the exchange being read as the measure of an already existing order (supply-demand), a complete resolution of inequality (money value-product cost) or a difference made as a commensuration of a difference (item-money), exchanges only proliferate further becomings, only open out onto more possibilities. Within these becomings power is not a capacity for concentration but one of dispersion. This characteristic of an inexhaustible latency, however was always there.

A bottle of Orangeade rests on a shelf behind a misted glass fridge door. It is both and neither a non-managed product and a managed product. It is both in the sense that; if a person carries it to the counter, the register scans the bottle, money is entered into the register – at that moment it will become a non-managed item. It will affect an exchange, and a moment other than Income Management, and one familiar to people buying Orangeade at many other times and places in Australia. However, if; it is carried to the counter, a Foodcard is proffered instead of cash, the bottle or Orangeade will fail to participate in an exchange – it will for that moment be a managed item. It will not become a cool refreshing drink. On the shelf and on the way to the register the baby bottle is neither managed nor non-managed, it is both in potentia. We can say that the prehension of managed items and non-managed items are real, they are these routines that are either one or the other. But, the routine holds both. It is this multiplicity. Recall that a prehension is always the prehension of another. Managed product prehends managed customer, as they are both in the event of Income Management. But the
products are still the concrescence of elements, they are not *a priori* givens. To understand this, and how number as an intensive process of enumerating value is involved, let us consider again the above transaction of registering the item.

Here the enumeration of value proceeds in a more complex way than during the registration meeting. It is more complex because value needs to be enumerated as two separate registers or degrees: as two separate numbers. First, items are carried to the counter. Then, either a Foodcard is offered or not. If it is, Foodcard value is enumerated as one-many, as so many dollars and cents and this is displayed as a numeral. Once the food card is proffered, items are scanned, but now it is important to make things like Orangeade separate from things like orange juice. If orange juice is scanned it is enumerated as a part of the whole 'Foodcard value' or managed value, but then is enumerated as a one-many in reducing the extent of value on the card by the extent of the price of the juice. If Orangeade is scanned, it is enumerated as part of the collection of managed items, and is then given an extent of a one-many that goes to constitute a separate cost. If a transaction is to occur for all the items, both Foodcard value and cash value must be worked. If a Foodcard is not proffered, items are simply enumerated as part of the shop and have an extent of value only effected by the differential mark up from being considered nutritious or not. The holographic work of number as relation, as event, this flipping between doing whole-part and doing one-many, is an intensity in enumerating of value.

**Beyond Value as Extension: number as event, value as its quality**

The clotting and dissolving that the holographic intensity of unity/plurality effects conceptualises number as event of enumerating value in a unique and perhaps unfamiliar way. Accounts of number to date, have number effecting value as a sameness
within which difference within value is determined. In conventional accounts of number, enumeration is purely a one-many relation, evaluating the magnitude of an already given extent by tallying already existing units. What is of value is always taken to be already established in the world, be it a universal real or a socially constructed one: a piece of pipe has length, a sum of money has value. Evaluation as a whole-part generalisation, is also doing value through a sameness, a vague whole, which is then decomposed into parts: families can decompose into relations, products can emerge within a market. However, for Income Management number participated in maintaining a multiplicity of registers of value, products and markets. These registers were not permanently distinct but determined and differenciated in distinct ways in each routine, through each number, and as each fold. The flipping was not a simple doing of whole-part relation to effect an ordering products as a market, and then the one-many evaluations within the market. Rather, the flipping understood as intensity is irreducible and always immanent in each routine. It is continuous and rapidly changing in that it effects market, product and customer at once, but does so differently each time in its incessant flipping between whole-part and one-many. Recall Maurer's notion of the 'alternate' as that which oscillates. Within Mutual Life value is understood as one-many, an understanding Maurer himself finds wanting in relation to alternative currencies (Maurer, 2005: 85) What the present account offers is a notion of what could be called alternative or oscillating value. Here, value does not oscillate up and down within a single register but is an oscillation between registers. The question I will come to consider shortly is, if control societies work through these oscillations, these potentials, these multiplicities, then research is no longer a radical nor distinctive practice if its remains directed toward a revealing or doing of such multiplicity. Our immediate concern now is, if the definitive work of enumeration is intensive, effecting particular
prehensions only momentarily, how can enumeration be conceived of as an enduring feature of the social? The answer requires a new understanding of value as a quality in the event number.

Until now I have assumed that the enumeration of value proceeds through number as event, and have been careful to maintain intensities as properties of the event not attributes of a discrete and enduring entity. Value however, does appear to be enduring. It returns in each moment and fold of enumeration with such resonance that here in the text number and value have been enmeshed as an event of 'enumerating value'. It is this knot of number and value I now want to address specifically. In continuing this juxtaposition of Deleuzian concepts and Income Management, value is Deleuze's fourth and final component of an event, the eternal object. Eternal objects are 'inseparable from the process of actualisation or realisation into which they enter, [and] they gain permanence only in the limits of the flux that creates them, or of the prehensions that actualise them' (1993: 90).

As eternal object, value is not reduced to an abstract object – as they are in disciplinary societies where they plot extensions of attributes, nor are they merely social conventions reduced to their material routines – as in the critique that social construction offers. Eternal objects are not opposed to creativity and the new. Value is repeated in material routines, but lives it only at the limits of these, as the modulations of becomings and therefore at the limits of particular actualisations. Value remains this 'pure Possibility' (Deleuze, 1993: 91). Here the pure potentiality is unity/plurality, which is never fully actualised. It is in this sense, as never fully actualised, that eternal objects are in the domain of the virtual and therefore outside time, hence eternal. A new value or set of values does not arrive nor manifest with the Northern Territory Emergency
Response nor with controlled societies. There is no before and after in the virtual. Nevertheless, through number the NTER as control society does actualise value in a novel way.

Number as relation is multiple and has the character of an event, at the limits of which value differentiates and emerges momentarily at the limits of actualisation, not limits in the sense of a constraining boundary, but in the sense of multiple points of convergence. It is these new points, these new coordinates or degrees of managed value and unmanaged value which regulate the permissions and modulations of a control society. Hence, in the NTER as understood as a doing of control society, number affects a successful intervention. This is not a co-constitution of value and control society in the sense the mutual prehension discussed earlier, effecting the 'values of the intervention'. Indeed, Deleuze writes that when one prehension grasps another, managed money grasps managed customer, it does so by 'apprehending eternal objects' which may be Qualities, Figures or Things (1993: 90). While the event number is continually gaining and losing elements and prehensions, customers and store cards, retailers and orange juice, value as eternal object persists, qualifying, not quantifying, each entity.

In The fold: Leibniz and the Baroque, the event performed is a concert, a baroque concert. The eternal objects are the 'notes of the scale' (Deleuze, 1993: 91). From the intensities of sound instruments emerge prehending one another in concert. However, it is the in between, the oscillating sound waves which constitute the event. These notes actualise at the limits of the oscillating sounds waves which constitute the event. There is no direct relation between the instruments, 'only an indirect harmonic contract to the extent they share the same expression: they "express one another" without harnessing each other' (1993: 92). Understanding value in the performance of
number has oscillating values sharing the same expression, number; not through harnessing each other through a common measure, but through an indirect harmony produced between the limits of the event. As we might talk of a concert having a certain quality, a certain harmonisation of notes, we can talk of number having a certain quality, as certain harmonisations of value, or valuations. Understanding value as a quality of number is where, according to Latour and Lépinay, one of Europe's most important but most forgotten social scientists begins. Gabriel Tarde argues that value

'is a quality, such as color, that we attribute to things, but that like color, exists only within us by way of a perfectly subjective truth … this quality belongs among those peculiar ones which, appearing suited to show numerous degrees and to go up and down this ladder without changing their essential nature, merit the name "quantity.'"(Latour, Lépinay, 2009: 8)

If value is a quality like colour, then value differentiates as the colour red differentiates itself from the colour blue. Red does not have more colour than blue, nor is it more yellow than blue. This difference is a difference in qualification. Yet they are both the 'pure possibility' of white light which can differentiate colour and qualify things as red or blue. Deleuze himself uses colour to articulate the problem, or the Idea, as white light which differentiates into differences which do not resemble one-another nor the Idea (Deleuze, 1999). Hence, understanding value as a quality opens up the potential for what different kinds of valuations are possible. Tarde's charge against the economists of the 19th century, and one which is maintained today in the re-discovery of his work is that 'economists do not sufficiently quantify all of the valuations to which they have access' (Latour, Lépinay, 2009: 12)[emphasis original]. Hence, when value is a quality which 'formats the social world' (Latour, Lépinay, 2009: 15) through the event number, the question becomes in what ways do achievements of number qualify or format the world. As Latour and Lépinay argue,
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‘what is at the basis of the social sciences, in his [Tarde's] view, is a kind of contamination that moves constantly, from point to point, from individual to individual, but without ever coming to a halt at any specific stop …

The great advantage of these ways of proceeding is that they immediately bring into plain sight the practical means through which the contagion, the contamination from one point to another, takes place.’ (Latour, Lépinay, 2009: 9) [emphasis original]

This chapter has demonstrated the practical means through which value moves from one point to the next through the event of number. What this account has shown specifically is that the quality of number which is an intensive enumeration of value, itself is not singular, but the inherently multiple relation of unity/plurality. Number does not exact value as solely a quantitative or extensive property, but as a quality within the intensive processes of the event. In claiming that number has this intensive quality through which it does value, I am not concluding that this quality is neither the exhaustive of nor exclusive to number (cf Verran, 2010). Analogous to Tarde's charge that economists are 'not sufficiently quantifying all the valuations they have access to', I contend that studies of number are not sufficiently quantifying all the valuations of number. It is to this task which value as eternal object is directed. Eternal object is a notion from Whitehead, which Deleuze is keeping alive. It is also kept alive, along which much of Whitehead, by Isabelle Stengers. In Latour's review of Stengers work on Whitehead, he argues that

'Stengers is right in using Deleuze’s crucial distinction between the potential/real couple and the virtual/actual one. Eternal objects protect us against the confusion between the two. It is because they play no direct role but are present nonetheless that events can play the full role. They don’t explain, but they allow the scene of the world to be fully deployed. (Latour, 2005: 235).

Working with value as eternal objects, as a virtual multiplicity, prevents this
empirical investigation of number from collapsing back into the limited analysis of the abstract/real. In establishing 'indirect harmonies' value as eternal object allows the event of number to 'play its full role' and analysis to sensitise itself to number's potential. This chapter has begun the task of performing number in a more full role which is taken up with full gusto in Chapter 5.

**Research as Screening: potential difference and composition**

I said above that this paper is doing a screening. In other words, it is a performative piece whose effect is a screen. What is the screen here? The elements of the screen are interspersed ethnographic samplers and samplers of Deleuzian concepts arranged in a mutually revealing juxtaposition. The screen is not a tool for descriptive work, though it does do description. The screen is also not a framing device, though it does frame. The screen is methodological, but it is not a method. The screen is not something extra which is applied to the Northern Territory Emergency Response nor Deleuzian concepts. Rather I understand the screen as the outcome of this juxtaposing arrangement of samplers. The screen is this composition.

So what does a screening do if it is not exhausted through as description or as framing device? Deleuze writes 'the screen makes something issue from the chaos, and *even if this something differs only slightly'* (emphasis original Deleuze, 1993: 86). This chapter has made something emerge, a novel conceptualisation of number and value. It is an account that is intensive, in that it pays attention to how the material routines of enumeration are done as modulations, modifying and effecting political and moral orders of collective life. Value, the eternal object of the event number, is the capacity of doing unity/plurality either as whole-part or one-many which is never predictable nor exhausted, but nevertheless always immanent in the practices of enumeration. Deleuzian
concepts - control societies, the event, intensities, prehensions, eternal objects have also emerged in doing this screening. They have emerged as material routines and descriptions of material routines. The routines here have been told as assembled moments. The moment of the managed customers, the moment of the managed business and the moment of the managed product. Within number as event, each of these are folds, actualised in registration meetings, Foodcards, product labels, orange juice and Orangeade, are mediated by value.

I could use the word 'resonate' to denote this practice of research which emerges (with its objects and author) through processes of intensive difference. The resonating between the samplers, ethnographic and conceptual, has produced something novel. However, isn't it this resonance and the production of novelty (new customers, new businesses, new products) through intensive differentiation (enumeration of value as multiple) the very processes through which the NTER and control societies work? Isn't this screening complicit, literally folded together, with the NTER and control societies? With a uncomfortable sense of surprise, I would answer yes. This chapter is a part of the event as are the managed customers, managed businesses and Orangeade. It is a fold in the event, even if it is only slight. In performing this screening I have picked things up which are at hand – a few short chapter's by Deleuze on concepts, a shop in a community in which I was living, a laptop to type notes, just as the NTER picked up things that were at hand – the Foodcard, Centrelink, its employees and customers, clipart. As an intervention in number and value as matters of concern for markets, money and livelihoods in remote Australia, an intervention which is producing difference and opening up possibilities for movement and re-alignment (Law, 2009), this paper merely expands the dispersive knowledge and power of NTER.
So what does this screening offer? This mutual revealing the NTER and Deleuze's control societies offers a way to go on with number and enumeration as not simply an extensive process of quantification but as an intensive process of qualification. The demonstration of these processes being materially enacted indicates that research into value and number can engage with the empirical as intensive processes. And finally, the screening makes explicit that when research considers itself as generative, of both concepts and new ways of living, this cannot be assumed as an unquestionable good, but always done with the possibility that ways of living and resisting are already being done.

**Going on … feeling our way into difference as potential**

In claiming that working value as quality opens up potential for difference within ongoing forms of living and resisting, I want to make a small gesture towards what kinds of openings such a potential can effect. Recall Mary's refusal to be registered for income management. I understood this refusal as a refusal to become data for managed money, to participate in the way number effected the valuation managed value. Let us quickly dismiss two common accounts that might use an extensive notion of value. First, taking value as natural property of money represented by number, one could suggest that Mary did not understand this 'value' and walked away in confusion. Or second, perhaps a more generous account would use value as a socially constructed good or desire, and one could suggest that Mary lived by different 'values' to the NTER and refused to accept its 'values' of authoritarian control, arrogance and a universal disrespect for individual lives. In both these accounts number, value and society are presupposed as given. There is no room in these accounts for change or creativity: Mary is a modern knower or primitive knower, she is with the State or against the State. I
want to offer an account that begins to work number as potential and value as quality.
Centrelink, as I have demonstrated was effecting number which was actualised through its quality value: a holographic oscillation of one-many/whole-part. This is value done within a European arithmetic. For Mary, value is done in a different arithmetic: gurruṯu. For example, Mary and her two children constitute the fundamental relation of yothu-yindi. As Mandawuy Yunupiŋu says,

‘Yothu Yindi refers to the child and its mother. But to understand the full meaning of Yothu Yindi you need to know a bit more … To see it from the child's point of view, every Dhuwa child has Yirritja mothers and Dhuwa fathers, and every Yirritja child has Dhuwa mothers and Yirritja fathers. Every Yolngu child has responsibilities both to mother's people and places and to father's people and places. Hence, every Yolngu person has responsibilities both to Yirritja and to Dhuwa.’ (Yunupingu, 1994: 113-114)

Hence, Mary and her two children constitute value within particular forms of relatedness and responsibility. For the purposes here, it is not important as to the specifics of how this is worked, but it is clear that in relation to this valuation, to work Mary's two children as two sums of fifty dollars within the register of managed money is a contestation in doing value that is both a logical and moral. In this episode, the differential created within contestation was made inaudible. The limits of living and knowing and their potentials was silenced as number prevailed. Perhaps Mary walked away because there was no good work to be done, no negotiation through which new ways to live collectively might be generated? To pursue solutions to such a question is not to go back to Mary (her solution was enacted there and then, Mary actually walked away). Rather, the task is to produce ways of doing number that might link up with different ways of knowing and living, generating potentials that are creative in making futures different from pasts.
Intensive Enumeration

Understanding number as an event and value as a quality of the event, works difference within number and value as a generative potential. It helps us become more sensitive to the relations and problems that constitute the world. Feeling one's way into difference as potential is not easy work. This is especially the case when actual differences feel so immense and so rigid that simply working within these solutions maintains a constant risk of having them structure both researcher and one's problems in their own form. Part Two considers the process of feeling one's way into difference as a potential. It begins with the researcher setting off in wrong direction by too quickly accepting the limits of the empirical as its givens.
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Chapter Three

From Helpful to Hopeful: becoming an observant participant within comparative research

An Active Comparison of Comparisons

The problem of number and mathematics is an enduring and active problem in Yolŋu lives and places. Its existence as a matter of concern in these postcolonial times and places was established in Part One. We established number's presence and significance as a problem, and how we might understand this as a problem. Part Two of this thesis is a re-performance of a particular event within which a postcolonial number and mathematics is articulated. This empirical encounter develops within the research and the researcher a postcolonial sensibility toward number and towards value as a problematic in the event. The occasion is a workshop entitled 'Maths as a Cultural Practice' (Charles Darwin University, 2007a) whose motivation is to research number
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and mathematics in remote communities. To do so number and mathematics must successfully re-emerge within this workshop-event. In re-performing the workshop here, I continue the on going life of this event, not as its repetition as representation or report, but as a new part of its becoming: its becoming as a researched workshop. This chapter articulates number as a participant comparison; that is an active and interested rapport. This rapport, this number as participant, endures in Yolŋu life and continues within the workshop event, including its expression here in the text.

To become familiar with participant comparison as an entity and become attuned to its expression, Part Two opens with Chapter Three which is an expression of participant comparison within another workshop. Here participant comparison is expressed as ethnographer-in-the-text. Establishing the author-in-the-flesh as ethnographer-in-the-text is important in making explicit how that persona is configured within a performative text. It is an achievement itself effected from within. As the author was a participant in occasions in which postcolonial number emerged, the ethnographer is a figure in the text, again a participant much like postcolonial number. This figure and text moreover, have a specific purpose. Part Two performs the comparison value: value as the extensive properties of metric objects, and value as the intensive becomings within collectives. Both value as extension and value as intension are themselves comparisons, common measures if you like. Hence, enacting them together as a interested and dynamic relation is a participant comparison of comparison. Participant comparison is not an entity external to the terms related, but a relation itself. It participates in an event, here in the two moments of the workshops, and is heard through its expression. Participant comparison is the figure through which this thesis feels its way into difference and develops a postcolonial sensibility.
Chapter Three concerns a workshop in which some Yolŋu visitors to a rural town outside Melbourne bring together a small gathering interested in the teaching and learning of weaving naturally dyed grasses and reeds. The occasion coincided with the beginning of the writing of this text and my involvement shows me as researcher heading off in the wrong direction, and being pulled back into difference as an internal property within an event. The figure of ethnographer-in-the-text as participant comparison which emerges within the postcolonial encounter of Chapter Three is sensitive to difference as primary, irreducible and constitutive of the encounter. It is with this sensibility that Chapter Four then performs the 'Maths as a Cultural Practice' workshop as a generative moment in the problem of number.

**Presentation: looking at the difference over there**

A year after returning from North East Arnhem Land my partner and I moved into a small regional area in the Southern State of Victoria, just outside the city of Melbourne. There we were fortunate to find two women who had also recently returned from North East Arnhem Land. The two women had been guests at a Yolŋu homeland as part of a cultural tourism program. The program is run by the homeland and invites women to live on the homeland and learn something about Yolŋu life and culture through the practices of weaving. During this particular visit, tentative plans were made for three of the Yolŋu weavers to visit the home of these two women and run a workshop as teachers and facilitators of Yolŋu weaving. The workshop was a great opportunity for all of us to continue our relationships with Yolŋu homelands, and much to our surprise we found we had also been adopted into the same bàpurru, the patrilineal clan group of family in Yolŋu society. The workshop invited participants from the local community and Melbourne. For those for whom the workshop would be their first
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even with Yolŋu culture, we wanted the workshop to not simply be an opportunity to learn some weaving techniques, but more so to experience a very different way of learning, relating to the environment and to each other. As organisers we collectively hoped the workshop would be guided by the Yolŋu teachers, follow Yolŋu pedagogies and come to respect some of the relations in which Yolŋu weaving is embedded. As an initial consideration of this, the workshop invited only adolescent and adult women.

As a small group in Victoria we initially wanted to begin to introduce some of Yolŋu life to the place of the workshop and to the workshop futures participants. To facilitate this we also needed to raise an extra two thousand dollars to fund the travel of the Yolŋu visitors. We planned an information evening during which baskets and materials would be on display, some of which would be auctioned, and each of us would give presentations that might give a sense of a Yolŋu world. The two women who had visited the artists and their homeland planned to talk about their time and experiences at the homeland, my partner felt it important to speak about education in the community where we lived and where she had been a teacher, and I offered to speak about Yolŋu philosophy. In the days before the presentation I put aside the writing of my thesis, its notes, references, and books and began planning my presentation.

We were expecting an 'alternative' audience, and one that would be supportive of Australian Aboriginal people, their rights and their art and be supportive of the workshop as an attempt at cultural exchange. I wanted to encourage this support to go beyond a naïve acceptance or love of Aboriginal people and culture as a romantic 'other' to mainstream settler Australian life (from which many of us, presenter and audience, were trying to escape!). I wanted a presentation that would explicitly challenge romantic framings of cultural difference and instead encourage people to work towards
developing a shared understanding through a self-understanding of our Euro-American ways of working with the natural and social worlds. Within this recognition of Euro-American knowledge and philosophy, I thought, I might be able to begin to expand the equally sophisticated knowledges Yolŋu have regarding both the social and natural worlds and laws regulating working with difference. In doing so I reasoned I was not presenting Yolŋu philosophy as an object or souvenir I had brought home with me. Rather, I was presenting Yolŋu philosophy as a problem for non-Yolŋu like myself and the future workshop participants. I began my presentation by setting myself and the gathering of information night attendees and future weavers the question, 'How can we as non-Yolŋu take Yolŋu seriously?' Here is a excerpt from the introduction of my presentation:

'My point, I think, is this – in order to begin to understand a knowledge and culture very different from your own, you need a good understanding of your own knowledge and culture first …. So rather then talk solely about Yolŋu philosophy, I am going to begin from a mainstream Western perspective and try to take us down a track that might begin to get us closer to understanding Yolŋu philosophy.'

In organising the information night we planned to have photos on display as part of our presentations. We arranged a projector and timetabled the evening such that our presentations would start on dark. I began preparing my talk as pairs of slides, with each pair of slides presenting a neat, visual juxtaposition of Yolŋu and Western philosophy. The first pair to be displayed (shown in Illustration 1) are two public expressions of Yolŋu philosophy that could easily be read in a romantic frame. One is from Yinjiya Guyula, a Liyaḏaliŋmirr man from North East Arnhem Land and lecturer at Charles Darwin University, who explains that for Yolŋu, education begins by accepting that 'we're sitting on the land, saying that that rock is actually alive' (Guyula, 2009: 4).
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The other is song lyrics from the internationally popular Yolŋu singer Geoffrey Gurrumul Yunipuyŋu, in which he sings of the orange footed scrub fowl being his mothers (Yunupingu, Geoffrey Gurrumul., 2008). This slide is juxtaposed with an image depicting a public expression of Western philosophy in relation to Indigenous people – the eight foot tall, blue specimen of 'our' greatest achievement of putting a modern mind into an native body in James Cameron's *Avatar* (Cameron, 2010).

The next pair of slides present both Yolŋu and Western philosophies as having a cosmology with an exhaustive division in the world. For Yolŋu, this is the existence of everything in only one of the two moieties, Dhuwa and Yirritja. For the West, it is the Nature/Society (body/mind) division. Then comes the juxtaposition of each of these divisions being important and productive and worked through using logics that were above the division itself. Dhuwa and Yirritja are worked together through Gurruṯu or

Illustration 2:

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kinship in important ways: marriage, caretaker relationships, adjacent land ownership, as well as important Yolŋu metaphors of Garma and Gaŋma (Marika et al., 1990; Marika-Mununggirritj, Christie, 1995). Nature and Society are worked together through mathematics in important ways in sciences such as climate science, population science, and the chemical and biological sciences.

My final pair of slides show two diagrammatic depictions of the system of relationships in Gurruṯu and the number system in Western mathematics (shown in Illustration 2 (Cooke, 1990; Booker, 2004)). The grey circles show the recursive structure and logic of the two systems. While this type of comparison of conceptual systems might be familiar and acceptable as a concluding achievement by the readers of this presentation here in the text, for the presentation at the information evening I ended with a reassurance that such a comparison had been successfully established in a 'both ways' maths curricula in North East Arnhem Land. This curriculum is the Garma Living Maths Curriculum (Thornton, 1996; Watson-Verran, Yirrkala School Literature Production Centre). So, my presentation echoed the justification of the Garma Living Maths Curriculum: 'r]ecursion is an important idea in Western maths and symbolic

Illustration 3:

Juxtaposing on left, the Yolŋu system of gurruṯu as drawn by Cooke in Seeing Yolŋu, Seeing Mathematics (Cooke 1990: 25), and right the Euro-American system of number from Teaching Primary Mathematics (Booker, 2004:104). Both texts bring attention to a recursive pattern which is indicated here by the grey circles.
logic. Recursion is also central to the abstract logic of Gurruṯu, the Yolngu kinship system' (Thornton, 1996: 56).

**Decomposition: situating the outside third of comparison**

The presentation was successful, and I was encouraged that, perhaps as a result of having my thinking unfettered by the demands of academic argument, I had outlined a comparison of two different mathematics. But the excitement waned rapidly. Where do you go from here? Is that really all that is required of thought? If it were, all that was required was government funding for the implementation of the Garma Living Maths Curriculum in schools across Arnhem Land. My talk was concerned with how we as potential participants in a bi-cultural encounter understand comparison and might therefore work comparatively. I had argued that good self-understandings are important in developing good shared understandings. The presentation I gave hoped to give a better account of comparison than what might be called comparison as opposition – Yolŋu knowledge as defined as the negation of the systematic and compartmental Euro-American metaphysics. The alternative account I provided had hoped to take Yolŋu metaphysics seriously, as positive or affirmative in its difference in relation to Euro-American metaphysics. Despite explicit claims to the contrary, however, I had neglected any self-understanding of the philosophical work that my presentation did.

In beginning with juxtapositions, displayed as vivid images coupling 'difference' together on a wall in a darkened room, my argument progressed through a sequence of resolving these differences. In doing so, my presentation understood and presented difference as negative. In comparing Yolŋu philosophy and Western metaphysics, my argument progressed through the foundationist 'image of thought' we encountered in Chapter Two, which understands philosophical work as the working of
abstract logics which gather more and more particulars as mere cases of a general proposition or concept.

In employing this Western metaphysical frame, I began with the difference between Yolŋu and Western metaphysics, which I immediately resolved by giving them internal characteristics. These internal characteristics were then comparable and found to be the same: each metaphysics was defined as having a fixed ontology with an exhaustive division. Hence, the difference between the two metaphysics become particular instances of a more general class of metaphysics: those with a foundational and bifurcated ontology. This introduced another difference, which was presented again as a pair of fixed images: Gurruṯu as an approach to working and managing the bifurcation within Yolŋu metaphysics and mathematics as an approach to working and managing the bifurcation within Western metaphysics. Again, this difference was resolved by imposing on both gurruṯu and Western maths internal characteristics: they were conceptual systems outside or above ontology which had a recursive logic. What was presented as difference once again became particular cases of a more general system of thought: an abstract conceptual system with a recursive logic. The philosophical work of my presentation was to resolve difference by making it particular cases of general entities.

The philosophical cunning of this imposed generalising is that it remakes all philosophies, Yolŋu and Euro-American, in the image of its own reasoning, while keeping this image implicit in its accounts. The comparison of difference anticipates difference as always and already particular cases of some general proposition. Hence, the difference becomes a negative: difference contained within the general. Moreover, the general claim itself and the logic of the general-particular relation, cannot itself be a
particular and must be imposed from outside the comparison of particulars. In refusing itself as a particular it cannot include any self-understanding because this would reduce itself to a mere particular. We might say that the third element which connects up or holds difference, that is the comparison, is concealed. On an illuminated wall, difference was able to be projected literally as juxtaposed slides which were resolved in turn by a third element, the reading of a text from the darkened sidelines off screen (both literally off the projected screen and off the screen that is the intensive processes of different/ciation). This comparison-as-presenter which has just been decomposed, however, is recomposed by a different form of comparison within the workshop itself. So let us skip forward to the weaving workshop proper.

**Participation: ethnographer-in-the-text as expression of comparison**

After I have marked off the arrival of all the workshop participants, I leave the room in which the workshop is taking place to the group of women who have gathered to participate. I take a seat out the front of the venue behind a table which has baskets for sale, and answer questions from passers-by and move people on who seemed to think the workshop is (or should be) a form of exhibition. Previously, the organisers including myself had suggested to the Yolŋu teachers that speaking in Yolŋu Matha, or Yolŋu languages, would be an important demonstration of cultural strength and difference. The main teacher agreed it was a good idea, but said that it could only be done if I were to interpret with her. At first I thought her response was not a serious request, more one of modesty or perhaps a lighthearted cautioning of a confident young research student. I was wrong.

As I sit at the table, someone calls out from inside, 'Okay Christian, come in
and be our interpreter?’ I go inside, the woman who I will be interpreting for gestures for me to sit next to her. I’m a little anxious and preferring to remain an outsider I sit down next to her but slightly outside the circle of seated bodies that the women form. She moves over and gestures for me to come right in, sitting alongside her. We are doing this together, myself being permitted to become as an honorary woman perhaps, for this specific purpose. I am perplexed because the woman I am about to interpret for is a competent speaker of English and could say what she needs to say either directly in English or in Yolŋu Matha and then English. She begins to speak and I am surprised my ability to understand what she is saying and being able to carefully craft my translations. I am enjoying becoming this translator. But before long I am missing words, and then not understanding what she is saying at all. My speech begins to stumble and then I am looking at her, bewildered and unable to speak at all. She compliments me on my efforts and then continues what she was saying in English. ’Not only am I redundant’ I think, ’but together we are making a mess in front of everyone else.’

In the days, weeks and months following the workshop, this disconcerting experience stayed with me. The clear and neat distinctions between two languages, two cultures and two knowledges that I had delineated in my presentation had been undermined quite openly and deliberately in the workshop. Indeed, I was specifically requested to be a participant in this occasion of irresolvable difference, in this case within the practice of translation. But the experience left me feeling more alive and interested than my presentation had. What was slowly becoming evident to me, was that we, as a group, were engaged in comparative work in which there is no outside, only participation. The translation I had so smoothly achieved in my presentation through imposed generalisation was simply not tenable in the situation of the workshop itself. My initial attitude towards my position as interpreter was one of redundancy. Perhaps
this was also the feeling after my presentation, as redundancy occurs when differences are subsumed by an imposed sameness. This position from which one imposes a sameness is the one I had taken in my presentation and the one I had wanted the Yolŋu teacher to accept in the workshop. What I experienced was an active refusal by the Yolŋu teacher for this to occur. In place of an imposed sameness emerged an active, sustained and shared engagement with difference. The shared work of speaking-interpreting was only possible because of difference, and it was important that it began, progressed and ended within this difference, without resolving it within an external and imposed sameness. This sustained and active comparison required a form of participation incommensurable with the fixed outsider who was off screen in the darkened wings of my presentation.

**Hopeful Expressions of Participant Comparison**

The figure I have developed here of ethnographer-in-the-text starts off as a presenter, confident in himself and his imposed comparisons. Unhappy with his presentation a decomposition begins which is only complete in his recomposition as a stumbling bewildered interpreter. This ethnographer-in-the-text is an expression of comparison: the presenter/interpreter, which is itself a *comparison of comparison*, as both presentation and interpretation are understood as doing comparative work. It is this figure which demonstrates 'comparison as a matter of concern' and in doing so joins Isabelle Stengers and her participation at the *Comparative Relativisms Symposium* in Copenhagen in 2010 (Stengers, 2011). Here, Stengers alerts us to two incommensurable forms of comparison within the social and natural sciences: *participant comparison*, which she describes as 'the creation of a relation, or rapport, or logos, and emphasize[s] that this creation has the character of an event', and *imperium comparison*, an external
standard imposed from outside the entities compared which both 'presupposes and
enacts the silencing power of this imposition' (Stengers, 2011).

Until now, Stengers argues, scientific practice has sustained itself through 'the
production and activation of the difference that matters for them [the participants within
science], upon what will allow them to evaluate and compare' (Stengers, 2011). Difference here is intensive, a divergence, a constant becoming of the new with
evaluations and comparisons diverging into more attempts at comparison. Participant
comparison is interested, necessarily open to resistance and rejection from its
participants, with contest and rigour relying on the 'continuation and reproduction of
such very events', Stengers argues (Stengers, 2011). The market economy however, is
not interested in such events, and universally demands of all science that it simply
produces profit. The relationship between the market and the academy threatens as a
'equivalency producing machine', incommensurable with situated and lively participant
comparison, and destined for a Darwinian contest survived by one side only (Stengers,
2011).

While Stengers proclaims an impending death of participant comparison,
others in the audience witnessed a 'hopeful moment' (Winthereik, 2011). Hope was to be
sustained not by holding fast to our comparisons from the academy, claiming better
imperiums from our objectivist past to apply in our market oriented future (for this is
surely death if it is not dead already), but by refusing to move on from the present. In
facing an impending death, it was Stengers' address which activated this hopeful
moment in the present, and it is this that Winthereik argues needs to be sustained. If
comparisons are rapports or collectives achieved and situated in always divergent
practices, then potential for futures is always immanent within these practices. Finding
ways to pay attention to these in the here-and-now reproduces a hopeful moment and sustains it. Hence, the divergent practices, which constitute participant comparison as particular becoming, are the very generative events which offer some hope for futures different to pasts, and which remade Stengers as a figure expressing a comparison of comparison in which innovation and research could go on.

I may be a bit immodest in my suggestion that my stumbling and slightly bewildered ethnographer-in-the-text could appear on stage with the likes of Isabelle Stengers. With Stengers, my feelings of being an intruder would be perhaps even more justified. Nonetheless, they are both ethnographer-in-the-text and now Stengers-in-the-text are expressions of participant comparison. They are active participants in collectives for which what is vital is the continual production of new comparisons, that is novel rapports. These figures however, are always open to resistance and refusal by participants both human and non-human. For the ethnographer-in-the-text, he started out seeking a bi-lingual and bi-cultural expertise, only to have it rejected in the very context in which he thought it would be desired and should demonstrated. This experience could not provide a new imperium to go on with, nor even some more knowledge to better inform the imposition of better comparisons. The refusal however, was simultaneous a request: a request for participation in an active and interested comparison. The experience of becoming participant comparison attuned me to the very difference through which the workshop occasion emerged and lived.

**Toward Maths as a Cultural Practice**

This ethnographer-in-the-text is a workshop participant in the next chapter. The chapter is a re-performance of a particular episode in the collective of postcolonial mathematics in Australia. In 2007, the Northern Territory hub of the National Centre for
Science, Information and Communication Technology, and Mathematics Education in Rural and Regional Australia (SiMERR) was granted some funding toward research on remote mathematics education. The Northern Territory SiMERR representative is Associate Professor Michael Christie at Charles Darwin University. He is a great friend and colleague of many Yolŋu and has done and continues to undertake 'transdisciplinary research' which is based within both and neither Aboriginal and Western knowledge traditions (Christie, 2006).

One of the most recent embodiments of this transdisciplinary research is the Yolŋu Aboriginal Consultant Initiative (YACI) which aims to develop a consultancy methodology for research that operates within Yolŋu protocols for research and agreement, while being understandable and hence acceptable by the organisations or governments which may engage consultancies regarding Yolŋu livelihoods such as housing, health, education and financial literacy for example (Charles Darwin University, 2007b). The workshop that was to both undertake the SiMERR research and the inaugural YACI research consultancy was the Maths as a Cultural Practice workshop. The workshop was held in the School of Australian Indigenous Knowledge Systems at Charles Darwin University. It brought together a familiar group of people and concerns. Ten bi-lingual professional Yolŋu adults, two men and eight women were employed as Yolŋu consultants. They are all respected members of their communities and clans, and in being dedicated to sustaining their culture are experienced in many forms of cross-cultural work including translation, interpreting, teaching, public administration, and media. Michael Christie was joined in facilitating the workshop by another Balanda staff member of CDU and long time friend and colleague of the consultants.
The workshop had two aims. First, the articulation of remote mathematics by the Yolŋu who were both familiar with and concerned about maths education in their communities and homelands. Second, to begin developing a workshop methodology within the YACI project. Hence, crucial for the success of the workshop was the articulation of the collective of postcolonial mathematics, which is at once located within Yolŋu lives and understandings, and is in the interest of SiMERR. Also participating in this episode were four research students: a current PhD student whose research concerned a pilot project in remote maths education, a former teacher and current PhD student researching computers and technology in a Yolŋu community, a researcher concerned with cross-cultural communication and media, and myself. Two months into my PhD, without a clear topic, I was to begin by researching this workshop itself.

In 2007, I could not understand any Yolŋu languages and so sat quietly taking notes from the sprinklings of English, as participants in the workshop spoke predominantly their various Yolŋu languages. My notes were sparse, and against the documentation, transcription and translation which was produced by the facilitators in the months following, they felt vastly inferior (for the extensive documentation of the workshop see http://www.cdu.edu.au/centres/macp/). But my notes did indicate three concerns. First, the workshop's articulation of two very different forms of value – 'place value' of Indo-European numbers in their inscription and 'sharing regimes' of Yolŋu gurrutu. Second, a preoccupation with understanding Western maths as being abstract, and third an irresolvable but healthy difference between Western mathematics and Yolŋu gurrutu. However, each time I went back to the documentation of the workshop these similarities and differences dissolved. It was only through becoming a workshop participant with Yolŋu once again in the weaving workshop that the Maths as a Cultural
Practice workshop became generative once again in my research.

The workshop cannot be repeated, but only re-performed with the character of an on going event. My interest in the workshop is its active translation into a researched workshop, something that as ethnographer in 2007 I found very difficult. As the figure of the ethnographer-in-the-text expressing participant comparison, I wish to articulate a participant comparison which endures in the collective of remote mathematics. This participant comparison insinuated itself throughout the workshop in 2007, as different kinds of value, number and mathematics with gurruṯu and Western number being positively different. Through this re-performance I want to engage with this participant comparison and make it generative once again. I still don't know what I am doing. I cannot reproduce some true workshop for you. As ethnographer-in-the-text I am within the collective itself, and I have a specific concern: what is the participant comparison of remote mathematics? This figure comes to life in the encounter like one of Serres' parasites of which he writes, 'He doesn't know how to do anything, and he is demanding … He is fixed on rarity. He demands something instead of nothing. That is both his existence and his reason' (Serres, 2007: 148). In articulating participant comparison, I am exacting, in the sense of thoroughly performing (ex- 'thoroughly' + agere 'to perform') the workshop, re-ordering it for the purposes of activating a difference in order to produce a rapport. By reasoning within divergent practices, I hope like those who witnessed Stengers participant comparison of comparison to sustain some hope for arriving at somewhere new.
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Where to begin addressing the problem of mathematics in remote Yolŋu communities? The workshop had gathered in the seminar room. Introductions are done. Each person introduces themselves, where they are from and what their backgrounds and interests are. The Yolŋu speak in their own languages and the Balandas speak in English*. Michael introduces the resources; white boards, video cameras, paper pencils, tea and food, and the workshop; it is a paid consultancy, payments will be worked out later and there is funding for a website. Michael ends his introduction by saying that hopefully we can reproduce Yolŋu forms of making agreement and knowledge. But how

* This re-performance of the workshop is in written English. It benefits greatly from the translated transcript made with much effort from the video documentation of the workshop, which can be found at [http://www.cdu.edu.au/centres/macp/whatemerged.html](http://www.cdu.edu.au/centres/macp/whatemerged.html).
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to introduce mathematics? One consultant addresses the problem of mathematics as a problem of value. Whose value is being used and reproduced in maths education? Is there value there in mathematics education for Yolŋu children? It is a problem of value and difference and this will be explored. But still, where to begin? One of the Yolŋu consultants and teacher, experienced in negotiating both-ways maths curricula offers a way in:

'Let’s forget about Balanda maths for a moment and concentrate on the Yolŋu side. Whatever Yolŋu do in their culture, there is maths in it. For example ancestral song, that’s talking about what English maths calls distance. If there are patterns underlying it, there has to be something in English that’s similar, in our designs, the waters tell it, the kinship (gurruṯu) tells it. In all these there’s maths included in it. That’s how we see it, with our foundation (djalkiri), that’s where it comes from.' (Charles Darwin University, 2007)

Beginning with the Yolŋu side is beginning with ancestral connections. These connections are referred to as djalkiri, foundation, or luku, footstep. These foundations are beginnings, the footsteps of ancestral beings laid down during their journeying through which the world was created. As these ancestral beings walked, swam, ate, hunted, 'whatever Yolŋu do in their culture', they gave shape to the land and its waters, and bought to life the people, birds, animals, vegetation, names, and languages. These beginnings are eternal and each ancestral track continues today. The actions of the ancestors are reproduced in daily life and in ceremony, regenerating these journeys, the land, the flora and fauna, the people, and the languages. The places produced and reproduced by on going situated practice, generate a history in place. Again, the foundations are eternal, located in places which constitute the landscape. These

* Sections of text taken from the transcript maintain the transcript's convention of keeping important Yolŋu words in parentheses in the text. For the consultancy this assisted with creating a glossary of concepts and producing key findings, as well as keeping evident in the text the process of translation and its necessary backgrounding. It is the latter reason for which I have kept this convention in this re-performance.
connections are specific. To demonstrate this, another consultant stands up, takes holds of her grandson's arm and asks the group, 'What’s this boy’s name? He is my gaminyarr (a specific kin relation), and his name is Djunuŋgu and do you know that name Djunuŋgu? Write it up on the whiteboard and then I’ll tell you. It’s from song, from gayku, Wanamaḻ.' Gurruṯu, the 'kinship that tells' these connections, provides the specific relations between land, clans, individual people, animals, birds, plants, water, winds, everything which constitutes the Yolŋu world. Working these differences well is a very important for Yolŋu. This foundation of Yolŋu cosmology and Yolŋu life, djalkiri and gurruṯu, is also a foundation for a mathematics. This became one of the key findings in the workshop's online report:

>'The sorts of investments (balyunmirr) and connections (djalkiri, gurrutu) which constitute Yolŋu identity are often understood as a form of logical reasoning, or mathematics. This is what is meant when Yolŋu people refer to ‘Yolŋu maths’.'
(Charles Darwin University, 2007)

Hence, Yolŋu mathematics, in having its own foundations, is fundamentally different and distinct from Western mathematics. Moreover, as both a foundation for identity and a foundation for a mathematics, djalkiri and gurruṯu can be understood as foundations for both knowing subjects and knowable objects. As one consultant described it, when children grow up in their own country, with the right people, experiencing their connections through the appropriate waters and winds, they have 'settled heads' appropriate for learning and becoming a knowledgeable person. Actively maintaining these connections is also maintaining 'settled heads'. If we understand an articulation of the subject-object relation in its broadest sense as learning, Yolŋu mathematics contains within it these relations and hence an immanent potential for learning. As long as the foundations are established properly, this potential is present whether it be directed towards learning the Yolŋu side or directed towards learning the
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Balanda side. For Yolŋu children,

'They need to find where we Yolŋu have ancestral connections, in their own place where their feet claim identity, then they can go on to make connections with whatever places, just as if that cloud had taken them. First they need to understand the Yolŋu side, then if they go back [to mainstream learning], they will understand the Balanda side.' (Charles Darwin University, 2007)

Establishing these Yolŋu foundations for learning, be that learning of Yolŋu or Balanda knowledge, was a familiar practice for the collective gathered at the workshop. Beginning with a Yolŋu foundation therefore, not only makes clear the existence and distinctness of a mathematics different to Western mathematics, that is a Yolŋu mathematics, but it provides the foundation to enter the problem of Western mathematics in Yolŋu society and activates the very problem the workshop was addressing. A pluralist or relativist retreat into this difference, though recognised, was simply not possible within this Yolŋu foundation.

'Some people say there is no match between Yolŋu and Dapaki [alternative word for Balanda] mathematics. You can correct me if you like, but in some ways they do [match], if you see how the Yolŋu understanding sits, and then you find how the Balanda systems goes, they will both work. If you marry them together you might get some understanding. That's what I've been hearing. That's where we get understanding, we need to go back, to where we received our foundations, to kinship, the moon, seasons, those sorts of things.'

So for Yolŋu, Balanda maths and Yolŋu maths can be compared through establishing a Yolŋu foundation which works to activate the differences of Balanda maths and Yolŋu maths. In introducing the metaphor of marriage, comparison-as-marriage is based within difference. Articulating this difference, therefore, is the foundation for marriage, which only then holds potential for understanding. But this marriage, it was admitted, is often difficult to sustain and regularly difference harden into divorce. There was a question as to whether contemporary divorces were any
different or perhaps worse than the divorces between Yolŋu and Balanda knowledge during the missions and their schools. At this point, it is time to approach the marriage from the other side and articulate a foundation of Balanda maths.

’If you don’t understand how the base ten works, you can’t work all the formulae. If you haven’t learnt really well about going from one to ten, ten to twenty, the way we [Balanda] use maths, we can’t understand formulae because underneath them we have the information in the equals sign.’ (Charles Darwin University, 2007)

It may sound odd to say that there is ’information in the equals sign’. Most of the time we think with and work with equals signs as equating or signifying an equality: 2 lots of 5 = 10. Sometimes this equating might be understood as a perfect transmission: z = 5. If one thinks of information as data, as input-output, then perhaps the equals sign has no information. It is simply a conduit. However, if one understands information from its etymology as a noun, information is the result of the the verb ’to inform’, that is the thing which gives form. This is the work of information as it is understood in information theory. In this sense, an equals sign has information in that it has an impetus to inform. An equals sign gives form to the relation: 2 lots of 5 = 10, z = 5, and this form is one of equivalence. This small thing, the equals signs, this little impetus, gives how the given is given, and within it, the given itself. As an operation of simultaneous production (of the given) and exclusion (of all other forms in which the given is given) the equals sign is one of Stengers’ imperium comparisons, an ’eradicating' and ’equivalency-producing' machine.” Now we have understood the information of the equal sign as impetus, we can continue with its participation in establishing a foundation for Western mathematics. The foundation may be re-articulated in the following way.

* It is also one form of Michel Serres' parasite in that is chases all other forms out: ’The problem, thus resolved [as one of equivalence], requires for its solution only the simple, elementary operation of exclusion’ (Serres, 2007: 178).
Western mathematics is possible because all givens are potentially equivalent. Mathematical problems are resolved when such equivalences are achieved, and formulae are used to both pose the problems and express their solutions in the simplest form. In order for equivalence to be possible, everything must be given and hence comparable by the same measure. This measure is extensive value, which has its purest expression through number. So, 'if you don't understand how the base ten works', that is the convention of using written number, you cannot express extensive value in its purest form. If you cannot express extensive value you 'cannot work all the formulae'. If you cannot work the formulae you cannot do maths because maths is the resolving of differences in extensive value.

The foundation of Western maths, that is how the given is given, is therefore a fixed ontology of discrete objects defined by internal properties of extensive value. As an 'equivalency producing machine' it cannot recognise any other system of value other than extensive value, including the necessary denial of its own quality of 'extensity' or being absolute and having no measure. The eradicating impulse of Western maths was certainly experienced by Yolŋu:

'Balanda maths is a world of its own, separate, from which we are alienated. There's nothing there to which we find connection. We are disorientated. There is no connection. We must learn why, the rationale, find reasons to learn: you are learning these things for this and this reason, so that you will feel comfortable, confident, and understand. So that you can help your relatives. Because old people are there, making sure that your work is good, 'fulfilling the task' properly, not shoddily.' (Charles Darwin University, 2007)

Without an explicit purpose or a rationale within Yolŋu life Western maths maintains itself as disconnected. For Yolŋu however, there are possibilities for connection. For example, Western maths can be embedded within kinship (gurrutura) and
the on going cyclic history of living in place (djalkiri) by doing maths under guidance of elders who are 'making sure that your work is good' with the purpose to 'help your relatives'. If this does not occur, then the experience of maths is analogous to seeing mangoes for sale in a shop while they are not in season in that time-place. Maths-as-mangoes is displayed while its foundation – the season, environment and conditions of its emergence, remains hidden or located elsewhere. This analogy was strengthened. Western maths was often like seeing an important ceremonial bread made from cycad nuts in the shop, removed from the collective negotiation within which the nuts are collected, bread produced, distributed and consumed. Both mangoes and bread, it was implied, are only rightly themselves and can only be 'tasted' or experienced properly if they are actively growing and emerging from the right environmental, ceremonial, kin and place connections. One consultant retold her visit to Australia's capital city, Canberra, and how this experience was again one of a given which conceals its foundation:

'I thought, what is the foundation of this [Australian] flag? On what it is standing? Here they are teaching us, and our children, teachings without foundation … they haven't established a foundation for the children. Where is their place? A purpose for their learning? Learning with whom, from whom? The curricula are coming from Canberra, there is no foundation for us there. It has come from somewhere else, disrespectfully cutting across. And if they don't do something, then Yolŋu will tell them and establish the foundations by themselves so that it can sprout anew in a true and meaningful direction.'

During her trip to the Australian capital this consultant had encountered the Australian flag, and in it she recognised the equivalency-producing machine of the Australian nation state, established itself on the eradication of the rights and recognition of all non-British peoples. Similarly, a student visiting a school encounters Western maths, an eradicating and equivalency producing machine. Both disrespectfully cut
across the paths of Yolŋu people. In bringing their curricula, teachers, teacher qualifications and schools the collective of Balanda mathematics refuses to negotiate a foundation for itself and for Yolŋu children. Its refusal toward negotiation and its resulting disconnection is dangerous, much like Stengers' account of the sciences facing the market. Facing this machine however, this consultant does not respond with a call to arms. She does not follow Stengers' into battle, making clear what is at stake and bracing oneself for an inevitable, yet honourable, defeat. Instead she responds by saying that if Balanda mathematics refuses to civilise itself, innovate and establish itself properly in new places, Yolŋu people and places will do so instead, cultivating meaningful foundations of a mathematics for themselves. She did not want the defeat of Yolŋu maths, but neither did she want the defeat of Western maths. She invited us to look for new shoots which were working with these two very different mathematics. Three such innovations were evident in the workshop; maths as tool, maths as mangroves, maths as yam.

**Some Metaphors for Working a Remote Mathematics**

One of the Balanda participants introduced the account of maths as a tool. She was previously a teacher and was experienced with Western number in classrooms in Yolŋu communities and in mainstream schools. She admitted that in all the places where she had taught, Western number was hard to get a handle on.

'All children learning maths are dealing with something which is basically a foreign idea', she said 'which is dividing up the world into numbers. … We've been talking a lot about how we get to understanding through metaphors, well here's a metaphor: a hammer. A hammer is a tool, but if it's the only one you've got, you walk around the world looking for nails or things to smash. And some people live a bit like that, if they only have numbers in their head, [then] that's their only tool for dealing with the world. That process has happened in Europe
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and America, and has come across the world. Well it didn’t actually start in
Europe it started in the middle east, this business about thinking the world in
numbers. It has become so common, that we have forgotten about its history,
have forgotten that it’s actually not natural …' (Charles Darwin University,
2007)

Understanding maths as a tool has advantages. A tool is an innovation that is
'actually not natural'. That is, an entity which is not a universal given, but one that only
emerges within a specific social and historical context. Moreover, reducing Western
maths to a tool, and specifically a hammer, defines more precisely its use, locates it
more strongly within this social context and places it at the feet of an actor who may
choose to use it or not. This account of tools as tools within people's heads, suggesting
that this relativisation is epistemological. Importantly, this relativising of the tool limits
the universalising impetus of Western mathematics presented above as residing within
equals sign. The account continued,

'I think that in our classrooms if we were more explicit with children, that it's a
very useful tool, just like hammers can be very useful, as long as you only use
them in the right place, and the wonderful thing for Yolŋu children is that they
already have this other fabulous map of the world, numbers are like a map of the
world.'

So there can be maps and tools each appropriate for a plurality of particular
purposes and territories (Turnbull, 1993, 2000). Being more explicit about this can help
a student, class or society better understand, strengthen and communicate the limits of
where and where not to the use these tools. The problem of Western mathematics in
remote communities therefore is translated into the problem of determining in which
contexts will its use be appropriate. This translation, however, is simply the work of
another equivalence producing machine. This tool-context comparison is understood to
have an extensive property of appropriateness. The measure or judgement of
appropriateness, that is the very measure of comparison, is enacted as an external imperium. While this may not be easily recognised as quantitative, it is nonetheless. Both tools and contexts are presupposed as having internal properties of the extension appropriateness, our new imperium comparison, adequation of which gives a greater or lesser extent of the very measure imposed, appropriateness. This relativisation of maths, however, is helpful. Another Yolŋu consultant reiterated what this teacher and researcher had just said,

'[She] said when kids go into school, they learn differently, this is what she was saying in English, “dividing the world into numbers”, that’s what she said. And I was sitting here thinking "That’s quite right, it’s true, our world has its own numbers, different numbers, different ideas, different knowledge, and when the kid jumps over on to the school side, s/he will learn differently, something different." So over there, the world is dividing into numbers, and the ones over here don’t recognise it, the kids, so that’s a point that we need to look at later on. That’s her point, is there something wrong with that?'

So not only can we understand Western-maths-as-tool as epistemological relativism; different people having different tools in their heads appropriate for use within their social world, but it can be made into a much stronger ontological relativism; the Yolŋu world has its own numbers which are distinct from the numbers inhabiting the Western world. What's wrong with that? What is wrong is that in order to sustain this difference as a distinct and knowable division, whether epistemological or ontological, we need to continue working with imperium comparisons and the privileged places outside either epistemology, ontology or both from which we know this difference. However, for the Yolŋu consultant, what this leads back to, is not how to find such as God-like position, but how to get back to the children and students who go between these two numbers, connecting them up through their daily life and schooling. Hence, difference was accepted and the problem emerged within this difference. Hopeful
divergences occur from within, and a second metaphor was introduced for this task.

'How do people find a pathway? If you go into the jungle or the mangroves, you know how to get back. If you get disorientated, you’re lost. The orientation was fine when it started, and somewhere it stopped. That’s why they can’t get it, they don’t understand the Yolŋu languages (matha) over at the school there. When we went to school we learnt English and Yolŋu languages (matha), these days at school they don’t speak in Yolŋu languages (matha). I’m just trying to find a pathway. Do you understand what I’m trying to do? I’m trying to find a way of getting in, so that we can also find a way out. Because somehow we go in with this maths and we get disoriented and can’t come out. We get stuck. That’s what possibly happens. I’m trying to tell a story to encircle the problem, to find a way, or a solution about what we’re talking about.

Taking this as an analogy to the work of the workshop, finding a pathway means being able to get into the problem and generate solutions in a such way that the solutions do not exhaust the problem or concern without which the work would become disorientated. When one goes into the mangroves one has a specific purpose - to find mud crabs and shell fish. However, once you are in the mangroves you are in. No matter if you are four steps in or four hundred steps in, when you look around you are confronted with the same depthless pattern of bark, mud, and leaves and a directionless pattern of dappled light and shade. For those of us who become too interested in finding this mud crab or that shell fish we become disoriented within minutes. Those who are experienced however, spread out around the mangroves before entering, and once inside appear more interested in shouting out to each other and finding themselves inside than finding anything like crabs. They call out each others' names and exclamations of 'Where are you?'... 'Over here!' ... 'Where?' ... Over here!' In walking and shouting the group can encircle the mangroves from within. The solutions one finds in working this way do not disorientate the work at hand by eclipsing the nature of the problem itself. It is a strategy for remaining located in the place within which the desired solutions can
emerge, while simultaneously maintaining an orientation towards getting out which ensures that the problem remains a concern generative of ongoing life.

This analogy is telling us that in order to keep the collective going, you always need to make explicit where you are in relation to others, yelling out no matter how odd it sounds to those who accompany you. In re-performing the workshop as a researched workshop, I have been doing an analogous performance of a venture into the mangroves. I am interested in coming out with something in particular: number as participant comparison. I am joined within this problem of a comparative mathematics by the participants in the workshop and their discussion. However, in researching the workshop I am joined by others who have ventured into the problem of disparate knowledge traditions and the problem of comparison. In order to not become disoriented as a researcher myself and come out with nothing new I have been calling out to these participants. Relativism are you over there? Good. Universalism where are you? Hey, imperium comparison! References and quotes can also be understood as this performance of calling out in order to maintain orientation. I call out to texts and researchers who accompany me in this problem. Just like in the mangroves, this calling out expresses a slight difference in position which is necessary to sustain a good orientation within a difficult environment. Maintaining these differences, however slight, is another expression of working Serre's parasites (Serres, 2007), in a way which closely resembles the word's etymology: para – 'beside', or 'adjacent but separate', site – 'local position'). It ensures that I do not join my other participants for too long or too closely, for doing so disorients the task. Nothing new is found individually and collectively if too much grouping occurs (a quick note of caution in this regard, never follow children or foreigners into the mangroves!). Hence, work such as mine here is always within the collective task of others who have also entered the mangroves of
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comparative research. A second analogy has helped me and the workshop be more
careful in searching for solutions.

'I can use this story about ganguri [a specie of edible yam], a ganguri metaphor
for collecting and findings yams. Like the ladies when they go out for hunting,
when they go into the bush [there are] some very prickly shrubs can really cut
you and cause you harm. It is like that, it was like that. We were endeavouring to
find some answers, some solutions, and when you find ganguri it’s hard work.
You go down and find the leaves and the vines and identify it, that it's the right
vine. Then you have to dig it, it’s hard work also to get it out of the soil and it's a
bit like that trying to identify, [to] go through the process [we are doing here]. It
hasn’t been easy particularly for myself, because most of the people here [at the
workshop] have been with the teaching profession for a long time, and they
know some of the ups and downs and even some of the blockages, stumbling
blocks, and pitfalls happening in their profession when it comes to Yolŋu
development progress in teaching, the education field.'

So encircling the problem from within is important, but so is paying attention
to how we find the solutions. It is hard work, dangerous and quite often painful. One
must accept that. Identifying the leaves or the vine is difficult in the rocky, and hillside
woodlands where you most often find ganguri. When you do identify the right leaf
which is on the vine you are still not at the nourishing solution, the yam. It is careful
work to follow a vine down to the yam. If you pull too hard and break and vine you may
loose it. Tracing number in the collective of remote mathematics is similarly difficult.
They are delicate things in an often unfriendly environment, and it is hard enough
glimpsing indications of their presence, let alone tracing from these glimpses to the
thing which is actively growing. But it is in these places, within which children cross
from one side to another and laws often 'cut across disrespectfully', that these numbers
are to be found. I do not wish to underplay or appear to be skipping over the many
difficulties of remote mathematics and remote education. However, including these
here, in a list or summary perhaps, would be to encircle the problem from the outside
which holds no hope for finding a new solution. So let us venture more deeply into the collective and along the way shout out in order to help not lose our orientation towards getting out with something new.

**Knowing Number: Internal Properties and External Relations**

Here a number is being sort as a participant comparison in the collective of Yolŋu mathematics education. As a participant comparison it is working towards sustaining a collective which can endure the frequent entering and exiting of new Balanda teachers, new curricula, and fluctuating funding and resources allocations in remote schools. The number is hoped to be sustained within twelve routine practices which are called 'probe tasks'. They are designed to be local tools with which to probe students heads to determine the presence of number there. It is committed to an understanding of number as an abstract entity of cognition. This number was introduced to the workshop in a performance by a teacher who is researching these probe tasks. It begins with the teacher and another participants assisting her in holding opposite ends of a thin, blue plastic strip, the kind used to strap boxes and crates. There is also a set of cards, playing card size with large numerals inscribed on them by hand. The teacher holds a card with '0' inscribed on it up to the us who are being the students.

'Does everyone knows this number?' she asks. 'It is zero. You can call it zero, naught, bāŋu.' Bāŋu is a commonly used Yolŋu word for none or nothing. Another consultant continues the introduction of this entity: 'When I was at school we called it nought, not zero, when we were growing we had pounds and ounces which changed to grams.' The teacher continues. 'I'll put it on this end' she says pegging the card with '0' inscribed on it on one end of the plastic strip. And this one?' She holds up a card inscribed with '100'. A few participants-cum-students reply 'one hundred'. The
participant-cum-teacher repeats the name and pegs the '100' card on the opposite end to the '0' card.

'So we've got a number line', she continues. Her and her assistant move apart making the plastic strip tight with the '0' card pegged on one end and the 100 pegged on the other. 'It's a bit wonky but that's okay because we might be out at an outstation [another name for homeland] and that is all we can find. Now what I am going to ask you is … I've got a number here and we're going to do an assessment. This is one we have been using at Shepherdson College [in the Gali'winku community] and Mapuru Homeland School. This one is what number?' She holds up a card inscribed with '48'. 'Forty eight', comes the reply. 'Forty-eight, that's right. Can someone come up and put this number where you think it lives? Where its place is on this line. Where would you put forty eight?' A participant-cum-student stands up, takes the '48' card, pauses momentarily and pegs the card on the plastic strip. 'What did he just do?' the teacher asks. 'He was looking for a place. He was looking for somewhere half [way along the line]. This man has a good number sense. Do you think he was on the right side of half? We can always check', and she folds the strip in half by joining the two ends.

So we have a plastic strip held tight by people at either end with a card inscribed with '0' pegged on one end and a card inscribed with '100' pegged on the other. Within this arrangement, the assessment, the probing, is a specific action elicited from a student. The important act is to peg another card with a different numeral inscribed in the correct place. A card with '48' inscribed is presented and another participant places it about half way. This important act is understood as demonstrating good number sense, or more casually described as 'knowing where numbers live'. It is performing a correct match or adequation of a numeral to its extensive value.
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To contrast this capable achievement of the task, the teacher who has been working with these tasks recounts a story where the definitive act of demonstrating number sense was absent. A six year old girl was presented the same arrangement of plastic strip help between two people with '0' and '100' cards pegged at opposite ends. She was asked to peg the '48' card in the right place. The student proceeded to count from the '0' card progressively to toward the '100' card: one, two, three, four, five, six and so on. As she said the sequence of number names she nodded her head and followed this sequence bit by bit along the plastic strip with her eyes until she had counted to forty-eight. At this point she stopped and pegged the card where her counting, nodding and looking had stopped. This student was familiar with Western mathematics and its numbers. She knew that there was a right place for the card to go and that the numeral '48' was the name of that place. The strategy she employed for determining this place, however, to count by ones, the most basic unit in Western maths, was not appropriate.

One might hypothesise that the girl was establishing the position by naming an ordered line of numbers through a sequence of naming, nodding and extending along the plastic strip. She would terminate the sequence when her number reached the position named 'forty eight'. She had the right idea that number was the determination of extent, a determination of how far along the strip. What she did not know was that independently of her practice of counting, that she achieved quite competently, the plastic strip with pegged cards at either end had already determined the correct position of '48'. In this routine the plastic strip (although wonky, blue, hard and thin) was assumed to have its most dominant attribute of length as clearly evident. As length is itself extensive, expressing only extensive value, it could be matched directly onto numbers because they also express extensive value. All that was needed was that this extensity be given some reference point, which were the cards inscribed with '0' and
'100' pegged at some distance apart. Number sense therefore, begins with knowing that this imposition of extensive measure is appropriate because it is given in the very being of things. It is an ontological foundation, the ways things are. The practice of assessment or demonstration is therefore merely revealing the character of reality, or explicitly repeating the given. Alongside this demonstration of Western number participating in the collective, a Yolŋu number was also demonstrated.

The Yolŋu mathematics was introduced by the season, midawarr, within which the workshop was held. In midawarr, the land and its rivers are drying out, it is becoming easier to travel about, and animals and fish are putting on fat. It is less a temporal duration than a particular transition of relations towards a different momentary stabilisation. Because it is midawarr, 'lots of people are taking their children hunting. Those kids know all about fishing … When the tide comes in, they go, and when it goes out they collect mirriya [bait crabs], and they know when to go back fishing again.' This short story was understood as evidencing or displaying the mathematics embedded in the season. 'See' the narrator said taking a pause in her description, 'it's midawarr time now.' As well as the transition into midawarr, there are other cycles people learn to work with. 'They know about which tide and which moon,' she continues, 'and which tide to go collecting diyamu [a specific shellfish].' Importantly the kids are involved in this mathematics. They come and say to the adults, 'Come on, let's go hunting for fish', and this, we are being told, is followed by some concerns that need to be addressed: 'What's the time?' 'What's the tide doing?' 'Who's going to check if the tide is coming in or out?' It may not be the right tide to hunt for fish, however, but there will always be other things to do until that tide is right for fishing. This narration of Yolŋu maths concludes here, 'If it's the wrong time, we'll do something else, go into the bush or into the mangroves for crabs and when the tides come in we'll go fishing and catch lots of fish.
Chapter Four

That's what midawarr season is like.'

So what are the important practices here in demonstrating a successful Yolŋu maths? First, we are told, it is important to know the season and the particular arrangement of plants, animals, and weather that constitute this season. The season at the time of the workshop was midawarr: the land and its rivers are drying out, it is becoming easier to travel about, and animals and fish are putting on fat. And then there are the rhythms and arrangements of the tides and moon. Paying attention to this and acting appropriately has different practices being done at different times and places: people collecting bait crabs on the mud banks of rivers at low tide, fewer people watching the tide near the shore at low tide as it begins to turn, some in the mangroves collecting mud crabs at low tide, and people fishing off the shore as the tide comes in.

Knowing how to relate to the environment well and performing the appropriate tasks for each time and place will end in a successful practice such that 'when the tides come in we'll go fishing and catch lots of fish.' Hence, for Yolŋu, practice does not concern the successful recognition of the appropriate object and then trying to determine its measure as extension. Rather, practice is about participating in a set of specific and dynamic relations: fish-water-tides-bait-buckets. What is important is that one pays attention to what practices work within which arrangement of relations and the collective participation in the transition of these relations: fish-sea-high tide-beach to fish-bucket-low tide-home. What is the appropriate action is different for each time and place. Hence, important acts are not those that identify a particular fixed attribute internal to things, but those acts which continue a working set of relations between things, even if these relations change from mud crabs in mangroves at low tide to fishing on the beach at high tide. This is what midawarr season is like.
Ethnographic Numbers: a Western achievement of Intensive Number

An account of the practices of Western mathematics and number analogous to the practice of Yolŋu mathematics – that is the practice of working relations - is possible. Helen Verran (Verran, 2001) develops such an account in Science and an African Logic. Here we are introduced to numbers as 'stabilising transitions' (2001: 162) achieved within the collective work of 'figuring relationalities' (2001: 175). Figuring relationalities is quite confidently and ordinarily achieved in everyday life, sometimes so often and in such banal routines that it is barely noticed. During midawarr, the collective figuring of the relationalities of tides, bait crabs, mangroves, people, equipment, and fish achieve certain transitions: mangroves during a tide going out was a good time-place for getting crabs while someone watched the tide, which would become tide coming in and people going fishing, which would become tide going out and people going home with a bucket full of fish.

Verran evidences her figured relationalities through stories of market places, playgrounds and classrooms, and also her own contrived tasks she performed with children in classrooms and in the shade of trees. These tasks are akin to the 'probe task' of placing the card '48' described above in which the successful student determined the extensive value of numbers and matches this to a position on a numerated plastic strip. The tasks Verran had performed were pouring amounts of peanuts and coke, from bowls to plates and from one cup into two cups. She describes the tasks as doing rituals 'in which complexity is managed by being shifted into complicated objects' (2001: 162). The 'complicated object' in the rituals Verran had performed was volume. In the case of the number line, the complicated object is length. In both rituals, shifting complexity
into complicated objects afforded a transition: a numeral '48' becoming a number with the appropriate extensive value (or not) and the student demonstrating their possession of number sense (or not), the volume of peanuts being the same (or not) and the student demonstrating an understanding of conservation of volume as extensive value (or not). These routines were stabilised and stabilising in that they enveloped 'definitive events' (2001: 169). These events were definite in that they simultaneously achieved the necessary object and subject specific for the situation.

Definitive events however, have specific relationalities. For Verran these are duration, extension and resistance. In the number line task the duration is between a '48' inscribed card then being held up as an independent thing, to now being pegged on the number line. The extension is between there the '48' was in the hand and here the '48' is in a place on the number line. The resistances are the '48' on a single card with a single peg such that a single card can only be pegged once in a single place, the plastic strip though wonky, held between two people, which ends at one person's finger tips and the '0' card and at another person's finger tips and the '100' card. The problem of constituting the definitive event is done as and through the figuring these relationalities of then-now, here-there, card-peg-plastic strip. If these relationalities can simultaneously achieve an extensive value of a numeral ('48') as the same as the extensive value of the strip (length) this extensive property – 'length', will become the single complex object which defines both number and strip, and the student will become a person with a good sense of this object. How might this be done?

To shift the complexity of this situation into the complicated object of extensive value requires a backgrounding of the relationalities of duration and extension. That is the then-now (duration) and there-here (extension) become fixed and
foundational. This is what enables an arm-span length of wonky blue plastic strip held between two people to become a 'number line': an always already existing object set in the indifference of space-time. Hence, the number line is an extensive object, fixed and known through its internal property of length. Once we have settled on this thing, we need to pay attention to the resistances, that is the way this object is presented and the properties it displays. This is paying attention to its internal properties of extent. In this case, a thin strip held tight with a '0' card on one end and the '100' card on the other is displaying its property 'length'. This tells us that the object is of length '100' units. We can therefore reason how far along '48' units might be: about half way as forty eight is about half of one hundred, or just less than half to be more precise. We can check this precision by literally folding this already existing number line in half.

Figuring the relationalities differently will produce a different stabilising transition, that is a different complicated object to go on with. For example, resistances might be backgrounded and more attention given to the specific workings of durations and extensions. In this case we do not have a number line, but a collection of things gathered together for a specific task: cards, numerals, plastic, and hands. Thus the task becomes participating in appropriate extensions and durations within this arrangement. We might help generate extensions and duration through counting; standing facing the number line, identifying a place to begin, '0', and then naming, nodding and looking at each little duration-extension. We utter 'one', nod look a bit further along to the right, utter 'two', nod look a bit further along to the right, utter 'three', nod look a bit further along to the right and so on. How do we known when the right extension-duration is achieved and can enable a placement of the card '48'? When the uttered name of '48' is the same as the uttered count 'forty eight'. We have reached the right place. This is what the young girl did.
Ethnographic Numbers: a Yolñu Achievement of Extensive Number

Using Verran's typology of relationalities we can also understand Yolŋu mathematics. Although midawarr is likened to a season, it is not a specific duration but an assemblage. Participating in midawarr has people going fishing which involves paying careful attention the specific arrangements of time-place. What is backgrounded are the resistances, the tides, mangroves, bait crabs and the rest. Simply put, 'this is what midawarr is like'. What is important is doing the definitive acts of midawarr. Fishing is doing the right routines in the right times-places. Whereas in a market place or a classroom Western numbers are figured very tightly and repetitively, Yolŋu mathematics are much more limited, occurring for short times and sometimes only once in a series of transitions which are all different. In the doing of relationalities of going hunting during midawarr, the transitions themselves kept changing, yet they hang together nevertheless and do achieve the catching of fish.

Using the ganguri yam metaphor, Verran's work has allowed us to follow the thin vine from its leaf down to the yam. It has been slow and careful work, but certainly worthwhile. The workshop was provided with two clearly identifiable numbers: Western number and Yolŋu number. Following this down like a ganguri yam has allowed us to avoid 'some of the blockages, stumbling blocks, and pitfalls happening' in many understandings of number. It has enabled two very different mathematics to connect up. In doing so it has kept the important differences: Western maths with its familiar figures of entities defined by extensive properties such as '48' and Yolŋu maths and its familiars of dynamic sets of relations such as midawarr. If we read Verran's work here as a working along a ganguri vine to find a shared understandings of mathematics, there is a
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vine offered in Yolŋu thought which does an analogous job. It concerns the collection of turtle eggs which are told here as buried in the sand on a particular beach. Half way through the story children are described as stacking eggs in piles of five – waŋgany rulu, [a single group of five], and then determining different amounts - marrma rulu [a pair of groups of five (ten)], lurrkun rulu, [a triplet of groups of five (fifteen)], and also marrma rulu ga waŋgany baythinyawuy, [a pair of groups and one more left over (eleven)]. I retell this account at length here because it demonstrates how extensive value can emerge within familiar Yolŋu practices.

A consultant draws the turtle tracks on the white board shown to the right. The tracks include a number of places where the turtle had dug into the sand. Another consultant describes the picture for us. 'You can see these turtle tracks, she’s coming out of the water and she made this, and here, and here and here, and here, and back down,' she begins. 'So if a Yolŋu who knows, he’ll see what lies there, there’s a secret that he will see in these tracks.' She explains that not all the places where the sand has been dug up are also places where eggs have been buried. Only one of the diggings will be a hole containing eggs. It is this particular place that the person is looking for. 'He will prod and find out where the turtle eggs are, and if he doesn’t know what he’s doing; when you look on the beach, he will dig until he has no energy, he’ll prod there, and get tired, he’ll poke here, until he gets tired, and here and find nothing.'
The consultant is a teacher at a homeland school and she goes on to say this is analogous to how she and others are like teachers, and if they do not know what they are doing they will tire themselves out. All Yolŋu, from both the Dhuwa and Yirritja moieties, have experience with many things that have tricks in hiding things underneath the ground including this turtle, which is Dhuwa and the orange footed scrub fowl which is Yirritja. In schools and in the church a similar experience can occur, and Yolŋu get worn out because they never find what is hidden within what is being shared. 'But if we learn about these areas' she says, 'in maths and in other areas, we will understand, and then we can help our own children, or our own group.' She returns to the description of collecting turtle eggs and says that people can use either a Balanda steel rod or Yolŋu casuarina stick to poke down into the sand. When the stick goes in quick, there is a hole there with eggs. But if you are not experienced in feeling this, you will wear yourself out. Yolŋu children, sometimes three years old, can do this. When these knowledgeable children find the eggs she says, they 'sometimes do it like this, they place four eggs together and a fifth one on top, ‘waŋgany rulu’, then they share out the turtle eggs. How many do you want? Waŋgany rulu’, marrma’ rulu’, lurrkun’, dambumiriw. Marrma’ rulu ga waŋgany baythinyawuy, that’s ten and one is eleven. So using the rulu they count using maths, we can get many, many eggs but we’ll still put them into rulu groups before sharing them.'

At this point another consultant comments that sorting the eggs as rulu is 'not all serious.' It can be quite fun, for example, 'like when there’s very big serious problem the mari and gutharra [particular relatives] can find something fun and they can solve the problem and make a joke in the middle of the fight.' This is almost the end of the story, however, one final point needs to be repeated. The woman who drew the picture reminds us that this story was about about one kind of turtle, of which there are five.
They have five different tracks, different eggs and difference ancestral connections. A good Yolŋu will learn these differences as they grow up and not get them confused.

This story again demonstrates the practices which constitute a Yolŋu mathematics. Here, it is important to know which turtle might have laid the eggs you are hunting for, and the tricks such turtles play in hiding eggs in only some places. A real expert can recognise the tracks, while most people just use a stick to prod into the sand at each mark. But if you really don't know what you are doing then you will find nothing. Knowing how the turtles and the beaches are related through which ancestral connections is also important in hunting. This is serious work. We are told that once all the appropriate actions are taken and result in the digging up of eggs, the eggs are then to be distributed.

The round turtle eggs are ordered in piles of five, pyramids with four on the base and a head of one. No matter how many eggs are found, they are put into piles of five before they are shared with kin. This distributing of eggs moreover is done through gurruṯu. But, we are told, this it not always serious. It might be done to make a joke or simply to smooth things over between kin. It is not serious ceremonial work. Here Yolŋu do work with a form of extensive value. Eggs are ordered as units of five, which are used iteratively until a collection of eggs is exhausted. Value is embedded within a specific task of enumerating and distributing eggs. It is only achieved in this context and only limited to a mundane sharing, separated from a serious negotiation of kin and ancestral connections.

The accounts of number as figuring rationalities and number as collecting turtle eggs demand that both number and accounts of number do not presuppose a foundation or imposition from outside. Number becomes a participant comparison within on going
practices. Importantly, despite its dynamism and multiplicity, this number does not
dissolve and disappear. It is as present and real as ever. This dynamic, multiple and
situated number, at work and expressed with collective practice, is an ethnographic
number. Participant comparison has first developed an ethnographer-in-the-text and now
an ethnographic-number-in-the-text. Following this ethnographic number 'in the wild'
will be the focus of Chapter Five. However, the *Maths as a Cultural Practice* workshop
has a little more work to do. This number as participant comparison has resonated with
the difference which generates a postcolonial mathematics in North East Arnhem Land.
It has expressed value as both extensive, the extensive and internal properties of things,
and intensive, the dynamic relations of becoming between things. More specifically,
these two modes of value can account for foundations without universalising them nor
rigidly separating them. Gurruṯu and djalkiri are primarily ordered on intensive number.
Extensive value can be achieved such as sharing turtle eggs through rulu, yet this is not
considered as important as the relations in which the sharing is constituted. For Western
maths on the other hand, the recognition of the extensive properties of matter set in
space time is important, but can also be told as the achieved limits of collective practice.
With these two modes of value operating, the workshop turned to the question of
money.

**What is the Value of Money?**

Money is a familiar routine of achieving and working with Western number in
the collective. It has increasingly permeated the collective, becoming more diverse in its
form. To quickly recap the life of number in Arnhem Land told in Chapter One, money
was introduced as cut out cardboard disks with numerals inscribed and sized to mimic
metal coins of the mainstream economy. Later, mainstream cash was introduced with
wages and royalties predominantly from mining, and banks were set up to hold this money. Social security has increased the circulation of money which now spreads not solely through cash, but bank cards, and telephone and internet-accessed accounts. Behaving appropriately in the contemporary collective now involves 'looking after the family budget.' Nevertheless, one consultant declared 'We still don't understand the value of money.' He continued saying that this misunderstanding is why 'money goes into your account and then out the next moment, like a bucket with holes in it. But we have to understand that …' he pointed out. There was a suggestion that the holes in the bucket were gurrutu, to which he replied 'Yes, those holes are called gurrutu. The white man might see it and say ‘Ah there’s a hole in the bucket’, but our buckets, the hole is gurrutu, you see, instead of wasting, it’s going back to the family … That’s good' he continued, '[it is money] for my maralkur, my gurruŋ, mari, waku, or miyalk [kin terms]. [We are] just giving money to all our kin so as not to give cause for embarrassment and humiliation.' In communities where there are few jobs, those who receive wages have their families 'lining up' for the money to be shared. How might this be experienced as a misunderstanding of money, or a misunderstanding of number?

Within a Balanda mathematics what is good is the achievement of a unity. Recall the probe task in which the correct use of number ('number sense') was the condensation of a complex arrangement into the unity of length which could then be given a specific and singular value. Number requires settling on a correct unity which has extensive properties. This is the case with both number as a universal entity and as a socially-historically embedded tool. Here, Western mathematics is a bucket, which is easily understood as participating in the achievement of a unity with extensive properties - a volume, let's say, of water. Understanding bank accounts as buckets has them participating in the achievement of a unity of money – a specific singular amount.
However, this was not the experience of many Yolŋu. They experience a misunderstanding of money because their accounts and their money never establishes an enduring unity. Yolŋu, we are being told, experience money flowing out all over the place as if the account was a bucket with holes.

What about the suggestion that the collection of holes was gurruṯu? Taking this suggestion seriously is recasting gurruṯu as a set of negative extensive values. Where a bucket without holes (Western number) defines positive extensive value – a volume determined by the diameter and depth of the bucket, gurruṯu (Yolŋu number) defines negative extensive value – an extent of holiness determined by the diameter of the holes and position on the bucket (perhaps metaphors for the strength of kinship relation and the regularity with which the relation is present). This is consistent with some other characteristic of gurruṯu, for example as a 'formally articulated system of beholdenness: it orders degrees and types of indebtedness' (Watson-Verran, 1989: 37). However, this reframing of gurruṯu as the negative of Western number was explicitly avoided. Yolŋu buckets did have holes, and it was stressed that they are meant to have holes and that this is good. The correct distribution of money through kin is good. One participant asked 'Are you saying that we don’t save money because we don’t know how to?' and then answered her own question, 'We don’t know how to do it. Or rather I don’t know how to do it. What does it mean not to know how to save?' If knowing the value of money is having buckets without holes, that is achieving number with its correct property as having positive extensive value, then Yolŋu don’t know this bucket. Yolŋu buckets are different.

Perhaps it was not that Yolŋu did not understand the value of money, but that they rejected positive value because it went against Yolŋu values, such as being
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generous. This understanding simply reframes maths as a tool, and shifts the question as to whether or not it is appropriate to use. The question of the tool itself, how the bucket in this case achieves value, is ignored. However, this is precisely the problem the value of money in Arnhem Land encounters. 'Our law says, we have our own ways, we have to do the right thing, we’re trying to fulfil our responsibilities, the ancestral laws say, they tell us from the foundations, (lukuŋur), we mustn’t leave others out. We are instructed (raypirri, ɲarra’ɲur) in ceremonies not to ignore our relatives. We will be embarrassed to look at them (lay-gori). Our law tells us (rom ga bāraŋga’yun) that we are restoring our kinship, value in kinship, laws, respect, all these more important cultural practices, more important than the money issue, than adding up the world, more so than that. That’s why there’s a question mark there, what shall become of Yolŋu further down the track? All those value studies are really good. Could money, rrupiya go down the drain, or start to accumulate, or start to have another value? For balanda? That’s really my question.' This really is the question. Money and number can have extensive value. Gurruṯu can be remade as extensive. Turtle eggs can be worked extensively. But, enumerating turtle eggs through extensive value was not important. It was simply a mundane routine located within a Yolŋu mathematics. However, the suggestion that gurruṯu, the Yolŋu foundation, was itself extensive like Western maths was rejected. Extensive value was rejected as foundational, and in being rejected the question emerged: can money really have a different value and extensive value? Could money value be understood akin to Yolŋu mathematics or Verran's figured relationalities. Could its value be one which connects up with practices which sustain Yolŋu life?
Chapter Four

**Going on ... into the wild**

Part Two of this thesis showed the investigation number and difference starting out in the wrong direction and losing the very problem of difference by resolving it into particular cases of some general concept. Difference became merely different attributes of abstract objects: ontologies, conceptual systems, and metaphysics. Situated as a participant in occasions of a workshop event with my Yolŋu friends and colleagues however, I experienced an active refusal to let difference fall into the indifference of abstract space-time. What was experienced at first as a refusal to work with difference as negative and reducible, became understood as a sustained effort of working with difference as positive and irreducible. Working with difference was understood as working comparison, and this in turn enabled the ethnographer to emerge as a comparison of comparisons: imperium comparison and participant comparison. Once slightly more attuned to comparison and comparisons of comparison we began the *Maths as a Culture Practice* workshop. As participant comparison effecting this workshop, we did not try to recognise comparisons, but rather continued the active work of comparison. Hence, the workshop can be understood as a comparative comparison of comparisons, that is an active production of a rapport within connecting and separating of different mathematics, themselves understood as modes of connecting and separating with common measures.

While this may seem complex, and perhaps unnecessarily so, the explicit and recursive work of comparison is what is necessary to ensure that difference is maintained as a differential, as an relational and irreducible potential, within each moment. It is this process of feeling our way into this positive difference that has constituted Part Two. Part Two has demonstrated the difficult and necessary work of
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 staying on the screen, of thinking within the process of different/citation, and maintaining the possibility of the shock of the new. And something novel did emerge: a number which is multiple and therefore one which holds a greater potential for particular solutions to actualise. The question 'can number live through valuations that are other than those of extension?' provides the impetus to go on, to investigate this potential of number. As a question it may sound deceptively simple, even with the re-introduction of the odd term valuation. It is deceptively simple in that if difference is not respected and carefully sustained (as occurred when researcher was presenter), it might be answered to quickly: yes, other 'societies' have other valuations and here is the evidence, or no, the valuation of number is universal and here is the evidence. It would become a problem in extensive value, or valuation as exclusively extensive, and answered simply 'by the facts'. But the problem of value which concerns number and difference demands further explication of what these valuations are and their potentials. This explication is empirical, and preparing for this task we have become sensitised to ethnographic numbers as dynamic, multiple and situated. The task now is to follow these numbers through a relational empiricism. 'Only an empiricist could say', claims Deleuze, 'concepts are indeed things, but things in their free and wild state, beyond "anthropological predicates"' (Deleuze, 1994: xx). So in sustaining this work of a relational empiricism, we follow number in its 'free and wild state', and in doing so we keep empiricism facing difference, and hope to have the problem of number and value articulate itself more fully through resonating with the differences that constitute the encounter of research.
Chapter Four
Part Three
Chapter Five

Numbers in the Wild: listening for number and amplifying its capacities

Re-introducing Oscillating Value as Eternal Object

In Part One number as event was introduced, within which value emerged as a quality through processes of qualification or valuation. The quality of the valuation in Part One was oscillating value, and specifically the incessant alternating of the unity/plurality relation between one-many and whole-part. Part Two has demonstrated a gradual attunement to working with value as a quality embedded within dynamic and embodied relations. Such an attunement was developed not though the recognition of patterns or correspondences of particular 'notes', but through 'indirect harmonies' which emerged through intensive difference. Part Two developed an ethnographic number as a participant comparison through which to continue research. This participant comparison
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holds within it the sensitivity to the danger of imposed comparison and losing difference to an outside concept. The device that can be successful in avoiding this danger was oscillating value as an eternal object, as demonstrated in Part One. Value as eternal object was the fourth component of number as event in Income Management, which lived at its very limits and produced ingression in the event. It is value as an eternal object which allows the event of number to 'play its full role' and allows analysis to sensitise itself to number's potential toward multiple valuations. Eternal objects are what prevents mistaking the actual/virtual for the real/abstract and keeps research on the screen, that is within the complex process of different/ciation.

Eternal objects are the devices which Celia Lury and Lisa Adkins advocate (Adkins, Lury, 2009), and which were introduced in Chapter One. According to Lury and Adkins, devices are hinges between the actual and virtual which co-ordinate the surface. This co-ordinating work which is always internal to the surface is an 'opening up' in the sense that it provides more degrees of freedom for the process of different/ciation, and hence a more complex and subtle potential becomes immanent in the event. Following Lury and Adkins again, devices as eternal objects are internal capacities. Value, therefore, is an internal capacity in the event number.

We begin to sense these capacities in listening and gradually resonating with the less audible and more subtle valuations. The resonating amplifies the full potential of the event number, which may at first be experienced as a cacophony, but if we persist we do begin to pick up harmonies and sometimes the notes that emerge as the limits of these harmonies. The more limits we sense the more we can listen for other indirect harmonies that are performing this collective composition. This is the task of this Chapter: taking number as event and value as device we go listening for number in the
A Valuation in the Classroom: (extensive)Value/order

On most days, after morning break Bonba Class do maths. Bonba always begins its maths lessons with a game. The purpose of the game is to make the transition from the morning break running around outside to sitting quietly inside. The game is also a familiar and entertaining group activity with which to introduce numbers into the classroom, before the students start to work more individually and with more unfamiliar numbers. The students, three boys and six girls, are between ten and twelve years old. It is a composite class combining the two final year levels of primary school. The class has one teacher, two assistant teachers and one parent assistant all of whom are Yolŋu. Having a class, both teachers and students, which is Yolŋu in this way is a rare occurrence in community schools in Arnhem Land such as this one (in Homeland schools Yolŋu staff have a greater role in teaching). In most schools in Arnhem Land, for most of the time, teachers are from elsewhere in Australia and are rarely Aboriginal. When I meet the Bonba Class to participate in their maths classes, I already know some of the students and staff and I am familiar in working our relationships through gurruṯu.
Chapter Five

I want to take advantage of this Yolŋu class and keep this present, and continuing to relate through gurrutu is one way of doing so. Kin terms are used both in defining the relationship between myself and others and in addressing them directly in speech and writing.

The teacher, my dhuway, announces that we are to begin with a game of cards. We all sit down in a circle, legs crossed, on the large mat at the back of the classroom. One of the older girls, my waku, is given a deck of standard playing cards, with the picture cards (king, queen, and jack) removed. With the slightest of flicks she sends a card spinning across the mat, only inches above the ground. It doesn't flip, revealing its face, nor veer off course. Its perfect flight covers the two meter space of the circle's empty interior and slides to a stop in front of another student. Waku deals four more cards to this student, five in total, then five cards to the student next in the circle, and continues dealing around the circle with each card delivered with the necessary concealment and precision. After several hands have been dealt, including one in front of me and one in front an assistant teacher, Waku stops dealing and spreads the cards in her hand into a fan. She holds a little more than five cards in her hand. She ends the dealing and places the remaining cards face down in a pile in front of her called the 'draw pile'. Three students miss out on being dealt a hand.

Waku turns over the top card on the draw pile. 'One ay high' she says and an 'A' (or Ace) is revealed. Whoever has a '9' card, the teacher explains, plays that card and makes a pair, 'A'&'9'. This act is called 'make'im-ten' and it is the pivotal move in the game. A student plays a nine, demonstrating a 'make'im-ten'. After this make'im-ten, the next card from the draw pile is flipped revealing a new card and a new potential for make'im-ten to occur. With the explanation and demonstration done, the game now
continues through each player going clockwise around the circle having the chance to make'im-ten. If a player cannot make'im-ten they pick up from the draw pile, which, as the game goes on, is replenished from shuffling the growing pile of pairs which result from successful acts of make'im-ten. The students are quick to make pairs and before long one calls 'bingo!'. The player has run out of cards and this ends the game. A new game is dealt, and this time includes the students who missed out on the last game.

After a few more games, one of the assistant teachers suggests we play so that the pairs make eleven. 'You need an eleven card for that!' the students protest. The '10' card is special and is played face up in front of you, reducing the cards in your hand without having to make'im-ten through pairing it with the card from the draw pile. The game continues on, but soon the teacher finds a deck with an '11' card (it is from a deck designed for the game 500, from which she has removed the twelve card and thirteen card, and all the picture cards). The teacher reads out the pairs that make eleven. 'Ace ga ten, two ga nine, three ga eight, four ga ten ...' 'Yaka, four ga seven' one of the students corrects, and together the teacher and some of the students complete the naming of the set of card pairs which make eleven. During this game one student hesitates on his turn, not sure if he can play or if he must pass and pick up an extra card. His classmates tell him what he needs to play. The game ends and we all move to the desks to begin the maths work from the Government curriculum. 'That game is about five' the teacher explains to me, 'because each of the children get five cards.'

Understanding the card game as being about five, or characterised by a quality of fiveness, brings our attention to a perhaps less familiar valuation enacted through number. The game is constituted by a group of people and a deck of cards. To initiate the game the group becomes individuated, or dividuated to be more precise, as players
through dealing hands of five cards. The game ends the instant a player has no cards. The game is re-constituted by another group of people being dealt five cards each, which may or may not be the same people. Hence the game orders itself through a decomposition: the deck of cards is decomposed as 'hands' of five and a draw pile left over, which is simultaneously a decomposition of a class of students into individual players and some people left over. 'Hands' are simultaneously the resultant collections of cards and the resultant dividuated humans hands of players. Constituted as hands in the game, players are now capable of literally ending the collective game single handedly. Understanding how the game proceeds through and as a decomposition of differenciating parts, is to understand that the game is about five. The fiveness of the game is the specific qualification which constitutes the players through a decomposition, and is named by the quantity of the set of cards as which each hand/player is constituted.

This decomposition of a class (with its students) is a simultaneous composition of a game (with its players). It is neither an 'abstract' generalisation nor the measure of some given extent. The decomposition/recomposition occurs as a continuous ordering and re-ordering in collective life. The class of students is already ordered in particular material and semiotic ways. The deck of cards is also already ordered as a deck (small rectangles of cardboard printed with two colours, red and black, four suits, ♠ ♣ ♥ ♦, with each suit with numerals from 1 to 10, and in this case the picture cards removed). As a performance through number, the valuation through which the game qualifies itself is order, an order which is named by its measure, hands of five cards. Through a capacity to order, number constitutes the real and through a capacity to value extension, number represents the measures of this ordered real (Verran, 2011). In using this typology from Verran I am using her term value, which in this thesis is extensive value.
Here, therefore, number sustains an enduring valuation as the oscillation order/(extensive)value. And we are told that order is the more important limit. The game is about five.

But the game is about ten at first and then eleven, is it not? Such a suggestion is based within a familiarity with working number as (extensive) value. In this understanding number works value which is an extensive attribute of the cards represented by their numerals. Working this limit does indeed help in transforming the game from makim'ten into makim'eleven. That the pair 'A'&9' performs a makim'-ten, however, suggests at the outset that the relevant inscriptions are not all numerals read as representations of extensive value. That the '10' card is played in front of the player and not on the pile or pairs, also indicates that makim'-ten does not necessitate an operation of addition on such extensive attributes. That before the game changed to make'im-eleven the sets of pairs which makim'im-eleven was recited, also suggests that a player could play comfortably and well working with this ordered set of pairs. That is, the game can be played through paying attention to the capacity of this ordering and making relations between a player's hand and draw pile through and as these ordered pairs. Perhaps the more important capacities in the game are its hands and pairs, fives and twos, not tens and elevens. Now we have been introduced into classroom numbers, it is now time to turn to the prescribed task. The task is completing a photocopied worksheet which, if it is to constitute a mathematics lesson, requires that number's capacity to do (extensive) value be amplified.

The classroom has four tables. Three girls sit at one, the other three girls at another, two boys at one table and one boy sits with his mother. The groups appear to be formed as gurrutu relations, and the teacher asks me to sit with my guthara. The
worksheet lists addition calculations and division calculations. We look at the first question, '26 + 15 = '. Another student has already got out a box of variously coloured match sticks and everyone is grabbing a handful. Guthara and I lay out the calculation using one set of matchsticks for each numeral. Number begins to emerge as (extensive) value: two match sticks for 2 and six match sticks for 6. A few days previously the class had worked with 'place value', noting that in a sequence of numerals the right most numeral represented units of a (extensive) value one, the numeral to the left of this represented units of (extensive) value ten, and the numeral to the left of this represented units of (extensive) value one hundred. Guthara combines the sticks of value one, counts them with her finger and writes '11'. She then combines the sticks of value ten and writes '3' to the left of the '11'. 'So what's the answer?' I ask. 'Three hundred and eleven' she says. I look at her with a puzzled face, indicating that something has gone wrong. Working with this class I had learnt very quickly that facial expressions are more commonly used than talking: unexpected results are met with expressions of puzzlement or alarm, closed eyes and stern faces indicate deep thinking, raised eyebrows indicates a possible way forward, and nods and smiles are reserved for when work is going well and often seem almost congratulatory towards the question for being so well behaved.

The student returns my puzzled look, and turns her face to the worksheet. 'So what's wrong with you then?' her expression asks the inscription '25 + 16 = 311'. 'Where did the tens go?' I ask. Her face relaxes and she rubs out the leftmost '1' of the '11' and writes a smaller '1' in the tens column: 25 + 16 = 31 1. 'So how many tens?' 'Four' she says rubbing out the inscription '31' and writing '4' and the completed inscription becomes '25 + 16 = 41'. I look over the the worksheet of the student next to me. For '243 + 232 = ' she has added and written '475'. 'What's the answer?' I ask. 'Five', she says. I respond with a facial expression of puzzlement. 'Seven ... forty seven' she says in
hopeful voice. 'How many hundreds?' I say. 'Four' she says. 'How many tens?' 'Seven' she replies. 'How many ones?' 'Five.' By having her name each numeral as an association with place value, I begin to read it back to her to demonstrate how to construct the spoken answer. I place my finger below the 4 and say 'four hundred, and …' I slide my finger to below the 7, 'seven …' I realise I need to add 'ty', and now as I find my mouth already saying 'five' I quickly slide my finger across to beneath the 5. I finish this little ritual in relief, and disbelief.

I had fully invested my participation in number's capacity for doing valuations as a numerical representation of extension. As I went to speak through this with the student, however, such a literal naming of each numeral and then the extension it represents (ones, tens, hundreds) was interrupted by a much more familiar spoken enumeration of 475, 'four hundred and seventy-five'. Convinced that this number would work through a purely semiotic valuing, I was quickly corrected by the necessary material ordering of the routine. This time, it was my body – pointing finger and speaking mouth, which felt number's valuation as an oscillating value/order. A rigid commitment to (extensive) value meant my performance was out of tune with what is usually such a simple momentary vibration. The drawn out account that is this little routine here, is also an expression of this felt dissonance.

Luckily, one of the more eager boys catches my eye from across the room. He is my gaminyarr. He is alarmed, and guides my eyes down to the worksheet in front of him. His expression suggests that his worksheet is slowly transforming into some kind of monster, and he very discretely but urgently brings it to my attention, and tilts his head to indicate for me to come and look. The monster is this: \( \sqrt{396} = \). We begin articulating the question by getting out matches for each numeral. I demonstrate that for
each pile of matches you can deal them out as if they are cards in a card game of three players by dealing one match to each of the three players, then another, then another until there are no matches/cards remaining. Facing our array of hands/groups of sticks I ask 'how many in this group?' 'Two group' he says, 'And this one?' 'Two group.' 'So the answer for the ones is two', I say, starting to feel more confident about working with number as the numerical representation of (extensive) value.

I am pleased that the card dealing routine is working. Handling match sticks like cards feels more familiar than working match sticks as doing extensive value. Working cards, however, has slightly changed. In the opening game one decomposed the relation class-deck as player-hand through dealing five cards to one player, then five cards to the next and so on. The 'fiveness' of the game provided the rhythm of the practice of dealing through which the game, its players and the draw pile became constituted. Just now, however, the ordering of the game was given at the outset by reading the leading '3' as establishing the extent of players, and hence the game, as given before the routine of dealing. The 'threeness' of this routine assumed players to be already individuals, not the vague whole of the class, and hence the valuation could be worked as purely extensive. Whereas the 'fiveness' of the first game produced a situation for going on playing (note that the remainder as draw pile is crucial for this), the 'threeness' of this second routine achieved a fixed and total distribution of the matches/cards as a solution which could then be read off. Turning our attention to the tens column, Gaminyarr says 'three group … three group … three group' cupping his hand around each group of three matches. He writes '3' in the tens column. For the hundreds he says 'one group' and completes the inscription, '3)396 = 132'. Gaminyarr begins to work quickly through the questions. A working number is being sustained. The reading off of the solution as 'two group' 'three group' 'one group' again alerts us to
the persistence of number in working as order, which is ignored at first by me who says only 'two', 'three' and 'one' and then by the numerals which are written as only 2 and 3 and 1.

Along with this working valuation of the event number we arrive at the next set of questions. Gaminyarr is not impressed at the apparent refusal by the new question to keep this valuation working. He decides he needs to bring in an ally and walks confidently to a plastic box from which he takes a calculator. He arrives back to his chair and punches the calculator buttons; \( \div \). The calculator displays '232.66666'. He straightens up in his chair, almost backing away from this unruly response. He looks to me and I return his expression which is somewhere between between fear and disappointment. Gaminyarr punches in the question again and the same numeric display returns. He does the question again but this time presses the '+\' key instead of the '÷\' key: '701'. I frown slightly and he bursts into a smile, admitting that bringing in '+\' is a little cheeky and perhaps unfair. He gathers himself together, straightens up in this chair, punches in the numeric keys again, and again '232.66666' appears. He is determined that this solution participates in the event number, so he cups his hand very carefully around the '6' furthest to the right and says 'six group'. He cups the next 6 and says 'six group'. 'These numbers are not groups' I say.

To describe this routine as not working groups, as number not working order, is to only accept number as valuating extension. Number as (extensive) value does not participate in the constitution of the world, it simply measures up what is already given: both things and their measures. Saying 'these are not groups' is telling Gaminyarr that in this routine we cannot treat number as a companion that can participate in further decompositions and recompilations, like a deck in a card game. However, just as the
card game concerns five, through the decomposition of the deck into hands through
dealing, and hands into pairs through make'im-ten, one can understand the calculator as
decomposing 698 into an order which is named: 232.66666. Indeed this is what place
value purports to do. However, in working the valuation of number as (extensive) value,
and numerals as representations, the ordering capacity of place value must be presumed
and accepted as a given not an achievement.

The worksheet is finished, and the other students are beginning to play games
in anticipation of the lunch time break. Naughts and Crosses (also called Tic-Tac-Toe)
and Connect Four are popular games. I begin playing Naughts and Crosses with my
mukul. The game is simple, four lines are drawn with a white board marker on a plastic
rectangle to make a grid, into which players take turns to inscribe a 'o' or a 'x'. The
player who draws three of their own shape in a row, vertically, horizontally or
diagonally wins and ends the game. After two turns each the game looks like this:

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I am 'x' and now it is my turn. Another student encourages me to go in
the bottom middle place. 'Two ways' she is saying, 'play for two ways'. If I place
my 'x' in the bottom middle the resulting arrangement holds within it 'two ways' to
win on my next turn. My opponent protests, telling her friend to be quiet. 'If I go there [bottom middle] will I definitely
win?' I ask. 'Yo!' the friend exclaims, with my opponent looking as though she has
already lost. I draw a 'x' in the bottom middle position and immediately my opponent
sees her opportunity to win, draws a 'o' in the bottom right and chastises her friend for
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causing me to lose.

I leave the two students to play against each other and begin watching the game of Connect Four. The arrangement the students are calling 'two ways' is popular here too, and again, in their attempts to achieve this tactically devastating arrangement, many players lose the game. The two students who are playing are my gaminyarr and my ŋaṉḏi. They are sitting cross legged on the floor. Between them is the plastic cassette into which red and yellow disks are inserted, piling on top of each other. Four of your disks in a row, horizontally, vertically, or diagonally, makes you the winner and ends the game. But this is more than an ordinary game of Connect Four. Each player has the pile of disks on the floor in front of them, and in their laps they hold large wads of play money notes. A third student is sitting between them holding an egg timer. 'Hundred dollar out?' Gaminyarr asks the adult teachers. The assistant teacher nods, and Gaminyarr places two fifty dollar notes on the ground. Ŋaṉḏi counts out five twenty dollar notes into a pile on the ground. Daṇḍi counts out five twenty dollar notes into a pile on the ground. The third student managers the money and gathers all the notes into a pile and puts the egg timer on top.

They play, taking it in turns to insert a disk and Gaminayrr wins. Daṇḍi asks 'nhämunamirr [how much]?' Two hundred', Gaminayrr says leaving all his winnings under the egg timer. Daṇḍi counts out two fifty dollar notes and five twenty dollar notes. They are placed under the egg timer. They play again and again Gaminayrr wins. 'One hundred' he says and the manager keeps two fifty dollar notes under the egg times and hands the rest back to Gaminayrr. Gaminayrr hands the money to me and says 'Three hundred.' 'Nhäk [what for]?' I ask. 'For shopping', he says. The games continue and Gaminayrr continues to win, now folding his larger wad of notes and tucking it under his knee. Daṇḍi is reduced to ten and five dollar notes which she is counting out.
Chapter Five

She comes across a one hundred dollar note much to her delight. Gaminyarr puts all his notes under the egg timer, the manager neatens up the pile and says 'walpum rrupiya [all the money]'. Dardi adds her last notes. Gaminyarr wins again and collects all the notes.

Still sitting I slide across the carpet back to the Naughts and Crosses game. 'Who's winning?' I ask referring to the two girls currently drawing 'o's and 'x's. But the game has changed. All the girls are now playing, as two teams of three girls each. 'Napurru eight' [We exclusive of you are eight]. 'Yaka eight nhumalaŋ!' [You all are not eight!]. 'Eight napurru, seben nhumalaŋ' [We exclusive of you are eight, you all are seven]. 'Seben nhumalaŋ' [you all are seven]. As these two students argue about the score, two continue to play. In response to the disagreement one of the players currently engaged in the ordering of 'o's and 'x's announces 'Eight-kum' [make eight] as she draws her shape in the grid and wins.

The disagreement continues and one player counts out all the wins on her team by going through each win in order, pointing with the palm of her hand to the player who won each game ending on the girl who has just won after announcing 'eight-kum'. They settle on a score and ask me to write it down. I record the scores, '8' and '8'. They tell me that the teams are called Shark and Crocodile, one Yirritaj team and one Dhuwa team. I write the names on a new page of my note book and write '8' beneath each name. After the next game I cross out one 8 and write a 9 for Shark. I continue this for a few games and then one of the players takes over. Gaminayrr is packing away Connect Four as it is about almost lunch time. 'How much did you win?' I ask. 'Maybe one thousand', he says grinning.

Through the organised activities of the card game and the worksheet, the class successfully engaged with number as a event. In beginning to work with numbers we
slowly felt our way into the difference of number working both order and (extensive) value. Indeed, we could account for both the card game and the worksheet as working with (extensive) value while backgrounding order or working with order and backgrounding (extensive) value. The trick was knowing which relation of background/foreground to do at which moment. In other words, the difficulty in participating in the event was producing a resonance or valuation of order/value. Though the worksheet demanded number be worked as (extensive) value, failing to pay attention to order resulted in losing your hold on (extensive) value. Though Naughts and Crosses demanded number be worked as order, failing to pay attention to (extensive) value resulted in you losing the game.

As the various games developed in the lead up to lunch, however, number became more fully expressed. This occurred through the occasions seeking more routines through which to generate better resonances, or valuations of order/value. Initially, the Naughts and Crosses game began as purely about order. The successful performance of a 'two way' arrangement was more often sort after than a win. However, through many actualisations of this game, the moment of winning itself became a rhythm. The students formed teams and began to record these moments as a score. Hence, the game began to fully articulate itself through (extensive) value also: 7 wins to 8 wins. This value, however, was always worked in relation to order, as demonstrated through the pointing to of each player in the order of their actualisation as winner through which the tallied scored was effected. More importantly, within the ordering of each game, the teams, the turns, and the markings 'o's and 'x's, the extension score became increasingly experienced and worked as immanent. This is demonstrated in that during the score 8-7, the player of the team tallied at 7 announces 'eight-kum' as she plays. The suffix '-kum' is translated as 'to become' or 'to make'. Hence, playing a game
was not simply about a successful ordering, nor a one off moment of winning, but a moment mutually embedded in a tally in which a player as an expression of a team can be explicit in actively 'making eight' or 'becoming eight'. Doing this valuation sustains the game, here in the text also, stabilising players, in this case as the teams Crocodile and Shark which themselves sustain the fundamental Yolŋu difference of Yirritja and Dhuwa.

In Connect Four, money became the mediator for amplifying the order/value valuation of number. The game began through determining 'how many out', that is what amount of money constitutes a player. The order of players emerged through an explicit doing of (extensive) value. As with Naughts and Crosses, winning became no longer a momentary occurrence but became folded, literally, into the notes piled under the egg timer. We could now not only enquire 'who is winning?' but also 'by how much?' Sustained winning effected a greater wad of notes which enabled not only further playing, but other transformations such as going to the shop.

The games became successful moments in the event number which lives through an explicit articulation of both ordering and (extensive) valuing. Working these as the oscillating valuation order/value has enabled the games to be continued here as researched games. Through using this valuation or capacity of number as device or hinge to open up the encounter we have been able to extend it explicitly and more carefully. Let us continue listening for a further valuations of number in the wild.

**A Valuation in the Long Jump: Symbol/Index/Icon**

The next number encountered in the wild is an athletic number. The occasion is the long jump competition in the regional sports meet. I have volunteered to assist in the
sports meet and have been allocated the job of adjudicating long jump. My yuyuyuku (younger brother), who had completed school the previous year, is also going to help.

The meet is well organised and I am given a box which includes a clipboard with paper, a pen, tent pegs, a tape measure and ribbons. The event is in the morning, as are all the individual athlete events, while soccer, volleyball and basketball are in the evenings.

Yukuyuku is waiting for me at the secondary school volley ball court, which was a large rectangle of sand. The athletes are to run along a gravel path toward the sand and jump as far as they can into the volley ball court from a piece of carpet pegged down at the edge of the sand. Also, waiting for us at the volleyball court is a rake, the carpet and a few small groups of young boys.

Clipped on the clipboard are sheets of paper. There is one sheet for each competition which is divided by gender and age: boys 12-14 yrs, girls 12-14 yrs, boys 15+ yrs, girls 15+ yrs. Each sheet is printed with a table with four columns: Peg Number, Name, Result, Distance. In the column 'Name', names are written in each cell. The others cells are empty. Each of the ten pegs have some masking tape on the end taped like a flag. On this flag is written a unique numeral from '1' to '10'. I read the instructions which state that the distance must be recorded for the best three results in each competition. Yukuyuku smooths the sand in a rectangle starting from of the carpet launch mat out into the sand pit. He draws a line in the sand from the edge of the carpet out into the sand parallel to the direction of the jumps, but off to the side so as it will not be effaced by the athletes as they land. The printed tables and the sand are now both prepared: clean, white, and rectangular with just the correct markings to appropriately manage the future markings that are to be made by the athletes. The expected way of making one's mark in an occasion like this is jumping the furthest and winning (but of course refusing to compete and jumping backwards are also rather prominent responses.
Yukuyuku and I assemble the young boys together, making sure they are all present by reading out their names and having them identify themselves. I point out where they can start running from and that any jump that is made with a foot stepping beyond the carpet onto the sand will not count. Each athlete has one practice jump and then three proper attempts after that. The group makes their way to the end of the run up track and each has one attempt at jumping. This is the practice jump and all that happens after each one is a quick re-smoothing of the sand by Yukuyuku and the rake. These practice jumps end and it is time for the real ones. These real jumps, ones that are to really count, distinguish themselves through the following routine.

I call the name of the athlete at the top of the list, loud so those gathered at the end of the track can hear me. An athlete steps forward, runs and jumps. My brother and I watch closely that he jumps from the carpet mat. The boy's foot takes off from upon the mat. This jump counts, and the boy lands feet first into the sand. Using the tape measure as a guide, Yukuyuku places it perpendicular to the line he drew in the sand. Starting from the mat he brings it level with the first indentation in the sand made by the athlete. This extension, first done by a leaping body now done through Yukuyuku's long arms is the jump. Yukuyuku looks to me. 'One' I say and hold up a single finger. He takes the peg with '1' inscribed on its flag and pokes it into the sand on the line next to the intersection with the tape measure. This makes a length on the line between the mat and the peg, analogous to the extension between the athlete's indentation and the mat. Once this jump is measured in this way, the sand is raked smooth again so there are no indentations. Yukuyuku nods to me and I call the next name down the list, against whose name is written '2'. A boy walks to the end of the path and begins to run …
This routine is done for each name on the list and until all ten pegs are pegged somewhere on the line in the sand (no jumps are disqualified). Row by row in the table printed on the sheet, name by name called aloud, boy by boy at the end of the track, jump by jump into the air, and peg by peg poked into the sand, this vigorous leaping of bodies through the air effects a row of pegs with little masking tape flags. The calling of a name initiated a running and a jumping which produced a mark in the sand. The mark was distinct, the only one on the smoothed out sand. The mark was itself marked by a peg. Through this routine a boy is produced as an individual and so is his jump which effects a pegging. The athlete, the jump, and the peg are all simultaneously the athlete, the jump, and the peg and all the same thing. In responding to the question 'where is Jason?' one could point to a boy, point to a peg, or if the timing was just so, point to the act of a jump. The numeral on the peg helps this tightly knotted relation to endure as distinct and not become some other arrangement of boy, effort, and peg. Forgetting that Jason is '7' would mean to not know where Jason is exactly in the occasion of the long jump. This is working number as icon. The typology icon/index/symbol, first used by Charles Sanders Pierce as a typology signs, has been re-deployed by Verran as a typology for sensitising oneself to number as a material-semiotic relation (Verran, 2010, 2011). Routines in which the sign-referent relation operates as a tightly bound co-constitution are iconic. Jason-boy-effort-peg-7 is an iconic material-semiotic relation. Routines in which the sign-referent relation operates as the representation of a more or less independent object are symbolic. Routines in which the sign-referent relation operates to sustain a dynamic relation between an index and a field are indexical. So far, number here is working iconically. What is important is the tightly knotted routines that make each individual athlete-jump-mark-peg-numeral. The order of the pegs themselves at this stage, is not so important. The potential of a re-ordering done by the pegs is
It is time for the second jump. It begins like the first; I call a name, a boy runs down the track and jumps into the sand. At this point however, the routine begins to differenciate as a new routine. If the boy makes a mark beyond their peg, that is they jump further (as human body) than themselves (as peg), then the peg is moved further to become in line with this furthest mark. The athlete (both human body and peg) have improved their jump. If, however, the athlete (as human body) does not jump further than themselves (as peg), the peg is not moved, and a separating begins to emerge between the athlete as human body that just jumped and the athlete as peg. The momentary agency of the second jump therefore is made more evident. A jump can now fail to move the peg, and when it does it almost immediately evaporates, except perhaps, for some disappointment and self admonishment.

This slight separating of human body and peg within the moment of the jump is number beginning to work as index. It is no longer an icon tightly constituting body and peg, but is now dwelling 'in the mess of the real' (Verran, 2011). Difference abounds: difference of bodies, difference of pegs, difference of jumps, difference of marks, difference of measures between peg and mark. But only some of these have the agency to count, that is to keep number alive. A peg only counts in relation to its co-constituted athlete, but a jump only counts if it makes a mark further than the peg. Difference in the event begins to affect number in different ways, or better put, number the event differenciates. For the second and third jumps this indexing went on as the pegs re-ordered themselves in relation to whether or not the jump counted as a better jump. This indexing work was more demanding. Now with all the pegs in the ground, Yukuyuku and I had to be more clear with each other as to which peg-athlete was jumping. The
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Numerals helped us do this, and so did the order of names listed in the table in which the athletes were called and then jumped. On a few occasions, an athlete lands close to the pegs pushing them and the sand around them and Yukuyuku has to carefully replace the pegs and re-draw the line on which they stand. The athletes must try harder in jumping further and moving themselves forward. Some athletes begin to land differently keeping their arms and torso forward so as to not fall back and make a mark behind that made by their feet. Yukuyuku must be careful in ruling with the straight edge of the tape measure as to which was further from the carpet, the peg or the new mark. The indexing continues until all the athletes have jumped three times. This work and its recording is immediate in its capacity to adjudicate which athlete jumped the furthest. Yukuyuku reads out the numeral on the peg furthest form the carpet, 'five', I confirmed the name for that numeral, 'Jason', recording the rank as '1' on the table, and Jason steps forward to receive the blue first place ribbon. The peg second furthest from the carpet is '3', and Chris receives the red ribbon for second place, and '6' or Terry gets third. I read the other names out in order but they do not get a ribbon. The group of boys now partly reordered as winners and losers walk away. The capacity for indexing in the occasion dissolves.

After the athletes have gone, Yukuyuku and I measure the distance of the three longest jumps. These are needed as the athletes who perform the best in all the various regional sport meets in the Northern Territory will be invited to be a part of the Territory team to compete in a national competition in Australia's capital city, Canberra. I hold one end of the tape measure to the edge of the mat, and my bother unrolls it until he comes to the furthest most peg. Again, for a moment, number becomes an index stretching out like the tape measure and the carefully holding everything just so. This indexing does not require the participation of athletes. Yukuyuku reads aloud from the
tape measure 'one hundred and seventy six'. I find the row on the table for Rank '1' and write next to it '176cm'. We do this for the second and third place, transforming the ordered peg/athletes into values of extension: 176, 164, 152. The transforming of these indexes into symbols, representations of extension, is the hope that these athletes will perform well elsewhere, both as numerals understood as symbols in the selection process for the Territory team in Darwin and as human bodies understood as icons on the track in Canberra.

The occasion of the long jump, its competitors, its jumps, its winner and its losers, is actualised through the valuation icon/index/symbol. The valuation was a constant oscillation. The calling of the names of athletes assumed each name represented a boy given in the group of competitors who was to become transformed into a tightly clotted icon of athlete-jump-mark-peg-numeral. To continue, the occasion had to transform itself and it was the indexical capacity of the event through which this was done, giving just the right foregrounding and background of elements. While this indexing effected a winner and loser, these themselves had to be transformed again as symbols in order to maintain the potential of oscillating value as icon/index/symbol to continue to sustain these athletes in further actualisations of long jump and hopefully further actualisation of winning. Hence, icon, index and symbol are only momentary limits of the eternal object icon/index/symbol, that once resonating can better articulate the enumeration event.

I just want to add a corollary on hope and value. Many Yolŋu athletes performed very well and produced themselves as numeric symbols which were liked by the Territory Team selection committee. This selection of athletes as numerals was done without the presence of the athletes themselves, who, once required to stand in as
themselves, were not as enthusiastic about living in Darwin for training and travelling to Canberra. As witnessed at the completion of the long jump, the boys and girls were only slightly re-ordered by the performance of the games, and soon got back to the other orders and demands of their lives. It is often remarked that these Aboriginal youth, these symbols, have such great 'potential' as athletes. It is often then lamented that these youth do not seem to know their own potential nor care for it, as in living their lives they appear to not recognise their potential and therefore let it 'go to waste'. Understanding these young people as symbols (of youth, of hope, of their 'race', of National pride, of the reconciliatory power of sport) refuses to understand them indexically or iconically. Yes, there is potential for these young people to achieve great things. But their potential remains (as it did as icon and index in the long jump) embedded in the relations that constitute their bodies and lives within which responsibility is collective and achievements are always fleeting and momentary.

Working 'potential' as some measure abstracted value was also evident in the documenting of the games. There were a number of still cameras and I had lent my video camera for recording the meet. I burnt hundreds of photos and hours of uncut video footage onto DVDs. These circulated around the students and consumed much of their time at school where computers were relatively easy to access. It was remarked to me that once you have seen one running race you have seen them all. Surrounded by hundreds of photos and hours of video after the meet, for some people particular events became units of the meet. Once you saw one of each type (running, long jump, discus, and so on) you have seen them all. For weeks afterward, however, the event continued with students and their families watching every event again and again, re-performing and participating in each one. This has been a small re-performance of long jump, or long jump as researched event. While the students and their families re-performed the
event perhaps more iconically, in place with the right people for days and weeks, some others experienced this collection of photos and video symbolically constituted by only a few important units. I have tried to perform it here indexically, paying attention to the here and now and amplifying the potential and the differences which constitute the event of number as one which lives through the oscillating value icon/index/symbol.

**A Valuation in Card Games: Cardinality/Ordinality**

'Come after work at about three thirty, four, quarter to four.' I was arranging with a young man who was my gäthu (son) when to meet him to go to the card games. Over the past few months I had made it known to those Yolŋu I knew well, that is many of my closest relatives, that I was interested in understanding the card games that were a prominent aspect of settlement life in Arnhem Land. I had asked one gäthu, who had said it was a good idea but that his younger brother was better at cards and that I should go with him. I asked this younger brother, another gäthu, and he said a wäwa (brother) of mine would be the best person, but when I ran into him and said I was told to ask him he said yet another wäwa was the right person to talk to. I had not been to any games yet and I had no idea that all these relatives who I knew quite well played. But one gäthu, after confirming on a few occasions that my reason for going to the games was simply 'to look', had agreed to take me to some games. This week was going to be it. It was pay week and as people's pay from work and social security comes in their accounts on Wednesday and Thursday the games begin to start.

So on Thursday afternoon at four, I walk down to the card games near gäthu's house. He sees me and gestures for me to come over. As I walk over I hear him explain that I will just be watching and that there is no need to feel embarrassed. It is a hot time of year and the games have moved under the veranda of a house. There are two games,
one with younger players and one with older women, both with players sitting in circles
on bed sheets, surrounded by some other adults, some watching, some coming and
going, and a few children. The older women were betting with fifty dollar notes. The
younger players were betting with five and ten dollar notes. The notes were faded,
wrinkled and well worn. I had never see so many ten and five dollar notes before. A four
or so year old boy pastes a ten dollar note across his chest: the note soft enough and his
body wet enough from sweat that it moulds to his skin and stays there. The games are
gun' game and each have five players. Each player is dealt seven cards. Each player has
to maintain a seven card hand, and, as they are dealt three more cards, one at a time,
they deliberate each one and either discard it or another one from their hand. 'Three
card, four high' someone says throwing their hand down showing three '4' cards. 'Three
card, eight high', another player says throwing their hand in front of them. 'Straight,
djimbaya' and a hand containing a sequence of '5', '6', '7' is thrown onto the sheet.
Djimbaya is a word for axe, which is used for '7' as the numeral and the tool have a
similar shape. There is a quick distribution of the notes and we are into the next game. I
missed who won.

'High and low' a player announces and place an extra ten dollar note on the
sheet. A few other players follow and these notes are divided into two identical piles of
notes. After the first deal, the player with the highest heart takes one of these piles and
the one with the lowest heart takes the other. The gun' game then continues with the
dealing out of the extra three cards. The players each have an idiosyncratic way of
hiding their cards. Many of the players are holding their hands with cards facing
inwards at both ends, so none of their hand is showing. Upon receiving a new card they
put it straight in their hand without looking at it. Then by turning slightly out of the
circle or bringing theirs hands closer in under their chins players carefully reveal to
themseleves small sections of the new card. Gäthu squeezes his hand on its edges with thumb and forefinger. His hand bows open only a few millimetres and he sneaks a look at this new card before releasing the pressure so the hand collapses flat again. Other players carefully slide the new card up revealing only the very top of the inscription on the face, then do the same for the bottom. A player throws their hand down and announces 'bâyŋu'. Nothing. Other players relax, fan out their hands and present their scores. Gäthu wins. His wife reaches over, takes some of his winnings before he puts a hand on it and then passes him a cold drink. There is very little talk, but this was no ordinary card game. It is being watched. After a few more hands Gäthu gets up and says we will go to another game.

We get in his car and drive to the other side of town. As we drive he explains to me that there are two numbers, one on the card side and one on the money side. 'Are they separate?' I asks. 'Yaka', they are not. Gäthu explains that the smaller numbers are on the card side and the larger numbers are on the money side. So, although these two numbers are different, they are not separate. Being familiar with number as multiple as a routine or event, so let us examine how this multiple number lives. On the money side, number is working to constitute the game and its players. On Wednesday and Thursday each fortnight, money is paid into people's bank accounts and card games begin to emerge. The games are held at different places within the town, with each place living through different gurruṯu relations between clans. The players within these games also effect these gurruṯu relations. This is how this present card game emerged: in the afternoon on a Thursday my gäthu took me to difference places where card playing was occurring.

Card games also differenciate themselves through using different
Numbers in the Wild

denominations of notes: fifty dollar game, ten dollar game, or a five dollar game. We witnessed this in the classroom when Gaminyarr asked 'how many out?' in initiating a game of Connect Four. The games also differenciate themselves by having different groupings of people sitting in circles on different sheets. Some games are played by older women, some games have younger players. Players emerge through the passing of notes onto the sheet. Through the gathering of these notes together as both individual notes and the collective 'till bank', the players become gathered together as players in the collective game. Once within gun' game, however, the players can further modify themselves and in doing so modify the game. By placing another note on the sheet and announcing 'high and low' the game differenciates into two simultaneous games. Now the players have constituted themselves in various ways in this multiple game, a hand is dealt to each player, and card number becomes more evident.

Gun' game has five players and once constituted through bets, the players are dealt a hand of seven cards. A hand only emerges within an order of players. Each hand, much like a human hand and its body, is internal to each player and conjures within them a transformative agency: now they can participate in the game's becoming. Each hand is not a stable thing, but a potential for re-arrangement. This arranging begins to operate through both the substitution of cards in and out of the hand as the three extra cards are passed around one by one, and a re-ordering of cards within the hand. At this point, the hands that can continue participating in the game and relating to other hands must achieve a set of three or four cards of the same number. This card number can be ordinal: 5, 6, 7. Or it can be cardinal: 4, 4, 4. Ordinal numbering does do order, but it is something more. There is a purpose or intension of rank or progression. The ordering has within it a temporality or an impetus for what is to come next. Cardinality has no such intension. It is outside of rank and outside of progression in that it relates directly
to an ideal value (the term cardinal comes from the meaning pivot or hinge, as a Cardinal in a church is a pivot between God and the world). Sameness through ordinality is effected as a progression – 5, 6, 7. Sameness through cardinality is effected by pivoting from the same ideal – 4, 4, 4. Hands that cannot achieve such arrangements of sameness are considered to be nothing. Their lives as hands and players in the game come to an end.

Hands that do become something begin to relate to each other in more complex ways but again through ordinality and cardinality. First, hands are worked cardinally in that number is done as the quantity of cards that are the same, with the largest quantity winning 3, 3, 3, 3 wins in relation to 4, 4, 4, and 4, 4, 4, 4 wins in relation to 4, 5, 6. Then, hands are worked ordinally in that a cardinal hand beats an ordinal hand: 4, 4, 4, 4 wins in relation to 5, 6, 7, 8. Finally, the hands that are still in the game are worked cardinally: four cards 'five high' wins in relation to four cards 'six high', for both sequences and groups of a kind. The 'height' of a hand is consider the cardinal card, now outside the arrangement of the hand, and in the moment that it can end the game.

The valuation internal to number here is an oscillating cardinality/ordinality. The switching between the two is also both ordinal and cardinal, with a slow progression through the ranking hands until the winner is realised. This actualisation of winner breaks the progression and in doing so momentarily connects card number and money number. The till bank which was born as individual notes (cardinal money value) which become an ordering of the collective game is finally re-performed as cardinal again, as a direct hinge to the winner. Cardinality and Ordinality are not abstract properties of numbers, but intensions of the event. They are the limits to which number converges in the event. The players do not 'know' numbers through some abstract
'ordinality' and 'cardinality', making decisions about what to do in each moment. The players do, however, know how to work with these limits as a valuation sustaining a card game and one's own participation in it. Although the actualisation of the event does effect a winner, this is just one moment of the valuation, and appears somewhat unimportant compared to the intense playing of the game. The win literally falls out of the event and into the pocket of the winner.

In a card game, hands, both hands of humans hands and hands of cards, do not hold extensive value: seven cards, or cards with values that add to twenty five. Rather they hold a potential for participation in the transformative enumeration through which the game proceeds and reaches its full actualisation. Actualising a game means working number through as the oscillating value cardinal/ordinal. The job of working with this valuation is a careful and skilful business which we witness in a second game called two card.

We are pulling up at the next game. Gäthu approaches first announcing that I am only here to look. I greet one of the players, Waku, whom I know well and he begins to explain the game as he and the other players are dealt two cards each. His hand is face down in front of him. The backs of the cards are printed with the same coloured pattern – blue hatchings - which distinguishes these same-patterned cards as a deck. Waku picks up his hand and rather than turning them face inwards, he places a card with red hatchings over the face of his hand. Holding his cards in one hand and applying pressure with his thumb he very slowly sides the bottom card up revealing the beginning of its face, then slides it back. He does this for his second card. He has an '8' and a '4'. The other players are now showing their hands and naming their hands. He says 'two' and explains to me that 'it is twelve, but we just say two.' The player with
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'seven' wins.

Understanding these numerals as doing extensions we could say that the players with the numerals which add to a multiple of ten or a numeral closest to a multiple of ten wins. However, this is not quite correct as the extension is always within a recurring order of one to ten. It is not how many times one recurs as the cards tally up an extension but where one is within the recursion of going from one to ten: 'it is twelve, but we just say two.' It is like an extension achieved by the fingers of human hands, this value is always embedded within a whole which is never more than ten. Although number appears to be working cardinal value, a single extension not a progression, it never completely transcends its ordinal capacity. In working number this way, any set of cards can be named as between one and ten.

In the next game, two players have eight. The player looking after the 'till bank' splits the collection of notes into two. Each pile is now a pile of three ten dollar notes. The winners are to play off against each other, but a young man throws in another three ten dollar notes, inserting himself as a player in the play off. Gäthu explains that if you win the two card, then the others have to raise and then you bet on the three card. The three players are dealt a third card which re-evaluates their hand and effects a winner. The winnings are taken by a woman who leaves one ten dollar note out and puts the rest in a plastic honey container she has sitting in her lap. Until now money has been constituting people as participants within the game, and as these participants become hands and eventually win or lose, money number then concentrates as the winner. During the game number on the money side has not been important. Now something new is happening. The ordinal capacity of card number which is sustained as the limits of the flux of the card game fails in evaluating the hands as rank. There are two eights.
Now, money number and card number simultaneously come into play reconfiguring the game towards a continuation of the potential for a win to occur. At once, bets, hands, and players are modified within a new order which continues the life of the hands which had become drawn and the till bank which had become not won.

Other players are starting to lay ten dollar notes on the sheet. Gäthu adds his. A woman next to him puts a twenty dollar note down and takes his ten. 'Ten change goďi?'' she says. Gäthu nods his approval. Gođi is an affectionate name meaning little one, which is often used for relatives with whom you have a joking relationship, such as a man and his mother-in-law's brother. Two cards are dealt to each player and Gäthu holds his hand a little out from his body so I can see. The first two cards, 7 and 9 give six. He pays more money to stay in the three card and is dealt the third card. He hides this in his hand and very slowly pushed it up. His thumb covers the numeral and we can just make out two red shapes. He straightens up slightly showing his excitement. It could be a 4, giving him the winning hand ten. He slides the card down and reveals the same pattern. This very careful reading of the cards gives the game great anticipation. Finally, he reveals his card and it is a 5. He scores one: the worst hand. The winner takes the money, leaving a ten dollar note in the middle and players begin to add their own notes.

Here again there is a slight modification. A person wants to become a player but does not have a ten dollar note through which the game prehends its players, and players prehend the game. She does have a twenty dollar note which can become two ten dollar notes. However, this exchange is not one done through a symbolic value. The note does not have properties but lives within immanent potentials to do both a symbolic value of an extension of money and an iconic value as a co-constituted player. She has to negotiate both the change in ten dollars and the change in the ways the notes
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constitute the players. 'Ten change gođi?' articulates the negotiation of a valuation which is both symbolic and iconic.

The games are growing. There are five or six players sitting in a circle on the sheet and perhaps more standing around. Some are handing money to players, perhaps playing on their behalf, others join in or deliver food or drinks. Someone shares a bag of almonds with the group. No one seems to be simply watching like I am. There are many five dollar notes on the sheet and the dealer, a middle aged woman is about to deal. She questions who is playing and calls for anyone who wants to play to enter the game. The woman's daughter, perhaps eleven years old, is sitting with her and she tallies the amount of players who appear to be sitting attentively in the circle, gesturing with her palm each time: 'one, two, three, ga four, five, six, seven, eight, nine, ten, eleven, twelve, thirteen ga fourteen.' Her mum tallies the same number of ten dollar notes, fourteen, but does so by laying them down in a circle analogous to the players, each player with a note in front of them. A few players re-arrange the notes so that each player has in front of them the particular note that constituted and constitutes them as a player.

Another indirect harmony in the limits of the event. First the players are counted through numbers as symbols with a young girl counting fourteen players and her mum counting fourteen notes. The young girl's counting of players is symbolic and her mother redoes the players as indexes, placing a note in front of each player. Some of the players however are not impressed with this and redo themselves and the other players as icons re-clotting the specific player-note pairs that constitute the game. What is interesting in this brief moment of negotiation is that another multiple valuation of number comes into play, perhaps because of the child's familiarity of working number
as symbol as she has learnt at school. Money numbers need to settle before card numbers can emerge, and this settlement or valuation is different each time.

Now that the money side is worked out the dealer begins again. She is swift and exact, spinning card face down across the sheet to each player. This time, however, a card catches the wind and flips face up. The card is left face up on the mat, and the game goes on with the dealer completing the dealing two cards to each player, each of whom turn one card face up. There is no bet on the two card hand and the dealer proceeds to deal out the third card. There are two winners. The fourteen notes are divided into two piles of seven and the new raise is seven five dollar notes of thirty five dollars. A fresh two cards are dealt and a few players match the raise of thirty five dollars. Gäthu explains that if there was thirteen players in a five dollar game and two people win, the raise would be five. Perhaps, if five is the lowest denomination of note, and thirteen notes cannot be equally divided into two winning hands, the note remaining after an equal division becomes extra, the raise.

The modulations through which the card game event lives continue, indeed must continue. This time, however, it is the card numbers which are re-negotiated. When the wind picks up a card as it glides through the air and its face revealed, the potential of the hand is compromised. A hand is no longer constituted first and foremost as part of a player. The hand is now partly lying face up on the sheet. The question of what constitutes a player and a hand is resolved by modifying what a hand is to become. A hand becomes two cards which are internal to the player and one card which is shared. This leads to further modification. Hands constituted through a wind flipped card, are already hands of three cards, so when such a hand cannot determine a winner, a new hand all together must be dealt. Now, the till bank does not end the game by becoming a
winner, but sustains the game *between* hands. And sometimes this requires some fine tuning. Money number requires more effort when the sum of money cannot evenly reconstitute the players remaining within the game. In this case both current players become constituted by the note remaining and other players can constitute themselves through this note. As I had explained to me, if there are thirteen players in a five dollar game, and there are two winners, the thirteen notes cannot be given evenly to the two players, so they each get six notes and hence have equally won, and the remaining one stands in as a player.

As we leave the game I say goodbye to Gäthu then realise that while I have been making research notes he has lost many money notes. So what is the value of this card game? In becoming a researched card game it cost money. Despite me not playing a hand in the game my presence is not divorced from valuations. So how to account for these valuations? Perhaps I should have paid the 'cost' of the research Gäthu and I carried out. Perhaps the accuracy of the account is what is valuable? But value is not solely an attribute of money nor a description. Value is a quality through which we enter into the event and try to put it into play in its full force. This is what we can understand valuations as doing in the card game in the text and on the sheet. In each case, money numbers and card numbers are negotiated through what constitutes a player and what constitutes a hand. It is the relation player-hand that connects up the numbers. If the players are not settled, then there can be no hands. However, if in realising their full potential the hands do no sufficiently differentiate the players, then the money number does not clot and the game flows on.

The indirect harmonies of the oscillation cardinal/ordinal is a way to enter into this event, as a player and a researcher. The cardinal limit of the valuation works a hinge
outside and inside a temporality. It is in a moment yet outside any progression of moments, and in being so, breaks time. It is a hinge between a person as yet outside the game and a player within the game, a winner which ends the game from within and a person who pockets the winnings. Yet this cardinality of money number does not simply bookend the ordinality of the game and its card numbers. It is always an oscillation. Sometimes it is evident in between completed games. Sometimes it is evident within games. Sometimes it is within the moment which effects a winner. Sometimes it is within a moment which sustains a game without a winner. Participating in the game here I also seek a good hand, a hand that works with potential, a hand that is good at recognising capacities in going on. I need to have a hand that both effects a win in the sense that, like the money that actualises a win, this account needs to move more easily from the actual circle of people sitting on the sheet. But I also want a hand that keeps playing, keeps articulating the game and resonating with its valuations such that number as an event can live on and continue expressing itself. These typologies, valuations or devices; (extensive)value/order, cardinality/ordinality, symbol/index/icon are perhaps constituting a hand/researcher in a relational empiricism.

A Valuation in Accounts: Symbol/Index/Icon

The enumeration of time and money is possibly the most pervasive form of valuation as extension, and there is no better reminder of this than a phone bill: '3:54 min:sec = $1.22', '1:57 min:sec = $0.84' and so on. And then, at the end of this listing, 'Total = $1324.25'. This is a very large monthly bill. Galay is showing it to me and explaining how such a bill is produced. She explains that at the end of last year she connected a land line phone at the Homeland where she lives. For one month in the wet season, when travel is difficult, the phone had become a highly used mode of keeping in
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touch, especially for the children. I look at the bill and notice that almost all the calls are
to mobile phone numbers, another evidencing of the uniqueness of a connected land
line. Each day at different times conversations were had and many things were
discussed and shared, all the while each second was tallied and translated into a tally of
dollars. After one month, this tally was summed and became a single debit against a
single account for a single phone service. Galay has another another letter: a notice of
demand for the outstanding amount to be paid.

Galay and her children have come over to our place to use our phone to call
Telstra, the only telecommunications provider in Arnhem Land. I call Telstra and
identify the account by the phone number written on the bill: 08 8987 3366. I explain
that the account is in the name of Galay who is asked to authorise me to speak on her
behalf. Galay does so and together we arrange for a repayment plan: one hundred
dollars each fortnight. The quickest way to begin fulfilling this payment plan is for me
to pay using my credit card and Telstra's credit card payment service and for Galay, who
does not have a credit card, to pay me cash. We arrange that I will keep the bills at my
house and until Galay can find a way to pay Telstra directly, each fortnight she will pay
me cash and I will transfer the amount to Telstra from my credit card. We also arrange
for the line to be connected again but for incoming calls only. For outgoing calls, people
will again use the Telstra Community Phone at the Homeland which charges calling
time against credit which is stored on cards sold by Telstra, called Phoneaway cards.
There is no mobile phone coverage at the Homeland. Phoneaway cards can be bought
from the council office, and Galay and her family leave hoping to get to the council
office before it closes. If they buy some Phoneaway Cards then they will have
successfully achieved a working order of phone services without paying the one
thousand three hundred and twenty four dollars and twenty five cents in one amount.
A week later my phone rings. Galay is asking me to bring the Telstra account number on her bill to the council office. I walk down to the council buildings. Galay is trying to arrange the one hundred dollars to be automatically deducted from her Community Development Employment Program (CDEP) pay – a government payment she receives for working in the school canteen. Galay gives the bills to the finance officer of the council who arranges the CDEP wages. 'You cannot pay that much out of your pay' he exclaims seeing the balance of over one thousand dollars. I tell him we have arranged for one hundred dollars to be paid each fortnight. 'You will need a letter', he says. Galay provides a new letter confirming the payment plan. The finance officer calms down but says he cannot make the arrangements now as he is leaving and will be away for a few days.

The next week, Galay's pay arrives and she is keen to transfer one hundred dollars to Telstra. She comes to our house to activate telephone banking with her bank. This is the next way that she can pay Telstra from her earnings before they become cash. Before she dials the phone number for the bank she writes down '567110' and '4.10.70'. I recognise her date of birth from when we were organising the payment plan with Telstra and assume the other number is her account number. We are told that to register for phone banking you need a pin number which you apply for using a paper form. We head down to the branch of the bank in town and wait to be served. The staff at the bank provide the form on which you also need to nominate six account numbers to which you can transfer money. 'Put family down' suggests the staffer. The nominated accounts must be within the bank. Still Galay cannot transfer money to Telstra.

What is keeping this episode going is an inability to align orders of money. Despite Galay being constituted as a holder of a phone service, a holder of a
government paid job, and a holder of a bank account, these three orders, all of which internally constitute money value as extension, cannot connect up. Number enacts this event through both icon and symbol. Working symbolically, as representing extensive value, number does an accumulation of time and of money. So much time a phone service is used produces so much money against the service account. So many hours worked in a school canteen produces so much money for a worker's bank account. Working iconically, Galay, the account holder and worker, is co-constituted as these accounts. Galay is in this much debt. Galay is in this much credit. As worker and account holder at the bank Galay can be linked, once a fortnight, effecting a transfer of money as extensive value. As a bank account Galay can also be linked to six other accounts at the same bank. As account holder of the phone service, however, she cannot be linked to either of her other positions despite all her attempts. Here, iconic work and symbolic work always separates out distinct and fixed orders.

And so we revert to the arrangement that does seem to work by backgrounding all iconicity in her transactions and operating purely symbolically. Galay gives me two fifty dollar notes, and money's capacity for iconicity is now with me. I get out my credit card and call Telstra. An automated voice asks me to enter the account number, then the bill number, then my credit card number, then the credit card expiry date, then the three digits on the back of my credit card. I enter each number using the keypad on the phone. Finally, I am asked to enter the amount I would like to pay followed by the hash key. I enter, '1 0 0 #'. Silence. I enter it again. An automated message informs me that 'Telstra does not process payments of less than one dollar fifty'. I hear the ringing tone begin and soon an operator answers. She says she has the account number and card number in front of her and asks how much I would like to pay. I say one hundred. That's fine. Come the reply. 'Your receipt number is … one, five, one, zero, four, four, zero,
eight, two, four.' I write this down as '15110440824' and next to it '$100' and the date on
the envelop containing the bills. Treating all these numbers as symbols, confident they
all represent the right thing, money, people, accounts and transactions, the routine
achieves a transfer of money to Telstra. However, having '1 0 0' not recognised as one
hundred and the writing of '15110440824' with the date on the bill itself is beginning to
sense that symbolic work does not exhaust the agency of number. These become
numbers only momentarily, indexing the field of inputs which Telstra automatic
payment services accepts and materially indexing the behaviour of an account: on this
date this transaction occurred for this amount. Elsewhere, 100 might pass as one
hundred and 15110440824 would be meaningless.

I drive Galay and family home. At the Homeland she brings out a Phoneaway
card and asks me to recharge it. This is part of the new routine of phone service. She
gives my a twenty dollar note. Galay has a collection of Phoneaway cards and I write
down the card number of the one I will recharge. Two of my sisters are there and they
ask if I can recharge two cards for them and they will pay me three twenty dollar notes
tomorrow. Each card is to be re-charged with thirty dollars credit. I write down these
numbers too and they take the cards.

At home I call Telstra. 'Thanks for calling the Telstra Phoneaway Service. To
continue in English press one.' I press '1'. 'You now need to enter your pin followed by
the hash key.' I mime the now familiar voice as it speaks. I key in the string of numerals.
'You have one cent left on your card … press star 5 for re-charge options.' I follow the
prompts, re-enter the card number, my credit card numbers and the amount. I am
waiting for the receipt number. 'This card has been suspended for recharge. Please wait
to speak for an operator.' This is new. It is new for the operator also. He puts me on hold
for a while. When he returns he says the card was put on a 'hot list for excessive use.' He re-credits the cards and transfers me back to the recharge service for me to do the other cards. I go through the series of punching the right buttons, and I am again anticipating a receipt number but again none is spoken. 'The value of your calling card can only be refreshed by using the same credit card previously used.'

Number here is enacting its indexical capacity in full. Phoneaway card numbers, which so often are stable self-same icons, not even co-constituting another name or person (much like like bank notes), suddenly differenciate. One is 'hot', the other is linked through a previous transaction to a credit card. Before this moment, outside a now excessive sequence of recharges, one Phoneaway card had worked. Outside this moment, in relation to another credit card, the other Phoneaway card had worked. These two cards are instantly transformed by differenciating fields, in which they both come to critical points: hot use and new credit card relation. One of these points is a one-many limit (excessive use), the other is a whole-part limit (wrong credit card relation). Moreover, both these limits only actualise and can be worked within the very doing of a recharge.

Through appreciating that iconic and symbolic capacities are always within the oscillating valuation icon-index-symbol we can begin to appreciate Galay's effort in working with phone numbers. Her effort was to amplify number's indexicality in order to link up two separating orders of money. This was everyday work, embedded within the materiality of mundane routines. It also meant continuing to work iconically and symbolically. In this episode I became the device for this amplification, transforming cash into credit card, and shifting the capacity from iconic to symbolic. Galay's ability to work me, my accounts and credit cards as a device like a tuning fork was careful and
successful, so much so that my sisters joined in. It was not long, however, that the
careful crafted routines, these harmonies of Phone services, Phoneaway cards and credit
cards began to disintegrate. The Phoneaway cards were also a device which indexed and
amplified this arrangement. However, during the simple routine of their recharge these
indexical Phoneaway cards were instantly redefined within a new field of permissions
and denials. Working indexically is never easy, as the fields within which the entities are
related are always dynamic and can alternate rapidly (Lury, 2011). It is the limit of
indexicality in the valuation of icon/index/symbol where we sense the oscillation at its
greatest torque.

A Valuation in Working with Cars: Symbol/Index/Icon

Bekiny’ is a red Mitsubishi Triton utility vehicle. Cars which become
companions for Yolŋu are adopted into gurrulu and are given appropriate names, just as
with people from outside North East Arnhem Land who become companions for Yolŋu.
Bekiny’ is owned by Gurruwikpik’s ᵇṯḏi (mother) and my ᵇḏi also as Gurruwikpik is
my wäwa (brother). It has been an important car for going into the bush, visiting
country, hunting and collecting materials for weaving, a tradition at which its owner is
highly skilled. It has not been used for a while as it needs a new engine. In the last week
some 'hoons' drove an old taxi in from the mining township four hours away. Speeding
along the main road from settlement to the barge landing, it careened into the
embankment and is now stranded, its life ended. This one might have a possible engine
for Bekiny’, and Wäwa has arranged permission to take the engine and see. I am driving
our car, Meṉḏa, past the abandoned wreck on the way to the Homeland where I am to
meet Wäwa and some other family before heading back to the wreck to remove its
engine. I see them up ahead already on their way. Yinydjapana, a Toyota Troop Carrier,
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is in front towing Bekiny'. I turn around, follow them back to the wreck.

We arrive at the wreck. Its rear axle is almost pulled off as it has bottomed out on the embankment. It has crashed into a few trees before coming to its resting place, and these have smashed the windows and damaged the car's panels. There are four cars and six men. All of us, cars included, born or adopted into same family. Three of the men I call wäwa (brother) and two younger men, about my age, I call gäthu (son). This is close family as it was Gurruwikpik who adopted me into his family and into gurruṯu. We all inspect the car, quite casually. First we inspect with our eyes: some parts have already been removed, the radio, battery and few other things inside. Then with our hands: panels are tapped, lights pushed back in, doors are jerked open, the bonnet popped up and some easily accessible hoses in the engine bay are pulled off. Bang! We all jump back. Someone pulled off the pipe for the air-conditioner. There are a few laughs and we all get back to the progressive dismantling of the car. There is no doubt that Gurruwikpik is in charge. The bonnet is forced back against the broken windscreen and Gurruwikpik points to all the bolts that mounted the engine to the chassis and which will need to be removed, 'dhuwal, ga dhuwal … dhuwal [There, and there ... there]' he is saying.

Until now there has been little conversation. The car is evoking particular actions from the men and the men educing action from the car. The car and the people are clearly a familiar collective. The group of men are familiar as brothers, fathers and sons. They are also familiar with cars: they are related to all the cars and these men have a reputation for being good mechanics and successfully maintaining cars in the demanding environment of unsealed roads, river crossings, bush tracks, and often severe heat. One of the family's cars, Yinydjapana, has survived for five years in the
settlement, and is said to be the longest surviving car in the settlement at present. But when it came to the wreck, there was a little more work to familiarise ourselves with this car through looking at it, knocking at its sides, prodding it and pulling at it. Although I had said it had come to the end of its life, it clearly still had some agency, the pressure in the air-conditioner unit was just part of the agency of the car that was going to affect and effect the collective work. It is not long, however, before the ability of the human bodies to sustain working on the car begins to diminish. Different tools are needed to keep going.

The bolts with which the engine is mounted will require some spanners, as do many of the hoses and pipes connected to the engine. Some of the bolts can only be reached from beneath the car. A box of loose tools is carried from Yinydjapana. A rag is spread on the ground and the larger tools are laid out on it, then covered to stop them getting hot in the sun. I go and get a jack from Meṉđa, and when I return, work is under way removing hoses and bolts from around the engine. 'Do you have any spanners?' I am asked. 'How about a screw driver?' I place my fairly new socket and screwdriver sets on the rag next to the other tools. These sets have their tools clipped into specifically sized recesses which are moulded into the plastic box that constitutes the set. The recesses and the tools within them are arranged in orders of ascending size. By now the car was up on jacks. 'Who wants to go under?' I look around, unsure that I have understood. No one responds. Wäwa looks to me. 'I don't trust jacks', I say. We walk a short distance into the bush and find an old car wheel. We roll it back to the wreck, lay it on its side, then slide it under the car. On its side the old wheel does not provide enough height and soon it is replaced by three jacks, one from each of the three cars, Bekiny', Meṉđa and Yinydjapana.
Let us pause and take a closer look at the two sets of tools. One set was a box with no internal compartment, a collection of tools inside it and a sheet. The sheet was unfolded and created a pallet on which to array some of the larger tools, and which could also be folded back over the tools to stop them getting hot in the sun. The second set was two plastic boxes with moulded interiors such that each tool clipped snugly into a particular recess of just the right shape and size. We can understand this progressive arrangement as an enumeration, a moment within a number event. The two sets of tools had within them potential for number. In one, tools were arrayed on the sheet with the largest first as they got in the way when searching with eyes and hands for smaller tools at the bottom of the box. The tools in the box were produced through on going relations with cars, the tools commonly used with cars staying on top, those used less worked their way to the bottom of the box. Each individual tool had a numeral printed into it, although more often than not this is a confirmatory check as the different tools had different sizes which were recognised by those who work regularly with them. In this way, the numerals on each tool produced a name for that tool, effecting tool-numeral in an iconic relation. The other set had the tools arrayed in a moulded plastic grid. In this set, the numerals were understood as symbols representing the size of the tool, and more specifically the measure of its opening. A size twelve spanner is understood to fit exactly a bolt measuring twelve millimetres in diameter. As a representation of measured size, these numerals can be put in an order, 10, 11, 12, 13, 14 and this is how the tool set was rigidly arrayed in its box. These two capacities of number are about to participate in the actualisation of working on the wreck.

While one gäthu slides under the car, two others lean over the bonnet and the three of them work on separate areas of the engine bay, following a hose, pipe or brace and undoing every bolt along its line. Others stand or sit nearby handing tools to those
now entangled in the car. 'Dunhi twelb [that one is a twelve]', one man says referring to the size of the bolt. 'Wanha fourteen [where's the fourteen]?' another remarks asking for a tool. 'Socket' he adds. Sockets have a reciprocating arm and are preferable to spanners which are fixed. 'Wanha fourteen [where's a fourteen]?' 'Dhuwal [Here].' 'Wanha twelb?' 'Darra ga using [I am using it].' 'Wanha tentja?' (the suffix -tja giving focus to the noun). The response to each utterance was a relation of bolt and tool. If the named bolt-tool was in use the person would seek another bolt to successfully relate to a tool. So the work continued. As people got tired, they stopped and others would take their place. After a while, less bolts required removing and fewer people worked on removing them. We pushed the engine, moving it slightly and identifying where it was still attached. More bolts to remove. As less tools were used they gathered on the ledge between the engine bay and the windscreen.

As the routin went on, however, neither of these numerated and enumerating tool sets successfully enumerated the event. The tools needed for this working with a car were a slightly different set than that arrayed on the sheet, and as Wäwa pointed out, engines don't use 15, 16 or 18 though these are included in the set that neatly arrays from 10 to 20 in one millimetre increments. The event enumerated a different tool set, one that was progressively produced on the ledge between the windscreen and the engine bay. This was not a set numbered though some 'frequency of use and ease in packing' in which numbers were worked as icons, nor was it numbered through symbolic representations of measured extent of bolt or opening. Rather this set of tools was indexing the work itself in the here and now. These tools only made sense in relation to this work of removing this engine beginning with what we had.

The moment itself carried with it a mode of valuation: the bolts on the car, the
calling of the names, the collective sharing of the work and the resources. This tool set is specific to this work. Once the engine was removed, the ledge tool set dissolved back into the two tool sets we began with, perhaps slightly modifying the box and rag set but not affecting the moulded plastic set. While number as icon and number as symbol became worked together as a here and now indexing, some of this indexing affects a different ordering of the icons as they re-emerge as a set. Unless a tool is lost or broken, or an extra tool gained, working number as symbol does not accommodate agency from its object, such as when number begins to work as an index. The tools remain only representative of what is considered a fixed universal measure. Hence, it is resonating with the indexical capacity within a working number which momentarily holds in the present the agency of the valuations of number.

These here and nows are always 'selections among potentialities offered to it by eternal objects' (Shaviro, 2007: 21). That is, the actualities of number are valuations among potentials offered to it by its eternal object oscillating value. Working with valuations as selections (the tool set on the ledge is such a selection here) brings to our attention the specificity and precision of valuations and their existence as the very limits of the collective performance of the event number. It is this sensitivity toward both the specificity of the material and semiotic work of number, and toward value as the limits of the potentials of number, that is the limits of the process of number's different/ciation, that is required for the task of working and thinking with number more fully in composing better cars and better worlds.
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Conclusion: The Potential of Number

Number's Role in the Progressive Composition of the World

To begin concluding, let us sustain the moment of enumeration of a tool set on the ledge between the windscreen and engine bay. The tool set emerges through an interested and situated task. It is an expression of this collection work, emerging from heterogeneous elements; a car wreck, tools and their arrangements, bodies and their experienced hands, trees and old wheels on the side of the road, gestures and utterances, remembered experiences, and modes of relatedness. It emerges in the here and now of a specific matter of concern: bringing a broken car back to life. The tool set is an embodied comparison, in the sense of a specific and interested rapport. It is a vital comparison, bringing new things to life and continuing collective living. As simultaneously embodied work and the expression of embodied work, the tool kit
functions indexically. The enumeration of the tool set is a selection, or a valuation.

Cars that work are crucial companions in sustaining contemporary Yolŋu livelihoods. They participate in sustaining the relatedness of peoples, places, and practices. But cars do not always work. They break down and demand our care. Cars only remain living through and as a constant decomposition and recomposition of parts. Sometimes the problem is simply a flat tyre in need of inflation, at other times a tyre is irreparable and a new tyre is needed. Sometimes the problem is more critical and a car requires a new engine. Parts are sourced from shops, wrecker’s yards and tips, from relatives, from an abandoned car and sometimes the bush itself. Through the progressive composition and recomposition of cars a certain valuation or selection of collective life is achieved, and some novelty is expressed, in this case a tool set.

This progressive composition (Latour, 2010) of working cars is analogous to this thesis which is a progressive composition of working number. As cars are important companions in sustaining contemporary Yolŋu livelihoods, this thesis has argued that numbers are also important companions in sustaining contemporary Yolŋu livelihoods. The demands of number have also shown that numbers are important companions in enlivening and sustaining contemporary research practices in the social sciences. This is because in an investigation of number at its limits requires a re-conceptualisation of both numbers and limits.

This thesis claimed that to date numbers in social science research have predominantly been understood as representing the extension: length, volume, power, trust – extensive value. Research on number therefore worked to recognise that which number represented, while accepting the very image of thought, that of the Recognition of metric objects, upon which number itself was understood. Such an understanding of
number was argued to be philosophically naïve, increasingly empirically unworkable and unproductive, and based within a ethics of imposition and disrespect. All difference was treated as negative, as merely the extensive difference between two things understood within an imposed measure. Inspired by Deleuze's metaphysics of the event and Verran's relational empiricism, this thesis developed a new empiricism which is situated, embodied, interested and collective. This has enabled an understanding of limits not as the extensive measure of an already ordered world, but as the achieved limits of collective life. Empirical research became directed towards the specific practices and routines through which these limits of number were produced.

A commitment to working relationally with number is a commitment to its recomposition in the here and now of research. As with working with cars, this continuing (re)composition of number is the practice of working comparatively in the sense of what comparison, what rapport, what assemblage of parts, works for going on. As with working with cars, what was to become a part was also a local and contingent decision: an old wheel, a tree, some water, a European philosopher, Yolŋu philosophers, a book, a workshop, a website, and an ethnographer. Each part was decomposed from the event of comparison itself. As with working with cars, the concern of this thesis has been to keep going, keep number working, humming and living so that the collective could keep going, keep thinking and keep learning.

Through working number as an event, novel arrangements and accounts of these arrangements have emerged. In this thesis, value has become a device through which a collective of number in Arnhem Land is progressively composed and re-composed, respecting the primary and generative difference which constitutes the encounter. These valuations have been considered as oscillating eternal objects:
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unity/plurality, one-many/whole/part, (extensive)value/order, cardinality/ordinality, and symbol/index/icon. As the tool kit emerged on the ledge below the windscreen as an expression of that collective work, value as an eternal object has emerged as an expression of number as event. Both are assembled through being sensitive to generative difference and resonating the indirect harmonies as that which the collective lives. We have been successful in keeping number working. Through attuning ourselves to valuations we have worked number problematically and sustained a humming, resonating and active number. We have kept it mobile through a sensitivity and respect towards difference. We have become tools ourselves, akin to tuning forks, and upon hearing this new resonance with some subtle familiarity, we ask ourselves the question: what to make of all this? Do we pack ourselves, our tools, back into the ordered sets called disciplines and methods, or do we throw them all in to the one big box called empiricism or perhaps even thought? Can we take them with us or are they always a local occasion? Are they in the way of other becomings or will they become something different themselves? Have we got anywhere at all? Anywhere new, interesting or important? Such questions concern novelty and responsibility and they demand a response.

Novelty and Responsibility in Relational Empiricism

This thesis has achieved number as a progression, and an account of both number and research as progressive. Progression is not Progress out of some darkness nor directed towards some utopian end, but the delicate task of seeking novel ways of constituting collective life (Latour, 2010). Novelty in this account emerges from within encounters. This is the importance of the distinction between the real/possible and the actual/virtual. The truly new can never be predefined in some possible world, but is
always present in the intensive becoming that is the actualisation of the virtual. Eternal objects are *not* Ideals imposing themselves upon the real, but passive entities which express *ingression* in an event. The important contribution of eternal objects is in maintaining a sensitivity to the differentials through which the world is constituted. Becoming sensitive to the *potentialities in the actual* through entering into resonance with more and more eternal objects has the effect of keeping the present open to a future that is truly new. Hence, in relational empiricism one can never ignore the necessities and responsibilities of the actual. As Deleuze and Guattari write in *What is Philosophy?*, 'it may be that believing in this world, in this life, becomes the most difficult task, or the task of a mode of existence still to be discovered on our plane of immanence today' (Deleuze, Guattari, 1994: 75). Relational empiricism works on the plane, on the screen, by believing in this present world.

Two occasions which give the problem of number in Arnhem Land its present necessity, in the world and in this thesis, are mathematics education and the Northern Territory Emergency Response. Australia as a collective has managed difference with disastrous effects over the two centuries of its existence as a colonial occupied land with various continuing Aboriginal nations and peoples. Each contemporary attempt at something new in the collective of Australia, each attempt at becoming post-colonial, is haunted by the very real fear that novelty is not possible, that we will simply repeat another version of the same: Colonialism 2.0 perhaps. There is no guarantee against this very real potential. The divisions and discrepancies in power, well-being, access and control of education, welfare dependency, and unemployment that are so often the painful expressions of the difference between those who are Aboriginal Australians and those who are Settler Australians are all too real. But while they appear to exhaust the actual of our experience, they do not exhaust the potential of our experience. It is our
persistent efforts in seeking the potential in the here and now, attuning ourselves to the modulations and tensors, the resonances and relations, that we can seek post-colonial becomings. The post-colonial is the sustained becoming of this situated sensibility.

Mathematics education in Arnhem Land has been a constant struggle. At first it was a struggle in disciplining the savages and later the struggle in savaging the discipline of mathematics, to use Martin Nakata's turn of phrase (Nakata, 2007). In this struggle, difference becomes ends, with 'two way' or 'both ways' curriculums becoming evidence of the successful recognition of a presupposed external difference. The difference that sustained the struggle internally and generated truly novel forms of education however, began to fall out of the present and became easily unacknowledged and too easily undermined. As remote education was eroded bit by bit, what were novel achievements became failures. With difference understood as external to the struggle these apparent failures were too easily explained away. They were all the same failures we had seen before, and blame was attributed to one side: either the failures of Aboriginal people or failures of the State. Worst of all, politics became indifferent to the present.

A post-colonial sensibility sustains difference as internal and generative. Difference is not ends, it never falls out of time. Becoming sensitive to the limits or resonances of this difference and accounting for them as eternal objects, as passive limits in flux, ensures we do not make this mistake. It ensures we enter into events within which the present can be fully deployed and multiplicity does not become multiple. While there are still actual failures and actual successes, there is also potential. The Maths as a Cultural Practice Workshop was one effort to sustain the difference as a generative potential in remote mathematics education and its re-performance in Chapter
Four also attends to this task. Respecting the places that maths curriculums can emerge and finding ways to resonate with these is a task that this thesis has demonstrated can be continued.

Difference as differential was actively worked in the NTER. Here, difference was understood to be a means to 'stabilise and normalise' Aboriginal Australia (Altman, Hinkson, 2007). With difference as merely a means however, the full affective force of Income Management was never questioned. What was important was that Income Management was achieving its ends, that it was differenciating thousands of lives, business, dollars and products which all became managed. Income Management was a callous and uncaring performance of multiplicity. But too often, while this was acutely felt in daily life, it was only the callousness and carefulness of the ends that were, and still are, fiercely debated. The failure of Income Management in doing difference therefore, was not its failure to do multiplicity (as with mathematics education) but its failure to sustain multiplicity, to explore it more fully and in more subtle ways. The negotiations and comparisons it opened up, its full potential was often actively ignored and gradually, despite many efforts, it faded into the background noise of political commentary. Acts of resistance such as a mother refusing to participate in a registration meeting, were literally papered over and at best were were simplistically understood and explained away as bad policy or bad mother.

Hence, while different, both remote education and the Intervention suffer from not appreciating the full potential of the present. Our potential is the present. The question becomes, are our ways of working sensitive enough to resonate with the potential multiplicity and amplify it in all its tones, the loud and the soft, the audible and the inaudible, performing them all experimentally and carefully. Such a sensibility
would appreciate resistances, however small, and take seriously the effect of giving them their full force. And hence we arrive at the problems of research as embedded ethically and empirically within the problems of living collectively. The challenge of the post-colonial encounter of number is what research is to make of the multiplicity of number, if it is neither means nor ends, good nor bad?

This question was addressed in Chapter Five through 'numbers in the wild'. If becoming wild is going beyond the old 'anthological predicates', as Deleuze, argues, then this can be read as suggesting a new anthropology of number. In this new anthropology of number, number is the new subject of the encounter. Numbers in the wild are actors in the present of the (new) empirical. These numbers are dynamic and live in the screen. As demonstrated in Chapter Five, they live within specific valuations or selections at the very limits of our collective work. Moreover, these valuations are the very problematics of research. They tune the researcher into the encounter. The value of number is the *ingression* in the event.

Numbers in the wild function indexically to open up the present in order to go on living. In going on, the agency of this new anthropology of number is the composition of these new more fully expressed numbers, or perhaps the enumeration of these more fully expressed compositions. These compositions, moreover, are always decompositions and recompositions. In Chapter Two, the research as presenter was only decomposed and shown to be working as imperium through the very recomposition of the figure of ethnographer-in-the-text as participant comparison. And again, it is number in the wild that is able to perform internally a re-reading of mathematics education and the Northern Territory Emergency Response in ways that are positive, constructive and life affirming. These numbers are some of the real potential for transforming maths
education and the NTER, which are perhaps just the beginnings of what differences such an active, multiple and truly 'wild' number can make in Australia and elsewhere.

The multiplicity of number is its potential, its virtuality. While the virtual can be ignored and the actual cannot, ignoring the potential holds no prospect for futures to become different from pasts. While the actual has effects in the present, it is indifferent to the present. The actual has always already occurred. The potential or virtual, on the other hand, is not indifferent to the present. It lives as the limits of the actual. And empirical research that is sensitive to the potential is not indifferent to the present. Relational empiricism considers the present as that which makes a difference, that is difference or multiplicity. It is through maintaining the present as constituted as difference that we become progressive, that we can begin to undertake the active and interested task of carefully creating the new.

**A Hopeful Potential for Number**

Consider a family living on an Homeland in North East Arnhem Land. The oldest generation living there remember the missions when they were young. Many of these men have died or are very sick. The women continue to collect and dye plant materials with which they weave baskets that are sought after internationally. Many of the adult men were trained as mechanics as young men and now sustain a fleet of cars for the extended family. A minimum of one working car is necessary to drive the children to the government school in the community twenty kilometres down the road, and to continue to look after the land which they own. Rather than live off government payments and the increasing control this effects, this family want to start earning some money from their effort in fixing cars and managing the environment. They have many of the skills, many of the tools, a strong desire to work where they live, a never ending
demand for cars to be fixed and a close and knowledgeable relationship to the area. 'This sounds like it has some potential' someone might say.

But, the men are not qualified mechanics nor rangers, the location is too remote to easily source parts, there is little money to pay for such services, local knowledge is not easily mapped into the categories of Natural Resource Management and everything is too mixed up with ancestral knowledge and authority. Does this increase or decrease the potential? If it can be held together the differentials are stronger. If we included more the potential will get louder. How might number participate in this potential and help it hold together? Number will surely be involved with money, bank accounts, carbon credits, GPS locations, school attendance and more besides. What selections and valuations will be negotiated and how might this be done? We cannot know. However, what a new understanding of number can offer is a wider appreciation of what number can do and in which ways.

The new potential of number is that it can hold together more complex and more subtle, more interesting and more interested ways of living. Understanding number as an event and value as its eternal object provides a way of accounting for this sensitivity in action. Numbers are devices which hinge the actual and the virtual and effect an opening up within the present. They help us maintain our presence on the surface and work indexically. A post-colonial number is one that does not restrict the valuations through which it lives, but lives through as many valuations as possible, seeking connection and comparison within the primary difference of the post-colonial encounter. To live well with post-colonial numbers is to amplify this difference a little more, the harmonies of which we are now beginning to hear.
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