

Logic in Australasia

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Ever since the 1960s, philosophical logic has played an important part in the shaping of philosophy in Australasia, and Australasian work in philosophical logic has played its part in research in the area. In this chapter I will introduce and assess this influence, concentrating on two major themes in Australasian philosophical logic, *modal* logic and *paraconsistent* logic.

The discipline of logic

To set the scene, I must say a little about logic as a discipline, for it does not find itself *wholly* inside the academic discipline of philosophy. Just as logic has a long *history*, reaching back to the work of Aristotle, it also now has a very wide intellectual geography. The discipline finds a home in Philosophy, and philosophical logic is the theme of this chapter. However, logicians find a home also among mathematicians, computer scientists, and also linguists, cognitive scientists and engineers. As Robert K. Meyer (of the Australian National University) has said, *logic is the Poland of the sciences*. It has very many large neighbours, who sometimes harbour benign interest, and sometimes wish to colonise the territory for its own.

The history of academic work in logic in Australasia, then, covers not only Philosophy, but also these other fields. Though out of the scope of this essay, there is much interesting work in logic done in other disciplines in Australasia, from the mathematical logic of Martin Bunder (Wollongong), John Crossley (Monash) and Greg Hjorth (Melbourne), the mathematical analysis of modal and temporal logic of Rob Goldblatt (Wellington) and Mark Reynolds (Western Australia), the knowledge representation of Norman Foo (UNSW/Sydney), complexity theory of Christian Calude (Auckland) the digital systems of Jen Davoren (Melbourne), and the implementation of proof systems and model generation of John Slaney (ANU) and Rajeev Goré (ANU). Work in logic in Australasia is diverse and thriving. Regular conferences and collaborations bring various sub-groupings of these researchers together, frequently across disciplinary boundaries. In some rare cases, including at present at Melbourne, there is also collaborative and interdisciplinary *teaching* of logic to undergraduate students. However, since philosophical logic is our theme, I will not touch further on the wider interdisciplinary context. Instead, let us focus on the home of logic in philosophy in Australia.

Genuine *research* in logic in Australasia commenced in the 1960s with Len Goddard and Richard Routley, both then the University of New England (UNE). They taught a masters program in logic, of whom Ross Brady (La Trobe) and Rod Girle (Queensland, then Auckland) are the most notable graduates. In 1964 a logic conference was held at UNE, after which *Australasian Association for Logic* (AAL) was inaugurated, and which held its

* Thanks to all of my colleagues in philosophical logic in Australasia from 1989 (when I had my first class with Graham Priest) to this day. For comments, feedback and the latest version of this paper, see <http://consequently.org/writing/logic_in_australasia/>.

first regular conference 1966: AAL conferences have been held regularly in Australian and New Zealand since then. While the association is interdisciplinary in membership and orientation, it is fair to say that its membership is primarily from among the philosophical community. As a glance at the abstracts of presentations given AAL conferences shows,* research in logic in Australasia is broad and varied. However, noticeable themes emerge : I will pick out just two to concentrate on here (1) work in *Modal Logic*, from the pioneering New Zealanders George Hughes and Max Cresswell (Wellington), through work on the modal logic of actuality by Hazen (Melbourne) and the two-dimensional modal logic of Humberstone (Monash); and (2) work in *Non-Classical* (relevant and paraconsistent) *Logic*, through the work of Richard Routley (later named Richard Sylvan) and Robert K. Meyer (ANU), and Graham Priest (Western Australia, then Queensland, then Melbourne) and their collaborators and students.

These themes do not exhaust the work of philosophical logic in Australasia, but they will enable us to understand its impact and influence both inside Australasian Philosophy and in the discipline of philosophical logic worldwide. We will consider these themes in turn, bookending the discussion with considerations of other currents in philosophical logic in Australasia; and closing with an evaluation of what distinctive features we can discern considering an ‘Australasian approach’ to philosophical logic.

Possibility & Actuality: Modal Logic

Before introducing the distinctive contributions of Australasians to the study of modal logic, I must take some steps back to introduce the core concepts. One way to introduce *modal* logic is to consider the core logical notions of identity and difference. Identity and difference are intimately bound up with our conceptions of what it is for something to be a *thing*, and therefore, how we conceive of the world around us. We use the concepts of identity and difference when we count. To say that there are at least two cows in the top paddock is to say that there is a cow in the top paddock and that there is a cow in the top paddock that is *not the same* as that other one. That “not the same” is “not identical to” or “differs from”. Notice that this works even if we don’t have names for the things in question (we can judge that there are three goldfish in the bowl even when we can’t tell them apart), and even in the infuriating case where we have names but we give two things the *same* name. John Howard (the former Prime Minister) and John Howard (the actor) are *two* people, not *one*.

Sometimes identity and difference of things is a tricky matter: ‘Phosphorous’ is the Ancient Greek name for the morning star: that star that is the last to fade away as the sun rises. ‘Hesperus’ is the name for the evening star: that star that is the first to appear as the sun sets. In fact, they’re both the same thing: they’re both the planet Venus, which is quite close to Earth, and has cloud cover which means it reflects a lot of light and is often the brightest small object in the night sky. Now, it was not a matter of reason alone that could convince an observer that Hesperus is the same *thing* as Phosphorous. Only astronomical observations and calculations (together with a bit of theory about what planets *are*) could do that. We can be *ignorant* of facts about identity. We can get things wrong when we count, not just by making slips of the finger or memory as we point and number things off, but because we don’t truly understand what is what.

* These abstracts are found in issues of the *Journal of Symbolic Logic* from 1967 to 1993, and then in the *Bulletin of Symbolic Logic* from 1994 to the present day.

But consider how to count *properties* instead of *things*. Philosophers have often wondered not just about *things* — whether everyday things like cows and planets; or more controversial things like minds, pains, numbers, species, dispositions and absences — philosophers have also wondered about the nature of *properties*. Take the property of being a *feeling*. Philosophers argue about what sort of property this is. What *is* it for something to be a feeling? Is a feeling located in the head? In the central nervous system? In what is felt? Australian philosophy is known (in the work of J. J. C. Smart and David Armstrong) as robustly *materialist*. For the materialist, whatever the property of being a feeling *is*, it is a *material property*, possessed by the *brain* or *body*.

But this is a thesis about the identity of a property: it's what's known as a *property-property* identity thesis; identifying one property (of being a feeling) with another (say, with being a particular kind of brain state). If this is a genuine *identity*: then we should say that anything at all that is a feeling is a kind of state of the brain. But we can ask this question in reverse. What would show us that the property of being feeling *wasn't* identical to being the property of a brain state? One way philosophers have attempted to show this is by way of 'thought experiments' — by arguing that it *could* be possible that there be a creature that had no brain states, that yet had feelings, mediated by some other mechanism.

We need not go into the details of how a thought experiment might work, for the very idea of a thought experiment is enough to introduce modal logic. For a thought experiment like this is only convincing one can conclude that it is *possible* that this creature possess a feeling without possessing a brain state of the required kind. When convinced by this thought experiment you are distinguishing two concepts by finding a scenario in which one applies and the other doesn't. The crucial factor is not that the scenario is plausible, likely or realistic. However, it has to be *possible*, at least in the sense of being a coherent 'way things could have gone'. With such a scenario — what we may call a 'possible world' we have the grounds to conclude that it is *possible* that something be a feeling without being a brain state, and hence that the two *properties* are not identical.

So, to take a prosaic example: the property of *being an Australian Prime Minister* is not the same as the property of *being a member of the Liberal party* because for there are very many people who have been Australian Prime Ministers who aren't Liberals. On the other hand, if you look at the property of *being an Australian Prime Minister* and the property of *being a male Australian Prime Minister*, they've been exemplified in exactly the same way through history so far.* Everyone who's been an *Australian Prime Minister* for the time we have had them, has been a *male Australian Prime Minister*, and *vice versa*. So you can't tell that these two properties are different, if they really are, just by looking at who has *actually* exemplified them.

Now clearly, things don't *have* to always be like this. You could imagine a slightly different way that things could have gone, such that a woman has been an Australian Prime Minister. The mere fact that this is a *possibility* tells us that the property of *being an Australian Prime Minister* is not the same as the property of *being a male Australian Prime Minister*. And this is a way of thinking that has become systematic in philosophy, that people have thought about not only how things *are* but how things *could have been had things been different*.

* However, happily, since this text was first written, Julia Gillard has served as *acting Prime Minister* while the serving Prime Minister Kevin Rudd was away from Australia.

Now this technology of things being differently in different possible circumstances (*possible worlds*) has been used by many philosophers, to understand the structure of what we can say about *possibility* and *necessity*. We now start taking these different circumstances where things could be different, very seriously, and we'll say that something is *necessary*, something has *got* to be the case if it's true in each of these different possible worlds and it's merely *possible* if it is true in at least one possible world. This kind of structure is studied in the discipline of *modal logic*, so called because we can think of possibility and necessity as *modes* of truth, respectively weaker than and stronger than bare truth. This work connects with considerations of time and tense, as modifiers such as 'always,' 'at some future time,' and 'sometime in the past' have similar logical structures to the modalities of necessity and possibility. We can conceive of necessity and possibility as ranging across different possible scenarios or *worlds*; temporal modifiers range in a similar way across different moments or *times*. The study of modal and temporal logic flowered from the middle of the 20th Century, and Australians have played their part. At the beginnings of the field, it was dominated by New Zealanders — first Arthur Prior's work from the 1950s (at Canterbury, then taking up a chair at Manchester in 1956; then Oxford from 1966), then in the work of George Hughes and Max Cresswell (Wellington), whose textbook *An Introduction to Modal Logic* provided the means for generation of students to learn modal logic. The later arrival of Krister Segerberg in Auckland meant that for the latter part of the 20th Century, New Zealand was a hotbed of work in this area.

It took some time for work in Modal Logic to find a place in Philosophy departments in Australia: However, with the arrival of Lloyd Humberstone at Monash University in 197X and Allen Hazen to Melbourne in 198X, research in Modal Logic not only found its place in Australia, but this research found its found a home in wider work in philosophy as well.

To explain the insight in Hazen and Humberstone's work: consider this. I eat ice cream. My favourite ice cream is Homer Hudson Chocolate Rock. One thing that I console myself with, after having eaten rather more ice cream than I should, is this fact: *that I could have eaten even more ice cream than I actually did*. At least I showed a certain amount of restraint. In one possible world (one which describes how things have actually gone), I have eaten one small tub of icecream. In some *other* possible world, I have eaten three tubs.



possible world 1



possible world 2

In possible world 1, I am excessive. In possible world 2, I am gluttonous. From the perspective of world 1, "I ate one tub of icecream" is true; from the perspective of world 2,

“I ate three tubs of icecream” is true. Furthermore, from world 1, we can say “I ate one tub, but I could have eaten three”, and from world 2, I can say “I ate three tubs, but I could have eaten one.” What is true is *relativised* to a possible world.

This much is standard modal logic. Notice, however, there is nothing yet in this picture that helps us understand my consoling thought: “I *could* have eaten more than I *actually* did.” We didn’t think of this as saying “I could have eaten more than one tub.” That much is straightforwardly true. From the point of view of world 2, I did eat more than one tub. But from the point of view of world 2, did I eat *more than I actually did*? If world 2 is what is what happens, then what I actually ate is *three tubs* not *one*. What we need is some way to figure out — from the perspective of world 2 — that world 2 is not what is *actually* the case, but merely what *could have been* the case. This is where Allen Hazen’s work in modal logic begins: he has studied modal logics with *actuality*. The simplest way to conceive of the picture is to contrast a paper street directory with a shop directory in a shopping centre. In the paper street directory, we see many different locations, but nothing distinguishes the one where you are. A directory at a location in a shopping centre shows not only the different locations in that centre, but also *where you are* as you look at the directory. If we expand the picture just a little, flagging world 1 with the “@” sign, meaning “you are here,” then we can reason as follows:



possible world 1: @

I ate 1 tub

I actually ate 1 tub

I ate as much as I actually ate



possible world 2

I ate 3 tubs

I actually ate 1 tub

I ate more than I actually ate

If we start at world 1, we should say that from the point of view of world 1, what I ate is one tub. Then there another *possible* circumstance where I ate three. In that circumstance I ate more than I *actually* ate, because to say that something *actually* happened is to refer back to the actual world: the world marked with “@” in the picture. In hypothetical circumstance, world 2, the statement 'I ate three tubs' is true, because that's how things go there, but the statement 'I *actually* ate three tubs' is false, because to see what actually happens, you need to go and look at the actual circumstance, rather than remain in the hypothetical alternative.

And it turns out, when you modify the picture of possibles to keep this in mind, it answers these kinds of puzzles and the picture is a very nice one. But this picture is incomplete.

Consider what we have learned as astronomers have changed their mind on how we should use the word “planet.” Going with the astronomers’ Official Definition, it’s actually the case that there are eight planets in the solar system. I used to think that there were nine, but we now learn that we have misclassified Pluto as a planet and there are actually eight planets.

Now of course “there are nine planets” *could have been* true. In fact, most of us thought that this *was* true. However, there are at least two different senses we could mean ‘could have’ here. One is that we could have meant something different by the word ‘planet’, but we don’t need to mean that. What we could mean is that had the history of solar system gone differently, had there been a little bit more matter in between Mars and Jupiter, so that the material now in the asteroid belt had actually coalesced into a planet, instead of just remaining lots of little asteroids, then there would have been nine planets; there would have been another rocky planet in between Mars and Jupiter. And had something really terrible happened and split Jupiter into two bits which had slightly knocked themselves out of orbit so that there were two planets about the size of Uranus or Neptune instead of one planet the size of Jupiter, had that happened, then there might have been ten planets in our solar system, and so on. These possible scenarios are the kinds of things we philosophers have in mind as *possible worlds*.

Now those are different possibilities, but what’s actually the case scientists tell us, and I have no reason to doubt them, is that there are really eight planets. Now think back to the morning star and the evening star: Hesperus and Phosphorus, what’s actually the case is that Hesperus, that planet, is identical to Phosphorus, they’re the same planet. Now imagine, had there been nine planets, had the stuff between Mars and Jupiter coalesced into a planet, would Hesperus still be Phosphorus? The answer is *yes*, Hesperus would still be Phosphorus because what’s Hesperus? Hesperus is that planet *there* — imagine we’re outside in the early evening, pointing at Venus. What’s Phosphorous. It’s the planet right *there* — imagine that we’re outside in the early morning pointing at Venus. When I’m asking Is Hesperus Phosphorus, I’m asking about *that* planet. Is it identical to itself? The answer is, *yes*. Could the world have gone differently so that this planet were *not* identical to itself? *No*. There’s no possible world in which that heavenly body (the one we pointed to, twice) was not identical to itself.

But there’s another sense in which, of course, the sentence “Hesperus is Phosphorous” could have turned out to be false: it may well have been for all we knew, consistent with everything that appeared to us that the planet that we saw first thing in the evening was Venus and the planet that we saw last thing as the sun was rising, was Jupiter instead. So now I’m not asking of some planet, “is it identical to itself,” but instead, I am asking whether, for all the evidence that we had at the time, was this something that would have been consistent with the way we were using the words “Hesperus” and “Phosphorous.” Could the environment have been such that we were using the words “Hesperus” and “Phosphorous” to refer to different things. If *that* were the case, then there is a sense in which “Hesperus is Phosphorous” could have turned out to be false.

This means that variation of possibility can take two different dimensions: we can think of possible worlds as alternatives to the way things are in two different ways. We can think of them as alternative histories, in which we apply the concepts with the “meanings” they really have. In this sense, there seems to be no possible world in which Hesperus is not Phosphorous. On the other hand, we could think of them as alternative bodies of evidence, or alternative contexts in which we could have learned our words or our concepts. In *this*

sense, there is an alternative circumstance with respect to which “Hesperus is Phosphorous” is false. We can say that “Hesperus is Phosphorous” is metaphysically necessary (true in every alternative circumstance) but epistemically contingent (false in some *epistemic* possibility). Clarifying these distinctions and elucidating the logic of these two different notions of necessity and possibility was the work of Martin Davies (Oxford; for some time at the Australian National University) and Lloyd Humberstone (Monash).

This was not only a great insight into the nature of the concepts of possibility and necessity: it also had far-reaching applications into metaphysics and other areas of philosophy: to take one example near to the heart of Australian philosophy, these distinctions apply to topics such as the philosophy of mind. Different positions in the philosophy of mind are actually characterised as identity statements. Is the state of being in pain identical to the state of neurons firing in a particular way? In one sense, you wouldn't think so, because you're not going to get to this conclusion just by introspecting, examining what the concept of pain is and the concept of a neural firing is, even the concept of a neural firing in a particular way that does things to the limbic system and so on. You might get connections between these things but you're not going to get there by examining the concepts — or so many of us think.

But that's just like saying you're not going to get the fact that Hesperus is identical to Phosphorus just by examining the concepts of Hesperus and Phosphorus, you've got to go out and do a bit of astronomy. Well various people say you've got to go out and do a little bit of cognitive science and a little bit of phenomenology and a little bit of other things to do the connections. But once you do that, perhaps you may be able to conclude that as a matter of *identity*, a pain *is* a neural firing, even though that's something that we have had to learn empirically. Furthermore, this does not mean that the *concept* “pain” is identical to the *concept* “neural firing of kind *P*” (for some characterisation of neural findings that constitute pains), for though they might agree in application in any different circumstance considered as a hypothetical possibility, they do not need to agree in all alternative epistemic circumstances. The routes by which we learn the concept pain and the concepts of neural firings of kind *P* may well differ (from the ‘inside’ and from the ‘outside’ as it were), though the targets may (on this story, at least) end up at the same place.

And so, we've got many philosophers in Australia such as Frank Jackson (Monash, ANU and now La Trobe), David Chalmers (ANU), John Bigelow (Monash), and Laura Schroeter (Monash, now Melbourne) who are examining the use of this kind of two-dimensional logic to analyse these kinds of questions. What is the way that we can characterise what we can say about possibility, necessity and identity and meaning? Two dimensional modal logic is an attempt to provide a framework for this kind of discussion.

Paraconsistency & Relevance: Non-Classical Logic

Possible worlds can be very, strange. There are possible worlds in which kangaroos have no tails, there are possible worlds in which swans are blue, there are possible worlds in which there are 10 planets in the solar system, there are possible worlds in which there's a Greens Prime Minister at the moment. Possible worlds can be very strange things indeed.

But maybe possible worlds not quite strange enough. Maybe there aren't enough different circumstances to make as many discriminations as we would like. For example, when I was talking about the identity and difference of properties we discriminated between properties when a thing could bear one of the properties without the other. We don't

demand that there *be* anything that has the one without the other, we just ask if there *could be*. But are there pairs of properties, which as a matter of *necessity*, if you have one you have the other, but which we recognise as different properties? Consider the following pairs of properties:

... is a triangle with each *interior angle* the same.
... is a triangle with each *side* the same length.

As a matter of geometrical necessity, if a triangle has interior angles the same, its sides are the same, and vice versa. *Equiangular* triangles are *equilateral*. Are the properties of being an equiangular triangle and being an equilateral triangle the same? To pick another example, consider the properties

... being a Prime Minister of Australia.
... being a Prime Minister of Australia and being such that $2+2=4$.

It seems that Kevin Rudd, John Howard, Paul Keating and so on... are equally good candidates for both of these properties. Nothing *could* bear the one without bearing the other, given that it is *necessary* that $2+2=4$.

However, in each case, some have wanted to say that there is something different *said* when we say that a triangle is equiangular than when we say that it is equilateral: that to say "Kevin Rudd is PM and $2+2=4$ " is to say something *more* than merely to say "Kevin Rudd is PM", even though they are true in exactly the same circumstances. There is a sense in which two claims, though *impossible* to pare apart in any different circumstances, nevertheless have different *subject matters*. An account of logic respecting *relevance* is needed to distinguish them.

Philosophical logic in Australia is known for tackling these issues too. Ever since Routley (a New Zealander) commenced work in relevant logic in the early 1970s, to be joined by Robert Meyer at the Australian National University in the middle of the 1970s, the centre of gravity of work in relevant logic moved from the United States, where it started with the work of Anderson, Belnap and Dunn, to the southern hemisphere, and especially, the Australian National University. A succession of students of Routley and Meyer, including Ross Brady (La Trobe), Michael McRobbie (ANU, then Indiana), Paul Thistlewaite (ANU), Jacques Riche (XXX), André Fuhrmann (ANU, Konstanz, Sao Paolo and now Hamburg), Errol Martin (Canberra), John Slaney (ANU), and Dominic Hyde (Queensland), together with research fellows, visitors and collaborators such as Nuel Belnap (Pittsburgh), J. Michael Dunn (Indiana), Stephen Read (St. Andrews), Edwin Mares (ANU, McMaster, then Wellington), Rod Girle (Queensland, ANU, then Auckland) and Greg Restall (ANU, Macquarie, then Melbourne) worked on relevant logic and related issues in Canberra through the 1970s to the mid 1990s. This work took many and varied forms. Routley and Meyer were most famous for their "semantics" for relevant logics, which related talk of relevant implication and consequence to 'worlds' in a way analagous to the way that possible worlds can model the logic of possibility and necessity. The crucial feature of 'worlds' in a semantics for relevant logics is that they can fail to be consistent and complete scenarios representing a coherent possibility. To distinguish the property of being an Australian PM from the property of being an Australian PM such that $2+2=4$, they would use a scenario in which Kevin Rudd (say) is PM, but in which $2+2=4$ would fail to be true. More radical even than that, relevantists would want to say that he arguments from

p to either q or $not-q$

and from

p and $not-p$ to q

both ought to fail, on the grounds of relevance: in each case, the premise has nothing to do with the conclusion. For this, Routley and Meyer would have us consider circumstances in which one piece of information p holds, but that the seeming tautology *either q or $not-q$* fails; and most drastic of all, they would take there to be a circumstance in which the self-contradictory statement p and $not-p$ holds, but in which the unrelated statement q fails to hold. Routley and Meyer's vision of the logic of relevance is one which grounds relevance on a family of 'worlds' or better 'scenarios' or 'set-ups' which may be incomplete (deciding neither q nor $not-q$) and inconsistent (taking both p and $not-p$ to be true).

This analysis of the logic of relevance is well-understood throughout the logical community, but it is perhaps salient that it was in Australian soil that these radical ideas most took hold, were taken seriously and thoroughly investigated. Since the first flush of these ideas in the 1970 and the radical impressions made by the founders, the current state of play in relevant logic is perhaps more measured and conservative. Recent work by Mares and by Restall has brought work in relevant logic in close connection with other traditions in information theory and 'situation semantics.' Though developed in isolation from much of the rest of the world, these ideas are now a part of the great tradition of modal and so-called "substructural" logics.

However, relevant logics are, in one important sense, the less radical sibling in the family of non-classical logics studied in Australia. The relevantist says that the argument from the contradictory premise p and $not-p$ to the conclusion q can break down on grounds of relevance. The fact that the premise is never true does not mean that the conclusion follows: one way to understand this is to say that there is an 'impossible scenario' in which p and $not-p$ is true, but q is not. Relevant logics are, therefore, *paraconsistent*. They do not take inconsistent information to be disabling. Relevantists do not take inconsistencies to be possible, but they at least allow that we can tell stories about such things, and in the telling of those stories the meanings of what we're saying doesn't break down irreparably, we can still tell what the things are *about*. We can still apply the concepts to those things in these inconsistent scenarios. However, not all paraconsistentists are paraconsistentists on the grounds of relevance. Some Australian logicians are famous for taking a harder line on contradictions. Instead of thinking of these inconsistent scenarios as merely hypothetical, some would have us think of them as *possible*, and indeed that some inconsistent scenarios are the way things actually are. This is the paraconsistency of the *dialetheist*, one who takes some contradictory statements to be *true*. Dialetheism is the radical strand of Australasian philosophical logic.

We can introduce dialetheism by way of the paradoxes. Consider the *liar* paradox

This very statement is not true.

Reasoning about this statement, if it is true, then what it says, goes. But what it says is that it's not true, so if it's true, it's not true. That must mean that it *isn't* true. But then, what it says, goes: it *is* true. QED. The *liar statement* is true, and it isn't.

Or so says the dialetheist.

The traditional response to this reasoning is to point to some principle I have used somewhere, and blame that. Frankly speaking, there is no consensus on where we should point the finger of blame. It is not called the liar *paradox* for nothing.

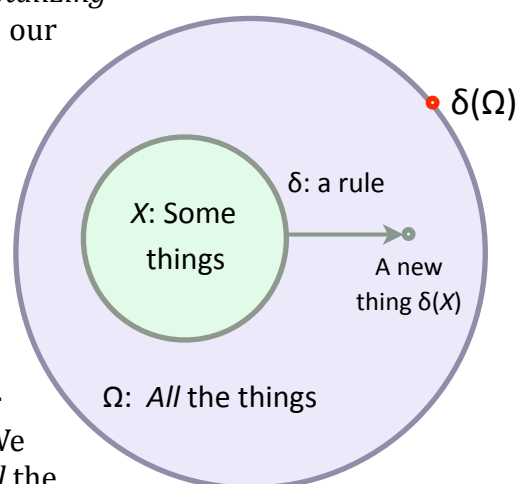
The dialetheist takes the more radical position, to say that this reasoning is all OK as it stands, and that we should simply accept the conclusion. This is a case where the contradictory pair of statements “the liar statement is true” and “the liar statement is not true” are both *true*.

Now, this requires a revision of our traditional understanding of how logic works, for it is nothing of not widely assumed that if a statement is true, then its *negation* is not, and that there is no circumstance in which a statement and its negation are both true. Here, the connection with relevant logic comes into the fore. Dialetheists have willing partners in relevantists, who agree that we should consider circumstances in which inconsistencies hold. Relevant logics have helped provide a coherent understanding of how inconsistent scenarios are to be modelled: relevantists and dialetheists differ only on whether we are to think of any of these circumstances as the way things *are*.

Graham Priest (UWA, then Queensland, then Melbourne) is Australasia’s — indeed, the world’s — most prominent dialetheist, and his students and colleagues, Chris Mortensen (Adelaide), Dominic Hyde (ANU, then Queensland), Mark Colyvan (ANU, Tasmania, Queensland, then Sydney), Koji Tanaka (Queensland, then Macquarie, then Auckland), JC Beall (Tasmania, then Connecticut), have applied dialethic ideas to issues of mathematics, semantics, vagueness and ontology. In this research, philosophical logicians are undertake (at least, collectively) a dual task. The technical part of the exercise is to develop and articulate the logical theory: this part of the work is mathematical and precise — though it is motivated by concerns in philosophy. The discursive and interpretive aspect of the work is to defend such accounts of things, and to tell a story about what it might *mean*. In the case of dialetheism, this dual task has been doubly urgent, because of the number of “incredulous stares” from colleagues, both friendly and not-so-friendly, who, understandably, take the doctrine of the possibility of true contradictions to be literally unbelievable.

Priest’s work, especially, views the inconsistencies arriving from the paradoxes as not merely a trivial, technical or ‘housekeeping’ matter at the outlying edges of our concepts. For Priest, the paradoxes come from the *totalizing* nature of our concepts: it comes from applying our concepts to their limits. The picture goes like this:

For many of our concepts, there is a field Ω of application: truth applies to statements, concepts to objects, sets are members of sets, etc. In many cases we have a rule δ where for any *subset* X of that field, Ω , we are able to find a thing $\delta(X)$ which is outside the original set X , but which is inside the field Ω . For example, given a set X of numbers, we can ask for the least number greater than all of them. That is a number (at least, it is if we continue conting into the *infinite*). We then ask, what about applying δ to the collection Ω of *all* the



numbers? It's a number, but it's bigger than all the numbers! Priest's dialetheist argues that we have a true contradiction here: $\delta(\Omega)$ is both bigger than all the numbers and is one of the numbers. It is not our place to assess the strength or otherwise of the argument here.* Suffice to say the *inclosure schema* provides a fruitful and interesting view not only at mathematical and semantic paradoxes, but also of other totalising phenomena from early Greek philosophy to poststructuralist paradoxes of the late 20th Century. Dialetheism provides a unique analysis of inconsistent boundaries at the limits of thought.

Other Streams

I have not been able to touch on other important streams in philosophical logic in Australasia: I must only mention other highlights here. In the 1970s and 1980s the teaching of logic both in Universities and in Schools in Queensland was revolutionised in the work of Rod Girle. Logic formed a part of the high-school curriculum in Queensland in the 1980s, and Girle's teaching methods have brought logic to classes of hundreds and thousands each year, at Queensland, and now at the University of Auckland. The teaching of logic in Australasia has long been a matter not only of practice but also critical reflection: Rod Girle founded the *Australian Logic Teachers' Journal*, which ran during the 1970s and 1980s, and Timothy van Gelder (Melbourne) brought a reflective practice to the teaching of critical thinking: he researched the effectiveness of teaching methods in critical thinking courses, and has shown that structured argument mapping techniques significantly improve students' ability to analyse and evaluate arguments.

The research community in philosophical logic Australasia has regularly been enriched by outsiders coming to visit and to stay: Hazen, Humberstone, Mares, Meyer, Priest, and Segerberg all came to Australia from elsewhere. Pavel Tichy (Otago) and Stan Surma (Auckland) also came to Australasia from Europe, enriching our community with expertise in transparent intensional logic and consequence relations, respectively. More recently, Jeremy Seligman (Auckland) came from the UK, via the US, bringing with him expertise on situation theory and hybrid logics.

In the late 1990s and early 21st century, Australia and New Zealand has seen more home-grown expertise in logic, but migration both into Australasia and out will continue to enrich and cross-fertilise philosophical logic and its surrounding disciplines.

The Way we Do Logic

I will conclude by considering the way Australasians *do* philosophical logic. As with other aspects of Australasian life, we are influenced by our isolation from the rest of the world. The centres of power and influence of the English-speaking academic world are far-enough away for radical ideas to take root here, without the watching eyes of any Orthodoxy. Prior's work in modal and temporal logic was a strongly minority interest during the mid 1950s, and it was at the forefront of the development of these ideas which are now completely mainstream in philosophy in the English-Speaking world today. Relevant logic started its life in the work of Anderson and Belnap in the United States, but it never reached a critical mass and *dominated* an environment in any place other than Australia in the 1970s and 1980s. Paraconsistent logic (and to a lesser extent, dialetheism) is now widespread, but centres of research are to be found in Australia,

* I haven't even *given* all the argument: the most interesting part of the argument is Priest's defence of the claim both that $\delta(X)$ is always larger than the numbers in X , and that $\delta(\Omega)$ is itself a number.

Canada, Brazil, Belgium and Italy: each of which is, to put it politely, outside the major US/UK axis of English-speaking philosophy. Our isolation provides room for idiosyncratic theorising to flourish, without the kind of uniformity imposed by a conservative orthodoxy.

But rebelling against orthodoxy for its own sake is not *much* of a virtue.* The virtue, it seems to me, in the Australasian approach to philosophical logic is the way that we have viewed logic itself. In a very important sense, the idea is not a new one: it goes back to Immanuel Kant's view of logic as a mere account of the form or structure of thought. This is both very humbling and inspiring. The view is humbling because we don't get to examine what particular thoughts are *about*, but merely their general form or structure; and it is inspiring because when we do logic we are giving an account of the structure and form of *thought as such*. Different logical theories in the tradition of modal, relevant and paraconsistent logics are providing tools for understanding the kinds of things we can say and can think — we are giving theories of the very stuff of our thought and talk. Looking back on our work in Logic over the 20th Century and into the 21st, you can see that our accounts of the forms of the things that we can say are very different from Aristotle's. Aristotle's logic subsumes judgement into the subject–predicate form: *all footballers are bipeds*; or *Socrates is a footballer*.

In our work in philosophical logic we have an account of logical structure in opposition to Aristotles: claims of possibility and necessity have their place and they have a different logical structure to other kinds of claims. Paraconsistentists and dialetheists proffer a different account of what we are doing when we *negate* or *deny*. When you develop a logical theory you are sketching out a map and proffering it as a way of viewing the landscape of what we can say and think. When logic is done well, that is a large and roomy map, which can serve as a place where different positions and theories and accounts can find their home, and which gives us illuminating ways to understand relationships between different claims and theories, and provides ways to see interconnections where we couldn't before.

If you think of logic like *that*, then you see it as opening up spaces for consideration and bringing new possibilities or interpretations to mind: The caricature of logic is that it is the kind of thing which *constrains* debate, by merely drawing out the inexorable conclusions which follow inevitably from the premises we have granted. But logic is never just like that because logic is not only driving the inexorable conclusions where the person doesn't necessarily want them to lead, logic isn't just about what arguments are *good*, it's also about what arguments are *bad*, and how conclusions don't have to follow because now we understand that there are different possibilities we may have not previously considered. Even more helpfully, accounts of logic provide us with new ways to say things, new understanding of what we have already said and thought, and a new sense of possibilities ahead. If the past is anything like the future, or even if it is radically different, there is reason to hope that philosophical logic in Australasia will play its role in charting out some of those possibilities.

* Though many of us have been known to quote Mao's dictum to "let a thousand flowers bloom, and a thousand schools of thought contend" approvingly. Hopefully the outcome is not to eliminate wrong-thinking opponents when someone has the power to do so...

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