



Railway Dreaming: Lessons for economic regulators from Aboriginal resource management lore

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1 Introduction

A third party access regime is intended to open railway track for use by those other than its owner. In so doing, policymakers hope that the monopoly a vertically integrated railway company has over rail transport region will be broken, and that above-rail operators will compete for business, using the railway track to do so on fair and reasonable terms of access that are overseen by a regulator.

However, an access regime does more than create competition; it also changes the property rights associated with the railway track, transferring some from the original owner to the access seekers who now also operate their trains upon the track. This means the nature of the asset changes; it is no longer purely private property, but is in fact a form of common property resource (CPR). If the track and its access regimes are to remain sustainable into the longer term, the CPR nature of the track must be reflected in its governance. Otherwise, Hardin's (1968) 'tragedy of the commons' may ensue.

This paper focuses on CPR governance mechanisms, and in particular on those used by Aboriginal Australians in the management of their most common resource; the land. Whilst on the surface, there might be few obvious links between a hunter-gatherer society and a railway, in fact the principles used by Aboriginal Australians are quite fundamental, and could usefully support competition and third party access.

Section Two of this paper explores some characteristics of CPRs, and asks whether railways subject to third party access might be considered as CPRs. Section Three provides a very brief overview of the literature on CPR governance mechanisms, drawing out some of the good-governance lessons that have emerged in the literature. Section Four explores governance mechanisms traditionally used by Aboriginal Australians in governing the natural resources necessary for their survival. Section Five then examines how the CPR governance principles developed by Aboriginal Australians might be applied to railways. Section Six concludes.

2 Common Property

The property type that is used to describe a particular resource or asset is a function of the property rights which are attached to it. Few resources are truly owned by a single entity, with no restrictions on their use, even in a modern economy. In fact, property rights can be highly complex, and often a single resource may have many claimants, each possessing a different type of right. A detailed description of the depth of this complexity is beyond the scope of this paper, but Ostrom & Schlager (1992) provide a rather neat schema, which highlights different categories of control, and the property rights associated with each of them. This is shown in Figure One.

Figure One: Types of Control and Property Rights

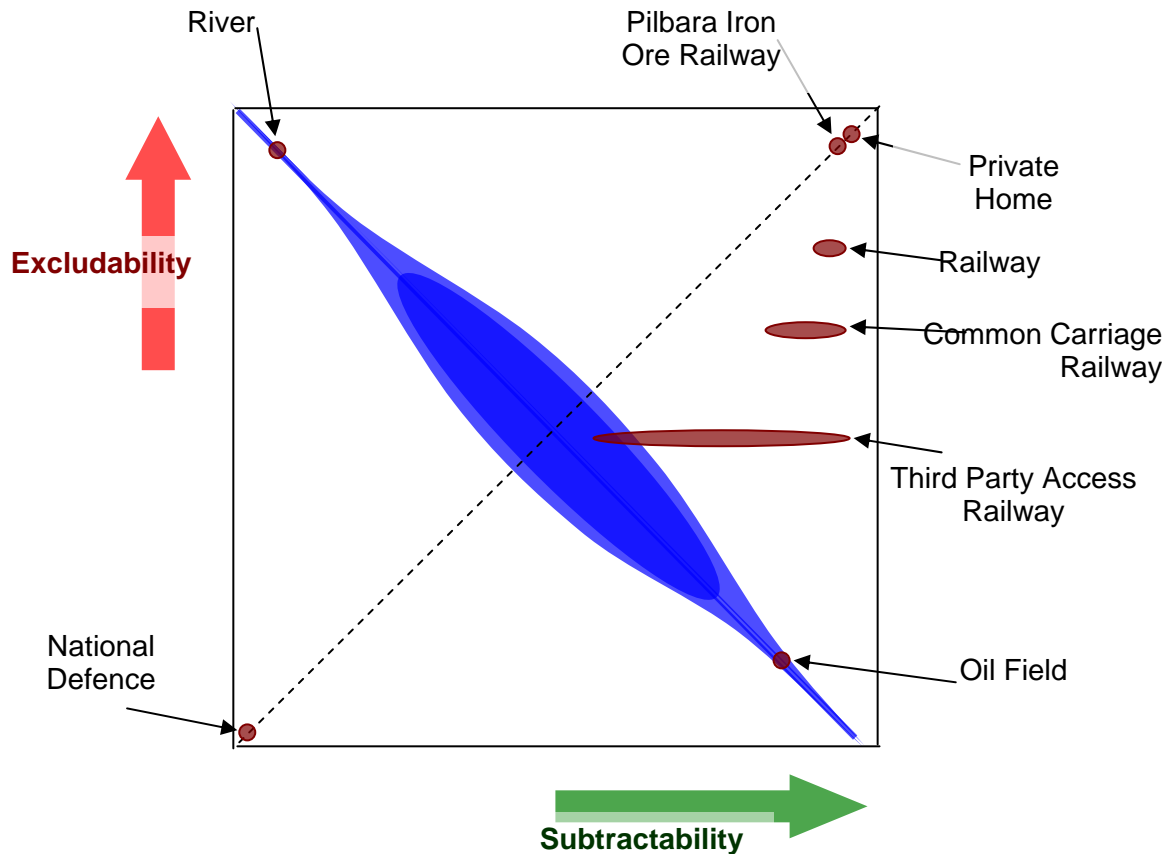
<i>Nature of Right</i>	<i>Nature of Right Holder</i>			
	Owner	Proprietor	Claimant	Allowed User
Access and Withdrawal	X	X	X	X
Management	X	X	X	
Exclusion	X	X		
Alienation	X			

An example of an allowed user might be a villager with profit-a-pende rights to resources in a forest owned by a feudal lord; she can take plants, but has no rights to determine how the forest is managed. A group of local fishermen might be allowed to lay claim to a fishery, after negotiation with a national government, and decide amongst themselves how the sustainable yield of the fishery will be divided. However, they cannot act alone (lawfully) to prevent the government allowing others into the fishery, nor can they sell the fishery to another party. Proprietorial rights might be given to a pastoral lease-holder, allowing him to operate a cattle ranch on a certain piece of land. He could determine how best to use the land for pastoral purposes, and exclude all others from the land, but he cannot sell the land to a third party for a use other than those allowed by the lease. Only someone who can exercise all four of these rights can be truly considered to be an owner of the relevant resource. Even in modern economies, such owners are quite rare. Certainly, much economic activity can be organised with lesser degrees of control.

The different types of property rights give rise to a typology of resources. Economists often make the distinction between private goods, from which rival use can be excluded, and public goods, from which it can't. Ostrom (1990), considers a third type of resource by adding to the criteria of excludability one of subtractability; whether use of the resource by one person takes from the resource something which another party cannot use. Ostrom (ibid) suggests that resources which are excludable and subtractable are private resources (like a mining lease), those which are neither excludable nor subtractable are public resources (like national defence), and that those which are not excludable but are subtractable are CPRs. Whilst private resources are best held in private hands and public resources by the state, CPRs are capable of a mezzanine level of governance, often at a local level. It is this form of governance which may be relevant for some railways.

CPRs need can be natural or man-made, and might be privately owned. An irrigation system is often a CPR, as is a car-park provided by a firm for its employees. In fact, very few resources are pure private goods or pure public goods. The two extremes are rather like perfect competition and perfect monopoly; useful concepts to develop theory but abstract from real resources in the economy. Consider national defence and private housing, often cited as examples of public and private goods (respectively). National defence is largely non-excludable, but nations exclude some within their midst from the protection of the state, expelling or imprisoning them in wartime. Moreover, although one person's consumption of national defence does not impact another's, moving the army from one part of the realm to another does change the ability of a country to defend its borders. By the same token, a private house is largely an excludable resource, but a homeowner cannot exclude the police, meter-readers or other officials who might have need to enter as part of their legal business. Nor can he cannot exclude the objections of his neighbours to the size of his house or noise of his parties. At the same time, although private houses are largely subtractable, they are not entirely so. In a housing estate with many very similar homes, the purchase of one home by its owner precludes others from enjoying that home, but if similar homes are located nearby, then arguably, other home-owners are not prevented from enjoying the same amenities the home provides. Other resources might represent different combinations of excludability and subtractability. Conceptually, one might imagine a schema such as that shown in Figure Two.

Figure Two: The Property Typology Space



In Figure Two, the dotted line represents resource for which excludability and subtractability are traded off against each other. Not all goods need lie along, or even near this line. From the perspective of an upstream user, a river has high excludability (it is relatively easy to prevent others from using the river by damming it), but low subtractability (use by downstream users does not affect that of upstream users, which abstract their water first). It thus sits in the top left of Figure Two. By contrast, an oilfield nearing depletion might have high subtractability (a gallon pumped by one landholder is unavailable to others, and the act of pumping could increase their costs substantially), but low excludability (absent of special laws, it is often difficult to prevent landowners sinking wells on their land). Thus, it sits at the bottom-right of Figure Two. Both the oilfield and the river are examples of CPRs. Between them lies a lens which illustrates the notion of CPRs occupying a “middle-ground” between private and public goods. The fuzzy edges of the lens are intended to encapsulate the notion that the distinction between a CPR and a public or private good is not always clear. Indeed, the same resource might be governed as a CPR in one jurisdiction, be nationalised in another, and be privately owned in a third. Designating a resource as a CPR is, to a certain extent, a social choice rather than purely a technical decision based on the resource’s objective characteristics. However, failure or inefficiency can sometimes result from the wrong choice of governance type. As a final point, a collection of railway types are also shown on Figure Two and these are discussed further in the section below.

2.1 Railways as Common Property

The obvious question to ask is where on Figure Two a railway lies. The answer depends upon the type of railway one is discussing. A railway like those transporting iron ore in the Pilbara, hauling its owners’ ore exclusively and operating where possible at full capacity, sits at the top-right of Figure Two. A commercial railway, providing haulage for third parties, is less excludable, as it has to honour its haulage contracts and therefore does not always have complete freedom to sell space on its trains. Nor can it necessarily alter its train operating schedule on a daily basis as the owners of the Pilbara railways can. Moreover, if

future demand is uncertain and investment lumpy, it may choose to operate with some spare capacity, meaning that use of capacity by one customer might not necessarily preclude use by another. Thus, the indicator for a commercial railway is further down than that for an iron ore railway, in indication that it is less excludable, and elongated into an oval, to indicate that it may be subtractable to varying degrees. A common-carriage railway follows a similar argument, except that the fact that it is required by law to haul the freight of all comers reduces excludability still further, and may induce more spare capacity to cope with a wider range of unseen demand. Thus it sits lower down than a commercial railway, with a longer oval marking its place.

A railway subject to third party access is different again. The whole purpose of a third party access regime is to reduce excludability. If it fails to do so, then it cannot support competition on the railway and the notion of third party access is a rather empty one. However, if a given piece of railway track is at full capacity, a third party access regime can also be rather meaningless, for the railway track owner has nothing to sell.¹ In fact, there should ideally be a fair amount of spare capacity available for sale on a given railway track to ensure that enough is available to give new above-rail operators the security of tenure they require to incur the fixed costs of establishing their own operations. For this reason, the oval indicating third party access railways is more elongated than those above it. The intersection with the CPR lens indicates that the more a railway subject to third party access has spare capacity, the more it becomes like a CPR.

A third party access regime not only moves a railway towards the centre of Figure Two. It also introduces some new actors (access seekers and regulators) and changes the balance of property rights held by those associated with the railway. In terms of Figure One, third party access seekers have access and withdrawal rights (of slots). The track owner has management rights over the track, and this means that it is responsible for ensuring that its capacity is maintained, and for train management.² Exclusion rights are shared between the track owner and the economic regulator; the former can exclude an access seeker who is unable to meet defined safety or similar standards, but the latter acts as an arbitrator in disputes between track owners and train operators, with an ability to force access. Alienation is shared between the track owner and government. In Australia, rail was privatised and corporatised with leases over the rights of way rather than their outright sale. Track owners can on-sell these leases to new track owners, as happened in Western Australia recently, but they cannot generally close a track and sell the land to another user without first seeking approval from government.

If an access regime is successful, and a railway track becomes a CPR, the question arises as to how it should be governed in order that it remains a CPR and does not suffer from a tragedy of the commons. The issue of effective governance of a CPR is addressed below.

2.2 Good Governance of Common Property Resources

Although not the first to examine CPRs, Hardin (1968) ignited the modern debate with his famous 'tragedy of the commons'. He suggested that, because exclusion was infeasible, users of common resources could privatise the benefits of overuse and socialise the costs, leading to over-exploitation. In a fishery, for example, the fisherman who catches more than his sustainable share of the harvest this season endangers the sustainability of the resource. However, he gains this season because he has more fish to sell. Since all fishermen face the same incentives, he posited an inevitable pressure towards over-exploitation; the tragedy of which he spoke. Hardin offered two solutions; the state could take over the resource and dictate use, or the resource could be privatised. Subsequent public policy has often followed one of these two paths.

¹ Policymakers address this by requiring access seekers to assist in funding infrastructure provided to meet their needs. This, in effect, provides a way of furnishing the track owner with something to sell.

² Some access regimes, notably in Europe, separate train management from track ownership.

There is, however, a third option. Hardin's model was essentially a non-cooperative prisoners' dilemma game and he was endeavouring to understand what outcomes one could guarantee in such a game.³ However, resource users do not necessarily play non-cooperative prisoner's dilemma games when ascertaining how a resource should be governed. In fact, they avoid such games; realising their futility, they instead co-operate and seek solutions which leave them all better off. Hardin was, in effect, too pessimistic.

This is the conclusion of the large CPR governance literature which challenged Hardin's conclusions, and found in fact that a defining characteristic of human cultural history is that people find ways to cooperate in resource management. There are both theoretical reasons why a tragedy need not happen (for example Aoki, 2001, Sethi & Somanathan, 1996 or Anderson & Swimmer, 1997), and empirical case studies showing where it has not (see Martin, 1989). Elinor Ostrom is perhaps the most prominent advocate in the field, and the International Association for the Study of the Commons (<http://www.indiana.edu/~iascp/>) the most prominent repository of literature associated with it.

It is beyond the scope of this paper to effectively summarise the vast CPR governance literature, which is why I focus on Aboriginal Australia in the following section. Moreover, as Ostrom (1990) suggests, the field has yet to develop a robust theory of CPR governance to match the theory of the state or the theory of the market, which explains the circumstances in which CPR governance is demanded and supplied. However, circumstances where CPR governance mechanisms are likely to work successfully have been categorised, as have a set of good governance principles. These are explored below.

Ostrom (2000) suggests that resources which share the following characteristics are more likely to be effectively governed via a CPR governance mechanism:

- Those where feasible improvements can be made.
- Those where indicators of condition are available at low cost.
- Those where the flow of benefits from the resource is predictable.
- Those where the system is small enough that its boundaries can be known and internal workings ascertained.

Whilst this list may give small hope to those involved in the climate-change debate, the above criteria seem easily satisfied for a railway. Railway track can support traffic in a variety of conditions, and it is usually not technically difficult to improve poor track (the economic viability of doing so is a different matter). Moreover, it is not technically difficult to check track quality or calculate track capacity, which shows what flow of benefits might be obtainable from it. Railways can be complex systems, but their physical boundaries are clear, and it is usually possible to ascertain how each one operates. Certainly, they are much simpler systems than an ecosystem.

Ostrom (ibid) also categorises the characteristics of stakeholders which support the use of CPR governance mechanisms. These are as follows:

- The resource itself is important to all parties.
- The parties have some form of shared vision about the use of the resource.
- The future is important to all parties (discount rates are low).
- Trust and reciprocity exist.
- The parties can write their own rules without being subverted by a higher power.

³ In a prisoners' dilemma game, two suspects are separated and told that if they inform on the other suspect, they will get a lesser sentence, with a conversely larger sentence for them if the other suspect informs on them and they say nothing. The police in this game do not have enough information to prosecute without one suspect "ratting" on the other, so the optimum (from the perspective of the suspects) is for both to say nothing. However, the incentive is to rat out the other party, and hence each gets a small sentence, rather than no sentence at all. The game is an allegory for a rather common situation where parties cannot communicate.

- The parties have some management experience.

The stakeholders for a railway track with third party access are usually business-people, and can hence be expected to have the requisite management experience, and abilities to generate trust and reciprocity, which are both essential for business. The remaining characteristics, however, are less clearly in evidence. Railway track is not necessarily of equal importance to all who use it. Intermodal shippers, for example, might also have access to competing road transport options, and thus be less willing to devote time and resources to a CPR governance mechanism. They are also likely to have a wide variety of visions for the future, in common with the different goods which they carry. Where the parts of the chain connected to the railway which they own privately have low fixed costs, which they can amortise quickly, they may not place sufficient importance on the future to support a CPR governance mechanism for a railway. Thus it is not clear that CPR governance mechanisms will be universally successful for railways.

However, not all railway stakeholders such shortcomings. Owners of mines, dependent upon railways for haulage place great importance on railways. This importance is also likely to be long-lived, given the high fixed costs they have incurred in their own mining operations, which would be lost if the railway failed. Where many mines in an area mine the same product, or product all designed for the same purpose (export, for example), they are likely to share a common vision. Thus, railways serving these stakeholders seem more likely to be able to develop good CPR governance mechanisms for their railways provided they are given the latitude to do so by government.⁴ Such latitude is not always forthcoming, due to conflicts with broader policy goals. In rail, policymakers are concerned about the degree to which industry self-government could result in a closed shop on a given railway line, damaging competition. Thus, where participants in logistics chains have been granted rights to work co-operatively (such as in the Hunter Valley) and create CPR governance regimes, these rights are rather circumscribed, and subject to assessment and frequent validation by the economic regulator. It is not the purpose of this paper to argue whether the potential for restraints to competition is worth this intrusion, but it seems unlikely that an industry subject to such oversight will develop robust CPR governance institutions by itself.

If these are the situations in which CPR governance rules are likely to arise, what characteristics do good CPR governance mechanisms possess? Ostrom (1990), surveying case studies of long-lived (operational between 100 and 1000 years) sets of rules, suggests that, whilst it is impossible to speak of “optimisation” in the sense that most economic models do, (since there is seldom sufficient information available), it is possible to distil the following seven principles of good governance:

- Clearly defined boundaries: participants need to know what rights they have, and over what territory or set of resources those rights exist.
- Congruence with local conditions: the rules and technology employed need to suit local physical and social conditions.
- Collective choice: those affected by the rules should be able to participate in decisions made associated with those rules.
- Monitoring: the policeman of the system should be accountable to its operators.
- Gradated sanctions: punishments for minor sanctions should be slight, allowing parties that err occasionally to return easily to the CPR governance mechanism, but repeated transgressions should be dealt with harshly.
- Conflict resolution: there must be a means of resolving disputes at the local level.
- Minimal recognition of organisation rights: higher levels of government should give local communities some ability to organise rules, and not subvert the process.

To this, as systems become more complex, Ostrom adds that the systems should be able to nest within each other. Most of the rules hinge upon aspects of poly-centricity; empowering

⁴ Passenger railways may also exhibit the same characteristics.

different jurisdictions with the ability to develop different solutions to the problems they face, rather than imposing “consistent” solutions from a bureaucratic centre. Polycentricity, rather than centralisation of decision-making and power is central to Aboriginal CPR governance systems, and is one of the key lessons which can be drawn from it. The next section discusses Aboriginal CPR governance mechanisms.

3 Aboriginal Resource Management

Australia’s Aboriginal inhabitants exclusively occupied the country for tens of thousands of years prior to white settlement in the late 18th Century. They lived as hunter gatherers, practising ‘fire-stick farming’ (see Kimmerer & Lake, 2001) in an environment where careful resource management was crucial for the survival of their society. The major resource which they managed was the land and sea which provided the resources necessary for their survival.⁵ They did so through a sophisticated system of rules, rights and obligations surrounding control of and access to resources. These rules were very practical, but deeply rooted in spirituality, and associated with the Dreaming; the central Aboriginal creation belief.

It is no more relevant to speak of Aboriginal resource management mechanisms than it is to speak of European or Asian mechanisms, for to generalise in this way is to hide a great deal of diversity. It is, however, possible to speak in terms of a few stylised facts, which provide a useful way of understanding the approach Aborigines used towards resource management. These facts may be expressed as follows:

- Land (and sea) is divided into relatively small plots, and inalienable rights to these plots were held by a relatively small group, usually an extended family. The rights and responsibilities of each member of the family in relation to that land depended upon their status within the family and from whence they had come. The notion of an individual “owner” is less relevant than it is in Western thinking, a fact which has bedevilled Native Title negotiations.⁶
- Associated with each plot of land are a number of sacred sites, which embody the spiritual aspects of the land, and form the constitution of Aboriginal law (Coombes, Brandl & Snowdon, 1983). Associated with each sacred site is a totem (like an animal, a plant species, or the rain) which is important to the inhabitants of all surrounding plots, and specific knowledge pertaining to the appropriate maintenance of that land. Sacred sites are usually associated with hunting bans and other rules which prevent over-exploitation of the resource which is their totem. This acts as a conservation measure, particularly in times of environmental stress.
- Practical and spiritual knowledge are intertwined, and indeed seen as indistinguishable, and thus the appropriate people on each plot of land will know the appropriate use of fire to rejuvenate grass, and the appropriate songs to placate the spirits of the land and ensure bountiful provision of resources. Moreover, both types of knowledge are seen as equally important.
- Knowledge about a plot of land and its sacred sites is itself sacred, and each generation of responsible people must go through a series of initiation procedures to learn aspects of the sacred knowledge. Elders, who possess this knowledge, are respected because of it, and deferred to in decision-making. They also have an obligation to share the knowledge, as this sharing is part of caring for the country under their care by ensuring that future generations know how to manage it. Elders can, however, generally decide to whom they reveal what information, allowing a degree of flexibility which ensures that information is passed to the person who will use it to the greatest benefit of the community in the future.

⁵ The relevant Aboriginal term is “country”, which has a much broader term than in its standard English usage, encapsulating land, sea, air, flora, fauna, (Aboriginal) people currently living on their land and the ancestors (historical and from the Dreaming) and descendants of those people. See Morphy & Frances (2006) or Rose (1998) for a more comprehensive definition and discussion.

⁶ The Pintupi word is *walytja*, a word which literally means “one’s own”, and can refer equally to tools, family or even oneself. Its antonym is *yapunta*, which literally means “orphaned (Myers, 1982). These terms provide a rather neat illustration of how Aboriginal people view property.

- No plot of land is sufficient to support its inhabitants all of the time, using only the resources on the land. However, each usually has some resource which is likely to be in surplus some of the time, and hence available for sharing with outsiders, whose own land may at that time be producing insufficient food for survival.
- Reciprocity is a social norm of overwhelming importance, and ownership is defined by being the person to whom requests for access must be directed, rather than by being the person who can preclude access. Social standing is defined by one's ability to provide something when asked, be it access to land or just a digging stick and each request establishes a future obligation to return the favour, thus cementing social ties.
- Access rights to land are gradated, according to one's level of knowledge about a particular plot of land, and the etiquette of asking for access becomes more formal the more distant are the ties between the access seeker and the person who makes the decision to grant access. Aborigines consider themselves "home" when they need defer to no-one in their access to land.
- Ties between people are based upon kinship, a concept which is intimately tied to the land of one's birth; one is who one is because of where one was born and where all of the people one is related to were born (Rose, 1998). Kinship ties are much more complex than a modern, Western, nuclear family,⁷ and they need to be, because they define the resources to which one can obtain access outside one's own home plot.

These stylised facts give rise to a highly complex, interconnected system. Since land holdings are generally too small to maintain food security for its custodians at all times, groups need to leave their home ground when food is scarce. In fact, most groups spend most of their times living and foraging with extended family groups from nearby plots of land, over a range which consists of all of their respective plots. The foraging groups themselves are not fixed, and an extended family (or indeed an individual) might hunt and forage with one group of people for one season, and another in a different season (Myers, 1982). Members of each foraging group, by virtue of the sacred sites to which they are attached, have responsibilities for different resources that are used by all. For example, members of the "kangaroo clan" would be responsible for maintaining sacred sites associated with kangaroo totems, and thus ensuring sufficient kangaroos are available for all clans in the region. This gives rise to a web of interdependence, and adjacent webs generally overlap such that the whole landscape was patterned with networks of interdependence amongst its inhabitants. Interdependence was a fact of life in respect of resource management; without it, the carrying capacity of the land would have been reduced. However, Aboriginal people also deliberately create interdependence; Layton (1985) discusses the sacred rites of Aboriginals in the Northern Territory, whereby one group of people were responsible for undertaking the rite and another for deciding when it should occur and for helping in preparations. Since the ceremony was vital for the maintenance of the land, it required the two groups to work together. Practising interdependence in this way ensured that it would work as expected when it was necessary for survival.

Interdependence is useful, but unrestricted interdependence can be harmful, because there is no structure within which favours can be exchanged and returned. Ostrom (1990) talks about CPR governance making use of a "lattice of interdependence". For Aboriginal people, kinship ties form the structure of this lattice. They also create a structure within which marriage (a key means of gaining access to resources) can occur and a structure within which people can vouch for others as they move further from their lands, or need to engage in higher-level co-operation. The structure is also obviously not limitless, due to the abilities of each person to keep track of the relevant ties. It would thus require considerable nesting to operate on the scale of a modern economy. The Chinese concept of *guanxi* represents an endeavour to do so which would probably have been recognised by Aboriginal elders, who also operated overlapping networks.

⁷ See Berndt & Berndt (1964) for a detailed taxonomy.

A strong social norm on sharing and reciprocation lacks the transparency of a market with prices where the buyer and seller discharge their obligations towards one another at the point of market transaction, and there is no intrinsic tie created. This is because borrowing and lending replace the clarity of prices with the ambiguity of favours which might one day be returned (by either the person to whom they were granted, or someone else tied to them). However, in a world of great uncertainty about future conditions, the ambiguity of favours might be preferable to the clarity of prices, because the social ties it creates between people are a resource that can be tapped in times of future need.

Thus, for Aboriginal people, ambiguity is not troublesome, but fundamental to their social intercourse (Myers, 1982). For example, kinship ties exist at birth, but are only activated by the actions of the person concerned and the reaction of others, notably elders, to those actions. The activation of each tie can be a complex process, and activation is not always guaranteed. This allows for flexibility in an otherwise rigid kin system, ensuring it can deliver the benefit of patterns of sharing to ensure survival through times of environmental stress without trapping people in the pattern. Ambiguity is enmeshed in ordinary life as well. Aborigines abhor conflict, and thus endeavour to avoid situations where one might need to give an answer to a question which could provoke an argument. Thus, when asking for access to land, one would not ask directly, but might rather ponder the availability of game in a certain area, within earshot of the person responsible for that area (Williams, 1987). The responsible person might agree that game was plentiful, hence giving tacit approval for hunting, or suggest that it is not.

3.1 The Driving Forces behind Aboriginal CPR Governance Mechanisms

The CPR governance system devised by the Aboriginal inhabitants of Australia was designed to solve an important problem; the low productivity of the land over which much of the population ranged and the wide climactic variation which it exhibited. Together, these factors meant that it was not feasible to allocate land such that each group could have been self-sufficient within its own range all of the time; the plots of land required would have been so large that contact between groups would have been minimal, with the attendant dangers of in-breeding and other pressures of isolation. Allocating land in such a way that each plot could mostly support its owners, with some sharing when each plot produced seasonal excesses of different items,⁸ as actually a more efficient response to the conditions in which Aboriginal people found themselves than a regime of pure private property and allows the land to support more people. Indeed, this was inadvertently discovered by white settlers, who did endeavour to divide the land as pure private property when they took it from its traditional owners. McAllister, Gordon, Janussen and Abel (2006) outline the agistment practices of modern graziers in Queensland which (although the authors do not make this comment explicitly) occur for the same reasons and in roughly the same fashion as traditional Aboriginal land management; cattle are grazed on their own lands most of the time, but graziers make use of networks of trust to find pasture in areas where its available when their own lands are barren. McAllister et. Al. (ibid) show how this system achieves better use of the land than more centralised solutions such as government drought relief.

As the example of Queensland graziers suggests, Aboriginal people are not unique in their land management practices. Indeed, theirs is a relatively common response to the environmental circumstances they faced. Perevolotsky (1987) notes similar practices amongst the Bedouin in Arabia, which he calls "reciprocal altruism". Perevolotsky suggests this occurs when regional variation in the probability of good resources being available in any given season is high, and the costs of excluding others from one's own resources in times of plenty are greater than the benefits of having local forage available entirely for one's own use. McAllister et. al. (2006) note similar practises in other semi-arid areas such as Zimbabwe and Niger.

⁸ Provided the timing of such seasonal excesses did not coincide, something the Aboriginal people managed to avoid over time by adroit management of land boundaries and understanding of the reproductive patterns of the resources available.

Whilst this is a common solution, it is not the only one. A modern economist might suggest that the market is the best solution; to trade surpluses in times of plenty to ensure survival in times of scarcity. Alternatively, the state might appropriate surpluses when and where they occur, and transport them to regions of scarcity. Huang (1997) outlines how this formed an important basis for governance in imperial China.

However, both the market and the state require the development of complex institutions which are not necessarily ideal for Aboriginal society. In Aboriginal Australia, the land did not produce sufficient surplus (under the technology then in use) to support a large state such as existed in Ancient China. Moreover, the lack of draught animals, coupled with the poor storability of many foods, meant that, whilst trade certainly did occur (in weapons, ornaments and other small, valuable items), it could not have become the basis for balancing feast and famine in Aboriginal society. Since, neither the market nor the state would have been particularly effective in Aboriginal society, Aboriginal people adopted the sophisticated CPR governance mechanisms outlined above.

3.2 Aboriginal Resource Management and Ostrom's Principles

It remains to consider Aboriginal CPR governance mechanisms against the seven criteria set out by Ostrom (1990). Firstly, consider boundaries. Physical boundaries were well-known to local residents and to neighbouring groups. They were generally associated with some changes in topography or flora (in Aboriginal minds, with the paths followed by their Dreaming ancestors) and were generally more porous in areas with lower rainfall, where survival was more dependent upon the ability to range more widely (Tomkinson, 1988). Each local group was also intimately familiar with its own rights and responsibilities on its own land, and on the land of those surrounding them. People from father away would be less clear about the rules. They would know that boundaries and sacred sites existed, but not always exactly where they were or what rules were associated with them. Aborigines used this ambiguity (which was inevitable; no person could remember all boundaries he was likely to cross in his lifetime) adroitly. An outsider unfamiliar with local rules would know that any mistake would be punished harshly, and thus an outsider on land with which he was not familiar had a strong incentive to contact the custodians of that land first, and seek their permission for the tasks he wished to perform (Altman & Peterson, 1988, Williams, 1982). In this manner, the custodians of the land knew precisely who was on the land, and what resources they were taking. Thus, ambiguity in the minds of outsiders was turned to an advantage which could be used in resource management.

Congruence with technological and social conditions was also achieved. Aborigines did not generally produce staple, storable products like grain, and hence groups had to rely upon neighbouring regions which had a surplus of seasonal produce in their own times of scarcity. With a lack of draught animals to transport food efficiently, they adopted the obvious solution; to move the people to the goods rather than the goods to the people. Who moved where was decided within a network of kinship ties which ensured that resources would not become overused. Similarly, as a pre-literate society, Aborigines could not write their rules down. To ensure the rules were remembered, and to ensure they had the necessary weight to be followed, they wrapped them in the cloak of religion, and made the passing down of religious lore a primary purpose of those within a group who had had the most time to learn and understand it; the elders (Gould, 1982). This is a common approach where literacy is low, and can be used to transmit highly technical information; Bronowski (1973) shows how monks in Japan used it to preserve highly sophisticated sword-making techniques.

Collective choice was exercised via the rights a person had to land. These are never exclusive; usually many decision-makers associated with a particular piece of land, and that each person had rights and responsibilities in many lands. Certain people (usually the first-born son of a first-born son) would have greater decision-making rights and responsibilities, but others who had passed the requisite initiation rituals might also expect a say in decisions of importance. How many of these rituals a person had passed, and hence how much of the

sacred knowledge of a place they knew determined how much of a say they had in the governance of that piece of land.⁹ Social standing was determined by the depth of knowledge one had about a particular site, and the breadth of sites about which one had some sacred knowledge. There was thus a strong incentive to both collect knowledge, and actively take part in decision-making.

Myers (1982, 1988) provides an illuminating account of the Pintupi people in the Western Desert in this regard. A young Pintupi man is born with his kinship ties in place, but not yet activated. To activate them he travels to the lands of his kin and applies to undertake their initiation ceremonies. Through this process, he ritually imbibes the land, and is then authorised to be consulted when decisions are made concerning the land. This not only increases his social standing, but also increases his future family's security, by increasing the network of resources upon which it can rely in times of scarcity.

Monitoring the activities of each group is undertaken through the responsibilities associated with sacred sites. As Rose (1998) explains, each is totemic, and the totem is associated with something which provides benefits to a wider community. Thus, if one group does not maintain its site adequately, the consequences will be widely felt, and other groups will intervene to see that proper maintenance is performed. For example, the totem associated with a sacred site on one group's land might be a rain totem, and hence this group would be responsible for ensuring through the right rituals, that rains were forthcoming. Another group might be responsible for a kangaroo totem, and hence be responsible for ensuring kangaroos were plentiful. Obviously, from a scientific perspective, it is easier to manage kangaroos than it is to manage rainfall. However, Aborigines believed that the spiritual process for ensuring both resources were provided in plenty was the same, and in practice, the result of the spiritual knowledge was a very practical form of conservation.

Justice and conflict resolution are broad topics, beyond the scope of this paper. Eggleston (1976) or Smith (2001) provide more detailed overviews. Compared with Western justice, Aboriginal justice has more of a religious basis, derived from the Dreaming, but it also has its system of precedent. It is administered by the keepers of Dreaming lore, the elders. The focus of its decisions is on maintaining harmonious social interactions. Thus, the presumption is that someone who had committed a crime is improperly socialised, and hence needed to be brought back to the "right path". This is an exemplar of Ostrom's (1990) 5th principle; people are rarely banished from the "game" entirely, but rather justice focuses on making the rules clearer when transgressions occur.¹⁰ Since the application of law involves a constant rebalancing of harmonious social interactions, and since the foundation of law is the timeless Dreaming, the process of law seldom allows for any complete resolution of a dispute; an event entering law often enters lore as well, and can influence social interactions between groups for generations.

Two further aspects of Aboriginal law are important for CPR governance. Firstly, through the kinship system, one could always find someone senior to both parties in a dispute who could act as a mediator (in fact, several people of differing seniority would often become involved). Since the elder(s) viewpoints had great moral authority, they were able to defuse situations. Secondly, it was based upon collective guilt and collective harm, which Smith (2001) likens to ripples fanning out from where a stone has been thrown into a pond. Thus, each wrong action creates 'fields of guilt' amongst the kin of the perpetrator and 'fields of impact' amongst the kin of the victim. Fields of impact mean that a strong individual could not easily abuse a weaker one, because he would have to contend with the abused party's family if he did, and fields of guilt mean that one could bring shame upon one's whole family through a misdeed, and hence internal sanctions were strong.

⁹ Tying decision-making rights to knowledge in this way stands in contrast to modern democracy.

¹⁰ This is not to say that banishment did not occur, nor that capital punishment was unknown. These were imposed when socialisation was either clearly impossible, or the damage wrought by the breach was sufficiently great that social harmony might be threatened by returning the perpetrator to the fold.

The final guideline from Ostrom is not relevant; there was no overarching state. Although each small clan was part of a larger tribe (Berndt & Berndt, 1964, report roughly 500 of the latter at the time of white settlement) these did not perform the same roles as a modern state, and were certainly not in a position to enforce their will on a regular basis on each of the smaller groupings within them. It is perhaps this lack of a higher-order state which explains the sophistication of Aboriginal CPR governance mechanisms.

It is not clear whether it is entirely appropriate to judge the collective wisdom of a thousand generations with the benchmarks developed by just one, but from the perspective of Ostrom's seven principles, the CPR governance mechanisms developed by Australia's Aborigines represent good practice. This is attested to by their long use; no governance mechanism produced by any other culture has exhibited the same longevity, and it is thus apposite to ask whether such a system can provide lessons to those charged with governing long-lived assets such as railway tracks. It is to this issue that I turn in the next section.

4 Lessons for Railway Governance from Aboriginal Resource Management

This section explores how lessons from Aboriginal CPR governance mechanisms might be applied in the governance of railway tracks. Examining the previous section superficially, if modern economic policymakers could somehow imbue railway track owners with the same strong social norm promoting sharing as existed for Aborigines, then much of the controversy surrounding access to the track would vanish. Instead, track owners would compete to provide access for the social status it provided. However, such social norms cannot be imposed in isolation. Instead, one needs to look at what drives the norms. Therein lies the lessons with potentially broader application.

The four key aspects of Aboriginal CPR governance mechanisms which can be translated to the context of a modern railway are fragmented ownership, interdependence, different gradations of decision rights to a single resource and ambiguity.

Fragmented ownership and interdependence should be considered together. If ownership of assets is fragmented, with no further thought about how the fragmented parts might interact, it seems unlikely that an effective CPR governance system will eventuate. Either the system will require ongoing external oversight, or it will fail. Consideration of interaction between disparate parts requires consideration both of what the parts actually do, and what power they give their owners. Although some disparity in power is inevitable, and need not necessarily doom CPR governance,¹¹ it should ideally be equalised as much as is practicable to encourage parties to work together. If this is handled adroitly, the system can often produce more than if no interaction occurs.

Aboriginal Australian's understood these principles, and indeed the carrying capacity of their land was enhanced by such a system. Railways too, have understood it. In the US, Class One railways are able to offer trans-continental services, even though they do not necessarily own track to all of the destinations they serve. They do so by each having track to the destinations they serve most frequently, and then "borrowing" capacity from their peers by sharing wagons or granting trackage rights. Obviously, such arrangements are only sustainable if the parties' net borrowings from each other are close to zero, otherwise one party who is consistently seeking trackage rights might either take over the party from whom it is seeking such rights, or be taken over itself. These governance systems evolved though more than a century of interaction between railways, often without direct government involvement. However, the US rail regulator, the Surface Transportation Board also endeavours to preserve equality in power, usually between railways and shippers, by making acceptance of merger proposals contingent upon their not leading to shippers losing the service of competing railways.

¹¹ See Ostrom & Gardner's (1993) account of Nepalese irrigation systems for both a theoretical exposition and case study example of CPR governance with asymmetric power.

In Australia, fragmented ownership of railways has, historically, been associated with isolation rather than interdependence; each of the State-owned railways carried goods from the hinterland to the main port(s) in each State, and interacted rarely with its peers. However, this historical legacy need not drive the future, and policymakers should ensure that future asset ownership patterns support interdependence and that rough equality in power occurs. This could provide a basis for good CPR governance mechanisms, which are not simply rent-sharing mechanisms, particularly if policymakers consider logistics chains as a whole, and how ownership and power are distributed across them. There are obvious issues of economies of density to consider when considering fragmentation, but this need not necessarily lead to centralisation as the only alternative.

Although railway track is the asset to which access is sought, it is not the only asset in a railway logistics chain. Different ownership of terminals, port infrastructure or maintenance systems may also act to promote the kind of interdependence which promotes a competitive industry. Moreover, it is not necessary to fragment ownership; in some cases joint ownership of assets can achieve the same aim. Lardner (1855) outlines how the car pools developed by railways in 19th Century England helped them develop sufficient interdependence to offer cross-country services, despite fragmented track ownership. More recently, in Mexico, privatisation of the rail network into a series of geographical monopolies involved joint ownership (by the concessionaires and government) of certain key assets critical to the whole system. Joint ownership of a train control system might perform the same role. The crucial aspect is not necessarily what is shared, but how sharing promotes the railways involved working together. Aboriginal people in the Northern Territory deliberately shared responsibility for sacred tasks (Layton, 1985), and this assisted in developing the systems of mutual reciprocity, such that they worked effectively to share the physical resources necessary for survival.

In some cases, despite the intentions of policymakers, interdependence might be difficult to create or sustain. For example, vertical separation is obviously intended to create interdependence between above and below rail operators. However, if the collective demand for track amongst train operators is greater than the amount of track the track owner has to sell, then the track owner can play each of the above rail operators off against each other to obtain a better price. Interdependence become dependence, and regulation is required to rein in the activities of the track owner.

Where this occurs, the Aboriginal solution of gradated rights and responsibilities may help. Indeed, this can be viewed as a way of creating interdependence. The same concept is useful in vertically separated railways, but its use is most clearly illustrated in the case where railways have been vertically separated. Gradated rights and responsibilities associated with a resource provide a mechanism by which those seeking access to it can have a greater say in the decision-making process that surrounds its governance. Whilst premium rights remain with the owner, other users can increase their stake in a particular resource. This is obviously good for the resource user, because he or she can thereby play a role in ensuring that the resource is governed in a way which is more in line with their own desires for its use. This can act to mitigate the dependence mentioned above, and promote interdependence.

However, perhaps less obviously, it is also useful to the resource owner. The basis of providing more rights in the Aboriginal system is the initiation system; those seeking the rights need to make some credible commitments and sacrifices in order to obtain their rights. Aboriginal initiation ceremonies might not be appropriate for railway executives, but the principles are. Those who want to be able to exercise greater rights in relation to the governance of a railway track could do so by making some form of costly commitment to it. This might take the form of a requirement to contribute funds for expansion (not just for infrastructure the access seeker will use, as occurs at present), or it might involve the access seeker allowing the track owner some degree of control over that part of its operations which can most effect track condition, like wheel grinding. The point is that mechanisms to impose

a cost on having a greater say in managing the track provides an opportunity for the track owner to ensure that the dilution of its property right is matched by some concomitant benefit, like a sharing of financial risk.

The final aspect which is useful is the Aboriginal use of ambiguity. Access regimes tend to abhor ambiguity, because it can cloak the abuse of market power. Hence, access agreements tend to be quite specific about prices and terms and conditions of access. Provided parties are able to perceive all of the information necessary to write such contracts, this is not a problem. However, when the clarity of the contract gets ahead of the information needed to support such clarity, problems arise. In such cases, less clarity, and more strategic use of ambiguity, as Aboriginal people do, might make for better access contracts. This, however, is contingent upon power being relatively evenly balanced. If it is not, then regulatory fears of abuse of market power might be realised.

An example from modern industry is perhaps useful. None of the majors (Shell, BP, Caltex-Ampol and Mobil) has a refining presence in more than two states, and transporting refined petroleum between states is costly. They thus need to gain access to the refinery outputs of their peers in states where they have no refining presence of their own. At the same time, they are (or were) roughly symmetric in this need. They could endeavour to gain access through some complex regime which specified price, terms and conditions and so on. However, this is rather cumbersome; it makes little sense for BP to sell a litre of petrol to Shell in WA, and buy back a litre in NSW. Thus, up until 2002, the majors operated a refinery exchange scheme, whereby they would effectively swap petrol produced in one refinery for that produced in another. This was more efficient than a formal access contract, with pricing and associated contractual conditions. The agreement dissolved because the WA government changed the specifications of fuel sold in the state, and hence the refineries were not on an equal footing on cost (WA's was more expensive to produce).

Railways are not the same as fuel refineries, and some more formal means of control are required, if only to stop trains from bumping into each other. However, the example shows that ambiguity (about future fuel needs) can be used to create a better contract, rather than being a burden. Aboriginal social interaction has many such examples.

5 Conclusions

This paper has argued that a third party access regime changes the property rights associated with a piece of railway track, making it a CPR. This occurs regardless of the nature of the nominal owner of the track. Indeed, to be successful, an access regime must do this. If third party access seekers cannot gain some degree of security of tenure over the track they wish to use, then they will be ill-disposed to making the fixed cost investment their above-rail business requires. Thus, the degree to which the CPR nature of the asset is reflected in its governance structure will be a factor in how well it is governed. This leads one to consider CPR governance mechanisms, and what they might bring to the economic governance of railway infrastructure, in support of competition.

Whilst economic regulation is barely a century old, CPR governance mechanisms have been part of human history for thousands of years, and there are thousands of examples from which one might draw lessons. In this paper I choose one which has sustained Aboriginal people and their environment in Australia for tens of thousands of years; their system of land governance. Superficially, there are few similarities between a group of hunter-gatherers using a landscape and a group of railway operators using a railway track. However, as this paper suggests, many of the fundamental notions underpinning CPR governance in Aboriginal Australia could also usefully inform railway governance today. The four which this paper discusses in some detail are fragmented ownership, the creation of interdependence, gradated rights pertaining to assets and the use of ambiguity.

Underlying all of these aspects is a different attitude to power. An unrestricted railway track owner has market power by virtue of its control of a monopoly infrastructure asset. Modern

policymakers endeavour to counteract this power by creating another locus of power; the economic regulator. This can be effective, but requires ongoing, pervasive intervention in the industry by the regulator.

Aboriginals treat power rather differently. Rather than creating a countervailing locus of power, they take the power which exists and spread it more widely, creating polycentricity. Polycentricity requires less oversight from the centre, and in the Aboriginal case, none at all. This was born of necessity; Aboriginal technology did not produce a sufficient social surplus to allow a central locus of power to develop. Thus, power had to be evenly spread. However, Aboriginal people were so successful at generating polycentricity that for tens of thousands of years, without any form of central government whatsoever, they sustainably managed the natural resources of Australia. Few other civilisations can make such a claim.

The advantage of polycentricity is that it requires less centralised control over the system in which it is used. In the context of the railways, there would be less need for economic regulation, because there would be less of a locus of (market) against which the regulator need act. Polycentricity requires an important change in focus on the part of policymakers. Rather than focussing on the visible consequences of an institutional structure which permits the exercise of market power, it requires a focus on institutional structure itself, to find a structure in which these adverse consequences are unlikely to arise. This requires policymakers to ask not what they can do to control the most important consequence of market power, price levels, but what they might do if price was the one thing they could not control, or alternatively, how they might structure the rules of the game such that it did not have to be controlled. Such questions can come only with a change in mindset; policymakers need to think less like schoolmarms, and more like Aboriginal elders.

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