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Circumscription Theory and Sociopolitical Evolution in Polynesia

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Of various theories that have been put forward to explain the origin of the state, one of the most influential has been Robert Carneiro's "circumscription theory" (1970, 1981). Carneiro's theory, coercive rather than voluntaristic, holds that war, conquest, and political subordination played the decisive role in the rise of the state (1970: 734). Carneiro recognized, however, that warfare—while a necessary condition for state formation—is not a *sufficient* condition. Seeking to specify the contexts under which warfare would give rise to the state, he developed the notions of *environmental circumscription, resource concentration,* and *social circumscription.* In this article, I examine the distinctions Carneiro draws among these three types of circumscription in order to establish their utility in explaining the evolution of sociopolitical complexity in Polynesia.

WHY POLYNESIA?

Several factors render Polynesia an exemplary region for testing theories of sociopolitical evolution. First, its stratified societies have provided virtually the "type" examples for the stage of sociopolitical evolution known variously as the "chiefdom" or "ranked society" (Sahlins, 1958, 1963; Goldman, 1970; Fried, 1967; Service, 1975). Rather than being relatively uniform in the details of their sociopolitical organizations, however, Polynesian societies display substantial structural variation, and differential degrees of complexity. A few of the most complex, like Hawai'i and Tonga, arguably meet the criteria for "states" (certainly, they meet the minimal definition set out by Carneiro, 1981: 69; see also Hommon, 1976).

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What makes Polynesia all the more intriguing as a unit for testing theories of sociopolitical evolution, however, is that this spectrum of ethnographic variation is now known to be the historical product of 3,000 years of divergence from a common ancestral society. The highly stratified dual "kingship" structures of Hawai'i and Tonga, the complex chiefdoms of Tahiti, Easter Island, Samoa, Mangareva, and other islands, and the simpler chiefdoms of the Tuamotu atolls all share certain persistent "structures of the long run" (Braudel, 1980) that are shared inheritances of a common history. Thus the ensemble of ethnographically documented Polynesian societies represent the "end-point" nodes of a radiating or branching *phylogenetic* structure, all merging historically in a common ancestral society, itself with even older roots in the ancient Lapita Cultural Complex (Kirch, 1984). Three decades of intensive work in historical linguistics and archaeology, in conjunction with the more traditional ethnographic comparisons, have now provided a firm basis for mapping, in time and space, the historical processes of phylogenetic divergence that led to the ethnographic spectrum of Polynesian sociopolitical diversity (Kirch and Green, 1987). In sum, Polynesia offers an exemplary region for the *controlled and systematic* comparison of divergent sociopolitical evolution among a set of phylogenetically related societies.

This critical aspect of *control* also extends to the environmental contexts within which sociopolitical change occurred. In Polynesia, descendants of the common ancestral society colonized a broad spectrum of environmentally contrastive islands. These environmental differences include climate, which ranged from tropical to temperate; basal geology, varying from volcanic to coralline; and size, from minute (80 hectares, Anuta Island) to "sub-continental" (501,776 sq. kms, New Zealand). Thus, in Polynesia, we have an opportunity to examine how colonizing groups, which at the time of initial colonization possessed essentially the same level of sociopolitical organization, responded in highly varied environmental contexts. This opportunity is well suited to the testing of theories such as Carneiro's, in which environmental characteristics are posited to play a significant role in channeling or constraining, if not actually determining, the course of sociopolitical change. The range of variation in Polynesian island sizes is especially important for the task of evaluating Carneiro's circumscription theory, for it allows us to compare such variables as land area, population size, population density, and agricultural intensity for a series of stratified chiefdoms.

The histories of individual Polynesian societies also vary in another critical aspect, one which is often overlooked in comparative studies: *time*. The Western Polynesian islands (Tonga, Samoa) were first settled about 1200-1000 B.C. On current evidence, however, central Eastern Polynesia (Marquesas, Society Islands, Cooks, Tuamotus) was not colonized until late in the first millennium B.C. Hawai'i was probably settled early in the first millennium A.D., certainly by A.D. 300 (Kirch, 1985). New Zealand, however, was not discovered by Polynesian voyagers until after A.D. 800 (Davidson, 1984). When, as in testing Carneiro's theory, we are dealing with *rate variables* such as population growth or changing density of land use, time is obviously an important consideration.

Space limitations do not permit an exhaustive analysis of every Polynesian case in this article. Instead, I have chosen to focus on three societies—New Zealand, Hawai'i, and Tonga—because (1) these were among the largest of the Polynesian chiefdoms in terms of total population, (2) they displayed a range of ethnographic variation in degree of stratification and sociopolitical complexity, with New Zealand the least stratified, and Hawai'i the most complex, and (3) their environmental settings varied significantly. The major environmental and demographic parameters of these three cases are specified in Table 1.

NEW ZEALAND

Despite being the second most populous Polynesian group, the New Zealand Maori never developed the same level of sociopolitical complexity as that of some demographically smaller Polynesian societies, such as Tonga, Samoa, or Tahiti. Although there were loose supravillage federations in Maori society (the *waka* and *iwi*), the basic political unit remained the autonomous "tribe" (*hapu*), headed by a hereditary chief. These were localized in one or more nucleated settlements, frequently fortified (the well-known *pa;* see Fox, 1976). Maori society evidently lacked anything approaching the centralized supralocal political structures of Hawai'i or Tonga, in which a number of lower and midlevel territorial chiefs paid tribute and allegiance to an islandwide paramount. Given the close correspondence between population size and level of sociopolitical complexity that exists throughout

TABLE 1
Case Study Parameters

Variable	*New Zealand*	*Hawai'i*	*Tonga*
Island type	"continental"	volcanic	upraised coral
Climate	temparate	subtropical	tropical
Total land area (sq. kms.)	501,776	16,692	647
Arable land (sq. Kms.)	10,000	200,000	40,000
Population at contact	115,000	200,000	40,000
Density (per sq. km. of arable land)	11.5	120	82
Population of maximal political unit	3,500	30,000	40,000
Date of colonization	A.D. 800-1000	A.D. 300	1200 B.C.
Time span of prehistoric occupation (yrs.)	800-1,000	1,500	3,000

much of Polynesia (Kirch, 1984: 98-99), New Zealand appears to be an exception. Does Carneiro's circumscription theory provide any clues to account for this?

New Zealand comprises more land area than the rest of Polynesia combined, and its contact-era population density is roughly estimated at about 11 persons/sq. km, one of the lowest in Polynesia. Thus, at first consideration, it might seem that environmental circumscription should not have been a significant factor in New Zealand's sociopolitical evolution. Indeed, one might suggest that the process of population dispersion Carneiro (1970: 735) describes for Amazonia was equally active in the Maori case, leading to the ethnographically documented territorial pattern of dispersed, autonomous, fortified villages.

Actually, the New Zealand case is far more complex. For one thing, North and South islands span a climatic gradient, in which Polynesian horticulture was effective only in the northern half of North Island (and had to undergo substantial agronomic adaptation at that [see Leach, 1984; Davidson, 1984]). Further, the best marine resources are concentrated along the northern coasts of North Island (Davidson, 1984: fig. 95). In effect, New Zealand presents a classic case of *resource concentration,* one of Carneiro's main types of circumscription. Turning to the ethnographic and archaeological evidence, we find that it was among the northern Maori that population was relatively densely settled, and in which warfare, fortified village construction, and political change were most intense, with the competition for limited arable land and marine resources a driving force. Furthermore, in the most densely

settled parts of North Island, *social circumscription* had also emerged by the time of European contact (see Vayda, 1961), with various tribal groups inhibiting the possibilities for a real expansion of their neighbors.

Given that both resource concentration and social circumscription were important factors in northern New Zealand, and that the population approached 100,000 persons, why were the regional polities only at the level of intermediate chiefdoms? The answer, I believe, has to do with time. New Zealand was the last Polynesian group to be settled, between A.D. 800-1000. Even at relatively high rates of intrinsic population growth, insufficient time would have elapsed for all arable portions of North and South islands to become densely populated by the European era.[1] This can be roughly demonstrated in a quantitative way using Carneiro's (1972) formula for the time required for shifting cultivators to achieve a situation in which all available land is utilized:

$$t = \frac{\log \left\{ \frac{W}{C(Y+R)/Y} \right\} - \log P}{\log (1+r)}$$

For the New Zealand case, the total area of arable land (W) has been estimated at 10,000 sq. kms (2,469,136 acres). Using Yen's (1974: 50) data on sweet potato yields, an estimate of 0.4 acre/capita/year can be derived for C, the area necessary to support one person. Ethnographic data on Maori sweet potato gardening suggest an average productive life (Y) for a garden plot of 2 years (Best, 1925; Leach, 1984), and an average fallow period (R) of 10 years. If we then assume an initial colonizing East Polynesian propagule of about 100 persons (i.e., the hypothesized capacity of a large, double-hulled voyaging canoe), we can calculate rough estimates of the time required to create "full land utilization" states under varying rates of population growth (r). We cannot be certain of the actual rate of intrinsic growth in any Polynesian society, and indeed, rates presumably changed from higher to lower over the course of occupation of individual islands (Kirch, 1984: 120-122). At a relatively high average rate of 0.008, however, some 1,160 years would have to elapse to achieve a full land situation. At a somewhat lower rate of 0.002, more than 4,600 years would be required. In other words, given New Zealand's short prehistoric sequence of only 800 to 1,000 years of Polynesian settlement, and short of an extraordinary rate of population increase, it is unlikely that a full land

utilization density situation could have been achieved prior to European contact.

The relatively short time span of Polynesian occupation, coupled with the archipelago's extensive area, thus may account for the general lack of sociopolitical complexity witnessed in the Maori ethnographic record. The density ratio of population to land had simply not reached levels where competition for resources was sufficiently intense to foster territorial conquest and annexation. Yet in the millennium or so that North Island had been inhabited, the archaeological record shows that substantial sociopolitical change did take place, and that the pace of change had started to accelerate greatly after about A.D. 1400. The principal signals of such change are the intensified construction of increasingly large fortified villages, or *pa*.

A recent settlement pattern study by Irwin (1985) of archaeological sites in the Kaipara Harbour area of North Island has provided significant insights to the late prehistoric processes of sociopolitical intensification in the more densely populated parts of North Island. Irwin's dating of a series of *pa* sites reveals a sudden expansion in construction and occupation in late prehistory, "as the settlement system passed through some kind of threshold" (1985: 77). Irwin identifies this threshold as due not only to "internal pressure" on agricultural and other resources, but also to "increasing pressure from groups outside" (1985: 100). In other words, only late in North Island Maori prehistory was circumscription beginning to have an effect on the local settlement system. And, as Irwin further observes, "the implication is that greater hierarchical organization was involved" (1985: 100).

It seems likely that, had Maori society continued to evolve uninterrupted by the Western world for another 500 to 1,000 years, the conditions of resource concentration and social circumscription that were so evident in North Island would have led to the emergence of an early state out of the ancestral chiefdoms documented in the nineteenth century. On the other hand, it is highly unlikely that the South Island Maori, with very low and dispersed populations dependent largely upon hunting, gathering, and marine exploitation, would have moved toward a more hierarchical political system. In short, the seeming paradox of one of Polynesia's largest populations having a less complex sociopolitical organization than other, smaller Polynesian societies resolves itself fundamentally as a matter of shallow time depth in a vast, resource-rich land.

HAWAI'I

At the time of Captain Cook's arrival in A.D. 1778, the Hawaiian archipelago was divided into four autonomous, warring political units, which—depending upon one's definitions—were either highly complex chiefdoms or early states (Earle, 1978; Hommon, 1976, 1986; Kirch, 1984, 1985). Semantics aside, all Polynesian scholars have ranked Hawaiian society as the most stratified and politically complex in Polynesia (e.g., Sahlins, 1958; Goldman, 1970). This being the case, if Carneiro's theory has any validity, the Hawaiian Islands should exhibit unambiguous evidence for circumscription of one or more types.

With a total of 250,000 persons living at roughly 120 persons/sq. km of arable land, both the contact population and the average density of the Hawaiian archipelago were the highest anywhere in Polynesia (Table 1). The high population density, and the historical and archaeological evidence for the distribution of settlement throughout virtually all habitable zones of all islands by about A.D. 1650 (Kirch, 1985), point to the importance of environmental circumscription in Hawai'i. Although large, the Hawaiian islands do not begin to approach the scale of New Zealand, and with an occupation time scale of 1,500 years, competition for arable land had become a driving force in Hawaiian politics by the late prehistoric period. This is indicated both in the archaeological record and in the chiefly oral traditions of the progressive expansion (by conquest and incorporation of smaller units and territories) of the Hawai'i Island chiefdom between about A.D. 1400 and 1790. Carneiro's (1972) formula, applied as in the New Zealand case, also indicates a situation approaching full density. At a high growth rate (r) of 0.008, full land use theoretically would have been reached within 930 years (i.e., by A.D. 1300), and within 1,860 years (i.e., by A.D. 2200) at a more modest rate of 0.004 (see Handy and Handy, 1972, for relevant details of Hawaiian agricultural practice). Only with the lowest rate of 0.002 would a full land situation require as long as 3,720 years.

More than simple environmental circumscription was at work in the Hawaiian case, however, for resource concentration is also significant, both on and between islands. On individual islands, resources differ substantially between the drier leeward and wetter windward sides, and tend to be concentrated in valley configurations. On the archipelago-wide scale, there is a geological gradient from west to east, with the younger, easterly islands lacking extensive areas of valley development

suitable for wet taro irrigation. As I have argued more extensively elsewhere (Kirch 1980, 1984, 1985), it is significant that the region in which political evolution was most intense was the eastern islands of Hawai'i and Maui, where the absence of prime irrigable land meant that pressure on and competition for arable land was much more acute than in the western islands of Moloka'i, O'ahu, and Kaua'i. Indeed, in these leeward slope settings, where shifting cultivation of taro and sweet potato formed the dominant subsistence regime, there is archaeological evidence that regional populations already had achieved a "full land use" density situation by late prehistory. On the other hand, the possibilities for intensive irrigation in windward settings and especially on the more westerly islands allowed for the potential buildup of even greater population densities than actually had been attained by initial European contact.

In short, both "classic" environmental circumscription and resource concentration can be identified as critical elements for the rise in Hawai'i of Polynesia's most complex polity, especially in the leeward regions of the Maui and Hawai'i islands, where the most powerful chiefdoms are known to have been localized. We cannot, of course, ignore the element of time (500 years more in Hawai'i than in New Zealand). Nor does the scope of this article allow me to explore other related factors, such as the role of agricultural intensification (irrigation) as an alternate route to political competition (see Earle, 1978). In short, circumscription theory provides important elements for understanding late prehistoric Hawaiian sociopolitical change, but not a wholly sufficient theory.

TONGA

Situated at the western gateway to Polynesia, the Tongan archipelago was colonized by the Lapita ancestors of Polynesians about 1200 B.C. As archaeological research has shown, it was in this region that Ancestral Polynesian Society developed out of the Lapita Cultural Complex (Kirch, 1984). Thus, of our three case studies, Tonga has had the longest time span for sociopolitical evolution, about 3,000 years. At European contact, the Tongan polity was, like that of Hawai'i, either a highly complex chiefdom or an incipient state (depending again upon definitions). Centered on the main island of Tongatapu, it featured an elaborate system of dual kingship that included both "sacred" and

"secular" paramounts (Gifford, 1929; Guiart, 1963: Appendix; Kaeppler, 1971; Kirch, 1984: 223-226). Outlying districts and islands were governed by chiefs from collateral lines junior to those of the paramounts, who annually sent tribute to the Tu'i Tonga at the chiefdom's central place in Mua, on Tongatapu.

Environmentally, the Tongan islands comprise the smallest of our case areas, with only 647 square kilometers of land area, consisting mostly of upraised coral limestone with sufficient soil and rainfall for shifting cultivation but wholly unsuited for irrigation. Although there are some differences in the distribution of marine resources, there is no marked resource concentration. By the time of European contact, population density averaged at least 82 persons/sq. km (perhaps more, depending upon one's estimate of the contact population), one of the highest densities anywhere in Polynesia.

Carneiro's model of simple environmental circumscription fits the Tongan case well. Applying ethnographic and ecological data reported in full elsewhere (Kirch, 1984: 219-223), we can apply Carneiro's (1972) formula for the calculation of the time required for shifting cultivators to achieve a full land situation. Under a production regime of taro-yam shifting cultivation, the main island of Tongatapu (224 sq. kms) would have reached a full land situation sometime between 300 B.C. and A.D. 700, after which competition for arable land would have intensified, leading to warfare, conquest, and political amalgamation. Although archaeological survey on Tongatapu has been limited (McKern, 1929; Groube, 1971; Poulsen, 1977), a major increase in the density of Polynesian Plain Ware ceramic sites surrounding the inner lagoon shore and other parts of the island suggests a concomitant population density increase by about A.D. 200-300. Archaeological evidence for increasing political complexity and stratification—notably, the construction of large, chiefly burial mounds and other kinds of monuments—appears toward the end of the first millennium A.D. According to a detailed series of historical traditions (Gifford, 1929; Bott, 1982; Kirch, 1984), Tongatapu was unified under a single paramount chief by the early second millennium A.D. Subsequently, the emergent paramount chiefdom in Tongatapu initiated a process of conquest and hegemonic expansion extending northward throughout the archipelago. Archaeological work on the northern outlier of Niuatoputapu, for example, indicates Tongan domination of the local polity by about A.D. 1600 (Kirch, in press).

Tonga thus would appear to offer the most straightforward case in support of the role of environmental circumscription in Polynesian sociopolitical evolution. Again, however, circumscription can only be understood *within the dynamic context* of (1) a rapidly increasing population and (2) a sufficient period of elapsed time to achieve a high density of land utilization.

COMPARISON AND CONCLUSION

Carneiro's circumscription theory does contribute to an understanding of the processes of sociopolitical development in three Polynesian societies for which the particular conditions of circumscription were quite different. In New Zealand, while "classic" environmental circumscription did not play a role on this largest of Polynesian archipelagoes, resource concentration and to some extent, social circumscription, can be identified as factors in the late prehistoric evolution of North Island polities and settlement patterns. In Hawai'i, both environmental circumscription and, to a lesser extent, resource concentration, were highly significant factors in the evolution of a political system that is said to have pushed "the boundary of primitive society itself" (Sahlins 1972: 148). Tonga, on the other hand, presents a straightforward case of classic environmental circumscription, in which Carneiro's model can be applied virtually without alteration.

While circumscription theory therefore stands up to this Polynesian test, I must stress that it is not always an entirely *sufficient* theory. This should not surprise us, for Carneiro presented it in a very generalized form, which perforce requires modifications and elaborations when it is applied to any particular historical sequence of sociopolitical development. For example, as I have pointed out, time depth is a critical factor when comparing the relative sociopolitical complexity of Polynesian groups. Furthermore, application of the model to Polynesia assumes that Polynesian colonizing populations continued to grow at relatively high intrinsic rates, at least until high densities were achieved. An explanation for such high rates of population growth, however, must be sought in phenomena other than circumscription (see Kirch, 1984). Nor can circumscription theory be taken as an explanation for the ultimate *origins* of Polynesian chiefdomship, but only for its differential

elaboration in several societies descended from a common ancestral society that was already hierarchically organized. Other factors, such as the role of production intensification and technological innovation, were also significant in Polynesian sociopolitical evolution and must be considered in any fully sufficient attempt to explain the processes underlying sociopolitical change in individual societies. (Space restrictions preclude further exploration, but see Kirch, 1984; Kirch and Green, in press.) Despite these limitations, however, the "circumscription theory" of political evolution would seem to deserve further application, testing, and refinement.

NOTE

1. The question of prehistoric population growth rates on Polynesian islands is complex, and cannot be reviewed in detail here. Clearly, however, the model outlined in this article depends upon two assumptions: (1) that human populations on all islands tended to grow to high density levels, rather than stabilize at low densities, and (2) that the average rates of growth, at least during initial phases, were relatively similar. In fact, these assumptions are supported both by theoretical considerations and by some empirical archaeological and paleodemographic evidence, both of which are extensively reviewed in Kirch (1984: 96-122).

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