ON NATURAL EXPERIMENTS IN SOCIAL EVOLUTION: THE CASE OF OCEANIA

CHRISTOPH ANTWEILER

Universität zu Köln

Abstract

This paper reexamines M. Mead's suggestion that Oceania is peculiarly suitable for natural experiments in cultural evolution. It is concluded that Oceania, especially Polynesia, provides a paradigmatic case for several factors in social evolution. The conditions that make the region suitable for experiments are discussed, and a number of hypotheses are suggested that are apt for examination in this context.

I. Introduction

The underlying assumption of this article is that the core in the study of social evolution is the explanation of descendence-with-modification of human cultural systems. This implicates parallels with evolutionary biology, but the underlying mechanisms are only partially the same (*cf.* Durham's review, 1990).

I investigate the question whether natural experiments can serve as a remedy against the often all too speculative accounts of social evolution. First of all natural experiments are characterized as a special form of hypothesis-testing fulfilling, if limited, important criteria of "true" experiments. Their usefulness within cultural anthropology was proposed in the fifties with Oceanic examples in mind (Mead 1957). In the following years this idea was mostly just metaphorically used or rejected totally, most probably because the fear of "biologization" of the human realm. I will try to give a methodological synopsis including recent attempts to natural experiments by archaeologists and cultural anthropologists and I will discuss the problems posed by such research designs.

Using the islands of triangle Polynesia as an example aspects of control and regional variation that are important in evolutionistic cultural change theories will be discussed critically. These are related to important issues in the study

of social evolution as 1. migration and diffusion, 2. velocity and directionality of long-term change and 3. the nexus of environment and culture in time, the latter being the theme of a possible "diachronical cultural ecology" in the future.

As a region, Polynesia is especially relevant for modelling local and internal change, and circumscription in human history. Of central methodological significance is the differing degree of isolation of Oceanic islands in time and space. This relative isolatedness is contrary to the misleading conception of total seclusion.

II. Natural Experiments as a Partial Solution to Problems in the Study of Social Evolution

There are some inherent problems in the study of social evolution understood as the search for causes of historical processes, which were already outlined in the introduction to this collection. Experiments are research designs that seek causes by testing hypotheses (including "null hypotheses", *cf.* Connor & Simberloff 1986: 156pp.). Experiments can be conducted in the laboratory as well as in the field. The central method in experimentation is the comparison of an experimental entity with a control entity or as the case can be, to existing data. Disruptive factors resp. third variables are eliminated or at least controlled. For this "internal validity" there are different methods available (elimination, maintaining stability, matching, randomization).

There is a continuum between the poles of true experiments in the above sense and thought experiments. In "true" experiments the conditions of both the test and the control group are examined; the independent variables are manipulated. A special form are "action experiments" (Argyris *et al.*1985: 113), *e.g.* the sailing trials with traditional-type Polynesian vessels conducted by Finney (1977: 277).

"Field experiments" or "quasi-experiments" (Cook & Campbell 1979) are conducted by social reality beyond the influence of the researcher, so he or she can hardly control or randomize disruptive factors nor can independent variables be manipulated. One can distinguish here whether the stimulus was knowingly placed, if not by the researcher, as *e.g.* in changes in management styles or unwillingly placed, as *e.g.* by a recession.

Computer "simulation-experiments" exceed the spatiotemporal possibilities of other experimental designs. They have the advantage that all assumptions must be explicated as the computer allows no ambiguities. Furthermore they often reveal unanticipated and complicated consequences of aggregated simple

processes. But such experiments are hampered by an unrealistic reduction of variables. An instructive example of computer experiments is Levinson, Ward & Webb's (1973) simulation of the settlement of Polynesia.

"Thought experiments" are at the other end of the scale of experimental research designs. In these one tries to control certain factors deliberately as in the well known example of Einstein imagining himself as a traveller on a beam of light reaching the conclusion that he could then not see his face in a mirror (imagine why).

In "natural experiments" a stimulus-like change was "set" in the natural course of history, similar to quasi-experiments. Either a causal component varied diachronically, while others remained constant(s). Thus the alterations in reality can be regarded as a manipulation of the independent variable. Or history delivered differing regional cases in which one component was varied, while in other cases were not. The colonization of one new volcanic island by animals or plants and the colonization of the different Galapagos Islands by finches provide examples of each of both forms. Natural experiments are quasi-experimental in testing hypotheses after the occurrence of the phenomena under study, therefore without the possibility to change the independent variables (thus known also as "ex-post-facto design"). The researched unit can only symbolically compared with a control unit ("correlation design") and the dependent variable can only be measured after the stimulus being set naturally. The advantages of natural experiments is their realism in time and space, thus their external validity is good. But they lack control of third and disruptive variables and thus are poor in internal validity.

III. Oceania as a "Laboratory" of Natural Experiments: Variation, Control and Controlled Variation

Oceania is classical as a cultural realm for applications and – far more seldom – tests of evolutionistic hypotheses (see Thomas 1989a for a recent critical discussion). Furthermore Oceania stimulated specific attempts in far-reaching historical reconstructions as Goodenough's (1955) of a common ancestral form of Malayo-Polynesian landownership. Especially Polynesia was a research focus for island studies in general as concluded by Davidson (1978: 62): "Much of what has been written about the processes of change operating in island culture has been written with triangle Polynesia implicitly or explicitly in view".

It can be claimed that (pace Thomas 1989a; 1989b) it is not just biases in the anthropological literature but specific methodological advantages that prompt

Polynesia as a region of specific anthropological interest. Oceania is the largest of all world cultural realms. It's land area, however, is small and fragmented consisting of a checkerboard of islands with a multidimensional spectrum of different and sometimes extreme environments, the later exemplified by the occurrence of typhoons and tsunami waves. The marine part is, on the contrary, amazingly continuous at first glance.

Madagascar and New Zealand, belonging culturally to Polynesia, provide, due to their size, striking continental complements to the Polynesian triangle taken as a marine realm. As big islands they contain many internal environmental as well as cultural niches providing "island" situations, that resulted in divergent trajectories of social evolution (*cf.* Kottak 1980 for Madagaskar).

Near Oceania is a region settled by humans so long ago that it can be treated "... as if it were a closed (though expanding) system of human communities" (Terrell 1981: 151). Remote Oceania (Micronesia, Polynesia and Melanesia east of the Salomones), especially Polynesia, on the contrary, is the fastest and latest settled of world's cultural realms. The peopling took about 2000 years and occurred sometimes so late that the first settlement can be documented quite well (*cf.* Friedman 1981; Green in Thomas 1989a: 35; Rouse 1986: 19).

Kirch (1980: 39) speaks of about fifty "cultural isolates" in Polynesia, but the isolation is greatly varied as it is often only seasonal, secular or pertaining only to specific respects. Furthermore some islands were culturally isolated after their primary colonization. Thus an unrepresentative choice of the parent population shows the "founder effect" known well in biogeography, in this case pertaining to physique as well as to culture (Green 1967; Terrell 1986). We have biased variations as well as prolonged endogenous cultural trajectories. One methodological problem is to distinguish true random sampling phenomena from culturally mediated pre-migration differentiations *e.g.* in the form of subcultures preferring to migrate. Some coral islands are so small that accidental arrivers could alter the existing culture significantly without being necessarily more adaptive. Vayda (1959: 832) showed that island smallness correlates positively with exogenous cultural influences.

Patterns of adaptive cultural radiation and divergent social evolution are found in situations when environmentally differing islands (or ecozones within one island) were settled from populations of the same origin, paralleled by the Galapagos case in organic evolution. Examples are Eastern Polynesia, Hawaii, the Easter Islands and New Zealand being settled prehistorically from the Societies and Marquesas Island groups (Terrell 1980: 41). Yet another situation arises when an island is settled from numerous other islands by populations differing in their preadaptedness but probably converging culturally (*cf.* Rouse 1986: 9).

External western influence and integration in The World (economic) System *sensu* Wallerstein was, collectively seen, late, rapid and intensive. Regionally it occurred at different times and intensities inviting an "experimental anthropology" exemplified by Hanson's (1973) analysis of political evolution in Tahiti and Samoa.

After having mentioned so much variation in environment as well as in culture we are prompted to ask: What are the constants we need for using Oceania, especially Polynesia for an experimental design in the study of social evolution? Firstly, Oceania as such was settled from one direction, namely from Asia in the West. This is evidenced by many physical, social anthropological, linguistic and, additionally, by recent data on the evolution of human teeth.

This does not deny that (a) some cultural traits, *e.g.* some cultigens, came from the Americas and (b), that there were return migrations within Polynesia. Polynesia shows – despite its many cultural variations mentioned above – basically much cultural, especially linguistic (Pawley 1981) homogeneity compared *e.g.* with Melanesia or Australia or the Indo-Malaysian cultural realm providing a basic source of control.

Other, more specific, controls are given by the geographical limitations of entry into the Polynesian triangle and in the limited transportation possibilities for humans and material culture by boats and rafts. The two possible voyage corridors are characterized by intervisible islands, monsoonally induced wind and sea current reversals and a zone sheltered from tropic summer cyclones (Irwin 1989; 1990: 90).

Polynesia was a virgin territory without previous populations and cultures that would have blended in less isolated circumstances. Thus Rouse's (1986: 37) statement that we have a "one-to-one relationship between language, culture, and race ..." applies at least for the time of first settlement of respective areas. A main methodological problem is that up to now we are not sure how many and which cultural traits and complexes arose within Polynesia itself.

A second possible useful source of control is the scarcity of resources of many and the environmental extremity of some of the Oceanic islands, the Gilberts-Ellice Islands providing an example (Koch 1965). Very specifically adapted artifacts document these environmental limitations. A related, but different, case are specific cultural traits covariating on ecologically similar (that is, controllable) islands, inviting questions about their function.

A very important further control is provided by gradual variations of certain physical factors and biological traits (the later called "clines") within Oceania as a whole. This holds true synchronically as well as diachronically. There are

clines in 1. the distribution of main land masses, situated mainly south of the equator and in the west, the east Pacific being almost free of islands, 2. in the faunal and floral distribution showing a decrease in biomass, numbers and species variety to the east; 3. in the temperature from both the temperate north and south to the warm equator and 4. in the precipitation declining to the east. Apart from these gradual, resp. clinal variations there are "watersheds" and irregular variations across Oceania as *e.g.* climatic seasonality.

IV. Islands Concrete and Theoretical: Circumscription and Relativeness of Isolation

As Oceania is a paradigmatic region for evolutionistic studies so are islands in general classic cases for anthropological studies in the holistic tradition. They seem to provide clearcut boundaries or "cultural microcosms" (Vayda 1968). Apart from the romantic and often escapistic visions of islands, scientifically they can be treated as limited systems, spanning from tiny ecological isolates to the earth as a whole in space. In such a systemic view, microhabitats in trees, mountain peaks or shallow seas in an ocean are islands. Apart from societies in New Guinea, *e.g.* the Tsembaga in an "island" situation within an island, there are cultural examples outside Oceania: the Yana in California isolated by the Sierra Nevada, the Yitsu isolated by inaccessible mountains in China and ethnic groups in Montenegrain Yugoslavia enclosed by mountains and the Yamana of Tierra del Fuego Island isolated from America by the Magellan Strait (*cf.* Its 1975: 22).

The special conditions of life on islands attracted the interest of biologists since Wallace and Darwin leading to the "Theory of Island Biogeography" proposing *e.g.* an equilibrium developing between immigrating and staying populations on islands markedly influenced by island size. Islands are partially isolated, access to them is limited, their surface is restricted, their resources are limited. All this can be summarized by the notion of "circumscription", although it has a specific connotation with the emergence of states in limited environments (Carneiro 1970). Circumscription resp. boundedness as a general phenomenon holds also for *e.g.* modern small (*e.g.* Andorra) and/or landlocked (Laos) and/or island states (Maldives, Comores). The "and/or" points out a yet unresolved uncertainty about the causal core of the phenomenon of circumscription which attracts more and more interest *e.g.* by international development experts.

Islands in the theoretical sense, that is relatively isolated systems, are methodologically rewarding firstly as they are reduced systems making their study easier. Culturally, the demarcation of human communities is less proble-

matic than in continental situations. Consequentially, islands are also especially suitable for studies in the "culture-environment nexus" (*cf.* Terrells 1986 "geographic system").

I claim that the careful study of island cultures is important anthropologically in a more general sense. Most human groups lived for a long time in relative isolation during prehistory, when our planet was scarcely populated. Seclusion in Oceania thus represents long phases of human history encountered seldom today, but important in the evolutionary formation of human societies. This should not be conflated with the misleading conception of contemporary ethnic groups as "isolated tribes" or "closed communities" well known in cultural anthropology.

The specific methodological potential of the islands of Oceania (and probably the Mediterranean Islands as well, *cf.* Cherry 1981) lies in the abovementioned gradual variations providing controlled variation in cause, degree and duration of isolation. We need more data about the isolation of different locales as hindsight is not enough: the degree of cultural isolation between islands for example is not per se higher than within one large island. Inland Melanesia and Remote Oceania represent locales of heightened isolatedness in Oceania (Terrell 1981: 248*ff.*; Irwin 1990: 90).

Island types in Oceania are a classic theme of physical geography textbooks. There are *e.g.* big continental islands (New Zealand), high volcanic islands (Hawaii, Tahiti), there are archipelagoes and small atoll islets (Tuamotu) as well as elevated atolls (Makatea). Island size is a useful ecologic marker as many features are associated with size, *e.g.* ecological vulnerability and extremeness, and effects of tsunami seawaves, of thunderstorms and of quick tectonic movements (Kirch 1980: 45), as well as susceptibility to introduced diseases because of few available species and econiches. Furthermore, due to the low carrying-capacity of small islands there are more density-dependent adaptations than on large islands.

The geographic distance as a second important variable increases generally to the east in Oceania, but there are some sudden leaps as well, this being the case *e.g.* between the Hybrids and Fiji and between Samoa and the Marquesas. There is a physical discontinuity in distance, island size and ecological impoverization between Near and Remote Oceania, which influenced the Lapita settlement. This situation presumably prevented Pleistocene settlers from crossing this barrier.

Polynesia provides many specific "subexperiments" within the great natural experiment of Social Evolution in Oceania. All Polynesian Outliers are small islands (constant), but their isolation varies between isolated atolls and small islands close to big ones (Davidson 1978: 72). Some islands are extremely

sequestered as Tikopia and the Easter Islands. The opposite are islands that lie within archipelagoes surrounded by numerous other islands, likewise if they are altogether more or less isolated like the Tuamotus, the Marquesas and the Society Islands. Altogether the isolatedness of societies differs enormously within Polynesia.

V. Courses and Causes: Tentative Hypotheses on Social Evolution in Oceania

What are the implications of isolatedness resp. circumscription for social evolution in Remote Oceania? I'll begin with general consequences on social evolution and proceed to hypotheses about the evolution of specific social traits or cultural complexes, *e.g.* institutions, that are ascertained on Polynesian islands.

One obvious cultural consequence of limited resources and ecological vulnerability is a requirement of cultivating special land-use systems. Often associated with such developments are complex, sometimes intricate, systems of social organization. On the other hand there will be a limited material technology if there are no suitable materials as *e.g.* wood lacking on small coral islands or if there is a restricted diffusion supply of innovations from outside (Bayliss-Smith 1977: 16). There are chronic shortages of food on many islands with a shifting-cultivation economy having cultural implications as well.

Several hypotheses and observations relate environment and evolution of social structures in Oceania. Goodenough postulated in 1955 that affiliative choice in a cognatic system might be a Polynesian response to the challenge of limited land resources and fluctuation in kin-group sizes. The Polynesian proclivity for the formation of groups by way of fissioning off of junior lines might act as a dispersal strategy for settling favourable zones of a newly colonized island. The institution of hereditary chiefs managing the economy in ancient Polynesian culture after the lowlands were already populated (and thus circumscribed) might be interpreted as a reaction to density-dependant selective pressures (*cf.* Kirch 1980: 47).

The circumscribed environment of islands might also lead to an increased perception of scarcity before actual population decline occurs. Especially the many indirect cues of scarcity will be less precisely perceived by societies interwoven into distributional systems with other social systems (Abernethy 1979: 22). Another implication of circumscription may be increased social complexity by way of competition and conflict as proposed in Kirch's "multivariate model" of evolution of societal complexity (1980: 47).

Some further examples may underline the possible relations between isolatedness and culture. Sahlins (1958) observed a correlation of concentrated resources on small islands with truncated descent lines on the one and of distributed resources on big islands with ramages on the other hand. Friedman (1981: 288pp.) describes the diarchy between political chief and religious priest as the consequence of the contrast between immigrants and the standing population on islands. He furthermore mentions a decline of prestige good systems from west to east within Polynesia related to a decline in the power to control trade due to the increase in distance between the islands to the east.

The west-east gradient from the Hybrids to Fiji is notably instructive. It coincides archaeologically with the arc distribution of Lapitan relics and the probable direction of colonization of the area. We have there an west-east reduction of island size, habitat diversity, habitat crowding and increasing biotic impoverization. A geologic transition from oceanic islands to complex metavolcanoes causes a reduction of available material for tools. All this is increased by a major increase in gaps between islands forming a true "bottleneck" (or "frontier" situation; Rouse 1986: 21) between the Hybrids and Fiji and again between Fiji-Tonga-Samoa and the Marquesas.

What relationship does the long-term natural experiment in social evolution in Oceania have to the classical issues in social resp. cultural evolutionism? Specifically what are the effects of prolonged insularity on the trajectories of societal change? One recent example in this direction is Allen's (1984: 20 pp., 35) finding that the three political types so well known from Sahlins' earlier work, namely elders, chiefs and big men, occurred in temporal sequence within (!) Melanesia. Furthermore they are associated with both size and complexity of respective societies. This three forms of political functionaries can be linked to a further classic in evolutionistic theorizing, evolutionary potential, in this case of patrilineal, agnatic and matrilineal systems respectively.

The character and degree of cultural isolation of an island society is, apart from the distance to the next island culture and the direction of prevailing currents, influenced by cultural characteristics of the society itself. Examples might be a culturally prescribed or technologically limited size of moving parties as well as such or other characteristics of potential contact societies. Lastly the knowledge of the marine realm and general norms promoting migration as well as situational motives to move might play a significant, if poorly understood, role.

Prolonged periods of complete isolation, if rare, may result in the preservation of cultural traits of early settlers evidenced in prehistory (*cf.* Evans 1973: 519) and ethnography (Vayda 1968: ix, xiii). On the other hand, prolonged isolatedness allowed undisturbed endogenous social evolution in some islands.

This resulted often in clearer directional trends than are found today in a more contact open world. Sometimes these trends may canalize societal change and end up in "runaway effects" similar to genetic drift. This has been documented above all firstly for ceremonial systems and secondly for "involutionary" phenomena, that is internal elaboration instead of evolutionary change, within the economic sphere.

The last point hints us to another classic theme in social evolutionism: differential evolution, thus, the differing speeds of different cultural dimensions within a society. Australia in relation to mainland Asia and Tasmania in relation to Australia provide challenging cases of prolonged demographic and cultural isolation leading to divergent social evolution. A further observation is the more continual cultural evolution in Australia in comparison to the Asian continent due probably to lacking influences from outside (Its 1975, Laughlin 1975: 615).

The evidence of a relationship between island size and continuity of change is at best inconclusive up to now. One might test hypotheses, such as that the smaller the island is, the more probable is continual cultural change as large population immigrations are less probable than continual arrivals of small groups. But this holds only true if the island is small but not isolated. Otherwise it might be missed by most sailing parties as potential immigrants. If the island in question is small and isolated it is most probable that exogenous influences will come from different sources. This likely results in a cumulative rather than a substantive form of social evolution, if there are continually arrivals. On the contrary, if arrivals are seldom, a "punctuational", that is abrupt changes might occur following each landing followed by slow evolution till the next arrival.

Small islands are especially vulnerable to population decimation, sometimes up to the total genocidal extermination of the inhabitants. The cause are often natural disasters; the effect being sometimes rapid cultural displacements. Irwin (1990: 92) exemplified with Hawaii and New Zealand, that only large islands are ecologically varied enough for their populations to survive prolonged isolation. Smallness combined with constant scarcity in resources can lead to unique cultural responses as for example forced inter-island contact to provide for food as evidenced on three Western Carolinian atolls (Alkire 1965).

Another theme of evolution, whereas often overlooked, are trends towards less social or technological complexity within social evolution, often called "devolution". An example is the readaptation to hunting and foraging which Chatham Islanders had to accomplish during their move from tropical to temperate zones within the Pacific. Concomitant cultural simplifications as *e.g.* a loss of competitive abilities could be documented in this case (Irwin 1990: 90).

The above hypotheses are only a selection of a multitude of potential hypotheses about social evolution within Oceania and especially Polynesia. These, often conflicting hypotheses, could be tested with natural experiments.

VI. Conclusion

Oceania, especially triangle Polynesia provides paradigmatic case material for several factors of social evolution. To test proposed hypotheses about the course or factors of social evolution it will be necessary to develop the area into a useful "laboratory" for conducting natural experiments.

Firstly, we need a more conscious concept of Oceania as a cultural realm for internal comparisons. There is a need for more data one the different degrees and characteristics of isolatedness of human communities in Oceania throughout history. A step into this direction is Irwin's (1990: 90-94) matrix of distances and angles between inhabited islands of Polynesia and Fiji.

Secondly – besides continuous long-term field studies in island cultures – an anthropologically meaningful concept of isolation resp. circumscription as a systematic phenomenon, which goes beyond the prevailing largely metaphorical notions of isolated island societies, is needed.

Thirdly we would need a theory of cultural transmission in human populations that includes diffusion phenomena, neglected by anthropologists in the evolutionistic stance since the unsettled quarrels between evolutionists and diffusionists early in this century.

If these goals are followed we might proceed to formulate more realistic models in the aim of seeking explanations of social evolution understood as the descendence-with-modification of social systems.

REFERENCES

Abernethy, Virginia
1979 *Adaptation and Cultural Adjustment*. New York, London: Human Sciences Press

Alkire, William A.
1965 *Lamotrek Atoll and Inter-Island Socioeconomic Ties*. Urbana: University of Illinois Press

Allen, Michael
1984 Elders, Chiefs and Big Men. Authority Legitimation and Political Evolution in Melanesia. *American Ethnologist* 11: 20-41.

Argyris, Chris *et al.* (Eds.)
1985 *Action Science*. San Francisco, London: Jossey-Brass.

Bayliss-Smith, Timothy

1977 Human Ecology and Island Populations: The Problems of Change. In: Bayliss-Smith, T. & R.G. Feachem (Eds.), *Substatence and Survival: Rural Ecology in the Pacific:* 11-20, London: Academic Press

Carneiro, Robert Leonhard

1970 A Theory of the Origins of the State. *Science* 169: 733-738.

Cherry, John F.

1981 Pattern and Process in the Earliest Colonization of the Mediterranean Islands. *Proceedings of the Prehistoric Society* 47: 41-68.

Connor, Edward F. & Daniel Simberloff

1986 Competition, Scientific Methods and null Models in Ecology. *American Scientist* 74: 155-163.

Cook, Thomas D. & Donald T. Campbell

1979 *Quasi-Experimentation. Design and Analysis Issues for Field Settings.* Chicago: Rand McNally.

Davidson, Janet R.

1978 Polynesian Outliers and the Problem of Cultural Replacement in Small populations. In: Green, R.C. & M. Kelly (Eds.), *Studies in Oceanic Culture History. (Pacific Anthropological Records* 11, 12) Honolulu, Hawai: Bernice P. Bishop Museum.

Durham, William

1990 Evolutionary Cultural Anthropology. *Annual Reviews of Anthropology,* Vol. 19: 187-210. Palo Alto, California: Annual Review, Inc.

Evans, J.P.

1973 Islands as Laboratories for the Study of Culture Process. In: C. Renfrew (Ed.), *The Explanation of Culture Change. Models in Prehistory:* 517-520. London: Duckworth.

Finney, Ben R.

1977 Voyaging Canoes and the Settlement of Polynesia. *Science* 1961: 277-285.

Fosberg, F.R. (Ed.)

1963 *Man's Place in the Island Ecosystem. A Symposium.* Honolulu: Bishop Museum Press.

Friedman, Jonathan

1981 Notes on Structure and History in Oceania. *Folk* 23: 275-295.

Goodenough, Ward H.

1955 A Problem in Malayo-Polynesian Social Organization. *American Anthropologist* 57: 71-83.

1957 Oceania and the Problem of Controls in the Study of Cultural and Human Evolution. *The Journal of the Polynesian Society* 66: 146-155.

Green, Roger C.

1967 The Immediate Origins of Polynesians. In: G. Highland *et al.* (Eds.), *Polynesian Culture History. Essays in Honor of Kenneth P. Emory:* 215-240. Honolulu: Bishop Museum Press.

Hanson, F. Allan

1973 Political Change in Tahiti and Samoa: An Exercise in Experimental Anthropology. *Ethnology* 12: 1-13.

Irwin, Geoffrey R.

1989 Against, Across, and Down the Wind: A Case for the Systematic Colonization of the remote Pacific. *The Journal of the Polynesian Society* 98: 167-206.

1990 Human Colonisation and Change in the Remote Pacific. *Current Anthropology* 11: 90-94.

Its, R.F.

1975 Ethnocultural Development of External and Internal Isolates. In: S. Polgar (Ed.), *Population, Ecology, and Social Evolution:* 227-234, The Hague, Paris: Mouton.

Kirch, Patrick Vinton

1980 Polynesian Prehistory: Cultural Adaptation in Island Ecosystems. *American Scientist* 68: 39-48.

Koch, Gerd

1965 Der Gilbert-Archipel als ein Sonderfall humaner Oekologie. *Naturwissenschaft und Medizin* 2: 27-46.

Kottak, Conrad Phillip

1980 *The Past in the Present. History, Ecology, and Cultural Variation in Highland Madagaskar.* Ann Arbor: University of Michigan Press.

Laughlin, William T.

1975 Aleuts: Ecosystem, Holocene History and Siberian Origin. *Science* 189: 507-515.

Levinson, Michael, R. Gerard Ward & John R. Webb

1973 *The Settlement of Polynesia: A Computer Simulation.* Minneapolis, Minnesota: University of Minnesota Press

Mead, Margaret

1957 Introduction to Polynesia as a Laboratory for the Development of Models in the Study of Cultural Evolution. *The Journal of the Polynesian Society* 66: 145.

Pawley, Andrew

1981 Melanesian Diversity and Polynesian Homogeneity. A Unified Explanation for Language. In: Hollyman & A. Pawley (Eds.), Studies in Pacific Languages and Cultures: in Honour of Bruce Biggs. Auckland: Linguistic Society of New Zealand.

Rouse, Irving

1986 *Migrations in Prehistory: Inferring Population Movement from Cultural remains.* New Haven: Yale University Press.

Sahlins, Marshall

1958 *Social Stratification in Polynesia.* Seattle: University of Washington Press.

Servive, Elman Rogers

1957 Differentiation by Adaptation in Polynesian Societies. *The Journal of the Polynesian Society* 66: 291-300.

Terrell, John E.

1981 Linguistics and the Peopling of the Pacific Islands. *The Journal of the Polynesian Society* 90: 225-258.

1986 *Prehistory of the Pacific Islands: A Study in Language, Customs and Human Biology*. Cambridge: Cambridge University Press.

Thomas, Nicholas

1989a The Force of Ethnology. Origins and Significance of the Melanesia/Polynesia Division. *Current Anthropology* 30: 27-41.

1989b On the Melanesia/Polynesia Division: Reply to Comments. *Current Anthropology* 30: 211-213.

Vayda, Andrew P.

1959 Polynesian Cultural Distribution in new Perspective. *American Anthropologist* 61: 817-828.

Vayda, Andrew P. (Ed.)

1968 *Peoples and Cultures of the Pacific. An Anthropological Reader*. Garden City, N.Y.: The Natural History Press.