The Detection of Patterns in Alyawarra Nonverbal Behavior

Woodrow W. Denham

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The Detection of Patterns in Alyawarra Nonverbal Behavior

by

WOODROW WILSON DENHAM

A dissertation submitted in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

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1973

Approved by

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This dissertation breaks new ground in social anthropology. It reports a field test of the feasibility of studying human nonverbal behavior by methods ethologists use in studying the natural behavior of non-human primates. The test was conducted during the final four months of a ten-month field investigation of a population of 260+ Alyawarra-speaking Aborigines who live in a cluster of native encampments at a remote cattle station in Australia’s Northern Territory. Mr. Denham collected approximately 200 hours of systematic, quantifiable data on the gross minute-to-minute patterning of ordinary Alyawarra camp behavior—some 50,000 behavior units in all. The dissertation outlines the rationale for anthropological research of this type, describes the nature of the field setting in which the test was carried out, and gives a detailed explanation of the recording system and associated data files. In addition, Mr. Denham illustrates the potential value of his data for precise cross-societal and cross-species comparisons by using a small portion of the material in an extensive analysis of Alyawarra infant transport behavior. The study as a whole is boldly innovative and was executed with admirable attention to detail. We regard it as an original and worthwhile contribution to knowledge.

Dissertation Reading Committee:

[Signatures]
Doctoral Dissertation

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Abstract

THE DETECTION OF PATTERNS IN
ALYAWARRA NONVERBAL BEHAVIOR

by Woodrow Wilson Denham

Chairman of Supervisory Committee: Professor John R. Atkins
Department of Anthropology

Traditionally, cultural anthropologists have devoted most of their attention to those aspects of human behavior that are distinctively or uniquely human, concentrating especially on verbal behavior or behavior that at least presupposes the human language capability. The research reported here was designed to test the assumption that a radically different approach to the study of human social behavior is feasible. The general orientation and the objectives of the research were derived largely from the many field studies of nonhuman primates that have been performed within the last fifteen years, and the methods that were employed were ones that can be used in field studies of the social behavior of any human or nonhuman primate population. A highly modified version of a computer-based notational system originally devised at the Regional Primate Research Center, Seattle, was used in recording 200 hours of nonverbal behavior occurring in an Aboriginal camp in Central Australia. Those records, in conjunction with comprehensive or exhaustive sets of relational, demographic, vital statistical, group compositional, meteorological, and ecological data can be analyzed separately and in all combinations by computer for the detection of population-typical patterns in behavior repertoires, interactions between members of the population, uses of space and time, behavioral periodicities, behavioral correlates of sex, age, kinship and genealogical relations, and so on almost indefinitely.

The first half of the dissertation contains descriptions of the notational system (named BEVRECS) used in recording the nonverbal behavior, the research site in Australia where the ten-month-long field project was conducted, and seven of the major data files generated during the research. The second half contains a wide-ranging introduction to the analysis of BEVRECS data, a detailed examination of infant transport among the Alyawarra Tribe and an examination of that data in cross-cultural and cross-species perspective, and a discussion of some of the problems encountered in performing a reliable “etic” study of a natural population of humans. It is hoped that the objectives, methods and results presented here will contribute significantly to the development of a general theory of sociobiology that will apply to humans as well as to nonhuman animals.
Acknowledgments

The research reported here emerged from a highly diversified and somewhat unorthodox educational background that required the toleration and the support of a great many people. As an undergraduate at the University of Mississippi, I discovered the excitement and adventure of anthropology under the guidance of Thomas Koehler, Department of Anthropology, the importance of conceptual problems in research methodology from John Wolfe and William Wilkes, Department of Psychology, and the basic orientation of the logical positivists from Thomas Flynn, Department of Philosophy. The intellectual tension generated by those four people as I completed the requirements for majors in the three fields of anthropology, psychology, and philosophy demonstrated to me the enormous value of working on problems that are interesting and challenging in spite of the fact that such problems often refuse to fit neatly into the compartments provided by academic disciplines and University Departments.

At the University of Washington, John Atkins accepted and encouraged my interest in disregarding departmental boundaries and at the same time provided the kind of stable reference point required for integrating the disparate methods and topics that led to the dissertation research and the dissertation itself. To him, to David Spain and Simon Ottenberg who served with him on my supervisory committee, and to Annabel Bitterman who performed much of the administrative work associated with my fellowships and research grants, I extend my thanks.

I spent a year as a Visiting Post-Graduate Student in the Department of Anthropology, University of Sydney, where W. Geddes and L. Hiatt were my hosts and advisors, and it was largely through their challenges, advice, and support that the fieldwork in Central Australia received financial backing.

The people in Alice Springs and elsewhere in the Northern Territory were extremely helpful in a great many ways. I am especially grateful to Mr. and Mrs. M. Chalmers of MacDonald Downs Station who welcomed me to the cattle station and into their home, who provided my initial contact with the Alyawarra Tribe and encouraged the Alyawarra to accept me as a friend, and who provided much of the logistical and moral support without which the research would have been much more difficult.

R. Millington of the Alice Springs office of the Commonwealth Scientific and Industrial Research Organization arranged for my use of meteorological equipment required for the fieldwork, and his staff and facilities in Alice Springs provided valuable support throughout the period of the research.

The Aboriginal people with whom we lived and worked accepted us freely and openly. Given the long history of bad relations between Aboriginal and non-Aboriginal people in much of Central Australia, that fact attests to the trust that the Alyawarra have in the Chalmers family, the trust that they can have in aliens such as ourselves when they perceive that they are receiving the respect that they deserve as individuals and as a culture, and the courage that they had in taking a chance that we would not betray them. We hope that we have been and can continue to be worthy of their friendship. Our debt and our gratitude to them are enormous.
The last person to be mentioned is Janet E. Denham who joined me as a field research assistant during the third month of the fieldwork and who subsequently became my wife. Her participation in the fieldwork greatly improved the quality and the quantity of the work performed there; she contributed much time and energy during the keypunching operations; and she has done a major portion of the typing of the dissertation. Furthermore, her own knowledge of the Alyawarra people and of the research methods and objectives have enabled her to constructively criticize and correct the dissertation at all points in its preparation. Although she was not involved in the planning of the research, the fieldwork and the preparation of the dissertation have been in all other ways a product of our teamwork. Her total involvement and support have been essential in making the project as a whole a completely satisfying experience.

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Introduction: General Description of Research Objectives

In recent decades, especially in the years since 1960, behavioral biologists with a wide range of interests and theoretical persuasions have performed a great many quantitatively-oriented field investigations of behavior among various vertebrate and invertebrate species including nonhuman primates. Their research has produced behavioral, ecological, demographic, and, in a few cases, relational data sufficiently comparable, from case to case, to permit fruitful comparisons of social behavior and ecological adaptations across species as well as among different populations of the same species. However, the traditional interests of cultural anthropologists have not led to the collection of any strictly comparable data for any natural populations of humans, and it was in the interest of closing this gap that the research described here was undertaken.

In contrast to traditional ethnography which concentrates almost entirely on those aspects of human behavior that are distinctively or uniquely human, this research emphasizes the neglected but equally important questions of behavioral continuities and commonalities which link man with nonhuman primates and with taxonomically more remote social animals generally. Although anthropologists have dealt in the past with topics that have no direct ties with the language capacity of the research population as well as with topics that presuppose the human language capability, their emphasis has been on language-based or language-related topics; we chose to emphasize topics that were primarily nonverbal in nature because those topics are common to all animal species including man. Consequently, the data sought and the methods utilized in the project differ quite sharply from those which are customary in ethnographic descriptions of human groups.

Specifically, the research had three major objectives:

- to obtain a comprehensive, reliable, systematic, and quantitative body of data pertaining to ecological, demographic, relational, and nonverbal behavioral characteristics of a small population of humans, such data to be strictly comparable, formally and substantively, with data that has been, is being, and can be collected in studies of any human or nonhuman population;

- to develop and test a new research methodology designed for obtaining the required data on nonverbal behavior, and to devise computer-based procedures for analyzing the fully integrated set of ecological, demographic, relational, and nonverbal behavior records; and,

- to use the analyzed data in preparing one or several monographs dealing with the ecology and social behavior of the study population in such a way that the large gap currently separating cultural anthropology and behavioral biology may be narrowed to the benefit of both disciplines.

The anticipated scientific significance of the research is related to the premises of the particular scientific tradition which stimulated us to conduct a study of this kind. Our general theoretical
orientation stems from a variety of disciplines with different substantive concerns but with similar scientific strategies: behavioristic and comparative psychology (Schneirla, 1950; Sidman, 1960; Skinner, 1953, 1959), animal ecology (MacArthur and Connell, 1966), ethology (Hinde, 1966), and primatology (Hall, 1965b). The cited references share a strong emphasis on the need for objective, quantitative descriptions of behavior in laboratory and field settings alike, the importance of the physical environment in determining the behavior of all organisms including man, and the value of Occam's Razor in interpreting scientific data. There is a suggestion, in this research tradition, that one of the prime factors retarding the development of more satisfactory anthropological explanations of human social behavior may be the fact that the fieldwork of cultural anthropologists has dealt with exclusively human aspects of human behavior to the neglect of the behavioral affinities of man with other forms of life. The research described here rests on the assumption that it is worthwhile to test the feasibility of an alternative approach which stresses human - nonhuman similarities rather than human uniqueness.

Specifically, it is anticipated that the body of data collected in the field study will be of scientific value in the following ways:

- by its facilitation of cross-cultural and cross-species comparisons in such behavioral dimensions as are shared by all primates;
- by its utility as quantitative baseline data for subsequent studies of changes in the behavior of the study population; and,
- by its stimulation of testable hypotheses concerning the nature and operation of social and environmental variables that control human behavior.

The objectives of this research have been used previously in formulating research programs with nonhuman populations, and each of the research methods and techniques employed in the course of the field research has been used, in some form and in isolation from all of the others, in laboratory or field research with human and nonhuman primates. Hence, there was a set of indirect precedents for the project, but no precedent, to our knowledge, for the selection and integration of the objectives, methods, and techniques which together constituted the overall program.

Although the research had the objectives explicitly stated above and developed in greater detail below, it can be described most accurately as exploratory research. Kaplan (1964), in his discussion of experimentation in the behavioral sciences, describes heuristic and exploratory experiments as follows. His description undoubtedly applies to observational as well as to experimental research, and in particular, it applies to the research described here:

[The heuristic experiment] is designed to generate ideas, to provide leads for further inquiry, or to open up new lines of investigation. . . . (The exploratory experiment] is frankly intended just to see what would happen IF ______. Often it is associated with new techniques. . . In general, it invites serendipity, the chance discovery; it is part of what we do to deserve being lucky.
Part 1. Research Methodology and Research Site

In order to achieve the objectives stated above, it was necessary to select or devise a set of research procedures that would yield data on the four major topics which have been the foci of attention in much of the field research conducted with nonhuman primates and other animal species: ecology, demography, nonverbal behavior, and relational characteristics. We decided that all of the data on each of those topics had to be collected systematically, it had to be comprehensive and reliable, and it had to be in a numerical or quantitative form. Furthermore, in order for the several sets of data to be analyzed together by computer, it was necessary to design recording procedures such that all portions of the complete data file would be interrelated both logically and structurally.

The first decision concerning research methodology was the selection of an observational behavior recording system (subsequently named BEVRECS) to be used in collecting the required data on the ordinary day-to-day nonverbal behavior of the study population. BEVRECS can be used in virtually any physical setting, but it had never been used in a field study of human behavior prior to this project. Since one of the main objectives of the research program was to develop and test the behavior recording system, it was decided to conduct the research in a physical and cultural setting that would present relatively few observational and recording problems in its own right. This suggested a small population (target size 100 people) with a simple material culture, living in a setting containing few obstructions to visibility. These three basic site selection criteria were met by the population of Aboriginal people, most of whom belong to the Alyawarra Tribe, living at MacDonald Downs Station, Northern Territory, Australia.

Part 1 of the dissertation contains three chapters. Chapter 1 is a description of BEVRECS, Chapter 2 is a description of the research setting, and Chapter 3 is a description of the data files.
Chapter 1. An Introduction to BEVRECS

In his recent book on research methodology in cultural anthropology, Pelto (1970) offers “… a list of essential ingredients that should be present or accounted for in any sound piece of scientific work”. The following is a greatly condensed version of the points contained in his list:

- The problem, the aim, of the particular work should be stated, and that problem should be researchable, at least in principle.

- The essential elements, or terms, of the problem must be defined, and they must relate to observable natural phenomena.

- The procedures of observation must be described in enough detail to permit replication of the research.

- The step-by-step analysis of those observations must conform to the usual canons of logic employed in the sciences.

- The work must be falsifiable.

As Pelto and others (e.g., Harris, 1964, 1968) have stated and demonstrated repeatedly, a large portion of all reported research in cultural anthropology is deficient with respect to one, several, or all of these requirements.

Partly in response to criticisms of poor performance as measured against these criteria, the founders and carriers of the tradition in cognitive anthropology have begun to devise a methodology that meets the demands of their critics, to work some of the bugs out of it in the field and in the laboratory, and to apply it to increasingly significant problems of broader interest within the discipline as a whole (Tyler, 1969). A major limitation of their methodology is that it does not work well in the study of nonverbal behavior - but then there is no good reason to assume or to insist that one methodology should do all jobs equally well. Nevertheless, anthropologists who are concerned primarily or partially with nonverbal behavior still have to rely on inadequate methods.

As anthropologists have become aware of and bothered by methodological problems in the study of human nonverbal behavior, several have attempted to meet the challenge by devising notational systems with which to make better records of that kind of behavior. Some have created highly specialized techniques such as those used in kinesics, proxemics, and choreography, each of which has resisted efforts at generalization for use with other kinds of nonverbal behavior. Others have proposed quite general ones, such as those by Whiting (1963) and Wright (1967), but those are so general that, in effect, they really differ very little from ordinary language. For some purposes they may have advantages over prose field notes, but so far it has not been demonstrated that their advantages outweigh the difficulties they impose on the user. Perhaps Harris' (1964) recording procedures will prove to be both productive and
valuable, but the system as described in the very difficult jargon of *The Nature of Cultural Things* appears to be somewhat inflexible and hard to adapt to a broad range of field conditions and settings. Of course, it is difficult to evaluate a methodology until it has been used and the results published, and nothing has been published yet in the anthropological literature by Harris or his colleagues to allow us to perform such an evaluation. (Cf. B. and J. Whiting, 1970, and R. Edgerton, 1970, for reviews of the dismal state in which we currently find observational studies of behavior within anthropology.)

Each of the notational systems just mentioned was devised specifically for the recording of human behavior. The behavior recording system (BEVRECS) to be described here is an artificial language and quantitative analytical method that was designed initially by Ruth A. Bobbitt at the Regional Primate Research Center, University of Washington, for the laboratory study of dyadic and triadic social interactive patterns and sequences of behavior among mother and infant monkeys. It has been generalized for the use with other primate species in the laboratory; it has been given a field trial in a naturalistic study of baboons in Africa; and it has been and is being used in laboratory studies of mother-infant interactions among humans (Kogan and Wimberger, 1966, 1969; Kogan, Wimberger, and Bobbitt, 1969). In March, 1972, the author completed a ten-month field study of social behavior among a small population of Aboriginal people of the Alyawarra Tribe in Central Australia, with much further generalization, development, and testing of BEVRECS as one of the basic objectives of the project. This chapter deals with the behavior recording system *per se*, and data from the Alyawarra study and from a short research project with patas monkeys (*Erythrocebus patas*) at Woodland Park Zoo in Seattle, Washington, are included only as examples of how the recording and analytical procedures operate.

**Structure.** Before we examine BEVRECS itself, we must look carefully at some basic properties of behavior that have received little attention from cultural anthropologists. Let us emphasize that this will be a discussion of behavior, not of men, monkeys, seagulls, or honeybees, but of behavior of any and all organisms. Unless otherwise indicated, "behavior" will be understood to mean simply "activity or change relative to the environment".

- Behavior can occur only where there is something that can change in some way, be it a subatomic particle, an organism, or a galaxy, and that something must be identifiable, if we are to study its behavior.

- That which behaves necessarily occupies space, and we can talk of its location in space.

- Changes necessarily occur in time, which means that they occur at some particular calendar-and-clock time, that they occur relative to other events in time, and that they have durations.

- Behavior, defined as change relative to environment, can occur only if there exists something other than that which is behaving and the other thing must be identifiable. (For some purposes, it may be convenient to relax this slightly, to permit "the environment" to refer to some part of that which is behaving.)

- We may discuss behavior as an abstract unitary concept, but in empirical research, we must study specific kinds of behaviors. Since there is an unlimited number of ways in which to
categorize behaviors, the selection of a particular categorizational scheme depends upon the purposes for which the scheme will be used. And regardless of the skills or lack of them displayed by the user, his categorization of behaviors will contain some measure of arbitrariness.

Behaviors, then, are more-or-less arbitrary categories of changes in more-or-less discrete and identifiable entities: the changes are relative to the environment in which the entity exists in time and space. A recording system that takes into account all of these properties of behavior should, in principle, be sufficient to the task of recording the behavior of anything whose activity can be perceived by the person or device engaged in studying it.

The characteristics of behavior just described (and others to be introduced below) can be listed as a set of variables by which any bit of behavior can be identified. Each of the variables can assume a specific set of values, and a unique set of values will describe a unique bit of behavior. The variables already introduced will be referred to henceforth by the following names:

- **ACTOR** the "thing" whose behavior is recorded
- **LOCATION** location of the ACTOR in space
- **TIME** moment when behavior occurs, measured against calendar and/or clock
- **ORIENTATION** an identifiable and relevant component of the ACTOR’s environment
- **BEHAVIOR UNIT** a specific category of changes relative to the environment

A value for the TIME variable will locate one event at a certain point in "absolute" time, and the TIMES for two events can be compared to determine which came before the other. Except in special cases, however, there is no way to examine the time values directly for information on the duration of activities. If we wish to examine our records for that information, and thereby obtain a comprehensive coverage of temporal relations, we must introduce another variable to be called TERMINATION. To obtain an equally comprehensive coverage of spatial relations, we may, under certain conditions, need an additional variable with which to record the location of an ACTOR relative to an ORIENTATION. We shall call it the RELATIVE POSITION variable.

The next variable is optional, too, but since it is invaluable in studies of human and nonhuman primate social behavior, we introduce it at this point. It is used in descriptions of activities in which an ACTOR and an ORIENTATION interact by means of another environmental component such as a tool, a toy, an item of exchange, etc. The item through which they interact will be identified as the OBJECT.

This gives us eight variables:

- **BEHAVIOR UNIT** pertains to categories of change.
- **ACTOR, ORIENTATION, and OBJECT** pertain to discrete components of the (arbitrarily circumscribed) system under investigation, with ACTOR being the primary, ORIENTATION being the secondary, and OBJECT being the tertiary focus of attention or interest at a given moment.
- **LOCATION** and **RELATIVE POSITION** pertain to spatial relations.
- **TIME** and **TERMINATION** pertain to temporal relations.
These eight variables certainly do not cover all of the information that could be recorded concerning a particular bit of behavior, and more variables may be added at the discretion of the user. For example, additional variables might include meteorological data, the kin relation between ACTOR and ORIENTATION, a unique sequence number for each entry, the identity of the observer who made the record, and so on indefinitely. These variables are optional, and the recording of values for each of them can be performed after completing an observational record.

In some applications, additional variables may be required for making intelligible records of events as they are occurring. For example:

- Movements between two LOCATIONS may be handled in either of two ways, one requiring only a single LOCATION variable used in conjunction with relatively complicated recording rules, the other requiring two LOCATION variables used in conjunction with relatively simple recording rules. (The nature of the job to be done, not the complexity of the rules, makes one or the other procedure more appropriate for a particular research program.)

- In natural settings more than in zoo or laboratory settings, it is frequently awkward or impossible to record the behavior of an ACTOR as a single entry without seriously distorting the temporal relations among various components of his behavior, or misrepresenting the social complexity of the setting in which the behavior occurs, or both. In order to overcome these problems, it is necessary to record sequentially certain activities that actually occur simultaneously. An additional variable, called CONTINUATION, can be used to mark an entry that is not complete in a single row of the recording form (cf. Figure 2). On the other hand, some of the variables listed above may be unnecessary in certain contexts. For example, if a researcher requires data on the frequencies with which activities occur but not on their durations, or if the research setting makes it impossible to record reliably the times at which certain activities terminate, he may delete the TERMINATION variable; and so on.

The version of BEVRECS represented by the list of variables in Figure 1A has been used successfully in laboratory and zoo settings, and the version represented in Figure 1B was used in our field research with the Alyawarra Tribe. Clearly there are fundamental similarities between the two, but the differences between them are large.
Figure 1. Variables used in two research projects
   A.  Zoo study of patas monkeys
   B.  Field study of the Alyawarra Tribe

The set of five core variables (LOCATION, ACTOR, BEHAVIOR UNIT, ORIENTATION, and TIME), the logical properties of the concept of behavior upon which the selection of those variables was based, and the general format for making behavior records (Figure 2: a rectangular matrix of EVENTS by VARIABLES) remain constant in these and other versions of BEVRECS, but the power and flexibility of the system are enhanced greatly by the freedom the user has in selecting optional variables to meet his own specific requirements.

If we arrange the variables in a certain order as in Figure 1 and assign one value to each of them, we have something to be called a BEHAVIORAL EVENT. There are at least two important reasons for standardizing the order in which the values for the variables will be recorded. If an observer were permitted to record them in any
order, it would be easy for him to make accidental omissions that would result in incomplete records, and it would be difficult for him to assemble completely unambiguous records. Either omissions or ambiguities would create problems for analysts, and it would be virtually impossible to meaningfully analyze records containing both kinds of defects. The order chosen by a user should be chosen for its ease of operation and for its compatibility with research previously performed with the several versions of BEVRECS.

**Vocabulary.** As indicated above, the general problem of behavior recording is as pertinent to the study of subatomic particles and entire galaxies as it is to the study of humans and other animals. Since this behavior recording system can be used in a study of any of those phenomena, it is impossible to select or devise a vocabulary before choosing a particular subject matter. For the sake of convenience and relevance, let us assume that we shall use BEVRECS in a study of the behavior of human or nonhuman primates.

Next, we must make two major decisions: we must select and state explicitly and precisely the problem or aim of the research, and we must select a specific research population. Since the values for each variable, and the definitions of those values, will be determined largely by the nature of the research problem and the composition of the system under investigation, it is impossible to select or construct a vocabulary that is suitable for a particular research program until decisions have been made on these two points.

Before proceeding, we must emphasize the following: The list of values to be constructed for each variable must consist of mutually exclusive items which, when taken together, are jointly exhaustive of the universe in question. That is, no two stated values can overlap, and provisions must be made for recording all possible values of each variable.

Although the real world and the events that occur in it may be continuous variables "in fact", they must be dealt with in a language of discrete variables, and the conversion from continuous to discrete is, of necessity, somewhat arbitrary. Consider the LOCATION variable. Regardless of how we decide to identify different locations - by latitude and longitude, by distance and direction from a bench mark, by plant community type, by political province, etc. - we must accept the fact that the definition that we devise for each value of that variable can be challenged by someone with a better sextant, a better tape measure, or a more refined method of categorizing plant communities. But if we explicitly describe our method of defining each value.

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**Figure 2.** Recording format: a rectangular matrix, expandable in both dimensions, of EVENTS by VARIABLES.
so that anyone else who uses that method can be expected to arrive at the same conclusions (i.e., if we provide operational definitions for each value of each variable), there can be little argument over the reliability, or replicability, of our research.

Either implicit in the two decisions concerning research problem and study population, or derived directly from them, is a third decision that is fundamental in shaping a BEVRECS vocabulary. We must select a "space-time resolution level" (Klir, 1969) that is appropriate for the job in question. This translates roughly as: How much detail is required? If we compare a recording with BEVRECS to a recording with a motion picture camera, we might think of this as a choice between wide-angle, standard, and telephoto lenses (spatial resolution), and high-speed, normal speed, and time-lapse operation (temporal resolution). If we are studying interactions between a mother and her infant in a restricted laboratory setting, we are likely to want to record in minute detail, capturing every observable activity and noting times of occurrence to the nearest second. For a study of social behavior among a small population of primates in a zoo cage, it may be reasonable or necessary to disregard some of the finer points of their behavior such as eye blinks and ear twitches, and to record times to the nearest quarter-minute. In our field study of a human population, where observations were being made at a distance of 150 - 800 feet, it was impossible to make reliable records of things such as changes in facial expressions (which can be handled very easily in a laboratory setting), and a temporal resolution of one minute proved to be completely satisfactory for our purposes. It follows, of course, that pairs of recordings made at two different resolution levels may be difficult or impossible to compare directly.

The concept of the space-time resolution level provides a general frame of reference for examining the old splitter-lumper problem as well. Depending upon the objectives of the research, we might record a particular activity as "limp" (in contrast with "march" and "ordinary walk"), as "walk" (in contrast with "run" and "crawl"), or as "locomote" (in contrast with "manipulate" and "vocalize"). This example comes from the BEHAVIOR UNIT vocabulary, but similar examples could have been derived from any of the other variables. It is a problem that is inherent in devising any kinds of classes, BEVRECS or otherwise, and perhaps the best rule of thumb for handling it here or elsewhere is to be a splitter until the vocabulary begins to be unmanageably large, then gradually begin to lump lowest order taxa (Altmann, 1965). Any time an ambiguous case appears, it can be assigned to a previously defined category and the definition of that category can be expanded to include the new case, or a new category can be labeled and defined. The advantages of being a splitter are most appreciated when it is time to analyze the data, since we can lump values temporarily at that time. If they are lumped during the data collection phase of the research, subsequent splitting is impossible and the detailed information is irretrievably lost.²

Now let us examine individually some of the BEVRECS variables and their values. LOCATION values refer to specific physical areas in which behavior can occur. Generally speaking, the conceptual problems associated with creating this part of the BEVRECS vocabulary will be minimal. ACTORS, the individual members of the study population, should present no conceptual problems either, but the practical difficulties involved in identifying ACTORS rapidly and reliably in a large study population may make it necessary to incorporate into the vocabulary a set of codes for "semi-identified" ACTORS such as "unidentified adult
male", or "unidentified child of unknown sex", etc.

Terms in the ORIENTATION vocabulary refer to relevant components of an ACTOR's environment - and here we have our first encounter with arbitrariness that many may find offensive. By "relevant components of the environment", we mean everything in the environment with which an ACTOR can interact and which the user considers to be significant for his research. The user has the perhaps difficult tasks of deciding which environmental components are and are not relevant for his research, and of providing adequate justifications for his decisions. Many of the items in an ORIENTATION vocabulary may be identical with items in the ACTOR list, since other members of the study population are likely to constitute relevant parts of the environment for human and nonhuman primates, but the selection of other items for representation in the ORIENTATION vocabulary is likely to present difficult problems. Since the vocabulary must contain an exhaustive list of terms, environmental components with which the ACTOR can interact but which the user considers to be nonsignificant for his research must be included under a term such as "other" in the ORIENTATION vocabulary.

Since the values and their definitions for the OBJECT variable will be a subset of those that comprise the ORIENTATION vocabulary, no discussion of them is required here.

Even though it is a bit more difficult to devise a BEHAVIOR UNIT vocabulary than it is to prepare vocabularies for the other variables, there is no difference in principle. As with the other variables, this vocabulary must consist of mutually exclusive items that are jointly exhaustive of the universe in question; all of the items in the vocabulary must be operationally defined; and much attention must be paid to several aspects of the problems of selecting a resolution level and a categorizational scheme that are appropriate for achieving the stated objectives of the research.

In spite of the consensus to the contrary, the total number of reliably identifiable, physically definable, and minimally complex behaviors displayed by any animal (including man, of course) is not particularly large. The "blooming buzzing confusion" that has attracted the attention of so many students of human social behavior comes from the enormous number of possible combinations of a relatively small number of simple behaviors. By "simple behaviors" we mean those motor acts that are readily identifiable as more-or-less discrete and invariable patterns that can be combined to form more complex units but which cannot be further subdivided without reducing them to fragmentary muscular contractions. As an example of a simple behavior, a BEHAVIOR UNIT, consider the locomotor pattern ordinarily labeled "walk". Walking consists of up-and-down movements of the legs repeated in a certain sequence and at a certain rate and magnitude, progressive changes in the location of the walking individual, and a variety of other movements. For some purposes, e.g., in the context of a neurological examination, each upward or downward movement of each leg might be identified as a separate BEHAVIOR UNIT, but in a study of primate social behavior, the stable pattern of motor acts ordinarily called "walking" might be acceptable as a basic unit. This indicates, of course, that the construction of a vocabulary of BEHAVIOR UNITS depends in part on the detection of patterned regularities in the behavior of the subjects of the study, and in part on the objectives of the researcher.

The English language, among others, presents us with a situation that could be quite confusing if it found its way into the BEHAVIOR UNIT vocabulary of a recording system such as
BEVRECS. We refer here to the fact that verbs can have both active and passive voices (e.g., groom, be groomed) and that some activities can be represented by two different verbs that function somewhat like active and passive voices of a single verb (e.g., give, receive). In order to keep BEVRECS as simple, versatile, and powerful as possible, it is necessary to include only the active form of such items in the BEHAVIOR UNIT vocabulary. In other words, "groom" and "give" are acceptable BEHAVIOR UNITS, but "being groomed" and "receive" are unacceptable. Otherwise, unnecessary redundancy is introduced into the records and analysis of those records becomes more difficult and about twice as expensive as it is if the redundancy is avoided. Although this decision might appear to create some serious problems, the problems can be handled more easily by the recording rules than can the problems that would result from its omission.

Vocal behavior can be handled in two rather different ways depending upon the species being studied and the objectives of the research. In laboratory research with BEVRECS, it has been a common practice to tape record all vocalizations occurring during an observational session, then code the sounds for contents, loudness, pitch, etc., and enter the codes at their proper places in the behavior record. When working only with humans, an alternative approach is to develop a vocabulary containing items such as "talk", "sing", "laugh", "cry", etc., and to note the occurrence of these events in exactly the same manner as in the case of any of the other values. Of course, both methods can be used simultaneously if that is necessary or desirable.

The BEHAVIOR UNITS mentioned to this point have been at the level of complexity typified by such words as "walk", "talk", "throw", or "bite". It may be convenient or necessary in some applications to devise BEHAVIOR UNITS that represent activities of much greater complexity. "Fight" and "play" are obvious examples of activities that consist of elaborate combinations of postural, locomotor, manipulatory, oral, and vocal behaviors that occur in patterns that can be identified rapidly and with considerable reliability. Complex sets of manipulative behaviors involved in technical activities might be represented by single terms such as “weave”, “paint”, or “build”. A user must be aware of the tremendous loss in detail that follows from using single terms for these kinds of complex activities, but if that loss is acceptable within the context of a specific research program, there can be no legitimate objection to incorporating such terms into the vocabulary.

A warning: For the results of a research program to be most useful in making cross-cultural and cross-species comparisons, it is important that all items in the vocabulary be defined in physical rather than functional terms. To slip from physical to functional definitions is particularly easy when selecting single ordinary-language terms to represent complex activities. If that mistake is made, the results of the research are likely to be unclear or in some cases even meaningless. ³

The RELATIVE POSITION (an optional variable) of ACTOR viéž-a-viz ORIENTATION will assume values that follow directly from our research objectives. If we are studying arboreal primates, we may decide to use such values as "above", "below", and "same level"; with mother-infant interactions as the topic, we may decide to use values such as “baby at breast”, “in mother’s lap - not nursing”, "less than five feet apart but not touching”, etc. Alternatively, we may incorporate relative position information into other variables. For example, the BEHAVIOR UNIT “carry” indicates that ACTOR and ORIENTATION are in a particular kind
of relative position, and if the CONTINUATION variable is being used, a marker in that column can indicate an activity that is occurring when the ACTOR is a member of a group of individuals. A record made with these organizational principles in mind can be analyzed for three relative positions: "carrying/being carried", "in a group", and if neither of those conditions is present, "alone". We may decide to restrict the use of this variable to spatial relations between the people (e.g.) who constitute the study population, or we may have it apply to relations between people and other values of the ORIENTATION variable as well. For most purposes, the first option should be satisfactory, and it is far easier to use than is the second one.

The TIME variable will assume values that represent the time of occurrence of each event. The user may select or devise a timing technique that best suits his purposes. The conceptual problems associated with this variable are likely to be minimal. Since the entries in the TERMINATION and CONTINUATION columns are related more closely to the operation of the system than to its vocabulary, references to those variables appear in the next section of this chapter.

All of the examples used in this discussion of BEVRECS vocabularies have been derived from the English language since that is the author's native language. This definitely is not meant to imply that the English language and its categorizational principles are necessarily the best from which to derive a vocabulary, nor that BEVRECS can be used only with English language categories. In fact, we hope that studies with and of BEVRECS will stimulate cognitive anthropologists to apply their skills to the analysis of schemes used for categorizing behaviors, a domain that seems to have been neglected by them until now, since their research should contribute to the improvement of BEVRECS vocabularies.

In order to make a behavior record as rapidly as observable activities occur, and to greatly facilitate subsequent analysis of the data, our next task is to devise a set of codes with which to represent the items in the vocabulary. Each of the codes assigned to values of a single variable must be different from all other codes for that variable, but any symbol can be used with different definitions under different variables. For example, we might let VT be the code for "talk", a BEHAVIOR UNIT, and for Victor Turner, a person in the study population who is both an ACTOR and an ORIENTATION. If we then observed Vic talking to himself, we could record it (legitimately but a bit confusingly) as VT VT VT. Obviously it makes sense to retain the single code, VT, for identifying Victor Turner wherever he appears in the record, but we should attempt to differentiate between codes that might be confusing.

As suggested by the code VT for "vocal – talk" and "Victor Turner", it often is useful to devise codes that have mnemonic value. When working at a high resolution level in a simple situation such as that obtainable in the laboratory, it is standard practice to use alphanumeric codes with mnemonic value and to adhere strictly to the format shown in Figure 2 when making observational records. But when working at a lower resolution level and in the much more complex field setting of an Australian Aboriginal camp, it was necessary to use a combination of alphabetic, numeric, and alphanumeric codes and several other symbols, and to view the format in Figure 2 as a flexible guide rather than a rigid frame for making recordings. After each observational record was made, it was converted to a final record in strict accordance with the format in Figure 2, and all values for all variables were represented in exclusively numeric codes.
in preparation for computer analysis of the data.

The ordered set of variables and the coded vocabulary of operationally defined values can be brought together now for making observational records of the behaviors characteristic of a particular population of organisms.

**Recording rules.** In our discussions of the structure and the vocabulary of BEVRECS, we emphasized repeatedly these two important characteristics of the system: its conceptual and organizational principles, and its flexibility and adaptability in a wide range of applications.

There was no attempt to tell a potential user just which variables to include in his research except for the five core variables which seem to be basic ingredients in any objective description of behavior, nor was there any attempt to establish a mandatory vocabulary. We believe that a set of generalized vocabularies, each designed for use at a specific resolution level, may be developed eventually for making records that are perfectly compatible for cross-cultural and cross-species comparisons, but that definitely has not been achieved yet. In this section, we shall be concerned with some of the principles upon which recording rules can be based, but not with individual rules themselves. Devising a set of rules for doing a specific job is the privilege - and the responsibility - of the user.

BEVRECS was designed 1) to facilitate objective and reliable observational recording of the behavior of interacting organisms, and 2) to facilitate quantitative analysis of the records made with it. The second design characteristic means that the utilization of each of the analytical procedures described in the next section of the chapter depends upon our being able to count entries in the observational record. Generally speaking, the analysis of a behavior record will yield numbers or patterns of numbers that represent the frequencies with which individual values or sets of values appear in the records. If this approach to record analysis is to be meaningful, we must insure that all entries can be counted in the same way.

Few people would have any difficulty in understanding and counting the BEHAVIOR UNIT representing a sneeze, an activity that is discrete in any common-sense definition of the term. A sneeze begins, continues for a short and finite time, and automatically ends. The BEHAVIOR UNIT “sneeze” can represent the occurrence (implying onset, duration, and termination) of the activity. However, activities such as sleeping have an indefinite duration, and an entry representing such an activity must be defined with greater precision than is necessary in the case of "sneeze". Since we defined "behavior" as “change relative to the environment", a BEHAVIOR UNIT is a record of a change. This means that we have no interest in repeatedly recording the persistence of an activity that has an indefinite duration, but that we are interested only in recording its changes. With regard to sleeping and similar activities of indefinite duration, the only entries that we can make, or need to make, are those that record their onset and their termination.

One of the basic properties of a BEVRECS vocabulary as described in the preceding section is that the values for each variable must be mutually exclusive and jointly exhaustive of the universe in question. Likewise the list of EVENTS that constitute a behavior record must be mutually exclusive (no overlap in content) and jointly exhaustive (all activities observed at the
selected resolution level must be recorded). By adhering strictly to this rule, biased and impressionistic recording is avoided, comprehensive and systematic records are obtained, and quantitative analysis of the records can be done simply and meaningfully.

The complete set of recording rules to be followed in a given project depends to a large extent upon the resolution level selected in accordance with the objectives and the setting of the research. Activities such as changes in facial expression, which are visible in great detail when the research population is in a small cage and the observer is less than ten feet away from them recording through a one-way mirror, may be perfectly invisible in a natural field setting where the observer is likely to be much farther away. In the laboratory, it may be impossible for any member of the research population to get out of the observer's line of sight at any time, and this enables the observer to make uninterrupted records of the behavior of a single individual as that individual interacts with all of the others in the research population. These factors make it possible, when working in a laboratory or at very close range in the field, to obtain observational records that are characterized by extremely high spatial and temporal resolution and that are given strong internal coherence by virtue of the one-individual-per-session feature.

But there are certain advantages to working at a lower resolution level, and some of the problems imposed by obstructions to visibility in the field setting may, in fact, be beneficial. One of the results of an increase in the distance from observer to observed, or the presence of opaque objects behind which the observed may disappear occasionally, or both, is an overall decrease in the frequency with which observable (therefore recordable) activities occur. When making a very high resolution record of the behavior of a single individual, it is impossible for a lone observer to make a similar record simultaneously of the behavior of a second individual. But if the resolution level is reduced sharply, the number of recordable events per individual per time unit decreases so much that it is feasible to record the activities of several individuals simultaneously.

Within any given observational session, BEVRECS is a behavior recording system that should enable an experienced user to record virtually every observable activity occurring at the resolution level selected for the research. But within the context provided by a research program as a whole, BEVRECS is a behavior sampling technique. Generally speaking, the user must face two rather different kinds of sampling problems. First, he must select a sample from the population with which he is working, and then he must record a sample of their behaviors. The first can be a 100 per cent sample, a random sample, a stratified sample, etc., depending upon the size and composition of the population and the objectives of the research (Pelto, 1970). The sampling of behaviors is a kind of space-time sampling, since only a minute portion of any lifetime is likely to be recorded during an actual observational session. Depending upon his aims, the user may decide to conduct short sessions (e.g., Bobbitt, et al., 1969: ten minutes), long ones (some sessions in our research with the Alyawarra: three hours), or ones of intermediate length (Kogan and Wimberger, 1968: forty-two minutes), and he may make records of standardized length or of variable lengths. Also, he may schedule his observations so that his records will cover only certain locations, selected types of activities, particular times of the day, etc.

The kinds of patterns in space and time represented by numerical patterns detectable in the
behavior records will be very different with different resolution levels and different kinds of samples. A detailed record of 100 hours in the life of a single individual ("x"), recorded over a period of 100 days, will reveal patterns that would never be seen in a low resolution record of 100 hours of behavior of a natural population of 100 individuals (including "x") over the same period of 100 days - AND vice versa. Both can be valuable, but they will be useful for very different purposes.

Rather than attempt to present a discussion of the sometimes intricate rules that can be devised for doing certain jobs with BEVRECS, we include here two brief excerpts from actual records made at two different resolution levels. Many of the rules followed in each case can be deduced from a careful examination of these records. The variables used in Figure 3A are the ones listed in Figure 1A; those in Figure 3B are the first eight listed in Figure 1B.

Figure 3A is a complete and continuous record of fifteen minutes in the life of one adult female patas monkey (*Erythrocebus patas*) living with four others of her species in a cage in Woodland Park Zoo, Seattle, Washington, on 30 May 1969. She is represented by the "A" that appears in Column 3 or Column 5 or both in each and every EVENT in the record. The EVENTS were recorded in the order in which they occurred, with their times of occurrence noted to the nearest minute. The other four monkeys in the cage are represented by the letters "I", "0", "Y", and "M" ("M" does not appear in this segment of the record) in Columns 3 and 5, and the activities in which "A" engaged, both alone and with other members of the population, are represented by the BEHAVIOR UNIT codes in Column 4. The numbers in Column 2 represent the position of "A" in space relative to other members of the group. The "T" in Column 7 differentiates a terminal EVENT from an initial EVENT so that durations of activities can be measured. For example, EVENT #31 at TIME 0957 says that "Y" began to groom ("HG") animal "A", while EVENT #37 at TIME 1000 says that "Y" stopped grooming ("HG...T") that animal. The duration of that grooming session was about three minutes. All of the activities recorded in this session occurred in the same LOCATION, represented by the "01" in Column 1.

Figure 3B is a record of the activities observed in a period of sixteen minutes in the Alyawarra camp at MacDonald Downs Station, Northern Territory, Australia, on 11 March 1972. Twenty different people (Column 2) were active during this recording session, and they engaged in recordable activities in a total of sixteen different LOCATIONS (Column 1). When an activity led to a change in the ACTOR's LOCATION, his initial LOCATION appears in Column 1 and his subsequent LOCATION appears in Column 6. Sometimes an activity involves only an ACTOR, as in EVENT #19 where ACTOR 086 runs (202) from LOCATION 51 to LOCATION 40; sometimes it involves two people as in EVENT #4 where ACTOR 169 carries (222) her son, ORIENTATION 105; sometimes it involves a person and one or more nonhuman components of the physical environment as in EVENT #28 where ACTOR 189 makes (322) a fire (631) out of small limbs (617). Sometimes two or more people do something together as in EVENTS #1 and #2 where ACTORS 232 and 235 walk together from LOCATION 40 to LOCATION 24. That the two EVENTS occurred together is indicated by the "1" in Column 7.

One of the largest and most important differences between the record in Figure 3A and the one in Figure 3B is in the number of individuals who were treated as observational SUBJECTS in each of the two sessions. In the records made with the patas monkeys, one and only one animal was
selected before the beginning of each session to be the SUBJECT of that session. Each and every EVENT in a record of the monkey’s behavior contained the code for the chosen SUBJECT for that session; i.e., the SUBJECT necessarily appeared in each and every EVENT as ACTOR, as ORIENTATION, or as both. In the research with the Aboriginal people, the population of the camp as a whole was thought of as the SUBJECT, and as such, any individual in the population could appear in any EVENT as ACTOR, as ORIENTATION, or as both. In the first case, the record dealt with one and only one individual and no other individual could appear in that record unless he or she directly interacted with the chosen SUBJECT of the session. In the second case, every individual in the camp's population appeared in the observational record with an absolute frequency that depended upon the frequency with which he engaged in observable and recordable behavior. In both cases, uncontrolled observer bias was held to a minimum and data analysis was kept relatively simple. Of course, it is possible for the observer to decide to record everything that one individual does and, while making that record, to record only some things that other individuals do. This decision could result in a sharply distorted view of behavior among the research population, and analysis of records of this kind is likely to be relatively awkward and difficult, but for some purposes this approach is likely to be very valuable.

Behavior records can be made with a tape recorder or with pencil and paper. Greater detail is obtainable with a tape recorder -especially in a laboratory setting - but pencil and paper are much more dependable and flexible in a field setting, and written records are far easier to transcribe and correct in the field. If neither medium is acceptable for some projects, users may devise new ones.

Most discussions of methodology either begin with or eventually focus on the closely related problems of validity and reliability. We believe that BEVRECS rates very high on both of these scales. An observer records an EVENT if and only if it happens, and each value is defined operationally at the resolution level required by the observer's research objectives. Certainly recording errors, both logical and typographical, can occur, and some accidental omissions are inevitable, but a large percentage of the errors can be detected and corrected by carefully examining a record soon after it is made. Figure 3A is not quite the same thing as a motion picture of fifteen minutes in the life of a monkey, but it is a fairly close approximation to it.

And like a motion picture camera or a videotape recorder, BEVRECS is a highly reliable recording instrument. It has been demonstrated (Bobbitt, et. al., 1964; Kogan, et. al., 1969) that inter- and intra-observer reliability can be maintained at better than eighty per cent even when observers are attempting to record such difficult to define and difficult to detect BEHAVIOR UNITS as subtle facial expressions. If we are willing to make minor sacrifices in detail, we can easily achieve even greater reliability with the system - better than ninety-five per cent reliability with locomotor and postural BEHAVIOR UNITS is not uncommon.

The problem of reliability testing can assume a variety of forms depending upon the nature of the research project in which BEVRECS is used. In a laboratory setting where a team of observers can be employed, it is feasible to make direct comparisons of the records made by two or more people as they observe and record, independently but simultaneously, a single series of activities.
### Figure 3. Sample behavior records from two research projects.

(Bobbitt, et al., 1964). In a field setting, where it may be unfeasible or impossible to arrange a test or practice session of that kind, it may be necessary to compare the patterns detected in different sets of records made by one person at different times, or by different people at the same or different times in two or more places. The problems encountered in the second case are much
more formidable than those experienced in the laboratory, but they are not insurmountable.

**Data analysis.** Regardless of the quantity or quality of one's raw data, techniques must be devised for analyzing them before they can be of any value to the scientific community. The following paragraphs are intended as nothing more than suggestions of some of the many possible ways in which behavior records can be searched for patterns. These basic operations can be classified as trend, structure, contingency, sequence, and rate analysis. Higher order operations including statistical tests of significance, Markov chain statistics, matrix algebra, digraph theory, etc., will receive no attention here. We must emphasize at this point the fact that all of the basic analytical operations to be described here can be used in the analysis of a single set of behavior records; i.e., it is not necessary to collect separate sets of records for each kind of analysis.

BEVRECS data can be analyzed manually, but that is not necessary. Since the BEVRECS format and coding technique make it very easy to transfer behavior records to a machine-readable medium such as electronic data processing cards, since an enormous quantity of data can be recorded with BEVRECS in even a short research project, and since the number and complexity of relationships available for analysis is virtually unlimited, it is likely that much of the analysis of BEVRECS data will be performed with the assistance of a computer. Much can be done with subprograms in the *Statistical Package for the Social Sciences* program system (Nie, Bent, and Hull, 1970); several special purpose programs are available already (Bobbitt, et. al., 1969, and n. d.); and additional programs will appear as the demand for them grows.

The easiest, and for some purposes, one of the most productive ways of analyzing a set of behavior records is to do nothing more than sort and count. How many EVENTS occurred in each LOCATION; how many occurrences were there of each BEHAVIOR UNIT; etc. More complicated versions of this kind of question might be: how many (or what percentage) of the observed fire-making activities were performed by members of each sex-age group in the population; or, which behaviors are common to all boys and girls under the age of five years, and in which ways do the behavior repertoires of those two sex-age groups differ. This kind of analysis can be used to produce quantitative behavior profiles for each individual or each category of individuals in the study population, or for each LOCATION or each TIME; it can yield quantitative measures of divisions of labor; etc. And the statistical operations that can be performed on the outcomes of these simple frequency counts are numerous.

Anthropologists and behavioral biologists with interests in developmental studies, enculturation and acculturation, culture change, etc., can examine a series of behavior records made at appropriate intervals in order to detect systematic changes in the behavior of their study population. For example, in research focusing on mother-infant interactions, we might want to know how various disciplinary practices change during the first year of the children's lives. It does not matter whether we use a longitudinal or a cross-sectional research design in collecting the raw data. If we have an exhaustive list of the ACTORS, BEHAVIOR UNITS, and ORIENTATIONS with which to define "mother disciplines child", we may search the behavior records for all occurrences of the designated combinations of items. If a longitudinal study had been performed, we would examine the behavior records for each infant separately and look for changes as the year progressed; if a cross-sectional study had been performed, we would classify
the infants by age interval and look for differences between age intervals. (Cf. Bobbitt, et. al.1964)

If we are interested in such things as sociometrics, communications networks, or exchange relations, we can examine a set of behavior records to discover who does what with whom. For example, if we want to know about food exchange interactions within the Aboriginal camp, we can search our records for all instances of food exchange between all ACTORS. A square matrix will be generated, with the number in each cell representing (e. g.) the percentage of all occurrences of food exchange attributable to each pair of people, with the ACTOR and ORIENTATION roles of each clearly shown. This procedure is likely to be extremely informative when we use a matrix of interactions in conjunction with matrices showing genealogical and other biosocial and sociocultural relations between all individuals in the study population (or our sample of that population). Kummer's (1968) study of hamadryas baboons demonstrates the usefulness of matrices of the first sort, and Rose's (1960) study of Australian Aboriginal kinship provides a model for the second.

We may wish to investigate various relationships existing between behaviors. One approach would be to ask such questions as: do cross-sex pairs who exchange food with each other also go away from camp with each other; or, do the BEHAVIOR UNITS "eat" and "drink" occur together (e.g., within the same minute) more often than would be expected by chance? Both of these questions, and numerous similar ones, lead to the construction of a 2 x 2 contingency table. Chi square and related statistics can be used to test for nonrandom distributions in the tables. (Cf. Bobbitt, et. al., 1969).

We may be particularly interested in the dynamics of social interactions. If so, we can search the records for instances of an EVENT such as "man says hello to woman", and in each case identify the series of EVENTS that immediately precede or succeed it. From such analysis, we might learn a great deal about response chaining, decision making, social "rituals", etc. (Cf. Bobbitt, et. al., 1969)

In fields as diverse as aerospace engineering, the physical sciences, many of the life sciences, and experimental psychology and economics in the social sciences, it has been found that detailed knowledge of the rates at which events occur, and changes in those rates, can be of primary importance for understanding the nature of the events themselves and for identifying the factors that permit a scientist or engineer to predict or control the occurrence of those events. Undoubtedly the absence of rate analysis from the anthropological literature is attributable in part to the kinds of questions traditionally asked by anthropologists, but an equally important factor has been the lack of a research methodology that would yield data suitable for that kind of analysis. Since the behavior records made with BEVRECS are ideally suited to rate analysis, and since that has proved to be a powerful analytical approach in so many other disciplines, it might be worthwhile for anthropologists to try it now.

Any value for any variable, or any combination of values for any number of variables, can be used in constructing a cumulative record in which time (read from the appropriate column in the behavior record) increases from left to right, and the number of occurrences of the value in question increases from bottom to top. Furthermore, each and every value that appears in a
record can be used as the basis for a separate cumulative record, and the complete set of cumulative records derived from a single behavior record can be examined together. This technique allows us to break down a complex record such as one of those in Figure 3 to yield several simple records of more-or-less simultaneously occurring activities, each cumulative record being synchronized with all of the others but fully disengaged from them. The use of this approach to analyzing the data results in our transferring the data from a nominal scale (sneezing: yes or no) to a ratio or interval scale (sneezing: 0, 1, 2, ... n times per hour) which allows us to use more powerful parametric statistics on data that, on nominal scales, could be analyzed with nonparametric statistics only.

Conclusion. Research that incorporates the methods described here will contain all of the ingredients that Pelto (1970) listed as essential in any sound piece of scientific work. The problem will be stated clearly, the terms will be operationally defined, observational procedures will be described in detail, analysis of the data will be straightforward, and the work will be falsifiable. However, since methods are not ends in themselves, a potential user of BEVRECS must give careful consideration to his overall objectives lest he find himself in the unpleasant position of doing work that is technically precise but which yields only trivial results. In other words, BEVRECS has much in common with the computer technology to which it is so closely related. Both are fine toys whose entertainment value should not be underestimated or ignored since it is through "playing" with them that we can learn much about their capabilities and limitations, and at the same time, both of them can be used in formulating and solving substantive problems of major theoretical importance in our studies of behavior.

Assuming that the laboratory or field worker does his job well using BEVRECS, what is he to do with his results? When appropriate procedures tell us that we have found a pattern that was not likely to occur by chance alone, we may offer that pattern as supporting evidence for hypotheses developed previously, or we may use it in framing generalizations about the behavior under investigation. If we take the first route, the pattern in some way supports an explanation; if we take the second, the pattern itself becomes something to be explained by other methods. Certainly deductive, hypothesis-testing research has an important role to play in anthropology, even though the discipline has little in the way of theory to guide the formulation of hypotheses. On the other hand, inductive, generalizing research has an important role to play, too. Since BEVRECS can be used equally well for either job, the user may - and must - make this decision for himself.

The description of BEVRECS presented in this chapter is one of the results of using the system in the field. It was impossible to describe it in such general terms before the realities of a field setting had been encountered and handled successfully. Prior to arrival at the field site, it was assumed that the version of BEVRECS represented in Figures 1A and 3A would be used in the research, but that proved to be neither feasible nor desirable when it came time to begin using the system. It was necessary, at that time, to develop the version represented in Figures 1B and 3B. And it was after the fieldwork began, but before it was time to begin using BEVRECS, that we realized the enormous role that the concept of the space-time resolution level was to assume in the overall organization of the entire research program as well as within the narrow confines of BEVRECS per se.
Chapter 2. The Physical and Social Setting

The fieldwork began on 1 June 1971 and ended on 25 March 1972. Figure 4 shows the general location in Central Australia where the research was conducted. The Stuart Highway on the west, the Plenty River on the south, the boundary between the Northern Territory and Queensland on the east, and the Barkley Highway on the north form an irregular square roughly 250 miles per side with an area of about 50,000 square miles.

Figure 4. Map of Australia showing general and specific areas in which the research was conducted.

All evidence available at this time indicates that, prior to permanent settlement of non-Aboriginal people in this area in the last decades of the nineteenth century and the first two decades of the twentieth century, the Alyawarra Tribe lived in the country along the Sandover and Bundey Rivers as far west as the headwaters of those two rivers and as far east as the present location of Ooratippra Homestead. The northern limit was Elkedra Creek and the southern limit was...
somewhere between the Bundey and Plenty Rivers. Following the permanent establishment of cattle stations (ranches) in Alyawarra country, the Alyawarra redistributed themselves, and as of 1 January 1972, major concentrations of members of that language group occur at MacDonald Downs, Derry Downs, and Lake Nash Stations, and at the government settlement at Warrabri. MacDonald Downs and Derry Downs are within Alyawarra country, Warrabri is near the boundary between Alyawarra and Walbri countries, and Lake Nash is well outside Alyawarra country. Other small groups of Alyawarra live in Alice Springs and on other cattle stations throughout the area represented in Figure 5. The total Alyawarra population appears to be slightly greater than 500 people, with about 250 of them residing at MacDonald and Derry Downs Stations.

Figure 5. Map of the general location of the research.

In the course of the field research, visits were made to Lake Nash and Warribri as well as to several smaller camps, but all of the data to be presented and analyzed later in this dissertation were collected with the people living in the group of four camps at MacDonald Downs and Derry Downs Stations. For this reason, and because of important differences in physical environment and history that would have to be handled if the entire area currently used by Alyawarra-
speaking people were discussed here, the comments in this chapter pertain exclusively to the people and places at MacDonald Downs and Derry Downs unless otherwise indicated in the text. This area is represented in greater detail in Figure 6.

![Figure 6. Map of the specific area in which the research was conducted.](image)

The Alyawarra live near the geographical center of the enormous arid region of inland Australia. Perry, et. al. (1962) indicate that the area represented in Figure 5 receives an average annual rainfall of ten inches. However, rainfall variability is at least as important as is average quantity in a desert or semi-desert environment, and an examination of the sketchy data available for the last sixteen years from the ten privately operated weather reporting sites located on cattle stations in the area reveals an annual rainfall ranging from 0.67 inches to 17.39 inches at various sites during that period. Generally speaking, January and February are the wettest months and July and August are the driest, but there is as much variability in timing as there is in quantity.

Although the effectiveness of rainfall is determined by a variety of factors, a rule of thumb expressed by residents of the area is that a minimum of two inches of rain is necessary for
bringing about any important changes in vegetation. An examination of the sixteen year records mentioned above reveals that rainfalls of two inches or more have occurred somewhere in Alyawarre country in every month except September and November, and at the same time, each site record shows a period of at least twenty-four months during which there has been no month with a rainfall of two inches or more.

Spatial variability is yet another important characteristic of Central Australian rainfall. Summer rains that occur in conjunction with major monsoonal depressions moving inland from the north coast of the continent may yield widespread, evenly distributed falls over 1,000,000 or so square miles, but highly localized thundershowers are much more common. Such rains often produce flash floods along ordinarily dry river channels, sending large quantities of water rushing down highly absorbent riverbeds through country that received no rain at all. This, of course, provides drinking water for animals that can seek out the water in the channels, but it has no effect on vegetation outside the small rainfall area and the river beds.

So despite there being an average annual rainfall of ten inches, and an average monthly rainfall that is highest in January and February, it is not at all meaningful to divide the year into wet and dry seasons or to think of rainfall as a cyclical activity with a twelve-month periodicity. There are wet times and dry times, and two consecutive wet times may be separated by as little as a few dry months or as much as several dry years.

Temperature, on the other hand, is distinctly cyclical, having regular twenty-four hour and twelve-month periodicities. Except during those rare periods when rain or heavy clouds are present, diurnal fluctuations of 25 to 30 degrees Fahrenheit are common, with summer highs reaching 110°F. and winter lows reaching almost to 32°F. The hottest months are December and January, the coldest, June and July.

Both absolute and relative humidity are generally very low throughout the year in Central Australia, thus depriving the area of the dew that is an important source of moisture in some arid regions. With relative humidity values on the order of 30%, night temperatures have to fall almost to freezing point before the dew point is reached (Perry, et.al., 1962:120).

High temperatures, clear skies, and low humidity combine to produce an average evaporation rate of ninety-five inches per year in an area with an average annual rainfall of ten inches. This situation, in combination with geomorphological factors, means that there is no permanent, naturally occurring surface water in the area of Figure 6.

As the topographic information in Figure 6 shows, the research site is located in country that is mostly flat to gently rolling. The western end of the Dulcie Range, a sandstone plateau with relief up to 300 feet at some points in this area, is one of the few conspicuous landmarks. Others are Mount Michael and Tower Rock, both of which rise to about 350 feet above the surrounding plains. Since the hills are rocky with occasional patches of sandy soil, and the plains are of sand or sand-clay mixture, water erosion has resulted in the development of many short and narrow flood channels. Most of them carry the rare rains from the hills into floodouts in the nearby plains where the water evaporates or is quickly absorbed. The two notable exceptions are the Sandover and Bundey Rivers. After heavy rains, they flow from southwest to northeast, merging
at Ammaroo Homestead, and continuing eastward for a total length of about 270 miles before emptying into a large floodout where they end.

A first impression of the locale is likely to be one of monotonous uniformity - red to brown sand plains with rare rocky hills, and sparse low trees interspersed with low shrubs or large expanses of spinifex, a spiky grass that grows in large and scattered tussocks. But within that superficial uniformity there is important diversity. Major variations in geomorphology and plant communities control the distribution and density of red kangaroos (M. rufus), the principal source of meat for the Alyawarra at MacDonald Downs and Derry Downs. While cattle and kangaroos do not seem to compete directly for the same plant foods (Frith and Calaby, 1969), country that is good for cattle is, at the same time, favored by the red kangaroo, and the sandstone uplands and spinifex sandhills that make poor pasture for cattle are avoided by the red kangaroo as well. The importance of native vegetable foods has diminished greatly in the years since 1958 when government-subsidized rations began to be distributed to the Aboriginal people, but the ecological diversity of the habitat was and still is significant in regard to that component of the diet.

Each of the camps shown in Figure 6 is located within half a mile of a permanent water supply coming from a bore (well) equipped with a diesel engine or a windmill. The bores, which were drilled to provide water for livestock, bring up a sufficient quantity of high quality water to meet the needs of a small human population as well. Rations, consisting of flour, baking powder, yeast, tea, syrup, powdered milk, sugar, rice, potatoes, onions, fruit, baby food, and laundry and bath soap are distributed at weekly intervals by the white family at the MacDonald Downs Homestead. There is a regular flow of money into and through the Aboriginal population in the form of pensions and child endowment funds from the Australian government, and in wages paid to the men when they are employed sporadically on the cattle stations in the vicinity. Much of their money is spent for clothing and additional European foods from the small store at the homestead, and some of it is spent for such luxury goods as portable radios and record players. A sizable portion of it is spent for items of western technology that have assumed great importance in the Alyawarra way of life as of 1972: .22 caliber rifles and shells for those rifles, and used automobiles and fuel and parts to keep them operational. Almost all kangaroo hunting is done with rifles, and the automobiles are used both for hunting and for transporting rations from the distribution point to the camps. Beer and other alcoholic beverages, which have become a problem of enormous proportions among some Aboriginal groups in Central Australia, is no problem at all in the camps at MacDonald and Derry Downs. Their importation is strongly discouraged by the white families and by the Aboriginal people, and the nearest source of supply is about 125 miles away.

In addition to providing rations and a small but steady supply of money, the Australian government has a direct impact on the lives of the Alyawarra at MacDonald Downs and Derry Downs in two other fields: health and education. Health services consist of a visit, once every six weeks, by two nurses poorly trained in public health and untrained in the cultural patterns of the patient population. Their duties include immunizing and regularly checking the weights of babies and children to the age of five years, and providing some emergency services when emergencies happen to coincide with their presence. The white family provide first aid as required, and consult with the staff of the Royal Flying Doctor Service via shortwave radio
concerning more serious problems, and the Royal Flying Doctor Service evacuates critically ill patients when necessary. Although infant mortality is high, health among those who have safely traversed the first year of life is very good, in spite of poor medical services.

The Northern Territory Administration, through its Welfare Department, is aggressively pursuing a policy of enrolling Aboriginal children in schools established for them on the cattle stations, etc., where they live. Those schools operate in such a way as to be totally incompatible with the expressed interests and desires of the Aboriginal people in the research population, and due to the nature of the facilities, the curriculum design, and the preparation of the teachers, they are basically incapable of contributing to a smooth transition from traditional to introduced cultural patterns for the people in the research area. One of these schools is operating on the station adjacent to MacDonald Downs, but the Alyawarra at MacDonald Downs and Derry Downs refuse to attend it. The establishment of another school at MacDonald Downs has been blocked successfully - at least for a while - by the white family at MacDonald Downs. Some of the children in the study population have received some European education at schools at Lake Nash, Warrabri Settlement, or Santa Theresa Catholic Mission, but they are in a tiny minority.

In other parts of the Northern Territory, missionary influence has been considerable, but it is negligible in the study area. There are no missions in the entire area of Figure 5, and the nearest ones are almost 300 road-miles from MacDonald Downs.

The four camps in Figure 6 are composed of people all of whom speak the same language, Alyawarra (although about two per cent of them speak it as a second language), and most of whom are interrelated with each other by multiple genealogical ties. The camps are located semi-permanently, major changes in their locations (i.e., moving an entire camp from one bore to another) occurring on an average of about once every two years for the last ten years. However, the compositions of the camps are highly unstable, with people moving frequently from one camp to another within the set of four. Much more rarely, a new individual or family arrives from outside the area, or a resident of the area moves to another cattle station, to Alice Springs, or elsewhere. Because of the linguistic uniformity, the high density of genealogical relations, and especially the much higher rate of movements within the set of four camps as compared with movements into or out of the area, it seemed reasonable to circumscribe this group of camps as the system to be investigated. The inclusion of any other camps within a reasonable travel distance would have resulted in crossing of linguistic boundaries, and a population larger than the one in the four-camp area was not required; to have excluded any of the four camps in that area would have resulted in our studying what would have appeared to be a highly unstable population which would have been a bit smaller than we needed in order to obtain the genealogical and other relational data that we wanted.

During the ten months of the research, the Aboriginal population at MacDonald Downs and Derry Downs Stations consisted of a total of 262 people who were permanent or semi-permanent residents of one or more of the four camps there. There were perhaps fifty more Aboriginal people who were visitors in the research area, but because of the spatial distribution of the four camps, the short durations of most of the visits and the other distracting activities associated with the ceremonies that occasioned many of the visits, it was impossible to keep an accurate record of Aboriginal visitors. All Aboriginal people who were known to be residing in the four-camp
area for a month or longer were classified as residents; all others were classified as visitors.

A population pyramid for the 262 residents (Figure 7) shows a sex-age structure for the population as a whole that is typical of a rapidly growing population. More than 50% of the population was less than twenty-one years old, and less than 15% was older than fifty years.

Because of extremely high mobility among the four camps, it is much more difficult to discuss sizes of the individual camps, or their sex-age structures, than it is to discuss the population as a whole. In summary, however, the data show "typical" sizes of the four camps to be as follows:

<table>
<thead>
<tr>
<th>Camp</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camp A</td>
<td>100</td>
</tr>
<tr>
<td>Camp B</td>
<td>80</td>
</tr>
<tr>
<td>Camp C</td>
<td>30</td>
</tr>
<tr>
<td>Camp D</td>
<td>30</td>
</tr>
</tbody>
</table>

Disregarding the fact that Camp C was abandoned near the 200th day of the research, thus reducing its population to 0, the sizes of the camps ranged from 205 at Camp A at the beginning of a series of initiations, and 112 at Camp D during another week of ceremonies, to a low of 8 at Camp D and 13 at Camp C at the beginning of the series of initiations just mentioned. Some of the older females living at Camp A never, to our knowledge, visited another camp, while some of the unmarried adult males moved from camp to camp as often as once every three weeks for the duration of the fieldwork.
Figure 7. Sex-age pyramid of the Aboriginal population living at MacDonald Downs - Derry Downs camps in 1971-1972.

Each of the four large camps (murelgwa) contains three types of small camps (mura) that are architecturally similar but socially dissimilar. They are as follows:

- **Ungundya**: men’s camp
- **Alugera**: women's camp
- **ANOARDEGAN**: single nuclear family's camp

There is one men's camp, one or more women's camp, and several single-family camps in each large camp.
Figure 8 is a map of Camp A as it was on 14 March 1972, and Figures 9 through 11 depict various mura at different times of the year. Since the composition of a camp changes frequently, and the spatial distribution of residences within a camp changes even more frequently, Figure 8 depicts one of the nine distinctly different phases in the continual evolution of Camp A as we observed it for ten months. Likewise, the individual mura are always in a state of flux, with changes in their day-to-day configurations being related to variations in afternoon high temperatures and night-time lows, wind direction and intensity, the likelihood of rain, availability of building materials, and so on. On any randomly selected day, the range of variation in size and shape of structures within a single large camp is enormous, but the assortment of structures is fairly constant, consisting of shades, shelters, and windbreaks.
Figure 9 Anoardegan (SL246). The structure on the left (urlya) is used as a shade and storage area. The tent-like structure (waga) is used mainly during rainy periods to deflect rain from the sleeping area.

Figure 10 Alugera (SL224). Since the prevailing wind in the colder months comes from the southwest, this structure was built to provide shade from the sun in the afternoon and protection from the wind at night. The depression on the downwind side of the windbreak, where the women and children sleep, may be covered with a tarpaulin supported on the vertical sticks.
The only structure in use at the men's camp when this photograph was made was the windbreak (dagwa) whose length varied from twenty to eighty feet depending upon the number of people spending the night there.

The population of 262 contained a total of forty-one married males and fifty-four married females. Of the married males, 71% had one wife, 27% had two wives, and 2% had three wives. The youngest married male was twenty-five years old, and there were seven males older than him who were not currently married, four who were widowers and three who had never been married. The youngest married female was fourteen years old, and there were twenty-four females older than her who were not currently married, twelve who were widows and twelve who had never been married.

Now let us focus on Camp A, the camp selected for most intensive study and the camp in which the BEVRECS work was performed.

The ungundya provides accommodations for all initiated males in the large camp who do not have their wives with them. That includes two widowers who are permanent residents of Camp A's ungundya, any unmarried males above the age of about fourteen years who happen to be visiting or temporarily residing in Camp A, and any married men who are visiting there without their wives. During the day, all of the initiated males in the entire big camp use the ungundya as a meeting place.

Camp A contains four alugeras. Three of them are the permanent residences of one or more widows, and the fourth is the residence of an unmarried fifty year old woman who has been unable to walk since an accident in childhood. Other people who use alugeras for their accommodations are unmarried girls at or past the onset of puberty, and all of the immature children of widows who reside in the alugeras. Since unmarried women are far less mobile than are unmarried men, overnight visitors to the alugera from other large camps are rare, but overnight visits from women and children who ordinarily reside in anoardegans within the same large camp are common. Some pairs of co-wives seem to "take turns" spending nights at the alugeras and at their own anoardegans, and young children who have older sisters or other close relatives living at an alugera spend nights there often or even regularly.
Just as the ungundya is the men's meeting place during the day, an alugera is a women’s and children's meeting place. Unlike the single ungundya which serves that function for all initiated males, one alugera is the meeting place for only a part of the big camp's entire population of women and children; however, due to the sex-age structure of the population, it appears that the size of the group of women and children who congregate at any one alugera is about the same as the size of the group of males who congregate at the ungundya.

Each anoardegan is the residence of a man and his wife or wives. The younger children of the family ordinarily sleep at the anoardegan with their parents, but there is much variability in this regard.

The women who, with their children, congregate at any given alugera tend to be the women who live in the anoardegans nearest to that women's camp. A superficial examination of the data indicates that those women tend to be real sisters or daughters, or close classificatory sisters or daughters, of the oldest woman who lives permanently in the alugera. Camp A, with its four alugeras, consists of four socially distinct subcommunities, each containing an alugera and a group of anoardegans whose female residents are interrelated in this way. There is considerable variation on this theme through time and between camps, but the high resolution records kept for camp compositions during the ten months of fieldwork, and the lower resolution records of camp compositions over the last ten years obtained during visits to abandoned camps and in conversations with a variety of people about those camps, indicate that these alugera-centered matrilineal subcommunities remain intact, spatially and temporally, and that in all likelihood they formed the core of the small nomadic groups that characterized Alyawarra social organization prior to the introduction of rations, permanent water supplies, and motor vehicles. More refined comments on this and all topics mentioned in this chapter must be delayed until the relevant data have been analyzed systematically, quantitatively, and exhaustively.

In the following paragraphs, we present a description of a day in the life of the people in Camp A. It is a purely hypothetical day, with each example of behavior selected for its value in contributing to a composite picture of life among the Alyawarra in 1972. Generally speaking, the examples were selected to suggest the kinds of behaviors in which people of various ages of each sex might engage at different times of the day. The behaviors observed during any real day are determined to a great extent by the values assumed during that day by the more conspicuous meteorological variables (temperature, rainfall, wind speed, cloud cover) and by the availability or non-availability of an operative motor vehicle, and the day's activities are affected strongly by the occurrence or nonoccurrence of Alyawarra ceremonies or of essentially non-Alyawarra activities that impinge on life in the camp such as the distribution of rations, visits by the health officials, etc. These special factors are ignored in describing the day, hence the composite picture is somewhat artificial; however, some of them are dealt with in separate paragraphs at the end of the chapter.

The day begins at or shortly after sunrise when people begin to unroll from their blankets and put on any clothing that they might have removed before retiring. Even in mid-summer, the hour just before sunrise can be uncomfortably cool, and the blankets and windbreak with which every mura is equipped encourage people to stay still until the temperature begins its rapid rise. Often
it is as much as two-and-a-half hours past sunrise before everyone in camp is up and about.

People urinate in the immediate vicinity of their residences shortly after awaking and at other times during the day. Defecation is done well away from and out of sight of the camp when people leave the camp alone intermittently throughout the day.

The first job of the morning, done ordinarily but not exclusively by the adult females, is collecting a few dead limbs from the open areas between the residences or from the countryside surrounding the big camp, and using that wood to build up the small cooking fires that died away over night. As soon as the fire is going again, a can of water is set in it for making the morning tea which, with kangaroo meat and bread or damper (an unleavened bread) from the preceding day, serve as basic breakfast foods.

Although many people eat breakfast at the mura where they spent the night, there usually are several people in the camp who go to different places in conjunction with breakfast. The two widowers who live permanently at the ungundya never make bread; rather, their bread and breakfast tea are prepared by the wives of another man, and the husband of those women delivers the food to the widowers each morning. Married women and children who spend the night at an alugera may return to the family's anoardegan for breakfast. Young men who have been initiated but are not yet married obtain their breakfasts from their parents, either by going to their parents' anoardegans for it or by receiving it at the ungundya when their fathers bring it to them, and young men whose own parents live in another big camp are “taken care of” by classificatory parents. When a young man acquires his first wife, a young woman, they usually reside near the wife’s mother, and that woman provides breakfast bread for the new nuclear family. The young man's mother provides much of their food, too, if his parents live in the same big camp.

After eating, the men from all over camp go to the ungundya for their regular relaxed and informal discussion of the upcoming day. They arrive one at a time over a period of perhaps half an hour, and after an hour or so - say, about 0900 - they disperse more-or-less simultaneously to begin the activities that will occupy their morning. If there is an operable motor vehicle in camp, perhaps half a dozen men between twenty-five and forty-five years of age depart in it with two or three rifles to hunt kangaroo. If there is a disabled but repairable vehicle available, repairs are undertaken on it. Some of the older men may leave the ungundya and go to a temporary small camp located about 200 yards away from the main camp where they spend the morning making bullroarers, boomerangs, shields, coolamons, etc., either for sale, via the white family who run the cattle station, to tourist shops 185 miles away in Alice Springs, or for use within the camp. A few of the young men fifteen to twenty-five years old may stay at the ungundya playing cards or checkers.

The women and children spend their mornings in a very different way. Shortly after 0800, those who are at the anoardegans begin to congregate slowly at the alugeras. From each of those focal points for the camp's four socially distinct subcommunities, parties of women and children ranging in size from three to fifteen people depart for the bore carrying cans to be filled with water. Infants are carried in coolamons (wooden bowls about ten inches wide by thirty inches long) by their mothers on these one mile round-trips, but children between one and six years old are carried in a variety of positions by a variety of people in addition to their mothers, and of
course those who can walk do so, getting rides with bigger people when they get tired. The morning trip to the bore does not require the participation of all women and children in the camp, but since several such water-carrying trips occur from each subcommunity each day, most of the women and children in the camp visit the bore at least once each day.

Purely domestic chores occupy some of the women's time each morning. Blankets and bed-rolls are put onto the storage area on the top of each shade, cans and clothing are suspended from the shade, and occasionally the sandy floor of the mura is swept with a broom made with a stick, a handful of spinifex, and a bit of string. By 1000, it is time to collect another supply of firewood to be used in cooking damper or a loaf of bread for the midday meal. Bread made with yeast is put into a large cast iron pan with a cover and the whole thing is buried with hot sand and coals from the fire, while damper is buried directly in the sand and coals without a protective container. Since the actual cooking of the bread requires relatively little activity or supervision, most of the women and children are free to do other things after mid-morning.

The initial construction and the continual repair and modification of the structures comprising the ungundya are done by the men, but the alugeras and, with a few notable exceptions, the anoardegans are built and maintained by the women. When a new alugera or anoardegan is to be built, most or all of the women and children in the subcommunity affected by the new addition or replacement contribute time and energy in helping the permanent resident of the new structure. At mid-morning, as many as fifteen women and children may depart, carrying axes to the stand of mulga trees growing in the flood-out east of the camp and to the banks of the creek bed just above the flood-out where other species of trees are more common. An hour or so later, they return with eight to twelve strong poles to be used in making the frame and strengthening the roof of the new shade, and enormous loads of fresh leafy mulga limbs to be used for covering the roof. Others, using sharp-ended steel rods as digging sticks, quickly dig the required postholes in the sand, and suddenly the frame is up. Constructing the windbreak and obtaining the poles required for erecting a tent-like shelter are group activities, too. With the enthusiastic cooperation of one’s real and classificatory sisters and their children, a new set of structures can be completed in half a day, but a woman who, with her husband and children, moves into a camp where she has no real or classificatory sisters may spend several days in erecting those structures alone or with the help of her husband. After the construction is done, new leafy covering material must be added about every two weeks, and when rain threatens, large quantities of spinifex grass are integrated into the roofs to make them more water repellant.

Instead of building, repairing, or modifying their residences, a group of women and children might depart for a day of collecting small lizards and plant foods in the country surrounding the camp. While there is no alternative to building and maintaining one's accommodations, there is a viable alternative to collecting small animals and plant foods. Weekly rations and items purchased from the small station store can be relied upon for a large portion of one's nutritional needs. Yet there are considerable differences in the extent to which the women in the four different subcommunities in Camp A collect indigenous foods. The list of items collected contains berries, seeds, tubers, fruits, sugar deposits, lizards, and grubs, and the equipment used in collecting and carrying them includes metal digging sticks, cans, coolamons, and sacks. None of the people in two of the subcommunities was ever observed departing from the camp or returning to it with the equipment or the food items just listed; members of the third
subcommunity averaged a bit over one foraging trip per week; and members of the fourth went as frequently as three or four times per week. Even in the case of the fourth group, however, there was no indication that native vegetables were more than supplements to and embellishments of the basic diet of kangaroo meat and the items obtained through the weekly distribution of rations.

All of the people in camp at midday temporarily suspend their activities to have their second meal of the day, and often to go to sleep for a while. After lunch and a nap at their anoardegans, the men resume their manufacture of artifacts or their repair of a vehicle. If there is no chance of getting a vehicle to operate well enough that day to use it for a kangaroo hunt, one of the men might go on foot for meat, but the much more likely solution to the problem of meat acquisition would be to postpone the hunt and try again the next day to get a vehicle to operate. When a hunt is made in a vehicle, the men and the meat return before or at sunset.

The number of animals killed on a hunt ranges from one to ten depending upon the size of the camp's population, the length of time since the last successful hunt, and the luck of the hunters. Occasionally a hunt will yield no meat, but such events are rare. The kangaroos may be distributed whole to various residences before they are cooked; they may be cooked at the ungundya, then distributed whole to the alugeras and subdivided there for final distribution to the anoardegans; or they may be cooked at the ungundya or at the hunting ground, cut up immediately into family-size portions, and distributed piece by piece to the anoardegans and alugeras.

In any case, the hunters or other men in the camp collect huge piles of dead trees and limbs to provide fuel for cooking the meat. The wood is ignited and the carcasses are singed in the flames after being eviscerated. Some of the coals are raked into a pit beside the fire, the carcasses are placed in the pit, and hot sand and coals are raked over them to fill the pit. About forty-five minutes later, the outer portions of the meat are well done and ready for consumption; deeper tissues are rare, but they will be cooked more thoroughly later when needed.

Since the hunt probably involved two or three men using rifles belonging to other men who did not hunt that day, and the vehicle probably was owned jointly by two other men who did not participate either, and was driven by yet another man, and so on, it is likely that all subcommunities and a sizable percentage of all nuclear families within those subcommunities were represented in some way on the hunt, and the meat from any hunt almost invariably reaches all members of the camp population if everyone needs some of it at that time.

When the night promises to be cold, several men leave camp with axes late in the afternoon and return a while later with dead logs up to ten inches in diameter and twelve feet long. They are cut in halves or thirds and used in making two or three fires strategically located in each residence to keep everyone warm all night.

The women spend their afternoons in making and cooking bread or damper for the evening meal, making clothes of material bought at the station store, and talking together at the alugeras while the children play. The water supply must be replenished, and perhaps some clothes - or some faces and hair - will be washed on the afternoon trip to the bore. More arm loads of firewood
may be obtained during special wood-gathering excursions away from the camp, or women returning from foraging trips may bring some with them. The wood gathered near home early in the morning tends to be small and characterized mainly by its convenience, while the pieces brought in during the afternoon tend to be three to four feet long, dry and straight. They stack well and weigh little, so that a woman can carry a sizable pile of them in a sling of natural fibers or a belt under her arm.

As sunset approaches, the men re-assemble at the ungundya where they talk together until a few minutes after sunset, at which time they return to their anoardegans for the evening meal and prepare for the night's sleep.

The children of the camp spend their day going places and doing things with their mothers and older sisters, and in playing in groups within their own subcommunities. Old automobile tires are among the most conspicuous toys, and a large variety of playthings are fashioned from convenient materials. "Motorcars" are made of two-pound syrup cans filled with sand and long stiff wire formed into axle, steering shaft and steering wheel, and windmills are shaped from metal cans, wire and sticks. The making of string figures is a popular pastime, and kittens and puppies are ever-present playmates. Despite the scarcity of trees in the camp, climbing trees occupies much of the children's time.

The really old people are the least active members of the population, but their continuing importance in the society is insured by an interesting combination of traditional and introduced factors. For the old men, there are responsibilities in ceremonial matters similar to those described elsewhere among Central Australian people, and the old women are equally important in a number of ceremonial contexts and in their roles as the senior members of the alugera-centered subcommunities. Western practices support the traditional pattern, since much of the money that enters the Aboriginal community comes in the form of government pension checks to men and women at or above the age of sixty-five years. Those funds, which enter the community at large through the old people, are essential for purchasing and operating the motor vehicles and rifles that are required for the continuation of life in semi-provisioned, semi-sedentary groups of a size much larger than was possible for nomadic groups in Central Australia before Western settlement began.

Occasionally, some of the men return to the ungundya after dark to sing songs of their Dreamings, and women and children may congregate at one of the alugeras for the same purpose. Although the topics of the songs may be important events in the Dreamtime, these evening get-togethers have the relaxed air of a party, and there are no restrictions on who may hear the songs. When ceremonies are in progress, such activities are much more formal.

Ceremonies among the Alyawarra seem to fall into three major classes: 1) initiations; 2) funerals; and 3) a variety of activities related more directly to the preservation and rejuvenation of all of those things that make up the natural world - the agriculture and animal husbandry of a people whose biological theory is radically different from that of the Western world, but one that is ideally suited to the realities of the Central Australian ecosystem. Funerals and some of the activities in the third class of ceremonies are reserved for initiated males, but other activities in the third class and initiations in particular require the joint participation of all males and all
females of all ages. There is no good reason to doubt that the ceremonies have enormous emotional value for the Alyawarra, but it is important to note that such events were known to occur within the area of Figure 6 on only 12% of the days during the field research, and that they were done in addition to, not instead of, the ordinary day-to-day activities already described.

Rations, which are distributed every Sunday, have had a major impact on the diet and on traditional modes of behavior associated with food acquisition. One of their side effects has been the introduction of the Western calendar to the Alyawarra. While the Alyawarra still refer to the irregular wet times and dry times and to the changes in plant and animal density and distribution controlled by rainfall, they now have a regular seven-day cycle which begins anew each Sunday, and a twelve-month cycle which begins anew each Christmas Day, a sort of super-ration day.

Ration day is a time when some or most of the people from all of the large camps congregate at the homestead, and it offers an excellent opportunity for observing the integration of traditional and new modes of behavior. Within a single camp, the presence of alugeras for the women and the ungundya for the men enables the total community to function well with virtually no contact between any adult males and any adult females except within the nuclear family.

The extremely rigid separation of the sexes is maintained on ration day in the following way: Male heads of households congregate near the ration shed and receive rations for themselves and their families first. Some of the widows and women whose husbands are temporarily absent congregate about 200 feet away with the children, and go to the shed for their rations when the men are finished. When the store opens after the rations have been distributed, the same separation of the sexes is practiced, except that while the women are sitting in the shade, gossiping and awaiting their turns at the store, their husbands and fathers are kept busy making trips between the store and a neutral area where they meet their wives or daughters with items from the store requested by the women. This arrangement is one which suggests that the sexual separation is one of mutual consent rather than anything resembling "male dominance", and this view is supported by observations of the key executive roles played by women in initiation ceremonies and in activities related to those ceremonies, and of the apparently even distribution and utilization of money throughout the entire adult portion of the population.
Chapter 3. The Data Files

The preceding chapter contains a superficial, impressionistic, qualitative, and extremely general description of life among the Alyawarra at MacDonald Downs Station in 1971 - 1972, while the following chapters contain detailed, systematic, and quantitative descriptions of small segments of that life. In order to improve the credibility of the preceding chapter and the intelligibility of the next ones, we present in this chapter a description of the several data files which together constitute the complete body of quantitative or numerical data pertaining to the Alyawarra, and a brief description of the internal organization of the data file as a whole.

The data file consists of eight major sections and several minor ones. Neither the ecological data nor any of the minor files will be discussed here or elsewhere in the dissertation. The files to be dealt with here have the following names:

- VS  Vital Statistics
- GD  Genealogical Data
- KT  Kinterms
- GC  Group Compositions
- DEMOG  Demography
- MET  Meteorology
- BEVRECS  BEVRECS

These files can be put into two categories. All of them are amenable to analysis for abstract patterns that are more-or-less independent of any set of space-time coordinates except "MacDonald Downs, 1971-72", but only some of them are readily amenable to analysis for spatio-temporal patterning. In principle, this dichotomy is arbitrary since all of the files pertain to phenomena in which differences develop through space and time. However, the VS, GD, and KT files pertain to phenomena that change too slowly for differences to be detectable in this one field study, and the geographical limits of the study preclude the detection of strictly spatial patterning in the files. The fact that the contents of these three change relatively little at the spatio-temporal resolution level of the project as a whole (i.e., Figure 6 by 297 days) makes them well suited to a role as the "background" against which to examine those phenomena that demonstrate change within the project's boundaries in space and time.

In the following description of the data files, several terms which must be defined operationally if they are to be fully understood are used without operational definitions in order to keep the dissertation to a manageable length. Operational definitions, in abbreviated forms, are included where their absences would result in complete unintelligibility of the text.

The VS file is a rectangular matrix of "people by characteristics". There are 378 people (262 in the research population and 116 deceased ancestors and primary relatives living outside the research area), for each of whom the following information was obtained: sex, date of birth, Alyawarra age category, intra-sex age order, patrifamily membership, "section" membership, type of residence, marital status, total number of known spouses, total number of current living spouses, total number of living children. Each person was assigned one and only one serial
number which was used as the label for his row in the VS file, and that same number was used for referring to him wherever it was necessary to do so in all of the other files.

For each of the 378 people in the VS file, the GD file holds the serial numbers of his father, his mother, and his spouse(s). By manipulating this file, it is possible to generate genealogies three to five generations deep for every one of the 262 members of the research population.

The KT file contains the kinship reference term used by a selected sample of 103 people for a sample of 225 people in the research population. Two hundred and twenty-five of the 262 members of the population were photographed, and kinterms were elicited by showing those photographs to 103 people, including all of the adults who were residing in Camp A while records were being made with BEVRECS. This resulted in a rectangular matrix 103 by 225 people (23,175 cells) with each cell containing a code number for one of the twenty-five kinterms in use at the time and place of the research. Although coverage of this topic was not exhaustive (i.e., 262 by 262), it was systematic and comprehensive (fifty-one males, fifty-two females; all ages, all generations, all marital statuses, all camps, all patrifamilies with ten or more representatives in the research population).

Changes in the contents of the VS, GD, and KT files occurred when births, deaths, or marriages occurred, but for the purposes of this dissertation, we shall assume that their contents were static during the course of the field research.

Now we examine the four files containing data that may show spatio-temporal patterning within the limits of the field study. The concept of the space-time resolution level, and an awareness that different patterns are detectable at different resolution levels, led us to work at three different "distances" from the people. At the lowest resolution level, we were concerned with activities that carried members of the study population to places outside of the research area depicted in Figure 4 (spatial resolution), and since those activities were rare, we recorded them whenever they occurred (temporal resolution). Further information was obtained on these activities and others when we examined in greater detail and more systematically the activities that carried people from camp to camp within the research area. At this increased resolution level, records were made at slightly irregular fifteen-day intervals. Next, we concentrated on the activities of the people residing in Camp A alone. Some of these records have a temporal resolution of one day, while others have a resolution of one minute. A second field trip, to be made (hopefully) within two years of the conclusion of the first one, will deal with residents of a single alugera, and the records of their activities will have a temporal resolution of three seconds.

The DEMOG file contains data recorded in two distinctly different formats, viz., maps and census records. First, there is a set of seventeen maps of camps in the area of Figure 4: one of Camp C, two each of Camps B and D, nine of Camp A, and one each of three camps abandoned during the year before the research began. In constructing this file, each nuclear family was assigned one and only one “household number”, and those numbers were used in labeling all of the structures in all of the maps. The members of the households were identified, of course, by their serial numbers from the VS file. Any one map, or any set of maps all made at the same time, reveal spatial patterning only, but a series of maps reveals changing patterns in both space and time, especially when the population is as highly mobile as it is here.
Because visits from camp to camp often were brief, we supplemented the maps with census data in a different format: a matrix of "people by census day number" at fifteen-day intervals, with entries in the cells representing the location of the people on census days. Those locations included the four camps in the research area, temporary stock camps within that area, and sixteen other Aboriginal camps, cattle stations, government settlements, missions, and towns known to have been visited by members of the research population during the course of the project. The maps can be converted from analog to digital records for computer analysis in conjunction with the census records and all of the other data.

The DEMOG file contains two separate portions in different formats; the GC file contains four separate portions, all of them in the same format. That format is a rectangular matrix with each row a different observed group of people, and each column a different feature by which the groups were characterized: DAY, TIME, LOCATION (ordinarily the "household number"), the nature of the activity in which they were engaged, and the serial number of each member of the group.

1. Six hundred group compositions were recorded on systematic visits to every structure and place of assembly in the vicinity of Camp A on thirty days scattered over the last 200 days in the field.
2. By being the first person awake in the camp it was possible for us to record the compositions of 225 groups who had slept together at the various mura in Camp A on ten nights.
3. Approximately 150 special-purpose groups were recorded whenever they were observed (ceremonial groups, hunting parties, etc.).
4. By far the majority of the GC data was derived from the BEVRECS file. Approximately 2500 groups of people were observed in Camp A in the course of the BEVRECS work, and the composition, etc., of each of them was entered into the GC file in the appropriate format.

The MET file contains the following records: temperature and humidity recorded with a thermohydrograph; wind speed obtained with a cumulative recording digital anemometer read every twelve hours; and rainfall measured with a manual rain gauge. Although these records will be useful in conjunction with dietary and other ecological data, their first use is in conjunction with the BEVRECS file where each EVENT contains six values for meteorological variables.

The last of the seven major files to be discussed here is that containing the BEVRECS data. The variables used in this research were listed in Figure 1B, a sample record was presented in Figure 3B, and a list of the values and their definitions appear in the Appendix. Most of the fifty-seven values for LOCATION I and LOCATION II variables are the "household numbers" mentioned in conjunction with the DEMOG file, and the 262 ACTOR values and 262 of the ORIENTATION values are the personal serial numbers that are used in all of the other files. The remaining ORIENTATION values and the OBJECT values represent categories of nonhuman components of the environment. Generally speaking, the seventy-three BEHAVIOR UNIT values resemble ordinary English verbs. The DAY value in any EVENT represents the day on which it occurred in the project which began on DAY 001 (1 June 1971) and ended on DAY 297 (24 March 1972). TIME values correspond to the time of day (Australian Central Standard Time, twenty-four hour clock) when the EVENT occurred. Values for the MET variables are the
following: daily high and low temperature; daily high and low humidity; daily wind speed average; daily rainfall total.

From the very beginning of the research, we made a determined effort to be accepted as friendly and extremely interested in the broadest possible range of Alyawarra activities. The project did not require intimate acquaintance with the Alyawarra language or with those aspects of Alyawarra life that can be dealt with exclusively through language, but we did require virtually unlimited access to all of the ordinary day-to-day activities and all of the residences in all of the camps. In order to have unlimited freedom to move about throughout the population and the research area, we felt that it was necessary to establish approximately the same kind of relationship with all people. We avoided direct involvement in the social organization and the activities of the people in so far as that was possible, and we refused to have anything even vaguely resembling a key informant. However, by the 180th day in the field, we knew every adult in the population well enough that we could walk into any mura unannounced and carry on a brief conversation without disrupting their other activities, and we could do this without regard to any of the ordinary Alyawarra restrictions on interactions between members of the various sex/age/kinship categories. We could aspire to that kind of cooperation only if we granted it; hence, the tent (home and office) was open at all times to anyone who wanted to visit it. We were always and unquestionably alien, but the Alyawarra accepted that as we had hoped they would, and showed an incredible degree of tolerance for what must have appeared to be exceedingly peculiar behavior, especially while we were collecting the BEVRECS data.

Approximately thirty hours of practice recording sessions with BEVRECS began on DAY 157, at which time we anticipated working at a distance of thirty to forty feet from the person or group being observed. Between DAYS 176 and 184, three deaths occurred in the research population, resulting in the abandonment of Camp C, a three-quarters of a mile shift in the location of Camp A, a quarter-mile shift in the location of Camp B, and a general redistribution of people throughout the research area. The BEVRECS work came to a complete halt while the turmoil continued. While we had requested and received permission to make the close-up observations, and there had been no visible opposition or resentment of the practice sessions at a distance of fifty feet or less, we felt that the resumption of observations at that close range might be unwelcome soon after the deaths. Yet we were unwilling to delay recording for analysis beyond DAY 200. In order to avoid the potential problems, we modified BEVRECS and established a single observation point from which to make all observations - a seat atop our Landrover parked adjacent to the tent. This increased the distance from observer to observed, and greatly decreased the extent to which we interacted with the people while observations were in progress. The change seemed to be appreciated by the people, and there was never any indication whatsoever that the making of the observational records had any effect at all on behavior in the camp.

The contour of the land and the location of the observation point made it possible to see all mura in the camp, and all of the pathways interconnecting them except for two short paths between two pairs of adjacent residences. The only obstructions to visibility were some of the structures at a few of the mura. The size of the camp produced some problems in seeing the more distant residences almost 800 feet away, but we accepted the bias introduced by distance rather than introduce other biases by using binoculars. All observations were made in full view of the
people, and no observations were made with anything other than the unaided eye.

All observational records were made by the author using a "shorthand" version of BEVRECS developed during the practice sessions. Within twenty-four hours of the completion of a record, it received preliminary processing (checking and correcting, coding in all-numeric characters and in the final BEVRECS format, and so on) by a field research assistant.

While collecting much of the early GC data, and during the practice sessions with BEVRECS, we memorized the serial number of every resident of Camp A, and we learned to identify all of those people on sight. That job would have been virtually impossible without a set of Polaroid photographs mounted on cards with the VS, GD, and KT data for each person. (These photos were the ones used in eliciting the kinterms.) Undoubtedly errors of identification were made in the BEVRECS records, especially for some of the highly mobile young men with whom we never became well acquainted. However, when we were unsure of a person’s serial number, we used one of the “semi-identified” codes in the ACTOR and ORIENTATION vocabularies.

The first BEVRECS data to be recorded and retained for subsequent analysis was collected on DAY 199, and the last record was made on DAY 287. During that period of eighty-nine days, 197.5 hours of records were made in 180 observational sessions.

Scheduling of observational sessions was done with the following criteria: We wanted 200 hours of records, and we had a limited amount of time in which to reach that objective; we wanted the observations to cover all daylight hours equally; we wanted the observational sessions on any single day to be scattered out rather than clustered; and, we required that the two end points of each observational session be determined by some factor other than the behavior of the people residing in the camp. We anticipated difficulties in attempting to make all sessions have the same duration, so we decided to be as flexible as necessary in this regard. Figures 12 and 13 show the actual distribution of observation times. The large gaps in Figure 13 occurred when it was necessary to visit Alice Springs for supplies, vehicle repairs, etc.
Figure 12. Total number of observation hours at each clock hour.

Because of the size of the population of Camp A, the natural flow of activities within it, the resolution level selected for the BEVRECS work, the uninterrupted visibility of the camp as a whole from the observation point, etc., it was feasible to attempt to record all of the observable behavior of every person in the camp during each observational session. We are not claiming or even suggesting that we did in fact record all observable behavior. It is certain that things were missed. But we did record every activity that we observed during each session; i.e., there was no intentional biasing of the records in any way at all.
Figure 13. Distribution of observation time, DAY 199 through DAY 287.

As we said before, the actual observations were written down in a shorthand version of BEVRECS and transcribed into the final code and format within twenty-four hours. Using that shorthand notation, the recording rate ranged from zero to nine entries per minute, but a single shorthand entry could expand to as many as thirty EVENTS in the final form if it were a particularly complex entry. [1] is a simple entry which, when transcribed, remains a single EVENT; [2] is a relatively complex shorthand entry which expands to sixteen EVENTS in the final form.

[1] 24 227 WN 1025

At TIME 1025 and LOCATION 24, ACTOR 227 walks without leaving the area identified as LOCATION 24.

[2] 24 173bc115/ds, 227/29/30/32c can, 174cc266/ds/can WW 93 1208

At TIME 1208 and LOCATION 24, a group of women and children walk away from the camp heading south (93). The group consists of ACTOR 174 carrying her infant daughter (266) in a coolamon, and 173 carrying her son (115) on her back. Both of them carry digging sticks, and 174 carries a can as well. They are accompanied by four teenage girls: 227 (the daughter of 173); 230 (the daughter of 173's co-wife); 232 (the daughter of 174); and, 229 (a motherless child who lives at the alugera with the other three girls). The four girls are carrying cans.

Making a simple entry like [1] required perhaps two seconds, but in order to be certain of all
identities and equipment in cases like [2], more time was required. When making a complex entry, it was possible to miss short-duration, simple activities that occurred simultaneously with it elsewhere in camp, and this factor undoubtedly biased the records very slightly against brief and simple activities.

The 197.5 hours of observing and recording with BEVRECS produced a data file containing approximately 50,000 EVENTS, of which Figure 3B is a sample of fifty EVENTS.

Figure 14 is a simplified diagram of relations between the data files described in this chapter. The VS, GD, and KT files are directly tied together since the rows (items) in each of these matrices are the individual people in the research population, and the columns (features) are characteristics of the people. For purposes of the dissertation, it is reasonable to tie the MET file directly to the BEVRECS file by including meteorological variables in the BEVRECS format, but it will be advantageous to disregard that tie when the ecological data are being examined. Each and every entry in the BEVRECS, CC, and DEMOC files contains the serial number of one or more of the people; hence, an entry or group of entries in all of those files can be analyzed in conjunction with all of the data in the VS, CD, and KT files, and in conjunction with each other. Ties between BEVRECS, GC, and DEMOG files are enhanced further by the household numbers which are defined in the DEMOG file and used consistently in each and every entry in the BEVRECS and GC files. And the BEVRECS and GC files are securely bound together by virtue of the fact that a major portion of the contents of the GC file was extracted directly from the BEVRECS file.

To say that it is possible to do a job is very different from claiming that we are capable of doing it at this time. The number and complexity of the analyzable interrelations among the variables within any one file and among all of the files are mind-boggling, and the quantity of the data is overwhelming. All of the analytical work with these files can be done by computer - and much of it must be done by computer if it is to be done in any reasonable amount of time and with any acceptable level of accuracy and completeness - but an enormous amount of preliminary work is required before it will be feasible to do much of the work that is possible.

One of the stated objectives of the research project as a whole is to develop methods by which to analyze the fully integrated data files. Work in that direction is in progress, but most of it remains to be done. The analytical work to be described, and the results to be presented, in the next Part must be thought of as illustrative examples of the kinds of things that can be done with the methodology. They are the results of early experimentation in manipulating the data files, and as such they are expected to be of much greater value in explaining BEVRECS than in explaining the Alyawarra.
Key to ties among files:

1. personal identification numbers
2. household numbers
3. BEVRECS observations

Figure 14. A diagram of relations among the files introduced in Chapter 3.
Part 2. Results of the Research

In this Part of the dissertation, we examine the BEVRECS data from three different perspectives. Chapter 4 contains a general introduction to some of the simpler analytical procedures that can be used in searching for patterns in the data, a broad overview of the contents of the BEVRECS data file, and a superficial description of some of the gross behavior patterns characteristic of the Alyawarra. In Chapter 5, the focus is on infant transport, one narrow aspect of Alyawarra behavior as recorded in the BEVRECS file, and the examination is highly detailed. In addition to a comprehensive description of infant transport among the Alyawarra, that chapter contains a review of the anthropological and primatological literatures as they pertain to infant transport, and cross-cultural and cross-species comparisons are attempted. In the next chapter, Chapter 6, our major concern is with the nature of the patterns detected in the two preceding chapters rather than with the contents of any of those patterns.

In the course of the field research, we encountered several problems which we had anticipated and several which we had not. Some were unique to the setting in which we worked or were relatively insignificant, while others will be faced by anyone else who uses BEVRECS or any similar recording system and solving them satisfactorily will be important if research of this kind is to be successful. Chapter 7 contains a description of the general problems that we encountered, a few of which have been mentioned in other contexts in preceding chapters.
Chapter 4. Introduction to the Analysis of BEVRECS Data

Since the BEVRECS data was put into its final form within twenty-four hours of recording, transferring it to punched cards for computer input began immediately after the termination of fieldwork. Temporal and financial limitations made it necessary for us to select a sample from the BEVRECS file rather than attempt to use all of it as the data base for the dissertation. After considering several criteria for selecting the sample, we decided upon the simplest and easiest one. As the records accumulated in the field, they were bound sequentially into three volumes of approximately five hundred pages each. The middle volume accumulated after the bugs were worked out of the system during the early recording sessions, and it contains records that were made before observer fatigue began to set in; i.e., in addition to containing a sufficient quantity of data for the purposes of the dissertation, we feel that this is the highest quality portion of the entire BEVRECS data file. All of the data in the middle volume was put onto data processing cards. That sample - approximately 30% of the total file - contains 13,997 EVENTS that were recorded during PROJECT DAY 241 through DAY 267.

Data quality control has been a problem since the beginning of the research, but we are satisfied that errors have been held to a tolerable level. Errors could occur at the following points:
- initial recording during observation sessions
- transcription to final form
- keypunching.

By the time we began recording for analysis at DAY 199, both of us had an intuitive grasp of behavior in the camp so that any entries in the observational records which seemed counter to our “feel” were questioned and dealt with within twenty-four hours of recording. Other errors could be detected by examining the logic of the entries in the observational record. For example, BEHAVIOR UNIT value 201 means "walk to" (from one LOCATION to a second LOCATION), while value 209 means "walk at" (locomote at a single LOCATION). If 201 appeared without a coded destination, or 209 with one, there was an error which could be corrected by checking preceding and succeeding entries in the record to see which behavior code for this entry was compatible with other behavior recorded for the ACTOR in question. These two checking procedures did not eliminate all recording errors, but they did eliminate most of the major ones. Entries which were found to contain errors that could not be satisfactorily resolved were discarded.

During transcription and card punching, two types of errors occurred: typographical errors, and errors in format. Checking for format errors was straightforward: we visually examined the cards - and the printout from the cards - to verify that all values were in the appropriate columns and that all punches were numeric rather than alphabetic. Checking for typographical errors was done after the first computer run which provided a one-way frequency distribution of all values for all variables. When we detected a value in the output which was not a legitimate value for the variable in question, we converted it to a “missing value” and omitted it from all subsequent analyses. The two verifying procedures resulted in the detection of about sixty-five typographical and format errors. With something on the order of 140,000 cell entries in the data
file, the detected error rate was 0.042%. Even if we assume that a figure as high as 90% of the errors escaped detection, the overall error rate would still be less than 0.5%. There is no known reason why the errors would be anything other than random noise, and hence are of no consequence for this analysis.4

In order to make meaningful comments concerning the contents of the tables used in the dissertation and to make meaningful inferences about the behavior of the Alyawarra, we must know a bit about the sex-age composition of the population of the camp during the days when observational records were made, and about the temporal distribution of observation sessions.

Although many of the most interesting analyses that can be performed with the BEVRECS data require the use of personal identification numbers so that behavior patterns of individual people can be examined, that work is expensive and time-consuming, and it can be done most productively only after the vital statistics, geneadata, kinterms, and census data have been prepared for computer analyses. In preparing this chapter all analyses that dealt directly with ACTOR and ORIENTATION variables were performed only after new ACTOR and new ORIENTATION variables were created by recoding the original values according to membership in various sex-age categories. The tables in Figure 15 show the names of the new variables created, the coded values for the new variables, and the number of ACTORS appearing in the data file who were members of the classes formed by the intersection of values for sex and age variables. In 15B, the sex distinction is omitted, and it is self-explanatory in 15A and 15C. The age categories are derived partially from Alyawarra terms for age groupings which correspond rather closely with social milestones in Alyawarra life, and partially from our decision to use physiological criteria as markers for age-group boundaries.

The physiological and social markers at 2, 15, and 45 years are clear: at or about 2 years, a baby begins to develop language skills, and fully independent and reliable upright locomotion has just been achieved; at or shortly before 15 years, there is the onset of puberty, male initiation, movement into single-sex dwellings for males and females, and shortly thereafter, perhaps marriage for females; at or about 45 years, the males' beards turn silver and they become "mature men" rather than "young men". The 45-year marker is not so clear for females, but in selecting the boundaries for these analyses, we felt it was reasonable to keep the classes of identical age span for both sexes. At 7 years, a person ceases to be called a "little boy/girl" and becomes a "big boy/girl", but there are no clear physiological markers appearing at this time, and in fact, this age distinction in the Alyawarra language is the one used least reliably by the people. At or about 60 years, a person becomes an old man/woman, but again the physiological markers are unclear and user reliability is relatively low.
### A. \*ACTOR, \*ORIENTATION, \*ORIENTATION\textsubscript{2}

<table>
<thead>
<tr>
<th>VALUE</th>
<th>NUMBER OF MALES</th>
<th>AGE</th>
<th>NUMBER OF FEMALES</th>
<th>VALUE</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>7</td>
<td>60-99</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
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</tr>
<tr>
<td>3</td>
<td>4</td>
<td>30-44</td>
<td>13</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>15-29</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
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<td>8-14</td>
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</tr>
<tr>
<td>6</td>
<td>10</td>
<td>2-7</td>
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<td>14</td>
</tr>
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<td>0-1</td>
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</tr>
</tbody>
</table>

### B. \*ACTOR\textsubscript{3}, \*ORIENTATION\textsubscript{3}

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<th>NUMBER OF FEMALES</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
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<td>45-99</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
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<td>TOTAL</td>
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</tr>
</tbody>
</table>

### C. \*ACTOR\textsubscript{2}

<table>
<thead>
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<th>AGE</th>
<th>TOTAL NUMBER OF PEOPLE (both sexes)</th>
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<tbody>
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<td>60-99</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>45-59</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>30-44</td>
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<td>15-29</td>
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<td>8-14</td>
<td>14</td>
</tr>
<tr>
<td>6</td>
<td>0-7</td>
<td>23</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>92</td>
</tr>
</tbody>
</table>

**Figure 15.** Distribution of ACTORS and human ORIENTATIONS by sex-age category.
Except for cells (5), (7), and (15) in Figure 15A, all three tables have sufficient numbers of individuals in each cell to make interpretations meaningful for the population and not just for (perhaps idiosyncratic) individuals. The ninety-two people in Camp A during the BEVRECS sessions constitute 35% of the MacDonald Downs - Derry Downs Aboriginal population and almost 20% of the total known Alyawarra population.

In obtaining the complete BEVRECS file, we scheduled the observation sessions to yield the same total amount of observation time for each daylight hour. However, there were observation-hour irregularities or inequalities in the 30% sample selected for the dissertation. To eliminate the distortion resulting from irregularities in observer behavior, we performed a series of operations which resulted in the adjustment of all values for all variables by a factor that reduced to zero the variability in observation session distribution.

Figure 16A shows the actual distribution of observational sessions during which the dissertation database was recorded. The row variable is observation day (17 actual days during the period DAY 241 through 267) and the column variable is time (the daylight hours, 0600 through 2000) in twenty minute segments. In Figure 16B, the solid line representing number of actual observation sessions per clock hour indicates the extent to which distortions in the records might have resulted from irregularities in session scheduling. The weighting factor transformed that irregular line into the dotted line which is constant.

The importance of this adjustment for all subsequent analyses of the data is illustrated in Figure 17. Figure 17A shows the percentage of the total number of actual observations (13,997) made at each clock hour, and Figure 17B shows the distribution of observations after the adjustment was performed. Figure 17B is an accurate representation of the temporal distribution of Alyawarra behavior through the day with observer behavior held constant, while Figure 17A reflects the undesirable combination of variations in Alyawarra behavior (17B) with variations in observer behavior (solid line in Figure 16B).

The temporal distribution of EVENTS as plotted in Figure 17B reveals some interesting things about overall observable behavior in the camp. There are three activity peaks during the day: the largest about two and a half hours after sunrise, another between noon and 1300 hours, and a third just at sunset. The first peak occurs as everyone is beginning the day's chores, the second, near the time of the midday meal, and the third, when the day begins to cool off. The major trough in the mid-afternoon can be appreciated when it is realized that the mean high temperature for the observation days in question was 99°F., and that the high temperature on 23% of those days was between 106°F. and 108°F. The number of days represented in this sample from the BEVRECS file is too small to warrant a comparison between hot days and cool days, but we predict that the complete file will show marked differences in the temporal distribution of activities under different environmental conditions.
The size of the sample file and the numbers of individuals in each sex-age category make it worthwhile to examine the temporal distributions of overall activity for specified sub-groups of the population. Figure 18 does this in two ways. Figure 18A shows the activity distribution patterns for all people in each category with sex distinctions disregarded, and Figure 18B shows the distributions with sex distinctions retained and age categories partially collapsed. In Figure 18A, we see that people older than 44 years are most active early in the morning and that there is a relatively steady decline in their activity level as the day progresses, while people younger than 15 years become active a bit later than their elders and distribute their activities more evenly.

**Figure 16.** Distribution of observation time, DAY 241 through DAY 267
throughout the day. In Figure 18B, we see that the activity pattern for males under 15 years of age is very similar to that for females under 15 years. However, the pattern for males in the 15-44 year age group is strikingly different from that for females of the same age, and the difference is just as clear-cut between males older than 44 years and females older than 44 years. Within the sex classes, it appears that the pattern for older females might be an “exaggeration” of the pattern for females in the middle age range, but there is no detectable similarity between the patterns for older and middle age men.

Figure 17. Temporal distribution of all EVENTS in the sample.

Figures 17 and 18 provide information on the patterning of total activity through the day, but there is nothing in those Figures pertaining to what kinds of activities occur, who performs them, where they occur, or the relative frequencies with which they appear in the file. In order to get an initial view of some of these details, we examined the one-way frequency distributions generated on the initial computer run.

Figure 19 shows one of the many ways in which these tables can be manipulated. Here we rank order, by increasing relative frequency, the values for each of three variables and discover that each of them produces a J-curve. The distribution of relative frequencies for the ACTOR variable (Figure 19C) shows that no single ACTOR makes any outstandingly large contribution to the total amount of recorded activity, while the distribution for
Figure 18. Temporal distribution of all EVENTS by sex-age classes.

BEHAVIOR UNIT (to be called BEVUNIT henceforth) shows that three values ("walk at", "walk to", and "carry nonhuman object") out of a total of fifty values (i.e., 6%) account for about 80% of all recorded behavior. *LOCATION1 is intermediate in this regard. The skewing that is so great in Figure 19B is due partially to actual behavioral characteristics of the ACTORS and partially to a bias introduced by the selection of a relatively low resolution level for this set of data. It is impossible to separate these two factors without additional research conducted at a higher resolution level. The bias in favor of recording locomotor and carrying behavior is constant across all sex-age classes, however, and for that reason it is not especially troublesome.

Figures 20 through 22 give a preliminary and general overview of similarities and differences in behavior repertoire for the sex-age classes from Figure 15, an introduction to the division of labor in the camp, and temporal distributions for a selected sample of labor activities.

In Figure 20, the six graphs display the relative frequencies with which each of nine categories of behavior were recorded for ACTORS in each of the designated sex-age classes. Each of the nine classes of behavior represents a single value or a group of values from the BEVUNIT vocabulary, some lumping being necessitated by the large
In this Figure, the values for the variables are arranged (from the left) in order of decreasing relative frequency.

Figure 19. Relative frequency of occurrence of values for three variables.
In each of the six graphs above, the nine divisions of the abscissa are, from the left:

1. Walk
2. Carry nonhuman object
3. Misc. manipulations
4. Carry person
5. Play
6. Run
7. Climb
8. Eat, drink, urinate, etc.
9. Other

**Figure 20A.** Behavior profiles – relative frequencies with which nine classes of behavior are performed by six sex-age groups.
Figure 20B. Behavior profiles – sex-age locomotor profiles.

number of BEVUNIT values and the relatively low frequency with which some of them appeared in the 30% sample of data.

Although a detailed discussion of the behavior profiles would be inappropriate here, a few summary comments are in order. We see, for example, that males do not carry other people, while all ages of females do carry other people. All people engage in a variety of manipulative activities such as hit, throw, dig, pour, push, pull, etc., but miscellaneous manipulations are most prominent in the profile for 15-44 year old males. Adults run only very rarely, children do so more frequently; but the relative frequency of running is four times greater for young males than it is for young females. The relative frequency of carrying nonhuman objects is positively correlated with age among both sexes; for running, there is a negative correlation among both sexes; and for walking, the relative frequency is positively correlated with age among males and negatively correlated with age among females. By performing a one-way frequency distribution of all locomotor activity recorded for each of the fourteen sex-age groups from Figure 15A, the last point can be examined in much greater detail. We see in Figure 20B the striking difference between the sexes in the relative frequency with which each age group engages in locomotor activity. (Adjustments were made, of course, to remove distortions that would have resulted from inequalities in the numbers of individuals in each sex-age group.)

Figure 20A contains six one-way frequency distributions of nine values of *BEVUNIT while controlling for values of *ACTOR (i.e., a simple cross-tabulation of *ACTOR by *BEVUNIT). Consequently, each of the graphs contains a complete (but gross) behavior profile for a single sex-age class.

Figure 21 is more complicated. The thirteen graphs in that figure were derived from a cross-tabulation of *ACTOR by ACTIVITY. ACTIVITY is not one of the variables in the basic BEVRECS list, but is a new variable created from the data. Each value for the ACTIVITY variable represents a combination of one BEVUNIT value with one
In each of the sixteen graphs above, the nine divisions of the abscissa are, from the left:

1. male > 45 years old
2. male 15-44 years old
3. male < 15 years old
4. female > 45 years old
5. female 15-44 years old
6. female < 15 years old

Key To Activities:

1. Carry person
2. Repair habitat
3. Repair automobile
4. Push automobile
5. Hit dog
6. Walk to bore
7. Walk to ungundya
8. Walk to alugera
9. Push unserviceable tires
10. Cook bread
11. Make fire
12. Chop wood
13. Carry water
14. Carry sticks
15. Carry bread
16. Carry tea

**Figure 21.** Relative frequency with which each of sixteen ACTIVITIES is performed by each of six sex-age classes.

ORIENTATION value. For example, the BEVUNIT "carry nonhuman object" can co-occur with any movable nonhuman object in the environment, and the ORIENTATION "bread" can co-occur with any of several BEVUNITS (e.g., eat, cook, throw, carry, etc.). In the sample data
file, the BEVUNIT "carry nonhuman object" co-occurred with the ORIENTATION "bread" on forty-two occasions. That pair of values from two different variables were united as "carry bread", a single unique value for the new variable ACTIVITY. The other ACTIVITY values were created by the same procedure. Subsequently, the cross-tabulation yielded the figures upon which the graphs in Figure 21 are based. Here we have one-way frequency distributions of the six values of the *ACTOR variable while controlling for values of the ACTIVITY variable. Figure 20A shows behavior profiles for each sex-age class while Figure 21 shows the "sex-age division of labor" for each of thirteen tasks.

Some tasks, e.g., cooking bread and carrying people, appear in this data sample to be performed exclusively by females (although we did observe men doing both on very rare occasions), and others, e.g., repairing automobiles, are done exclusively by adult males. With one exception, all other tasks are performed by both males and females, although the contributions by each sex-age category vary in a number of interesting ways. The one exception is that the only people who push tires (i.e., unserviceable automobile tires used as toys) are young males. In fact, pushing tires is the only activity in this list to which young males make any important contribution, while young females make sizeable contributions to performing many of the tasks necessary for the continuing day-to-day operation of the camp - transporting people, water, firewood, bread and tea: and repairing habitats. Hitting dogs (which can be combined with "throwing sticks at dogs") is virtually a universal behavior pattern, sometimes appearing to be a task (keeping dogs out of food, etc.) and sometimes, a pastime.

In addition to learning who does the items in the ACTIVITY list, we can obtain a cross-tabulation of ACTIVITY by *TIME to examine the temporal distribution of task performance in the camp. The graphs in Figure 22 show this clearly. An alternative and equally revealing set of graphs that could be extracted from the ACTIVITY by *TIME table is that in which we control for time and examine the relative frequency with which each activity occurs at each clock hour. And it would have been a simple matter to cross-tabulate ACTIVITY by *LOCATION to see the spatial distribution of the performance of tasks.

The BEVRECS data recorded from DAY 241 through DAY 267 contains information pertaining to 1311 groups of people, and that data was coded in the GROUP COMPOSITION format during preliminary processing in the field. Since this information is directly related to behavior profiles and divisions of labor, a little of it is inserted at this point. In extracting the GROUP COMPOSITION data from the BEVRECS file, we required that we were able to see all members of a group before the group could be included in the GROUP COMPOSITION file. In practice, this meant that only those groups were counted that were well away from structures that might contain or conceal unseen members. Hence, the groups represented in Figures 23 and 24 are, essentially, groups in motion between two LOCATIONS. In many cases, it was possible to make
In each of these twelve graphs, the ordinal is time in 1-hour intervals beginning at the top of each graph at TIME 0601.

Key To Activities:

1. Carry tea 7. Cook bread
2. Carry person 8. Make fire
3. Repair habitat 9. Chop wood
4. Repair automobile 10. Carry Water
5. Push automobile 11. Carry sticks
6. Hit dog 12. Carry bread

**Figure 22.** Temporal distribution of ACTIVITIES.

reasonable categorizations of the overall activity of the observed group - collecting firewood, hauling water, playing, repairing a car, etc. - but in others, we knew only that the group went from one LOCATION to another with no detectable task being performed. A group is defined as
1) two or more people 2) who are outside of the cleared areas that surround each structure, 3) who are closer to each other than they are to anyone else and 4) who are all moving in roughly the same direction if they are in motion.

Figure 23A is a one-way frequency distribution of group sizes for all 1311 groups in the sample. Figure 23B contains distributions for male-only groups, female-only groups, and groups containing members of both sexes. All four distributions give J-curves. Mean group size is lowest among male-only groups and highest among mixed groups. In Figure 24, we see distributions of group sizes for nine different classes of groups, some of which coincide roughly with some of the values for the ACTIVITY variable. Seven classes of activity groups have typical J-curve distributions, but two of them give skewed normal curves. Further analyses can be performed to determine the sex-age compositions of the groups while controlling for activity type; temporal distributions; genealogical and kin terminological relations within the groups; and so on.

Figures 16 through 24 were derived from cross-tabulations all of which produced rectangular matrices. However, procedures which necessarily yield square matrices are especially interesting. Figure 25A is a square matrix generated by cross-tabulating *ACTOR by *ORIENTATION, with all nonhuman ORIENTATIONS deleted. The only conditions under which an ACTOR and a human ORIENTATION co-occurred in a single EVENT was when there was some kind of direct physical interaction between a pair of people. Such direct physical interactions included carrying, leading, exchanging objects, throwing things at, etc.; simply being together did not constitute a direct physical interaction, and that condition was coded differently in the records. The row and column values are the sex-age groups from Figure 15A, and the cell entries are percentages of the total number of recorded interactions.

In order to interpret the table, it is necessary to know the frequencies expected by chance as well as the frequencies observed. A summary of expected frequencies and observed frequencies by collapsed sex-age categories appears in Figure 25B. Given the actual sex-age structure of the population, we see that female-female interactions occur with a frequency that is only a bit higher than expected, while male-male interactions are one-fourth as frequent as would be expected by chance. Interactions between the sexes are a bit higher than would be expected overall, but when we control for the age of the males who interact with females, it is obvious that highly unexpected things are happening. Females interact with male children about 3.5 times more frequently than expected, and with adult males about 7 times less frequently than expected. A $x^2$-test shows that the differences between observed and expected frequencies are significant at beyond the 1% level of confidence.

Not only can we examine interactions between pairs and categories of people, but also, by cross-tabulating *LOCATION1 by *LOCATION2 we can examine interactions between specific pairs and general categories of LOCATIONS. The EVENTS from which Figure 26A was derived were simply all of those in which there were entries in LOCATION1 and LOCATION2 columns. Clearly, much more refinement could be achieved quite easily.
In each of these four graphs, the abscissa is “group size” beginning at "2 people" and increasing from the left in 1-unit increments.

**Figure 23.** Relative frequency of occurrence of groups of specified size and composition.
In each of these nine graphs, the abscissa is "number of people in group" beginning at 2 people and increasing from the left in 1-unit increments.

Key To Activities
1. collecting leafy limbs
2. collecting sticks (firewood)
3. walk to residence, reason unknown
4. walk to neutral area within camp, reason unknown
5. leave large camp, reason unknown
6. play group
7. water-hauling group
8. food gathering group
9. repairing or pushing automobile

Figure 24. Relative frequency of occurrence of groups of specified sizes engaged in nine different ACTIVITIES.
### Figure 25A. Detailed distribution of interactions between pairs of sex-age classes.

<table>
<thead>
<tr>
<th>Sex-age Combinations</th>
<th>Frequency of occurrence of pairs (percentages)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Expected</td>
</tr>
<tr>
<td>Female-Female</td>
<td>53.3</td>
</tr>
<tr>
<td>Female-Male Under15 Years Old</td>
<td>9.9</td>
</tr>
<tr>
<td>Female-Male Over15 Years Old</td>
<td>19.9</td>
</tr>
<tr>
<td>Male-Male</td>
<td>16.9</td>
</tr>
</tbody>
</table>

*ROW and column values as defined in Figure 15A.

*Figure 25B. Expected and observed distribution of interactions among collapsed sex-age classes.*
Five of the eight LOCATION-categories in FIGURE 26A are nonresidential in nature. If we disregard those and concentrate exclusively on the fourteen single-family dwellings, the four women's camps, and the one men's camp, we see an outstanding characteristic of interactions between pairs of residential units within the Alyawarra camp. In Figure 26B, the upper entry in each cell is the expected frequency of interactions between structures in each pair of categories, and the lower entry is the observed frequency. Again, a $x^2$-test shows that the differences are significant at beyond the 1% level of confidence.

In Figure 26C, the pairs of LOCATION-categories in Figure 26A are rank ordered according to the relative frequency with which interactions occur between them. The ability to rank order people, places, times, activities, etc., and all combinations of values for the different variables enables us to perform many kinds of correlational analyses that would be impossible otherwise, and when used in conjunction with the other data files (i.e., genealogical data, vital statistics, etc.), the analytical possibilities are virtually unlimited and, so far, unexplored.

In order to get some idea of the types of residential units at which people engage in much of their activity, we created a new variable (NORALK) and cross-tabulated *ACTOR by *LOCATION1 while controlling for NORALK. NORALK is a binary variable whose two values represent the presence and absence of nondirected locomotion, "walk at" or "run at" (in contrast with "walk to" and "run to"), as the BEVUNIT value. The resulting table was a matrix of 92 rows by 56 columns in which each cell entry represented the relative frequency with which a given ACTOR engaged in non-directed locomotion at a given LOCATION. By using that 5052-cell matrix as the raw data in conjunction with a manual sorting of the kinship and genealogical data, it was possible to construct Figures 27A through 27C. The three portions of that Figure are, in fact, the same table examined from three different points of view.

Cell entries in Figure 27A represent percentages of all NORALK occurring at each row-column intersection; in Figure 27B, they represent the relative frequency with which a given sex-age class engages in NORALK at each LOCATION-type; and in Figure 27C, they represent the relative frequency with which each sex-age class engages in NORALK at a given LOCATION-type. All figures were adjusted to eliminate biases due to inequalities in the number of ACTORS in each sex-age classes. Each of the three tables can be examined both row-wise and column-wise for different kinds of patterns in the distribution of this particular behavior among the various people and places in the camp.

The column and row totals from Figure 27A yield the summary table, Figure 27D, which shows that males and females are roughly equal in the mean frequency with which they
A.  relative frequency (%) of interactions between all classes of LOCATIONS;
B.  interactions between classes of residential structures;
C.  terminal point pairs arranged in order of decreasing relative frequency of interactions.

**Figure 26.** Interactions between LOCATIONS
Key to location values used in parts A, B, and C of this figure:
1. At one's own anordegan
2. At the anordegan of one's own parent or one's own child when the ACTOR in question does not reside with the person to whom the anordegan belongs
3. At an anordegan other than those designated by Values 1 and 2 above
4. At OIC'S own alugera
5. At an alugera other than one's own
6. At the ungundya
7. At LOCATIONS other than those designated by Values 1 - 6 above

Figure 27. The distribution of nondirected locomotion (NORALK) by males and females among various categories of residential LOCATIONS.
engage in NORALK, but that there are major differences in the mean frequency of NORALK at each LOCATION-type. Figure 27B shows that adult males do most of their NORALK at the ungundya and at their own anoardegans, and that women do most of theirs at an alugera and at their own anoardegans. Females never NORALK at the men's camp and males under 15 years of age do so only very rarely. In spite of the fact that young males and young females are alike in that they were never observed engaging in NORALK at the men's camp, there are major differences in the NORALK pattern between the sexes even before the age of 15 years. Several of the proceeding Figures reveal similarities between mature males and immature females - similarities that we did not even suspect while we were doing the fieldwork - and we see another of them in Figure 27B. Both adult males and immature females do about 24% of their NORALK at their own single-family residences and approximately half of their NORALK at camps at which adult members of the opposite sex are rarely or never present. On the other hand, both mature females and immature males do about half of their NORALK at their own single-family dwellings and only a third of them at the women's camps.

We might wonder how "walking at" certain LOCATIONS compares with "walking to" those LOCATIONS. Although a great deal of detail was omitted in preparing Figure 28A, enough remains to give some indication of the answer to the basic question. We see, first, that members of all four sex-age groups were observed walking to all three types of residential units, but that adult males were never seen walking at alugerans and no females were ever observed walking at the ungundya. Does this mean that people sometimes visit the camps of the opposite sex, perhaps for lengthy periods, but remain immobile while there, or that their visits are not only rare but brief as well? A subtraction of arrival TIME from departure TIME for each of the recorded visits of the kind in question (impossible with the SPSS programs) would reveal that virtually all of them had durations of less than one minute; i.e., we might suspect that they were made by people running errands and not pausing for visits with the residents. In contrast with this, we see that immature females do 48.1% of all walking to single-family dwellings and only 18.3% of the walking at them, while for mature females those figures are roughly reversed. The same is true for walking to and walking at the women's camp. This might suggest that mature females concentrate their locomotor behavior at certain LOCATIONS and change their LOCATIONS relatively infrequently while immature females change their LOCATIONS relatively frequently and "rest" between trips.

The graphs in Figure 28B show the temporal distribution of “walking to” for each type of residential structure. Since 85% of all walking to the ungundya is done by males and 85% of all walking to the alugerans is done by females, the graphs show that simultaneous morning peaks of inter-LOCATION locomotion occur for both sexes, directed strongly toward the two types of single-sex dwellings, and that the people locomote toward their respective single-sex LOCATIONS more between 0800 and 0900 than at any other times of the day.

By controlling for the created variable RALK (locomote between two LOCATIONS) while cross-tabulating *LOCATION1 by *LOCATION2, it was possible to generate a square
A. Relative frequency of locomotion to and at location classes by sex-age classes

<table>
<thead>
<tr>
<th>TYPE OF LOCATION</th>
<th>CLASS OF LOCATION</th>
<th>SIX-AGE CATEGORY OF ACTORS</th>
<th>FEMALE</th>
<th>FEMALE 15-99 yrs</th>
<th>MALE</th>
<th>MALE 15-99 yrs</th>
<th>ROW TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adardegan</td>
<td>walk to</td>
<td>48.1%</td>
<td>25.4%</td>
<td>15.7%</td>
<td>10.7%</td>
<td>100.0%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>walk at</td>
<td>18.3%</td>
<td>68.0%</td>
<td>12.5%</td>
<td>15.2%</td>
<td>100.0%</td>
<td></td>
</tr>
<tr>
<td>Algiersa</td>
<td>walk to</td>
<td>32.6%</td>
<td>32.2%</td>
<td>15.0%</td>
<td>6.2%</td>
<td>100.0%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>walk at</td>
<td>29.0%</td>
<td>55.5%</td>
<td>15.3%</td>
<td>-</td>
<td>100.0%</td>
<td></td>
</tr>
<tr>
<td>Urgunova</td>
<td>walk to</td>
<td>8.3%</td>
<td>4.4%</td>
<td>4.1%</td>
<td>83.1%</td>
<td>100.0%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>walk at</td>
<td>-</td>
<td>-</td>
<td>1.4%</td>
<td>98.6%</td>
<td>100.0%</td>
<td></td>
</tr>
</tbody>
</table>

All cell entries are row percentages

Figure 28. “Walking to” and “walking at” three categories of residential LOCATIONS.

matrix of locomotor interactions between all pairs of LOCATIONS in the camp. Figure 29A is a modified version of that matrix. The strength of the tie between each pair of LOCATIONS is represented by the size of the entry at the intersection of each row and column. All cell entries, which represent total percentages, were multiplied by ten, and any value less than 0.1% was omitted from the table. The matrix is an abstract version of the total traffic flow diagram that can be analyzed extensively by means of graph theory.

We display in Figure 29B, in an intuitively more appealing form than in Figure 29A, the contents of that matrix superimposed on a slightly distorted map of camp. The enormous wealth of relational information contained in this matrix can be appreciated best when we realize that the number of EVENTS upon which it is based is 5870, and that this particular matrix covers all ACTORS, at all TIMES, carrying and not carrying other people, and so on. Much more refined matrices, actually several highly refined
matrices, can be generated by cross-tabulating while controlling for values and combinations of values from other combinations of variables. For example, a single cross-tabulation of *LOCATION1 by *LOCATION2 by *ACTOR3 by *TIME by RALK would generate a total of eighty-four separate matrices, each with 484 cells. The fine details which would be clearly visible in that set of matrices are totally obscured within the single matrix in Figure 29A, since Figure 29A is a composite, encompassing all the data that would appear in the eighty-four separate matrices. One of those eighty-four would, for example, give us a precise view of the travel paths for 15-44 year old males between eight and nine o’clock in the morning. In various combinations, they would reveal, e.g., overall travel paths for a given sex regardless of age and time, paths at a given clock hour regardless of sex or age of the ACTOR, and paths for a given age group regardless of sex and time. And all eighty-four examined together provide an astonishingly dynamic view of the social organization of a particular population of people in an isolated camp in Central Australia.

Many of the figures presented and briefly described in this chapter deal with locomotor behavior since locomotion constituted a major portion of the activities appearing in the BEVRECS file. The figures perform at least three major functions: 1) they illustrate, with a few simple examples
and with real data about real people, some of the many kinds of ways in which the single BEVRECS data file can be analyzed with the SPSS program package; 2) they begin to suggest the outlines of a comprehensive, quantitative description of Alyawarra non-verbal behavior in early 1972, a description that can approach exhaustiveness at the chosen resolution level as the contents of the other data files are brought into use; and 3) they reveal an enormous variety of nonrandom patterns, each of them begging for an explanation and suggesting multiple hypotheses which can be tested by statistical procedures, using the contents of one, several, or all other data files in conjunction with the BEVRECS data.

As a demonstration of analytical technique and method, this chapter represents nothing more than preliminary probings during which we began to experiment with ways of manipulating the BEVRECS data file. All of the computer analyses done to this time have been simple one-way or two- to four-way frequency distributions. There have been no attempts to perform any kinds of correlation analyses, scalings or factor analyses, all of which are possible with SPSS; there has been no experimentation with stochastic analyses or any kind of mathematical procedure that is beyond the capabilities of the SPSS computer programs; as yet, many of the logical, as well as the financial and technical problems associated with the overall integration and computerization of the complete eight-section data file remain to be solved, hence no attempt has been made to computer-analyze two or more files simultaneously.

The first-order analyses presented here reveal nonrandom patterns in space and time, nonrandom patterning of activities across sex and age categories, nonrandom patterns in interactions between sex-age categories, between individuals, between places on the map, and between genealogical and kin terminological classes of people. To this point, all analyses have been 100% descriptive, with no attempts having been made to test any hypothesis other than the most general of all hypotheses: i.e., observable and recordable behavior occurs randomly in time and space throughout the research population. That hypothesis can be rejected unequivocally on the basis of the evidence contained in this chapter.

In the introduction to the analysis of BEVRECS data presented in this chapter, we gave a superficial picture of a few of the nonverbal behavior patterns characteristic of the Alyawarra, using those patterns primarily as a means of demonstrating some of the kinds of things that can be done with the behavior recording system and the SPSS computer programs. In preparing the figures upon which the chapter is based, we made no attempt to deal with a particular substantive issue; on the contrary, a conscious effort was made to deal with disparate topics in order to demonstrate the enormous range of substantive issues that can be investigated using a single BEVRECS data file that was compiled without any specific substantive topic being selected in advance of data collection. Any one of the topics dealt with in the chapter, plus a large number of others not even touched upon here, could be chosen for intensive examination by a person with special interests in a particular aspect of Alyawarra behavior. In the next chapter, we support this assertion by presenting a detailed examination of one substantive topic. Specifically, we shall deal with infant transport among the Alyawarra.
Chapter 5. Infant Transport among the Alyawarra

Although socialization in the broadest sense of the term is a process that continues throughout an individual’s entire lifetime, few would challenge the assumption that much of a human's socialization occurs during the early years of life, when the child is dependent upon others for his survival. According to Ewer (1968), there are four basic modalities in which mammals handle the survival needs of their offspring: carrying (monkeys), following (horses), nesting (rabbits), and caching (some antelopes). It seems reasonable to assume that the basic modality of child-rearing places major constraints on the socialization process of a given species, and furthermore, that a detailed understanding of the many components of a given modality, as practiced within a given population, will be of importance in understanding the social structures and behavioral processes that characterize that population, the species to which it belongs, and the group of species using the child-rearing modality in question. The literature dealing specifically with the four basic modalities of child rearing is scanty, and it is in the interest of improving this state of affairs that we have prepared this chapter on the carrying of infants among the Alyawarra.

In a recent article on the socialization process, Williams (1972) presents a concise description of the different views of socialization that have emerged in the three disciplines that have dealt with the topic, as it pertains to human behavior. Anthropologists, using socialization to refer to the intergenerational transmission of cultures, generally do comparative research based on data from a large number of cultures. Psychologists, using the term to refer to the infant’s acquisition of motor control, study particular individuals in a single culture. Sociologists, using it to refer to the training of infants and children for future social performances, deal with a series of events affecting individuals in large social groups in one culture. In addition to these overlapping but divergent uses of the term "socialization", there are the terms "enculturation" and maturation" which refer to the same set of phenomena.

Mead (1963) points out that it is necessary to distinguish between statements concerning these phenomena that are true in all human cultures, and those that are true only in one culture. Williams (1972) uses this distinction as the basis for formulating contrasting definitions of "socialization" and “enculturation”. He suggests that socialization be used to mean the set of species-wide requirements made on human beings as they learn human culture, and enculturation to mean "the process of learning one culture in all its uniqueness and peculiarity". In light of recent publications (e.g., Jay,1968, passim) dealing with behavioral differences between different populations within a single species of nonhuman primates, it is not only reasonable but necessary to generalize Williams' definitions so that they are applicable to all primate species, and perhaps to all species of animals as well.

As defined here, socialization and enculturation are not separate processes; rather they are related as parts of a conceptual hierarchy. Each "normal" young individual of any species will have a series of experiences that are unique to it alone, that are characteristic of the particular population or social group of which it is a member, and that are typical of the species to which it belongs. From an analysis of the behavior of several individuals of a given population it is possible to
distill a general description of a particular enculturation process; from a description of the enculturation process among several populations of a given species, it is possible to distill a description of the socialization process that characterizes that species.

The relationship between "maturation" and the enculturation-socialization conceptual hierarchy is different from the relationship between enculturation and socialization. The concept of "learning" is central to the definitions of both enculturation and socialization. Maturation (and the related concept of "development") as used in psychology and zoology are related somewhat more closely to the structural and chemical changes that occur in an organism as it grows older. These changes are, to some extent, the biological foundations upon which the socialization process is based. Of course, the numerous and complex feedback relations that exist between "nature and nurture", "learning and instinct", "structure and function", etc. make this distinction rather arbitrary, and under certain conditions it becomes not only useless but also harmful. As a first approximation, however, it can be a useful distinction in selecting a focus for research. In studies of maturation, the young individual tends to be the primary focus of the researchers' attention, and other members of the population with whom the young may interact tend to be of secondary interest. Studies of socialization tend to focus at least as much if not more attention on adults and other socializing agents as they do on the young.

Both lines of investigation - socialization research and developmental studies - ask questions about various aspects of specific sets of behavior: presence or absence of a particular class of behaviors in the repertoire of individuals, populations or species; age at which the behavior appears and/or disappears from the repertoire; presence or absence, and nature of, sex-related differences in the behavior in question; the course of changes in style, frequency, and intensity of the behavior; and so on. Clearly, questions such as these can be asked concerning any class of behaviors, but the answers will be more or less meaningful depending upon the nature of the behavior category in question. For example, if we (along with Whiting, 1966, and other anthropologists) selected "nurturance" as the behavior category to be examined, and decided to investigate that topic within a small random sample of human populations, the questions just asked would be very difficult to answer meaningfully because of the multitude of different behaviors to which the label "nurturance" might apply. To investigate the same questions with a small random sample of mammalian species would be virtually impossible. However, if the behavior category selected for investigation were one such as "nursing" rather than "nurturance", most of the problems encountered in cross-cultural or cross-species comparative studies would vanish.

Rheingold (1963), in editing a book entitled Maternal Care in Mammals, decided to omit any consideration of humans from the book for another set of reasons. The amount that had been written about maternal care in man was too great to fit into the book, and at the same time, very little of that material lent itself to clear and definite summarization. It was true in 1963 and it remains true a decade later, that more is known about the pathologies of child-rearing than about its normal manifestations, and that which is known about its normal course has been derived more from retrospective accounts and responses to questionnaires than from direct examination of the behavior in question. Rheingold felt that greater progress in understanding this aspect of human behavior would be made when investigators focused more on what human caretakers do in caring for infants and children and less on what they say they think or feel about them. We
are in total agreement with her.

In our field study of the Alyawarra, we obtained a large quantity of purely observational data, much of which is related directly to maturation and socialization, using behavior categories which, like "nursing", can be investigated easily among any human, nonhuman primate, or mammalian species. In this chapter, we present a description of various aspects of infant transport among the Alyawarra based on the data in the BEVRECS file described and used in preparing Chapter 4, examine the data for patterns that are directly related to questions of both enculturation-socialization and maturation, and compare the data on infant transport among the Alyawarra with some of the data which is available for other human populations, for nonhuman primate populations, and for other classes of mammals.

Ewer (1968) classifies the child-rearing practices of mammals as follows:

1. **Nesting**: the young stay in one location, usually where they are born, and the mother either stays with them continuously or leaves them alone for long periods.

2. **Caching**: the young stay in hiding places which change occasionally, and the mother leaves them alone for long periods.

3. **Following**: the young stay in constant proximity to their mother by locomoting with her wherever she goes.

4. **Carrying**: the young stay in constant proximity to their mother by riding on her body or by being carried by her.

There is some overlap in these categories, as when nesting animals (rats) carry their young in their mouths as they move to new nests, or when cached young (some antelope) follow their mothers to new places of concealment.

Quantitative data on the frequency and duration of separations between infant and caretaker, the frequency with which resting places change, the relative frequency of carrying to following, and so on, would be invaluable in classifying a specific population according to this scheme. Except in marginal cases, however, a decision based on less precise data is likely to be accurate. It has been suggested (cf. Blurton Jones, 1972) that man, or at least some human populations such as the present-day English who leave their infants "safely parked away from their mothers", might be marginal cases. Although Blurton Jones cites no data which suggest that the child-rearing practices of English mothers resemble more closely those of mammals who typically cache their young than those who ordinarily transport them, we have several measures of behavior among the Alyawarra which allow us to approach this problem quantitatively, hence with greater precision.

**Description** Among the ninety-two individuals who constituted the population of Camp A, there were eighteen infants who were observed being carried, three of whom were under two years of age. In sixty hours of observation, the three youngest infants were seen locomoting thirty one times for a mean frequency of 0.1 times per observation hour per infant, and they were seen
being carried 247 times, for a mean frequency of 1.3 times per observation hour per infant. Both of these figures are inconsistent with the definition provided for "nesting"; a carrying frequency of 1.3 times per hour would seem to be incompatible with the definition of "caching"; and the 13:1 ratio of carrying to walking would seem to rule out "following". These data strongly support our subjective judgement that the Alyawarra are a human population whose basic child-care modality is that of carrying rather than nesting, caching, or following.

The portion of the BEVRECS file from which we obtained the data for the preceding and all of the following computations contains 510 cases of "carrying human". In performing the computations upon which some of the figures in this chapter were based, all of the cases were used, but in some instances (as in the preceding paragraph) only a portion of the 510 cases were called for. The number of cases used in preparing each Figure in the chapter is given in the captions of the Figures. That number ranges from 427 to 510 cases, and from such a large number of cases we can learn a great deal about infant transport among the Alyawarra.

As Alyawarra infants grow older, they become more and more independent in getting from place to place, so that by the time they are six years old they are never carried. This transition from complete dependence to complete locomotor independence is a gradual one which seems to occur at different rates for male and female infants; however, the composition of the population was such that nothing final can be said yet.

In Figure 30A, eighteen infants who were carried a total of 494 times are separated by sex and rank ordered by age. There is considerable variability in the number of carries received by children at each age, but within each sex there is a steady decrease in the mean frequency of carries received as age increases. For infants aged 3, 5, and 6 years, it is possible to make comparisons between the sexes. The mean frequency of carries of 3 year old males is 7.7 times greater than that of 3 year old females, and the lowest frequency of carries of a 3 year old male is double the highest frequency of carries of a 3 year old female. At 5 years old, the sex difference is smaller, but the mean frequency is still 50% higher for males than for females. At 6 years of age, the frequency has fallen to zero for both sexes. The mean frequency of carries of infants of each sex and age are depicted graphically in Figure 30B.

At the age when Alyawarra infants complete their transition to total self-reliance in locomotion, they begin to carry other infants. This too is a gradual transition and there is a marked difference between the sexes in the extent to which this behavior is acquired. Of the 510 observed cases of infant transport, 507 were performed by females and only 3 by males.


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<th>SEX</th>
<th>AGE (YEARS)</th>
<th>IDENTIFICATION NUMBER OF CARRIED</th>
<th>NUMBER OF CARRIES RECEIVED</th>
<th>MEAN NUMBER OF CARRIES RECEIVED AT EACH 1-YEAR AGE INTERVAL</th>
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**Figure 30.** Number of carries received by each infant and by each 1-year age interval; n=510.
In Figure 31, the mean frequency with which each member of each age group is carried is compared with the mean frequency with which each participating member of each age group was observed carrying someone else. That is, people who were never observed participating in infant transport were not counted in obtaining the figures in the right-hand column. Thus all but 13 females were included and all but 2 males were excluded from it. Of the 13 females who were excluded, 7 were above 50 years of age, and the other 6 were distributed evenly throughout the 26-50 year age groups.

The young female begins to carry other infants during her fifth year. The mean frequency increases throughout her juvenile years, stays high through her child-bearing years, and drops sharply to zero about 5 years after the birth of her last infant. The behavior profiles in Figure 20 show that females under 15 years perform 38% of all observed instances of infant transport, females 15-44 years old perform 43% of them, and females over 44 years old perform 19% of them. Figure 21 shows that infant transport accounts for 4% of all recorded EVENTS for females under 15 years of age, 6% for 15-44 year old females, and 7% for females over 44 years old.

There are five distinctly different styles which the Alyawarra use in carrying infants. The coolamon, an elongated bowl that is used for carrying a variety of foods and almost everything else that requires a large container for transport, serves as a carrying device for tiny infants. In it, the infant rests in a horizontal position and often is covered with one or several layers of cloth which keep him warm in winter and protect him from insects in summer. When the infant is being carried in this device, there is no body contact between him and his mother, who is the only person who transports an infant in a coolamon. Ordinarily, the coolamon rests on the mother's hip and is held there by her arm. Occasionally, an infant will be transported short distances while the carrier holds him upright with both hands, well away from the carrier's body. It is probable that carries in this style, more often than carries in other styles, terminate with the infant's being handed to another person, but the data have not yet been analyzed in a way that will allow us to support this point quantitatively. In this carry style, the only contact between infant and carrier is through the carrier’s hands.

The other three styles require that the infant be in an upright position, and there is a great deal of body contact between the infant and the carrier since in each case the infant sits on the carrier’s body and sometimes clings to it as well. These three styles are as follows:

- the infant sits astride a hip of the carrier;
- he sits on the carrier a shoulders with his legs astride the carrier’s neck;
- he rides on the carrier’s back with a leg on each side of the carrier's waist.

While riding on a carrier's hip, an infant's primary contribution to the effort would seem to be through using his legs to hold on to the carrier’s body. It is our impression that the infant's hands ordinarily are free when he is being carried on the hip. When he is riding atop someone's shoulders, the infant Is responsible for maintaining his balance which he usually does without stabilizing himself with a hand on the carrier's head. The dorsal position requires that the infant do a large share of the work by clinging around the carrier's body or shoulders. The carrier often assists the infant to stay in place by putting her hands behind her back after the infant is in position and clasping her hands beneath his hips to provide a seat for him.
Figure 31. Relative frequency of participation in infant transport, as carrier and as carried, by age of participant; n=510.

Of the 510 recorded instances of infant transport, the hip-carry style was by far the most common, accounting for 45.6% of all observed carries (Figure 32A). This style was used regularly by all classes of carriers (Figure 32B) and for all classes of infants (Figure 32C). However there are distinctive patterns of variation in the use of each of the styles. The relative frequency with which the coolamon-carry is used by carriers under 30 years of age is zero, it increases sharply in the 30-44 year age range, and it is the most frequently used style in the 45-60 year age range. Carrying in the hands and on the back are at their highest relative frequencies among juveniles and adolescents, with frequencies of use for both decreasing regularly with increasing age of the carrier. Carrying both on the hip and on the shoulders increases in relative

<table>
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<th>AGE IN YEARS</th>
<th>RELATIVE FREQUENCY WITH WHICH AVERAGE MEMBER OF EACH AGE GROUP IS CARRIED</th>
<th>RELATIVE FREQUENCY WITH WHICH AVERAGE MEMBER OF EACH AGE GROUP CARRIES ANOTHER</th>
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<td>TOTALS</td>
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<td>100.0%</td>
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</table>
frequency with increasing age through the juvenile and adolescent years, then declines regularly thereafter.

When it is the people being carried rather than those who do the carrying that are rank ordered by age, the patterns that emerge are again quite clear. The hip-carry accounts for 30-50% of the carries for all ages of infants; only the youngest infants are carried in coolamons or in the hands; carrying on the shoulders is introduced during the second year of the child's life and accounts for 20-25% of all carries thereafter; carrying on the back does not become an important mode of transport until the infant's third year, and thereafter it remains a bit more common than the shoulder carry.

Together, the two graphs in Figure 32 show that the coolamon is used by the oldest carriers in transporting the youngest infants; the hand-carry is used by the youngest carriers in transporting the youngest infants; the back-carry is used by young carriers in transporting the older infants; the shoulder-carry is used by young-adult carriers in transporting the older infants; and the hip-carry is used by and for all age groups.

It must be emphasized here that the distributions in both graphs in Figure 32 are dependent, to a large extent, upon the precise composition of the camp's population at the time when the records were made. Since the only three infants who were transported in coolamons (by their mothers) had mothers at least 30 years old, the regular use of coolamons by mothers in the 15-29 year age range is not reflected here. There may be other less obvious factors at work as well. Perhaps the relationship between the age of the carrier, the age of the infant being carried, and the carry style most frequently used can be expressed in a form that is insensitive to variations in the composition of the population, but it is not yet clear to us what that relationship might be.

Next we examine kin relationships between those who carry and those who are carried. Among the Alyawarra, a person may carry her (or his) own child, a real or classificatory sister's child, a real or classificatory sibling, or a child in any one of the other 24 Alyawarra kin-terminological classes. Figures 33 and 34 provide two different answers to the general question: What is the kin relationship between the carrier and the infant being carried?

<table>
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<th>CARRY STYLE</th>
<th>RELATIVE FREQUENCY OF USE (%)</th>
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<tr>
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<td>COOLAMON</td>
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<tr>
<td>HIP</td>
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<td>SHOULDER</td>
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<td>BACK</td>
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</tr>
<tr>
<td>TOTAL</td>
<td>100.0%</td>
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</tbody>
</table>

88
Figure 32. Use of five carry styles; n=510.

In Figure 33, we rank ordered by age all of those people who were observed carrying an infant, and we asked: What relationships are there between each carrier and the infants whom that person carries? In Figure 34, we rank ordered by age all of the infants who were observed being carried, and we asked: What relationships are there between each infant and the people who carry him or her?

It is very clear from Figure 33 that there is a strong correlation between the age of the carrier and her relationship to the infants whom she carries. Juvenile and adolescent females carry siblings; fully mature females carry their own offspring; and there is a distinct transitional period during which an adolescent or young adult female carries the offspring of her own sister. (In the Alyawarra kinship usage, a woman's sister's child is a classificatory "own child".) The people
who carry infants in the "other" relations are the older juvenile females.

The most conspicuous feature of Figure 34 is that almost every infant is carried both by the mother and by siblings. We feel that the following point is an important one: There were no observed carrying interactions between a female and her brother's offspring, and there was only one case in which the identity of an adult male was of any value in establishing the kin relationship between a carrier and a person being carried.

Thirty-six different people were observed carrying a total of eighteen different infants. This requires, of course, that the mean number of infants carried by one person (0.5 infants per person) be lower than the mean number of people by whom an infant is carried (2 carriers per infant). Neither Figure 33 nor Figure 34 reveals any strong correlation between age and number of adults or infants involved in transport interactions, but there is a suggestion in Figure 34 that younger people carry more different infants than do older people.

Figures 33 and 34 were prepared to reveal the outlines of the genealogical and kin terminological aspects of infant transport among the Alyawarra. Nothing more than the distribution of interactions was in question in those Figures.

A much more detailed examination of the topic is provided in Figure 35. Figure 35 is the same as Figure 34 except that cell entries in Figure 35 represent the actual number of recorded cases in which a particular infant was carried by a member of each of the relational categories. Mothers performed just over one-half of all recorded instances of infant transport and the infants' real or classificatory siblings performed about one-third of them. Since an Alyawarra infant's mother's sister may or may not be his mother's co-wife as well, these two kinds of mother's sisters were dealt with separately in preparing Figure 35. In those cases where mother's sister was not mother's co-wife, the person in question was too young to have a husband of her own and was in many ways more like a classificatory older sibling than like a classificatory mother.

Time, expressed in terms of age, has been of primary importance in all of the Figures presented so far in this chapter. All of them have used the human lifetime as the time span within which changes have been examined. Equally important temporal units are the 24-hour and 365-day cycles. Because of the small part of the year covered by the data file in use here, we can make no comments concerning changes in infant transport that might be related to seasonal changes; however, changes related to time of day are quite clear. The distribution of infant transport throughout the day, depicted in Figure 36, shows major concentrations of activity at mid-morning and again late in the afternoon. The distribution of these 510 cases is not radically different from the temporal distribution of all activities as plotted in Figure 17B, but it stands in sharp contrast with the distribution of many other tasks as plotted in Figure 22. The low points in early morning and early-to-mid-afternoon correspond to the overall low activity rates just as the people are beginning the day and later as they rest in their shades during the hottest part of the day.
"X" indicates the presence of a particular relationship between carrier and infant(s).

**Figure 33.** Kin relationships of infants to those who carry them; n=485.
"X" indicates the presence of a particular relationship between infant and carrier(s).

**Figure 34.** Kin relationships of carriers to the infants whom they carry; n=485.

Just as there are several different kinds of answers to the "who", "how", and "when" questions about infant transport, there is more than one way to answer the "where" question. The next four Figures provide some of the answers to that question.

The matrix in Figure 37A shows the relative frequency with which infants are transported between all pairs of residences within Camp A, and the matrix in Figure 37B shows the distance in feet between each pair of residences linked by people transporting infants. We may multiply these two matrices together to determine the distances traveled between residences while transporting infants. Figure 37C shows the relative frequency with which different distances are covered while transporting infants between residences. About half of all of these journeys cover 200-300 feet, and only 15% cover more than 500 feet.

The matrices in Figure 37, examined in conjunction with the matrix (not included in the dissertation) of distances between all pairs of residences in camp, reveal the pattern that is shown in Figure 37D. The mean distance between pairs of structures that are linked by infant transport is less than the mean distance between all pairs of structures, indicating that one is more likely to visit a nearby neighbor than a distant one when carrying an infant. Furthermore, the mean distance traveled when transporting infants between residences is considerably less than the mean distance between residences linked by infant transport, indicating even more strongly that it is one's nearest neighbors, rather than distant ones, who are most often visited while transporting infants.
### Table

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<th>INFANT'S IDENTIFICATION NUMBER</th>
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<th>TOTAL NUMBER OF CARRIES</th>
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<tr>
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<td>1</td>
<td>1</td>
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<tr>
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<td>1</td>
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<td>115</td>
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</tr>
<tr>
<td>094</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>086</td>
<td>1</td>
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</tr>
</tbody>
</table>

**Figure 35.** Relative frequencies with which infants are carried by members of six kinship categories; n=485.

![Relative Frequency Plot](image1)

**Figure 36.** Temporal patterning of infant transport; n=510.

93
The sociogram in Figure 38 was derived from the matrix in Figure 37A. In order to improve the clarity of the sociogram, cell entries of less than 0.5 in Figure 37A were not reproduced as travel paths in Figure 38. Since the slightly distorted map of the camp used as the basis for this sociogram is identical with the map used in preparing Figure 29B, it is possible to gain a clear impression of the social differences between all inter-residential locomotion in general and that special case of inter-residential locomotion that occurs in infant transport. We are not yet prepared to make any detailed quantitative comparisons between Figure 38 and Figure 29B.

Given the presence of the men’s camp, four women's camps, and fourteen single-family residences in Camp A, we may use the frequency matrix in Figure 37A to compute the observed frequency of interactions between the three different types of structures, then compare the observed frequency with the frequency expected by chance (Figure 39). A $x^2$-test shows that the differences between expected and observed frequencies are significant at beyond the 1% level of confidence. Almost all of the inter-residential infant transport occurs between single-family residences and women's camps. This is consistent with the pattern detected in all inter-residential locomotion and presented in Figure 26, and this one is even more divergent from the expected distribution. The pattern is clearly visible in the sociogram in Figure 38 where almost all of the travel paths connect anoardegans with alugeras.

Of course, the transport of infants is not restricted exclusively to travel between pairs of residential structures. Some of the activity occurs at a single residence, some of it involves places within the camp which are not residences, and some of it involves places outside the camp. Although transport between residences is of major importance, it accounts for slightly less than half of all observed instances of the activity.
A. Relative frequencies of interactions between residences; cell entries in percent
B. Distances between interacting residences; cell entries in feet
C. Distribution of distances traveled between residences while transporting infants
D. Summary of inter-residential distance data. (n=427)

Figure 37. Spatial distribution of infant transport
See Appendix for information regarding residence numbers.

Figure 38. Sociogram of infant transport between all pairs of residential structures; n=209.
Figure 39. Relative frequencies of infant transport interactions between three categories of residences; n=427.

Figure 40 shows the relative frequencies of infant transport between residences and all other types of locations, and the mean distances traveled during those journeys. Since less than 2% of all cases involved movement between pairs of locations neither of which was a residence, those few cases were disregarded in preparing this Figure.

All of the relative frequency values in Figure 40 were taken directly from the data, and the mean distance value of 292 feet is that which was obtained in preparing Figure 37. The other mean distance values are estimates which are to some extent intuitive. We know the sizes of the residential areas, the separation between the residential areas, and the distance from the water supply to one of the structures in the camp. We feel that all of the estimates are close ones except for the distances traveled away from camp. Sometimes a person would go no farther than a few hundred feet outside the camp to collect firewood, while on other occasions, a party would leave on a food gathering trip that might last all day and cover up to 15 miles. Hence, the estimate of 1000 feet traveled outside the camp is nothing more than an order-of-magnitude guess. However, the relative frequencies are accurate, the distance value of 292 feet is accurate, and three of the four estimated distance values are at least within fairly narrow ranges imposed by known characteristics of the occupied area.

If we assume that all of the figures are correct, we can compute an overall mean distance traveled by a person transporting an infant. That distance is 106 feet. If we assume that some of the estimated values are incorrect, we can manipulate the model to arrive at overall mean travel distances based on revised estimates. For example, if the estimated distance value of 45 feet is doubled, the overall mean distance increases to 109 feet. If the estimated distance value of 12
feet is doubled, the overall mean distance increases by six inches to 106.5 feet. If we delete the journeys which were to and from areas away from the camp (i.e., those cases for which the estimate is least reliable), the overall mean distance increases to 113 feet. If we assume that the structures at residences obscured some of the instances when infants were carried at residences, we may increase the relative frequency of those instances to a higher value. By doubling the "at home" value to 32.6%, the overall mean distance decreases to 87 feet. Regardless of which of these revisions is made, the overall mean distance traveled while carrying an Alyawarra infant remains very close to 100 feet, a value which may be found to resemble closely or differ greatly from those of other human or nonhuman populations.

One of the next steps in the analysis of our field data will be to integrate the GROUP COMPOSITION file with the BEVRECS file. This will enable us to determine the size, composition, and task orientation of each of the groups in which infant transport was observed. Because the data has not yet been analyzed quantitatively for this information, we are not prepared to make any comments on these important aspects of infant transport among the Alyawarra.

<table>
<thead>
<tr>
<th>DESTINATION OF CARRY</th>
<th>RELATIVE FREQUENCY (PERCENT)</th>
<th>MEAN DISTANCE PER CARRY (FEET)</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAY AT HOME</td>
<td>16.3</td>
<td>12</td>
</tr>
<tr>
<td>WITHIN CAMP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. neutral area</td>
<td>11.9</td>
<td>45</td>
</tr>
<tr>
<td>b. another residence</td>
<td>49.1</td>
<td>292</td>
</tr>
<tr>
<td>OUTSIDE CAMP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. the bore</td>
<td>10.0</td>
<td>2640</td>
</tr>
<tr>
<td>b. away from camp</td>
<td>12.6</td>
<td>1000</td>
</tr>
<tr>
<td>TOTALS</td>
<td>100.0</td>
<td>106</td>
</tr>
</tbody>
</table>

Figure 40. Distances traveled while transporting infants; n=510.
Interpretation  The patterns presented above comprise a comprehensive description of infant transport among the Alyawarra, but they do not provide an explanation of it. Much work remains to be done before that can be accomplished. In order for explanations to be scientific, general, and of predictive value, rather than historical, particular, and of no predictive value, they must deal with recurring events. A scientific explanation of a truly unique event is, by definition, impossible. Our quantitative description of Alyawarra infant transport reveals a great many patterns in the behavior of the research population, but an attempt to explain those patterns for the Alyawarra alone would be, by definition, nonscientific. They are patterns that characterize the population as a whole; hence they must be found to recur in other populations before they can become candidates for scientific explanation; that is, we must first establish that we are dealing with something that is not unique to the Alyawarra before we can provide a scientific explanation of it.

The explanation of behavior involves three separate kinds of approaches, each of which has several sub-categories (Hinde, 1966).

First, the events selected for study must be related to other events or conditions which immediately precede them, including changes in stimuli impinging on the behaving organism, changes in hormonal and other internal conditions, and so on. Explanations of this kind can lead to the development of techniques for eliciting or suppressing the behavior at some arbitrarily chosen moment, given the presence of the behavior in the repertoire of the subject organism.

Second, the ontogeny of the behavior must be examined. What patterns of external and internal factors control its form, frequency of occurrence, and so on, as the organism advances from conception through birth, maturity, reproduction, senility, and death.

Third, behavioral differences between individuals and between populations provide the material upon which natural selection operates. Explanations from this perspective deal with the long-range (multi-generational) adaptive values of the behavior under investigation, and the conditions which are responsible for its presence in the species-typical behavior profile of the subject organism. These questions of immediate causation, ontogeny, and ultimate causation may be investigated either experimentally or through the comparative study of naturally-occurring situations.

The initial task of identifying what it is about Alyawarra infant transport that might be a legitimate subject for scientific explanation, and the subsequent task of providing those explanations, both require comparative data from other populations of mammals (including other human populations) whose basic mode of child-care is to carry the young. In an attempt to obtain the necessary comparative data, we performed a brief survey of the anthropological literature and a more thorough survey of the literature dealing with the behavior of nonhuman primates in their natural habitats.

Sex of carrier. Surely the simplest question to answer about infant transport in cross-cultural and cross-species perspective concerns the sex of the carrier. Impressionistic reports are readily available, but quantitative data is virtually nonexistent. Mitchell and Brandt's (1972) review article on paternal behavior in nonhuman primates shows that among some nonhuman primate
species (especially New World monkeys), most infant transport is performed by males; among others, most or all of it is performed by females; and among still others, the task is shared to varying degrees by both sexes. Among some primates, the transport is performed initially by females, but as the infant becomes older it is done more and more by males. Rheingold and Keene (1965) report that among humans in public places in Washington, D.C., 59% of the observed infant transport was performed by females and 41% by males. Among the Alyawarra, the task is performed almost exclusively by females. Whiting, et al. (1963) indicate that both sexes engage in the activity among six human populations which they studied, but their reports do not enable us to determine the relative contribution of each sex.

Age of carrier. Lancaster (1972) notes that monkeys and apes have relatively few off-spring during their lifetime and that the loss of an infant through neglect or inexperience would be very costly. Hence, it is important for the survival of the population that the requisite child-rearing skills be learned prior to the time when an adult assumes full responsibility for a new infant. Hamburg (1969) emphasizes that the handling of infants by juvenile and adolescent females is quite common in monkeys and apes. The handling of infants by juvenile and adolescent males is more variable, ranging from near absence among some of the macaques, to the opposite extreme with hamadryas baboons (P. hamadryas) among whom juvenile males adopt and care for infant females with whom they later form stable reproductive units (Kumer, 1968). Human populations (including those described by Whiting, et. al., 1963) seem to be characterized by the occurrence of infant transport by juveniles and adolescents in addition to that provided by adults, but quantitative data which can be compared directly with that for the Alyawarra is not available.

Genealogical relations between infant and carrier. With the tremendous amount of effort that anthropologists have expended in the study of genealogies and kinship and in the study of child-rearing practices, it seems reasonable that we might be able to find a wealth of information on the intersection of these two characteristics in non-Western societies. Certainly the data is easy to obtain among human populations, but cultural and social anthropologists have not published it. For example, Whiting, et. al. (1963) do nothing more than mention the fact that older children occasionally assist their mothers in caring for (presumably carrying, among other things) their younger siblings. Rheingold and Keene (1965), in their study of infant transport by people in Washington, D. C., found that 18% of observed carries were performed by people other than the infants’ parents, but further details are missing. Their study indicates that Washingtonians differ greatly from the Alyawarra among whom 48% of the recorded cases of carrying were performed by non-parents; however, the research in Washington and that with the Alyawarra did not yield strictly comparable data because of differences in sampling procedures.

Students of nonhuman primate behavior have been eager to obtain and publish relational data for the populations they have studied but it has been extremely difficult for them to do so. The only effective way to identify relations between individuals in a nonhuman population is to follow known mother-infant pairs through several generations. Even this approach yields no firm knowledge of paternity except in those cases where stable monogamous or polygynous reproductive units are typical (e.g., among gibbons, colobus and patas monkeys, and hamadryas baboons). Long-term studies of provisioned populations of Japanese and rhesus macaques and chimpanzees are beginning to reveal the importance of older siblings in the care and socialization of infants (Kaufmann, 1966; Lawick-Goodall, 1971; Sade, 1965). Observations on monkeys by
Jay (1963), Rowell, et. al. (1964), and others on the maternal roles of adolescent and adult females other than infants’ own mothers suggest that relational data will be especially interesting as soon as it is obtained. But at this time, quantitative data on genealogical relations and infant transport are not available for natural populations of human or nonhuman primates.

**Carry style.** This topic has received a great deal of attention, probably because each style is relatively easy to describe and the presence or absence of any particular style in the behavioral repertoire of an individual or species is relatively easy to ascertain. However, quantitative aspects of carry styles are somewhat more difficult to obtain and their appearance in the literature is correspondingly rare. The diversity of styles used by mammals is enormous: marsupials have pouches; the young of some rodents attach themselves so securely to their mother's nipples that it is difficult to dislodge them; adult dogs and cats carry their young in their mouths. Among primates, the young generally grasp the fur of an adult with hands and feet and receive little assistance from the adult. At first, they cling to the ventral surface, then later to the back, and some eventually learn to ride sitting in an upright position on the carrier's back.

Rheingold and Keene's (1965) observations showed that Americans in Washington, D. C., used the following styles in transporting infants: at the adult's chest; facing backwards over the adult's shoulder; sitting on the adult's hip; sitting astride the adult's neck; riding on the adult's back; and being transported in several different kinds of devices. The transition from the predominance of one style to the predominance of another is gradual, as has been noted in the primate literature. Rheingold and Keene found that the chest and shoulder styles were used more frequently with younger infants than with older ones, and that hip, neck, and back carries were used more frequently with older infants than with younger ones. In their complete file of 546 cases, they included only six cases of infants being carried in devices.

Generally speaking, the styles used by Americans in Washington, D. C., and the styles that we observed in use by the Alyawarra can be classified according to whether the infant is in a ventral position, a dorsal position, or a lateral position (on the hip). In both human populations, the use of the ventral position decreases in relative frequency as infants get older, and in this regard humans resemble monkeys and apes who display a similar change in behavior. But unlike monkeys and apes, human infants learn to travel on the carrier's hip in addition to learning to ride in a dorsal position. Furthermore, neither the infants of Washington nor those of the Alyawarra seemed to make any major contribution to their own transport by clinging to their carriers; rather, the carriers provided most of the support for the infants. In this regard, too, humans behave differently from other primates.

**Diurnal cycle in infant transport.** Although the primate literature contains virtually no references to the timing of infant transport per se, there are numerous references to daily cycles of troop movements (Carpenter, 1965, howler monkeys; Hall, 1965a, patas monkeys; Schaller, 1965a and 1965b, gorillas and gibbons; Southwick, et al., 1965, rhesus macaques; Yoshiwa, 1968, langurs; etc.). It would seem that we might make a reasonable prima-facie case for expecting a very close similarity between the temporal patternings of inter-location locomotor activity in general and infant transport in particular, thus allowing us to make cautious inferences concerning the temporal patterning of infant transport among nonhuman primates. However, this line of reasoning is not supported by our data for the Alyawarra. The transporting of Alyawarra
infants reaches a high frequency about two hours after the people begin to awake in the morning, and it reaches an even higher frequency late in the afternoon (Figure 37C). Locomotion directed away from or towards residences reaches its highest frequency in mid-morning, and the afternoon peak in this activity is quite small (Figure 28B). Reliable data for other human populations seem to be unavailable at this time. Therefore, we are unable to make any meaningful comparisons between the Alyawarra and any other human or nonhuman primate population with regard to the daily cycle in infant transport.

Spatial patterning in infant transport. The distance covered by animals carrying offspring ranges from inches to miles, depending upon a great many factors including structural characteristics of the species, diversity and distribution of food sources, presence or absence of threats from predators, and so on. Among nonhuman primates whose carry styles most closely resemble those of humans, infants may be carried up to several miles per day (Devore and Hall, 1965; Jay, 1965; and others) but data on distances, frequencies, and so on are not readily available in the literature.

Another aspect of spatial patterning, and one for which much more information is available, has to do with the kinds of destinations to which young are carried. A great many people - far too many to cite here - have pointed out the many behavioral similarities between humans who are omnivorous and nonhuman primates who are vegetarians. On the other hand, Schaller and Lowther (1969) have dealt with the behavioral similarities between humans and social carnivores such as lions, wolves, and spotted hyenas, whose social systems may resemble those of the early hominids more closely than do the social systems of any living nonhuman primate. Let us consider this problem strictly in terms of infant transport and its implications.

Among nonhuman primates, infants ordinarily are carried (usually by females) whenever the social group (males and females) travel to or from feeding places and when foraging is in progress. Among the social carnivores, infants are left in dens and guarded by an adult while the remainder of the adults in the group go hunting. After the kill, meat is brought to the infants by the hunters, or, if the infants are old enough to walk, they go to the site of the kill. Among the Alyawarra, infants are carried regularly by their mothers and other older females on foraging expeditions, and on several occasions single but complete nuclear families (adult males included) were observed departing from camp to gather vegetable foods. In this regard, Alyawarra infant transport and the social network of which it is a part are almost identical with the social behavior of many vegetarian nonhuman primates. On the other hand, Alyawarra infants were never observed being carried on a kangaroo-hunting expedition. Kangaroo hunting is performed exclusively by adolescent and adult males (except shortly after heavy rains when it is done by late-adult females), and the meat is brought back to camp for distribution to infants and their care-takers. In this regard, Alyawarra infant transport and its social matrix are strikingly similar to those aspects of behavior among social carnivores.

From this perspective, the sexual division of labor and the sharing of food that distinguish humans from all other primate species are not evolutionarily new behavioral characteristics, but rather they are the logical product and the near-perfect synthesis of two complementary but radically different lifestyles. Human infants are carried on foraging expeditions as are nonhuman primate infants, and they are left with adult guardians while other adults go on hunting.
expeditions as are the infants of social carnivores. We see no reason to agree that the basic social life of humans is an "evolutionary product of the success of the hunting adaptation" (Washburn and Lancaster, 1968; emphasis ours) nor that we should use the term "hunters" in referring to pre-agricultural human populations "despite the fact that the majority of peoples [to whom the term is applied] subsisted primarily on sources other than meat" (Lee and Devore, 1968; emphasis theirs). To emphasize either hunting or gathering is to miss the real point; viz., that human societies and the human socialization process are based upon a complete integration of the basic properties of both ways of life, and both of those components are operative in the life of a human from the moment of birth.

In our brief survey of the literature, we searched for patterns at several different levels of abstraction. Within a single population such as the Alyawarra, it is possible to detect quantitative patterns in many different aspects of infant transport, and our primary objective in searching the literature was to locate data at this level of abstraction for a variety of populations and species. The second objective was to ascertain, for selected aspects of infant transport, what similarities in patterns characterize groups of populations or species. We had very little success in meeting our primary objective, and as a consequence we had even less success at the next level. The third level of abstraction, the search for orderly relations between second-level patterns and other variables such as taxonomic groups or ecological niches, was even more difficult to approach.

We expect that the literature will contain, eventually, enough data on many aspects of infant transport to permit us to provide explanations for them using the approach recently illustrated by Blurton Jones (1972) in dealing with the basic question: Why do human mothers carry their babies? Citing data on milk composition (Ben Shaul, 1962), sucking frequency (Wolff, 1968), and duration of feeds (Findlay, 1969; Martin, 1968) from many species of mammals, Blurton Jones shows that mammals with milk of low protein content have infants whose sucking frequency within feeding sessions is low and whose feeding sessions are relatively long, and that the opposite is true for mammals with milk of very high protein content. Rabbits, for example, have very high protein milk, the infants feed once every twenty-four hours, and the feedings last only 4-5 minutes. The higher primates all have low protein milk, frequency of sucking within feeding sessions is low, and feeding sessions occur very frequently and last from 10 to 30 minutes each. Human mothers and their infants, like all of the other higher primates, are adapted for the infant to stay with the mother, something which is typical of a continuous feeder in any taxonomic group. Caching the infant is precluded by the requirement for frequent feeding, and the human infant is incapable of following its mother. So the human mother may stay with her infant in one place all of the time (e.g., in a nest) or she may take it along with her when she travels. It is not yet clear what factors other than general primate morphology led to the adoption of the second alternative rather than the first one. It is very clear, however, that the kind of explanation being sought is scientific, general, and predictive rather than historical, specific, and non-predictive. Hopefully, our quantitative data on infant transport among the Alyawarra will provide some of the raw material which will facilitate the development of more explanations of this sort for human social behavior in general.
Chapter 6. Abstract Patterns

The patterns presented in Chapter 4 and in the first half of Chapter 5 were ones that emerged directly from the data when relatively simple analytical procedures were used. In the second half of Chapter 5, we attempted to perform cross-cultural and cross-species comparisons at that very low level of abstraction. In Chapter 6, we shall examine again the patterns in Chapters 4 and 5, but from a new perspective, one that allows us to perceive more abstract patterns.

In one sense, all patterns appear in space and time since those are the dimensions of our world, but some of the most interesting patterns become obvious only as abstractions in which space and time are incidental. They are derived when certain calculations are performed with the raw data or with patterns detected in the raw data. According to MacArthur and Connell (1967), science is a process in which we find simple relations (patterns) among the things that we actually observe, then find more basic relationships among the first simple patterns, then discover even more fundamental relationships between the second-level patterns, and so on. As a science becomes more sophisticated and interesting, the patterns with which it deals appear more and more to relate entities which cannot be observed directly. The patterns that appeared in Chapters 4 and 5 were confined, generally speaking, to the more concrete end of a concrete-to-abstract scale. Here we are more concerned with the abstract end of that scale.

Figure 17 and Figure 20 represent two distinctly different kinds of patterns in time detectable in the BEVRECS file, Figure 17 depicting a cyclical phenomenon and Figure 20 depicting one that is evolutionary. The peaks and troughs in Figure 17 correspond to periodicities in behavior that appear to be correlated primarily with the diurnal cycle and secondarily with daily and seasonal variations in the values of meteorological variables. Behavioral periodicities of this sort appear to characterize all living organisms, and this particular kind of periodicity is one of a much larger class containing, among others, circadian rhythms, reproductive cycles, and annual cycles. When Figure 17 is examined outside the biosocial context provided by other human societies and other social animals, and the conceptual context provided by other kinds of behavioral periodicities, it is nothing more than a peculiar picture; when it is examined within either or both of those contexts, and when hypotheses are tested concerning the relationships between the behavioral periodicity (a dependent variable) and independent variables which may be controlling changes in its values, we can learn a great deal about the relationship between the Alyawarra and their environment, and between the Alyawarra and all other societies and species of organisms.

Figure 20 represents one of two ways in which BEVRECS data can be examined for patterns that change progressively with time. These patterns might be discussed from a variety of theoretical viewpoints and classified in a number of ways including maturational and developmental sequences, the unfolding of innate behavioral characteristics, behavior modification through learning (enculturation and acculturation), and so on. They are cumulative changes in the behavior of individuals within single lifetimes, and as such they are in a larger class containing, among others, culture change, ecological adaptation, and biological (structural and behavioral) evolution. Figure 20, a cross-sectional view of behavioral characteristics of individuals in
different sex-age groups, presumably reflects the kind of behavioral changes any individual would experience in a lifetime of 60 years as a member of the Alyawarra Tribe.

Longitudinal rather than cross-sectional analysis has not been attempted with the data base used for the dissertation because of the short time span of the 30% sample from the complete BEVRECS data file. We are confident that the 100% sample will reveal some changes in behavior that can be interpreted reasonably as uni-directional rather than as cyclical even though the complete file covers a period of only 100 days. For example, ACTOR 262, a 2 year old female, made a conspicuous locomotor transition during the observational portion of the fieldwork. When we began recording with BEVRECS, she was carried almost everywhere she went, but by the end of the project, she walked almost everywhere she went. The patterns that appear both in cross-sectional and in longitudinal analysis of this particular data file are characteristic of the research population in particular, but to what extent are they characteristic of Aborigines, of hunter-gatherers, of humans, of primates, or of social animals in general?

Both cyclical and unidirectional phenomena can be examined for temporal orderings. For example, within the 24-hour cycle, walking (Figure 28) and carrying people (Figure 36) frequently co-occur temporally, but within a 60-year lifetime, walking precedes carrying another person. Likewise, the cooking of bread logically and, within a given day, temporally precedes the carrying of it (Figure 22), but within a female's complete lifetime, she carries bread long before she cooks it (Figure 21).

In addition to cyclical and unidirectional changes and temporal sequences of behavior, graphs in Chapter 4 provide us with some hints as to how the Alyawarra allocate their time for different activities, and how much of the time they are inactive. Some educated guesses concerning energy expenditures per man-hour for tasks such as food-acquisition, water-hauling, child-care, and habitat construction, combined with information from the data file on man-hours invested in each activity allow us to make inferences concerning energy utilization by the population as a whole. This information is basic to ecological research regardless of the ecosystem under investigation, and comparative studies of ecosystems are almost impossible unless abstract patterns such as these are available.

Patterns in space, detectable in BEVRECS data, are somewhat more difficult to handle in cross-cultural and cross-species perspective than are patterns in time, because time (seconds, minutes, hours, days, years) is recorded in the form of interval scales as observations are made, while space is handled as a nominal scale during recording and must be converted to ordinal, interval, or ratio scales of various kinds for comparative studies.

The maps of Camp A made during the course of the BEVRECS phase of the research, and the ground plans for each of the individual habitats made near DAY 100 can be converted from the standard analog format into a digital format of distances between LOCATIONS and areas occupied by each LOCATION. LOCATIONS can be rank ordered on a "public - to – private" scale (in terms of visibility, for example), on an ownership scale (one's own, belonging to a kinsman of 1...n degree removed), by relative distance from the nearest water supply, and so on. Analysis of the BEVRECS data in conjunction with these and other scales will reveal the extent to which organisms and activities vary in density and distribution, space is allocated for special
purposes, sex and age groups are segregated spatially, space is used differently by the sex-age
groups (e.g., in Figure 27B male children were observed in open areas away from habitats - and
away from their mothers - much more frequently than were female children), etc. These patterns
can be compared directly across cultural and species boundaries, and they can be utilized in
developmental and ecological studies and in studies of perception, cognition, and the spatial
correlates of "distance" in its genealogical, genetic, and kinship senses.

Several of the Figures in Chapters 4 and 5 deal with behavioral characteristics of the different
sex-age groups that comprise the total population. Figure 20 shows gross behavior profiles; Figure 21 reveals a bit about the population-wide distribution of labor; Figure 22 indicates sex-age differences in the temporal distribution of behavior frequency; and Figures 30 through 40 deal with several aspects of one of the basic components of child-care, viz. transporting children.
Together, the patterns that emerge from these tabulations begin to suggest the outlines of a
quantitative description of social roles as they actually are performed daily in an Alyawarra
camp. Although we cannot examine the BEVRECS data to discover what the Alyawarra say
they expect certain categories of people to do, we can see what certain categories of people
characteristically do; determine the range of variation within each category; search for and
investigate major deviations from behavioral norms; perform factor analysis to see whether our
semi-arbitrary sex-age category boundaries, based on physiological and ethnoscientific criteria,
are located properly when behavioral criteria are given top priority, and so on.

At the lowest level of abstraction, questions about roles can be handled on a nominal scale, but
all questions about status are based upon the concept of an ordinal scale. This is not an
appropriate place to deal with either how to convert nominal scales pertaining to roles within a
given population into other kinds of scales that are more amenable to comparative analysis, or
how to select nominal-scale criteria valid for rank-ordering individuals or categories of
individuals in terms of status, especially since we need dynamic rather than static views of both
role and status if our research is to be most productive. When these problems are resolved,
however, the patterns detectable in the BEVRECS data will be immediately usable for
comparative purposes.

The square matrices in Chapters 4 and 5 illustrate some of the kinds of patterns that we can
detect in interactions between all pairs of entities of various types. Some deal with interactions
between individuals and between classes of individuals, some with those between specific
LOCATIONS and between classes of LOCATIONS. Those dealing with individual people can
be examined in conjunction with square matrices of genealogical and kin terminological ties
between each pair of people, and others can be examined in conjunction with the square matrix
of physical distances between all pairs of LOCATIONS and the matrices of genealogical and
terminological distances. Other square matrices that can be generated with the entire Alyawarra
data file include those for marriage exchanges between patrifamilies, co-membership in
residential units, and co-occurrence in groups of various kinds. Together, this complete set of
matrices will contain most of the basic information required for obtaining a quantitative
description of Alyawarra social organization and social structure that can be directly compared
with structural and organizational characteristics of any population of social organisms.

In preparing for and conducting our research with the Alyawarra, we took all feasible
precautions to insure that our methods and techniques yielded reliable records and that those records contained valid descriptions of Alyawarra behavior at the selected resolution levels. Since we are confident that all of the data is valid and highly reliable, we feel safe in presenting it to the scientific community as baseline data that can be used safely in conjunction with future studies of Alyawarra social behavior. In other words, the patterns we detected in our data from the Alyawarra can be used to obtain quantitative measures of culture change if they are examined in the context of a series of re-studies conducted over a period of several years. If the re-studies are conducted in accordance with the procedures used in performing the research described here, it is inconceivable that any controversy might develop that would resemble the classic disagreements between Redfield and Lewis concerning life in Tepoztlan, or Goldfrank and Benedict concerning life among the Pueblo Indians (Pelto, 1970:30-34).
Chapter 7. Problems Encountered in Using BEVRECS

Since the development and testing of a new methodology were objectives of paramount importance in the project, a discussion of problems that we encountered with the BEVRECS portion of the project should prove valuable to others interested in conducting similar research. Some of the problems were introduced earlier in conjunction with the topics to which they are most closely related, but in the real world, we encountered and solved the problems sequentially, and their logical and chronological relations were much more important at the time than were their topical affinities. We believe that the following examination of the problems in order of occurrence will provide useful information on how we perceived and organized the research as well as on the nature of the problems themselves.

The first problem occurred five months before DAY 001, at which time we made two decisions: 1) to reduce the planned duration of the project from eighteen to twelve months, and 2) to do the fieldwork alone rather than to have a trained female co-worker who could conduct BEVRECS observations with the Aboriginal women. The multiple reasons for these changes are not relevant here, but their implications are great. An eighteen month study would have allowed six months for preliminary preparations before beginning to record with BEVRECS, and twelve months in which to record, thereby facilitating the detection of behavior patterns with an annual periodicity. The deletion of 180 days in the field could be handled in one of two ways: 1) by reducing the duration of the preliminary preparations to three months and that of the BEVRECS work to nine months, thereby yielding a record of a truncated annual cycle; or 2) by retaining a six-month preliminary phase and obtaining only enough BEVRECS data in the remaining time to permit us to fully develop the recording system, file integration procedures and analytical procedures, and to begin to learn something about the Alyawarra. We arrived in the field with both options under consideration, knowing that a final decision could be delayed until DAY 90, at which time we would either begin nine months of BEVRECS recording, or switch to the second alternative, postpone the initiation of BEVRECS work for an additional ninety days, and do a pilot study only, which we could terminate as soon as we felt that we had had enough experience and obtained enough data to satisfy the requirements of that option.

The decision to work alone rather than with a trained female co-observer had none of the adverse consequences that we had anticipated. When we arrived in the field, we hoped to make BEVRECS observations at the high resolution level of Figure 1A, in which case we felt that the Alyawarra would be less apprehensive with a female than with a male observer working at such a short range from the women. With the decision to work at a lower resolution level, the sex of the observer proved to be irrelevant. (The field research assistant who recoded all of the "shorthand" recordings did not make any of the initial records herself.)

By explicitly stating our research objectives and selecting our research methods before going into the field, it was possible to make, prior to arriving in the field, tentative flow charts of the events and activities that had to occur, in order of occurrence, if the objectives were to be reached in the time available for the fieldwork. The order of events in the flow charts for OPTION 1 and OPTION 2 were identical, the only difference between the two options being in
the amount of time allocated for each activity. (The criteria for ending the project were somewhat different for the two options, but those criteria were not part of the flow charts.)

To some extent, the problem of developing a good working relationship with the Alyawarra was like that faced by any fieldworker in cultural anthropology, and it was the first problem encountered in the field. Our efforts were aided enormously by the white residents of MacDonald Downs Station who have almost fifty years of experience in living and working with the Alyawarra, and who recommended us highly to the Aboriginal people. Had the relationship between that family and the Alyawarra been poor, or if we had received a cautious or negative reception by that family, we would have expected a lengthy delay in establishing a good relationship with the Alyawarra. However, on the third day after our arrival in camp, groups of men began coming to the tent to learn about our specific plans and to begin teaching us their language and behavior; on the fourth day, even larger groups of women and children began paying similar visits. After a week, we began repaying the visits, and the free flow of people between tent and Aboriginal residences never diminished.

One of the most important ingredients in establishing rapport was our systematically photographing every adult and almost every child in the entire population. With a Polaroid camera, we made two photographs of each person, one of which we mounted on the card which we used in eliciting and recording vital statistics, genealogical data, and kin terms. The other was given immediately as a gift to the person photographed. Those two photographs were of equal importance in building rapport. The rapport-building value of the gifts is obvious. The value of the others derived from the ways in which we used them and the cards on which they were mounted. They served as flash cards for eliciting kin terms, an activity in which almost everyone participated frequently either as respondent or as on-looker. We tentatively approached a number of ways in which people categorized themselves and each other - just enough to give them an idea of the general topic in which we were interested, beginning with the most obvious categorizational scheme (sex) and moving gradually to more complex and abstract topics (age, marriage section, patrifamily membership, and so on) - then had individuals and groups sort the cards and specify the criteria by which they made the classifications. The sorted cards were used as items to be arranged by the people on the basis of genealogical relations so that all genealogies could be reconstructed in spite of a total (and never violated) injunction against mentioning the name of any deceased person. Hardly a day passed during the first two-thirds of the fieldwork when we did not interact with several people by way of the photo-deck, without which the research would never have had a chance of succeeding.

By making the photographs, and subsequently discussing each person’s own photo and those of everyone else with everyone photographed, we had a legitimate reason to make several visits to each person in the population and each residence in the camp, and by getting everyone involved in the activities, we avoided getting stuck with any one person as a key informant. Meanwhile, we rapidly learned to identify on sight every resident of Camp A and all other adults in the entire population as well.

Prior to our arrival at the research site, we thought that we should delay the acquisition of genealogical data and kin terms until we were well into the BEVRECS phase of the project in order to avoid the possibility of biasing the observations because of prior knowledge of relations
between the ACTORS. Then on DAY 029, several of the men began teaching us kinship terms. At that time, we could alter the plan, do the best job that we could with the relational data, and maintain the strong interest and enthusiasm of the Alyawarra, or attempt to postpone learning anything about this fundamental characteristic of Alyawarra life and thereby risk serious damage to present and future rapport with the people. Clearly, the situation called for a change in the order of events in the pre-fieldwork flow charts.

In beginning to record vital statistics, genealogical data, kin terms, and demographic data, we had to make our first decisions on codes that would inter-relate all of the data files and, especially, become the BEVRECS LOCATION, ACTOR, and (most of the) ORIENTATION vocabularies. This task was relatively free of problems, but, when DAY 090 arrived, we were not finished with most of the preliminary work, and formalization of the BEVRECS vocabulary was far from complete. Hence, we opted for a pilot project.

It was at this point that we encountered a problem not anticipated when we prepared the flow charts. There is no way to predict when a disaster will occur, but to expect a completely trouble-free year in the field is to be very naive. We were not so naive as to predict a totally predictable year, but we had failed to form contingency plans which could be put into effect during each activity plotted in the flow chart. When three deaths occurred in a period of nine days, we suddenly had to do a great deal of re-thinking which led to the realization that a shift in resolution level was necessary and that such a shift would be far from disastrous. In fact, we had not even given much thought to the concept of the space-time resolution level until we were confronted with three unexpected deaths - and it is important that more than one death occurred at that time. Had only one occurred, the disruption, turmoil, and anxiety among the population probably would not have been serious enough to bring us into an uncomfortable confrontation with our original decision to work in accordance with the scheme presented in Figures 1A and 3A. We shudder to think what might have happened had another catastrophe occurred at an earlier or later period in the research, but at the same time, we wonder what other concepts might have emerged as important ones had we encountered other major obstacles.

We were ready to begin recording with BEVRECS on DAY 180; the first death occurred on DAY 176 and the third on DAY 184. We gradually regained our composure, and on DAY 199 we began recording at the new resolution level, using a revised vocabulary. So we were three weeks behind schedule and beginning to experience mild panic. A three month delay at DAY 090 was more-or-less expected; a three week delay at DAY 180 was frightening.

The reason for anxiety at this point was our uncertainty as to the data acquisition rate with BEVRECS. We knew that we wanted a large volume of data, but with no prior experience at the new resolution level, we could not even make an educated guess as to the amount of observation time required to accumulate a given number of EVENTS. Faced with this glaring lacuna in our knowledge, we decided to try for four hours of observations per day. We promptly learned two important things: 1) four hours of recording per day in the summer in Central Australia is nothing short of suicidal, but 2) to maintain an average of two hours of recording per day for 100 days would give us ample data for the purposes of a pilot project. That is what we did: 98 days and 197.5 observation hours after the beginning of the BEVRECS recordings, we departed Central Australia. We know now that the over-all data acquisition rate was approximately 220
EVENTS per hour, which is 220% greater than the figure we arrived at through an uneducated guess during the two weeks immediately following the third death.

The unexpectedly high data acquisition rate with BEVRECS produced problems of its own. Basically, the question is: how much is enough? We knew that the reduced resolution level had resulted in our observing many activities with far less frequency than would have been the case at a higher resolution level; correspondingly, we were recording certain conspicuous locomotor activities at a disproportionately high frequency. We were confident that we would quickly record enough locomotor EVENTS to make meaningful statistical inferences concerning that kind of activity, but what about the other kinds of behavior? We simply took a chance that 200 hours of recording at more than 200 EVENTS per hour would yield adequate frequencies for most of the values for all of the variables. Had we been equipped to perform even the simplest of computer analyses in the field, it would not have been necessary to make this kind of potentially disastrous guess.

The decision to stop with a BEVRECS data base of approximately 50,000 EVENTS was due in part to the realization that financial and temporal limitations were likely to make it very difficult to derive any real value from additional data, and that additional data would be really important only if the observational sessions were distributed over an entire wet-dry cycle, a condition impossible to meet in the time allocated for the BEVRECS phase of the project. The cost of EDP cards, keypunching, computer time, etc., were not covered by our research grants, and we were certain that we would be unable to analyze, in the foreseeable future, more than 200-hours-worth of BEVRECS data. Furthermore, we seriously doubt that there is anything that can be learned from 75,000 EVENTS recorded at the selected resolution level over a period of 150 days that cannot be learned from 50,000 EVENTS recorded at the same resolution level during a 100 day period.

The multifaceted problem of data quality control was discussed in Chapter 4. Without another person to check the entries with her own understanding of BEVRECS and a firsthand knowledge of life in the camp, the error rate would have been much higher and the data acquisition rate would have been reduced by 50%.

The desert of Central Australia is a harsh environment even when one is surrounded with the best of equipment and creature comforts. Given our decision to live right in the Alyawarra camp, we were reasonably well outfitted: a 15' by 15' tent, gas stove and refrigerator, tables, chairs, cots, copious supplies of food from Alice Springs, a shade built for us by the Alyawarra where we could sit when the temperature in the tent became intolerable, a Landrover, and so on. But it is really difficult to appreciate the harshness of the environment until one has spent 197.5 hours seated atop a Landrover in temperatures ranging as high as 109.7°F, with winds gusting as high as forty miles per hour, or spent well over 200 hours in an Alyawarra shade (urlya) where the density of flies often is very high, while checking, numerically coding, and doing a variety of “bookkeeping” tasks related to the BEVRECS data. It would be far more accurate to say that we survived the problems of the environment than that we solved them.

Another problem which we handled (or failed to handle) in the same way was boredom. During the first 200 days of fieldwork, each day was different from most others, and even though some
were unpleasant, the overall experience was fun. During the last 100 days, we derived a great amount of excitement and satisfaction from the rate at which the BEVRECS records accumulated and from the patterns that we began to see emerging, but there was no fun at all in sitting on top of that Landrover for 197.5 hours. However, this problem could have been handled successfully had we known then what we know now. During the planning phase of the research, we were quite anxious. This was caused, to a large extent, by often voiced skepticism and criticism of many who had had field experience and who were familiar with the methods and objectives of the research, partly by our own awareness of potential difficulties, and partly by a fear of failure and of the unknown quantities inherent in one's first field experience. Since the BEVRECS portion of the project was the main source of anxiety, we decided to attempt to finish by DAY 180 everything that could be finished by then, so that if serious problems arose with the BEVRECS we could devote our full attention to solving them. Fortunately, we encountered no major problems with BEVRECS, but unfortunately, that left us with almost nothing else directly related to the objectives of the research to do. So we got bored.

After completing the fieldwork, we had to face the problems of time and expense involved in transferring the BEVRECS data to EDP cards, and subsequently processing the data with the CDC6400 computer and SPSS programs. The quantity of BEVRECS data was unnecessarily large for the purposes of the dissertation, and exploring the relations between that file and all others was not feasible at this time. One of the stated objectives of the research is to devise new analytical procedures useful with the data, but to this point we have concentrated on learning how to use the computer and the SPSS programs which are already available and applicable.
Part 3. Conclusion

Our research with the Alyawarra was designed explicitly to straddle the gradually fading boundary between cultural anthropology and behavioral biology; consequently, it fits comfortably in neither of those disciplines. The only hypothesis tested thus far, viz. that observable and recordable behavior occurs randomly in time and space and throughout the research population, was soundly rejected, but that most obvious of hypotheses could have been rejected intuitively; hence the hypothesis was vacuous as well as null, except in so far as its rejection indicates the pattern-detection capabilities of BEVRECS. The dissertation itself is a progress report on work that is far from finished, even in terms of the three objectives stated in the introduction. Yet we feel that there are several reasons why the work completed to this time should be presented to the anthropological community now.

Within the past decade, cultural anthropology in the United States has experienced an intensifying schism, accompanied by acrimonious debate, between those who perceive anthropology as a formal science (especially the cognitive anthropologists) and those who perceive it as a natural science (e.g. the cultural ecologists). We predict that the arguments will diminish as it becomes increasingly clear that the differences between naturalistic and formalistic sometimes are spurious and frequently are reconcilable, but to still the battle, we need field data and analytical procedures that can be seen as non-threatening (or perhaps as equally threatening) to both parties. Hopefully, the research introduced here can help in this regard.

The patterns that appear in the Figures in Chapters 4 and 5 were derived from our field records of the behavior that we perceived among the research population. Presumably there is a high positive correlation between what the members of the population did and what we wrote down, but it is essential to keep in mind that we can analyze nothing more than our records. In doing that, we arrive at a second-order analysis of Alyawarra behavior (i.e., we are certain that the correlation between our records and their behavior in less than perfect).

From the patterns that we detect in our records and in their behavior, we can make inferences, if we wish, concerning rules by which the behavior might be regulated. They are inferred rules or statistical generalizations derived from analyses of an exhaustive and unedited set of records made during a finite time. As such, they do not enable us to predict exactly what a specific individual will do at a specific time or in a specific situation. Cognitive anthropologists, criticized harshly (Harris, 1968) for doing work that has a similar characteristic, have based their responses on the analogy between the cognitive description of a culture and the grammar of a language (Tyler, 1969). We, on the other hand, base our response on the analogy between our study of a population of people and a field biologist's study of a population of baboons or ants.

In other words, we have taken the population, not the individual, as our unit of study. If we cannot predict specific behaviors of specific organisms in specific situations, it is because we had no intention of acquiring that skill. However, armed with the knowledge of Alyawarra behavior that can be extracted from the BEVRECS (and other) data files, we, like the well-versed cognitive anthropologist, can "approximately anticipate" (Frake, 1964:112) the behavior of
individuals, and be surprised along with the Alyawarra when someone does something that is especially rare in a given context.

The procedures devised by cognitive anthropologists have, generally speaking, required only one or a few key informants and the cognitive structures derived from their data have been static models that cannot easily accommodate individual variations or progressive changes in informants' behavior. All of the data in all of the files produced with the Alyawarra were obtained with as many different participating individuals as was possible, and individual variation and cumulative change are basic ingredients in the mix. We see the research as a preliminary step toward building dynamic models of the behavior of the research population.

We feel that it is useful to view the so-called "emic-etic controversy" as a debate over the relative merits of two sets of "emics". Cognitive anthropologists advocate the use of the emics of the research population, while we adopted the emics of the English-speaking community of behavioral biologists. We agree with Tyler (1969:14) that the usually implicit anthropological metalanguage that gives rise to the similarity of chapter headings for nearly all ethnographies is one that has been unproductive, but there is good reason to believe that the metalanguage of the biological sciences might offer a viable alternative that has already demonstrated its productivity in an enormous range of applications. The BEVRECS variables and the methods for deriving their values, most of the other variables and values in the other data files, and all of the detectable patterns in the records are expressible in and based upon a metalanguage that is eminently suited for comparative work with populations (tentatively, read cultures) as the units of study. We strongly agree with the efforts of cognitive anthropologists who are attempting to create a new metalanguage which ultimately may facilitate cross-cultural comparisons of cognitive structures, but for them to assert (cited by Harris, 1968; Tyler, 1969) that their way is the only way is to be a bit naive.

The patterns appearing in Chapters 4 and 5 and the discussion of them in Chapter 6 raise a great many vague questions concerning the identity and nature of the variables controlling the behavior which we observed and recorded. However, there have been no attempted explanations and no testing of hypotheses because we feel that to do so at this time would be premature. We are only beginning to sift out empirical knowledge about Alyawarra behavior. To attempt to explain something without really knowing enough about the subject to ask specific, intelligent questions is not likely to be very productive. We anticipate that the heuristic value of the project will be demonstrated in part by the many specific questions raised as the search for patterns proceeds to increasingly complex and subtle relationships.

E.O. Wilson (1971:458-460) concludes his recent book on The Insect Societies with a chapter entitled "The Prospect for a Unified Sociobiology". His remarks are extremely important and pertinent to the research in which we are engaged; hence in the following paragraphs, we paraphrase several portions of that chapter.

Wilson feels that we will have a unified science of sociobiology when the same parameters and quantitative theory are used to analyze both termite colonies and troops of rhesus macaques. Both termites and macaques live in cooperative groups that occupy territories. In both cases, members of the groups communicate among themselves, they are intensely aware of the
distinction between group members and non-members, and kinship plays an important role in group structure. In both kinds of society, the division of labor is well-marked. Of course, the differences between termite colonies and macaques troops are great, but it is out of deliberate over-simplification such as this that the beginnings of a general theory are made.

According to Wilson, the principal goal of a general theory of sociobiology should be an ability to predict features of social organization from knowledge of population parameters (i.e., demography and genetic structure) and behavioral constraints imposed by the genetic constitution of the species. The kind of theory that he envisions is conceived as being hypothetico-deductive, which means that it is built from models designed explicitly to test our basic assumptions. Such theorizing proceeds roughly in three steps. First, empirical knowledge is organized into concepts which in their most desirable form are sets of measured variables. Precisely defined relations among those concepts then become the postulates of our knowledge. In the second step, models are used in deducing the consequences of the postulates, and new predictions about the real world are contrived. Finally, those predictions are examined through experimentation and analysis to test and revise the original concepts and postulates. The predictions which survive this examination become postulates for the next subordinate level of theory. This procedure can be used to link evolutionary theory and ecology to population biology and thence to sociobiology. Wilson believes that the formulation of a general theory of sociobiology constitutes one of the great manageable problems of biology for the next two or three decades.

Wilson's oversimplified description of termite and macaque societies fits Alyawarra society with ease, and the ecological, demographic, relational, and behavioral data that constitute the raw materials for a theory of sociobiology are available, to a first approximation, for the Alyawarra. Although the contents and the structure of the complete Alyawarra data file should permit interested scientists to use it in testing hypotheses stimulated by everything from communications theory to psychoanalytic theory, we are especially eager to have it become a contribution toward the data base upon which a unified theory of sociobiology will be established.
Appendix. Abridged BEVRECS Vocabulary - Alyawarra Project

LOCATION1 and LOCATION2

01 - 32  Anoardegans
33 - 37  Alugeras
38       Ungundyga
41- 43   Automobile repair sites
44       Bore (well)
45 - 47  Ceremonial locations
48       Any temporary sleeping site
49       Our tent
50 - 53  North, east, south, and west outside the camp (excluding the road)
54 - 55  On the road to the bore or homestead
56       Neutral area within the camp

ACTOR

001-500 Specific people
590-599 Partially identified people
590    Child, sex unknown
591    Female child
592    Female adolescent
593    Female adult
594    Female, age group unknown
595    Male child
596    Male adolescent
597    Male adult
598    Male, age group unknown
599    Person, sex and age unknown
ORIENTATION

<table>
<thead>
<tr>
<th>001-599</th>
<th>Same as ACTOR values 001 – 599</th>
</tr>
</thead>
<tbody>
<tr>
<td>619</td>
<td>Dog</td>
</tr>
<tr>
<td>620</td>
<td>Cat</td>
</tr>
<tr>
<td>621</td>
<td>Chicken</td>
</tr>
<tr>
<td>622</td>
<td>Animal NOC*</td>
</tr>
<tr>
<td>623</td>
<td>Standing tree</td>
</tr>
<tr>
<td>624</td>
<td>Leafy limbs</td>
</tr>
<tr>
<td>625</td>
<td>Bare pole</td>
</tr>
<tr>
<td>626</td>
<td>Sticks</td>
</tr>
<tr>
<td>627</td>
<td>Log</td>
</tr>
<tr>
<td>628</td>
<td>Spinifex</td>
</tr>
<tr>
<td>629</td>
<td>Plant NOC</td>
</tr>
<tr>
<td>630</td>
<td>Food, nonspecific</td>
</tr>
<tr>
<td>631</td>
<td>Indigenous meat</td>
</tr>
<tr>
<td>632</td>
<td>Indigenous vegetable food</td>
</tr>
<tr>
<td>633</td>
<td>Indigenous sweets</td>
</tr>
<tr>
<td>634</td>
<td>Indigenous liquid food</td>
</tr>
<tr>
<td>635</td>
<td>Grubs</td>
</tr>
<tr>
<td>636</td>
<td>Introduced meat</td>
</tr>
<tr>
<td>637</td>
<td>Introduced vegetable food</td>
</tr>
<tr>
<td>638</td>
<td>Introduced sweets</td>
</tr>
<tr>
<td>639</td>
<td>Introduced liquid food</td>
</tr>
<tr>
<td>640</td>
<td>Bread</td>
</tr>
<tr>
<td>641</td>
<td>Body wastes</td>
</tr>
<tr>
<td>642</td>
<td>Water</td>
</tr>
<tr>
<td>643</td>
<td>Fire</td>
</tr>
<tr>
<td>644</td>
<td>Rocks, sand, etc.</td>
</tr>
<tr>
<td>645</td>
<td>Whirl wind</td>
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</tbody>
</table>

*NOC = not otherwise coded

OBJECT

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<tr>
<th>001-599</th>
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</thead>
<tbody>
<tr>
<td>619-672</td>
<td>Same as ORIENTATION values 619 –672</td>
</tr>
</tbody>
</table>
BEHAVIOR UNIT

01 Sit 33 Pour
02 Stand 34 Harvest
03 Lie 35 Push, pull
04 Stretch 36 Relocate NOC*
05 Walk to new LOCATION 37 Open, shut
06 Walk at a single LOCATION 38 Spread
07 Run to a new LOCATION 39 Chop
08 Run at a single LOCATION 40 Manipulate with foot
09 Run after 41 Make
10 Jump 42 Repair
11 Fall 43 Disassemble
12 Crawl 44 Adjust
13 Scoot 45 Dress
14 Climb 46 Launder
15 Swing 47 Clean house
16 Dance 48 Cook
17 Ride bicycle to a new LOCATION 49 Gather
18 Ride bicycle at a single LOCATION 50 Fight
19 Move (nonhuman ACTOR) 51 Play
20 Carry nonhuman object 52 Have tantrum
21 Carry person in hands 53 Look and listen
22 Carry person in coolamon 54 Eat
23 Carry person on hip 55 Drink
24 Carry person on shoulders 56 Lick
25 Carry person on back 57 Yawn
26 Lead 58 Spit
27 Groom 59 Carry in mouth
28 Hit 60 Sleep
29 Wave 61 Urinate
30 Hold 62 Defecate
31 Throw, drop 63 Nurse
32 Dig 64 Vocalize

*NOC = not otherwise coded
Notes

1. Basic references for the language and its applications to the study of *Macaca nemistrina* social behavior are the following: Bobbitt, Jensen, and Gordon, 1964; Bobbitt, Jensen, and Kuehn, 1964; Bobbitt, Gourvich, Miller, and Jensen, 1969; and Jensen, Bobbitt, and Gordon, 1969.

2. For further discussions of the selection of appropriate space-time resolution levels as a fundamental problem in general systems theory, systems analysis, theoretical biology, etc., see Klir, 1969:38-41, 111-114, 268; and Gerard, 1957.

3. See Harris, 1964:82-88; Wright, 1967:56-98; Altmann, 1965; Scheflen, 1968; and Bobbitt, et al., 1969 for further discussions of various aspects of the general problem of recording relatively complex activities.

4. The analyses performed to this time have been done with the CDC6400 computer at the University of Washington Computer Center. The programs and procedures used for this work, described in detail in Nie, Bent, and Hull (1970) and in the University of Washington Computer Center Manual W00054, are contained in the *Statistical Package for the Social Sciences (SPSS)* system of computer programs. All of the data and the data-defining information required for duplication of the analyses presented here are stored on magnetic tape and are available for duplication by anyone with a legitimate reason for having access to the information.

5. This kind of curve is, of course, the same as that typically obtained with one-way frequency distributions of a broad range of social and biological phenomena from sizes of Australian Aboriginal tribal areas arranged in order of average annual rainfall (Birdsell, 1953) to numbers of American cities arranged in order of population size.

6. An asterisk preceding a variable name indicates that a re-coded version of the input variable was used in the computation in question.

7. These values were arrived at intuitively rather than by a systematic examination of all combinations of BEVUNIT and ORIENTATION values, and for that reason they are simply suggestive of analytical possibilities rather than final words about the Alyawarra.

8. The GROUP COMPOSITION data, in the group composition format, was punched onto data processing cards and was used in preparing Figures 23 and 24. It has not been stored on tape, and no detailed description of it is included here. A copy of the data and all data defining information are available on request.

9. These styles are discussed later in the Chapter.

10. The survey of the primate literature was facilitated greatly by exhaustive bibliographies on primate behavior in habitat provided by the Primate Information Center, Regional Primate Research Center, University of Washington.
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