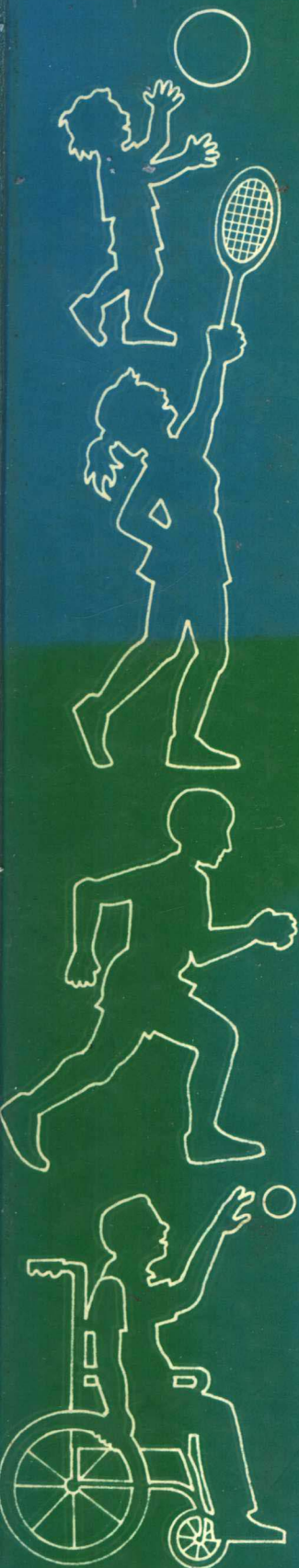


foundations of

Physical Education, Exercise, and Sport Sciences



WILLIAM C. ADAMS



Foundations of Physical Education, Exercise, and Sport Sciences



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PREFACE

During the past quarter century, physical education has increasingly become an academic discipline, though it retains a strong professional context. Further, a dramatically enhanced societal awareness of the role of structured physical activity programs now extends well beyond the traditional educational institutional setting. The development as an academic discipline has resulted in an increasing tendency for scholars to specialize in one of the subdisciplines basic to the study of human movement, such as biomechanics, exercise physiology, motor learning, or sport psychology. Concurrently, the application of structured physical activity programs has become more pluralistic and diverse. This is particularly evidenced by the increasing attention to the role of physical activity and fitness in the achievement of health and well-being, which has now become more firmly established in schools, colleges, and universities, as well as in community organizational settings, health clubs, the corporate sector, and in clinical settings. Indeed, the title of the text, "Foundations of Physical Education, Exercise, and Sport Sciences," implies that the term physical education is now recognizably inadequate to describe the expanded role of human movement studies and its societal application in the late 20th century.

There are numerous introductory textbooks in physical education, many of which have treated the academic body of knowledge somewhat superficially, focusing instead primarily on pedagogical and professional aspects, including the identification and description of attendant career opportunities. In this text, the latter are treated in brief, with the primary thrust entailing a thorough examination of the basic knowledge of the field. Accordingly, material from the basic subdisciplines has been selected and organized to whet the appetite of students interested in the broad field of physical education, exercise and sport science at an early stage in their college matriculation, as well as to establish an integrating element that provides an awareness of the many linkages that exist between these specialized areas of study. In this manner, growth in one's broad perspective of the field can be more effectively enhanced with completion of advanced coursework in one or more of the specialized areas covered in each chapter.

In essence, the text represents a holistic approach to the multidimensional study of human movement, in that it also examines the principal applications of this fundamental knowledge base to particular subpopulations, especially in terms of

developmental and health maintenance and enhancement aspects. This intent stems from the accumulating impressive evidence that physical activity and physical fitness contribute to good health. It includes documented evidence about human physical activity and health related behavior, as well as application of this information to one's own life and to those of others that one influences in family, or in other social or professional life settings. Thus, while subdisciplines such as biomechanics, exercise physiology, and sport psychology can be studied for inherent basic knowledge, they provide a more important societal impact via their effective application.

While the most important basic concepts in physical education, exercise and sport science are identified in the text, they are not examined in detail appropriate to a challenging upper division course. Indeed, in many institutions, physical education majors take an entire course in each of the subject areas covered in the nine chapters herein. This, then, is an introductory text that gives the college student interested in the study of human movement and its place in modern society, a broad perspective of the field. As such, it is not intended solely as the introductory theory course for the physical education major, but also for students enrolled in a general education course in a liberal arts and sciences curriculum which permits an elective in this field of increasing societal importance.

The order of material presented has been arranged to achieve the objectives identified above. The first chapter is prefatory, but broad and integrative, in that it deals with the history of human organized physical activity programs and modern man's continued need for vigorous physical activity. The integrative concept basic to this presentation is anthropologic, including both physical and cultural dimensions. Distinction between the roles of science in the continued growth of the knowledge base in human movement, and of the philosophic process in ferreting out elements of its comprehensive meaning in terms of benefit to modern man, is also made. In the next four chapters basic concepts, supported by data from the scientific literature, are presented in the primary subdisciplines of the field: (1) biomechanics, (2) exercise physiology, (3) motor learning, and exercise and sport psychology, and (4) the sociology of sport and physical education. In addition to a theoretical overview, numerous examples of various aspects of physical education, exercise and sport applications are given. In the next two chapters, the relationship between physical activity and (1) growth and development to adulthood, and (2) the aging process, are examined. Next, the concepts of health, well-being and fitness are surveyed, with emphasis on the development of chronic "life-style" disease. In the final chapter, the role of enhanced physical activity in alleviating the effect of several important chronic diseases is examined.

There are several features of this text which should be useful to one teaching an introductory course in physical education. Each chapter begins with an introduction that provides a summary statement of the scope of material to be covered. Further, each chapter ends with an enumerated summary emphasizing major points. Throughout the text, basic concepts are identified and developed via citation of original research or carefully chosen substantiation advanced in specialized textbooks of the field. The latter, especially those listed in the bibliography of each chapter, afford a ready source for the student interested in a more detailed treatment.

A basic premise employed in this text is that even beginning students in the field should be presented with data in some detail that substantiate fundamental assertions. Accordingly, tables and graphs have been plentifully employed to aid in presenting salient data substantiating major concepts. Selected photographs have also

been incorporated to improve presentation of material and emphasize key points. While the number of basic concepts and the magnitude of data presented may seem initially formidable, this text can prove particularly useful to the instructor who wishes to present an introductory course utilizing a text similar in approach to those readily available for introductory courses in traditional academic disciplines, such as anthropology, physics, physiology, psychology, and sociology. An accompanying caveat is that some departments might find it better to use this text in a team-taught course employing a specialist in one or more of the major areas covered, though one person must clearly assume primary responsibility for assuring effective integration.

I acknowledge the valued input of numerous undergraduate students, whose relatively uninhibited questions and viewpoints provided additional insight over the past 25 years in the development of the prototype course for which this text has been written. Thanks is extended to numerous colleagues—at the University of California, Davis, and elsewhere—who intentionally, and sometimes unwittingly, provided feedback over the years relative to the purpose, scope, and usefulness of an introductory foundations course primarily focused on the academic knowledge base of the field. The selection and organization of the material in the text represents my original work, but it is with pleasure that I acknowledge the contribution of others' ideas, as well as much of the data presented in the text, which represents an impressive collection of scholarly productivity by many colleagues in physical education, exercise and sport science. Errors and omissions, however, are my sole responsibility.

I am grateful for the original illustrations prepared by Geoffrey Adams, Candace Ireton, and William J. Penny, Ph.D. Appreciation is gratefully extended to organizations and publications which made illustrations, photographs, tables, and other material available. Finally, I am deeply indebted for the wide ranging contributions of Candace Ireton, which included all administrative aspects of preparing the manuscript for forwarding to the publisher, editing of the original manuscript, word processing, preparing outlines following review of original source material, as well as preparing original drafts of several pages of text. It is hard to visualize how this project could have reached fruition without her manifold contribution.

Davis, California

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1

ANTHROPOLOGIC, HISTORIC, AND PHILOSOPHIC FOUNDATIONS OF PHYSICAL EDUCATION

INTRODUCTION

Until the late 1960s, physical education in the United States was almost exclusively considered a profession. That is, the field possessed a scientific and philosophic basis, employed specialized skills, and performed a service to society. It offered physical activity instructional programs in educational institutions which were designed to make contributions to the mental, social, emotional, and physical development of students (i.e., education through the physical⁸³). Further, it developed and administered programs of professional training for teachers and coaches to conduct these physical activity instructional programs in sport, dance, and exercise.

Physical education in the United States has developed and expanded during the past quarter century in two principal ways: (1) it is increasingly an academic discipline (though it retains a strong professional context) with a growing body of knowledge whose central focus is human movement (i.e., man engaged in physical activity); and (2) via the dramatically enhanced societal awareness of the optimal health/fitness role of structured physical activity programs that now extend well beyond the traditional educational setting. The latter has been spurred primarily by societal forces outside of the profession, including increased leisure time, enhanced discretionary income, federal public health sup-

port,^{76,77} and expanded media exposure.^{66,68} The application of structured physical activity programs has become more pluralistic and diverse, including those for preschool children, middle-age adults, and senior citizens, in addition to the traditional programs in educational institutions. This is particularly evidenced by the increased role of fitness based programs in the achievement of health and well-being, now widely available in community organizational settings, health clubs, the corporate sector, and clinical settings.³⁵ This growth outside of the educational setting has provided an expanded array of career options for physical education majors beyond traditional teaching and coaching careers, including health/fitness instruction, physical therapy, athletic training, sports administration, sports communication, and sports marketing.³⁹

Physical education's growth as an academic discipline has been a resultant of the enhanced role of science and research in higher education, and the need of the profession for more sound information and theories upon which to develop and administer its programmatic offerings.⁶¹ A number of specialty areas of knowledge have developed, but there is disagreement among physical educators as to which are properly regarded as subdisciplines. Biomechanics, exercise physiology, motor learning and sport psychology, and sport sociology are generally accepted subdisci-

plines. Other specialty areas with less well-developed knowledge bases include: (1) history and philosophy of physical education and sport; and (2) physical education and sport pedagogy. The latter is concerned with the systematic study and development of facts and theories relevant to physical education and sport program curriculum content, teaching methods, organization and administration, and teacher preparation.⁶⁵

The continuously increasing knowledge base in each of the academic subdisciplines within college physical education departments has resulted in an increased tendency for specialization. Less concern has been evidenced for the profession's continuing need for educating professionals who can provide effective integration of this information, together with well-organized delivery (teaching) of structured physical activity programs to an increasingly varied clientele.²⁵ Hence, there is a pressing need for effective interaction and communication between these seemingly diverse but effectively interdependent elements. That is, the academic subdisciplines in physical education have a binding commitment to devote some of their effort to providing information that can be utilized to develop structured physical activity programs of higher quality. Concurrently, those who develop the pedagogical skills of professional physical educators must be aware of the latest information from the various academic subdisciplines which can be implemented most effectively.

Recent expansion of structured physical activity instructional programs beyond the traditional educational institution setting has resulted in a change of emphasis in the way physical education is defined in terms of its objectives for individual participants. There is now more emphasis on physical education as a life-long process involving education both *of* and *through* the physical, or as Metheny states, "learning to move and moving to learn."⁴⁴ In addition to the previously identified holistic developmental objectives for educational institution participants, modern programs seek to enhance the opportunity for one to achieve optimal development of motor skills and physical fitness commensurate with health

and well-being, together with knowledge and attitudes likely to enhance one's electing a physically active lifestyle.

The broadened societal setting for structured physical activity programs, and the decreased emphasis on professional preparation of teachers and coaches, together with the increased emphasis on the study of human movement as an academic discipline, has led to an identity crisis for physical education departments.⁶¹ As Cheffers and Evaul state: "If human movement is the discipline that incorporates a body of knowledge about human beings in motion, then physical education is a profession that applies that knowledge."^{13:xii} This observation suggests that physical education may not be the best descriptor, at least alone, for a university department increasingly dedicated to the scientific study of human movement. Janz et al.³⁶ surveyed all 680 4-year institutions offering degree programs in physical education to determine (1) if they had changed their name, and (2) if so, whether a new common name for the profession was evident. They found that 33% of the institutions responding had changed their name during the period from 1976 to 1988, with one-half of them having done so in the last 3 years. Sixty-five percent included physical education in their new title, linking it most frequently with the terms health, leisure studies, or sport studies. The primary reasons given for retaining physical education in the new name chosen were that the latter more accurately described areas of specialization, while maintaining an overall title that was easily recognized. Of those departments electing to change their names without retaining physical education in the title, most were large institutions granting master's and/or doctoral degrees. Primary reasons cited for electing this option included: (1) more accurately describes areas of specialization; (2) reflects curricular priorities; (3) enhances image in academia; and (4) enhances grant funding opportunities. The authors concluded that the trend toward name change has not resulted in a commonly accepted departmental name, although kinesiology, human performance, human movement, kinetics, sport science,

and exercise science were names cited most often.

The choice of title for this text reflects my contention that physical education is no longer an adequate term to describe this modern, highly diverse field. However, it has over a century of tradition in professional and public acceptance and understanding, and appears to remain an appropriate descriptor for physical activity instructional and professional training programs.^{27,61} Thus, it is retained, while exercise and sport sciences are added to encompass an overarching focus of the primary academic subdisciplines of the field.

While history and philosophy of physical education and sport are important extensions of their traditional humanities disciplines, they are accounted for in the text title only by inference in the term physical education. Fundamental information and concepts from these knowledge bases, together with examination of the anthropologic perspective of human movement (both cultural and physical) constitute the remainder of this chapter.

ANTHROPOLOGIC PERSPECTIVE

Anthropology, literally is the study of man. It is the science dealing with the interaction of man's culture, biology, and environment. Anthropologists are concerned with study of the individual human, but also with the comparison of societies of people both contemporary and historic. Of particular importance is how groups adjust biologically and culturally to their environments. Accordingly, the two major subareas of study are physical and cultural anthropology. While early cultural anthropologists observed and recorded the ways of life of "primitive peoples," many now study the impact of modern technologic societies on cultural changes necessitated by this complex environmental change in man's life. Biologic demands of the environment are a primary concern of the physical anthropologist, particularly with respect to the long history of human evolution. Since man adapts biologically via the relatively slow process of evolution,

the highly technologic, urban environment we now live in may well place demands on us that we are biologically ill-prepared to handle.⁸⁰ Biologic evolution has facilitated man's capacity for assimilating a complex culture, and the two are interrelated in man's ability to cope successfully with the environment.

Culture is sometimes defined in a narrow sense to indicate a society's level of accomplishment in literature, music, and art. Anthropologists consider it in a much broader context to include "the complex whole of knowledge, beliefs, morals, law, custom, art and any other capabilities and habits acquired by man as a member of society."^{23,7} As such, it is not inherited biologically as is so much of the body structure, function and personality predisposition. Instead, culture is learned from other humans, and not only by children from their parents, as in biologic heredity. Indeed, man is born very much an animal, in that his behavior is characterized by involuntary reflex actions, such as crying, blinking, and sucking. However, man is also born with unique potentialities, including the capability of analyzing and describing, of thinking, and of recording and communicating thoughts. He is the most plastic and adaptable creature on Earth, and hence is able to survive and flourish in widely varied environments. Because he is the most educable creature, his cultural heritage has become vastly more complex than even the highest forms of sub-human animals. At birth, however, the infant is not yet a personality, i.e., ideas, interests, fears, and desires are not yet formed; one's occupation, economic and social status are still to be shaped by experience. Sorokin compared the infant's development to a phonograph, when he asserted:

He is like a phonograph, capable of playing any record. A well-constructed phonograph, to be sure, plays any record better than a poorly constructed phonograph. But what records it will play—whether a Beethoven symphony or jazz—does not depend upon the phonograph. Similarly a person born with a superior constitution may develop a better mind and play his "sociocultural records" better than one born with inferior hereditary endowments; but what "sociocultural records" he will play usually de-

pend on rather little upon the organic or biological factors.^{71:5}

The interrelations between the biologic and cultural components of human evolution are best understood in terms of how they serve the same basic function—adaptation to man's environments, though in a subtly distinct way. Dobzhansky²³ contends that most contemporary evolutionists are of the opinion that adaptation of a living species to its environment is the chief agency impelling and directing biologic evolution. Further, this process takes place through natural selection, which promotes the survival and reproduction of the carriers of some genetic components and inhibits others. Dobzhansky further states:

The construction of man's body and the conformation of his intellect developed as they did because they made our species biologically highly successful. The genetic basis of man's capacity to acquire, develop or modify, and transmit culture emerged because of the adaptive advantages which this capacity conferred on its possessors. Culture is, however, an instrument of adaptation which is vastly more efficient than the biological processes which led to its inception and advancement. It is more efficient among other things because it is more rapid—changed genes are transmitted only to the direct descendants of the individuals in whom they first appear; to replace the old genes, the carriers of the new ones must gradually outbreed and supplant the former. Changed culture may be transmitted to anybody regardless of biological parentage, or borrowed ready-made from other peoples.^{23:20}

It is a mistake then to consider culture as an independent variable subject to genetic transmission, which then would exhibit natural selection akin to a social Darwinism effect.²³

MAN'S EVOLUTION AND PHYSICAL ACTIVITY

Man's biologic evolution extends over millions of years, with the first true man, *Homo erectus*, living as a hunter and food gatherer over a substantial geographic area at least 1½ million years ago.⁸⁰ *Homo sapiens* existed 35,000 to 50,000 years ago in much the same environmental demand relative

to physical activity necessary for provision of an adequate food supply. Astrand¹ contends that early man's successful evolution necessitated hours of walking each day in order to get enough food. The motivation for this habitual activity was not love for exercise but plain hunger. More recently, perhaps 10,000 years ago, plants were domesticated and man became more an agrarian, stationary farmer.⁸⁰ However, this also required hours each day of vigorous physical activity, which has only recently (within the last 100 years in the United States) been replaced as the predominant lifestyle characteristic of our increasingly industrialized and high-technological society. Astrand¹ has contrasted this century as representing only 1 centimeter in a 460 kilometer journey of the evolution of life on earth. Another important aspect of this recent change is that man previously lived in small groups, with a less complex culture to assimilate and probably with less emotional stress.⁸⁰ Kraus and Raab summarize the significance of this basic change in human lifestyle:

A tremendous transition has taken place in the biologically short period of time that has transpired from primitive man to the present highly civilized and domesticated citizen: a transition from an active and physically strenuous life, subject to privations and hardships of climate, to an extremely well protected but caged existence. It seems unlikely that such a change of environment and mode of living can take place without major reactions of the organism. While adaptability to new circumstances is one of the outstanding qualities of the human body, as well as the human mind, it can function only within certain limits. It is likely that overly dramatic changes of living habits may throw the organism off balance.^{38:4}

One should appreciate that from the standpoint of biologic evolution, man has been propelled ahead thousands of years. His nervous system, emotions, vital organs, and muscular system appear far behind in their power of adaptation when compared to recent advances in science and technology.⁴¹

BRIEF OVERVIEW OF TECHNOLOGIC DEVELOPMENT IMPACT ON MAN'S PHYSICAL ACTIVITY LEVEL. Contemporary American society is in a state of rapid change brought about primarily by the impact of science and technologic development, and its wide diffusion in our culture. Their effects on our work and leisure patterns have been manifold, and there is also evidence of enhanced difficulty in behavioral adjustment to an increasingly complex societal input. In addition, economic innovation, particularly the impact of Keynesian economics, has produced a credit system that has resulted in a greatly expanded demand for goods and services. These significant changes in our way of life have hardly produced the utopia some had imagined when 20th century man became increasingly relieved of hard physical labor. Bates has aptly summarized the apparent dilemma arising from these changes:

We now have . . . an abundance of goods and services for nearly everyone which even the privileged few could not command a century ago. We have a wide variety of machines to replace physical labor, giving leisure time to all ranks of society . . . We are well into the "space age," and the fantasies of yesterday's science fiction become the realities of tomorrow. Yet our time has also been called the "age of anxiety." We have goods and services, but we don't quite know what to do with them. We have leisure, but we are not sure how to use it for the greatest satisfactions . . . we calm our nerves with great quantities of tranquilizers and alcohol; we can scarcely provide room enough in our hospitals for the mentally ill. Utopia is here—and we are afraid . . . The problem of our age, then, is to gain the wisdom we need to use our growing power intelligently.^{3:107}

Automation. Automation is a technologic advance that has produced at least four significant changes with which modern-day America must contend: (1) Less physical effort is required for workers to complete their occupational tasks; (2) many are obliged to perform monotonous assembly line work; (3) more jobs in the service category, involving hours of sitting at a desk or behind a counter, have been created; and (4) a vast majority of our populace has increasingly larger amounts of leisure time available, though there is conflicting infor-

mation as to whether this trend is plateauing.^{18,38}

Industrialization and Urbanization. Industrialization, urbanization, and prosperity are other resultants of this country's scientific and technologic advance. They have made man's life less physically rigorous in working and securing goods and services, yet at the same time, apparently have occurred so rapidly that he has been unable to make a satisfactory adjustment. Industrial progress means more production which, in turn, usually results in a higher standard of living. Thus, people have not only more leisure, but more money to spend on leisure. As more jobs have arisen in our urban industrial centers, much of our rural population has migrated there. This urban "population explosion" with the accompanying space demands for housing, parking lots, and industrial enterprises seriously jeopardizes open play space for all age groups at an increasing rate. In addition, our living tempo has greatly increased and we hurry from place to place meeting one deadline after another.³⁸

Today, most Americans ride wherever they go, and use an endless variety of machines to accomplish chores in and around the home. We employ power-driven tools for housework, leisure time handiwork, and even for exercising! Certainly, it is well to stop and ask the question: Is there really drudgery inherent in our play and leisure activities? Another important related concern regarding leisure is its worthy use. This concept has been studied in some detail by Nash,⁴⁷ and is presented in graphic summary form in Figure 1-1. There are four levels above a zero category. Nash rates the field of entertainment and amusement, such as television, radio and popular movies, all as an antidote to boredom, nearest zero. Next on the scale is the level of emotional participation, followed by active participation and creative participation. Nash feels that it is desirable and necessary to participate in leisure experience at all of these levels. However, he cautions that too many activities low on the scale are dulling. Below zero on the scale is depicted as a level of anti-social behavior as reflected in delinquency and crime.

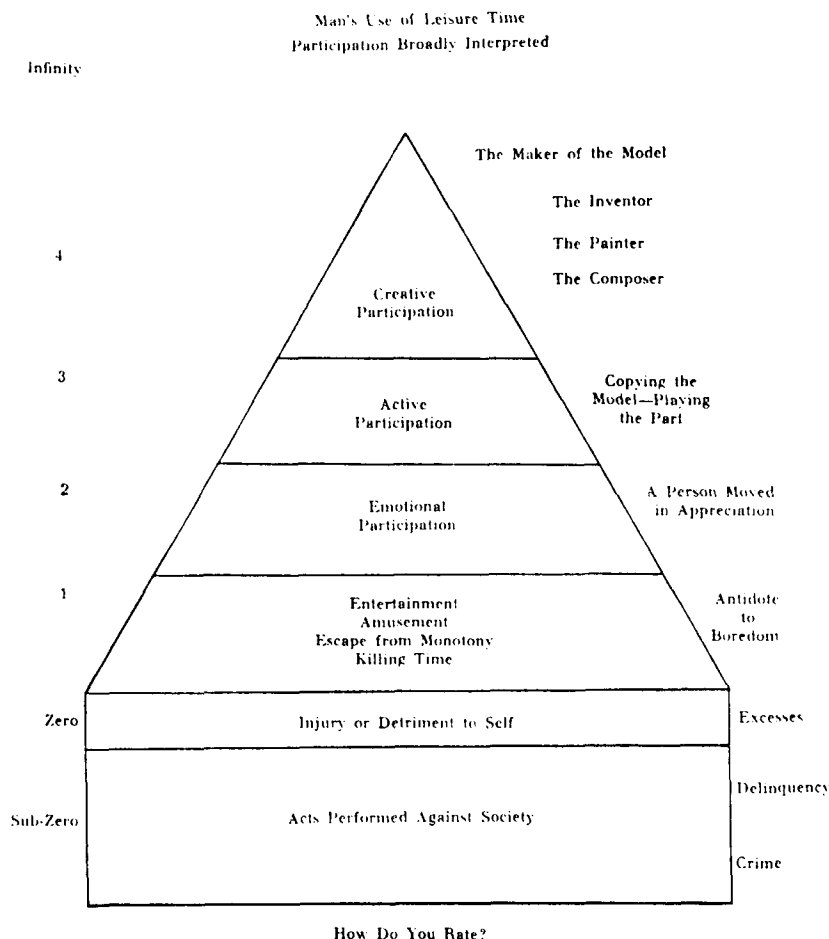


FIG. 1-1. Scale for rating man's use of leisure time-participation broadly interpreted. (From Nash, J.B.: *Philosophy of Recreation and Leisure*. St. Louis: Mosby, 1953, p. 89.)

It should be noted that physical activity can make a contribution at three levels: (1) as an antidote to boredom through observation of sport (level 1); (2) as an emotional experience gained through the support of a team or sports group (level 2); and (3) as a provision for active participation in a variety of activities (level 3). Physical activity also has the potential to contribute at the creative level for a few individuals. However, this potential is not unique to physical activity participation, as it applies to many other life activities.

There is ready evidence in our society of many individuals who spend the vast majority of their leisure time in non-creative, sedentary activities that are often merely an antidote to boredom (level 1). However,

there is increasing evidence of a growing number of people who are becoming more actively involved in leisure time pursuits, including fitness activities and sports participation.⁷⁴ While the latter represent only two kinds of many worthwhile leisure time pursuits, their value is further enhanced because of our largely activity-void jobs.

HEALTH EFFECTS OF INSUFFICIENT PHYSICAL ACTIVITY—HYPOKINETIC DISEASE. The first American public health revolution—bringing infectious disease under control—has been largely successful, in that today they account for only 1% of total deaths. However, efforts to deal with the vast increase in chronic disease and mortality have only recently showed notable prog-