The Genesis of Animal Play

Testing the Limits

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1 Play: Many Meanings, Few Answers

Now in myth and ritual the great instinctive forces of civilized life have their origin: law and order, commerce and profit, craft and art, poetry, wisdom, and science. All are rooted in the primaeval soil of play.

—Huizinga (1955: 5)

1.1 Prologue: Different Visions

Huizinga's claim is certainly strong, but one only more subtly expressed by many other writers (e.g., Dissanayake, 1992; Lorenz, 1981). Following Huizinga's lead, Stephenson developed an influential theory that ''mass communication in its play aspects may be the way a society develops its culture—the way it dreams, has its myths, and develops its loyalties'' (Stephenson, 1967: 48). My goal in this book is not to evaluate the first part of Huizinga's statement, but to explore the origins and more fundamental legacies of ''the primaeval soil of play.'' Before we start to look for these origins and how they have affected the development of play, some old but enduring ideas about play should be examined.

A satisfactory theory of play is still wanting, and yet a man does not learn through any kind of instruction or study in later life anything like so much as the child learns in the first four years of his careless existence, through the perceptions and ideas acquired in his play.... as I have previously spoken of the experimenting of little children as play, I may now mention the internal resemblance of their procedure to that of the naturalist. (Preyer, 1893: 42)

This charming view of play expressed by one of the first important scientists to study child and infant behavior reflected a progressive, and still prominent, view of play. It reflects the great influence of Charles Darwin, who himself pioneered the study of human children with the tools of the naturalist and comparative biologist.

Now consider a chilling portrayal, written in 1888, of where this all may lead (H. G. Wells, 1934b). To set the stage, a perplexed Time Traveler from the nineteenth century has met some of the inhabitants of a future world, the Eloi:

I had always anticipated that the people of the year Eight Hundred and Two Thousand odd would be incredibly in front of us in knowledge, art, everything. Then one of them suddenly asked me a question that showed him to be on the intellectual level of one of our five-year-old children. (Wells, 1934b: 18)

These sunloving Eloi were delicate, attractive, excitable, and playful. Indeed, they originally viewed the Time Traveler as just another plaything. Perhaps, the Traveler thought, this change in the human species was a result of its success in taming the forces of nature, for ''in a state of physical balance and security, power, intellectual as well as physical, would be out of place'' (Wells, 1934b: 24) and succeeded by art, eroticism, languor, and decay. Indeed, the artistic impulse had itself almost died away by this time, and the Eloi were reduced to adorning themselves with flowers, dancing, bathing, eating fruit, singing in the sunlight, and ''making love in a half-playful fashion. . . . The too-perfect world of the Upper-worlders had led them to a slow movement of degeneration, to a general dwindling in size, strength, and intelligence'' (Wells, 1934b: 25).

Something was amiss, however. For example, how did the Eloi, who did no work, obtain their clothing? The Time Traveler discovered that a subterranean offshoot of humanity, the Morlocks, were responsible for keeping the Eloi provided with life's necessities. More intelligent than the Eloi, Morlocks were ghostlike creatures with bleached skin and big eyes. Unable to stand light, they were nocturnal carnivores and preyed upon the Eloi. They had their own language. Reproductive isolation was complete.

The Time Traveler realized with horror that the ''Eloi were mere fatted cattle, which the ant-like Morlocks preserved and then preyed upon.'' He tried to empathize with the Morlocks, descended from the working class, but the Eloi retained more of our human form and thus claimed his sympathy, try as he might to see them merely as the well-deserved end of a ''wretched aristocracy in decay'' (Wells, 1934b: 46). ''I understood now what all the beauty of the over-world people covered. Very pleasant was their day, as pleasant as the day of the cattle in the field. . . . And their end was the same'' (Wells, 1934b: 56). By striving for a society marked by comfort, ease, security, and permanency, and seemingly attaining it, the human intellect had committed suicide.

It is a law of nature we overlook, that intellectual versatility is the compensation for change, danger, and trouble. An animal perfectly in harmony with its environment is a perfect mechanism. Nature never appeals to intelligence until habit and instinct are useless. There is no intelligence where there is no change and no need of change. Only those animals partake of intelligence that have to meet a huge variety of needs and dangers. (Wells, 1934b: 57)

In the end, neither the mechanically minded Morlocks nor the effete Eloi could escape change, culminating in the macabre drama the Time Traveler beheld.

Of course, this is mere fantasy written more than a hundred years ago. I have devoted space to this story because it represents a pessimistic view of what play means or where it may lead. The author of *The Time Machine*, H. G. Wells, was enthralled with Darwinism and was an influential popularizer of science as well as an eminent novelist. As he later wrote about his early science fiction novels, he wanted to provide ''a glimpse of the future that ran counter to the placid assumption of that time that Evolution was a pro-human force making things better and better for mankind'' (Wells, 1934a: v).

Accepting Wells's resistance to orthogenesis (the then scientifically popular doctrine that evolution is inevitably progressive), we might well consider that play, like evolution itself, should not be viewed as a vehicle for transmitting our current cultural values. Just as evolution was viewed as benignly progressive at the end of the nineteenth century, play, at the end of the twentieth century, was also viewed as a uniquely positive force by many educators and scholars (e.g., Singer & Singer, 1990). Wells was correct about evolution. Could he have also been correct in viewing excessive play as degenerate behavior? On the other hand, Preyer's view on play in children as the origin of experimentation has been reinvented by an eminent engineer who sees in play the origins of engineering design (Petroski, 2003).

Both Preyer and Wells understood that the roots of human behavior must be sought in changes over evolutionary time and comparisons with other animals. It is unrealistic to think we can truly understand human play without understanding the play of dogs, monkeys, and turtles, although most treatments of human play pay scant attention to the nonhuman animal literature (e.g., Fromberg & Bergen, 1998). Indeed, when the subject is the evolution of human behavior, many scientists and scholars draw back from an objective look at our own behavior (Burghardt, 1985a), seemingly afraid of what they will see. Being themselves human, there are certain myths and rituals they find comforting, myths and rituals that Huizinga (1955) might even see as deriving from play.

Nevertheless, often for political and ideological reasons, science and logic are suddenly found wanting when the evolutionary lens is focused on our own behavior. If the existence of play is thought to be independent of the pruning shears of natural selection, then an evolutionary analysis of play, including human play, may also appear suspect. Nonetheless, many scientists increasingly see an evolutionary approach to virtually all aspects of human behavior as both inevitable and necessary (Barkow, Cosmides, & Tooby, 1992).

Members of the general public are often disturbed by an evolutionary interpretation of human behavior for reasons that are only superficially different from those invoked by intellectuals who hold that only human bodies, not our minds and behavior, have biological origins (e.g., Gaylin, 1990; Lewontin, 1998). The two groups just have different cultural and religious heritages. Chief among these reasons is the presumed need

to have a rigid theological discontinuity between ''the human'' and ''the animal,'' lest human dignity (or the human soul) be degraded. Yet these same individuals will readily recount the exploits, joys, fears, and suffering of their pets and are especially fascinated by play. They apply the most endearing but uncritical anthropomorphism in interpreting animal behavior. They are vigorous, though often selective, in condemnation of animal abuse and neglect. Perhaps some day they will be able to follow the lessons and intuitions from their own experiences and resist, without guilt and fear, scientific ignorance that is too often cloaked in righteousness. The biblical quote that follows is as unambiguous as the first two chapters of the book of Genesis are contradictory, and is compatible with evolutionary attitudes informing modern science, as well as many religious traditions.

> I said in my heart with regard to human beings that God is testing them to show that they are but animals. For the fate of humans and the fate of animals is the same; as one dies, so dies the other. They all have the same breath, and humans have no advantage over the animals; for all is vanity. All go to one place; all are from the dust, and all turn to dust again. (Ecclesiastes 3:18–21, NRSV)

In short, to understand play we need to examine its genesis without preconceptions; to understand play in human beings, we need to study other playful species and test our ideas; to understand animals that play, we need to study those that do not. Genesis is no help. The study of play is indeed a minefield, and one must be resistant to the paradox and the pun!

1.2 Many Meanings

The study of play has gone through periods of faddish enthusiasm and benign neglect (Fagen, 1995; Power, 2000). Serious scholars typically ignore play; the exceptions also find themselves ignored. This is particularly true of the study of play in nonhuman animals. Scientific journals are filled with studies on obviously important behavior patterns of animals: eating, drinking, mating, parenting, and avoiding predators. How do animals learn? How do they communicate? What kinds of behavior are inherited? How are territories and dominance relationships established and maintained? What are the factors influencing whether a species has a mating system characterized by polygamy or monogamy? How do animals recognize relatives? How do they cooperate and help each other? Play behavior itself is either ignored or assumed to be important in an animal's survival and simply cataloged and described along with other behavior patterns.

The problem with play is that we are unclear as to what it is, what it is good for, how it originated, and how it evolved. We are so confused about play in our own species that it is not surprising that most scientists working on animal behavior shy away from

a topic that, as I know from experience, leads to at best amused interest and a shared story about a pet. And in the case of biologists who do not work on behavior, blank stares and brief awkward pauses are more often the norm.

As this book will show, there is much confusion and debate about play in the animal literature. The problem for those wanting to create an ''animal model'' of human play comparable to animal models of learning, obesity, AIDS, or the behavioral effects of environmental toxins and drugs, is that there is even more confusion about the nature of play in our species than in animals. Consider the following contrasting views, all of which have been stated in the literature (Fagen, 1981; Huizinga, 1955; Lorenz, 1981; Mergen, 1982; J. L. Singer, 1991; Sutton-Smith & Kelly-Byrne, 1984; Turner, 1982).

- Play is the process most conducive to improved motor skills, learning ability, imagination, and educational attainments in infancy and childhood.
- Play underlies all creativity and innovation, including art and science produced by adults.
- Play, like idleness, is not only wasted time, but is also a process leading to the neglect of study and work.
- Play is just fooling around; the start of the slippery slope leading to delinquency, gambling, and even crime.
- Play is freedom.
- Play is the happy and enthusiastic participation in life.
- Play is cruel sport, teasing, and competition.
- Play is an essential respite from the solemn cares of life.
- Play is serious behavior in which the arts of war are learned (think of the Duke of Wellington's remark about the Battle of Waterloo being won on the playing fields of Eton).
- Play is encouraged by the powerful in society to distract the masses from their oppression, or more benignly, their lack of control over decisions affecting them.
- Play must be organized and controlled by governments or other adult institutions to control young people and channel them into responsible adulthood.
- Play has been idealized by manufacturers in order to sell expensive toys to nervous parents rather than their children.
- Play behavior has been exploited by manufacturers so they can produce and sell antisocial or gender-stereotyping toys and violent games that appeal to children, but have no socially redeeming value.
- Play is subversive and undermines the state.
- Play is a bourgeois product of industrialization and was so labeled only after work became estranged from everyday activities.
- Play is the source of the rituals and myths by which we structure our lives. All life is but a game or a stage on which we strut during our allotted time.

If these often contradictory assertions are not sufficient cause for scientific despair, other authorities argue, increasingly in these postmodern days, that play is beyond definition and scientific study. By trying to capture play, we lose it. Huizinga states that play should be ''approached historically, not scientifically'' (1955: ix). Hyland holds that play needs a ''reflective'' approach untouched by the concerns of conceptual clarification that mark the ''mathematical sciences'' (1984: xxii). Even if play could be defined, which he doubts, a definition is not ''needful.'' Play lends itself to being viewed as an ineffable mystery or even as intrinsic to spiritual quests. Even animal play researchers have become enmeshed in this net. Fagen (1993) has claimed that the study of play encroaches upon spiritual territory, a region where scientists have to confront their own goals and humanity and are thus threatened. In child development, however, play is definitely considered to be important and it has been endlessly classified and studied (Berk, 1996; Garvey, 1990), although without any consensus on its nature or role (Power, 2000; P. K. Smith, 1996).

In his recent writings, one of the most prolific and seminal writers on play has focused on these ambiguities in how we characterize play (Sutton-Smith, 1997, 2003b). Such confusion poses dilemmas that we need to resolve before going on to talk about what play is, why it exists, and how it has evolved. Sutton-Smith tries to resolve the ambiguities of play by organizing views of play into seven traditions, each with its own rhetoric and associated with different historical traditions, meanings, forms, players, disciplines, and scholars.

- Progress Play is viewed as an adaptation, as progressive, and as essential for learning, for acquiring skills and socialization, and for development of the brain, cognition, and emotion. Associated with evolution and enlightenment-era environmentalism, most biological, psychological, and educational notions about play, and their authors, fall into this camp. Juveniles are the prime players.
- Fate Play is viewed as existential optimism. Play has a dark side associated with animism, divination, magic, chance, chaos, unrealistic expectations, and psychic masochism. Gamblers are the typical players.
- Power Play is viewed as hegemony. Play involves strategy and skill games, with the ends being victory and enhanced status. From play fighting and teasing in children to athletic contests and deep play (play that has serious consequences to one's life or possessions) in adults, the primary players are in politics and warfare. The disciplines of sociology and history focus on this rhetoric.
- Identity Play is viewed in a social context. Play involves symbolic interaction, bonding, communal life, and such rituals as parades, festivals, parties, theatrical performances, political gatherings, and religious services. Its origins lie in anthropology and folklore traditions, with the general public the primary players.
- Imaginary Play is viewed as transformation. In animals, this is reflected in play being fragmentary, exaggerated, reordered, or repetitive. In humans, this rhetoric is man-

ifested in pretense, fantasy, symbolism, creativity, and imagination. Scholars in art and literature emphasize this rhetoric. Its origins lie in romanticism. Actors are typical players.

- Self Play is viewed as a peak experience. Play involves positive emotions and affect, ecstasy, flow, relaxation, and optimism. It involves leisure, as well as solitary activities and extreme games. This is play as individualism. Players are often avant-garde.
- Frivolity Play is viewed as the world turned upside down. Here we find inversions and role reversals (e.g., Mardi Gras). This is the world of nonsense and grotesque realism. It derives from, and contrasts with, the work ethic and is studied by the students of popular culture. Typical players include the trickster, the jester, the comedian, and the fool.

Listing these seven rhetorics of play does not solve any real issues about play, and Sutton-Smith accepts them all as legitimate in their own ways. It is interesting that all seven have some counterpart in animal play. The list, however, does suggest how controversies originating in the use of the word *play* may derive from vastly different phenomena. Once this is recognized, it may be possible to address or put aside the real points of difference, as the case may be. The summary I have offered here does not do Sutton-Smith's sophisticated analysis justice, to be sure. It will also not be the last word on how the ambiguities of play should be formalized. Regardless, classification is a necessary first step in any effective analysis, and this one has brought the diverse uses of play concepts into one barn, if not into the same stalls. The rhetorics have power. Sutton-Smith (personal communication, 2000) has told me how the adherents of the progress rhetoric (which to them is truth, not just a point of view), hijacked a public television series on play on which he was working as a major consultant. They rejected any views or findings that questioned play as an unqualified positive force, or that pointed out the complexities of play.

Play, being a protean concept, lends itself to the diverse meanings encapsulated in the seven rhetorics of human play. There are similar confusions infecting the study of animal play, confusions largely clarified only in the past two decades (e.g., P. Martin, 1984a).

1.3 Animals as Players

With all these conflicting concepts and rhetorics about play, the study of play in animals may seem to be not only a minefield but also a quagmire into which no scientist should want to step. If not blown up, he or she may simply sink out of sight. On the contrary, recent work on animal play has begun to open up the field for an effective scientific analysis (Bekoff & Byers, 1998; Power, 2000). Much work remains, but exciting research, carefully and quantitatively performed, is providing new insights at many

levels of analysis. That is the good news. The bad news is that play is much more diverse than anticipated, and it is hard to know what can be generalized across various kinds of play and even among closely related species (Pellis, 1993).

Our modern understanding of animal play largely results from new information. This includes descriptions of play in little-known species, as well as experimental studies with traditional laboratory animals such as Norway rats, mice, dogs, cats, and several species of monkeys and apes. Combining this information with the wealth of data on human beings, especially children, provides a more holistic view of play in the more playful and well-studied species, and has been admirably accomplished by Power (2000).

What has also greatly aided in the new generation of play research, as well as the reinterpretation of earlier research, is the application of modern ethological approaches to understanding important aspects of animal play. This allows us to pinpoint what we need to know and helps us discriminate between real controversies and those based on the different rhetorics.

1.4 An Ethological Perspective

Ethology can be defined succinctly as *the naturalistic study of behavior from an evolutionary perspective.* Its modern origins lie in the post-Darwinian synthesis of comparative biology, comparative psychology, and natural history (Burghardt, 1985b; Lorenz, 1981). Ethology was responsible for reawakening interest in the study of instinctive behavior in animals (Burghardt, 1973; Tinbergen, 1951). Initially controversial, such instinctive behavior patterns are now a feature of most current animal behavior study, although the term *instinct* is usually avoided. Some of the conceptual accomplishments of ethology as applied to play will be discussed in later chapters. Here a general methodological description will help in evaluating the theories in the next and later chapters.

The first characteristic of ethology is that it begins with describing behavior. Ideally it is an objective, descriptive catalog of behavior patterns of interest, often called the ethogram. Animals are observed either in nature or in captive environments that provide appropriate settings and stimuli. After acquiring some behavioral knowledge of a species and its natural history background, there are five specific classes of questions that can and should be asked about every type of behavior. The first four of these stem from the four aims of ethological analysis as formalized by Niko Tinbergen (1963), the Nobel Prize-winning ethologist. They roughly map onto the classic four causes of Aristotle (efficient, material, final, and formal) (Killeen, 2001).

The first aim is to study what factors *cause* or *control* behavioral performance (e.g., physiological, sensory, ecological, social, and other processes). This is the realm in which most psychological and biomedical research (and research funding) takes place.

Too often the complexity found here leads to scientists getting stuck in this realm. The second aim focuses inquiry on *ontogeny*, the development of the behavior and its underlying mechanisms, in the life of the individual. This is accomplished by not only describing how behavior changes over the life-span, but also by carrying out experiments on the role of environmental events in altering behavioral paths, and the duration and consequences of such interventions (e.g., early experiences, prenatal effects, learning). The third aim is to study the *adaptive value* of performing the behavior in terms of enhancing fitness at some level (e.g., individual, offspring, or group). The term *function* is often used to refer to the third aim, but it may be confused with the study of how the performance of any given behavior enhances or decreases the successful completion of any activity, regardless of whether that behavior is adaptive in an evolutionary sense. (As an extreme but clarifying example, consider a botched versus a successful suicide attempt!) Adaptive function is perhaps the best description. The fourth aim is to inquire into the evolutionary *origins* and *phyletic radiation* of a behavior and the processes by which this is accomplished or limits the study of the other three aims. This fourfold approach covers almost every aspect of behavior that one should know in order to understand it. It has had a continuing influence on current research. For example, Tinbergen's four aims are used as the conceptual framework in a major review of animal communication (Hauser, 1996).

For ethologists and other students of behavior, none of this is new. In the study of play, however, the application of these aims was not well articulated or stressed until the 1980s (P. Martin, 1984a). Once these aims were applied, however, guidance in formulating research questions at different levels was made possible. In terms of play, the four aims can be framed in the following way: What are the internal and external processes leading to performance of playful behavior? What is the ontogenetic path of play and its development in the life of the individual animal? What are the consequences to an animal of performing a given playful behavior or behavioral variant? How did play evolve from nonplay and what has been its evolutionary history?

In this book, the fourth aim is the central one. The main questions are the following:

- Is play just a trash-can concept for a motley set of behavioral phenomena that share superficial characteristics?
- Do all kinds of play share common causal mechanisms deriving from common ancestors?
- What factors led to play becoming prominent in the lives of so many animals, yet absent in so many others?
- Where does playfulness first appear in animal evolution and did it evolve just once or repeatedly?

The answers to these questions are neither simple nor obvious. They cannot be obtained without considering all four of Tinbergen's ethological aims. By the end of the

book, I hope to have provided some answers and helped to inspire the search for better ones.

Notice that the key element of this ethological approach is that the same behavior must be examined from different perspectives. Many current controversies in all areas of behavioral study stem from the view that study of one aim excludes consideration of the others. For example, comparative and experimental psychology developed a strong interest in issues of mechanisms and developmental history, especially learning. Thus they emphasized the first and second aims, often termed proximal causes or factors. Until after the 1960s, most animal psychologists largely ignored what animals actually did in the wild; they also failed to consider the evolutionary history and ecological theater in which behavioral repertoires were shaped. In the 1970s, sociobiologists and behavioral ecologists reacted to the lack of rigorous field studies of behavior and the impact of ''selfish gene'' theory by ignoring ''mere mechanisms,'' as well as development, and asserting through their research that adaptation and natural selection (aim three) were the primary, if not sole, sources of understanding.[1]

For others, evolution in a broader sense was also important, but aims one and two were downplayed (Alcock, 2001). Ethological aims three and four were thus termed the ultimate causes or factors. Although mechanisms and ontogenies are essential in understanding adaptation and evolution (Burghardt, 1997), a generation of graduate students and faculty were taught that these were unnecessary and an integrated ethology was not needed. This attitude unfortunately alienated psychologists and physiologists on the other side of the ''proximal''–''ultimate'' split. The exchange between Alcock and Sherman (1994) and Dewsbury (1994) provides an illuminating glimpse of these issues.

The heavy emphasis on studying behavior from a largely adaptive perspective had baleful consequences for the study of play, since 20 years ago the empirical basis for claims of the adaptive value of any kind of play was virtually nonexistent. Nonetheless, the adaptive value or ''function'' of play was viewed as its most important feature because of the great confidence that behavioral ecologists had in the power of natural selection to modify behavioral phenotypes rapidly in natural conditions.[2]

Consequently, since empirical evidence was lacking, support for the adaptive evolution of play was sought in mathematical modeling that was often divorced from any detailed behavioral knowledge. Fagen's early writings (Fagen, 1974, 1981), created in the early, heady days of sociobiology under the influence of E. O. Wilson (1975), epit-

1. For a recent impassioned statement that aim three trumps all others and that ''causal pluralism'' reflects ''fuzzy thinking,'' see Reeve (2001).

2. There is a striking parallel here with the excessive confidence shown two decades earlier in psychologists' ability to control and predict behavior with conditioning methods and reinforcement schedules.

omized this view: ''Analysis of play using hypothetico-deductive evolutionary theory may offend ethologists and comparative psychologists who prefer data to mathematical models and physiological metaphors to evolutionary logic'' (Fagen, 1981: 480). Despite this rhetoric, mathematical modeling largely failed to provide new insights and research direction (Burghardt, 1984), a judgment that Fagen himself seemed to reach only later (Fagen, 1993). In retrospect, these efforts were premature. We just did not know enough about the details of play to generate any predictions that were both novel and general. As we gain more information on the actual rates, costs, and behavioral details of play, mathematical modeling of play will have a revival.

Today there is a growing realization in both biology and psychology that Tinbergen was indeed correct. We need to approach behavioral problems from a multifocused perspective (Burghardt, 1997). Tinbergen viewed the division of ethology into the four aims as a useful analytical and methodological framework, but information gained by work on each aim needed to be carried out with some understanding of the behavior from the other perspectives and integrated into a complex dialectic. Tinbergen never meant them to stand alone. He merely felt that it was important for students of behavior to stand back and recognize that to understand any behavioral phenomenon, all four classes of questions must be asked.

Why was this seemingly obvious point such a major contribution? The basic approach of understanding phenomena from different perspectives was not original with Tinbergen, of course, even in biology. As noted earlier, Aristotle's four causes captured comparable themes in a preevolutionary context. Nonetheless, researchers and scholars repeatedly failed to recognize such pluralities as they pushed their pet views or favorite approaches. Heated controversies over early theories on play, which are reviewed in the next chapter, occurred in large part because the protagonists confused the aims and how to test ideas about them. For example, it should be apparent from the four aims that a hypothesis on the effects of nutritional levels on the frequency of play can be neither proved nor disproved by showing that play does or does not aid in survival or fitness.

Play was somewhat of an enigma to Tinbergen himself, for he claimed that play has ''subjectivist, anthropomorphic undertones'' and might never be able to be ''satisfactorily defined objectively'' (Tinbergen, 1963: 413). This book takes on both of these challenges (chapter 3).

Tinbergen left out one group of phenomena in his four aims: the emotional, experiential, or phenomenological aspects of behavior. He did so because he was trying to gain the acceptance of ethology in a behavioristic *Zeitgeist* (spirit of the times) in American and British academic psychology and animal behavior (Burghardt, 1985a). When he was writing his creative early work (e.g., Tinbergen, 1951), some schools of animal behavior, especially in Europe, were still highly teleological and vitalistic (Bierens de Haan, 1947). Behavior was a product of purposeful striving and mental causes

that could never be understood through the analysis of an animal's physical features, including the brain. In order to clearly protect ethology from being tainted by such views, one of the most distinctive attributes claimed for play, that it is fun or pleasurable, could not be validly investigated. Why? Because it involved ''subjective'' phenomena that Tinbergen felt were beyond scientific study (Tinbergen, 1951) and opened the door to pure speculation. Behaviorists also avoided such labels, despite accepting expressions such as ''positively reinforcing'' or ''self-rewarding.'' These latter terms described behavior derived from primary drive reducers such as food, water, copulation, or pain avoidance. Any attributions of emotion, consciousness, or awareness to animals were highly suspect.

The denial of subjective factors did not have an immediately detrimental effect on most ethological research and probably was salutary: There was so much basic work to be done in describing and analyzing the myriad behavior patterns and diversity in courtship, predation, and social organization. One outcome, however, was to ensure that play remained a topic largely neglected by researchers who wanted to be considered ''hard'' rather than ''soft'' scientists.

Many persons studying play in animals, as well as in human beings, viewed play as containing a subjective component. Indeed, for many the defining characteristic of play was ''having fun,'' and this is still true today (Spinka, Newberry, & Bekoff, 2001). Since traditional behaviorists and evolutionary biologists think fun is impossible to study in animals, especially ''lower ones'' such as rodents and birds, the basic premise of studying play was thus highly dubious from the start (Burghardt, 2003). I never realized the extent of this bias until I started writing this book and had to deal with skeptical colleagues. Since for many other researchers the essence of play is that observers must be able to recognize and appreciate the phenomenology or experience of play, play research has suffered.

Certainly we must have empirically verifiable data before accepting the statement that a behavior is enjoyable to any animal, but this caveat is as true for our understanding of play in people, including babies and children, as it is for animals. It is also true for the study of emotions in general (Panksepp, 1998a). As we will see in chapter 3, using a subjective component as a criterion for recognizing play, in isolation from other criteria, fails for numerous reasons. Nevertheless, in the study of play, more than any other area, the experience of the playing animal cannot be ignored.

In order to rectify the omission of an animal's ''private experience'' in the study of behavior, I have promoted a fifth aim to supplement Tinbergen's four aims (Burghardt, 1997). The case for doing this is not repeated here, but new methods, including brain imaging, neuroendocrinology, neurochemistry and pharmacology, virtual reality, computer simulations, and molecular genetics have led to a greater need to incorporate such issues into ethology and psychology. Table 1.1 shows each of the five aims with its application to play.

Table 1.1
The five ethological aims as applied to play behavior

Name	Related Terms	Description	Application to Play
Control	Causation, mechanism	Internal and external factors underlying behavioral performance	Do animals play more at high temperatures? Is the neocortex of the brain essential for play?
Adaptive function	Adaptiveness, function, survival value	Contributions of behavior patterns to individual, group, reproductive, and inclusive fitness	Do animals that play fight more in their youth fight better as adults? Do animals that play fight more have more offspring?
Development	Ontogeny	Patterns and processes in behavioral change during individual lifetimes	How does play fighting change in frequency between juvenile and adult stages?
Evolution	Phylogeny, genetic and cultural inheritance	Historical patterns and processes in behavioral change across generations and taxa	Did pretend object play evolve independently in cats and apes?
Private experience	Personal world, phenomenal world, subjective experience, heterophenomenology	Patterns and processes in life as experienced	Is all play accompanied by a few specific emotions or one?

1.5 Applying the Perspective: Horsing Around

People have kept, bred, raised, trained, worked, ridden, raced, and studied horses (*Equus caballus*) for millennia. Horses are surprisingly playful animals and engage in all the major kinds of play.[3] Exaggerated movements involving running, jumping, bucking, and related patterns of behavior performed by horses, alone or in groups, characterize locomotor play. This is particularly prominent in foals (figure 1.1a). Manipulative play with objects is also common (figure 1.1b). Social play is characterized by chasing, nipping, mounting, rearing, striking, circling, and other behavior patterns that can be classified as either play fighting or precocious sexual play (figure 1.2). Thus, a large series of prominent activities involving elements derived from locomotor, grooming, feeding, fighting, and sexual behavior patterns constitute play in horses. If we go through the five aims, the information available or needed for understanding each and how they often overlap or complement each other, can be illustrated. What is apparent is how little we really know.

3. Unless indicated otherwise, the following information on horses is derived from George Waring's book on horse behavior (Waring, 1983).

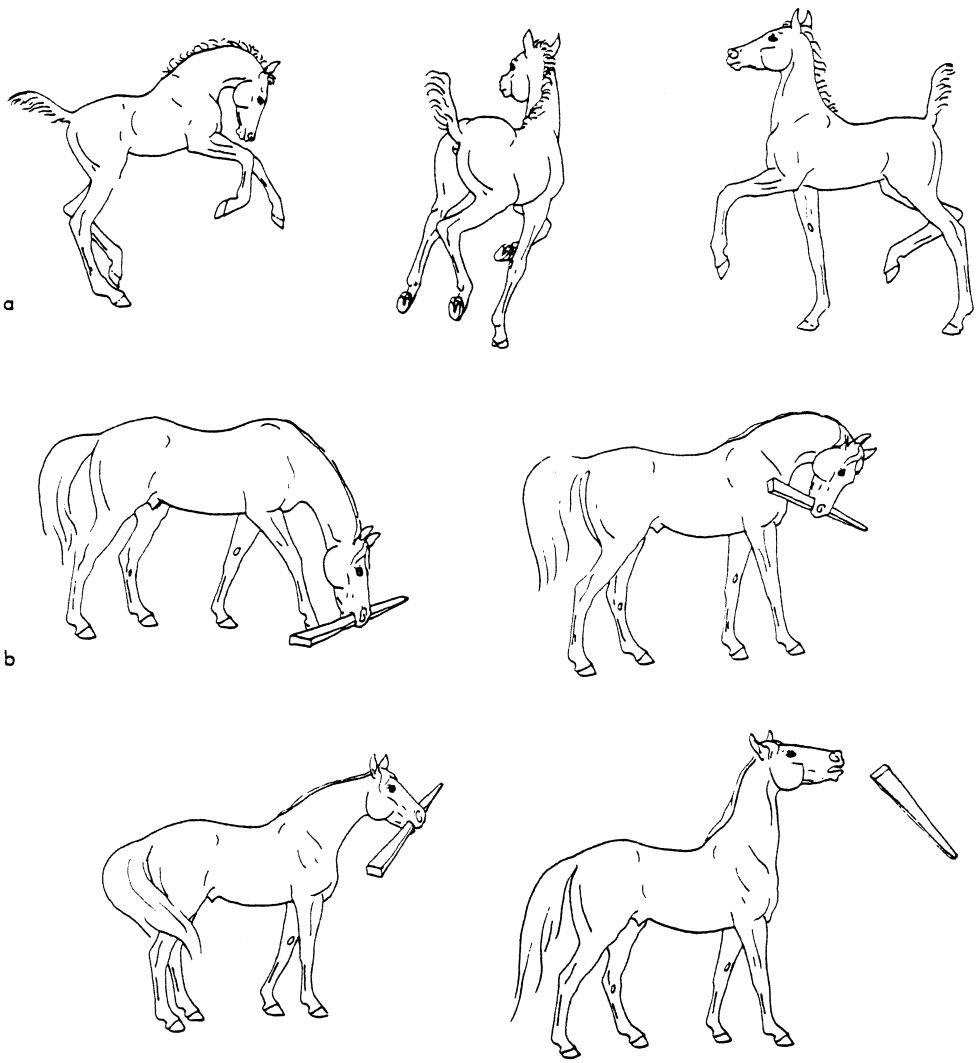

Figure 1.1
Young horses playing. (*a*) Locomotor play. (*b*) Play with objects. (From Waring, 1983)

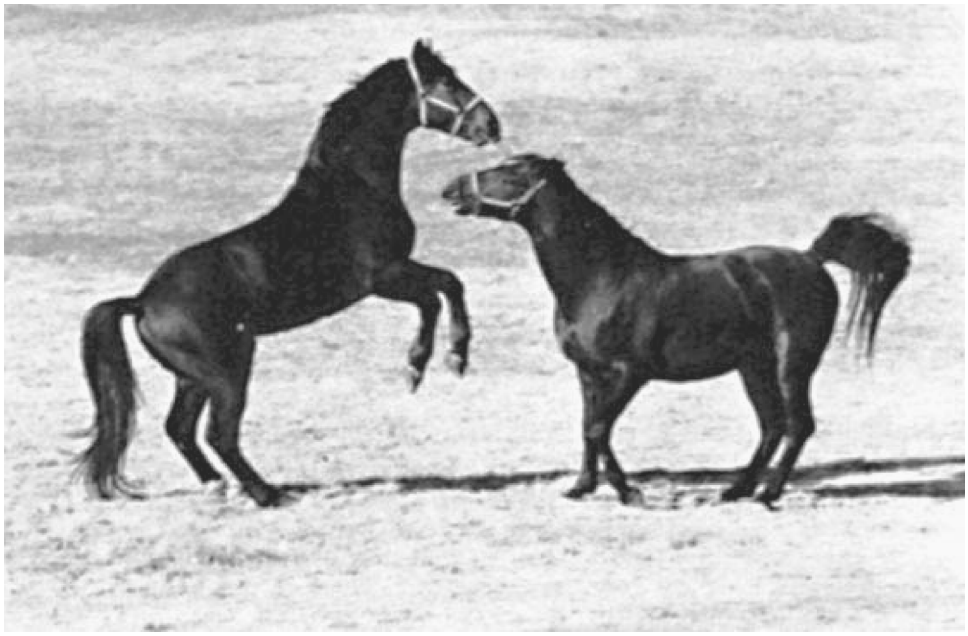

Figure 1.2
Social play in young male horses. (From Waring, 1983)

1.5.1 Aim 1—Control

The amount of information needed to understand this aim is enormous and includes the roles of the senses and motor abilities; the environmental (space, structures, microclimate), temporal, and social contexts; the role of internal mechanisms, including health, physiology, motivation (e.g., arousal), cognition (e.g., prior conditioning), and nutritional condition; and genetic factors. These issues alone warrant a lifetime of work and involve studies at different levels of analysis, from the molecular to the ecological. Needless to say, we have little of this information, even for a domesticated species as well studied as horses. Recent evidence suggests that differences in play among individual foals of the same breed on the same farm have a genetic basis (Wolff & Hausberger, 1994). The presence of other horses and their age and sex influence the kinds and amount of play performed. Approach and other behavior patterns seen in play fighting apparently serve as indicators that the interaction is playful and not serious.

1.5.2 Aim 2—Development

Horses are born with functioning senses and motor abilities. They are thus classified as a precocial species. In fact, foals can be observed playing within 2 hours after birth

(Waring, 1983). Exaggerated galloping play may occur. Play with the mother that involves nipping and biting various parts of the mother's body also takes place the first day. Foals also mouth objects such as hay, twigs, and grass, although they do not eat solid food for some time, not even being able to graze while standing. Changes occur rather quickly. After a few weeks, locomotor play occurs over greater distances and also when the foal is separated from its mother. Social play with the mother declines as other foals are sought out as play partners. However, play with the mother is now more of a mutual rather than a one-sided affair and the foal inhibits its initially rough biting.

After a month, the play behavior of male horses (colts) begins to differ from that of female horses (fillies). Colts play aggressively with each other for long periods. They may also play with yearlings. Generally, however, they pair off and partners do not interact with other colts except when chasing. Sometimes a colt and filly will pair and become play partners, but play fights are less rough than in colt pairs. Filly pairs engage in less social play than colt pairs. Filly pair play is also often characterized by frisky galloping side by side. In addition, play partners also perform quieter affiliative behavior with each other, such as mutual grooming.

Sexual behavior, including mounting and erections, is seen in young colts. Colts mount almost any object, including their own mother. Puberty and dispersal from the maternal band are not seen until the second year, at which time fillies have their first estrus and serious sexual encounters take place. Waring (1983) repeats the suggestion made by Tyler, in an unpublished dissertation on sex differences in behavior, that the more frequent play fighting in colt pairs than in colt-filly or filly-filly pairs is due to the precocious sexual behavior found in colts.

Adult play is rare in horses. Budiansky (1997) quotes observations that Przewalski's horses (an ancient and nearly extinct breed) in a zoo played less than 0.2 percent of the time.

1.5.3 Aim 3—Adaptive Function

The significance of play in horses is little known, which is true of play in all animals (P. Martin & Caro, 1985). How the different play elements function in the performance of play bouts or sequences can be inferred from careful description (Pellis & Pellis, 1998b). We could even try to relate the performance of different behavior patterns to physiological changes in heart rate, arousal, and the brain. Having a play partner may aid in later social competition for mates or harems. Perhaps a horse that plays more will be healthier and live longer. Almost all the vigorous exercise a foal has occurs during play (Fagen & George, 1977). As far as I am aware, there is no unequivocal information on any of these supposed benefits of play in horses except, perhaps, how discrete play elements function in bouts. The methods that need to be used to rigorously establish the adaptive value of play are systematically discussed in chapter 5.

1.5.4 Aim 4—Evolution

Horses are members of the mammalian order Perissodactyla, which includes close relatives such as zebras and asses, as well as the more distantly related tapirs and rhinoceroses. Play throughout the order appears rather similar in both the kinds observed and their developmental pacing (Fagen, 1981). This suggests that play in this order is a plesiomorphic (ancient universal) trait that shows only minor variation across species. However, detailed comparative observational studies are not available, so at this point little more can be said about the evolution of horse play, or even how it differs from play in other orders of mammals. Budiansky (1997) states that horse breeds that are more foal-like in appearance (such as having proportionately longer legs) seem more juvenile in behavior than Przewalski's horse and ponies, and thus may play more as adults. We also need to know more about the source of play behaviors in their ''serious'' counterparts and the possible links among play elements and their quantitative expression.

1.5.5 Aim 5—Private Experience

Play in horses is often described as exuberant, spontaneous, and intense. Appropriate partners and environments facilitating play are sought out by the animals. Beyond this, it may seem difficult to infer anything useful about what play means to the playing horse. Waring (1983), however, does provide a detailed description of lip, head, eye, nostril, and ear movements that, along with sounds, indicate ''sensual pleasure.'' These are most often observed when the horse is groomed, scratched, or rubbed by others or by itself. Measurements of pleasurable states during play have not yet been carried out. However, heart rate, which is a measure of emotional and temperament variability, has been measured in young horses in response to presentation of a novel object (an open blue umbrella) suddenly lowered into an arena. The horses were allowed to investigate it (Visser et al., 2002). Not only did their heart rate increase when they were confronted with the novel stimulus, but variabilty in the heart rate declined, which is often found when an animal's attention is focused. Heart rate changes were consistent over time and differed among horses, with those deemed more ''emotional'' showing higher heart rates. Studying heart rate changes during free play sessions might be useful in assessing the experience of horses when they play.

As with humans, many animals can be described as shy or bold (Wilson et al., 1994). Human personality, it is generally agreed today, can be described by five factors generally labelled Neurotocism, conscientiousness, extraversion, openness to experience, and agreeableness. These personality characteristics are now being applied to other animals with considerable success, horses in particular. Positive scores on the last three factors may be associated with playfulness. In a careful study, nine stable workers independently evaluated ten horses using questions derived from human personality tests and achieved remarkable agreement on all five factors (Morris, Gale, & Duffy,

2002). Thus, although horses cannot fill out their own questionnaires, they, like us, can be reliably judged by those that know them.

There is clearly much that is not known about the play of horses; the kinds of information needed to address the ethological aims are diverse and extensive. All five ethological aims need to be kept conceptually distinct when examining early, but still useful, ideas about play in the next chapter, and when the defining characteristics of play are derived in chapter 3. Indeed, I have cheated a bit here. Why, a skeptic might wonder, should any of this horseplay be called play?