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# Play and Exploration in Animals – A Comparative Analysis

*Exploratory behavior and play are very often discussed together. However, despite many similarities they are two distinct forms of behavior. They have different evolutionary histories and they develop in different ways. Both forms of behavior play a crucial role in the development of sophisticated and complex psyche. The paper discusses similarities and differences between exploration and play. The hypothesis of the joint development of exploration, play and animal intelligence is proposed.*

***Keywords:*** *Play, exploratory behavior, curiosity, adaptive function, animal behavior, comparative psychology*

## Play and Exploration in Animals

It is by no means easy to make a clear distinction between animal behaviors that are classified as exploratory, and those that fall into the category of play. These two forms of behavior often alternate, and sometimes one inhibits the other. Classic books on animal behavior discuss exploration and play together (Marler and Hamilton, 1966). Still, despite obvious similarities, it seems unlikely that they are one and the same. There are reasons, therefore, to look closer at the similarities and differences between those two cognitive processes and social activities, both of which are of key importance from the evolutionary standpoint.

## Common characteristics of play and exploration

Both play and exploration are forms of behavior that elude simple classification. There are several reasons for that fact.

1. One is that they **occur irregularly**. This is why, in the traditional ethology of K. Lorenz and N. Tinbergen (Lorenz 1982, Tinbergen 1951), play and exploration were hardly within the scope of their description of behavior. What the ethologists were looking for was cyclicality and recurring patterns of behavior. Repeatability of a behavior and its cyclical occurrence over time allowed them to determine its biological function and mechanisms. Animals, however, tend to explore their environment and engage in play on a highly irregular basis. It would be difficult to outline a regular schedule of these behaviors.

2. Another common characteristic is the **multiplicity of locomotor behaviors involved in play and exploration.** When playing, animals perform activities typical for other behavioral categories. It could be a sequence of hunting behaviors, fighting, biting, chasing, initial stages of sexual behavior or manipulation of objects (toys), e.g. a piece of wood – all done as a part of play. Hence play is definitely not a behavioral category that can be distinguished on the basis of characteristic motor patterns. There are, however, certain features of these patterns that enable animals to recognize their interaction as play, rather than, for example, an attack. One such feature is the incompleteness of performed sequences, i.e. stopping and resuming them in an atypical rhythm and place in the chain of actions. Another element helping to determine that a given behavior is play-related is its exaggeration compared to the same activity performed in a biologically relevant context. The same is true of exploratory behaviors. They are often composed of motor elements belonging to other modes of behavior. For example, an animal investigates an object by biting and licking, which is typical for the feeding behavior. It can also carry an object in a way similar to carrying its young or keep at a distance from the object, as it would in the case of a high-ranked member of its group. Some animals develop specific signals to inform their partners that their next action will be playful in nature (Knutson, Burgdorf, & Panksepp, 1998).

3. The element that makes play and exploration similar is that they are **triggered by a great variety of**

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**stimuli**. According to ethological theory of behavior, the key factor is the presence of stimuli specific for a given sequence of behaviors. It was that precision of the stimulus-behavior description that brought so much significant data on regulation of feeding, mating, and hunting behaviors. Such specific stimuli cannot be determined in the case of play and exploration. The two form of behaviour can be triggered by the presence of an object or playmate. Moreover, animals initiate play and exploration in response to a lack of stimuli (boredom).

4. **The ease with which play and exploration are interrupted by external stimuli.** Anyone observing animals at play is familiar with this phenomenon: play or exploration is halted abruptly by stimuli of varied strength and content, sometimes completely insignificant. It is easy to make the mistake of ascribing low rank to the instincts of inquisitiveness and play, since so many, and often so weak distractors are capable of interrupting these types of activity. However, field studies on animals playing and exploring in energetically restrictive conditions, as well as studies on deprivation of these behaviors demonstrate the key importance of experiences gathered by animals through these activities.

5. **The adaptive value of play and exploration** is another problematic issue in the functional analysis of these behaviors. There is no doubt that, although very energy-consuming, they rarely result in providing the animal with new energy resources[1]. Their direct costs are quite significant. Besides expending energy, animals risk encountering a predator. To say that in the short-term perspective the costs clearly outweigh potential benefits would be to state the obvious. Furthermore, the alleged benefits are difficult to pinpoint (Lancy, 1980; Pisula, 2003). There are numerous hypotheses about the benefits an animal gains from playing. One of them relates play to improving locomotor skills. R. Fagen (1981), one of the most experienced researchers in the field, noted that it is closely connected with "underdefined" environment and equally underspecified behavior. This hypothesis was recently developed towards the definition of play as training for an unexpected social or physical event (Spinka, Newberry & Bekoff, 2001). The adaptive role of exploratory behavior is related to gathering information about the environment, even if such information has no adaptive value in the immediate future. Its significance may emerge later, e.g. when the animal is faced with new circumstances, such as the appearance of a predator on the previously explored territory. K. Lorenz (1982) presented this concept in his discussion of knowledge gathered in the course of exploration and stored away for later use. This idea was confirmed by the research of M. Renner (1988). Apparently, the element common to both types of activity is the mechanism of uncertainty reduction. The hypothesis of the central role of this mechanism in behavior regulation was convincingly presented by I. Inglis (2000).

[1] We must make a clear distinction between search behavior oriented at finding food from exploration proper, which is not directed towards a specific object, but at stimulation and information about all aspects of the environment.

## The relationship between play and exploration, and their development

The co-occurrence of play and exploration may be analyzed on three levels: from the point of view of individual differences, and from the onto- and phylogenetic perspective.

So far, the relationship between play and exploration has not been particularly well documented. The correlation of these two forms of activity in terms of individual differences is confirmed indirectly, e.g. by results obtained in studies on the need for stimulation. So far, the only empirical study addressing the matter directly (Pisula, Gonzalez Szwacka and Rojek, 2003) provided data suggesting a positive correlation between the frequency of play in young rats and the intensity of exploration in mature animals. And even though informal observations clearly indicate the presence of a strong correlation between the frequency of play and exploration, this relationship still has not been adequately documented and further research is required.

The ontogenesis of play and that of exploration are only partially analogous. A characteristic stage in the development of mammals is a marked increase in the intensity of play and exploration just before weaning, peaking in the prepubescent period (Fig. 1). On the other hand, the characteristic decrease in the intensity of play in adulthood is absent in animals with a high Encephalization Quotient (*EQ*) and highly sophisticated psyche (Fig. 2). Maintaining a high intensity of both forms of behavior may be considered a predicator for the presence of complex cognitive processes and social behaviors in a given species.

## The basic differences between play and exploration

A comparative analysis of play and exploration in taxons of different levels clearly demonstrates differences in terms of these forms of behavior. Phylogenetically, exploration is one of the oldest forms of behavior, on a par with feeding and defensive behaviors. This is reflected in a passage from S.J. Holmes (1905, p. 108): "…The lives of most insects, crustaceans, worms… show an amount of exploration that in many cases exceeds that made by any higher animals." Thus, exploratory behavior is an integral part of animals' behavioral repertoire, from the

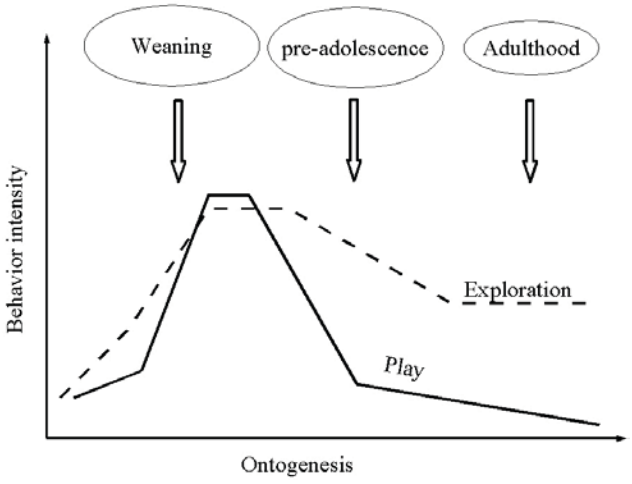


Figure 1. General diagram of exploration and play development in a typical mammal (e.g. a rat). Solid line – play; broken line – exploration.

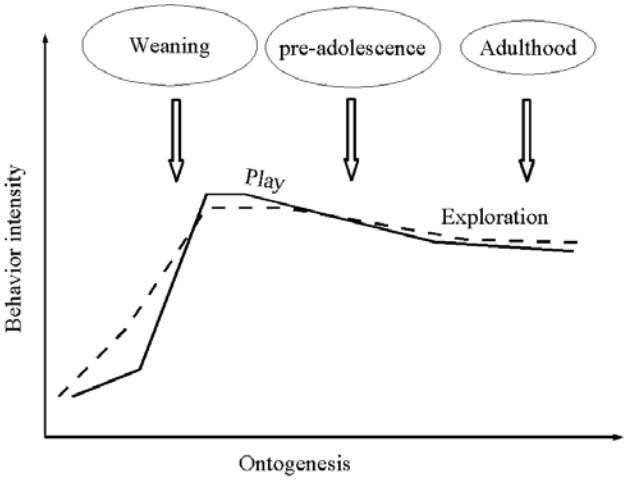


Figure 2. General diagram of exploration and play development in mammals with highly complex and sophisticated psychic processes (e.g. dolphins or chimpanzees). Solid line – play; broken line – exploration.

simplest organisms to the most sophisticated mammals. The evolutionary development of exploration is manifested in the increasing complexity of behavioral forms and sophistication of regulatory mechanisms, rather than in its increased intensity (cf. Pisula, 1998, 2001, 2003, 2004).

The same is not true of play. The pioneer of systematic research on play, R. Fagen (1981), concluded (or rather confirmed the conclusions of Darwin) that play is present only in a handful of species, mostly mammalian, and out of this group – predominantly in carnivores, elephants, primates, and cetaceans. Among birds, he found play in corvids and parrots. From a comparative analysis of mammals, it is possible to deduce a positive correlation between the intensity of play and the Encephalization Quotient (Iwaniuk, Nelson, and Pellis, 2001). Although neither clear-cut nor present within individual orders, this relationship is evident from the between-order analysis. We can say with certainty that play is directly related to the development of cerebral cortex resources that make up the so-called "association cortex" (Turlejski, 1997). This type of cortex is particularly prominent in previously mentioned orders of mammals. In their detailed analysis of the relationship between cerebral development and play, S. Pellis and A. Iwaniuk (2003) introduce the concept of levels of behavior control. They argue convincingly that animals with larger brains are capable of activating a greater number of various behavior control mechanisms. Growing complexity of a control system means that more effort is required for its integration. Play could be one of the ways to create interrelationships between different levels of behavior control. There is also no doubt that animals that play are typically highly intelligent. It should be noted here that the simple view of the animal kingdom which made Fagen, limits the phenomenon of play to higher mammals and birds is currently undergoing revision. As it turns out, other vertebrates also engage in play (Kramer and Burghardt, 1998). We should mention, though, that the species described by Kramer and Burghardt (emydid turtles) lives in large groups, and as such faces the adaptive task of developing social skills. There is some initial data on play in some invertebrates (Mather and Anderson, 1999). Undoubtedly, the number of animal species in which play remains an important component of behavior in maturity is relatively small, and includes mostly animals with a high Encephalization Quotient (Iwaniuk, Nelson and Pellis, 2001).

We are left with the last, and probably the most difficult issue in the comparative analysis of play and exploration: the motivational mechanism. There is a plethora of theories aiming to explain the motivation behind exploration (cf. Pisula 2003). It seems, however, that there is some overlap between various theoretical concepts. While we cannot rule out the possibility that receiving stimulation and information produces a certain type of pleasure (for higher organisms), we must note that the dominant role is played by uncertainty reduction. This uncertainty, regardless of theoretical approach, is invariably related to the aversive motivational state. Play, on the other hand, is governed by hedonistic mechanisms (Bekoff, 2004), which are phylogenetically more recent and which regulate the behavior of a smaller number of animals.

## Concluding remarks

Both play and exploration are forms of animal behavior directly linked with cognitive and social functioning. Therefore, anything we learn about their evolution and regulation in animals adds to our knowledge of cognitive processes in humans. We know that although play and exploration are often mentioned together and discussed in the same chapters of animal behavior manuals, they are two different forms of behavior. They have divergent

evolutionary histories, and are driven by different motivational mechanisms. They also differ in terms of their ontogenetic development. We know, however, that their co-occurrence plays a key role in the development of sophisticated forms of psyche, and more directly, intelligence.

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