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B. PLAY

Ritualization in ontogeny: I. Animal play

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In an evolutionary context the meaning of the term 'ritualization' is crystal clear. For, as we have already heard in this Symposium, there is abundant evidence that, in the course of evolution, intention movements, displacement activities, etc., have been developed, modified or schematized to serve as social signals or 'releasers' for appropriate behaviour in fellow members of the species.

The meaning of ritualization is also clear in human life. Here ritual is an act often repeated, especially in a ceremonial way, which represents, stands for, or *symbolizes* some ideas, emotions or events. The ritual acts of religion are the ideal examples where every act of a complex rite symbolizes to the participant, some significant facet of doctrine or dogma. Through the ages the acts themselves have often become simplified and stereotyped, have been reduced to a minimum, so as to mime the original idea in the simplest possible manner, often with the utmost economy of gesture.

When we come to consider ritualization in the life of the individual animal we are somewhere between these two extremes and, in fact, encounter great difficulties of definition and interpretation. Obviously one *could* use the term ritualization so widely as to include all habit formation—but that would include almost the whole of comparative psychology and make nonsense of the Symposium. I consider that the most important idea to stress when discussing ritualization in animal ontogeny, is that of a 'symbol'. Thus ritualization becomes 'an action acquired, or modified, in the course of individual experience so as to be able to serve as a signal expressing symbolically, to individuals of the same or other species, a course of behaviour or an intention'.

Today, I am simply going to discuss very briefly the most clear-cut case of ritualization as it develops in the life of the individual animal—namely in 'animal play'. It is regrettable that Dr Monica Holzapfel could not have spoken to us on this subject. I shall refer extensively to her work.

Play in human beings is something which is done lightly and gaily, freely, not in earnest but with a sense of fun, providing recreation and amusement. (Obviously this definition excludes much present-day professional 'sport'.) But has all or, indeed, any animal play such a connotation? And can we recognize it if it has? Is there, in fact, any *objective* way of recognizing play. We shall see that there are characteristics which, taken together and interpreted with reasonable caution, do give us strong grounds for believing that in the higher animals much play is psychologically similar to the play of human children.

Where, then, can we find play-like behaviour in the animal kingdom? I do not think we can reasonably use the term of any invertebrate behaviour that I know. 'Play-like'

behaviour can often be seen in fishes particularly in the low intensity stages of nest building as in the Stickleback (*Gasterosteus aculeatus*) (Van Iersel 1953), but there seems a good reason for thinking that many examples of this kind represent only the simplest transference activity and are not to be equated (with any confidence) with anything that we would call play in the human species. There are, in fact, a few observations which suggest that something more nearly resembling such play can be found in fish; but I think they are at present too doubtful and casual to warrant discussion of the subject. Coming to reptiles, there is one well authenticated instance of *play-like* behaviour (Hill 1946) concerning a Komodo Dragon (*Varanus komodoensis*) in the London Zoo which regularly pushed a shovel about over the stones as if to make as much noise as possible. But here again, it seems likely that the action was simply a transference of an instinctive act (probably related to sex or territorial defence) from its normal objective. Once we come to the birds and mammals however, play is so obvious and widespread, both in the young and in the adult that I venture to doubt whether there is a single species in either of these vast groups where some traces of play behaviour could not be found if carefully searched for. I think the provisional assumption must be that it is universal.

How are we to recognize play when we see it? The different types of conditioning, especially as combined in trial and error learning, provide a means throughout all vertebrate animals and many others besides, of aquiring skills. And if, indeed, practice makes perfect we should expect something like play to have a large part in the life of the animal when it is developing and perfecting its motor habits. Groos (1898) regarded all incomplete reactions as play and described the biological value of them as practice. But the evidence for this as a comprehensive theory is very weak, and obviously neglects some important considerations. For if the behaviour that we see appears to consist solely of stereotyped components of instinctive behaviour patterns coming out at the time of life when they are due to mature, it is doubtful if we are justified in regarding this as play. It is characteristic of the initial maturation of instinctive behaviour patterns that the more stereotyped components or consummatory acts, at or near the end of a chain of instinctive behaviour elements, tend to appear before the introductory elements which constitute the appetitive behaviour. This often results in these acts appearing in isolation—apparently unrelated to the normal stimulus—in fact appearing as vacuum activities. They may appear incomplete (or if complete, disoriented) because the performance of the full pattern is not yet physiologically possible to the animal. Such uncoordinated or disordered appearance of behaviour patterns may well be of value in achieving fine adjustment and perfection by practice, but it is hardly what we can mean by play (Thorpe 1963). Characteristics of play and play-like behaviour together, can be listed as follows:

(1) Play may include (*a*) innate patterns of behaviour, (*b*) acquired patterns of behaviour, and (*c*) elaborate combinations of the two.

(2) Play is not directed towards a specific consummatory situation. This is to say, it does not succeed in arriving at a specific biological goal, and for this reason, amongst others, often strikes us as 'not in earnest'. It appears in fact, to be performed for its own sake or, to put it another way, to be 'its own consummatory act'.

(3) Play behaviour and vacuum activity both give the impression of being incomplete; but the latter arises from high intensity drive as if internal factors force it, so to speak, to

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burst out; it seems 'one-track minded' whereas the former is strongly affected by the immediate environment and by there being 'things to play with'—again giving the impression of not being in earnest (Holzapfel 1956*a*).

(4) Play may have its own appetitive behaviour which seldom appears as stereotyped and as characteristic of the species as does the appetitive behaviour in the normal 'instinct'.

(5) Play is often related to an object, a 'play-thing', which is not one of the normal objects of serious behaviour. These objects may include the body as a whole, or its parts.

(6) Play has often a strong social component and consists of actions performed with a partner or partners; usually, but not always, of the same species.

(7) Play is often repeated, sometimes appearing quite indefatigable—much more so than the instinctive acts upon which it may be based (Holzapfel 1956*b*). Instinctive systems of behaviour involved in the play of higher animals are most usually (*a*) prey catching, (*b*) fighting and territory, (*c*) sex and reproduction, and (*d*) exploration.

Much highly organized play appears very close to exploratory behaviour. Where we get play combining innate and acquired patterns of behaviour the innate patterns appear to be due to an instinct specific drive of low-level and to a general non-specific activity, of the kind which appears to underlie so much general exploratory behaviour. Indeed, Holzapfel suggested that when we have such a general drive contributing to play behaviour we can recognize it by the lack of preference for any instinctive actions over learned ones. By determining the relative proportions of these two, we can arrive at a fairly good estimate as to how far a general drive is involved. Nissen (1954) points out that with a highly social animal such as a Chimpanzee (*Pan satyrus*), the more heterogeneous or varigated is an object the more attention it gets from the animal. (See also Welker 1956*a*, *b*.)

It will be obvious from what has been said that the most striking feature of play in the true sense, whether in animals or men, is the extent to which the behaviour is divorced from the serious business of life; in animals it is free from the restriction imposed by the necessity of obtaining a specific goal. Where the greatest freedom is manifest entirely new behaviour patterns will tend to be developed and, therefore, it is here that real individual ritualization is most likely to be shown. So in what follows I shall confine myself to discussing one or two of these more advanced cases. For obvious reasons most of the careful work that has been accomplished on the subject has dealt with animals in captivity. From this it has sometimes been assumed that play is particularly evident in captive animals simply because they are living an easy and rather restricted life where their daily physiological wants are satisfied and they are in fact 'bored'. Having nothing to do, they therefore play. In fact, the evidence does not, I think, support this conclusion in general. True, both young and adult captive mammals, such as chimpanzees, polar bears, otters and foxes, play compulsively in captivity; but observations in the wild, where they have been made, suggest that the same is true in nature whenever opportunity offers. Miss Jane Goodall (personal communication) gives it as her strong impression that young chimpanzees in the wild play quite as much as they do when in zoos, and that the play of adults in the wild is much more prevalent than it is in captivity. The same picture seems to emerge from the observations of Crisler (1959) and others on Wolves (*Canis lupus*). While, therefore, it is desirable, where possible, to refer to play of wild animals rather than captive

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ones, there is no reason to think we go very far wrong in basing our conclusions on studies of captives, in particular on studies of tame animals leading a fairly full life.

It is characteristic of the social play of animals that there is usually an introductory phase of appetitive behaviour which provides a stimulus or an invitation to other members of the species to take part. In this introductory behaviour we may notice a feature which is characteristic of animals learning a new action or co-ordination of actions, and which leads particularly to a process of ritualization. That is, the behaviour tends to become reduced to its simplest components by waning or dropping out of elements—according to the principle designated by physiologists (since Cannon 1929) as 'homeostasis'. Such a process can be observed in the standard instrumental learning or motor learning (trial and error situation) when the animal is in the process of acquiring the required action of bar-pressing or whatever else it may be. Thus a rat being trained to bar-press on a full reinforcement schedule in a Skinner box may start out by pressing the bar with unnecessary force or with careless, wasteful or ill-controlled actions. But as the training proceeds the actions become more and more skilled and economical so that it comes to use no more than the minimum requirements of strength or activity in securing the rewards. That is, it simplifies and stereotypes actions as far as is possible consistent with success. The most easily measurable aspect of this is that the actions tend to decrease in variability as the learning proceeds. When we consider the vast literature on behaviour of rats and other animals in Skinner boxes, there seem remarkably few studies which document this kind of behaviour change at all adequately. Yet it is an instance of what, in the nineteen-thirties, was known amongst psychologists as the 'Law of Least Action' (Wheeler 1929) or the 'Principle of Least Effort' (Tolman 1932). These 'laws' emphasized an important aspect of behaviour which has been neglected by psychologists of late, to the extent that they are almost completely ignored in modern text-books. Perhaps the somewhat inflated wording in which they were set forth led to over-optimistic expectations as to their value for exact prediction, which then, rather naturally, turned to disillusionment. Nevertheless, the present neglect of the matter by psychologists is hardly justifiable and it is interesting that, at last, more precise analysis of some instances of the 'laws' as they apply to the co-ordination of actions is being carried out. But as yet no coherent picture emerges from such papers as there are. I think the discrepancies can, however, be explained as due to differences at different stages of the process of learning, differences in methods and experimental conditions and also the probable effects of over-training. Thorndike (1898, 1911), in his classic work on the learning of cats and kittens to escape from puzzle boxes, found a remarkable tendency to ritualize meaningless responses, such as scratching or licking, to get out of a puzzle box. This is, of course, the very opposite of the process we are considering since the action does not improve; on the contrary quite irrelevant actions continue apparently indefinitely. However, this could well be explained by the state of the subjects of Thorndike's experiments—captive cats or kittens in a state of 'utter hunger' so that they were desperately anxious to reach the food outside. The structure of the box was such that there was no possibility of the animal seeing any relation between the movement of the lever and the opening of the door. In its wild scratching, and scrabbling around, the cat would sooner or later, accidentally touch the lever and so escape to the food. The hunger-drive was so strong, and was maintained at high strength

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under subsequent trials, that the cat tended to continue exactly on future occasions, whatever movements it happened to have been engaged in just before the first opening of the door. A rather similar situation is described by Gilhousen (1931) when he found that rats which had been trained to execute a difficult jumping response in order to get food, continued this even when an easier route was provided. Here, it seems that perhaps overtraining was the explanation; or it may even have been that the very difficulty of the response required so much practice that when perfected it was hard to eradicate. In the ordinary Skinner box experiment with rats such effects can doubtless be duplicated; but if the rat, as it usually is, is in a normal partial state of food deprivation it is found (Antonitis 1951) that variability does decrease during acquisition of a performance and increases again during extinction. However, to set against this there are the recent findings of Carlton (1962) who records that large rewards and high motivation both decrease variability, whereas judging from the results of Antonitis and of Thorndike and Gilhousen, we might have expected the reverse. Herrnstein (1961), studying the pecking response in pigeons, found a greater decrease under partial reinforcement than under continuous reinforcement. It is difficult in this case to relate the conditions of experiments sufficiently exactly with those in the rat studies to be able to offer any plausible explanation of the differences.

Actions are sometimes learnt as a result of a single trial when the motivation or the reward is at very high intensity. This is known to experimental psychologists as 'one trial learning' and the results where the actions are very highly stereotyped indeed, are sometimes known to such workers as 'superstitious behaviour'. This is of course a misnomer, because the facts do not justify in any sense the implication that the animal is experiencing a mental state such as we experience when we act in a superstitious manner. However, there is one famous case described by Konrad Lorenz (1961) where a pet goose having accidently acquired such superstitious behaviour, gradually reduced it over a period of daily experience for nearly a year by homeostatic waning. Then once, under great stress, it omitted the 'ritual' which it was still performing in embryo on its way upstairs to the place where it spent the night. It then suddenly stopped, *retraced its steps*, performed the ritual, now in its highly reduced state, after having shown signs of sudden and great alarm and then, the ritual over, the goose became calm again and proceeded normally to its roosting place. This really does look like superstitious behaviour because of the alarm created, apparently, by having forgotten to perform the action and by the subsequent pacification caused by the retrieval of the situation before it was 'too late'. But as far as I know, this is the sole example of an animal action which plausibly suggests superstition.

Although, as far as I am aware, homeostatic waning and ritualization have not been specifically studied in the case of animal play, it is very obvious to any observer used to watching social interactions of tame animals, whether with members of their own species or with their human associates. Thus, one of my own dogs solicits fondling and scratching by licking the hand. The fondling wanes, she licks again; but over a long period the intensity of the lick has waned until it is just, and only just, sufficient to maintain the attention she requires. The lick has, so to speak, become a ritualized or token lick, the significance of which is perfectly understood.

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Rather surprisingly the play of both young and adult birds illustrates very well both the high development of social play which can occur and also ritualized routines of playing with moveable objects, particularly those objects which can be thrown up into the air and caught again. A year-old Greenland Raven (*Corvus corax principalis*), studied in the Zoological Gardens in Copenhagen, quickly learned to throw pebbles, snail shells and a rubber ball vertically in the air, catching them again with great dexterity. It would often lie down on its back and shift its playthings from the beak to the claw and back again. It also developed play association with a dog, and it appears from the account that ritualized gestures and intention movements of the two animals must have been in some degree understood by each. Thus they had a game of catch in which they would run round a tree so that the animals chased each other by turns (Højgaard 1954). Games of catch of this kind are very common in social animals and generally seem to involve some ritualistic behaviour which is interpreted as a signal by the players. Thus wild chimpanzees (J. M. Goodall, personal communication) particularly young animals, will engage in very persistent games, just as children do, of chasing each other round trees and then suddenly reversing direction so that the chaser becomes the chased.

The way in which the play of young birds with moveable objects can provide a signal for other associates to do the same is well illustrated by the work of Sauer (1956) in which he hand-reared twelve young Garden Warblers (*Sylvia borin*)—taken as young nestlings. These young birds, like so many others, picked up small stones and treated them as substitutes for prey, dropping them and catching them again. As soon, however, as a stone was accidently dropped into a glass dish making a ringing sound, all the birds showed great interest and from that moment began deliberately to drop stones into the dish. Play in domestic cattle has been well studied—it may occur throughout their life but is commoner in the young than in the adult (Brownlee 1954). The play of zoo animals with toys, especially with balls, is very well documented and has been intensively studied by Inhelder (1955). Many of these games obviously treat the moveable object as a substitute for another member of the species, but in addition to this there is an enormous amount of elaborate stereotyped play which must involve innate movements and learnt ones in elaborate co-ordination. Perhaps the most remarkable of all, certainly the most bizarre, is the complex, play of a 6½-year male Indian Rhinoceros (*Rhinoceros unicornis*) which Inhelder describes. This animal would play with a ball for about 50 minutes at a time. There was a definite introductory phase after which play reached a maximum intensity, and it was only during the period of maximum intensity that certain movements, such as those by which the ball was thrown high in the air, were performed at all. During the course of months the climax movements gradually tended to occur earlier in the bouts. One point that comes very clearly out of Inhelder's work is the stereotyped nature of many of the games and the preference which so many animals exhibit for new toys rather than old ones. It almost seems as if they like to work out new games once the old ones have become highly stereotyped. And with the rhinoceros the new movements made up a higher proportion of the total activities than the old.

The 'king-of-the-castle' games of young lambs must be familiar to everybody. Here again there is obviously some ritualization which is understood as an invitation to play and which assists in controlling its subsequent course. Red Deer (*Cervus elaphus*) display

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very similar behaviour (Darling 1937) and buffalo (Geist 1963) have a tendency to play similar social games. The Moose (*Alces alces andersoni*) does not apparently have running games, but does provide the second known example amongst ungulates of play with objects. A wild bull has been seen playing in a beaver pool with a peeled stick 2 feet long, pushing it under water, picking it up then dropping it again. Moose appear to be particularly fond of water games (Geist 1963). The behaviour of the semi-wild cattle of the Camargue has been carefully studied by Schloeth (1961) and a good deal of play with moveable objects has been found. Wild sea lions have elaborate games with play objects both in the surf and in the open sea (Eibl-Eibesfeldt 1955). Adult females join in these games but not bulls in charge of a territory. However, bachelor bulls indulge in solitary play with solid objects. All these observations help to explain the expertise of sea lions when trained in circuses.

The extent to which wild animals will play with other species is surprising. Baboons, both young and adult, have games of tag in which they catch at each others tails, etc. Half-grown bushbuck have been seen trying to join in; in one case this was at first ignored, but then the small buck lowered its head and a young baboon grabbed the back of its neck whereupon the bushbuck pranced about, apparently with delight. Similarly, young baboons have been seen jumping on the back of young impala who show no resentment whatever. (Grzimek, B. & Grzimek, M. 1960). Here again, there must be some intra-specific 'understanding' of the play-mood and the signals or gestures which go with it. It is remarkable that this should occur between animals as widely separated as primate and ungulate. Much careful observation upon a pet African Civet Cat (*Viverra civetta*) and a pet lion cub by Hubbard (1963) reveals much human-like behaviour. It seems that the affection of the civet for its human companion was non-sexual. The lion cub, like the famous 'Elsa' of Mrs Joy Adamson, showed extraordinary forbearance with its human playmates as if realizing the dangers of its own strength. In one case the young lion was actually found protecting a human child from its angry parent enraged to spanking point. The development of play behaviour in socially-living Rhesus monkeys (*Macaca mulatta*) has been carefully followed by Hinde, Rowell & Spencer-Booth (1964) and Rowell, Hinde & Spencer-Booth (1964). The first signs of play are seen at about the third week and the adults join in to some extent. Each adult-infant pair seems to work out a play routine which changes week by week as the infants get older. From about a month onwards the infants' play may cause adults to threaten them or drive them away—for instance when they jump on the females' backs, or swing on their tails. In particular cases this may develop into quite complicated rituals of 'aunt-teasing'.

But perhaps the most elaborate social games of wild animals are those found, as we should expect, in one of the most highly social of all animals—the wolf. Here, as with the primates and some birds, we often get an overwhelming impression of sly and mischievious fun—yet often with a determination not to do serious hurt. In the wolves (e.g. Crisler 1959) the variety and ingenuity of the games, especially of tame wolves with humans, is remarkable and clearly involves an understanding of individually acquired routines.

This consideration of animal play and its function in acquiring skill, in mastering the external world and in extending the perceptual horizons, inevitably raises the problem of human play. What light, if any does the study of animal play throw upon the play and

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freedom of human beings? There is, indeed, good reason for thinking that the prolonged childhood of the human species, coupled with the extreme infantile sexuality (occurring as it does so long before there is any possibility of consummatory sexual behaviour), have been of prime importance in the process of freeing appetitive behaviour from the primary needs (Bally 1945). This, and man's growing mastery of his environment, have been the essential first steps not only for play but for all those activities which transcend mere maintenance and which underlie the mental and spiritual development of man; activities which, though originating in 'play', have produced developments of enormous significance for the human race.

I am much indebted to Mr M. Morgan for some references on response variability and allied topics.

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