

INTRODUCTION

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[Plates 7 to 11]

In preparing and attending this symposium, I was confronted by many new facts and ideas and by markedly divergent approaches to the subject. As a result, I was able to attain a more all-round picture of the problem of ritualization, which was of great help to my own thinking. Accordingly, in lieu of attempting the impossible task of writing a critical summary of the proceedings, I have considerably expanded my opening to give what I hope will prove to be a useful introductory conspectus of this important and widely ramifying subject.

Sixty-four years ago Selous (1901) made the first detailed observational record of elaborate mutual display—a subject not even mentioned by Darwin (1881) in his lengthy analysis of sexual selection—in the widely distributed Great Crested Grebe (*Podiceps cristatus*). Thirteen years later (J. S. Huxley 1914) I gave the first scientific description and analysis of its courtship ceremonies, noted that some of its display-behaviour was carried out in a ritual manner, and deduced that some displays functioned as an emotional bond between the mated pair.

I also described and analysed the displays of the Redshank (*Totanus calidris*), the Red-throated Diver *Colymbus stellatus*, the Herons and Egrets (*Hydranassa tricolor* and *Leucophoyx thula*) (J. S. Huxley 1923, 1926), the Oystercatcher (*Haematopus ostralegus*) (Huxley & Montagu 1925) and other birds (J. S. Huxley 1938*a*), and referred to them as *rituals* or *ceremonies*, as Selous (1901) had also done for the Stockdove (*Columba oenas*), the Stone Curlew (*Burhinus oedicephalus*) and other species. I included all displays, whether mutual or unilateral, under the head of courtship, and interpreted them in modified Darwinian fashion, in terms of sexual selection on the basis of their psychophysiological stimulative epigamic function. It was not until much later, after Eliot Howard's notable work on territory (1920, 1929) that I realized that many displays were concerned with threat (J. S. Huxley 1938*b*).

Meanwhile Heinroth in Germany (1926–28) has described many avian displays and interpreted them as based on innate motor patterns of behaviour, and Whitman in America (summarized 1929) had stressed the communicative value of display in stimulating and synchronizing pair-formulation and copulation.

These ideas lay fallow for nearly a quarter-century, but were then fused and developed by Lorenz (1935, 1952, 1965*b*), with the indispensable aid of Tinbergen (1948, 1951, 1964), to form the basis of the modern and rapidly growing branch of study we call ethology. Indeed Lorenz, in a recent retrospective lecture, went so far as to call Whitman, Heinroth and myself the Founding Fathers of the new science. But behind us, as Lorenz would be the first to agree, Charles Darwin stands out as the heroic ancestral figure, who not only wrote the first scientific treatises on the subject—*The expression of the emotions in man and*

animals (1872) and the final two-thirds of *The descent of man* (1881)—which are devoted to sexual display and sexual behaviour, but in his theory of natural selection, provided us with the key to the understanding of the evolutionary origin and further development of animal behaviour-patterns in higher animals, including crustaceans, cephalopods, insects, spiders and vertebrates.

Darwin with his robust but scientifically disciplined common sense, and his understanding of the value of the comparative method in biology, realized that higher animals had emotions, that those and other aspects of subjective awareness were not mere epiphenomena, but operative elements in a unitary patterned organization which combined material or physiological with mental or psychological factors; and therefore that behaviour, whether of animals or man, cannot be adequately understood without taking emotion and other subjective phenomena into account. With this he paved the way for a unified psychophysiological approach to ethology and psychology in general.

I have attempted to develop these views by formulating a two-aspect concept of psychophysical monism (J. S. Huxley 1964). This envisages the joint evolution of two inter-related processes of higher organisms—physiological metabolism, converting the physico-chemical raw materials of the environment into more complex substances and more efficient physiological and anatomical organization; and psychometabolism, converting the raw materials of subjective experience into qualitatively more distinctive forms and more efficient organizations of mind and awareness.

Accordingly, in addition to the objectively definable ethological terminology of motivations and drives, releasers and displacement activities, I shall not hesitate to use subjective terms such as *fear*, *hostility*, and *enjoyment* when they help us in the study and interpretation of observed animal behaviour—as they certainly do in regard to human behaviour.

One interesting conclusion of modern ethological study is that an animal's characteristic pattern of behaviour consists of a number of major organized entities or units, each with a distinct function or set of functions, which may be called behaviour-organs. This leads to the further conclusion that we can establish a scientific comparative morphology of behaviour-organs in the same way as we have established a scientific comparative anatomy of structural physical organs like limbs or kidneys; and furthermore can deduce how such behaviour-organs evolve—by exaggerating one component, reducing another to a functionless vestige, or altering a third to subserve a new functional role.

An even more important conclusion is that the great majority of animals' behaviour-patterns have been subjected to a process of ritualization. Ritualization may be defined ethologically as the adaptive formalization or canalization of emotionally motivated behaviour, under the teleonomic pressure of natural selection so as: (a) to promote better and more unambiguous signal function, both intra- and inter-specifically; (b) to serve as more efficient stimulators or releasers of more efficient patterns of action in other individuals; (c) to reduce intra-specific damage; and (d) to serve as sexual or social bonding mechanisms.

Ritualized behaviour-patterns can all be broadly characterized as *displays*. They are based on motivated intention-movements, either singly or in combination, frequently with the addition of displacement and redirected activities.

This can best be explained by means of a few examples. The simplest ritualized displays

are *monovalent*, arising from singly-motivated intention-movements. Thus the intention-movements expressing readiness to fly off in birds have had their communicatory function enhanced by special postures exposing conspicuous markings, like the white rumps of many species, thus alerting a whole group to possible danger. Young Guillemots (*Uria aalge*) are a special case: when taking their first flight from the cliff ledges to the sea are relatively helpless as their primaries are still incompletely developed; accordingly, this flight is precluded by a striking intention-display serving to alert their parents, who join them in their flight and see that they come to no harm.

The monovalent food-begging ritual of nidicolous bird nestlings has been highly ritualized with elaborate stimulatory colours and markings of the gape (see Swynnerton 1916).

In the Great Crested Grebe the invitatory display-ceremony of both sexes, but especially the female, is also monovalent. The bird adopts the horizontal female copulatory position, either on open water, the mating platform, or the nest, and this serves as a releaser of copulatory behaviour in its mate. Another monovalent activity which has been ritualized, but without enhancement of signal function, is that of predacious carnivorous mammals (Leyhausen 1965). Thus, in Viverridae and Felidae various specialized innate patterns of predation behaviour, like the death shake and the killing bite, are specialized adaptive formalizations of generalized aggressive behaviour.

Bivalent motivation is frequent, notably in threat activities between rivals of the same sex, where it involves a combination of aggression and escape motives, and the corresponding intention-movements for attack and fleeing. These may occur in alternation, but are often combined in a compromise intention-attitude or threat. (See Lorenz 1964, 1965 *b*; Tinbergen 1964, 1965; Andrew 1963.) (See plate 9.)

Ritualization here has been very important, notably in reducing intra-specific damage, by ensuring that threat can ensure victory without actual fighting, or by ritualizing combat itself into what Lorenz calls a tournament.

During its ritualization, the psychological effect of threat is enhanced by various means—exaggeration of apparent size or strength; bristling of fur or feathers; and additional conspicuousness of fighting organs, like beak in birds, fangs and teeth in carnivores and primate mammals, horns and antlers in ruminants, and often of the regions surrounding them (face in primates, face-mask in gulls, crest in grebes and herons, etc.)

In some lizards, threat through size-exaggeration has become mere bluff—but it works, and actual fighting never occurs, figure 10. In deer, antlers have a dual function. They are so constructed that fights are very rarely fatal or even damaging: and their allometric growth often makes them so large that the mere sight of them deters a rival from attempting combat.

Another method of reducing intra-specific damage is by a change in the balance of motivation with distance from some proprietary centre, as is especially clear in territorial species of birds and mammals. The attack drive of a territory-owner diminishes and his escape drive increases in relation to his distance from the centre of his territory, and their relative strengths are reversed when inside another male's territory. Trespassers are thus at a disadvantage, and hard fighting for territory is rendered infrequent—except where available territory sites are in short supply. This occurs with marine iguanas in one of the Galapagos islands: here vicious and damaging fights between females for possession of

displaying sites are frequent, while on the other islands, where more sites are available, only ritualized damage-reducing tournaments occur.

One method of ensuring that tournament fights provide maximum damage-reduction is to introduce non-aggressive or appeasement gestures into the ritualized display. These often consist of turning the weapon-containing region away from the opponent, as is seen in the 'head-flagging' of gulls (see Tinbergen 1951, 1965, p. 30) or the corresponding head-movement of some antelopes (Walther 1965), which turn the beak or horns sideways.

A hierarchical rank-order ('peck-order') of graded dominance superiority and inferiority is found in most birds and mammals which live in small groups. It is based on a combination of fighting and individual recognition. It is biologically advantageous, since, once established, it leads to virtually total absence of intra-group fighting, with more time for feeding and other basic functions as a result (see, for example, Lorenz 1935, 1965*b*). In species like Jackdaws (*Corvus monedula*), which normally pair for life, the female takes the male's rank—an interesting parallel to human behaviour (Lorenz 1952), where of course similar 'peck-orders' (superior-inferior systems) occur, notably in established military, religious and aristocratic hierarchies, but also in everyday social and business life.

In social predators like wolves, intra-specific (intra-pack) damage has been almost totally prevented by the evolution of special submissive or appeasement attitudes, which are adopted by the weaker animal in conflict situations. These act as releasers for a built-in inhibitory mechanism in the stronger animal, who is automatically stopped from actually attacking the other.

Appeasement tactics may also be effective in reducing damage in man. Deliberate adoption of a submissive and apologetic attitude, if properly carried out, has been successfully used by one ethologist of my acquaintance to escape the consequences of traffic misdemeanours.

The most elaborate and interesting animal ritualizations are *trivalent*, notably the epigamic displays of birds, which involve three motivations—sexual attraction leads to closer proximity, and closer proximity arouses both hostility and fear. Hostility and fear may temporarily produce actual attack (as by male House Sparrows occupying nesting sites on approaching females at the onset of the breeding season (Summers-Smith 1963)). They may lead to an alternation of aggressive and escape bouts. Frequently, however, a compromise attitude is adopted, as in many cases of inter-male threat, and is then ritualized to give maximum stimulatory and communicatory effect. In most vertebrates, the male shows more aggression and hostility than the female.

In addition, redirection and displacement activities often occur, and may be incorporated in the ritualized display: male hostility to the female is normally redirected towards a potential male rival, as in cichlid fish: if no other male is visible, as in an aquarium, the male's aggression is directed against his mate, and he may kill her. In the abnormal circumstances of captivity, notably in the absence of a conspecific female, the male's entire sexual display may be redirected at inanimate objects, such as a food-trough (e.g. in the Argus Pheasant (*Argusianus argus*) (B. de Haan, in J. S. Huxley 1949, p. 66). Redirection of hostility is frequent in man, as when a frustrated business man or administrator takes it out on his inferiors, or an angry disputant thumps the table instead of hitting his opponent.

In situations where conflicting drives are in equilibrium and neither can be overtly expressed, the high motivational tension may spill over into whatever other pattern of motor expression is available, even though the resultant actions are not efficiently performed, and are irrelevant to the situation. In birds, such *displacement activities*, as ethologists call them, include displacement preening, displacement gathering or presentation of nest-material or of food, and even displacement sleeping (with eyes open). In sticklebacks we find displacement nest digging and displacement nest ventilation. Some activities seen in conflict situations, like the violent grass plucking of Herring Gulls (e.g. Tinbergen 1951, fig. 91) appear to combine displacement with redirected aggression.

Displacement activities may later become functionally incorporated in the display and themselves become exaggerated or modified in the process of ritualization (Tinbergen 1951, p. 113; Lorenz 1965 *b*). This has been thoroughly investigated in a comparative study of the displacement preening seen in Anatid display (Tinbergen 1965, p. 126).

Displacement gathering and presentation of nest material plays an important role in the display, greeting, and nest-relief ceremonies of many birds, such as Grebes and Herons (figures 2; and 4, plate 7). In birds, food presentation by the male in courtship is probably a displacement activity derived from food presentation by parent to offspring; it is normally elicited by the female adopting the posture of a food-begging chick. In the Arctic Tern (*Sterna macrura*) (Cullen, unpublished) ritualized food presentation has been redirected in various ways: e.g. bachelor males may successfully obtain food carried by mated males by adopting the female food-begging attitude, and then use the booty to advertise their bachelor status or to present to an unmated female (figure 13, plate 10).

In carnivorous insects and spiders, food presentation in courtship is a displacement or redirection of normal adult feeding behaviour—captured prey is presented to the female instead of being eaten. In Empid flies, the presentation is ritualized to facilitate copulation. The stimulative effect of the ceremony is enhanced by the prey being embedded in a conspicuous balloon of white bubbles secreted by the male; and in some species a flower or other bright object is presented instead of prey (Richards 1927; J. S. Huxley 1938 *a*).

In some spiders, wrapped prey is presented. But in many others there is no food presentation, and the male's visual or tactile display is highly ritualized so as to establish his non-prey status and permit his sexual approach (Bristowe 1958); figures 6; and 7, plate 8.

Ritualized display may be socialized, notably in birds, with the result of enhancing its psychophysiological stimulatory function, in regard to gonad maturation, readiness to copulate, or both. In colony-nesting birds, display between members of a pair may stimulate others to display: this appears to promote the biologically advantageous Fraser Darling effect or synchronization of reproduction within the colony (Tinbergen 1963). Similar social facilitation by 'psychological infection' occurs in the group displays of male House Sparrows (*Passer domesticus*) (Summers-Smith 1963) and in threat displays in social primates (Hall 1964, p. 53 f; Carpenter 1958). It also occurs in the curious 'piping parties' of the Oystercatcher (*Haematopus ostralegus*), whose piping display subserves both threat, epigamic stimulation and pair-bonding (Huxley & Montague 1925).

The social enhancement of stimulatory function is most obvious in birds with hill or 'arena' displays, like Blackcock (*Tetrao tetrix*) and other grouse, some Phasianidae, and Ruff (*Machetes pugnax*). In ruffs the stimulatory effect is still further enhanced by the male's

unique polymorphism (Ford 1940). In all such cases continual ritual threat displays and tournaments between males alternate with quite different epigamic displays directed at visiting females (figure 5, plate 7).

The enormously increased intra-sexual advantage enjoyed by successful males in such polygamous-promiscuous species leads to the exaggeration of display characters far beyond anything found in monogamous species (J. S. Huxley 1938*a*; Mayr 1945, etc.)

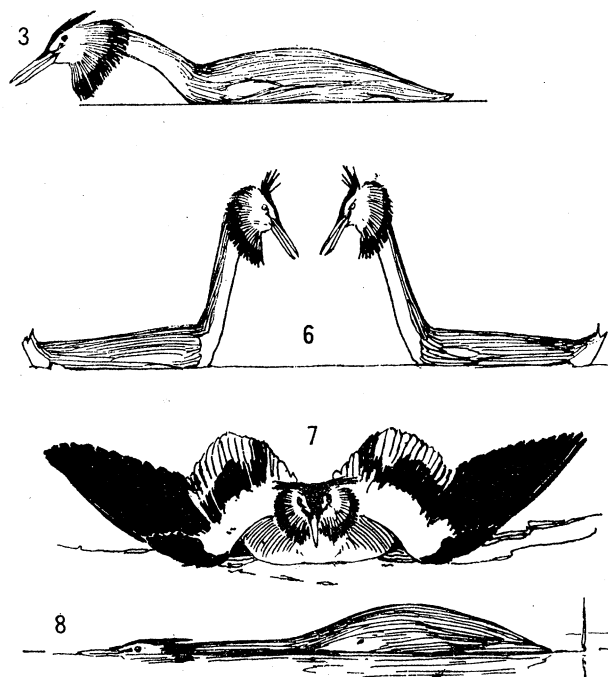


FIGURE 1. Display ceremonies in the Great Crested Grebe *Podiceps cristatus* (from Huxley 1914).

(3) Hostile (threat) display to a rival. Derived from an aggressive attitude slightly inhibited by fear. (6) Mutual head-shaking by a mated pair. Derived from a triply motivated situation: sexual attraction involves close approach, and this induces combined hostility and fear. The repeated headshaking reduces fear by turning the bill downwards and sideways out of its attack position. The crest and tippets enhance the stimulatory effect of the display, which now serves as a pair-bond. (7) The striking-cat attitude apparently originated from a bivalent situation where fear is combined with sexual impulse. In the remarkable 'discovery ceremony', in which one bird of a pair dives and emerges vertically close to its mate, the other adopts this attitude. It is also given by unmated females when approached too closely by other birds. (8) The monovalent invitation displays is derived from the position adopted by the female in copulation. It is now an intention movement serving as a sign-stimulus of readiness to copulate, and may be performed by either sex, on the nest-platform or on open water. See also figure 3, plate 7.

The significance of post-nuptial (post-reproductive) social displays, which bear no resemblance to reproductive threat and epigamic displays, remains very puzzling. The most curious case is the 'aerial harvest festival' of acorn-storage performed by the colonial California Woodpecker (*Melanerpes formicivorus*) (Ritter 1938, cited by Wynne-Edwards 1962, p. 320 f.). The acrobatic autumnal social displays of the Stone Curlew (*Burhinus oedipnemus*) are equally puzzling, though they may have some significance in relating to impending departure on migration, as presumably also holds for the early spring gatherings



FIGURE 3

FIGURE 3. The 'parallel run' ceremony of the New World Western Grebe (*Aechmophorus occidentalis*). This spectacular pair-bonding ceremony is analogous to the Great Crested Grebe's penguin dance (figure 2). (Photo by courtesy of Walt Disney.)



FIGURE 4

FIGURE 4. Nest-relief ceremony in the Louisiana Heron (*Hydranassa tricolor*). This ceremony has its origins in a trivalent situation involving sexual attraction, hostility and fear. The upright neck of the sitting bird is an appeasement gesture signifying non-attack, as is its mate's displacement presentation of nest-material (sticks) which are built into the nest by the sitting bird before the pair change places. The mutual display of striking epigamic structures is sexually stimulating. This elaborate ritual, which occurs also during the nest-building period, is the major pair-bonding ceremony in this and other herons. (J. S. Huxley photo.)



FIGURE 5. The 'stage' or display arena of the Stage-maker Bowerbird (*Scenopoetes dentirostris*). The male clears the stage of dead leaves and other debris and decorates it each day with fresh leaves of selected species of trees, which he saws off with his adaptively serrated beak. They are actually placed with light underside visible: if reversed, the male turns them back. Some broken snail-shells are usually added. The male sings loudly and almost continuously from a song-perch 2 to 10 ft. above the arena, but does not perform any visual display. (From A. J. Marshall 1954, photo. S. W. Jackson.)

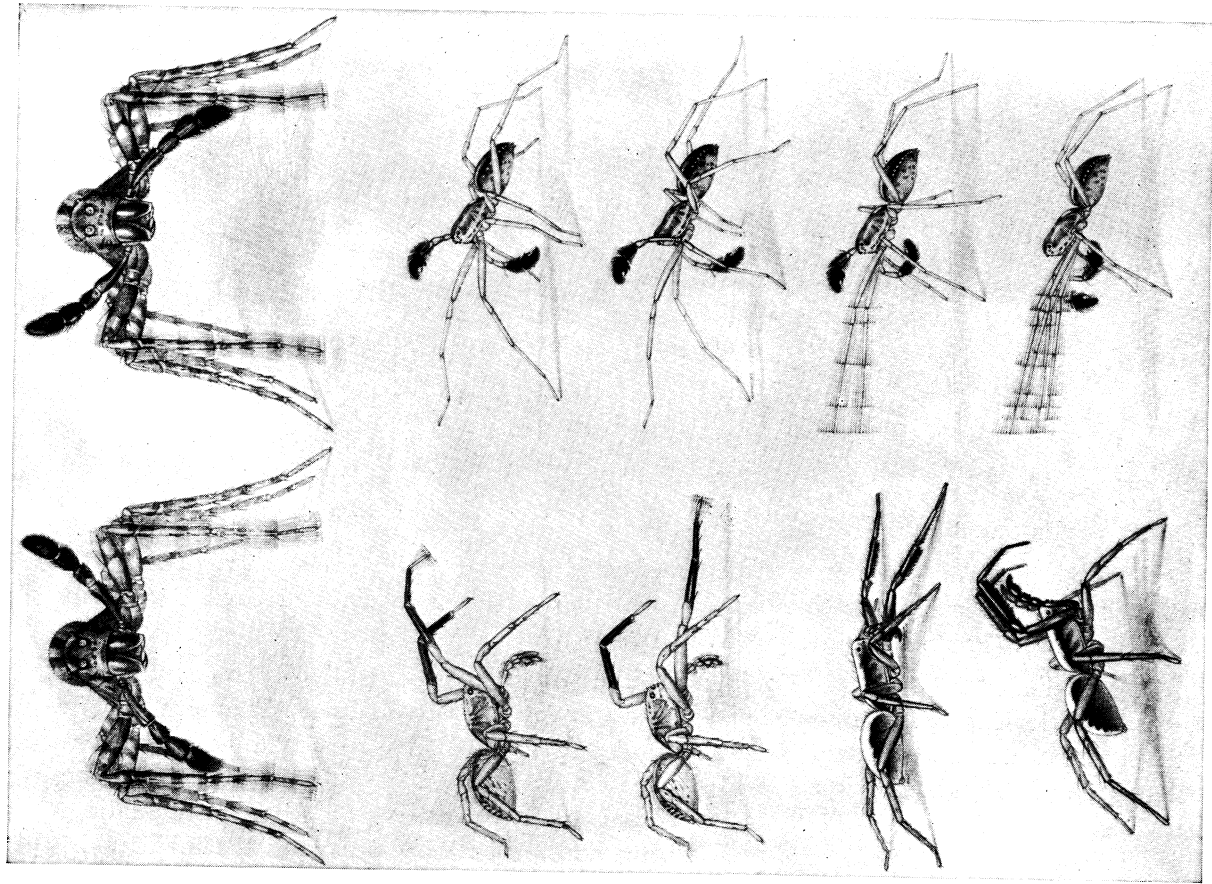


FIGURE 8. The display of male Lycosid hunting spiders signals their non-prey status to the female. Above and on the right, the 'semaphore' display of *Lycosa amentata* and *L. nigriceps*. Centre and bottom left, the displays of *Trochosa terricola* and *Tarentula barbipes*. (From Bristowe 1958.)

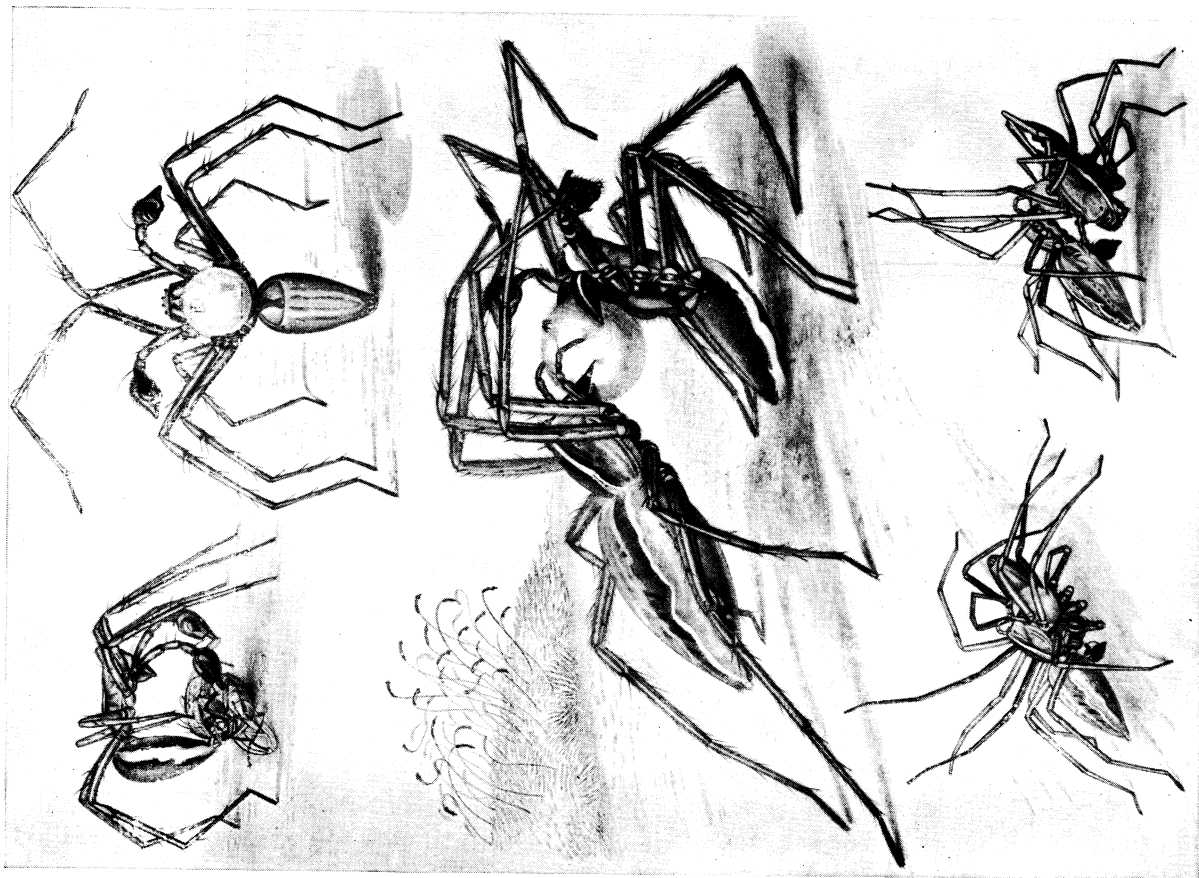


FIGURE 7. A male *Pisaurus mirabilis* wraps a fly in silk, displays it and himself, forcibly presents it to the female, and prepares to copulate with her. (From Bristowe 1958.)

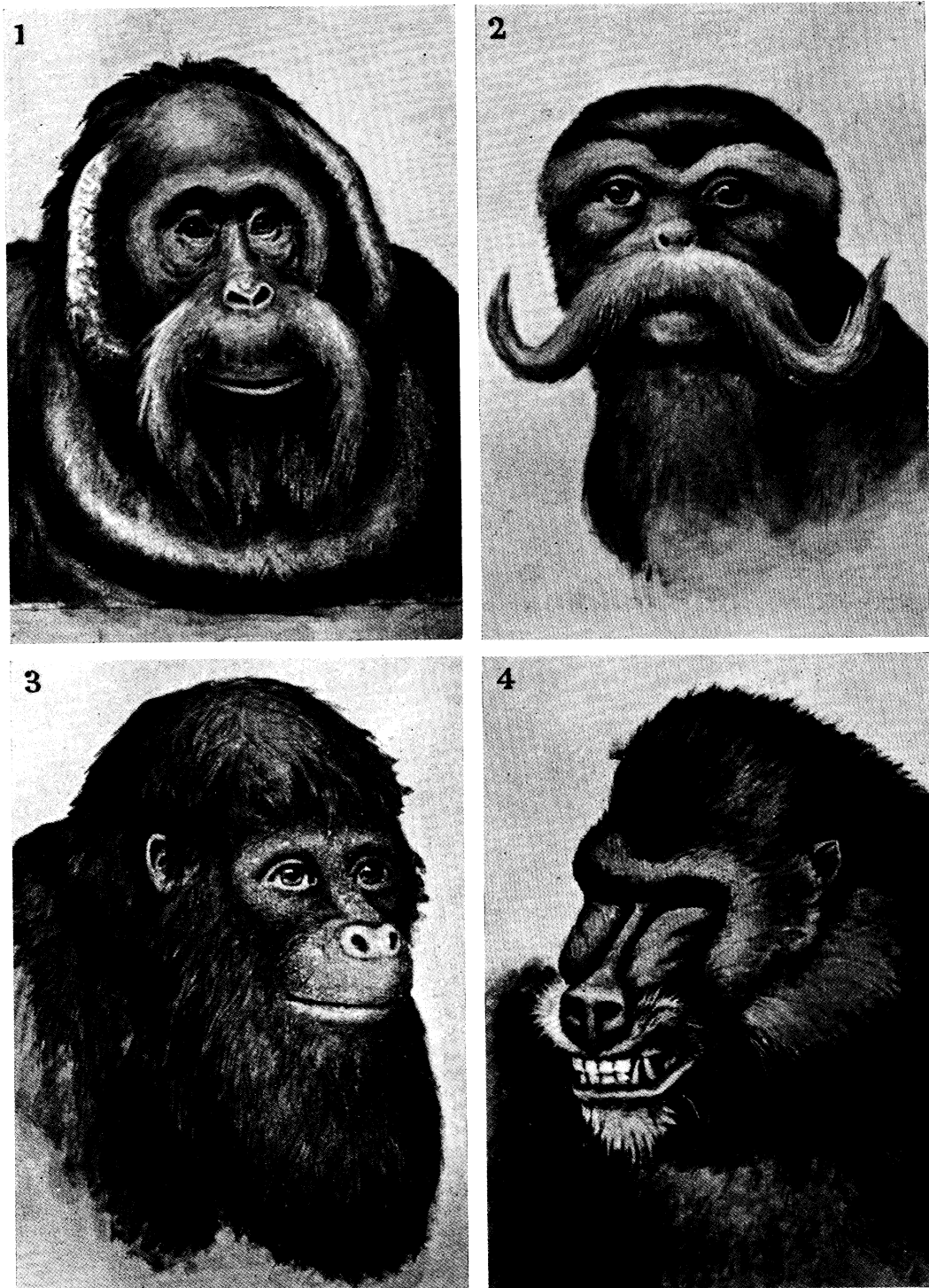


FIGURE 11. Facial threat-characters in male primates. (1) Anthropoid: Orang-utan (*Pongo pygmaeus*); (2) and (3) New world primates; (2) Tamarin Marmoset (*Midas imperator*) (Hapalidae), (3) Satan Monkey (*Chiropotes satanas*) (Cebidae); (4) Old World baboon: Mandrill (*Mandrillus sphinx*) (Cynopithecidae). (From Pycraft 1913, drawings by I. Thornton.)

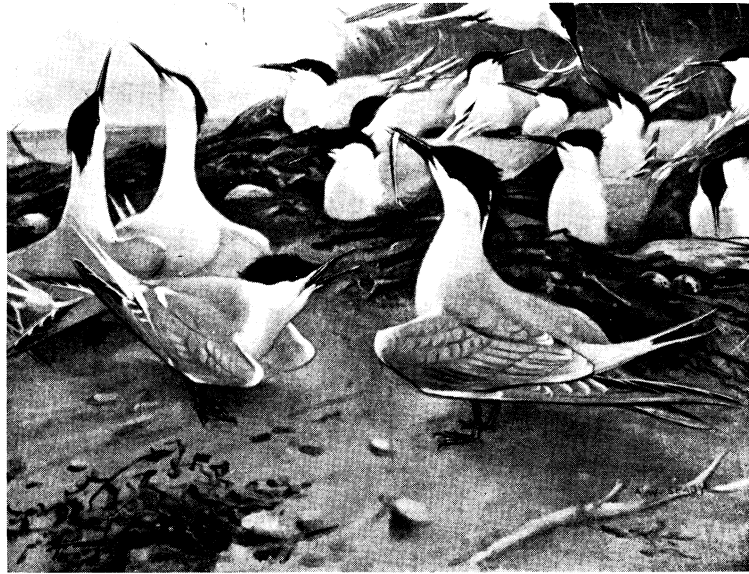


FIGURE 13. Displays in the colony-nesting Sandwich Tern (*Sterna sandvicensis*). Left, a mutual display in non-attack position. Centre, food-presentation display by the male to the female, who adopts the juvenile food-begging attitude. (From Kirkman 1911-13, vol. 3.)



FIGURE 14. Yellow pine with approximately 50 000 holes bored by the Acorn (California) Woodpecker (*Balanosphyra formicovora*) to store acorns. (From Wynne Edwards 1962, after W. L. Dawson.)



FIGURE 15. Social display flight of acorn woodpeckers during acorn storage.
(From Wynne-Edwards 1962, after Ritter.)



FIGURE 16. In its social autumnal displays the Stone Curlew (*Burhinus oedicanus*) wave their wings, run about erratically and fling themselves sideways. (From Selous 1902.)

of Redwings (*Turdus iliacus*) in their winter quarters, and for the autumnal gathering of swallows and martins. However, the occasional dawn-flights of flocks of swallows and martins, which fly up into the light of the rising sun, remain wholly unexplained (Van Beneden & Huxley 1951): figure 14, plate 10 and plate 11.

In many territorial animals, ritualized advertisement of territory ownership is important. Marking the boundaries of a territory may be effected by ceremonial flights (as in the 'roding' of the Woodcock (*Scolopax rusticola*)); or by deposition of dung (as seen in civets and vicuñas) or of urine (as seen in Canidae, Klieman 1966, and in distorted form in the 'leg-lifting' of domestic dogs), or of both together; or by the secretions of special glands (as in mongooses and antelopes: see Bourlière 1954, p. 225 f.).

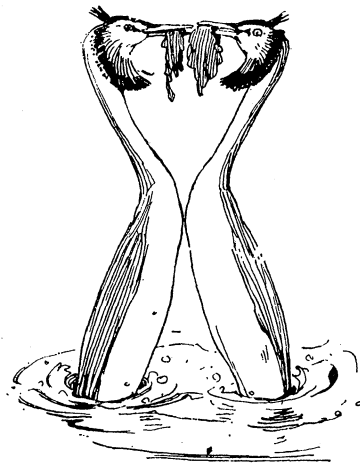


FIGURE 2. The penguin dance is the most elaborate of the great crested grebe's pair-bonding displays. After a bout of intense head-shaking both birds dive, emerge with nest material (water-weed) in their bills, swim towards each other, and rear up breast to breast. They then indulge in a head-shaking display, which continues after they have dropped the weed and returned to a normal position. The gathering of nest-material is a displacement activity (p. 253) which has become an essential part of the ceremony (from Huxley 1914).

The primary function of that highly ritualized activity, bird-song, advertises, both to rivals and potential mates, a male's ownership of a territory. It doubtless evolved through an elaboration of simple call-notes (Thielke 1964) so as to act as a form of signalling effective at a distance, and also unambiguously distinctive of the species. In areas where one of two closely related sympatric species with distinctive songs is absent, selection pressure is relaxed and the song of the other species becomes less distinctive; e.g. in the Meadow Pipit (*Anthus pratensis*) in Iceland, where its close relative the Tree Pipit (*A. trivialis*) is not present (J. S. Huxley 1951), and the Chiffchaff (*Phylloscopus collybita*) in regions where the visually very similar Willow Warbler (*P. trochilus*) is absent (Thielcke 1965 and in this Symposium).

Dr Thorpe in this Symposium discusses the extraordinary pair-bonding 'duets' of African shrikes, and also stresses the puzzling fact that, whereas the capacity to sing the complete song is innate in some birds, like the Whitethroat (*Sylvia curruca*), it is not so in others, like the Chaffinch (*Fringilla coelebs*), where the 'innate' song is highly imperfect, and the full song has to be learnt by hearing it during a certain critical period (Thorpe

1956, chs. 14 and 15). The same sort of thing seems to be true for human speech, which has to be learnt, and is normally learnt during infancy by imitation of self and others. Later learning by less direct methods, as in deaf-mutes like Helen Keller, leads to abnormal imperfect vocalization.

Other species, like the Mocking Bird (*Mimus polyglottus*) and the Sedge Warbler (*Acrocephalus schoenobaenus*) are vocal mimics and incorporate many non-specific sounds into their songs, which consequently show wide individual variation. Parrots, on the other hand, though capable of a high degree of vocal mimicry, never employ it in nature. The whole subject of the origin and significance of sound mimicry needs further investigation.

Vocal mimicry is interesting in having an *autesthetic* as well as (usually) an *allaesthetic* function. Avian vocal mimics (like human infants) enjoy practising new vocalizations and including them in their repertoire. Similarly, good songsters like the Blackbird (*Turdus merula*) practise new phrases prior to incorporating them in their perfected song. As one would expect, there is considerable individual variation in this respect, as also in the bower ritual of the Satin Bowerbird (*Ptilinorhynchus violaceus*) (Marshall 1954), where only certain individuals perfect their bowers by painting their lower parts.

The most striking *autesthetic* rituals are those of play and sport. The play of young mammals with long and active juvenile periods, like carnivores, ungulates, elephants and primates, certainly constitutes a valuable preparation for adult life, through the repeated exercise of adaptive motor patterns of behaviour during their automatic maturation. In some cases it does not involve improvement of performance by practice, but in others practice-learning does occur. Thus in young lions there is play-learning of hunting methods, supervised by adult females (Schenkel 1966).

In many species play is a socializing activity, participated in either by groups of young, as in monkeys (Harlow & Harlow 1962; Hall 1964; Carpenter 1958), or by adults and young together, as in Felidae: in lions several adults and their cubs take part (Schenkel 1966).

Play occurs in adults of other species (e.g. in elephants, seals, dolphins and chimpanzees, though often not to the same extent as in young animals).

In any case play seems clearly to be enjoyed by the participants. And when we come to what I venture to call sport, like the deliberate snow-sliding of adult otters, the ice-floe riding of adult Adelie Penguins (*Pygoscelis adeliae*) (Levick 1914), the leaping (and the learnt games) of dolphins and porpoises and the occasional extraordinary flight games and aerial antics of adult Corvidae (personal observations, and see Selous 1901, pp. 135 f., 255 f., 295 f.), it cannot be of direct selective advantage, especially as such behaviour is so sporadic—though the full exercise of the creature's capacities may perhaps help somewhat in keeping it fit. In any case the performance is clearly to a large extent self-rewarding, enjoyed for its own sake, just as in human sports like skiing or figure-skating.

Simian and anthropoid exploratory and inquisitive behaviour-patterns are also largely self-rewarding, and form a bridge to human curiosity, to spatial, scientific and aesthetic exploration, and general enlargement of experience.

The extraordinary behaviour by which Stoats (*Mustela erminea*) first attract the attention and then cause the immobilization of Rabbits (*Oryctolagus cuniculus*) appears to be based on ritualized play activity, but urgently requires further study. The rabbit's non-adaptive induced immobility appears to be analogous to the ritualized (adaptively formalized)

'freezing' and death-feigning of many animals, including the Opossum (*Didelphys marsupialis*) (Bourlière 1954; Morris 1965); many adult and larval insects (e.g. Imms 1956, p. 190; Gwynne 1965); and spiders (Bristowe 1939-41, 2, p. 435, and 1958, p. 264).

Grooming is important as an intra-specific social and sexual bonding ritual, notably in non-human primates (e.g. Carpenter 1958; Hall & Devore, in press) and, in various modified forms, in man. In birds, grooming takes the form of allo-preening (Sparks 1965); this is derived from the monovalent ritualized or at least highly formalized activity of auto-preening.

Highly ritualized inter-specific grooming occurs in some fishes, the groomed species benefiting by the removal of fungal or other harmful growths, which are eaten by the groomer. Some groomers are visually and behaviourally mimicked by quite unrelated species, which take advantage of the 'appeasement' attitude induced in the groomed species to bite pieces of flesh from them.

Similar examples of ritualized (adaptively formalized) mimetic behaviour are seen in insects, notably in clearwing moths and hoverflies (syrphids) which mimic bees and wasps, but also in some butterflies which mimic nauseous models, and in various insects and spiders which mimic ants. The biological advantage is usually that of immunity from predation, but the bee- and wasp-mimicry of flies like *Volucella* appears to enable them to gain unmolested entry into their hosts' nests, where they scavenge for food (see Imms 1956, ch. 9).

Still other cases are seen in the 'snake display' of Tits (Paridae), Wrynecks (*Iynx*) and other cavity-nesting birds (Sibley 1955); the distraction displays of many avian species which mimic the behaviour of a wounded bird or of a small mammal to lure predators away from the nest; and the extraordinary conspecific behaviour associated with the 'egg-dummies' of male Cichlid fish, which attract females to the vicinity of the male's cloaca and so facilitate the fertilization of the real eggs in the female's mouth (Wickler 1962).

Restriction of activity, as in captivity, may lead to pathological rituals, such as repetitive pacing; or, in agile species, to new and individually ritualized acrobatic activities adapted to the cage environment. When crowding is added, the resultant stress may result in anti-adaptive deritualization and disorganization of behaviour. Obvious analogies occur in man.

Mal-adaptive and non-adaptive survivals of originally adaptive ritualizations may occur in new environments; e.g. in Gannets (*Sula bassana*) the spread of colonies from cliffs to level ground renders the original ritualized combat-pattern non-adaptive and productive of considerable intra-specific damage (Nelson 1965). The domestic dog's turning round on a rug is a non-functional relic of a ritualization which was useful in the wild.

Two divergent tendencies seem to be operating in animal ritualization. One is for ritualized behaviour to evolve in the direction of an ethological reflex, by producing signals which release appropriate action with the minimum of delay: the other is to produce long-continued ceremonies with a sexual or social bonding function.

During vertebrate phylogeny, ritualization has tended increasingly towards more efficient bonding, with more elaborate ceremonies, in which individual learning plays an increasing role, notably in the primates. Their ritualized behaviour foreshadows various

human factors, especially in regard to rank organization, play, and, in chimpanzees, primitive dances. Similarly, primate characters used in threat and sexual ritualized behaviour foreshadow aspects of human dress, adornment, scarification and deformation which perform the same functions (see Laver 1964).

I now come to ritualization in man. Although there is wide disagreement as to the use of terms like *ritual** in anthropological or psychological discussion, for simplicity's sake I shall continue to use *ritualization* in a broad sense to denote the adaptive formalization and canalization of motivated human activities so as to secure more effective communicatory ('signalling') function, reduction of intra-group damage, or better intra-group bonding.

I am not competent to discuss human ritualization in detail, but as an evolutionary biologist I would like to stress some general points. The first is the striking operational similarity between its results and those of ritualization in higher animals, which, as Lorenz has pointed out, clearly demonstrate the convergent evolution of functionally analogous but not genetically homologous behaviour-organs. Secondly, there is the radical difference between biological evolution in animals, based on genetic transmission, and cultural evolution, based on non-genetic cultural transmission (tradition).† This depends largely on man's capacity for true (symbolic) language, which itself can properly be regarded as ritualized (adaptively formalized) behaviour (see Haldane 1955; Schenkel 1964). The only well-formalized animal language is that of bees (von Frisch 1954).

Thirdly, there is man's unique learning capacity, which promotes a much greater complexity and variety of ritualizations than is found in any type of animal. This, as Erikson (1961, 1964) has pointed out, coupled with the unique prolongation of man's learning period and his outstandingly slow post-natal development to maturity, necessitate a succession of behavioural ritualizations adapted to the successive stages of his psychosocial ontogeny. Accordingly, the process of human ritualization in psychosocial evolution has a primarily ontogenetic, not a phylogenetic basis; is directed mainly by psychosocial selection, not by the genetic mechanism of natural selection; and is relatively extremely rapid, operating in terms of decades instead of in millennial periods, and shows acceleration.

Fourthly, the phenotypic variability of man's behaviour has steadily increased during psychosocial evolution, owing to his unique learning capacity interacting with his increasing cultural complexity, and has led to a high degree of individuation. In man, individual variety is greater than in any other organism, and individuals can play a far

* *Ritual* (my italics throughout) as an adjective is defined by *The Shorter Oxford Dictionary* as 'pertaining or relating to...rites; of the nature of...a rite or rites': and *rite* is defined as 'a formal procedure in a religious or other solemn observance; a custom or practice of a formal kind (e.g. rites of hospitality); the general or normal custom, habit or practice of a country, now especially in relation to religion or worship (e.g. the Roman rite)'. *Ritual* as a noun is defined as 'a prescribed order of performing religious or other devotional service; a book containing the order to be observed in the celebration of religious or other solemn service...the performance of ritual acts'.

† In certain primates, e.g. the Japanese Macaque (*Macaca fuscata*), what may be called proto-tradition occurs, leading to each group having its own food tradition, with a particular range of acceptable foods. Now and again new foods may be incorporated in the traditional menu, and new rituals (e.g. special food-washing ceremonies) may develop in relation to them (see Southwick 1963).

more important role in influencing social activities and cultural evolution. This importance of the individual is enhanced by man's symbolizing activities, whereby outstanding individuals acquire large accretions of significance, and become social, political or religious heroes. We need only think of the permanent enhancement of individuals like Jesus or Napoleon, Moses or George Washington, Virgil or Michelangelo, or the ephemeral enhancement of musical virtuosos or film stars. The same applies to single outstanding events, which may become occasions for repeated commemorative rituals and celebrations.

Fifthly, man alone has crossed the threshold to full self-consciousness. This leads to the formation of a much more definite body-image, and also of a true self-image, both of which become important elements of many ritualizations.

Sixthly, in man alone does infantile repression of guilt occur, with resultant formation of the Freudian Unconscious and Super-ego, and the further consequence of projective thinking, by which man projects elements of his own personality into natural objects and forces, thus personalizing them: and into or onto other persons, real or imaginary, slave or ruler, friend or foe, thus endowing them with qualities not inherently theirs.

Finally, many more human ritualized activities have a strong autesthetic or self-rewarding component. When wholly autesthetic (e.g. in ritualized or disciplined private meditation) they tend to lose their allaesthetic communicatory (signal) function.

As a result of these various distinctive properties of man's mental life and capacities, behaviour and development, the process of ritualization in man is far more complex, elastic and various than that in animals, and leads to a much wider range of results.

In man, we find not only the adaptive canalization and ritualization of overt behaviour, but also that of thought or 'inner behaviour', resulting in motivated idea-systems and in internal (psychological or mental) organizations concerned with guilt and conscience, anxiety and 'oceanic' feelings. Secondly, every human being has to construct his private ritualizations, his own canalization systems, to guide the chaos and conflict of infantile thought and feeling into individually adaptive as well as socially acceptable channels. Thirdly, ritualization in the broad sense may spread from the emotional into the intellectual sphere, there resulting in adaptive canalizations of thought, like concepts and formulae, ethical and legal principles, scientific laws and theological doctrines. Such extended ritualization is no longer directly comparable with ritualization in animals and should perhaps be more strictly categorized as formalization, but both have similar functions, and both must be considered together in any general survey of the adaptive canalization of behaviour.

The resultant organizations of thought and behaviour can be almost infinitely more complex than anything seen in animals—e.g. kinship and caste systems, religions and cosmologies, with their symbolic expressions in rites and ceremonies, architecture and art.

The arts involve ritualization or adaptive canalization of the creative imagination, the sciences that of rational conceptualization based on a self-corrective exploration of experience, and logic and mathematics that of abstract reason.

Creative works of art and literature show ritualization in this extended sense, in being 'adaptively' (functionally) organized so as to enhance their aesthetic stimulatory effect and their communicatory function. They differ from all other products of ritualization in

each being a unique creation (though they may share a common style, which of course is itself a ritualizing agency). As Heisenberg said when playing Beethoven's Op. 111 to a group of scientists, 'If I had not existed, someone else would have discovered the Uncertainty Principle: but if Beethoven had never existed, we should not have had this great piece of music. That is the difference between science and art'.

A successful work of art is an organized whole, of variety integrated in unity, involving diverse and sometimes conflicting elements of diverse quality, and operating at different levels of overt expression and on different levels of perceptual awareness: it acquires a significant form by transforming its content. This 'structural situation' or aesthetically effective patterning by the artist on his work, can properly be regarded as a special kind of ritualization (see Gombrich 1960, 1963).*

As a result, the whole work (or single elements in it) exhibits the phenomenon of multivalence or multisignificance (including what Empson (1961) calls ambiguity and aspects of Koestler's bisociation (1964)), in carrying overtones and being supported by undertones, as well as in its overt expression. This is, perhaps, especially clear in poetry and oratory as against scientific description or logical argument. Obvious examples are Coleridge's *Kubla Khan* and Blake's *Tyger Tyger burning bright*,† Churchill's 'blood, sweat and tears', or Shakespeare's 'The quality of mercy is not strained'.

The proper development of personality involves a somewhat similar process of ritualization, *sensu lato*, in demanding the integration of diverse and sometimes conflicting elements or factors into an effectively organized and meaningful whole. Failure to incorporate certain elements, such as the proprioceptive factors involved in posture, or the aesthetic factors involved in the enjoyment or practice of the arts, leads to incomplete or faulty personality development.

This also applies to our perceptions, which we build out of the raw materials of direct sensation (see, for example, Cantril 1965). We normally impose on the process of perception a customary or 'normal' framework derived from conscious or unconscious learning from experience.

The powerful formalizing effect of this ritualization of thought and feeling, even when unconscious, is revealed by our various escapes from it—into the fantasy-organized world of our dreams (Hartmann 1965); or the disturbing world induced by sensory deprivation (see Lilly 1956); or the ecstatic but profoundly significant world into which we are conveyed by what are appropriately termed the transports of sexual love at its highest and deepest; or the supernormal visionary world revealed by psychedelic drugs (see later); or, the abnormal world into which schizophrenics and other psychotics are driven (see later); or the new world of behaviour imposed on the personality by hypnotically induced alterations of perception (Fogel & Hoffer 1962; J. S. Huxley 1964, p. 429); the transcendent inner world discovered by the great painters, poets and composers; or the transcendent inner world discovered by the disciplined and ritualized explorations of meditation, mysticism and yoga (see A. L. Huxley 1960, *passim*).

Both schizophrenia and psychedelic substances like *LSD* (lysergic acid diethylamide)

* On this primary patterning, the secondary patternings we call *style*, *fashion* and *taste* are superimposed.

† The multivalent potency of this poem is so great that, on first hearing it recited, the young Bertrand Russell was overcome and had to lean against the wall to prevent himself falling.

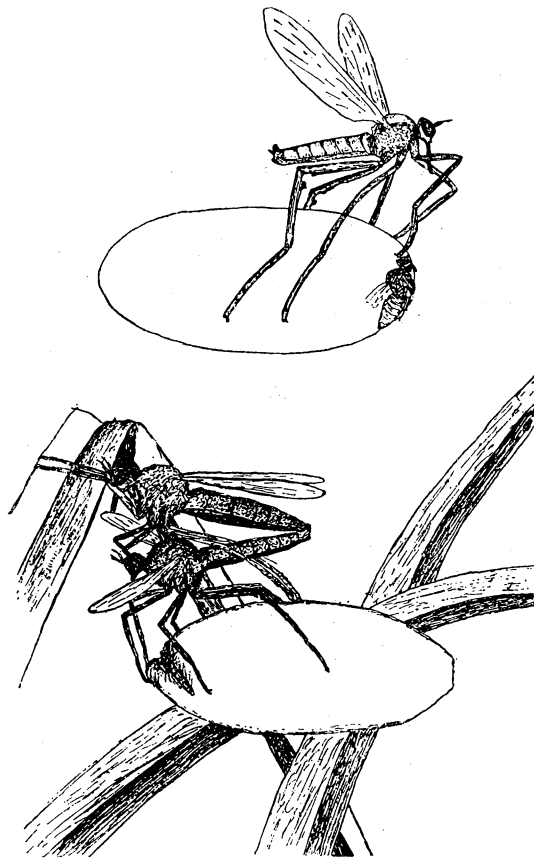


FIGURE 6. Empid display. Above, a male *Empis* displaying prey embedded in an opalescent balloon of bubbles which he has secreted. Below, the male copulating with the female, who has accepted the prey in its balloon. (From Meisenheimer 1921, after Aldrich and Turley.)

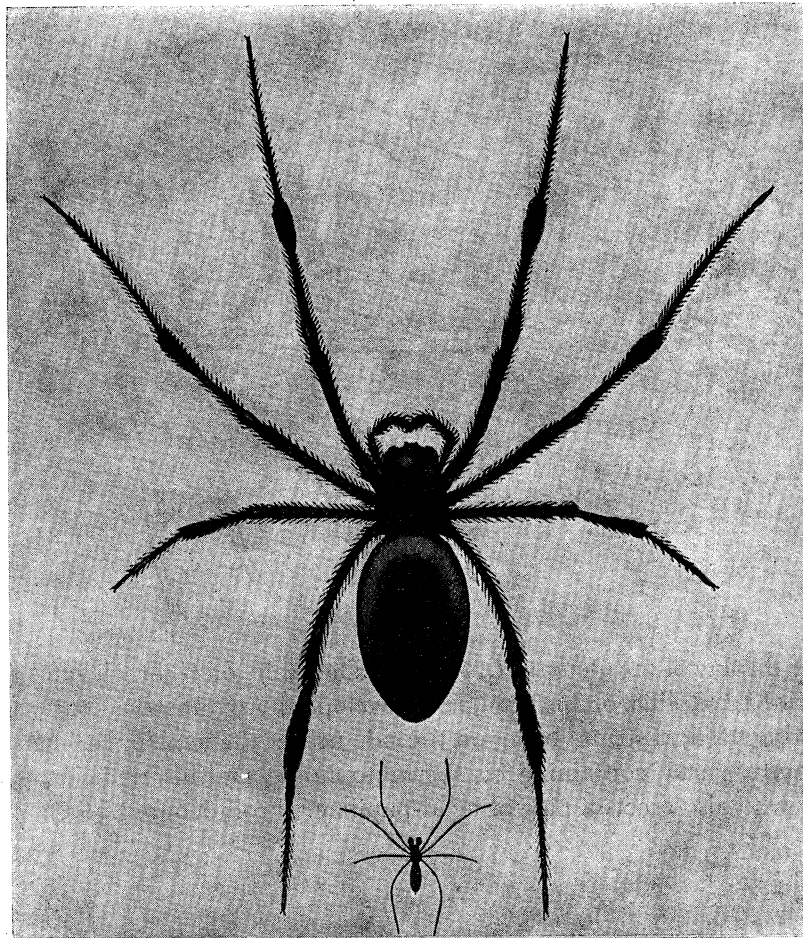


FIGURE 9. Male and female of the orb-web spider *Epeira* (*Araneus*) *nigra* from Reunion Island. The 500-fold smaller male spends most of his time on the female's back. (From Meisenheimer 1921, after Vinson.)

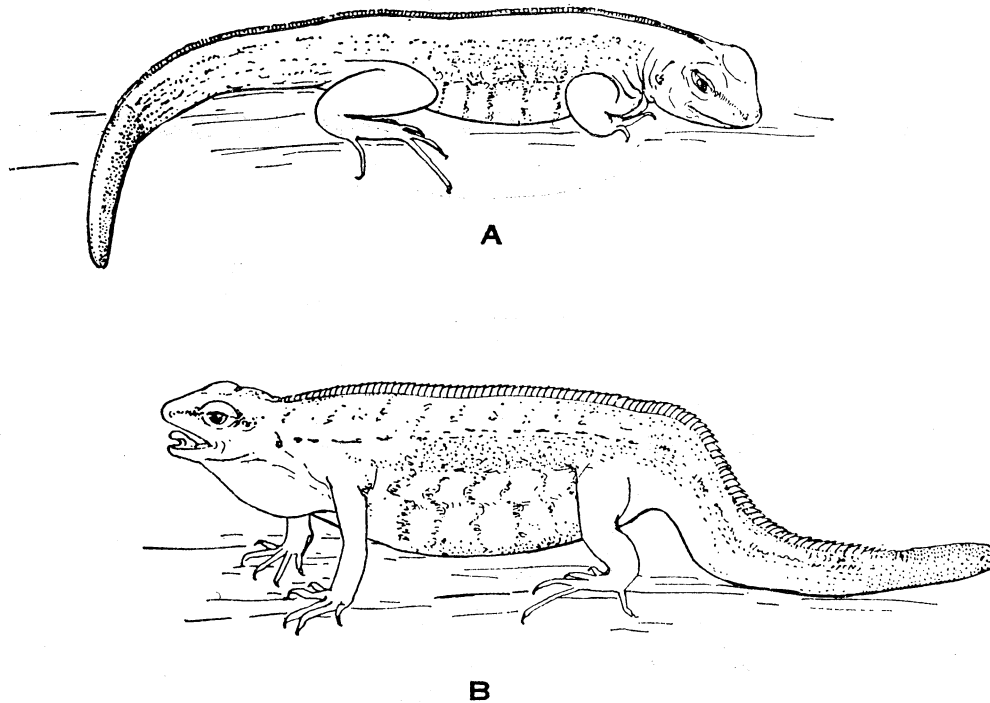


FIGURE 10. (A) The normal attitude of the male Lizard *Leicocephalus schreibersii*; (B) its lateral bluff-threat display, which exaggerates its size and menacing appearance and has become a substitute for actual fighting.

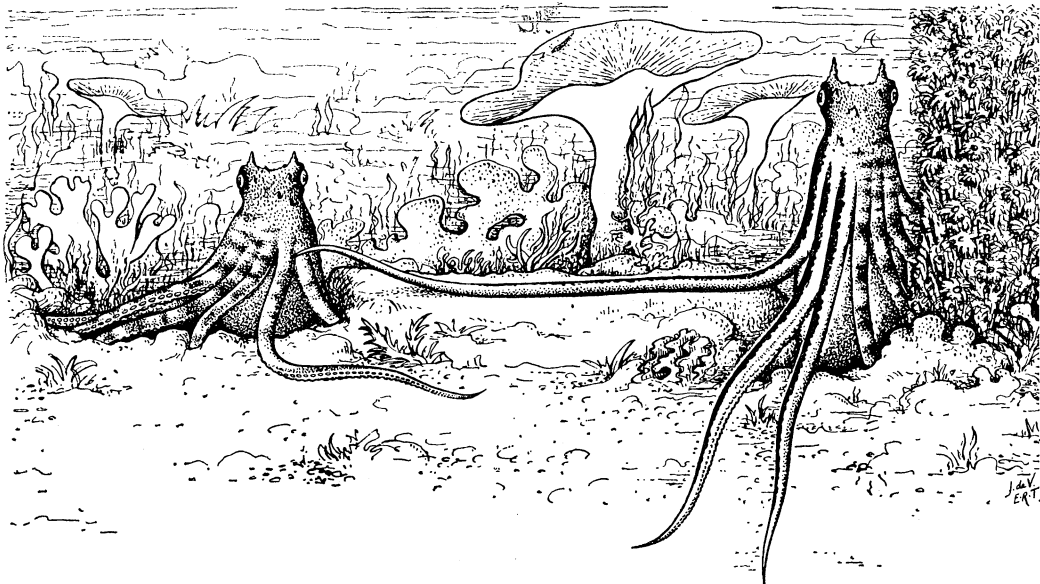


FIGURE 12. Mating display of the Octopus *O. horridus*. The male, on right, elevates himself vertically, erects two horn-like papillae on his head, and develops an asymmetrical pattern on his body and arms, the striking vertical stripes being on the side nearer the female. He then extends his third right (hectocotylus) arm, containing his spermatophores, and inserts it into the mantle cavity of the female, who also erects a pair of head-papillae. (From Young 1962.)

seem to exert their effects by interfering with the 'normal' ritualization of the perception-building process. In schizophrenia this is effected endogenously, by a genetic error of metabolism; the resultant lack of stable, adaptively formalized 'standard' percepts and concepts leads to a progressive failure of communication with others, and this to eventual withdrawal into the abnormal 'unrealistic' but sometimes rewarding private world which is all the schizophrenic has been able to construct (see Huxley, Mayr, Osmond & Hoffer 1965). This is a reversal of adaptive ritualization, as it increases ambiguity and impedes communication.

The administration of lysergic acid to spiders also has unadaptive results, paradoxically by causing them to construct webs of *greater* regularity than normal. They resemble schizophrenics in becoming 'withdrawn' from exteroceptive stimuli; their perceptive awareness is thus reduced, and they do not adjust their webs to the irregularities of their sites (Witt 1952, 1956, 1965 *a, b*).

Psychedelic substances frequently enhance and distort visual perception of form and colour, distort spatial perception, radically alter time-perception, and enhance the sense of significance (e.g. they can exert profound emotional and spiritual effects: they may induce an intensely rewarding state of well-being but in other subjects and other circumstances an appalling state of horror or despair (see, for example, A. L. Huxley 1960; J. S. Huxley 1964, p. 414 f.).

The combined-effect of body tonus and perception is also an important factor in ritualizing behaviour and may be experimentally altered to produce hallucinations.

Such facts seem to me to necessitate an ethological approach to human affairs in general, including human ritualization in the broadest sense. Ethological methodology includes (*a*) careful observation and description of ritualized behaviour, followed by comparative study; and (*b*) its analysis, aimed at discovering the psychosocial mechanisms of its operation, and its relation to environmental and historical change (see, for example, Tinbergen 1948, 1963, 1965, ch. 9; Bowlby 1957.)

There are many fields in which such an approach should be profitable. One is the comparative study of various kinds of formalized expressive behaviour in different cultures at different levels of development. Gestures are an obvious example: they become ritualized into signals of threat or submission, greeting or desire (see Darwin 1872, *passim*) and may form the basis of social convention and group bonding. Another is the comparative study of rituals based on psychological projection—scapegoat rituals, from the Jews' expulsion of a single symbolic goat to the Nazis scapegoating of the entire Jewish race; rituals of atonement for sin, from the Jewish Day of Atonement to the doctrine of Christ's vicarious atonement for the sins of mankind; and the multifarious rituals of sacrifice, including that of substitute sacrifice, like the killing of a substitute priest-king.

Then there are rituals involving masochism, like those of flagellants, and those involving sadism, like public executions and torture; military rituals—of discipline, from rigid rank-hierarchy to commando training, and of damage-reduction, from single combat and 'gentlemanly war' to the Geneva convention; rituals of national prestige and bonding, like Russian May Day celebrations or British Coronation ceremonies (see Shils & Young 1953); medical rituals, from uroscopy and the Hippocratic oath to illegibility of prescriptions and the bedside manner; psychiatric rituals, greeting and hospitality rituals; legal

rituals; appeasement rituals like hand-shaking; moral rituals, including their relation to tabu and to religion; and their fossilization in codes of purely external observances; mourning rituals (see Gorer 1965); liturgical rituals; parliamentary and committee rituals; oath-taking rituals (whose power was demonstrated by Mau-Mau); and of course the universal 'rites de passage' concerning birth and name-giving, initiation into adult life, marriage, death, and concern with ancestral spirits; and the equally universal seasonal rituals, like Christmas and Easter, together with long-period rituals, like anniversary and centenary ceremonies, and those concerned with calendrical cycles, as in Aztec and Maya culture.

Humour, except in rudimentary form, is peculiar to man. A study of the ritualization or canalizing of its expressions, from the licensed fooling of court jesters to comedy, farce and satire, would be valuable.

Human displacement rituals merit further study—they obviously cover a wide range of activities, from scratching one's head when puzzled or lighting a cigarette when slightly frustrated to going off to play golf instead of sitting down to make a difficult decision.

The non-biologists in this Symposium have discussed various of these rites and ceremonies in detail. Here I only point out some of their general features.

First, although most human rituals and ceremonies are preponderant symbolic and non-genetic, a few have an innate genetic basis and act as signals or automatic releasers of behaviour in others. The classical example is the smile-signal operating between infant and mother (Spitz & Wolf 1946). Starting as simple reflex behaviour, it is elaborated by experience and is incorporated in the mother-infant bonding ritual (Bowlby 1958, 1963), and in later life becomes a flexible symbolic gesture of considerable importance in daily social life.

While some complex symbolic rituals, like those of solitary meditation and prayer, concern only the individual, most of them, like collective worship or tribal dancing, have a social function—to ensure individual participation in a group activity, and to canalize and intensify the group's mood.

All symbolic rituals and ceremonies are essentially magico-religious in origin; during cultural evolution, extended ritualization tends to reduce their magical component, and often to secularize them. However, even the rituals of the higher religions still contain many magical elements.

Magic, in the strict anthropological sense, is based on the belief that both nature and man can be brought under compulsion and controlled by psychological means—through spells, incantations, prayer, sacrifice, and special personal or professional powers. Magic systems are logical, but not rational: they are based on the non-rational premises of primitive projective thinking and may continue to be believed in even where the rational-empirical approach has produced efficient new technological results: e.g. crop fertility rituals as necessary backing for neolithic agricultural techniques.

Magical belief-rituals survive and play a part even in the highest and most scientific cultures of today. They survive in our superstitions, our Polycrates complexes, our compulsion neuroses, in our reliance on the sacred force of oaths and on religious as against civil ceremonies for baptism and marriage, in our hero-worship and our devotion to political and religious leaders, and in pilgrimage and petitionary prayer.

And when we say that we are 'under the spell' of beauty or great music, or call a view of a work of art 'magical', we are acknowledging the existence of magic, in the extended sense of non-rational, emotional and often unconscious formalizing or patterning forces, which are essential for all transcendent experience. Instead of rejecting these forces or pretending that they do not exist, we must explore them and ritualize them to best advantage.

During psychosocial evolution, rituals evolve in various ways. They become ecologically adapted to different habitats and to different ways of life. Thus, after the neolithic revolution, hunting rituals had to be abandoned or relegated to a secondary position, and quite new rituals concerned with agriculture had to be evolved.

They also become politically adapted. The religiously tolerant Roman imperial system led to ritual syncretism; whereas societies which professed revealed dogmatic religions like Christianity and Islam were opposed to syncretism in principle and attempted to impose a single body of belief and ritual practice.

Human play differs from animal play in two important respects. First of all, children's play is not merely an expression of exploratory urges and enjoyment of the free exercise of motor expression; it also includes an acting out of various of their psychological problems—their relations with adults, with each other, with the environment. In all play involving catching and escape, fear as well as aggression is acted out (see, for example, Opie & Opie 1959). Here, as in many other fields, psychoanalytic theory helps us to understand human ritualization (see Erikson 1961).

Secondly, it has partly been formalized into games—i.e. play subject to definite rules. Competitive games, especially team-games, are ritualized damage-reducing outlets for aggression, and can serve as substitutes for war, in William James's phrase.

The symbolic or ritually expressive 'acting out' of personal problems and conflicts through painting, writing, constructional play, or in actual dramatic form, is of psychiatric importance. The aim of magico-religious rituals like those of Haitian voodoo is to dissipate painful ideas and obsessive fears through symbolic and sometimes violent ritual expression (F. J. H. Huxley 1966): conversion hysteria can be regarded as an unconscious attempt to achieve similar ends through a symbolic displacement activity.

An extension of one aspect of play is seen in *escape rituals*—organized activities in which man can escape briefly from the disciplined morality and monotony of everyday working life. They include carnivals and fairs, Dionysiac orgies, pharmacologico-religious rituals like the peyote ceremony of some Amerindians, cup finals, and organized holidays *à la* Butlin. Theatres and cinemas and dance halls also provide an escape into the formalized other world of the stage-play, the film and the dance.

Escape rituals are important social safety-valves: when traditional escape rituals have died out or been suppressed, safety-valve rituals spring up to take their place, sometimes ludicrously orgiastic like Beatlemania, sometimes socially anti-adaptive like teenage gang rivalry: one of the tasks of present-day industrialized societies is to provide adequate escape-rituals for their members.

As in animals, stress situations readily lead to distortion of normally stabilized behaviour in man, and may even produce total breakdown of the 'inner ritualization' involved in personality patterning. Some human compulsive rituals are merely peculiar, like

Dr Johnson's obligatory touching of posts when out for a walk, or many people's semi-compulsive ritual of avoiding treading in the cracks between paving-stones.*

An ethological approach could clearly prove of great value in psychiatry. It could also prove of value in education. The ancient rituals of education '*a posteriori*' by flogging, or by other physical punishments, and the still existing ritual of education by a succession of quantitatively markable examinations involving the regurgitation of memorizable facts, are clearly inadequate. If education is not to consist in what Dorothy Parker scarifyingly described as 'casting sham pearls before real swine', it must incorporate rituals, in the extended sense of organized integrative patterns, of explanatory adventure, enjoyment, and fulfilment, always free but always disciplined. Skinner (1964) points out the value of scientifically formalized teaching methods.

Human ritualization resembles that seen in animals in showing the same pair of divergent trends—towards simplification and communication and immediate almost automatic action on the one hand, as in the mechanization of prayer into prayer-wheels or mere repetition of paternosters; and to complexification, delayed action, long continuances, and bonding function on the other, as in the Mass or the initiation rites of almost all cultures.

Finally I want to point out some peculiarities of human ritualization caused by the much greater speed of psychosocial than of biological evolution. This leads to a much higher frequency of non-adaptive or even mal-adaptive survival of rituals originating in relation to an earlier psycho-social environment.

A striking example concerns the Lisbon earthquake of 1755, where Pombal's rescue operations were gravely hindered by religious insistence on ceremonies of intercession (Kendrick 1956). Prayers for rain and ceremonies to avert divine wrath as manifested in pestilence or volcanic eruption, are non-adaptive in a scientific age.

On the other hand, adaptive time-binding and socially bonding traditional rituals in institutions are widespread. The smallest institution in which they can operate effectively seems to be the school (Lorenz 1965*b*). The Old School Tie is a real bonding mechanism, as well as a piece of neckwear acting as a personal recognition signal.

There may also be survival of vestigial rituals, quite analogous to vestigial structures in lower organisms: e.g. the carrying of nosegays, originally to prevent catching contagious diseases, by English judges.

The converse effect is much more serious—the failure of existing human groups, including the human species as a whole, to ritualize their behaviour adequately or effectively in relation to the radically new psycho-social situations of today. This applies to all three aspects of successful ritualization—its communicatory, its conflict-reducing, and its positive bonding functions. Thus the discovery of simple and effective contraceptive methods, together with the growing menace of over-population, has rendered our traditional approach to sex obsolete: new ritualizations are needed to transcend promiscuity, male indulgence and intemperate procreation, and build a true art of love with profound bonding effects, as well as a manageable world society.

* A boy at my prep school invented an extraordinary private ritual, which I commend to the attention of my anthropological and psychological colleagues. Every morning at breakfast he would conceal some porridge, take it up to the urinal, and deposit it in the second compartment from the left.

Secondly, all religious, pseudo-religions and quasi-religions involve formalization or canalization: (a) of intellectual framework—a theology or ideology; (b) of ethics—a moral code; and (c) of expression—ritual in the restricted sense, liturgy, the cult of images, etc. With the weakening of traditional religious systems, better ritualization, of doctrine and moral practice as well as liturgy, is needed for their adaptation to modern conditions. It is still more urgently needed for emergent ideological systems. Attempts are being made to develop appropriate social and moral principles and marriage and funeral ceremonies of a quasi-religious nature for humanists, but much more must be done before a religiously and socially effective humanist system can emerge.

Thirdly, as regards the world situation, the United Nations and its supra-national activities have been very poorly ritualized. Even its flag is a feeble symbol-stimulus compared with almost all national flags: it lacks both professional peace-keeping forces and anything comparable to the national development teams and service corps, like the U.S. Peace Corps and the British V.O.S. Professional ethologists and psychologists are needed to help remedy these deficiencies.

They are also needed to help in the most comprehensive task before this generation—the achievement of a new and effective adaptive patterning of thought and belief about man's place and role in nature.

Intellectually satisfying patterns of thinking and emotionally satisfying patterns of expression and action are urgently needed to canalize successfully man's overriding world activities—the prevention of nuclear war, co-operative world development, the increase of quality rather than quantity, the building of fulfilment societies and of open-ended self-transforming psychosocial systems—in a phrase, the proper ritualization of human destiny on an evolutionary basis.

I hope that this symposium will illuminate one important aspect of the situation and draw attention to the need for concerted action on the basis of co-operative multi-disciplinary thinking.

In conclusion, I want to add my personal thanks to all the contributors, many of them from foreign lands; to the chairmen; to the Zoological Society of London for giving us the use of their fine hall and their other facilities, both gastronomical and zoological, and for allowing me to call on the invaluable services of Dr Desmond Morris; to Dr Tinbergen, F.R.S., for advice on recent developments in animal ethology; and to Dr J. M. Tanner and my son Francis Huxley for similar advice in various human fields; to Mr Walt Disney and Mr David Attenborough for permitting the use of some of their remarkable films. Above all, I want to thank the Royal Society for asking, encouraging, and very materially aiding me to organize this, the second of the symposia they have recently sponsored, designed (after a gap of some 150 years) to bring together representatives of the natural and social sciences, of medicine and psychology, of humane learning and the arts, for joint discussion and mutual illumination; and in particular I wish to thank our then President, Lord Florey, for his encouragement, for his attendance and chairmanship throughout the meeting, and for the steps he has taken to ensure the continuing discussion of the subject under the Society's auspices.

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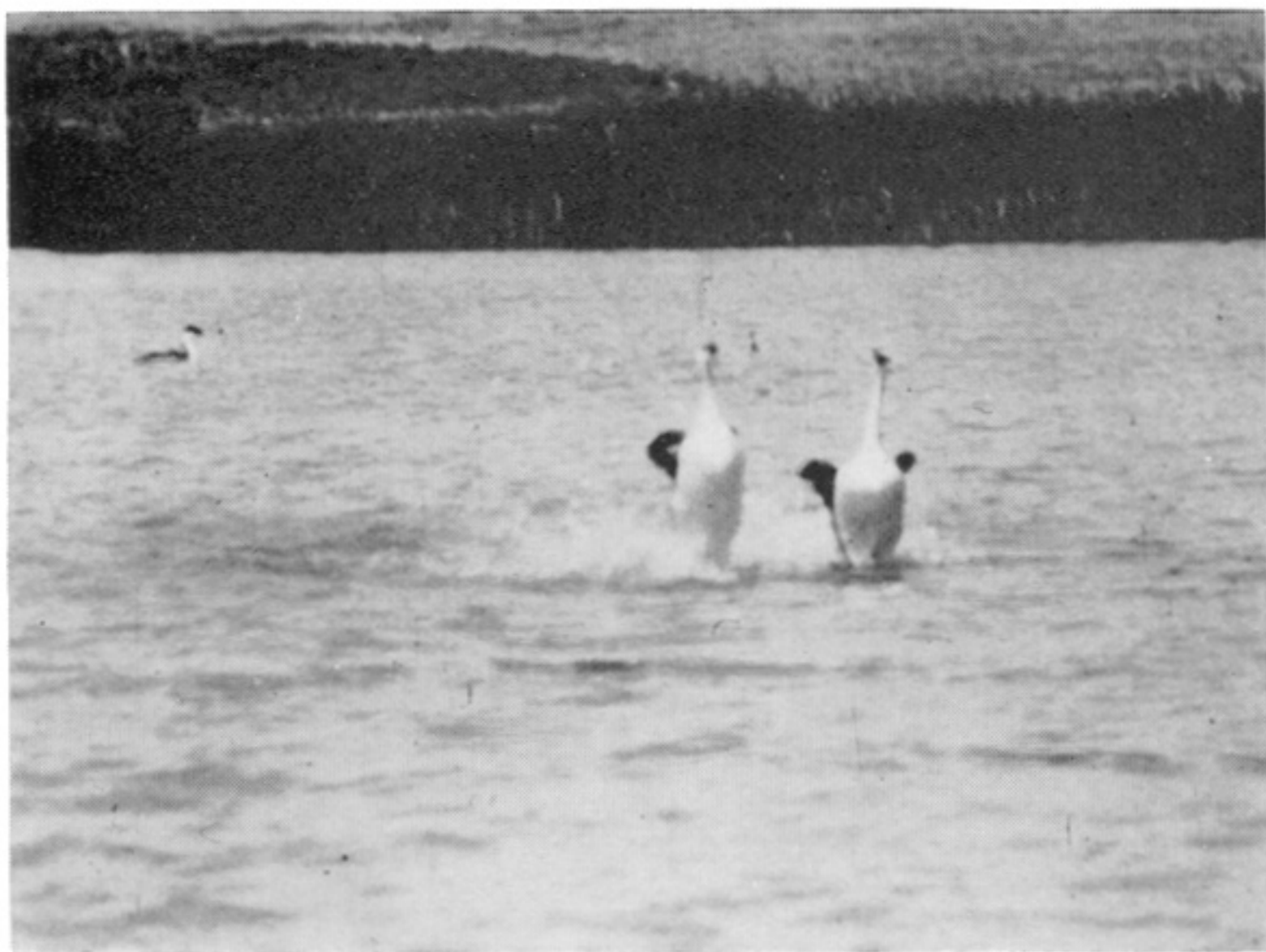


FIGURE 3

FIGURE 3. The 'parallel run' ceremony of the New World Western Grebe (*Aechmophorus occidentalis*). This spectacular pair-bonding ceremony is analogous to the Great Crested Grebe's penguin dance (figure 2). (Photo by courtesy of Walt Disney.)



FIGURE 4

FIGURE 4. Nest-relief ceremony in the Louisiana Heron (*Hydranassa tricolor*). This ceremony has its origins in a trivalent situation involving sexual attraction, hostility and fear. The upright neck of the sitting bird is an appeasement gesture signifying non-attack, as is its mate's displacement presentation of nest-material (sticks) which are built into the nest by the sitting bird before the pair change places. The mutual display of striking epigamic structures is sexually stimulating. This elaborate ritual, which occurs also during the nest-building period, is the major pair-bonding ceremony in this and other herons. (J. S. Huxley photo.)



FIGURE 5. The 'stage' or display arena of the Stage-maker Bowerbird (*Scenopoetes dentirostris*). The male clears the stage of dead leaves and other debris and decorates it each day with fresh leaves of selected species of trees, which he saws off with his adaptively serrated beak. They are actually placed with light underside visible: if reversed, the male turns them back. Some broken snailshells are usually added. The male sings loudly and almost continuously from a song-perch 2 to 10 ft. above the arena, but does not perform any visual display. (From A. J. Marshall 1954, photo. S. W. Jackson.)

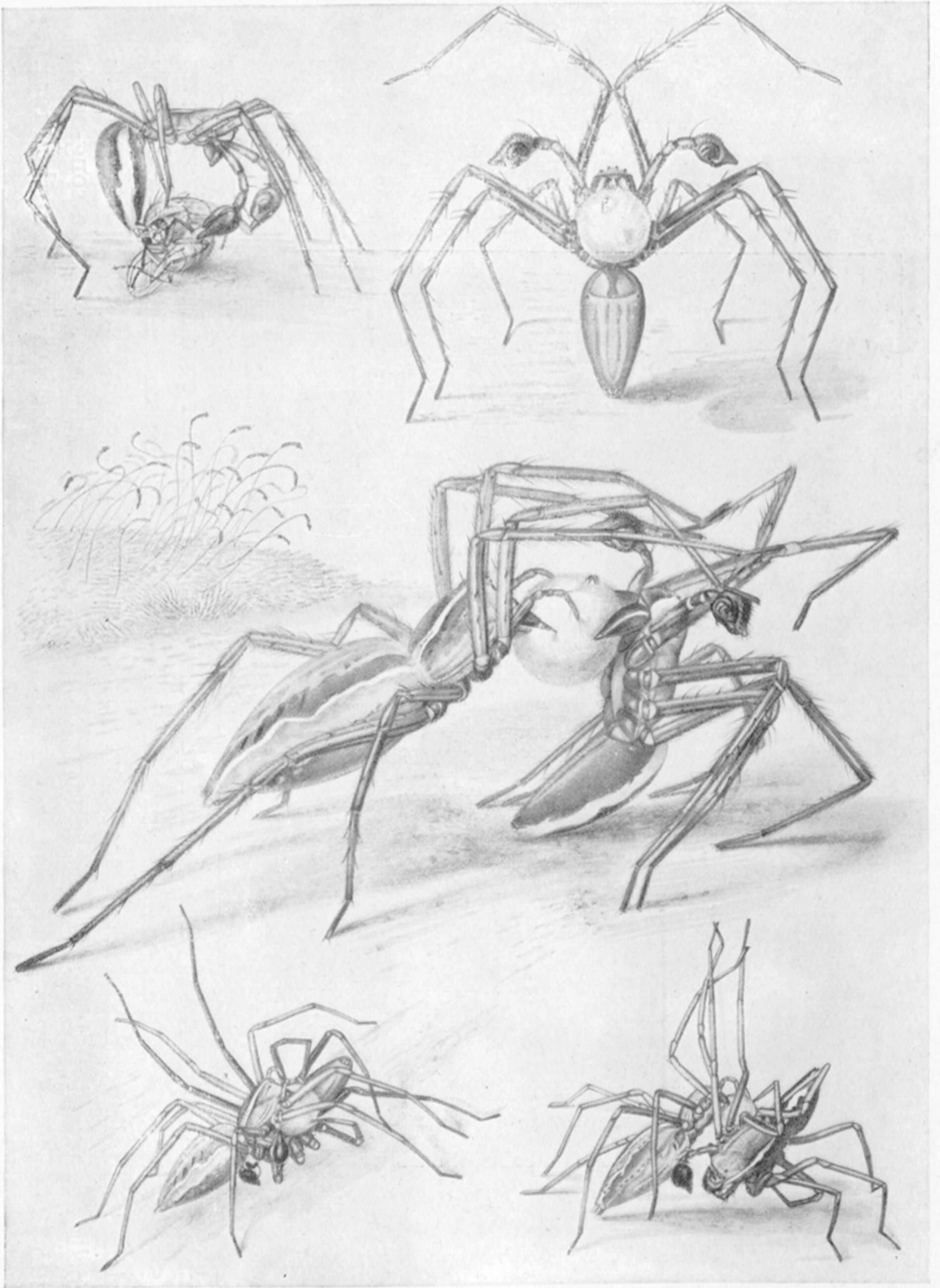


FIGURE 7. A male *Pisaurus mirabilis* wraps a fly in silk, displays it and himself, forcibly presents it to the female, and prepares to copulate with her. (From Bristowe 1958.)

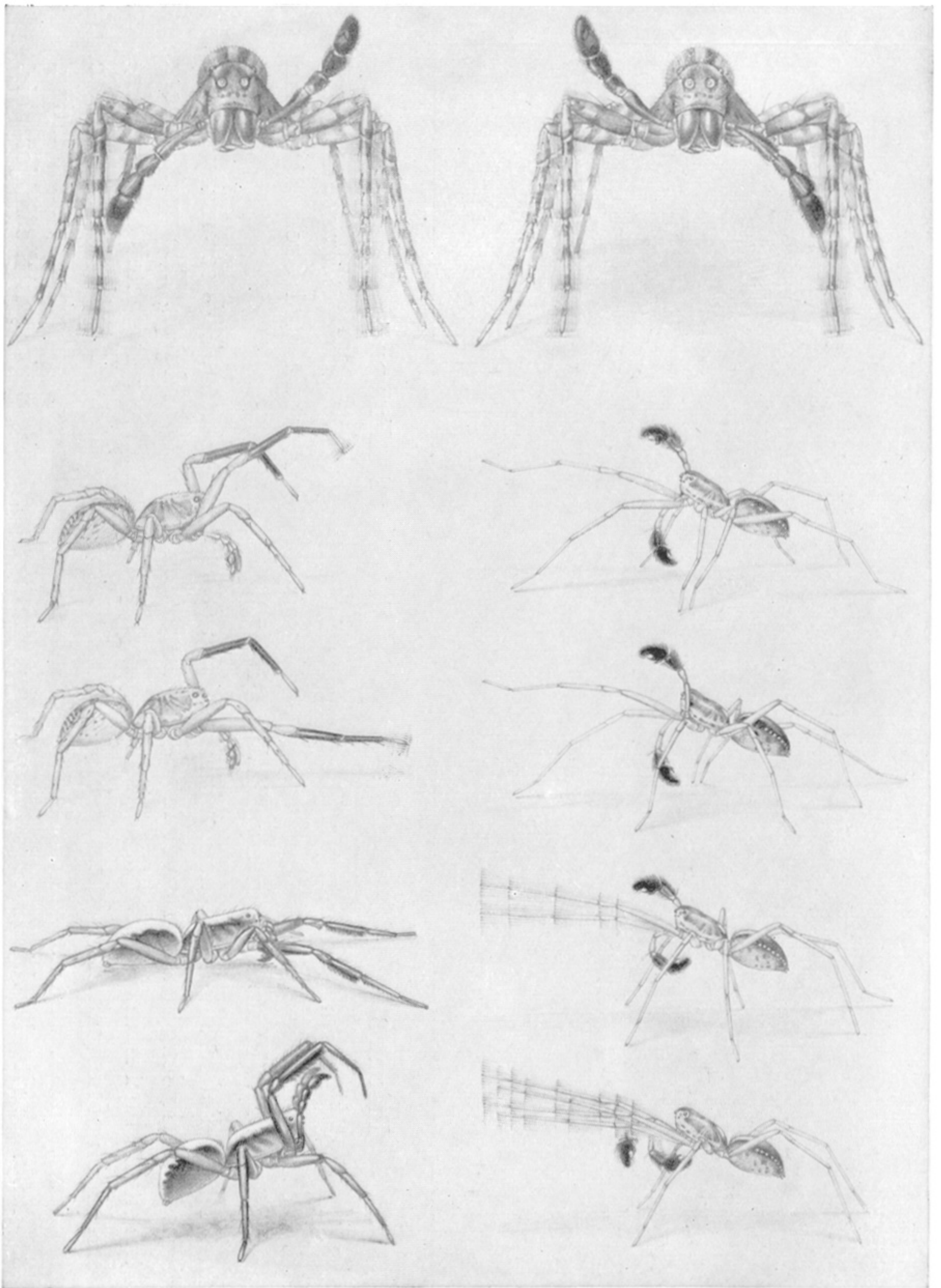


FIGURE 8. The display of male Lycosid hunting spiders signals their non-prey status to the female. Above and on the right, the 'semaphore' display of *Lycosa amentata* and *L. nigriceps*. Centre and bottom left, the displays of *Trochosa terricola* and *Tarentula barbipes*. (From Bristowe 1958.)

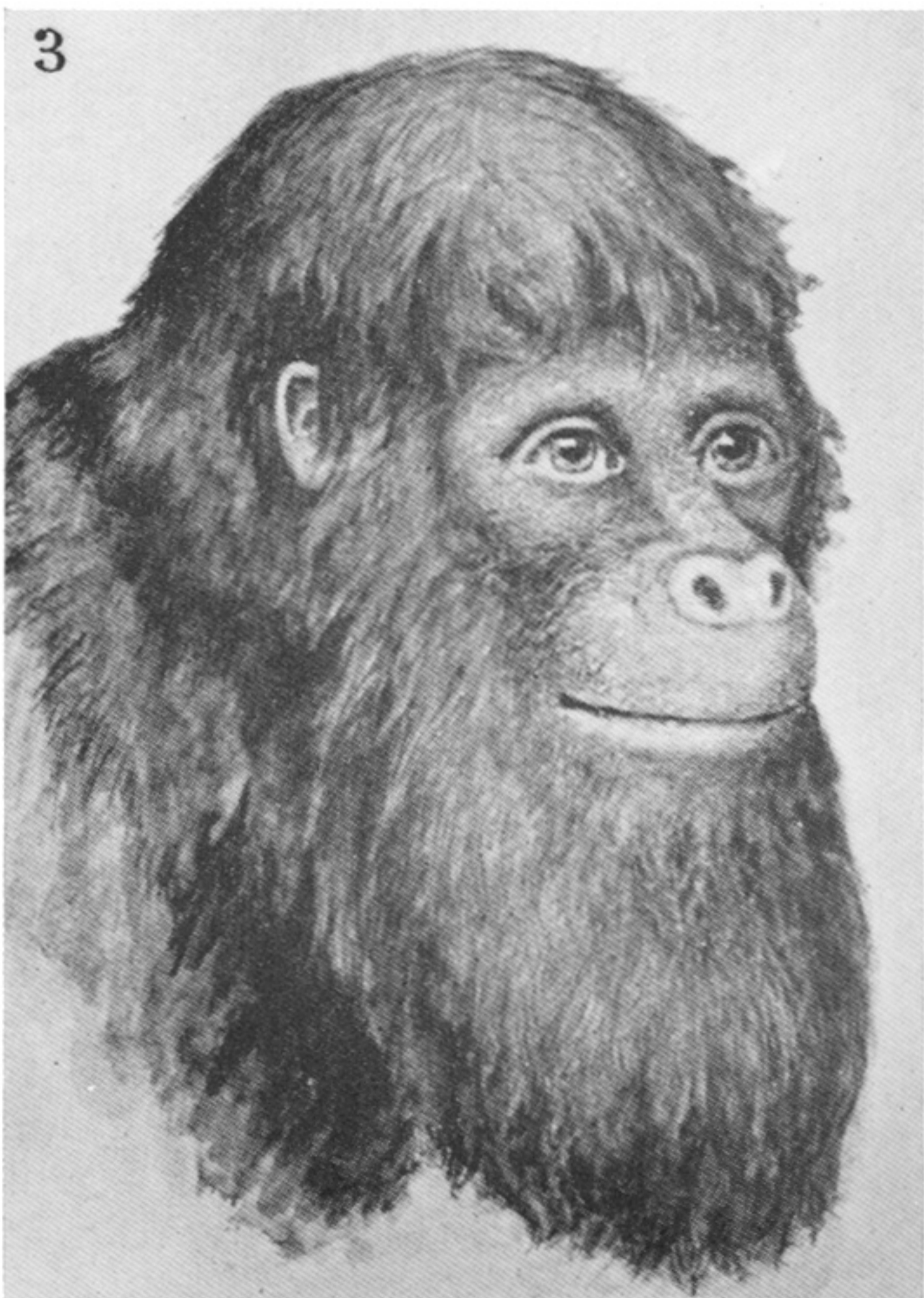
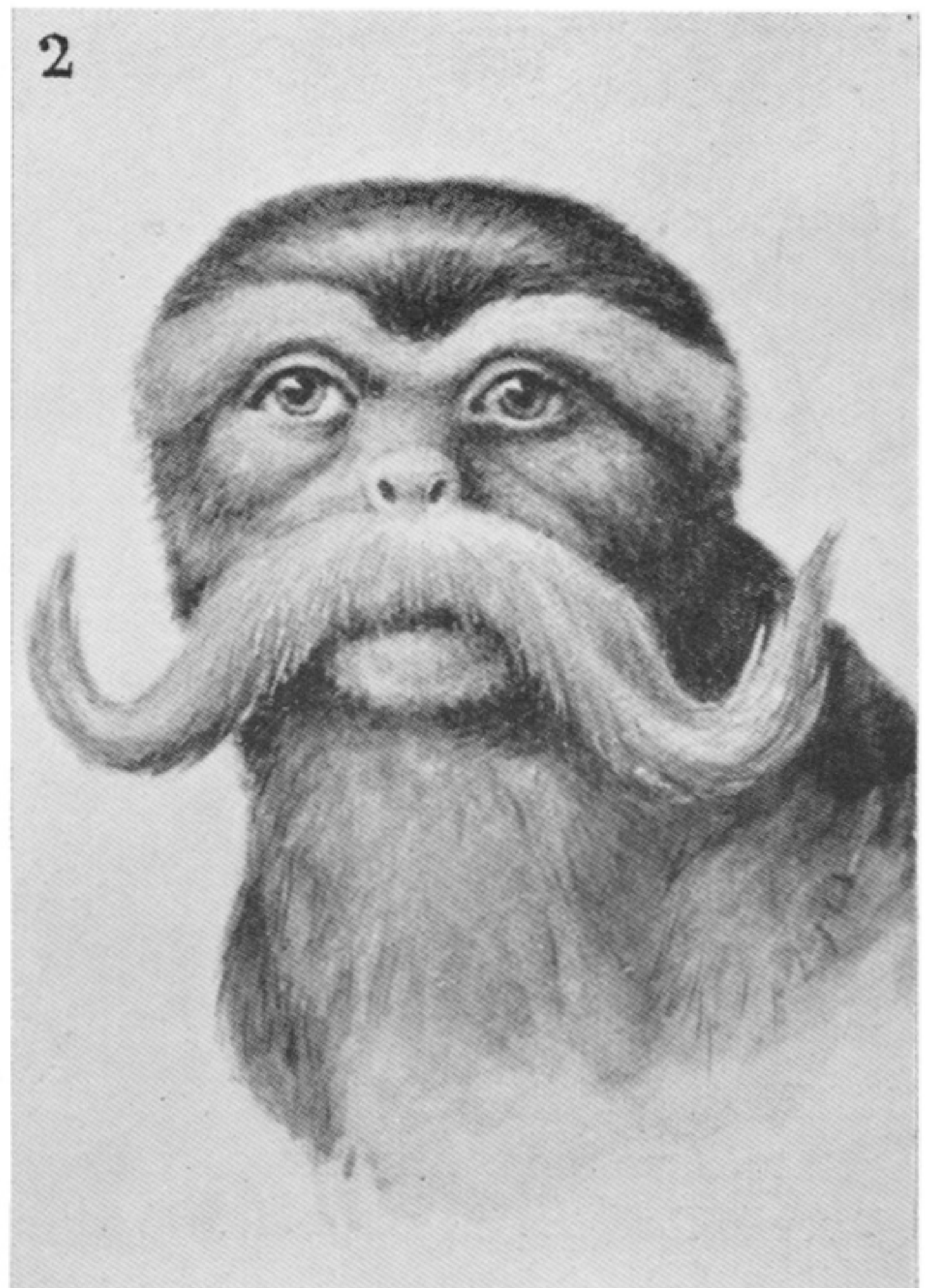
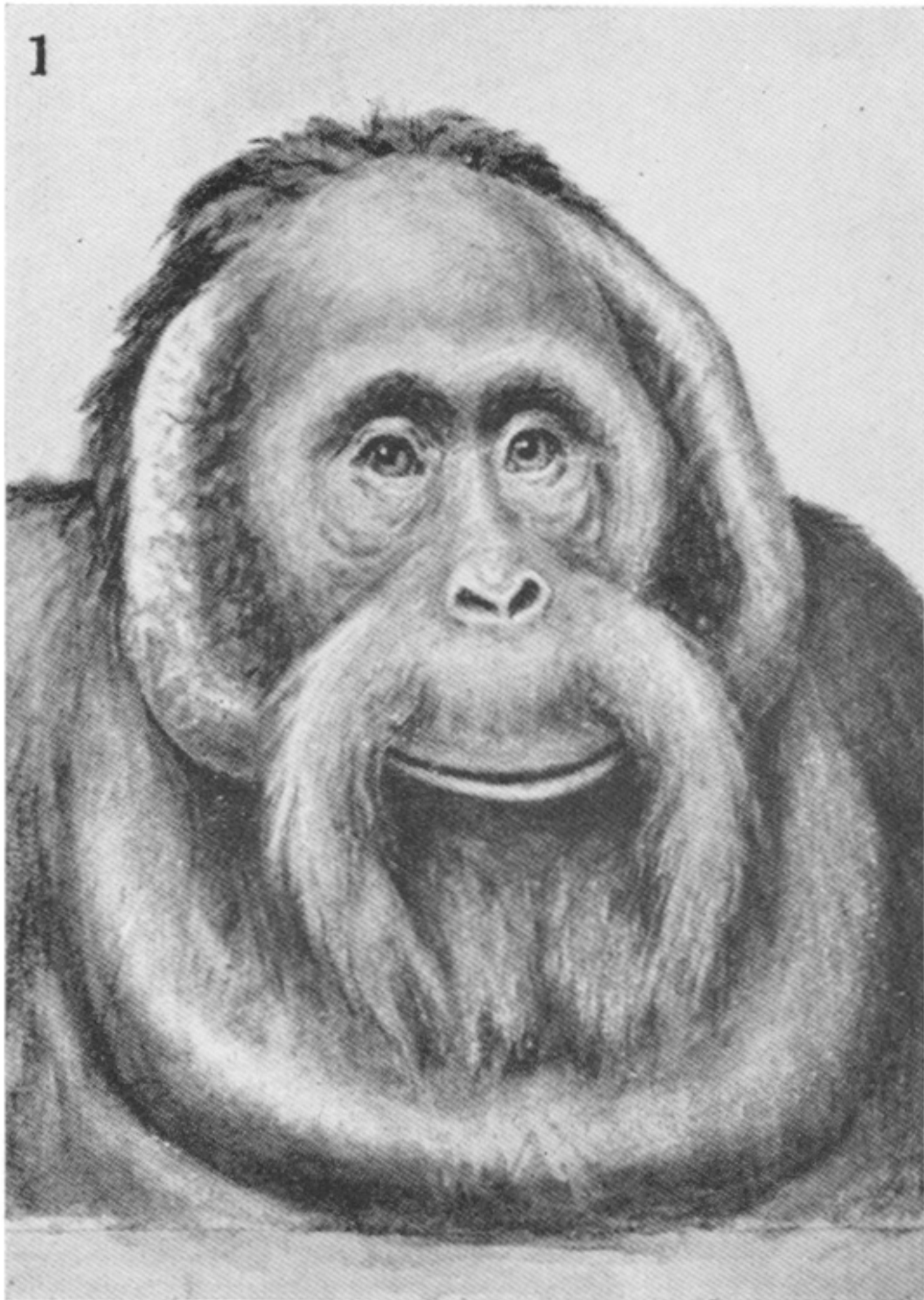


FIGURE 11. Facial threat-characters in male primates. (1) Anthropoid: Orang-utan (*Pongo pygmaeus*); (2) and (3) New world primates; (2) Tamarin Marmoset (*Midas imperator*) (Hapalidae), (3) Satan Monkey (*Chiropotes satanas*) (Cebidae); (4) Old World baboon: Mandrill (*Mandrillus sphinx*) (Cynopithecidae). (From Pycraft 1913, drawings by I. Thornton.)

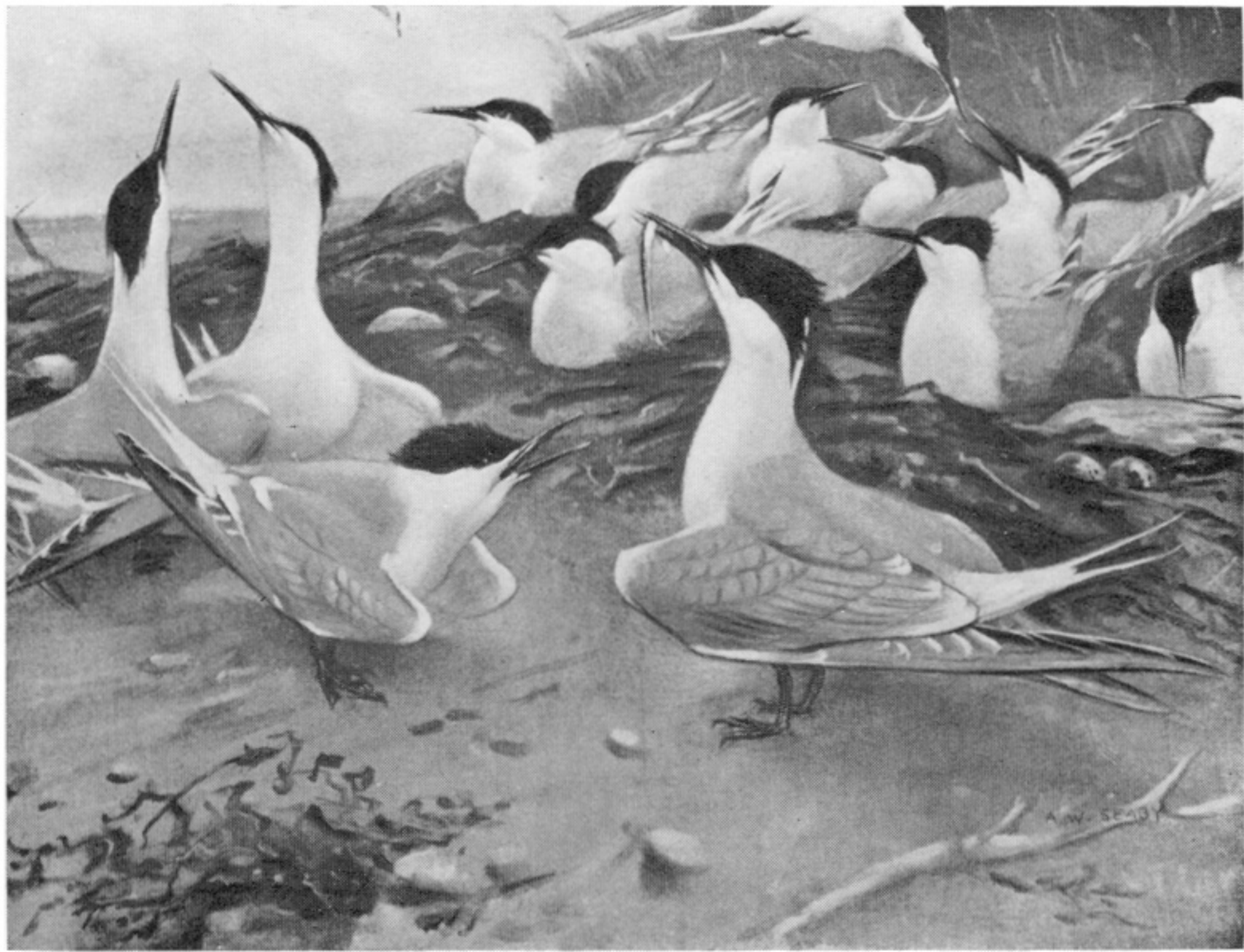


FIGURE 13. Displays in the colony-nesting Sandwich Tern (*Sterna sandvicensis*). Left, a mutual display in non-attack position. Centre, food-presentation display by the male to the female, who adopts the juvenile food-begging attitude. (From Kirkman 1911-13, vol. 3.)

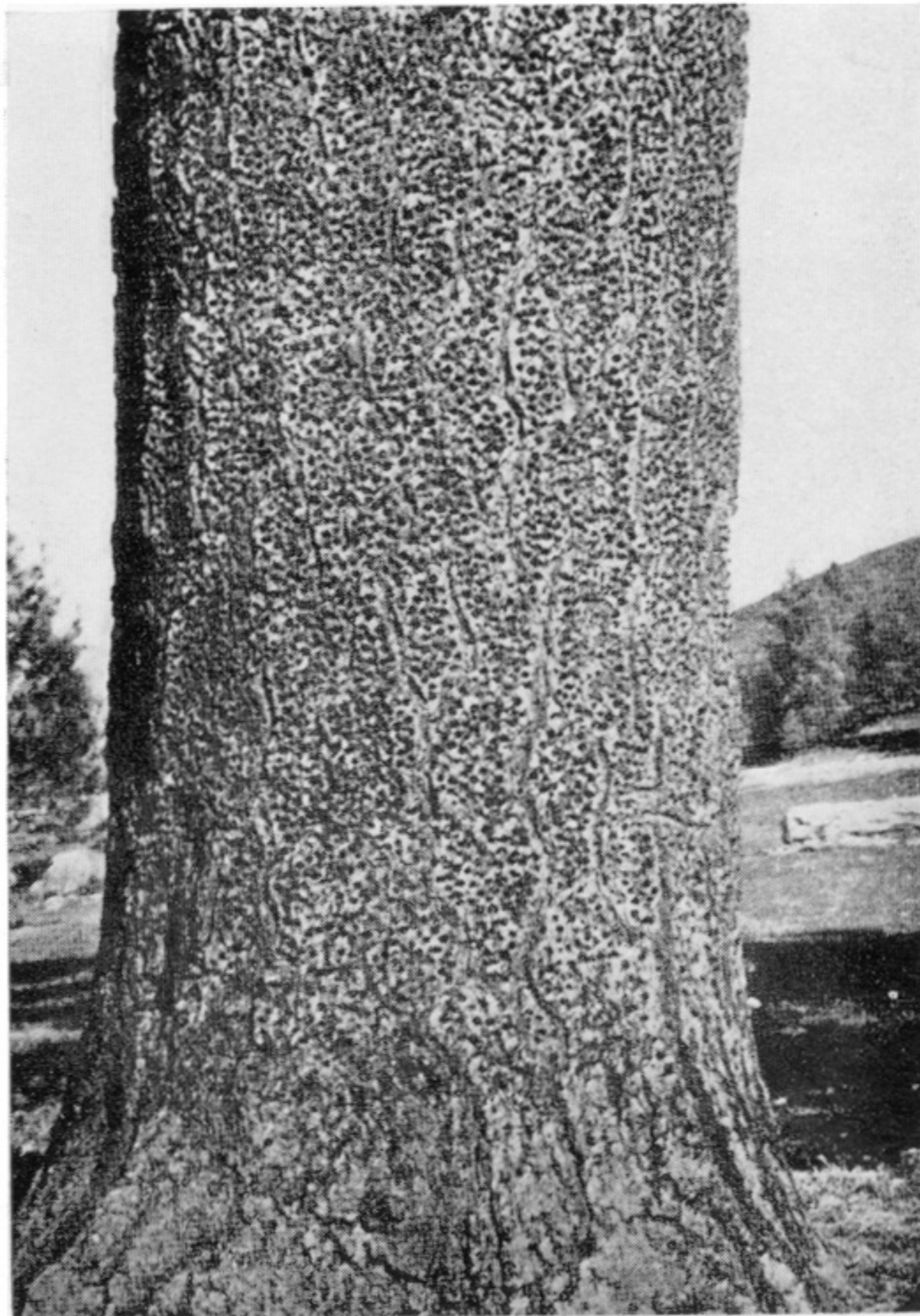


FIGURE 14. Yellow pine with approximately 50 000 holes bored by the Acorn (California) Woodpecker (*Balanosphyra formicovora*) to store acorns. (From Wynne Edwards 1962, after W. L. Dawson.)

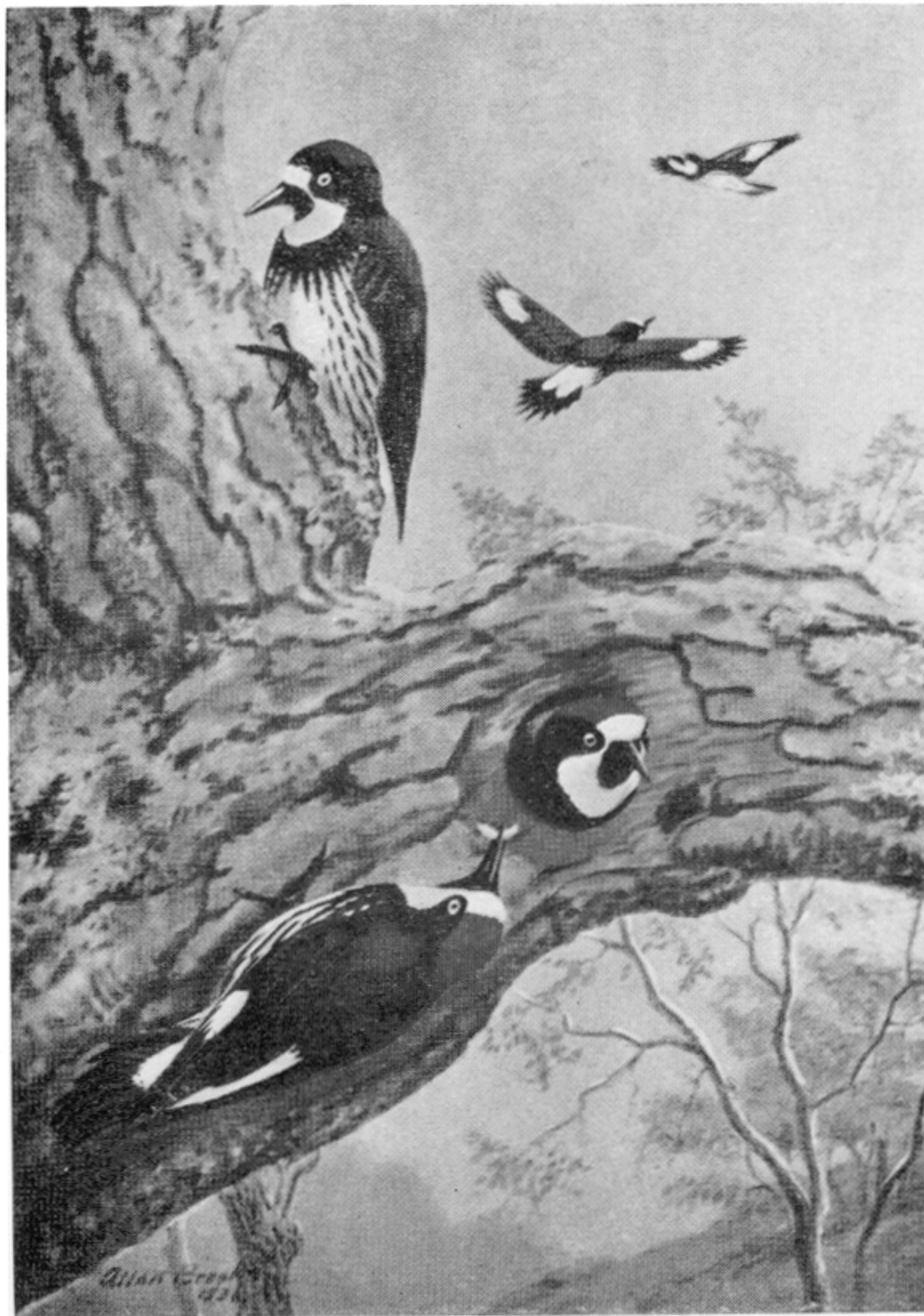


FIGURE 15. Social display flight of acorn woodpeckers during acorn storage.
(From Wynne-Edwards 1962, after Ritter.)



FIGURE 16. In its social autumnal displays the Stone Curlew (*Burhinus oedicanus*) wave their wings, run about erratically and fling themselves sideways. (From Selous 1902.)

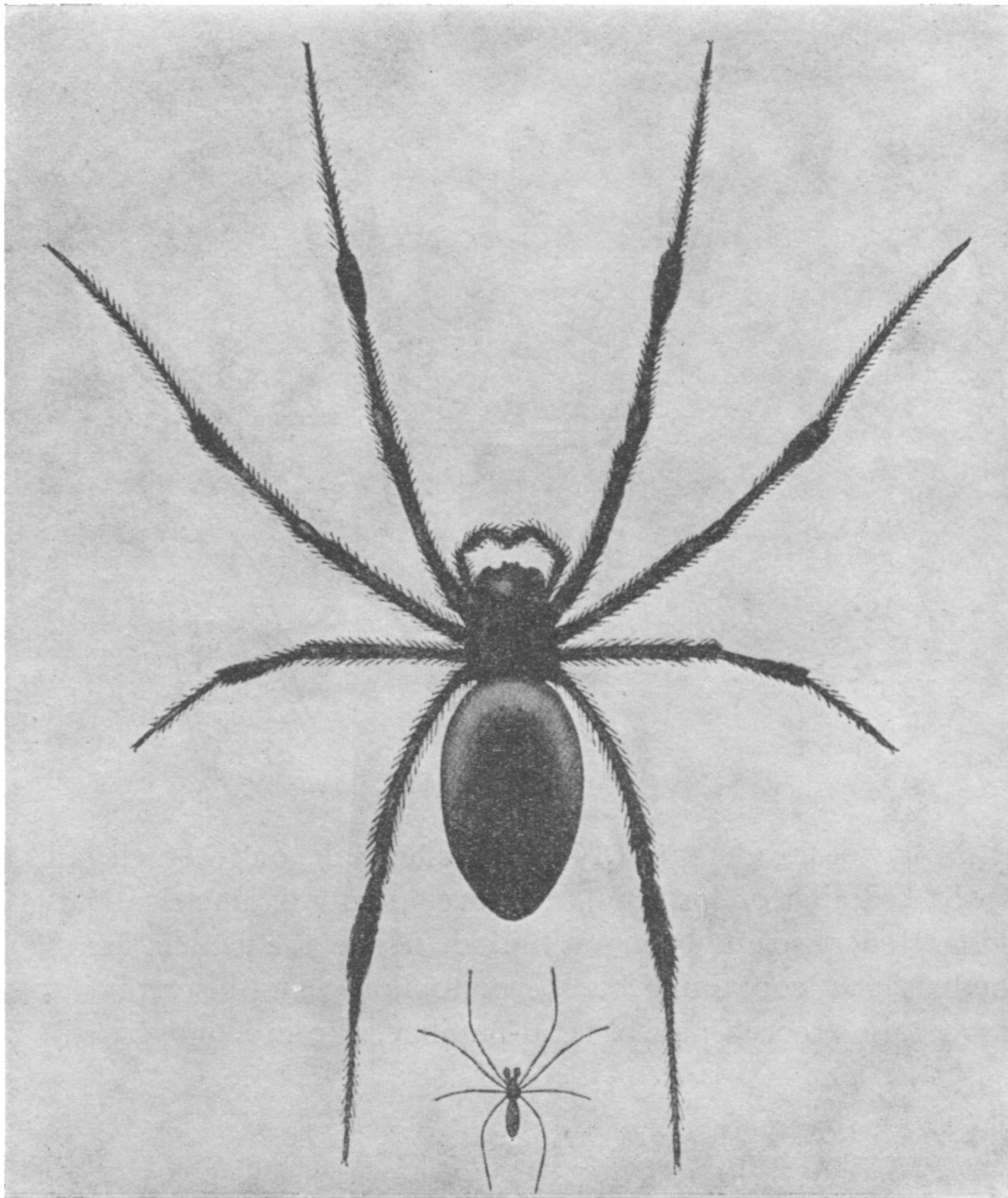


FIGURE 9. Male and female of the orb-web spider *Epeira* (*Araneus*) *nigra* from Reunion Island. The 500-fold smaller male spends most of his time on the female's back. (From Meisenheimer 1921, after Vinson.)