

The Concept *Privacy* and Its Biological Basis

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Privacy is viewed as a regulatory process that serves to selectively control access of external stimulation to one's self or the flow of information to others. It may be manifested by a physical separation or withdrawal from conspecifics. Privacy may also be manifested by actions that mislead potential competitors as to the motivational status or strength of the individual in question. The degree to which this occurs is often related to simple economic (cost/benefit) principles. But in each species the variables that define the cost/benefit equation may vary. Generalizations about privacy are thus unlikely to prove useful.

The solitary recluse and the lone possum both portray familiar, if extreme, scenarios: "I want to be alone." Can these forms of privacy shown by men and possums be considered similar in any but surface features? To what extent in the animal kingdom does privacy subserve common functions? To what degree does it rest upon similar mechanisms? What are those functions, and how are they served? What is the significance of withdrawal from usual social contacts? Is withdrawal related to other manifestations of privacy? Is total separation from one's kind to be viewed as one end of a continuum that also extends to total immersion in a society? Or is separation a pathological state qualitatively distinct from other, more tempered, forms of isolation? These are the queries to which we direct our focus.

PRIVACY: HOW BASIC A TRAIT?

According to Westin (1967):

Man likes to think that his desire for privacy is distinctively human,

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a function of his unique ethical, intellectual, and artistic needs. Yet studies of animal behavior and social organization suggest that man's need for privacy may well be rooted in his animal origins, and that men and animals share several basic mechanisms for claiming privacy among their own fellows. . . .

One basic finding of animal studies is that virtually all animals seek periods of individual seclusion or small-group intimacy. This is usually described as the tendency toward territoriality, in which an organism lays private claim to an area of land, water, or air and defends it against intrusion by members of its own species. A meadow pipit chases fellow pipits away from a private space of six feet around him. Except during nesting time, there is only one robin on a bush or branch. . . . For species in which the female cannot raise the young unaided, nature has created the "pair bond," linking temporarily or permanently a male and a female who demand private territory for the unit during breeding time. Studies of territoriality have even shattered the romantic notion that when robins sing or monkeys shriek, it is solely for the "animal joy of life." Actually, it is often a defiant cry for privacy, given within the borders of the animals' private territory to warn off possible intruders. (pp. 8-9)

No small number of authors have similarly affirmed the biological roots of human social intercourse. This affirmation rests largely upon the undoubted continuity in the evolutionary sequence that led to vertebrates and man. From this, however, it does not follow that because two behavior patterns are similar in appearance, or even in function, their underlying mechanisms and origins are alike. The seemingly identical green surfaces of forest insects may be developed with different pigments or even nonpigmented, refracting scales. Hence, we should not begin our inquiry by assuming that perceived similarities reflect an evolutionary sequence.

PRIVACY: A BIOLOGICAL VIEW

Withdrawal from others is ubiquitous across most of the animal kingdom. Exceptions, however, are notable largely among the colonial invertebrates and social insects. The degree and character of withdrawal does differ, however, ranging from physical separation to a restriction of information transfer. How, then, does one distinguish the type of withdrawal that corresponds to our human view of what constitutes privacy?

We propose that the concept *privacy* is best viewed as a regulatory process that serves to selectively control access of external stimulation to one's self or the flow of information to others. It has been appropriately likened to the processes that

produce changes in the permeability of a cell's membrane (Altman, 1975). Privacy thus entails both a restriction of inputs (including those from the physical and biological *Umwelt*) as well as of output. It is also a dynamic process, not unlike its analogue, the cell membrane, and is capable of showing continual and selective shifts in permeability. Privacy may depend upon controlling or limiting interactions with others, through territorial behavior, for instance. Conversely, territorial behavior may also serve to maximize social contacts, not prevent them (Armstrong, 1947). Furthermore, control over stimuli (privacy) can also take place independently of territorial behavior or physical isolation. Margulis (Note 1) has stated the distinction between privacy and territoriality clearly:

[We should not] confound control over information (privacy) with control over interactions (territoriality, personal space, crowding). These phenomena are related in the world of events but nevertheless are analytically distinct at the conceptual level.

The degree and character of the privacy an organism attains must represent a compromise between competing forces. A German parable (cited in Wilson, 1975, and attributed to Leyhausen) recounts the dilemma of two hedgehogs that sought to keep warm by huddling closely together. Warming was thus achieved, but their prickly spines produced another problem. This resolved when they drew apart. Courtesy (the compromise between competing forces) represented that distance at which heat exchange and tactile discomfort were perfectly balanced. This distance, not incidentally, would be expected to change with ambient temperature.

Some of the competing processes that determine the values of the forces controlling the flow of information are doubtless to be found in the immediate environment: A cold pup will be less likely to isolate itself from siblings than a hot one. Other controls may relate to past contingencies, the time since last feeding, or, more remotely, to the amount of social contact received in previous months. The etiology of social (or private) responsiveness may even be traced to the experiences of the unborn subjects' mother. For example, the degree of "emotionality" of pregnant mice directly affects the emotionality of their pups (Keely, 1962). Finally, ultimate, or historical, factors must be considered: The point of present-day compromise may be influenced by mechanisms that were formed in response to pressures that acted at some considerable time in the past.

Interactions between organisms have been conceptualized in

terms of economic principles (Hannon, 1976). This was implied by Malthus and made explicit by Darwin. For instance, if the cost-benefit ratio of maintaining an exclusive territory is more favorable than that of adhering to the waiver of territorial claims, territoriality will evolve, and the territory holders may be expected, in evolutionary time, to prevail. Thus, we see defense of feeding territories manifested in such organisms whose foods are more or less evenly spaced, in small packets, and are of predictable occurrence—for instance, nectar-feeding birds (Gill & Wolf, 1975). Feeding territories would not be expected where the food occurs randomly, relatively unpredictably, or is available in excess but transitory quantity, as is the case of fish-eating seabirds (Klopfer, 1969). Similar reasoning has been applied to the question of why species differ in their sexual systems, ranging from asexuality through hermaphroditism, haplodiploidy, polygamy, polyandry, and monogamy (Ghiselin, 1974). Thus, the relevance to man of animal studies of privacy depends upon the discovery of the governing principles upon which the presence and form of privacy are predicted, rather than upon the description of privacy *per se*.

The multifaceted aspect of behavioral control and development, the dependence of behavior on a variety of proximate and ultimate causes, often has not been adequately considered in the search for simple causality. At the very least, multiple causality implies that surface similarities or similarities between mature structures cannot be taken as evidence for similarities in the molecular structures from which the mature structures develop (Lenneberg, 1967). This severely limits, if it does not altogether disallow, the use of so-called analogous (similar in function) and homologous (common origins) structures or behavior in evolutionary and comparative studies (Klopfer, 1976).

Classical ethologists, for instance Lorenz (1974) in his Nobel address, have maintained otherwise. They believe so strongly in Darwin's continuity of mental evolution and the applicability of the methodology of comparative anatomy to behavior as to have few doubts about their ability to retrace the pattern of behavioral evolution from studies of extant forms. Darwin's belief in the continuities in behavior was almost certainly correct, but this does not require one to treat behavior as though it were an explicit structure, coded by a specific portion of the chromosome and transmitted from generation to generation in accordance with Mendelian principles. If this is not required, then the comparative anatomic approach to behavior becomes invalid. We must then view behavior as

a system that has multiple controls, including some which are genetic. The pathways of causality and control are numerous, however, with many cross-overs, so it is rarely if ever possible to isolate single heritable factors whose effects are inevitable and irreversible. (Klopfers, 1976, p. 12)

Extrapolation from one species to another depends upon distinguishing those features that are due to a common function (analogues), which do not aid in evolutionary extrapolations, from those that share a common origin (homologues). The interactive nature of behavioral development and control, however, precludes so simplistic a dichotomy. Whether structures or behavior are judged analogues or homologues depends heavily on the level of the analysis—the “grain” of the investigator’s perceptual field (Klopfers, 1976). Facile extrapolations from rat, or even monkey, to man are thus also precluded.

This does not mean that animals have nothing to teach us about man. Aside from the academic interest attached to privacy in other animals, we can study the form and function of privacy in these animals in hopes of delineating governing principles that, in turn, might provide insight into the human need for privacy.

TYPES OF PRIVACY

There are solitary species and there are social species. These attributes are distributed throughout the animal kingdom. In his seminal treatise on biosociology, Wilson (1975) recognizes four lineages that lead to separate pinnacles of sociality: the colonial invertebrates (including creatures like the Portuguese man-of-war), the social insects (including the honeybee), birds, and mammals. Man represents the culmination within the last group. Moving from the first to the last of these pinnacles, Wilson perceives increasing interindividual aggressiveness, selfishness, and decreased dependence upon group membership for survival. A solitary honeybee cannot survive; a solitary man has survived, despite the fact that the species to which the man belongs has also by far the richest, most complex, and malleable social forms. This underscores the repeated and independent emergence of sociality in different phyla and the consequent necessity for examining governing principles rather than specific examples.

Physical Separation

Among truly solitary organisms, the issues concerning privacy are most easily resolved. The ultimate determinants of the solitary

habitat are generally scanty or widely distributed resources on which the organism depends, though sometimes this condition leads to a particular type of sociality, as in the Hamadryas baboons (Kummer, 1971). The proximate determinants, their lability, and the effects of violation of the solitary habit can well be subject to experimental manipulation. Where seasonal alterations occur, or changes in behavior as a function of changing environmental conditions, the role of specific ultimate factors may also be confirmed. The solitary, stationary locust is transformed into the social, volant form as a result of the increased tactile stimulation that growing populations produce. In this case, enough jostling by conspecifics ultimately overcomes a tendency to retire (Ellis, 1959).

Species that are usually social show differing degrees of separation. Many species of perching birds defend individual territories. To this extent they can be said to insist on a private breeding or feeding ground. At the same time that a territory assures one degree of privacy, however, it also provides a periphery for interactions with others, which may be a major function of territoriality (Armstrong, 1947). Birds certainly know their territorial neighbors: Weeden and Falls (1959) among others, have shown, using tape recorded songs, that a territorial male responds quite differently to the recorded calls of near and distant neighbors.

Sociality may also be of the communal sort, as in the Galapagos mockingbird (Hatch, 1966), which defends a group territory, or the degree of communality may shift along with food or other resources dependent on climatic conditions. This is presumably the case in Mexican jays where the degree of sociality appears to be labile (Brown, 1964). Even within communal societies, however, individuals may temporarily withdraw, as does the female moose during parturition (Altman, 1958). Whether withdrawal is always occasioned by such predictable circumstances and whether it is always functional represents a set of queries to which we can as yet provide no answers.

Withdrawal, a physical privacy, may also represent the only way to achieve concealment; in turn, for many organisms, concealment may be the sole defense against predation. It is possible to develop models that allow prediction of cases in which a solitary, private mode of life would be favored over gregariousness (Triesman, 1975). If a potential prey’s privacy protection comes from hiding and if detection by a predator results in but a single kill, group formation may be the best strategy for the prey. Where the predator makes multiple kills, privacy is favored. Of course,

prey organisms have other needs, too, that may conflict with the need for remaining watchful. Increased gregariousness increases the number of watchers, perhaps offsetting a decrease in concealment. Triesman (1975) has developed a mathematical model based upon statistical decision theory for predicting the degree of gregariousness or solitariness certain circumstances might generate. A broader although qualitative treatment of this theme has been provided by Alexander (1974), who has attempted to list all possible advantages and disadvantages to group life. A recent field study of colonial bank swallows (Hoogland & Sherman, 1976) also illustrates the application of models to understanding sociality. The colonial swallows Hoogland and Sherman studied were found to suffer increased competition for nest sites and materials and for mates, to experience more misdirected parental care, and to suffer from enhanced transmission of ectoparasites. All of these drawbacks were apparently offset by the reduction in predation that coloniality produced.

Information Management

Privacy exists even among highly social animals. Although extensive social bonding limits the amount of privacy that can be achieved by withdrawing from a group, other means of achieving privacy involving management of the flow of information can be used. Thus, even while surrounded by neighbors, privacy can be achieved by preventing others from acquiring complete and accurate information about one's internal state or future intentions.

Acquiring accurate information about the environment is essential for survival, and the elaborate sensory capabilities of most social animals attest to this fact. In general, an organism's relative fitness is related to its ability to correctly perceive and interpret its surroundings. Thus, the better an organism observes and assesses the environment, the greater its chances of surviving, finding mates, reproducing, and ensuring the success of its progeny.

The importance of acquiring accurate information applies to social situations as well. This is especially true in situations in which rivals contest the acquisition or ownership of a valuable resource. In such situations, the ultimate acquisition of the resources is interwoven with the organism's ability accurately to appraise a rival's competitive proficiency and strategic intentions. Although it is generally imagined that most competitive encounters are extremely violent, the fact is that most interactions are resolved

without recourse to physical contact. Instead, contests involve the use of nontactile signals and displays and are terminated when one contestant convinces the other of its superior competitive ability. By understanding the relationship between the benefits derived from and the costs associated with physical aggression, it is easy to envision how nonviolent competitive tactics could have evolved. Clearly, physical contact, where might is challenged directly, provides the most precise means for assessing an opponent's competence while demonstrating one's own ability. But such accuracy is not acquired lightly. Costs assessed in the currency of sacrificed future reproductive potential, resulting from an injury, are often greater than the rewards associated with the resources being contested. As a result, natural selection leads to a reduction in violent physical contact until a balance with respect to costs and benefits is struck.

Using game theory, Maynard-Smith (1976) has shown that in a hypothetical population in which there are only three types of competitive behavior—displays, escalations, and retreats—selection will neither favor individuals adopting a totally "hawkish" strategy (escalate until injured or until an opponent retreats) or a totally "dovish" strategy (display but retreat before being injured if the opponent escalates). Thus, even in the simplest models, selection works to attenuate the use of force and to increase the use of signals.

With nontactile signals playing such an important role in determining the allocation of resources among the individuals in a population, it is not hard to imagine that selection would work to make such signals more stereotyped and less ambiguous. One result of the evolutionary transformation (ritualization) of behavior patterns into effective communicative signals is that they will acquire a characteristic form or "typical intensity" (Morris, 1957). According to Morris, typical intensity describes the relationship between the form of the signal and the motivational state of the animal. Figure 1 is an adaptation of Morris's illustration of a behavior pattern showing typical intensity. Over the normal range of internal motivational levels, the form of the display does not vary. Only at extremely high or low levels of motivation does the form of the signal become altered.

Ethologists have accepted Morris's notion that such displays have been selected because they provide an accurate means of transmitting information. However, even though it may be true that signals of a characteristic form reduce the ambiguity of the overt messages associated with them, the fact that the form of

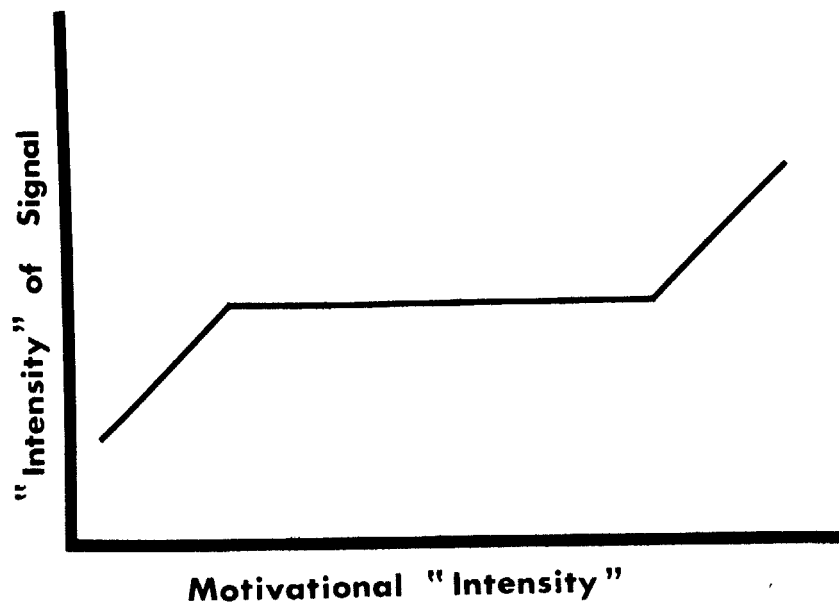


Figure 1

Relationship between the form of a display and the animal's internal motivational state for a display showing "typical intensity."

these signals is not associated with the organism's motivational state enables the sender to keep some information about itself or its intentions to itself. In essence, the organism has obtained some privacy. Thus, although an animal may send an overt message, such as "I plan to escalate if you do not retreat," by means of a signal of typical form, it may also be hiding the fact that its present motivation level is low and that in reality it is on the verge of withdrawing. As a consequence, one of the functions of privacy is the withholding of information that otherwise might provide an opponent with a competitive advantage. If this is often the case, then privacy should be considered an essential element in the struggle for survival, and its existence underscores the claims of Wallace (1973) and of Otte (1974) that animals actively deceive others.

Humans also can shield their true identity by constructing particular images of themselves. We do this to generate feelings of security and happiness. We are experts in withholding informa-

tion in order to accomplish economic, political, sexual, and social goals deemed necessary to our emotional well-being. The techniques used are quite diverse and range from adjusting personal attributes, such as mode of speech and manner of dress, to formulating elaborate legal checks and social conventions to insure confidentiality in dealings with people and institutions. However, to the degree that the human need for privacy may also have a proximal motivation in the desire for happiness, it is a peculiarly human concept.

Since the maintenance of some degree of privacy is important for an animal's survival, it is important to evaluate some of the competing forces, in terms of costs and benefits, that determine the level of privacy exhibited in particular cases. Clearly there are benefits associated with privacy. For instance, by increasing another individual's misinterpretations of the environment an animal may increase its own fitness. In general, increases in fitness that are associated with increasing levels of privacy can be represented by monotonically increasing functions such as G in Figure 2. However, as depicted by the function dG/dp in Figure 2, there is a decrease in the amount of fitness gain associated with increasing levels of privacy. This means that although increased privacy leads to greater fitness, each additional increment of privacy contributes less to the total than the previous increment. Also, there are costs associated with the maintenance of privacy,

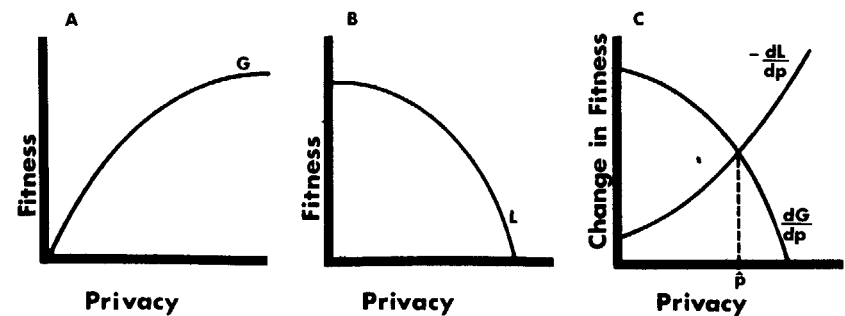


Figure 2

(A) The function G shows the fitness gain associated with increasing levels of privacy. (B) The function L shows the fitness loss associated with increasing levels of privacy. (C) An equilibrium level of privacy (\hat{p}) is achieved when the change in fitness loss function, $(-dL/dp)$, intersects the change in fitness gain function, (dG/dp) .

whether it is in the energy expended in patrolling a territory, in the time wasted in prolonged interactions in which the organism endlessly attempts to assess the true state or intentions of its opponent, or simply in the loss of inputs that results from withdrawal. Such costs could be represented by monotonically decreasing functions such as L in Figure 2. In this instance it appears that the change in fitness loss, as depicted by the function $-dL/dp$ in Figure 2, increases as the level of privacy increases. This means that although increased privacy lowers fitness, every subsequent increase in privacy increases the amount of fitness lost. As illustrated in Figure 2, populations will exhibit an equilibrium level of privacy (\hat{p}) that will be reached when the marginal gain in fitness due to increased privacy equals the marginal loss of fitness due to increased privacy. The exact location of the equilibrium will depend on particular aspects of an animal's environment and social system because the shapes of the functions are generated by these considerations. For example, the equilibrium level of privacy exhibited by a species will vary depending on its reproductive cycle or whether populations inhabit open or closed habitats.

VIOLATIONS OF PRIVACY

What happens when the equilibrium level of privacy is altered? The physical constraints applied by overcrowding, for example, may disrupt the mechanisms that ordinarily assure privacy. But if all members of a crowded population suffer a proportionate advantage, there should be no change in their relative fitness. It is as if everyone's currency were simultaneously devalued. Yet observations reveal both a variety of individual pathologies that appear in response to "violations," as well as behavioral mechanisms that mitigate some of the effects of crowding.

A revealing analogue of the mitigating processes can be seen at the neuron level. If a stimulus such as a brief tone, light, or touch, which usually elicits an alerting response, a withdrawal, or startle, is repeatedly administered, the response wanes. Direct recording reveals a cessation or reduction in the afferent flow (see Hinde, 1970, for a discussion of the various forms of habituation). Thus, the nervous system itself has a built-in defense against the repeated intrusion of monotonous—and hence presumably meaningless—signals. Behavioral habituation, or the failure to respond overtly to repeated invasions of privacy, is in fact often seen among captive animals. If their usual spacing

is compressed, and to this extent their degree of privacy reduced, initial bouts of battle may be replaced by a seeming tolerance. However, the aberrant reproductive condition of at least some animals in the population and pathological changes in their adrenal function reveal that, in many, the imposed violation of privacy does disrupt normal physiology, and no mitigation occurs.

The best studied exemplars of changes in physiology associated with crowding are doubtlessly rodents, for many rodents have for decades been known to undergo cyclic changes in population density (e.g., Elton, 1942). As densities rise, life spans shorten, fecundity falls, and hormonal pathologies appear (Calhoun, 1963; Christian, 1963). The causal nexus is still a subject of controversy: Do the increasing densities lead to changes in selective pressures, favoring previously disadvantaged individuals whose physiology differs from the norm, or do the rising densities directly induce endocrine dysfunction? Nevertheless changes in the behavior of the individuals in the population do occur and as a result densities become reduced, usually before there is irreversible or long-term damage done to fragile habitats. One implication is that privacy, by preventing exhaustion of resources, is indeed so valuable a trait as to have led to the fostering of mechanisms that preserve against its violation (Christian, 1963), though this is far from a proven case.

In the laboratory it is possible to compel animals to remain in contact in violation of their own inclinations. This allows demonstration of the fact that physiological changes, including adrenal dysfunction and reproductive failure, may be directly induced in the individuals so treated. Calhoun (1963), working with Norway rats, also demonstrated a behavioral syndrome that included an inability to feed except in the company of others, even though the resultant crowding worsened the animals' condition. "Pathological togetherness" thus entered our vocabulary. It is not yet known, however, whether this induction of pathologies through the violation of privacy ever occurs under natural conditions; there remains much dissension on this point. However, we can conclude that where a species normally maintains some degree of separation from others of its kind, mechanisms exist that mitigate the consequences of intrusions. These may range from mere habituation or selective nonresponding to repeated signals from a near neighbor to reductions in fecundity. The fact that crowding so frequently leads to a reduction in fecundity does suggest (though it does not prove) the adaptiveness of and intrinsic importance of privacy to normal physiology.

SUMMARY

In sum, there are innumerable instances of nonhuman animals acting in a manner that characterizes humans seeking privacy. This may entail spatial isolation, physical withdrawal, or a form of deceit in which true intentions are misrepresented. These seemingly different forms of behavior have in common a regulatory characteristic: They selectively control access of external stimulation to one's self or the flow of information to others. This, we suggest, is a useful, operational definition of the concept *privacy*.

Viewed in this light, the evolution of privacy can be interpreted in economic terms: To the degree it provides a profitable cost margin (enhances fitness) it will persist. In every species, of course, the variables that define the cost/benefit equation will vary, and thus for each case we must expect to have to examine the details de novo. Facile generalizations about the nature or costs or advantages of privacy are unlikely to prove useful. At the same time, the economic approach does reveal governing principles to which man and beast are similarly subject. It is in this sphere that we can recognize evolutionary continuities.

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