IN THE SHADOW OF THE ENLIGHTENMENT: II. REIMARUS AND HIS THEORY OF DRIVES

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The Enlightenment, with its swarms of brilliant intellectuals, bouyed along on its bright surface of progress and excited with its own reason, rarely had the patience to be skeptical toward its own notions of human and animal nature. At its very center was the releasing empiricism of John Locke, particularly as simplified in France by Condillac. And its basic assumption was that nothing in the mind or in behavior is innate. Experience is the master builder of all.

Hermann Samuel Reimarus (1694-1768), as described in Part I,[1] wrote his *Principle Truths*[2] in 1754 chiefly against the Epicureans and their notion of the evolution of life out of matter. Six years later he expanded one part of it into his *Triebe der Thiere*[3] or *Drives of Animals*, which is the most thorough attack on empiricism possible. This work, the last that Reimarus was to complete, is one of the important yet neglected intellectual leaps of the eighteenth century. Its method and perhaps its failing is classificatory, to exhaust the subject of animal behavior by classifying it into drives. But in doing so, Reimarus does the best thinking about animal behavior of his day, far outweighing the effete anthropomorphizing of Condillac, Leroy, and others. Part II is an exposition of this work and an estimate of its place in intellectual history.

The Semantic Question

Doubtless Reimarus' use of the word *Trieb* as an alternative for *Instinkt* in the *Principle Truths* was sufficiently unusual to arouse some discussion. The *Drives of Animals* thus quite properly begins by noting this semantic problem. The problem is doubled for us as we try to find the most proper English equivalent. In English, the word instinct has been used in many different senses since the Elizabethan period, while the word drive only came into the psychological vocabulary with Woodworth in 1918.[4] In German, however, there have always been the

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[1]J. Jaynes and W. Woodward, "In the Shadow of the Enlightenment: I. Reimarus against the Epicureans," *J. Hist. Behav. Sci.*, 1974, *10*, 3-15.

[2]H. S. Reimarus, *The Principal Truths of Natural Religion*, trans. by R. Wynne. London: B. Law, 1766. The original work was entitled *Die vornehmsten Wahrheiten der natürlichen Religion*. Hamburg: J. C. Bohn, 1754[1] (1755[2], 1766[3], 1772[4], 1782[5], 1791[6]). See our discussion, ibid., 9-13.

[3]H. S. Reimarus, *Allgemeine Betrachtungen über die Triebe der Thiere, hauptsächlich über ihre Kunsttriebe, zur Erkenntnis des Zusammenhanges zwischen dem Schöpfer und uns selbst*. Hamburg: J. C. Bohn, 1760[1] (1762[2], 1773[3], 1798[4]). Cf. text to ftnte. 55 below. Chapter, section, and page references to the 1762[2] and 1798[4] editions of the *TT* will be given.

[4]R. S. Woodworth, *Dynamic Psychology* (N. Y.: Columbia, 1918), 36-43. By 1934, it has been equated with the German concept *Trieb* and given an empirical and a theoretical basis: "A drive is conceived after the analogy of the drive of a machine, and is intended as a concept broad enough to cover both organic activating conditions (such as hunger) and cerebral conditions such as mental set or desire for a particular object. Syn. urge, Ger. *Trieb*." H. C. Warren, ed. *Dictionary of Psychology* (Cambridge: Houghton Mifflin Co., 1934), 85. Cf. R. S. Peters, *The Concept of Motivation* (London: Routledge and Kegan Paul, 1958), 100: "Drives, it seems, were conceived as a result of the marriage between mechanical and purposive theories which took place during the period between the two world wars."

two words, drive (*Trieb*) and instinct (*Instinkt*). Even in the eighteenth century, both words had been so used and misused as to leave some doubt as to their reference, a problem of which Reimarus was well aware:

> The words drive and instinct have fared much the same as the word nature, which people once tried to make into an empty word in a similar way . . .[5]

He complained that the word drive, or drive action (*Trieb-Handlung*), "was hitherto so undefined and nebulous that it scarcely had a certain meaning."[6] One could say that the whole book, argumentative in tone, is an attempt to define the concept of drive by classifying the kinds of drives and their characteristics.

The Three Types of Drive and Their Interaction

In animals and man, there are three large classes of drives:

> If we now take the word Drive in its most widespread connotation to mean the operation of the abilities, since it does handle all natural efforts toward specific actions, then we have three kinds of kind of Drives in animals. There are the automatic drives (*mechanische Triebe*), which belong to the body as to a machine, and which are bent upon performing such actions as maintaining life. There are awareness drives (*Vorstellungs-Triebe*), or the effort of the soul to be conscious of things in accordance with present and past conditions of its body. There are volitional drives (*willkürliche Triebe*), in other words the effort of the soul to embrace whatever promises pleasure through its sensation and awareness and to withdraw from that which threatens pain by specific actions.[7]

The latter are in turn subdivided into (a) approach-avoidance drives set off by inclination (*Neigung*) or aversion (*Abneigung*)such as approaching food or withdrawing from pain and (b) the skilldrives (*Kunsttriebe*). These latter are what are usually referred to as animal instincts, nest-building, mating, migration, or whatever, and what both Reimarus and we ourselves are primarily interested in. We shall come to their characteristics and further classifications in a moment.

These three essential types, automatic drives, awareness drives, and volitional drives are never observed alone but always interacting with each other. Awareness drives, for example, interact with the automatic drives of respiration and heartbeat. Reimarus stresses that even in human behavior our awareness of our feelings in certain situations results in blushing or laughter or crying, *et cetera*, and that these interact with the volitional drives as well.

[5]Reimarus, *TT*, Chap. 4, §57, ftnte. 14 (97, 170). Similarly in this century, overtones of the scholastic *instinctus* are heard in philosophical definitions of the Germanic *Trieb*, where it is both "the simplest event of will" and "through mechanization becomes reflex-like," R. Eisler, *Handwörterbuch der Philosophie* (Berlin: Mittler & Sohn, 1922[2]), 674. In German psychology, confusion has given way to polarization, *Instinkt* referring to "inborn behavior in animal life, e.g. Craig, Tinbergen" and *Trieb* being "a designation . . . (according to Rohracher) for 1) an experience of compulsion . . . 2) of autogenic origin . . . 3) accompanied by feelings . . . 4) and a decrease in consciousness . . . , F. Dorsch, *Psychologisches Wörterbuch* (Hamburg: F. Meiner, 1970), 425-6.

[6]Reimarus, *TT*, Vorrede (3, iv).

[7]*Ibid.*, Chap. 1, §2 (2, 86).

Awareness Drives

What are the conscious attributes of animals? Reimarus attributes to animals sensation, attention, representation, association and memory, and indistinct ideas, giving accounts of these matters which Wundt, who had read him thoroughly, was later to make familiar at the beginning of academic psychology. Reimarus' discussion of attention, for example, is very suggestive of what was to come. Consciousness or awareness has a clearer focal portion and a relatively indistinct margin, the focalization of consciousness being due either to the intensity of the stimulus or to its pleasantness or unpleasantness. In the one case, attention is involuntary, in the other case, voluntary:

> Such particular and focalized awareness (*besondere und ausnehmende Vorstellung*) of a certain thing originates in part from the stronger impression of external things, in part from the excitation of pleasure or pain (*Lust oder Unlust*). The former attention is involuntary, the latter is voluntary.[8]

The limitation of the conscious field is quite a remarkable observation for Reimarus' time, although it is obviously embedded in the Wolffian philosophical literature in which he schooled himself in the earlier book, *Die Vernunftlehre*. Thus, it was the reading onto animals of a psychology elaborated for humans that constituted the originality of Reimarus.

What of memory images in animals, something of course which Descartes could not conceive of? For Reimarus, since images mingle indistinguishably with memory, images exist in animals just as they do in man:

> We term this imagination (*Einbildungskraft*), and it is undeniable that the animals too have imagination; that a horse wants to enter the stall because it imagines to itself again the good fodder taken there . . . But I doubt very much, on account of the difference which I shall subsequently explain, whether the animals can also lose themselves voluntarily in their representations of the past (*Vorstellungen des Vergangenen*), and proceed intentionally from one to another, and from it to a third, *et cetera*, and give themselves over to an entire field of ideas of absent things, as we men are accustomed to do.[9]

[8] *Ibid.*, Chap. 2, §12 (18, 101). This passage is understood historically as a modification of the psychology of Christian Wolff, where attention is accorded a central role in the conscious representation of the external world, i.e., in awareness. The faculties of the soul—sensation, imagination, memory, attention, intellect, appetition, affection, volition, and nolition—are dependent upon the representative force to produce sensible ideas. Awareness is limited in that it is finite and can only contain a few representations at a time; thus the laws of sensation and imagination, appetition and volition, are based on this limitation, e.g., "If diverse objects act at the same time on diverse sensory organs, that which has the greater force or acts more strongly on the sense organ draws the attention toward itself (§370). . . . If we perceive pleasure from whatever thing, we fix our attention on it and keep our fixation on it (§371). . . . If one perceives whatever loathesomeness in a thing, he averts his attention from it (§372)." *Christian Wolfii Psychologia Rationalis*, ed. by J. Ecole, *Gesammelte Werke*, 2. Abt., Bd. 6. (Hildesheim: Olms, 1972), 295, originally published at Frankfurt and Leipzig: Renger, 1734.

[9] *Ibid.*, Chap. 2, §14 (20, 103). As in postulating an "awareness drive," so in denying to animals a volition based on "representations of the past," Reimarus goes beyond Wolff by his treatment of animal psychology in greater detail. Animals have the faculty of imagination, or of producing perceptions of sensible objects which are absent; and animals are governed by appetition and aversion, the inclination toward an object in which they perceive good and away from an object in which they perceive bad. Here Reimarus is superimposing the contention of Wolff's final chapter in the *Psychologia Rationalis*, "On the Souls of Animals," that animals are destitute of volition or free will (§763), upon the earlier exposition of imagination and appetition in *Christiani Wolfii Psychologia Empirica*, ed. by J. Ecole, *Gesammelte Werke*, 2. Abt., Bd. 5 (Hildesheim: Olms, 1968), 54 (§92), 440-1 (§579, §581), originally published at Frankfurt and Leipzig: Renger, 1732.

However, association in animals is merely perceptual, radiating out from a present starting point instead of from previous ideas. Animals cannot remember the past as past, which, of course, is the basic Aristotelian distinction between human and animal memory. For animals, the present and the past form a distinctionless mass; they cannot distinguish their experiences nor make general notions. For us, the trees turn green; but for the animal, tree and green and a lot of other things coalesce into a single vague perception.[10] Nor can animals compare two concepts by means of a third, which is the basic logical process of human inference. This is not because animals do not have language. Rather, because they do not have memories of the past, hence concepts, they cannot reason. And here, referring to his earlier *Vernunftlehre*, Reimarus is answering Condillac (*Traité des animaux*)[11] and indicating that the difference between man and animals is not just one of degree, but one of kind.

Approach-Avoidance Drives and Conflict Behavior

Approach-avoidance drives are the first subdivision of volitional drives, and they are systematically defined in terms of the automatic and awareness drives which underlie them:

> Yet the animal drive which we call volitional (*willkürlich*) is not merely automatic (*mechanisch*) and corporeal. It consists rather in an approach (*Neigung*) or avoidance (*Abneigung*) of the will with respect to a past, although unclear, awareness (*Vorstellung*), *viz.* to the sensation of sensible pleasure or pain.[12]

In contrast to the other subdivision of volitional drives, the skill drives, the approach-avoidance drives are common to men as well as animals. In both cases, they operate "for the conservation and welfare of the individual and its species." The distinction between rational man and irrational animal is somewhat blurred here, since the "basic drive" for self-preservation is based on a hedonic principle, which implies a conscious choice. The key is that God has implanted not only the skill drives but also the approach-avoidance drives to accomplish His purposes in animals; in modern terms, there has to be a hereditary mechanism of sense organs, of bodily organization, and of nervous tissue sensitive to different possible stimuli. Thus God's Design gives animals the semblance of rational behavior, whereas man alone engages in rational thought.

[10] *Ibid.*, Chap. 2, §22 (38ff, 118ff). This is not quite the Wolffian distinction, however. Memory for Wolff is the faculty of recognizing the ideas reproduced by the imagination, and consequently, the objects which they represent (*Psych. Emp.*, §175). Reimarus apparently took exception with his conclusion that "the souls of animals enjoy imagination and memory" (*Psych. Rat.*, §755). However, Wolff made the further distinction between two kinds of memory: sensitive memory is the faculty of recognizing confused representations (*ideas reproductas*) and intellectual memory is the faculty of recognizing distinct representations (*Ibid.*, §279). Since concepts require distinct ideas or representations, and judgment requires concepts (Cf. *Vernunftlehre*, in Part I of this paper), Reimarus may be understood in this passage to be accepting sensible memory for animals but denying intellectual memory.

[11] E. B. de Condillac, *Traité des animaux* (Amsterdam & Paris: Jombert, 1755), Part 1, Chap. 5; Part 2, Chaps. 2-5. Cf. Reimarus, *TT*, §22, and *TT*, §§117-8. This difference of kind stems from differing interpretations of the role played by distinct and confused representations of the past in animal knowledge. Reimarus thinks that Condillac goes too far in stating that animals acquire skills (*Kunstfertigkeiten, l'instinct*, respectively) the way humans do, by comparison of concepts leading from initial distinct reflection to later indistinct, yet more rapid, insight (§118). As our later discussion will show, Reimarus ascribes to skill drives (*Kunsttriebe*) the otherwise inexplicable and complicated actions which animals perform in spite of their confused representations.

[12] Reimarus, *TT*, Chap. 3, §32 (51, 131).

Reimarus later terms these same drives of approach and avoidance affect-drives (*Affectentriebe*).[13] This lends credence to our interpretation of them as conforming to a hedonic principle. In the case of conflict between two opposing ideas of pleasure and pain, the past experience and the present moment might combine to reinforce or to oppose each other. For example, when the dog hesitates to snatch a stick of bread laid under its nose, it is curbing its sensible desire (*sinnliche Begierde*) through the sensible fear (*sinnliche Fürcht*) of the master's uplifted stick. Reimarus calls these half-volitional actions (*halb willkürliche Handlungen*), thereby admitting a confused representation to the dog, if not a conceptualization of waiting. The animal might thus seem to be exercising free choice (which occurs only in man), but actually the strongest stimulus will win out. In man, the solution to such choices is rational; it is not the strongest stimulus and excitation (*Eindruck und Reiz*) that wins out, but "the clear insight of the preponderating good or evil in our rational choice."[14]

These affect or approach-avoidance drives have a natural unstructured form (*natürliche Triebe*) which can undergo change into artificial drives (*abartende Triebe*). Here Reimarus adduces examples of animals subject to domestication: camels, reindeer, horses, donkeys, cattle, pigs, sheep, goats, dogs, cats, and poultry. He refers specifically to training the birds of prey to hunt on behalf of man. Such artificial reorganization is brought about "because mankind knows how to connect these animal excitations with their natural drives, and thereby to direct them according to his intentions."[15] Consistent with his foregoing explanation of volitional and awareness drives, Reimarus limits the modification of animal behavior to external control, to compulsion (*Zwang*), training (*Abrichtung*), or human nurturance (*Erziehung*), rather than to internal controls such as rational inference or memory.

The Skill Drives

Pleasure and pain, approach and avoidance, natural and artificial are much too simple to explain very much. Reimarus refers to ideas that mothers suckle their young simply to relieve the distress of distended mammary glands. But this cannot explain the care that is bestowed on the young. Nor can such hedonic principles say anything about the building of nests by birds in preparation for eggs, and similar phenomena. There must, therefore, be another class of drives to account for the complicated behavior patterns observed throughout nature, drives of which the animal is not distinctly aware either of the result of the activity it produces or of the means required to reach it. And this type of drive is Reimarus' special interest, and what he calls *Kunsttriebe*, which we translate as skill drives:

> Skill is a name for any systematic competence of intentional actions which leads to a certain purpose even when suffering many deflections. Now since the animals possess by nature such systematic competence for the conservation and welfare of their species, where in fact many deflections would be possible, they possess by nature certain innate skills. As each animal has a natural striving, i. e., it has a drive to put into effect its native skills for its needs, the animals thus have — each according to its kind — certain natural skill drives, which make them skilled in applying the special means for the conservation and welfare of themselves and their species by application of a systematic competence.[16]

[13] *Ibid.*, Chap. 3, §43 (71, 147).
[14] *Ibid.*, Chap. 3, §34 (55, 134).
[15] *Ibid.*, Chap. 3, §36 (59, 137).

A purposive deist who was seeing the benevolent purposes of God in all nature, Reimarus classified the skill drives according to their purposes as follows:[17]

(1) Movement skill drives, including the ability to move the whole body in locomotion or to move particular limbs in a purposive way. Included here are types of movement suitable to a particular habitat, such as found in caterpillars with their suction feet, which enable them to move in a vertical direction; or the suitable structure of the limbs of mountain goats who can leap from crag to crag with an astonishing lack of fear and sense of balance (both favorite species of Reimarus).

(2) Habitat selection, literally seeking "the proper natural element in the proper region." This includes also the drives to change a habitat under certain circumstances, to migrate from one climate or region to another "in the face of changes of season and temperature," and hibernation.

(3) Nourishment skill drives, within which class he places the abilities of animals to procure food, hunting behaviors, food gathering, as in squirrels burying nuts or harvesting ants storing grain, or even the skill drive of predators in waiting for the right time of day for hunting.

(4) Skill drives "for averting harm from inanimate things," which include abilities of animals to avoid dangerous places, nest-building, grooming, burrowing, cocoon and web-spinning, or behaving in illness so as to maximize the possibilities of recovery, etc.

(5) Skill drives "for averting harm from other animals," including abilities of animals to recognize and avoid natural enemies, various fear and avoidance behaviors, defense behaviors, abilities of animals to avoid ambush as the ejecting of fluid in squids, the diving of ducks, the quills of porcupines, the running and freezing of hares. "Community defense" patterns and fear of man also belong in this category.

(6) Mating skill drives, including all behaviors due to pairing, recognizing the opposite sex of the species, call notes, copulatory postures, and relationships between the adults of the family such as mutual assistance or polygamy.

(7) Parental skill drives, including egg laying and care, nest-building, egg incubation, immediate post-partum behavior in mammalian mothers, the rearing, feeding, weaning and defense of the young.

(8) The skill drives of the new-born, including hatching and suckling behavior, filial behavior of various kinds, and the "technical skills (*Kunstfertigkeiten*) appearing right at the commencement of life" such as the abilities of nidifugous birds and mammals, or of insects hiding themselves in a foam, web, or leaf blade.

[16] *Ibid.*, Chap. 4, §56 (94, 168).
[17] *Ibid.*, Chap. 7, §85 (140ff, 208ff).

(9) The social drives, such as the gregarious drives, "the natural languages of the animals among one another," or the "republics" of bees, wasps, ants, beavers, and others, as well as the societies which last only for a certain time in the life histories of the species. Reimarus rejects the view of Buffon that the beavers live together by free choice rather than "by a natural necessity," pointing out sarcastically that if men drive them away, it will not cause them to give up their social way of life and of nest building.[18]

(10) The skill drives of learning, which Reimarus calls "the class of broad modification (*Bestimmung*) and alteration (*Abänderung*) in the natural drives." This includes the modification of drives according to circumstances, or because of extraordinary accidents, or through human coercion and domestication, or through human art and training. The fact that Reimarus means that the very ability to modify innate behavior is itself an innate capacity is an important realization for someone in the eighteenth century.

In the examples given for each of these types of skill drives, we think it is fair to guess that some of the observations are his own, such as the instinctive displays of the moth spinning a cocoon, the hermit crab seeking and finding an empty shell, or the ant lion digging its funnel-shaped trap in the sand. But for the most part, his evidence comes from his wide reading, from Buffon whom he likes to respectfully refute theoretically, from Roesel,[19] the eighteenth century entomologist, from Réaumur,[20] Swammerdam,[21] and Guer[22] as in his previous work. Others occasionally referred to include Robert Beverly, Friedrich Christian Lesser, Robert Boyle citing Robert Whytt, Galen, Aristotle, and Charles Bonnet.

The Characteristics of Skill Drives

Having classified the skill drives into these ten large groups (which subdivide, incidentally, into 57 types of skill drives), Reimarus goes on to list 26 characteristics of skill drives.[23] Such a list is indigestible intellectually without some kind of rumination, and so in describing their content, we meld them into four: their final cause or purpose in conserving the species, their efficient cause or the immediate occasioning of the skill drives, their innateness, and finally their modifiability. We will discuss these in turn.

[18] *Ibid.*, Chap. 6, §83 (137, 206). Reimarus cites "Herrn Buffon (III. Th. II. B., p. 37)." See G.-L. L. Buffon, *Histoire naturelle générale et particulière avec la Description du Cabinet du Roy* (Paris: Imprimerie Royale, 1749), *2, 3*. Cf. Reimarus' refutation of Buffon's view of animals as machines, *TT*, Chap. 9, §112 (226, 282).

[19] A. J. Roesel von Rosenhof, *Die monatlich-herausgegebenen Insecten-Belustigung*, Nüremberg: J. J. Fleishmann, *1* (1746); *2* (1754); *3* (1755) which due to sickness did not appear until 1759, and *4* (1761).

[20] R.-A. de Réaumur, *Memoires pour servir à l'histoire des insectes*, 5 vols., Paris: Imprimerie Royale, 1734-42.

[21] J. Swammerdam, *Bybel der natuure, of Historie der insecten*, with Latin trans. by H. D. Gaubius, *Biblia naturae, sive Historia insectorum*, 3 vols. Leyden: I. Severinus, 1737-8. Reimarus used a German edition as well, but he does not give the edition and we have not found it; Cf. *TT*, Chap. 7, §93 (163, 227), and ftnte. 27.

[22] J. A. Guer, *Histoire critique des bêtes*, Amsterdam: F. Changuion, 1749. Reimarus refers to his definition of instinct in *TT*, Chap. 4, §57, ftnte. 14 (97, 170).

[23] Reimarus, *TT*, Chap. 7, §§86-101 (146-188, 214-248).

(1) *The conservation of the species* (characteristics 1-9). At the back of Reimarus' thinking is his wish to discover God in the purposive action of nature; thus his first group of characteristics of skill drives is their necessity for the "conservation and well-being of the species" (*Erhaltung und Wohlfahrt der Arten*). In the *Principal Truths*, he had previously argued for the plentitude of animal species on the basis of God's infinite power of creation. Consequently, it is not surprising to find him stressing the same plentitude of skill drives and the uniqueness of skill drives to each species. Just as every animal has the necessary skill drives, so there are no extraneous ones. This does not prevent thousands of individuals from dying prematurely, but it does insure that the numbers of any species remain in balance with other species. Even in the earlier book, the idea of the balance of nature in terms of population is emphasized in several places, for example:

> If some species of brutes have enemies, they know with what weapons Nature has furnished them, and attempt to defend themselves with them . . . ; so that one species of animals keeps the other in due Equilibirum and none of them are destroyed, but such as are superfluous in that species.[24]

It is the species that the skill drives are to conserve, not only the individual.

(2) *The activation of skill drives* (In Reimarus, characteristics 10-15). The skill drives are activated partly by material sensations of pleasure or pain from external stimuli and partly through a steady inner sensation of the organic condition of that particular drive. The significance of this is developed in several related characteristics which comprise a mediation model of sorts.

> All individual animals of a species, when they are free, behave with their skill drives according to one predetermined manner, rule, and model, at least in the fundamentals; so that only accidental dispositions remain for them to determine.[25]

There are three factors, the sensory representation (*sinnliche Vorstellung*), the sensory desire (*sinnliche Begierde*), and the drive (*Trieb*). Every skill drive can be understood as an interworking of the sensation upon the animal body so as to give rise to the voluntary execution of the desire. Every action is thus under the direct influence of the past, through unclear sensory representation, and of the present through sensory desire. Only by analogy could we term this memory and intention in animals.[26] The emphasis, as these findings show, is on the innate structure: Robert Beverly's *History of Virginia* described a snake which bit despite a partially cut-off head, F. C. Lesser's *Insecto-theologia* mentioned a wasp cut in two which was able to cling with its head and point its stinger for three days, and Robert Whytt in *An Essay on Vital and Involuntary Motions of Animals* reported that a butterfly with its head removed not only copulated but produced eggs.[27]

[24] Reimarus, *The Principal Truths, op. cit.*, 225.

[25] Reimarus, *TT*, Chap. 7, §92 (157,224).

[26] *Ibid.*, Chap. 3, §34 (55, 134), §§49-50 (83f, 156f).

[27] Reimarus cites these sources in *TT*, Chap. 7, §91 (156-7, 227-8): R. Beverly, *History of Virginia* (London: R. Parker, 1722²[1705¹], 260ff; F. C. Lesser, *Théologie des insectes*, trans. fr. German by P. Lyonnet (LaHaye: J. Swart, 1742), 2, 84ff; R. Boyle, *Some Considerations touching the Usefulnesse of experimental Naturall Philosophy* (Oxford: Printed by H. Hall for R. Davis, 1663), *2*, 16, cited in R. Whytt, *An Essay on the Vital and Other Involuntary Motions of Animals* (Edinburgh: 1751), 385ff.

(3) *Innateness* (characteristics 16-21). Skill drives are performed the first time with systematic completeness and without any previous practice. Reimarus cites Swammerdam who surgicially removed the young from a pregnant water snake and, thrusting them into water, watched them swim immediately; and Galen's famous goat study,[28] so often quoted in the eighteenth century, in which a kid was caesarianly delivered and immediately stood and scratched its side in the normal manner. Newly hatched spiders are able to build webs, showing that the skill drive of web building is both inborn and inherited (*angeboren und erblich*). Réaumur, whom everyone in this century highly respected except Buffon, is mentioned in regard to the bees which he observed immediately after hatching. They flew to the field, collected food, brought it back, and distributed it to the cells without instruction from others. These observations were extremely important in the eighteenth century, since the empiricists were maintaining at the same time that all animal behavior is learned.

Reimarus lists two more characteristics which we mention under this inclusive characteristic of innateness. These concern the temporal loci in the life history of the animal at which the skill drive occurs. The first is that some skill drives are expressed only at a certain age or condition, or even just once in an entire life; insects may bury themselves or spin a cocoon preparatory to the one-time process of metamorphosis; and in many animals, egg laying occurs only once. The other characteristic is that animals often try to use limbs before they have them, such as calves, rams, and kids which butt before the horns are present.

(4) *Modifiability* (characteristics 22-26). The skill drives can change to meet new circumstances and can be developed by experience; the young "are not only nourished, but also reared, instructed, accustomed, and conducted toward the commencement of their way of life."[29] The training given by parents plays a part in developing the skill drives of the young, as when polar bears, sea-lions, sea-otters and sea-cows suckle their young on land, push them into the water to learn to swim, and later retrieve them. And even when skill drives are fully developed they can adapt to new situations, as is observed in the variability of birds' nests within a given species.

Skill drives can also correct themselves when some change in circumstances occurs. Roesel (whom Reimarus often mentions) unwound the strands from a caterpillar as it spun, and the caterpillar never stopped spinning until it was exhausted; Aristotle had observed this among spiders.[30] An animal machine à la Descartes might have been presumed to stop after secreting the requisite amount of thread. Réaumur is cited again for destroying part of the bumblebee nest and watching the bees reconstruct it, mending the intersection of destroyed walls without losing the pattern. And Bonnet watched the tiny ant lion struggle countless times to push a stone out of his funnel-like pit in the sand "almost like the myth of Sisyphus".[31]

[28]Reimarus, *TT*, Chap. 7, §93 (161, 227). He cites J. Swammerdam, *Biblia naturae, op. cit., 1*, 174 and Galen's *Hippocratis epidemiorum VI. et Galeni in eum commentarius V.*, in *Omnia Cl. Galeni Permageni opera. . .*, 8 vols., Conrad Gesner, ed. (Basil: H. Frobenius, 1542ff), *6*, 509.

[29]Reimarus, *TT*, Chap. 7, §97 (170, 235).

[30]Reimarus, *TT*, Chap. 7, §99 (176, 240), citing Roesel, *op. cit., 1*, §§6-7; Réaumur, *op. cit.*, 1, 246, *3*, 124, *4*, 124; Aristotle, *Historia animalium, 6*, 57.

[31]Reimarus, *TT*, Chap. 7, §98 (175,239).

Indeed, Reimarus' wish to refute Descartes' beast-machine notion leads him to some very suggestive remarks:

> The attention (*Beachtung*) of animals and the orientation of their sensible organs, as in the axes of the eye and the ear, onto that object which beforehand had made only the weakest impression, could not take place without imagination and free will. For otherwise, the animals would always have to go to meet the strongest sensation with the strongest movement, owing to the mechanical laws. Consequently, the eye-axes would always orient toward the strongest light, but not toward that object which struck the eyes from an angle and therefore is weak, dark, and unclear. It is moreover apparent that the movement of animals is guided by past and absent objects . . . The uplifted cane produces fear in the dog who was previously beaten by it; another dog is happy (at the sight of the cane), for he is accustomed to go out with his master whenever he takes up the cane; a third gets ready to jump when his master holds the stick in front of him.[32]

This discussion of the modifiability of skill drives is somehow disappointing because it is so close to some profound insight, particularly when one considers it together with his discussion previously of innate skill drives of modifiability that operate on other skill drives. Because this is so important in current theory, we look in vain for some emphases that Reimarus is placing upon the matter. But we must confess that it seems more like his attempt to fit his theory of the God-given skill drives onto the existing facts which he respects so much.

Critique of Reimarus

One of the first things to notice in all this is the remarkable development and refinement of Reimarus' concepts as he goes deeper into the problem. As a young man in his Latin treatise of 1725, *Instinctum brutorum*, he had called animal behavior patterns instincts. Thirty years later in *Die vornehmsten Wahrheiten der natürlichen Religion* he uses the words instinct and drive as equivalent and with very little development; the behavior patterns of animals are simply implanted in their nature by God and are described without analysis or classification. But six years later in *Die Triebe der Thiere* the basic problems are no longer hidden away in the "wisdom of God." Drives are described as innate bodily organizations including nervous tissue sensitive to specific environmental stimuli:

> Now each and every animal alive has, by virtue of his sensation, an unclear consciousness of the changes of the nervous parts (*Nerventheilen*) of its body and of their condition: it feels which stimulus (*Eindruck*) is or is not in accordance with its nature.[33]

Drives range from common reflexes through approach and avoidance responses to external objects to complicated acts whose purpose is to maintain the species rather than the individual. Even consciousness and learning are both inborn drives which can operate on other drives. Although the formulation is neither as explicit nor as

[32]*Ibid.*, Chap. 9, §109 (213,271).

[33]*Ibid.*, Chap. 3, §33 (54, 133).

tested by experiment as we have come to expect in such matters, this is nevertheless an astonishing advance over all the previous formulations of the problem.

Why is this such an advance? Previous explanations of behavior, animal or human, had in general been on what we shall call the knowledge-model. For man, this is still a part of our everyday thinking. Man acts from knowledge; he knows how to do things and knows what he is doing, and his knowledge is a prior condition for his actions. For the empiricists, such knowledge in either animals or men was gained by experience. For the traditionalists, the knowledge in man was gained by experience but in animals by God's implantation — a view which Reimarus as a young man supported. But for the mature Reimarus, the explanation of animal behavior is not in such incorporeal knowledges implanted either by God or experience, but in these innate physiological organizations called drives.

Nor is Reimarus' final concept different from the contemporary view in its general outlines. The emphasis on specific stimuli, on the sensitivity of certain sense organs to receive these stimuli, and the resulting tendency to behave in a certain pattern, a pattern which can be modified depending on both past and present circumstances has a very contemporary ring. The idea that learning itself is an inherited characteristic not unlike other drives, though operating on them, is not different from the view introduced by Whitman[34] and followed up by Tinbergen.[35] Of course, there are no notions similar to what Armstrong[36] called displacement activity, nor to what Lorenz[37] called action-specific energy and vacuum activity. From our point of view, this is all to his credit. All three of these modern concepts based on the energy metaphor have recently been placed in doubt and can be reduced to a competing response notion, the particular response occurring which has the strongest stimulus present.[38] And this is very similar to Reimarus' discussion of conflict behavior, that if two conflicting drives are present, the one with the strongest stimulus will be manifested.

One aspect of Reimarus' theory does not in any way fit in with modern conceptions. This is his class of awareness drives in which the whole question of consciousness is wedded to that of motivation. Consciousness as a drive is still strange to contemporary ears. And how opposite to the usual metaphor of consciousness as a receptacle of ideas! Perhaps the closest modern correlate to Reimarus' view here is that of Dewey[39] who saw thinking as an innate adaptation to thwarted desires which ceased when desires were fulfilled. Consciousness is not a static process to be analyzed out into a structure as Wundt or Titchener[40] would like it to be, but a constantly changing area of awareness around a focus of attention that adapts the animal or man to a changing and problematical environment.

[34] C. O. Whitman, Animal Behavior. *Biological Lectures from the Marine Biological Laboratory.* Woods Hole, Mass., 1898.

[35] N. Tinbergen, "An objective study of the innate behaviour of animals," *Bibliotheca Biotheoretica,* 1942, *1*, Pt. 2, 39-98.

[36] E. A. Armstrong, *Bird Display and Behavior.* Oxford: Clarendon Press, 1947.

[37] K. Lorenz, "Über die Bildung des Instinktbegriffs," *Naturwissenschaften,* 1937, *25*, 289-300, 307-318, 324-331.

[38] R. J. Andrew, "Intention movements of flight in certain Passerines and their use in systematics," *Behaviour,* 1956, *10*, 179-204.

[39] J. Dewey, *How We Think.* Boston: D. C. Heath & Co., 1910, *passim.*

[40] W. Wundt, *Grundzüge der physiologische Psychologie* (Leipzig: Engelmann, 1911[6]), *3*, 733-738; E. B. Titchener, *A Textbook of Psychology* (New York: Macmillan, 1909-10), *1*, 36-41.

His Immediate Influence

We might suppose that originality of the type that Reimarus evinced in his last book would become a pivotal group of ideas in the major discussions of the time. But this was definitely not the case. Aside from the furor aroused in religious circles by Lessing's anonymous publication of Reimarus' "Apologie,"[41] Reimarus continued to be known among philosophers for his *Vernunftlehre*[42] and his *Die vornehmsten Wahrheiten* and to be ignored by the scientific public. As for the public with a traditionalist point of view, Reimarus' espousal of natural religion was enough to alienate them from the fundamental Catholic or Protestant position. Who would read him, hearing rumors of his "Apology" wherein he called Jesus a secular savior?[43] And the Empiricists, riding the high fashions of the Enlightenment, were basing knowledge on a sensationist model of the mind: they would not bother with Reimarus' emphasis on the innateness of drives. Condillac's follower, Leroy, however, in originating the theory of instinct as inherited learning, does answer Reimarus' arguments for innateness of instinctive behaviors.[44] Then the *Encyclopédie* article on "instinct," which in 1765 had the Condillac stress on language-like behaviors, making no mention of Reimarus, was in the 1777 *Supplément* devoted exclusively to a summary of his book, calling it "the best and most methodical which we have on this subject."[45] As for the Epicureans, whom we discussed in Part I, LaMettrie had died in 1751 and Maupertuis in 1758, while Buffon did not care.

Such notice as his final work did attract came from the Berlin circle centering around Frederick II. Moses Mendelssohn, a disciple of Lessing and Christian Wolff, was a young Jew accepted by this Christian circle, having made a name for himself through his critical writings on aesthetics including *Briefe über die Empfindungen* in 1755. It was he who, though educated in Hebrew, essayed to polish his German style with a critique of Reimarus' book. This review was published in four installments in 1760 by a younger contemporary and bookseller, Friedrich Nicolai, in his magazine for the educated public, *Briefe, die Neueste Literatur betreffend.*[46] The review and Reimarus' 104-page reply to it in the 1762 second edition of *Triebe der Thiere* show that both men were intimately familiar with Wolff's *Psychologia empirica* and *Ontologia,*[47] however they responded differently to them.

[41] See Part I of our paper (ftnte. 1 above), especially ftntes. 4-9.

[42] H. S. Reimarus, *Die Vernunftlehre.* Hamburg: J. C. Bohn, 1756[1], 1758[2], 1766[3], 1782[4], 1790[5].

[43] *Hermann Samuel Reimarus. The Goal of Jesus and his Disciples,* intro. and trans. by G. W. Buchanan (Leiden: E. J. Brill, 1970), 95.

[44] C.-G. Leroy, *Lettres sur les animaux.* Nüremberg, 1768. Republished with posthumous letters as *Lettres philosophiques sur l'intelligence et la perfectibilité des animaux, avec quelques lettres sur l'homme.* Paris: Bossange, Masson, et Besson, 1802; trans. into English as *The Intelligence and Perfectibility of Animals from a Philosophic Point of View, with a Few Letters on Man, partly under the pseudonym of The Naturalist of Nüremberg.*" London: Chapman & Hall, 1870.

[45] D. Diderot and J. d'Alembert, eds. *Encyclopédie ou dictionnaire raisonné des sciences, des arts et des métiers par une société de gens de lettres* (Neufchatel: S. Faulche et Co., 1765), *8*, 795-799; *Supplément* (Paris: Panckoucke *et al.* and Amsterdam: Rey, 1777), *3*, 609-611.

[46] M. Mendelssohn, untitled review of Reimarus' *TT*, in *Briefe, die Neueste Litteratur betreffend* (Berlin: F. Nicolai, 1760), XV-XVIII, 233-279.

[47] C. Wolff, *Philosophia prima sive Ontologia* (Frankfurt & Leipzig: Renger, 1730[1], etc.) in Jean Ecole, ed., *Christian Wolff Gesammelte Werke* (Hildesheim: G. Olms, 1962), II. Abt., *3*; *Psychologia empirica* (Frankfurt & Leipzig: Renger, 1732) in J. Ecole, II, Abt., *5*.

They agreed that Wolff had limited his psychological commentary to humans,[48] Mendelssohn even gives equivocal assent to the extension of this to animals. While he accepts "those skill drives which show an inner regularity in the volitional movements of the muscles," he rejects the explanation of "external skills . . . which seem to be brought to completion under a well-thought out plan."[49] At issue is the definition of mind as consisting of implanted drives to approach and avoid, which he can accept because drives here are undetermined, and as consisting of inborn perfections or skill drives, which he rejects because the "exact determination of the (mental) powers toward a specific purpose" is unexplained.[50]

In his retort, Reimarus brings forward Wolff's definition of determinism: "when from any possibilities for a given thing, one or more must really be affirmed with the exclusion of all the other possibilities."[51] Reimarus defends his "levels of determination" (*Grade der Determination*) for the inner sensations and the affect drives with the argument that just as the fall of an object in a straight line is determined by its gravity, so the excitation of a sense organ is determined by a particular stimulus. Reimarus further argues that Mendelssohn, in adhering to Wolff's definition of the human mind too closely, had failed to take account of the special differences in animals and humans. In particular, the "original power of representation[52] (*ürsprüngliche Vorstellungskraft*) is not, as the Wolffians claim, a single abstract capacity (*Fähigkeit*), but a particular perfection (*Fertigkeit*) among many."[53]

The fact is that Reimarus had not explained the skill drives and their amazing perfection; he had only described and catalogued them. Mendelssohn's criticism was valid in this aspect, yet had he read Reimarus' book more carefully, he would have found an acknowledgement of the same:

> One should not confuse the two things with each other; by the naming of the skill drives, I express the matter itself, as it is before the eyes of everyone, not however its cause or the manner of its possibility.[54]

In general, nevertheless, the scientific work of Reimarus came at the wrong time in the history of ideas to receive its proper discussion. It might have been even less known had it not been for his son, Johann Albert Heinrich Reimarus, who almost alone recognized the significance of his father's *Die Triebe der Thiere*. A physician, sometime friend of Erasmus Darwin, and himself an occasional writer on animal subjects, he saw to it that the later editions came out and were supplemented by Hermann Samuel's subsequent handwritten, but not yet published, writings on the same subject. In the third edition of 1773, following Reimarus' death in 1768, there is appended a half-finished work, extensively annotated by his son, entitled *Angefangene Betrachtungen über die besonderen Arten der Thierischen Kunsttriebe*, and it contains an added part by his son on the subject of the *Pflanzenthiere*, such as corals, polyps, etc. A fourth edition, with an introduction written by Johann Albert appeared in 1798.[55]

[48]Reimarus, *TT*, "Anhang von den verschiedenen Determination der Naturkräfte" in 2nd through 4th eds., Chap. 12, §§157-193 (1-104, 438-528). See especially §167 (14, 452) and cf. Mendelssohn, *op. cit.*, 235.

[49]Mendelssohn, *op. cit.*, 276-277.

[50]*Ibid.*, 251.

[51]Reimarus, *TT*, "Anhang," Chap. 12, §§163-4 (8, 445).

[52]Mendelssohn, *op. cit.*, 275.

[53]Reimarus, *TT*, "Anhang," Chap. 12, §166 (11, 450).

[54]*Ibid.*, Chap. 4, §59 (100, 172).

Reimarus and Wundt

The first important reference to Reimarus by name in the scientific world occurred a century after his death and is something of a surprise. This is when Wilhelm Wundt, in lecture 29 of the initial edition of *Vorlesungen über die Menschen und Thierseele*, wrote:

> The founder of present-day animal psychology is H. S. Reimarus (*Allgemeine Betrachtungen über die Thiere* [sic], *hauptsächlich über ihre Kunsttriebe*, Hamburg, 1773) The definition of the contemporary concept of instinct (*Instinkt*) derives from him. According to his view, all actions of animals are basically determined. Sensation, dim ideas, memory, and imagination are ascribed by him to animals, though understanding and reason are denied them. In its main lines, this view of the mental life of animals has remained the dominant one until now, and it has come down into popular opinion, even though a great number of authors spoke against Reimarus' conception insofar as they began their investigation of the mental life of animals on the principle of explaining everything possible by analogy to human minds.[56]

Astonishing! for Wundt, in discussing instinct, has left out the motivational aspect of Reimarus' *Triebe* completely, even to omitting it from the title of Reimarus' book. Of course, the impact of Kant on theories of will and Darwin on theories of instinct, not to mention the concept of the reflex developed by Marshall Hall, would certainly have changed the connotation of both instinct and drive. Thus when in lecture 50 Wundt finally discusses the word *Trieb*, he does not mention Reimarus, but uses it synonomously with the words for sensual appetite or desire (*Begierde, Begehren*).[57] Later on Wundt moved away from even the sensual appetite interpretation of drive toward a more mentalistic theory: willed actions become habitual under the influence of practice and external stimuli, and they are accompanied by affects of tension, release, and activation.[58] Applying this human theory of will to animals, Wundt accepted the inheritance of drive movements (*Triebbewegungen*) which are midway between volitional movements and reflex movements, and which become conscious and acquire a feeling after their initial elicitation by a stimulus.[59] For all its neglect of Reimarus, Wundt's final systematic view of motivation is surprisingly similar to his, probably as a student of Wundt suggested,[60] because they each took account of awareness, feelings, and innate behavior patterns rather than because of any direct influence of Reimarus' writings on Wundt.

[55]See ftnte. 3 above.

[56]W. Wundt, *Vorlesungen über die Menschen- und Thierseele* (Leipzig & Hamburg: L. Voss, 1863[1], 1892[2], 1897[3], 1906[4], 1911[5], 1919[6]), 1st ed., *1*, 490.

[57]*Ibid.*, *1*, 459f.

[58]W. Wundt, *Grundzüge der physiologischen Psychologie*, 3 vols. (Leipzig: A. Kröner, 1911[6] [1874[1]]), *3*, 278-9.

[59]*Ibid.*, *3*, 252-5.

[60]W. D. Scott, *Die Psychologie der Triebe* (Leipzig: H. John, 1900), 48.

His Later Influence

Reimarus thus had no direct influence on the writers of his time or those of the ensuing century. But his indirect influence is quite another matter. That he was widely read in his own day is suggested by R. Wynne, the English translator of *Die vornehmsten Wahrheiten*, who in 1766 claimed in his Preface that "the original work has met with universal approbation in Germany and Holland."[61] And the swift succession of new editions of his works, particularly *Die Triebe der Thiere*, is witness that the concept of drive was being widely considered if rarely mentioned. In all, these two works went through ten editions and five translations; while each was translated into French and Dutch,[62] only the former book appeared in English. We may therefore conclude that the concept of drive thus slipped into popular thought, particularly in Germany, as the Romantic movement began in the next century.

As Otto Klemm has pointed out, "the influence of the semi-theological doctrines of Reimarus upon natural scientists was practically negligible."[63] And yet the Grimm brothers cited Reimarus in their etymological dictionary for the commonest meaning of *Trieb* as an "inner driving power."[64] Ironically, the elaborate theory of drives was lost on science, and the root meaning prevailed in philosophical and literary usage. In 1794, J. G. Fichte devoted five of eight propositions for "the groundwork of the entire science of knowledge" to a concept of subjective causation based on *Trieb*.[65] Schelling used the term *Kunsttrieb*, "a calling forth of something outside of oneself," for the human activities of architecture and music, and he classified the *Triebe* into three levels which are reminiscent of Reimarus.[66] Von Hartmann based his concept of the unconscious on a *Trieb* which is "purposive action without consciousness of purpose" and is not exclusively tied to a pre-arranged mechanism of nerve centers.[67] But Schopenhauer gave the concept a new emphasis as the sex drive, which he defined as "a causal series, in consequence of which a new life appears."[68] As the twentieth century began, Freud used the term *Trieb* for libidinal energy, though his translators have clouded an already murky use of the word by mistranslating it as instinct.[69] This curious reluctance to translate *Trieb* as drive is also present in William McDougall's huge attempt to deduce all social behavior from a few very Reimarus-like impulses which he called instincts.[70] In 1918, R. S. Woodworth finally introduced the English term "drive" as a theoretical construct denoting the impulsive energy of either learned or innate behavior, but he never referred to the term thereafter.[71] It remained in use particularly in the vocabulary of such experimentalists as Richter,[72] who simply assumed that it was the same word as the German *Trieb*. In the 1920's, as instincts in McDougall's sense came to be attacked by Dunlap,[73] Kuo,[74] and others drives came more and more to fill the same role in psychological parlence. And in the decades that followed, drive became one of the essential variables of learning theory and the central concept of the science of motivation.[75]

[61] Reimarus, *The Principal Truths, op, cit.*, Preface.

[62] Translations into Dutch were by J. Lulofs, *De voornaamste Waarheden van den natuurlyken Gods-Dienst*. Leyden, 1758; and J. W. van Haar, *Allgemeene Beschouwingen van de Driften der Dieren*. Leyden, 1761. Translations into French were by Erman, *Essai sur la Providence*. Berlin, 1768, and R. de la Tasche [Latache], *Observations physiques et morales sur l'instinct des animaux*. Amsterdam, 1770.

[63] O. Klemm, *A History of Psychology*, trans. from the German by E. C. Wilm and R. Pintner (N. Y.: Scribner's Sons, 1914 [1911]), 114. A fuller exposition of the content of the *TT*, due to Klemm's influence, may be found in E. C. Wilm, *The Theories of Instinct*. New Haven: Yale, 1925.

[64] Jacob and Wilhelm Grimm, *Deutsches Wörterbuch*, 32 Vols. (Leipzig: S. Hirzel, 1952f [1854]), *22*, 446-7.

[65] J. G. Fichte, *Grundlage der gesamten Wissenschaftslehre* (Leipzig: F. Meiner, 1911 [1794]), 205-245.

[66] *Schelling Sämmtliche Werke*, ed. by K. F. A. Schelling (Stuttgart & Augsburg: J. G. Cotta'sche Verlag, 1860), *7*, 456.

[67] E. von Hartmann, *Philosophy of the Unconscious*, trans. from 1884[8] (N. Y.: Harcourt, Brace & Co., 1931 [1868[1]]), 79 and Appendix.

[68] *Schopenhauer Sämmtliche Werke*, ed. by A. Hübscher from first complete ed. of J. Frauenstädt (Wiesbaden: F. A. Brockhaus, 1966 [1818]), 387.

[69] *Works of Sigmund Freud*, trans. and ed. by James Strachey (London: Hogarth, 1966), *1*, xxiv-xxv. It is to be hoped that future translations of psychoanalytic material will correctly use the term drive instead of instinct.

[70] W. McDougall, *An Introduction to Social Psychology* (London: Methuen, 1908), Chaps. 2-4.

[71] R. S. Woodworth, *op. cit.*, 36-43.

[72] C. P. Richter, *A. Behavioristic Study of the Activity of the Rat* (Baltimore: Williams & Wilkins Co., 1922), *passim*.

[73] K. Dunlap, "Are there any instincts?" *Journal of Abnormal Psychology*, 1919, *14*, 307-311.

[74] Z. Y. Kuo, "The net result of the anti-heredity movement in psychology," *Psychological Review*, 1929, *31*, 181-200.

[75] Outstanding among modern sources for philosophical and historical clarity is R. C. Bolles, *Theory of Motivation* (N. Y.: Harper & Row, 1967), Chap. 5 and *in toto*.