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### The Intentionality of Some Ethological Terms

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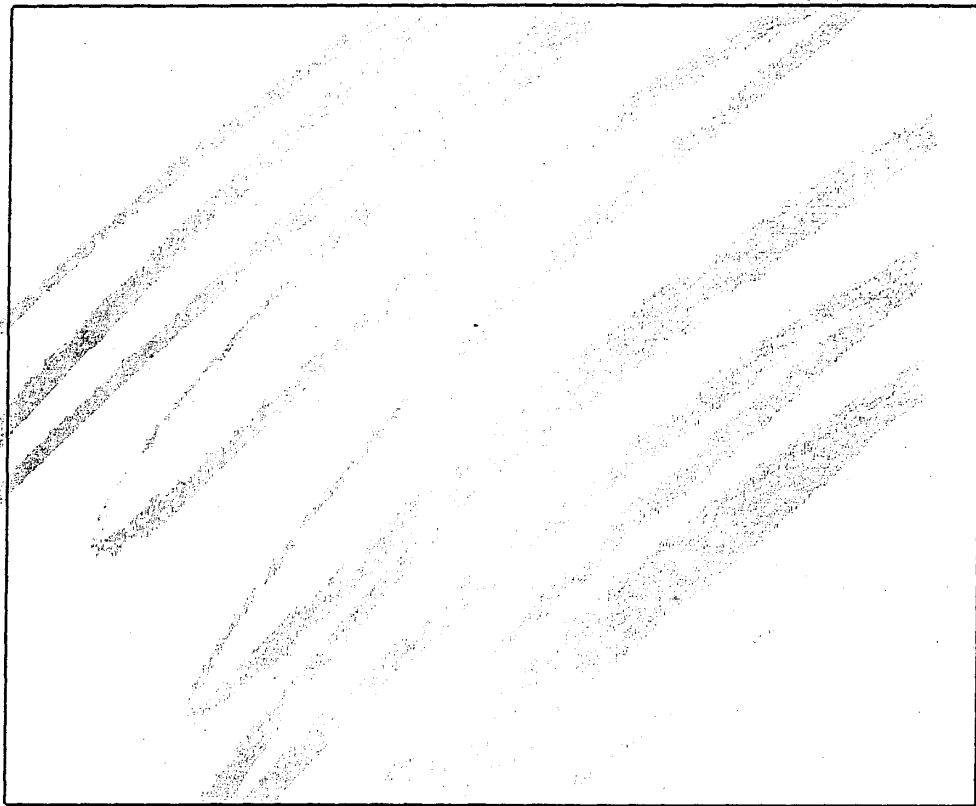
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## THE INTENTIONALITY OF SOME ETHOLOGICAL TERMS

Nicholas S. Thompson  
and  
Patrick Derr

### ABSTRACT

The apparent incompatibility of mental states with physical explanations has long been a concern of philosophers of psychology. This incompatibility is thought to arise from the intentionality of mental states. But, Brentano notwithstanding, intentionality is an ordinary feature of higher order behavior patterns in the classical literature of ethology.

### I Introduction

In an earlier publication, we (Derr and Thompson, 1992) argued that intentional explanations (i.e. explanations of the form "x did y because of a want, belief, or thought with respect to y") had suffered from a misunderstanding of the role of intentional terms in explanations of behavior. Much of the criticism of intentional explanations flows from the assumption that intentional terms appear amongst the initial conditions in intentional explanations while their more natural place is within the covering laws. In the initial conditions they violate Hempel's (Hempel and Oppenheim, 1948) rule that there can be no logical connection between the initial conditions and the explanandum. Moreover, their intentionality presents a problem for verification. But as covering laws, they violate no rule about a logical connection, because no rule forbids a logical connection between the covering law and the explanandum. And since covering laws are extensionally explicable as referring to overt patterns of behavior, and are empirically testable by observing these patterns, their intentionality presents no problem of verification.

As we reflected on this argument, we realized that it defied a time-honored principle of the philosophy of psychology: Brentano's irreducibility thesis. This principle implies that there is a fundamental incompatibility between intentional states and behavior. Yet classical writers in ethology — the biological study of animal behavior — assume that higher order behavior patterns DO display intentionality. The purpose of this paper is to bring these two literatures into contact with one another.

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### II The Idea that Mental States are Inherently Non-physical

The doctrine of the incompatibility between mental and physical states is widely rehearsed in contemporary philosophy of psychology. For instance, Rosenberg (1988), after reviewing the arguments for the various means of reconciling materialism with mentalism writes:

...there is no description, known or unknown, of the intentional causes of action, which is itself *extensional*, and thus none that is independent of a description of their effects. [Thus, the Law that relates beliefs and wants with circumstances and actions] turns out not even to be of limited employment as a causal regularity, for the elements it connects cannot even in principle be shown to bear contingent relations to one another. [p.49]

Rosenberg connects the idea of intentionality to the ineffable subjectivity of mental states. He writes

...If we think about it, [the connection between mental states and the intentionality in the statements used to describe those states] should not really be surprising. Beliefs and desires are "subjective": They are mental or psychological states. They reflect the ways we look at the world: our points of view, which differ from each other and change as we acquire different information about the world. They represent some facts about things in the world or some state of affairs we desire. But never all the facts, the complete picture. [p.44]

By the next page, Rosenberg's identification of intentionality with subjectivity has reached a new level. Here he claims that the only source for our knowledge of intentional states is the description which the agent would give his own behavior. He writes:

...Thus, to explain an action with *full* precision, one must identify the very sentence in which the agent would describe his action and *therefore* the very sentences in which the agent would describe his beliefs and desires. [p.45]

This argument that mental states are inherently non-physical is often founded in Brentano. Dennett (1978) writes:

...Consider that warhorse in the philosophy of mind, Brentano's Thesis that intentionality is the mark of the mental: all mental phenomenon exhibit intentionality and no physical phenomena exhibit intentionality. [p.xvii]

and

...Brentano did after all reintroduce the concept of intentionality precisely as the distinguishing mark of the non-physical, ...[p.94]

And contrasting the physical with the mental, Chisholm (1957) writes

...physical — or nonpsychological — phenomena, according to Brentano's thesis, cannot thus "intentionally contain objects in themselves." In order for Diogenes to sit in his tub, for example, there must be a tub for him to sit in; in order for the horse to eat his oats,

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there must be oats for him to eat; and in order for James to shoot a tiger, there must be a tiger there to shoot.

And Field (1978) writes:

...[Brentano's second problem is] intentionality. Many mental properties — believing, desiring, and so forth — appear to be *relational* properties: more precisely, they appear to relate people to non-linguistic entities called propositions. So any materialist who takes believing and desiring at face value — any materialist who admits that belief and desire *are* relations between people and propositions — any such materialist must show that the relations in question are not irreducibly mental. Brentano felt that this could not be done; and since he saw no alternative to viewing belief and desire as relations to propositions, he concluded that materialism must be false. [p.78]

### III. Marks of Intentionality

If intentionality is the mark of the mental, what is the mark of intentionality? Two indications seem to be intentional inexistence and referential opacity. Each of these calls attention to limitations in what can be inferred about intentional states, as opposed to what can be inferred from non-intentional ones.

"Intentional inexistence" calls attention to the fact that the objects of intentional states, such as wanting, believing, and perceiving, need not exist. Hence, from the existence of an intentional state, it is not possible to infer reliably that the object of the state exists. For example, from the facts that Smith wants a beer and opens her refrigerator in pursuit of a beer, it cannot reliably be inferred that there is a beer in the refrigerator.

"Referential opacity" calls attention to the fact that it is not possible unambiguously to identify the object of an intentional state from its description. One and the same intentional state may have multiple possible objects. Thus, from the fact that Smith opens her refrigerator in search of a beer, one cannot determine that she is seeking a cooling beverage. She may be seeking a mildly inebriating beverage, or a beverage that will hasten a belch, or a liquid to flavor a stew.

If intentional inexistence and referential opacity are indeed two marks of intentionality, then the doctrine that intentionality is inconsistent with physicalism entails the claim that physical phenomena cannot display either intentional inexistence or referential opacity. But, in fact, both intentional inexistence and referential opacity are ordinary features of behavior as described in classical ethological literature.

### IV. Behavioral Patterns that are Intentional

Do behavior patterns display either intentional inexistence or referential opacity? Key concepts in ethology automatically assume that frequently observed

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animal behaviors do display these properties. Are the ethological descriptions plausible? The following examples suggest that they are.

### A. The "Umwelt"

Many of the key terms of ethology were coined by Jacob Von Uexkull (1934/1957) and were introduced into the vocabulary of the field by one of its nobel winning founders, Konrad Lorenz (1935/1957).<sup>1</sup> Jacob Von Uexkull's work, "A Stroll through the World of Animals and Men: A Picture book of invisible worlds", is an extraordinary essay, mixing the language of physiology and phenomenology. Its central concept is that of the umwelt, "...the phenomenal world or self-world of the animal." [p.5] The umwelt of any creature is the world implied by its sensory equipment and its behavioral reactions. Von Uexkull illustrates the umwelt with a loving description of the self-world of the wood tick.

The tick hangs motionless on the tip of a branch in a forest clearing. Her position gives her the chance to drop on a passing mammal. Out of the whole environment, no stimulus affects her until a mammal approaches, whose blood she needs before she can bear her young.

And now something quite wonderful happens. Of all the influences that emanate from the mammals's body, only three become stimuli, and those in a definite sequence. ...The whole rich world around the tick shrinks and changes into a scanty framework consisting, in essence, of three receptor cues and three effector cues — her Umwelt. But the very poverty of this world guarantees the unfailing certainty of her actions, and security is more important than wealth. [p.11]

One of these stimuli is butyric acid, an odorant released by all warm blooded animals, that the tick uses as a cue to drop from its perch. A few paragraphs later, von Uexkull continues:

Like a gourmet who picks the raisins out of a cake, the tick has selected butyric acid alone from among the things in her environment. We are not interested in knowing what taste sensations the raisins give the gourmet. We are interested solely in the fact that the raisins become sign stimuli in his world, because they have special biological meaning for him. Nor do we ask how butyric acid smells or tastes to the tick; we merely register the fact that butyric acid, because it is biologically meaningful to the tick, becomes a receptor cue for her. [p.13]

This last passage makes clear that in using terms like "phenomenal world" and "self-world," von Uexkull has not cut loose his biological moorings. The umwelt is not internal to the animal. When we go to recognize the umwelt of a creature, its sensory organs and its overt behaviors are not proxies for the animal's umwelt; they constitute it!

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<sup>1</sup>I have tried through extensive quotation to convey some of the flavor of these wonderfully original classic works, but we would strongly recommend a reading of the originals to any philosopher who harbors the illusion that referential opacity and intentional inexistence are solely the property of human speech acts.

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Although he does not use the term, von Uexkull is at great pains to stress the referential opacity of the *umwelt*.

To the fox, which has built its lair between the roots, the oak tree has come to mean a solid roof, which protects the fox and its family from the hazards of the weather.

...In the owl's world...the oak tree also has a protective tone. Only this time it is not the roots, which lie wholly outside the owl's realm, but the mighty limbs that serve it as a protecting wall.

To the squirrel, the oak tree, with its many ramifications, providing a wealth of comfortable jumping boards, gains a climbing tone, and to the songsters which build their nests in its farthest crotches and branches it offers the supporting tone which they need.

Corresponding to the different functional tones, the perceptual images of the oak tree's numerous inmates, too, are differently shaped. Each *Umwelt* carves a specific section out of the oak, whose qualities are suitable bearers for both the receptor and effector cues of the respective functional cycles. In the ant's world all the rest of the oak vanishes behind its gnarled bark, whose furrows and heights become the ant's hunting ground.

The bark-boring beetle seeks its nourishment underneath the bark which it blasts off. Here it lays its eggs. Its larva bore their passages underneath the bark. ...But they are not entirely protected. For not only are they persecuted by the woodpecker which splits off the bark with powerful thrusts of its beak; an ichneumon fly, whose fine ovipositor penetrates through the oakwood (hard in all other *Umwelten*) as if it were butter, destroys them by injecting its eggs into the larva...[pp.74-5]

Because the oak tree is so many different things to the creatures that interact with it, to say that the oak tree is in the *umwelt* of one of these creatures means very little unless we know which feature of the oak tree is important to the life cycle of the creature in question. Von Uexkull concludes:

In all the hundred different *Umwelten* of its inmates, the oak tree as an object plays a highly varied role, at one time with some of its parts, at another time with others. Sometimes the same parts are large, at others they are small. At times its wood is hard, at others soft. One time the tree serves for protection, then again for attack.

Should we attempt to epitomize all the contradictory properties which the oak tree as an object displays, only chaos would result. [pp 75-6]

Apart from "the *umwelt*," Von Uexkull's essay introduces several other quasi-theoretical terms to describe various aspects of an animal's *umwelt*. Two of these, the "companion" and the "search image," became key terms in ethological literature.

### B. The "Companion"

One feature of von Uexkull's *umwelt* is the companion. A "companion," in von Uexkull's sense, is not an objective social partner. It is the sum of the properties of a class of social partners projected by an individual's social reactions. So, for instance, if a male english robin defends its territory, as David Lack showed, as vigorously against a bit of red fuzz on a wire as it does against a living male robin, then "red fuzz on a wire" constitutes the territorial defense companion of the male robin — by definition. Although von Uexkull introduced the concept to the

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literature, its fullest development is in Lorenz's classical essay (Lorenz (1935/1957), *Der Kumpan in der Umwelt des Vogels*. (The companion in the Bird's world.) Under normal rearing circumstances, all social reactions of a bird are directed toward members of the same species, giving the impression that they know conspecifics as multifaceted objects. But by hand rearing birds, Lorenz was able to dissect out the different functional cycles of the birds' lives. He demonstrates that individuals related to the other as different companions without ever knowing the other as constant objects. His best-known example is the Jackdaw, Jock:

...I once had a young jackdaw reared in complete isolation, who was conditioned to me in all its jackdaw behavior, except for two functional cycles: the activities of flying with the flock, and those of feeding and caring for other young jackdaws. The first of these had been conditioned to hooded crows when its group instinct matured. ...It did not regard the other jackdaws as flight companions. Every morning, when I had let the birds out, this one rose high into the sky and started to search for its flight companions, the hooded crows, whom it always succeeded in locating unerringly. But when its parental reactions matured it suddenly adopted a recently fledged young jackdaw, whom it led and fed in a manner perfectly typical of the species. ...In the life of this particular jackdaw a human being featured as the parent companion, hooded crows as flight companions, and a young jackdaw as the child companion! [pp 108-9]

Thus, even though a jackdaw is to another jackdaw normally an appropriate flight companion, parent companion, and child companion, Lorenz's rearing techniques demonstrate that the same objective conspecific individual is actually a different companion depending on the circumstances and history of the jackdaws it is interacting with.

### C. The "Search Image"

Another feature of the *umwelt* is the "search image." Von Uexkull introduced the term amongst several which referred to what he called magical phenomena. "Magic" to von Uexkull refers to situations in which an animal's behavior clearly relates to an object that is not present in the *umwelt* of the observer, as when a caged, isolated starling engages in insect-chasing behaviors. The search image is the object designated by the relationship between the searching behavior of the animals and the context in which that behavior takes place. Von Uexkull illustrates the concept with the following personal example.

When I spent some time at the house of a friend, an earthenware water pitcher used to be placed before my seat at luncheon. One day the butler had broken the clay pitcher and put a glass water bottle in its place. When I looked for the pitcher during the meal, I failed to see the glass carafe. Only when my friend assured me that the water was standing in its usual place, did various bright lights that had lain scattered on knives and plates flock together through the air and form the water bottle. [p. 62]



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Von Uexkull's discussion makes clear that the intentionality of the search image is in the form of extensional inexistence. That von Uexkull's behavior at the table is relevant to a clay pitcher in no way implies that there is a clay pitcher there to be found. Similarly, that a caged starling chases a fly, in no way implies that there is a fly in its cage to chase.

### V. The Intentionality of Other Biological Concepts

Before closing, we would like to explore the possibility that intentionality is a universal property of biological systems. For at least von Uexkull, and perhaps Lorenz as well, intentionality goes deeply into the structure of the organism and its component parts. We believe that the most central concept in behavioral biology — natural selection — is itself intentional. Selection explanations are of the form: "The organism has a particular form because nature has selected for it." For an example, let us suppose that nature selects for white polar bears. Another way of stating this concept is that nature selects that [polar bears are white]. Now, let it also be the case that white polar bears, lacking pigments in their skin, are susceptible to skin cancer. Just as we would not say that Lady Astor selected a cruise on the only major transatlantic liner ever to sink on its maiden voyage, we would not say that nature had selected a pigment level that causes susceptibility to skin cancer in polar bears. The selection statements in evolutionary explanations display referential opacity in the same way that reports of Lady Astor's choices do: Nature does not select for whiteness *per se*, but for whiteness in only one of its descriptions.

One might object that the intentionality of natural selection is only apparent, and arises simply from the metaphor "nature selects." But this objection can be met. Evolutionary explanations are instances of filter explanations (Lipton and Thompson, 1988). Filter explanations are of the form: "Aggregate A is characterized by A because aggregate X + A has been through an A-filter." Even though filter explanations are essentially mechanistic, their truth value is likewise sensitive to changes in the description of their key terms. So, for instance, filter explanations display extensional inexistence because nothing about designating an A-filter requires that there ever be — or not be — any A's in the world. A clean-oil filter would be a device that would remove impurities from oil even if no such impurities existed. Furthermore, filter explanations display referential opacity in that valid substitutions in the description of a filter do not always preserve truth. For instance, if it is true by definition that clean oil is oil that has passed through a clean oil filter and also true for the purposes of argument that the clean oil filter passes no particle larger than a millimeter in diameter, then it is true that a clean oil filter passes water. Yet oil with water in it is not clean oil.

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Other important biological concepts seem likely candidates for intentionality. For instance, even though a gene may produce deleterious consequences under some circumstances, we would not refer to it as the "gene for" those consequences. In fact, we suspect that any system that uses one variable as a cue for another — for instance receptors, membranes, enzymes — will display some form of intentionality.

### VI. Conclusion

If ethology's classical terms are intentional, why has this fact been overlooked? The reason lies, we think, in what Whitehead (1935) called, "The Fallacy of Misplaced Concreteness," that is, the error of mistaking the abstract for the concrete. In describing the development of modern science, Whitehead stressed the debt owed the 17th century's dedication to the concept of "simple location." But he then went on to stress the limitations of this notion:

So long as any theory of space, or of time can give a meaning, either absolute or relative, to the idea of a definite region of space and of a definite duration of time, the idea of simple location has a perfectly definite meaning. This idea is the very foundation of the seventeenth century scheme of nature. Apart from it, the scheme is incapable of expression. We shall argue that among the primary elements of nature as apprehended in our immediate experience, there is no element whatever which possess this character of simple location. [Whitehead, 1935, p.]

As long as we think of an intentional state as some sort of instantaneous causal transient within the organism that directs the organism's behavior, then intentionality becomes a problem for science because nothing in the material world is sufficient to pick out one intentional cause from another. But if we think of an intentional state as an organization of events in space and time chosen by the animal's behavior, then intentionality poses no problem to causal explanation because the pattern is itself a material "thing." It was this insight that lay at the core of von Uexkull's terminology and Lorenz's adoption of it. The intention of a behavior pattern is not some hidden inner "mental" state, but an empirically determinable feature of a complex, overt high-level behavioral pattern.

This conclusion is consistent with a perspective called descriptive mentalism (Thompson, 1987, 1988). From the perspective of descriptive mentalism, *talk of mental states can be best understood in terms of higher order patterns of behavior*. When they are understood in this way, they preserve their intentionality, even while remaining objective properties of objects in nature and, therefore, fully compatible with the causal chain of events familiar to scientists.

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