

Meaning in Animal Communication: A Zoosemiotic Analysis

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“Well, there remained the matter of the uncertain, vacillating *scandal of meaning*.”¹⁴

1. Definition of Meaning: The Game of Defining Meaning.

Before looking at the problem of meaning with respect to animal communication it would be prudent to begin with an analysis of what exactly do we *mean* by meaning? - a dreadful tautology, but one that has preoccupied philosophers and scientists alike for thousands of years. In the everyday understanding of meaning there are three main definitions which come to mind:

- i) meaning as signification as in the question "What does that sign mean?" (Type1)
- ii) meaning as intention as in the question "What do you mean by that?" (Type2)
- iii) meaning as purpose as in the question "What is the meaning of life?" (Type3)

These three main definitions can be joined by a score or more - the authors, Ogden and Richards in their book *Meaning of Meaning* (1923) for example listed sixteen categories. While there are many more, I would like to concentrate on the three main types. These are problematic enough! If we turn to the first in which we have the statement A(R)B. The standing for/signifying is a relationship (R). This relationship is dependent upon a convention. A(R)B because of C. The convention in this case is language. Even in the absence of language one requires a convention for signs. Here we can classify meaning into two types: natural meaning and conventional meaning. Natural meaning occurs outside of a system of signification like language. Often natural meaning is fixed, whereas conventional meaning is arbitrary. In Saussure's model of signification, while there is an implied referent, the process is closed, i.e. meaning is bounded by the system of language. Since there is no explicit referent, Saussure's semiology is dyadic. The model of Charles Peirce differs in almost all the dimensions. It has both natural and conventional components in its definition of meaning, it moreover has a dynamic triadic form that includes an explicit referentiality. It also includes a

¹⁴ Floyd Merrell, (1997) *Peirce, Signs and Meaning*. Toronto: University of Toronto Press. page vii.

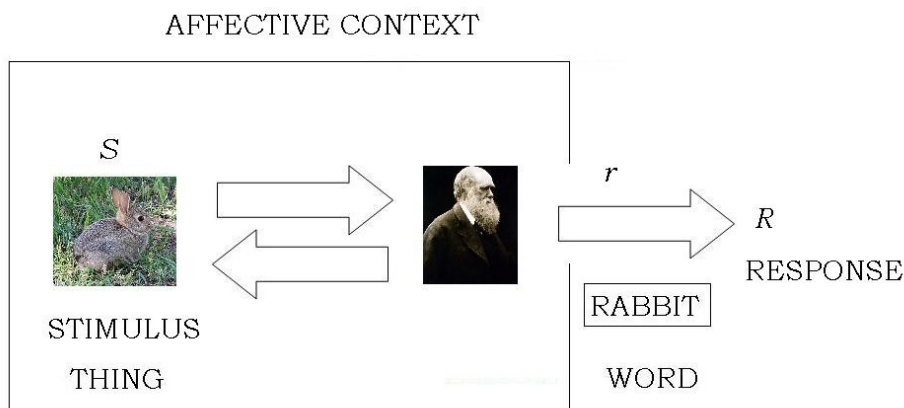
quasi agent/structure called the interpretant. We can briefly then arrange the dimensions of meaning as:

1. closed or open referentiality
2. dyadic or triadic
3. agency or not
4. structural or dynamic
5. quasi-agents or not

These two interpretations of meaning are semiotic and come under the branch of the sciences called linguistics. We find in linguistics several other interpretations with different configurations. Some like Ogden and Richards (1923) have a closer affinity with the common sense dyadic notion of meaning: word and thing. They have merely added thought, as in: word, thought and referent. Others like Leonard Bloomfield have been influenced by behaviourism and view language in Pavlovian terms of : stimulus, word, and response.

Leonard Bloomfield (1933)

S ----> r----->R

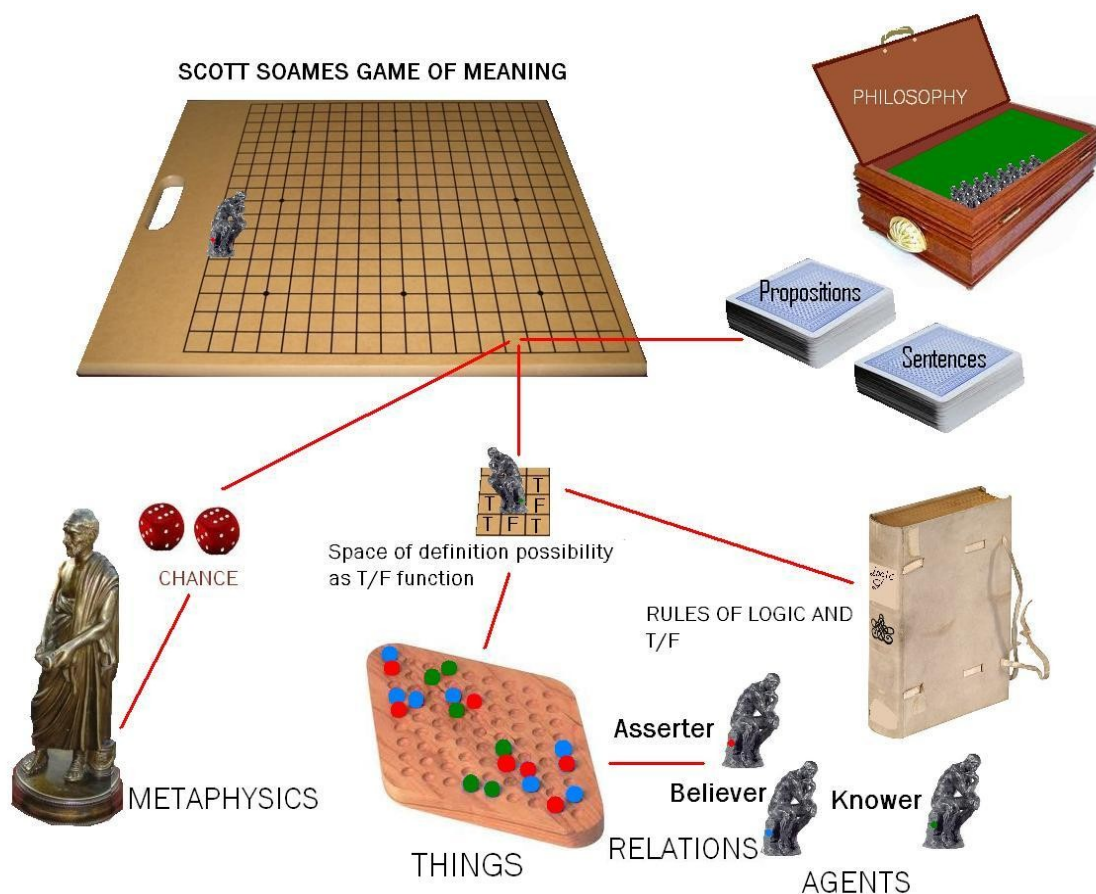


Based on Crystal, 2010, pp. 104-5.

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The model of Charles Morris has similarities (Morris, 1971); its sign is also streamlined. He wanted semiotics to be scientific - and to this end, he not surprisingly decided that the term "meaning" was too problematic. He called it "imprecise", because presumably it was ubiquitous like Charles Dickens' London fog, getting everywhere, and yet remaining throughout vague. Rather than retain such a nebulous term, Morris argued that meaning

should be replaced with specialist terms for each of its instances. This actually causes definitional inflation. Nevertheless, Morris's theory of the sign is much more *manageable* than Peirce's. We will return to this point shortly, but for now I would like to examine another division in linguistics, one which provides us with two separate but allied sub-branches, namely semantics and pragmatics. These two sub-branches or fields in their way quite nicely correspond with the first two of the main definitions of meaning, i.e. signification and intentionality, respectively. In semantics one studies what words or signs stand for in the context of language or a communication system; whereas pragmatics studies the meaning in use between agents. We can see here that though the definition(s) of meaning are in themselves complex in linguistics, we can add further complexity by comparing these various definitions of meaning with those in other sciences or fields of enquiry. For example linguistics differs in its approach to those used by philosophers. In his encyclopedia of language, Crystal (2010) in his comparison tells us that linguistics has a broad range of interpretations and definitions of meaning, while on the other hand in philosophy, particularly analytical philosophy the focus is on propositions and naming. A good example of the latter is Soames (2010).



In the above illustration we have a ludic display of the components of what is essentially a propositional approach to meaning. At the beginning of his book on meaning Scott Soames provides us with the assumptions behind the problem in the relationship between sentences and propositions. I have reduced them to the following:

- A1) Some things are asserted, believed and known. These relate agents [...]
- A2) The things asserted, believed, and known are bearers of (contingent or necessary) truth and falsity.
- A3) Propositions – the things satisfying A1 and A2 are expressed by sentences [...]
- A4) Propositions are not identical with sentences that express them [...]

The problems are to be found in the last. There are a lot of things going on at different levels. The “game” of meaning here is “closed” and formal. The frame is essentially logical. The question of truth and falsity I have illustrated in spatial terms as the “space of definition possibility”. A question we might ask, is how do assertions, beliefs or knowing start? What are the relations between the things ASSERTED and the agents ASSERTERS? What are the relations between the THINGS. Note that the game of meaning belongs to the SET of PHILOSOPHY. All of these factors determine the nature of play between the elements in the defining of meaning. In his book the question of metaphysics is not addressed. I added the Aristotle piece (METAPHYSICS) as part of the implicit rules of the game. When Soames states at the beginning of his book:

*In what follows. *I will take it for granted that words, phrases, and sentences have meaning, that for each meaningful expression there are correct answers to the question “What does it mean?”, and that two expressions mean the same thing when the answer to this question is the same for both. p. 1*

Here in philosophy the interest is in the discovery and test of core statements, propositions, and their relations in language, thought and the world. Unlike the linguists who seek as many examples as possible drawn from languages, the philosophers tend to work with a discrete number of similar propositions and statements, often as variations on those used by Frege, Wittgenstein Austin, and Searle. There are numerous factors involved in this conception of meaning and language – and of course Noam Chomsky in his review of B.F. Skinner’s delivered his *coup de grâce* a long time ago. (Chomsky, 1967). In his review Chomsky argues for a more scientific approach to meaning on the lines of syntax:

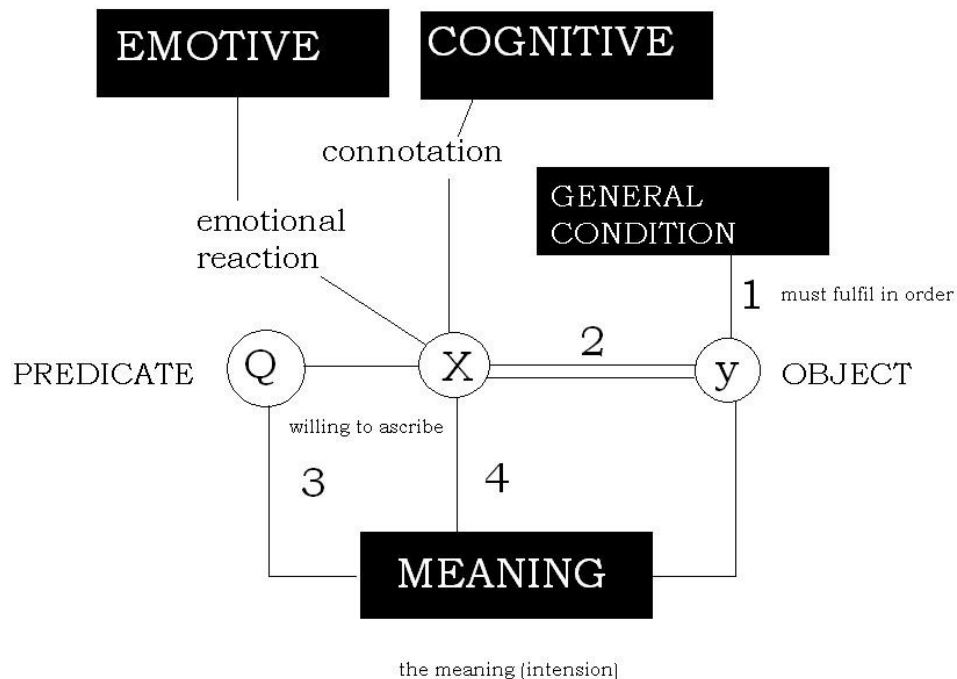
It is at least possible, furthermore, that such a notion as semantic generalization, to which such heavy appeal is made in all approaches to language in use, conceals complexities and specific structure of inference not far different from those that can be studied and exhibited in the case of syntax, and that consequently the general character of the results of syntactic investigations may be a corrective to oversimplified approaches to the theory of meaning.

He also refers to the philosopher Carnap’s conception of meaning:

R. Carnap gives a recent reformulation in "Meaning and Synonymy in Natural Languages," Phil. Studies, 6 (1955), 33-47, defining the meaning (intension) of a predicate Q for a speaker X as "the general condition which an object y must fulfil in order for X to be willing to ascribe the predicate Q to y." The connotation of an expression is often said to constitute its

"cognitive meaning" as opposed to its "emotive meaning," which is, essentially, the emotional reaction to the expression.

Rudolf Carnap (1955) Model of Meaning



When we take a bird's eye view of meaning, we discover that the definitions of meaning/s are dependent very much on the system in which they are produced - indeed just as one in nature talks of environmental constraints having an impact on evolution and development, here one can say that the context of definition has a huge bearing on how meaning is defined or even resisted. For example the types of meaning can be categorised functionally as in grammatical meaning and differential meaning in linguistics. In turn these constraints on the definition of meaning colour the whole approach to communication. We saw how Morris wanted it reconfigured because it was imprecise for his scientific application - others like Shannon & Weaver in their mathematical model of communication found it to be an irrelevancy - because their remit from Bell was the study of the flow of information not the analysis of its content. We can see that each field or branch as a system has its own rules and procedures with regard to defining meaning and its own explanation limits. The limit of an explanation is equivalent to what the British philosopher R.G. Collingwood called the "absolute presuppositions" (Collingwood, 1940). These are, and I am taking a more practical approach than Collingwood here, the kinds of propositions that border the system and the metaphysical scope. For example, if I talk to a plumber about his or her work, he or she will talk about the pipes, taps, pressure and so forth. They might even talk about the calcium build up. All these pertain to the work at hand. However, if the plumber starts to talk about the nature of water, one starts to see a drift into questions that are not directly work or system

related. The explanation lies outside plumbing. Also using the same analogy, if you are having a house renovated and need the plumbing and electrics changed - while the plumber and electrician are working towards a common goal - renovating the house - they will however stick to their own field of expertise and work on problems discrete to their own professions. That is similar to how the semantician and pragmatist work within linguistics.

It was from this bird's eye conception of how various academics define meaning that I thought of tests for definitions of meaning. One way of testing something is to put it into the context of a game as above. Here we can consider a game in which two semioticians or semiologists are competing to define meaning. We can envisage a board like a go board in which each of the players has to move their pieces. Imagine that one is concerned with defining type one meaning. What do they require for their game? They might need two sets of cards - one for the signifiers and the other for the signified. They would need a book or guide that gives them the conventional rules. What about the players in their game? They must share the same codes. The game is one of relations. One player randomly turns over a card with a sign on it. The other player must guess its meaning - if they cannot, then another card is over turned. Still no meaning? A third. The first sign is eventually understood in the *context* of the other cards. Once that happens, then the other player starts. Now let us look at the triadic model of Peirce. To play this game we need three sets of cards - one for the *representatum*, another for the *interpretant*, and finally one for the *object*. Meaning arises in the semiosis. Unlike the dyadic system, the triadic is reliant on interpretation and referentiality. If we look at Peirce's definitions of the sign (there were many throughout his life) we find that the basic structure corresponds to the Ogden and Richards model (who were obviously influenced by Peirce). However, Peirce's interpretant is a troubling concept, because it seems to at various times to function as a concept (Ogden & Richards) / the signified (Saussure). One even feels that it sometimes functions as an *avatar* of the interpreter, instilled with *quasi-mind*. When we analyse the "two" games of defining meaning, we see that in terms of play, the dyadic game is the simplest - but could given the need to contextualise - take just as long as to play. But there is another dimension to Peirce's model of the sign - metaphysics. While the relations in the convention of language are taken for granted as being arbitrary - the classes of signs and their meanings in Peirce's model are determined by a kind of Aristotelian metaphysics which divides "the world" into categories of firstness, secondness, thirdness. These three categories are referred to Peirce in his letters and writings as "modes of being". Staying with the metaphor of a board game, we can compare the "rules" in the two subgames. In Gérard Deledalle's intellectual biography of Peirce he tabulates quite nicely the trichotomies of signs:

	Firstness	Secondness	Thirdness
Representamen	Qualisign	Sinsign	Legisign
Object	Icon	Index	Symbol
Interpretant	Rheme	Dicisign	Argument

This table exemplifies the inherent problem in the Peircian semiotic system, because we see that in its structure a direct metaphysical input that arose from his engagement with Aristotelian categories and phenomenology. How he arrived at these categories is complex, but not it seems up for discussion. Saussure on the other hand in his account of signs does not

have such metaphysical baggage. Charles Morris sensibly took a pair of methodological scissors and cut through the woollier parts of Peirce's semiotics, nevertheless he also felt the necessity to rename key concepts and terms, contributing to the general mystification of semiotics – ironical since his main enterprise was clarification for application in the sciences. In their book *Rules of Play* (2004), an excellent and concise introduction to all aspects regarding design of games, the authors Salen and Zimmerman discuss the nature of the rules in terms of three levels:

1. Operational Rules - the written out rules used to play the game. p.130
2. Constitutive Rules - the "underlying formal structures that exist "below the surface" of the rules presented to players." p. 130
3. Implicit Rules - "unwritten rules of the game". They are rules concerning matters like "etiquette, good sportsmanship, and other implied rules of proper game behavior". p.130

In the dyadic game, the matching or associating of the signifier and the signified are the operational rules. The convention or language provide the constitutive rules. The implicit rules are those to do with culture and society, how these affect the play of the game.

In the triadic game, the linking or associating the three components are the operational rules. The constitutive rules are logical and metaphysical. The implicit rules are those to do with culture and society, how these affect the play of the game.

For the smoothness of the game there needs to be rule cohesion. In other words the rules should not conflict or cause friction in the play. Here we see a clear difference between the dyadic "game" and the triadic "game"; in Saussure's game the first two rules do not really conflict - though the third to do with the character of the convention, might if there is disagreement in the players cause trouble. However, these are formal problems to do with relations. In the triadic game, the problem arises in the first two, because the second level of rules (logic and metaphysics) are not in themselves compatible, and the notion of belief in categories determined by Mind/God, requires a belief which belongs to the third level of rules. The matching of the cards takes place within a logical structure or program that is established not by culture or society, but by a particular deity or force. Consider for example the difference in a Humean and Kantian game of meaning. We would find in the former no recourse to God as an ultimate explanation of the rules of definition of meaning, but in the latter, there is a dualistic logic that has the God create the logic by which one can discover the God: a supreme tautology. Players who like myself do not believe in a religious force, find the inclusion troubling, moreover since as I explained above, here we have crossed over from discussing meaning in terms of the semiotic theory/system into pure metaphysics - which is entirely another game and requires additional rules and cards etc. Indeed here we have an example of Type Three meaning:

Type Three

This game is called Telos. The goal of the game is to interpret the purpose of the message (signs). This is an esoteric game. The game has a box containing figures of philosophers or

religious symbols Each of the players will be assigned a philosopher or religion - this is done through roll of the dice. Each of the players must then play the game according to the guide given to them. The significance of each word or image depends of course on the interpreter. The game is played as follows. A card is overturned and each player must rank from a scale from zero to five what significance that symbol, word or image might have on the other players. The one who is the closest in his or her guess wins. They can roll the dice and move forward according to the outcome.

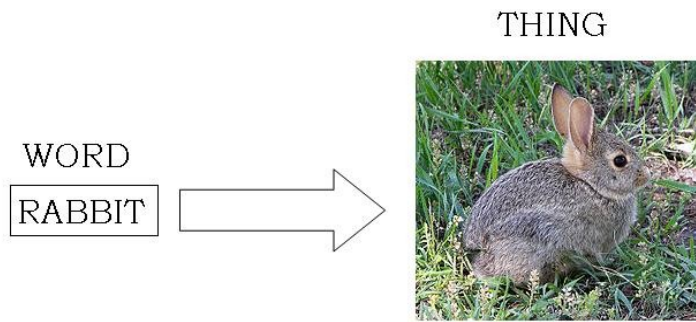
Type Two (The Pragmatic Version)

In this game there are three main sets of cards. One with the signs, another with the things, and one more for concepts. In addition to these cards there is one more set which is for dispositions or affects. The game is a board game. Each of the players has a piece with which they move round the board, the purpose is to successfully interpret what the other truly means (intends). The players can alter their tone, gestures and the other has to guess the real message.

By looking at the definition of meaning as if it were a board game we saw that definitions are constrained:

- i. By the particular context or field of enquiry
- ii. By competition within the larger field or science
- iii. By the players themselves
- iv. By publication

2. The Meaning Debate in Animal Behaviour Studies



Based on Crystal, 2010, pp. 104-5.

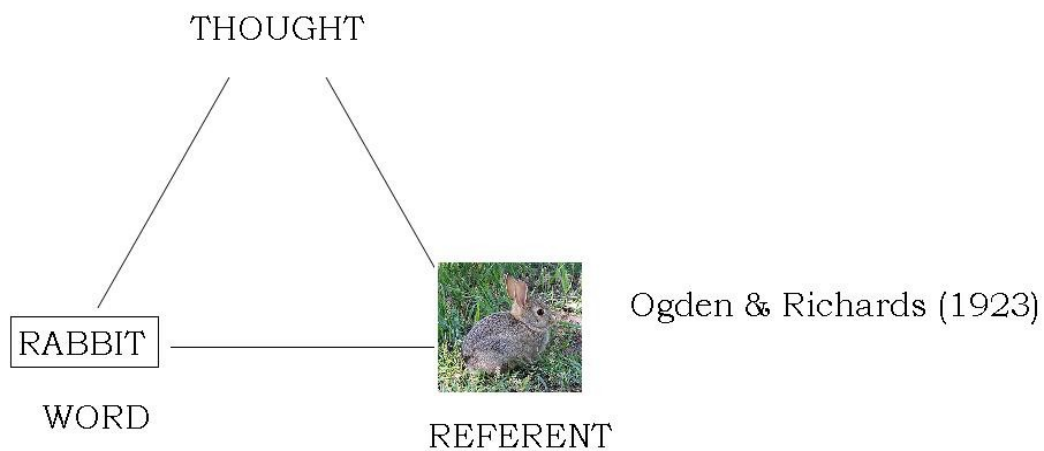


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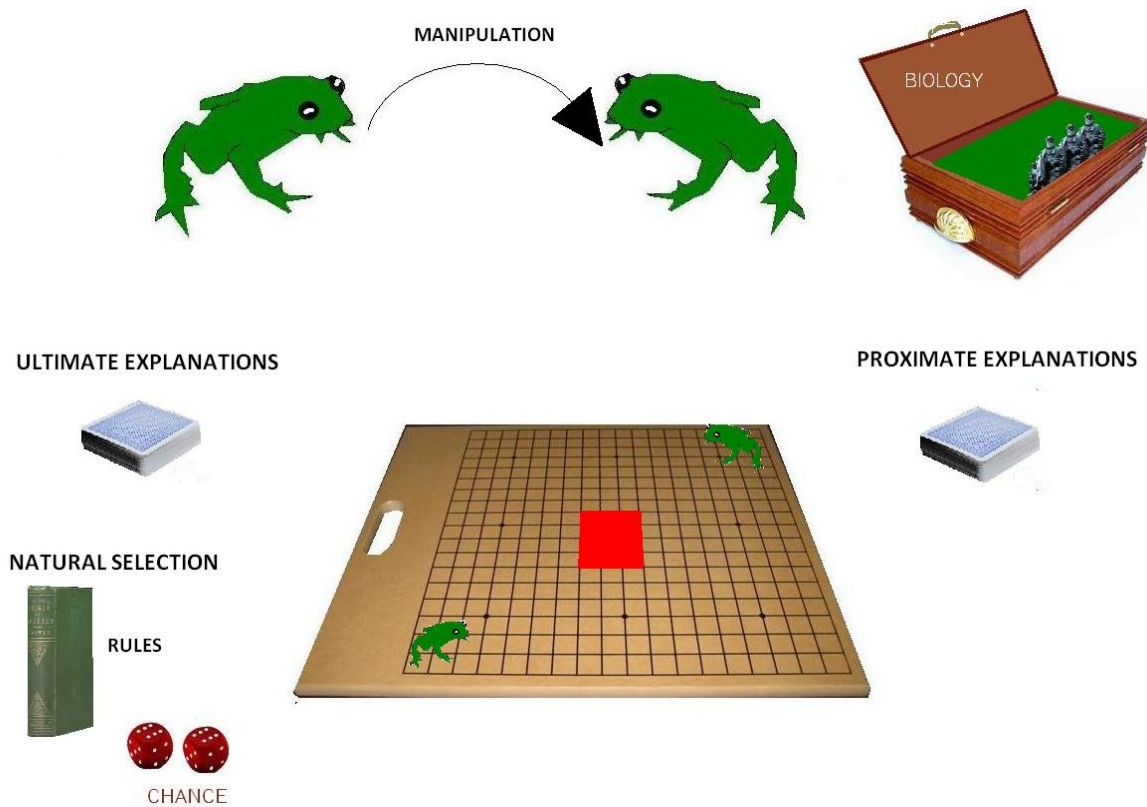
Over the past thirty or so years, since the publication of an article by Richard Dawkins and John Krebs (1978) which argued for a non information based approach to communication ("Animal signals: Information or manipulation?" In J.R.Krebs & N.B. Davies (Eds.) (1978) *Behavioural Ecology : An Evolutionary Approach*. (pp. 282-309). Sunderland: Sinauer Associates.) there has been a division in animal behaviour studies into roughly two camps, the adaptionists following Dawkins and Krebs on the one side that advocates a tough Darwinian stance towards communication where animals manipulate another to their advantage (asymmetrical relation) and the other side that views communication as symmetrical - that is having a sender and a receiver in a mutualistic relation - here the sender *shares information* the receiver. When the 1978 article was first published there was a flurry of publications that took sides. Dawkins and Krebs concluded with a red flag for the informational school:

We are contrasting two attitudes to the evolution of animal signals. One attitude, which we have here called classical, emphasises cooperation between individuals. Cooperation is facilitated if information is shared ... The other attitude, which we espouse, emphasises the struggle between individuals. If information is shared at all it is likely to be false information, but it is probably better to abandon the concept of information altogether. Natural selection favors individuals, whether or not this is to the advantage of the manipulated individuals. (p.309)

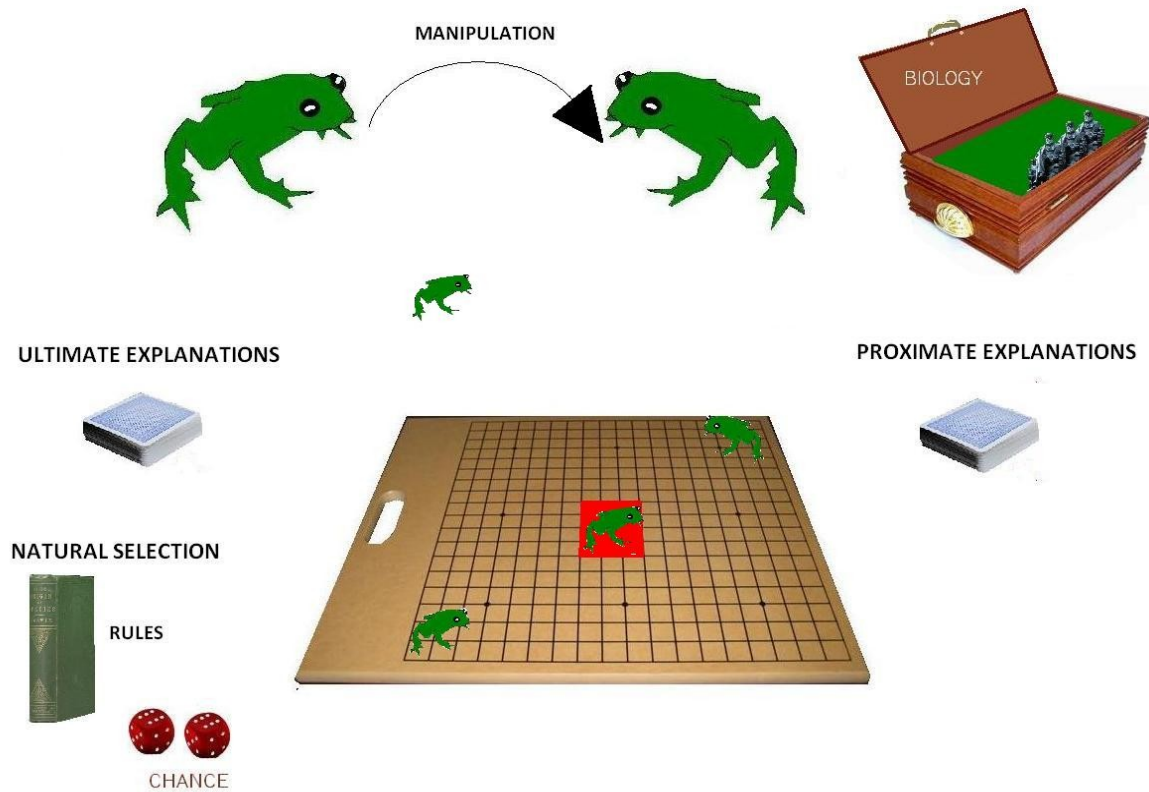
At the time the information school critiqued the D & K thesis of manipulation because it was making "unacceptably strong claims for their manipulation hypothesis" which for Smith (1986) was already incorporated within the informational interpretation. Moreover W.J. Smith argued that the manipulation hypothesis was bringing back some of the now discredited terms used by Konrad Lorenz - i.e. out of date European *classical* ethology prior to the integration of genetic theory. They took a "short-term view of social behavior" ignoring the "long-term social interdependence" therefore rejecting the important aspect of "evolution of cooperative behavior", they also assumed that informing was full and reliable - which it is not, and finally they failed to realise all misleading signals are a form of mimicry.

Reactions to Dawkins and Krebs included both praise of their use of the logic of natural selection, and identification of a problem with their formulation. Myrberg (1981), Beer (1982), Wiley (1983) and Smith (1986a) insisted that "information" and "manipulation" are complimentary rather than alternative concepts. Information, several argued, has to do with the proximate coupling between signaling and situation (e.g. semantics), or between signaling and the behavior of perceivers (e.g. pragmatics). The term manipulation was used metaphorically and is actually defined in ultimate terms, i.e., of the average impact of the signal on signaler and perceiver fitness. (Owings; Morton, 1998, 41)

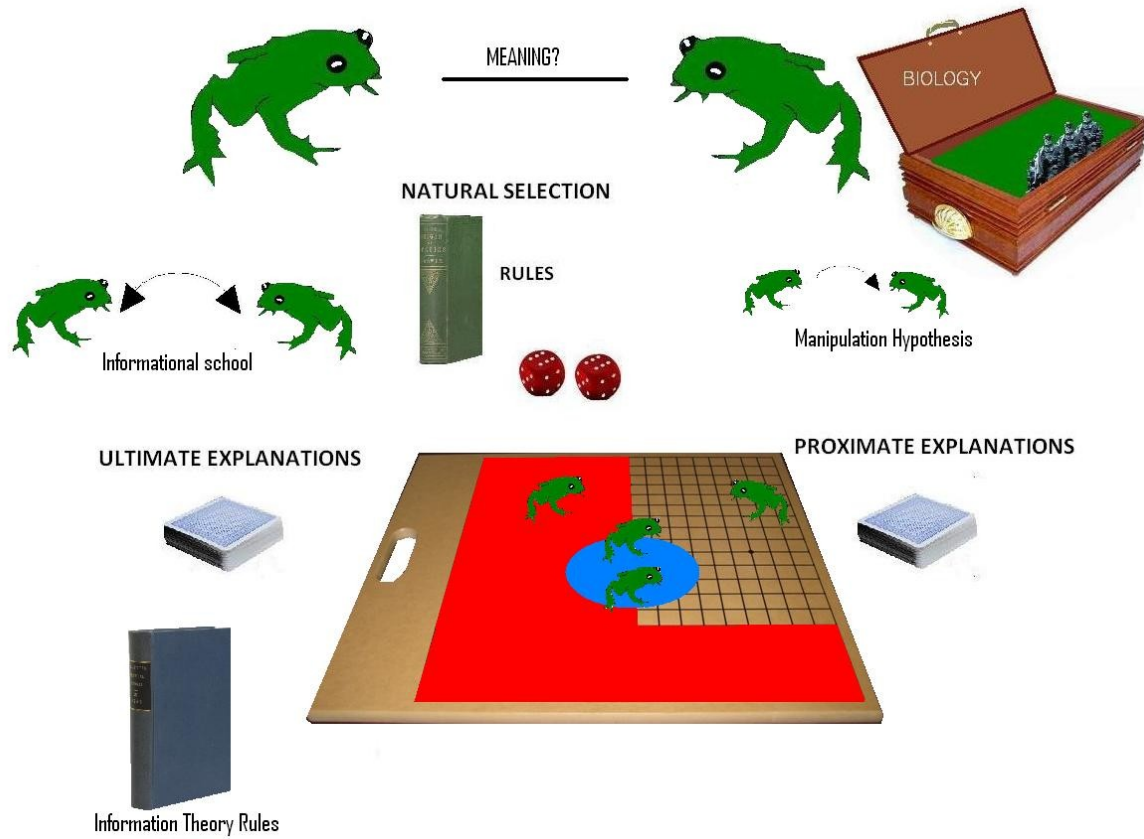
Let us look at a definition of meaning according to a manipulation hypothesis. Suppose we consider the case of a frog "communicating" with another frog. In the Dawkins and Krebs (1978) model they must explain the event in strict terms of natural selection and explain the event and its proximate and ultimate causation (according to Tinbergen et al). In this game of meaning (which is really the game of non meaning) the players take two animals (frogs) and they must avoid the red area (the danger area which is informational/linguistics) and then move the pieces towards a set goal for example – mating. How do they arrive at being next to each other without communicating meaningfully?



In the above game of meaning the operational rules are governed by evolutionary logic, the constitutive rules by biology, and the implicit rules governed by the scientist's practices. The players here are cooperating which makes it in some ways a non game – unless one has to draw the other into the red square. However, by doing so that player endangers his or her own survival – because the game requires that they mate. We must then have another player. This player is in the middle of the board and is female. The two males must "manipulate" her out of that square – she on the other hand must draw them into the square.



Imagine now if the game is played between those who subscribe to an informational approach and those who subscribe to a manipulation hypothesis. In the centre we have a blue circle representing the females. The males must using their particular strategies attract and mate with the most females. In this particular game I have given the informational school (red) the most territory – this represents their ranking in the *Animal Behaviour* journal. The other school in the unmarked squares has a disadvantage. When we look at how meaning in animal communication is determined – it has a lot to do with academic power relations that establish paradigmatic status, even though the principal rules are accepted by both. There are additional rules that come from the mathematical theory of communication. What are their status? Do they affect the play? What of the implicit rules? Do all the players agree on the implicit rules of defining meaning? Both seem to agree on the constitutive rules – and perhaps on the operational rules. But do the rules of mathematical communication challenge natural selection rules or make the operations of play more difficult. Certainly any additional rules add more complexity and time to play the game. This is countered by the informational school who would argue that if the players take time to learn the rules of information theory, the game would be much simpler and practical. Besides they would argue also that the manipulation hypothesis requires some formidable mathematics as well drawing from game theory among others.



Any game would not be interesting if it did not include penalties or obstacles. One might be the “tautology” card. One cannot in this game use the word “mean” in the definition of meaning. Another penalty card is the “representation” card. If one draws this card. One must prove that the particular instance of meaning is represented physically. This would balance the game, since those in the informational school would need to prove physical sites.

The purpose of using the board game model in meaning definition analysis is that it allows us to be able ascertain relations between models and theories of definition. We can see the nature of the constraints and the elements that are connected with competition.

Problem of Representation of Meaning in Animal Communication

Over the past year or two the problem of meaning has cropped once more in the field of animal behaviour studies (see journal *Animal Behaviour*) . In 2009 Rendall, Owren and Ryan challenged the informational school and its reliance on information theory :

The upshot is that, although informational approaches have tremendous intuitive appeal, they are at one and the same time both too loose and too restrictive to cover the broad range of animal-signalling phenomena. They are too loose because their core explanatory construct, information, is either only ever vaguely defined and operationalized, or, more often than not, left entirely tacit. (p.234)

More importantly they see a flaw in the approach because

Studies of primate communication are often couched in the metaphor of language where meaning is the central explanatory construct and arises from the common representational states of speakers and listeners. This representational parity in language occurs when the speaker and the listener have similar representational processes that ensure corresponding coding and decoding of signal meaning. The details of signal design are not critical. Indeed the design, or form, of most words is thought to be largely arbitrary with respect to the things they represent. What is more critical is that speakers and listeners make implicit attributions about each other's mental states, such as their thoughts, beliefs or states of knowledge, because these are what motivate and sustain reciprocal semantic exchange. (pp.234-5)

When we analyze the above passage we can see that the authors have doubts about attributing meaning and representation (in the linguistic sense) to animal communication. Worrying for biosemioticians and zoosemioticians is that they see no evidence of primates in either their behaviour or in their neurobiology of “perspective taking and mental state attribution abilities considered to be foundational in to the referential quality of human language.” (ibid., p.235). This was quite damning -- not surprisingly the informational school responded in an essay in the same journal (Seyfarth et al 2010).

Far from being ‘teleological’ and ‘circular’, research inspired by the informational perspective has clarified differences in the mechanisms that underlie the behaviour of signallers and recipients; revealed differences between species in the information that recipients acquire from signals; suggested fundamental differences between language and animal communication; and inspired a growing number of studies that examine the neurophysiological basis of call meaning. The informational hypothesis thus continues to prove its value in the most important way possible: by suggesting observations and experiments that drive our field forward.

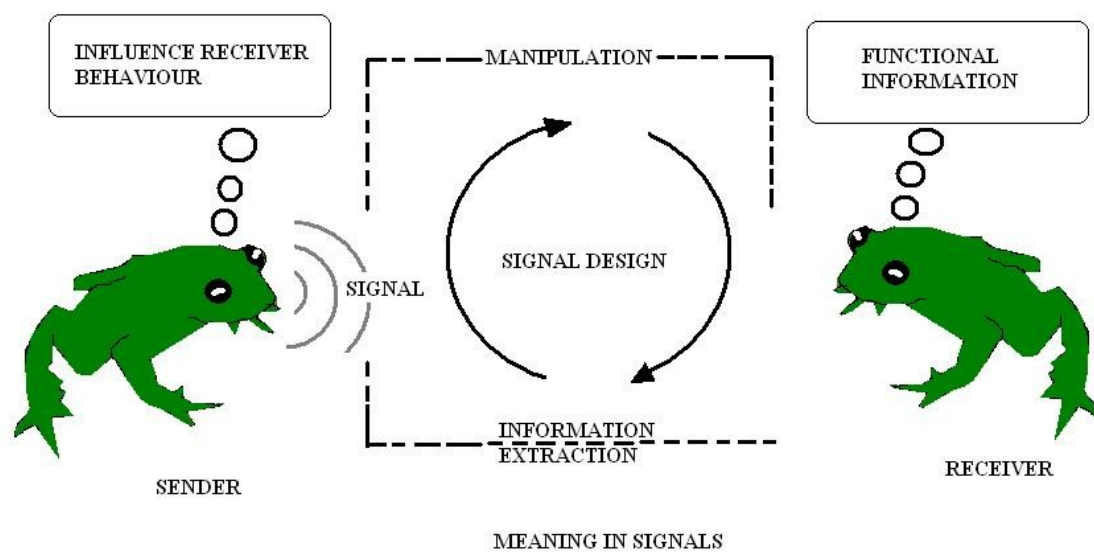
Robert M. Seyfarth Dorothy L. Cheney, Thore Bergman, Julia Fischer, Klaus Zuberbühler, Kurt Hammerschmidt (2010) “The central importance of information in studies of animal communication” *Animal Behaviour* **80** (2010), pp.3–8

Interestingly the authors in their riposte used the same expression used earlier against Dawkins and Krebs (1978) ,i.e., that Rendall et al “*have set up a straw man*” p. 4. While they argue that information theory has provided good results, they do not elaborate on the criticism regarding information exchange and representation nor really do they address the problem of biological evidence of putative sites, indeed this is what they have to say:

In fact, adopting such heuristic terms has a long and continuing history in the biological sciences. ‘Gene’, ‘memory’, ‘mental map’, ‘auditory template’ and ‘neural representation’ are other examples of words or phrases that scientists have used to label an entity whose

physical properties they are only beginning to understand. The inability to specify precisely the information conveyed by a vocalization (that is, its meaning to a listener) does not prove that information is entirely absent. (p. 6).

This does not seem entirely convincing. It seems that they take it for granted that if one primate calls and another as a result changes their behaviour in response – there is learning and meaning in the exchange. There must be. A pragmatic perspective is offered by Font and Carazo who bring together the two strands of animal behaviour studies (adaptionist and informational) into one model.



Model based on Font and Carazo (2010)

However, this model is dealing with signals – not with signs. One can say that it is still not really tackling with *the* true problem of meaning, since it is principally discussing the observed external behaviour of the animals without discussing issues to do with the notion of inner representation as a prerequisite of meaning production. The signal is the “sign” carrier or the messenger. What about the significance of the content in semiotic terms? What about the sites for meaning representation? At this juncture we can move toward a physical account of meaning.

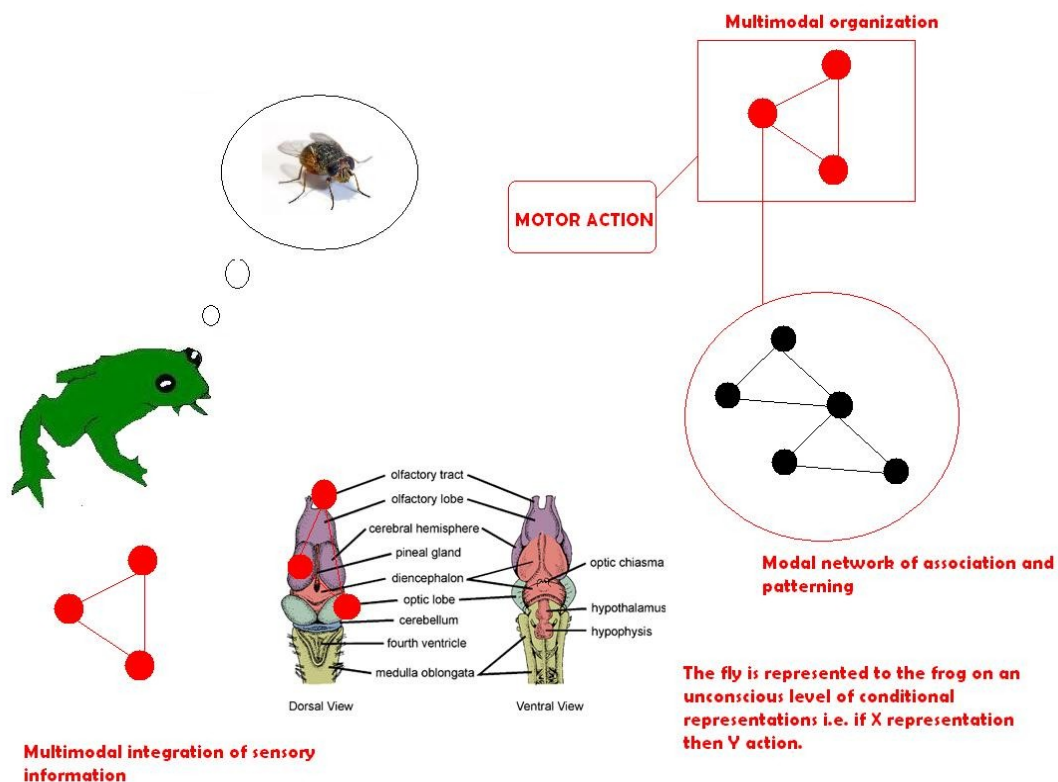
The Semantic Memory Model

Semantic memory registers and stores knowledge about the world in the broadest sense and makes it available for retrieval. If a person knows something that is in principle describable in the propositional form, that something belongs to the domain of semantic memory. Semantic

memory enables individuals to represent and mentally operate on situations, objects, and relations in the world that are not present to the senses: The owner of a semantic memory system can think about things that are not here now.

Endel Tulving “What Is Episodic Memory?” (1993) *Current Directions in Psychological Science* Volume 2, Number3, pp. 67-70

The concept of semantic memory as one of several memories (multiple memory systems) owes its origins to Endel Tulving who came up with the hypothesis in 1972. Since then much work has been carried out to isolate and identify the differences between episodic memory and semantic memory which belong to a larger category of declarative memory. We can see from the past literature that semantic memory was seen as exclusive to humans and grounded in language and amodal that is operating at another level to sensory motor functioning. However as neuroimaging have shown these theories about semantic memory are wrong. Semantic memory is not amodal, as in the representation of concepts areas of the brain connected with this or that sensory modality are activated too, In other words semantic memory processing is distributed across the divide between declarative and procedural memory zones. This challenge to the amodal model of semantic memory raises the possibility of a non linguistic – conceptual memory.



Information is hierarchical and structured according to the stages in the cognitive processing. In the above cartoon presentation, we see the fly (the referent) and the sites where it is

represented – beginning of course in the sensory organs where cues are received as waves or molecules and then filtered, the information converted into secondary signals that provide more defined information as the animal’s sensing systems move through reception, sensation, integration, perception and towards action or non action. The disposition of the animal is dependent on numerous factors including its homeostatic conditions. When a frog is in a predatory mode then the information received will be categorised according to the features or patterns that correspond to prey. Here the information from potential prey such as movement, colour, and so forth is received as cues not as signals. The fly is not communicating to the frog, though its movements etc do *indirectly* communicate information. Here we see the problem of nomenclature as the fly’s movements are:

A

1. Received as mechanoreceptive waves (signals)
2. Received as optic signals

B

1. Secondary signal
2. Signal within nervous system

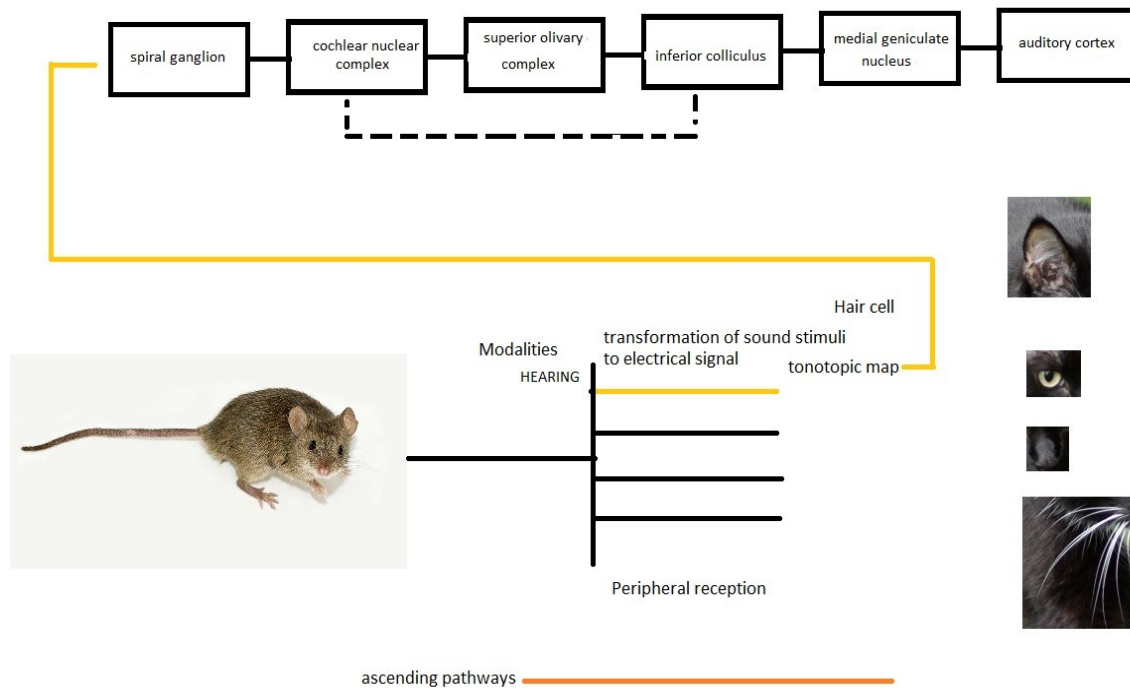
C

1. Cue i.e. not as a signal

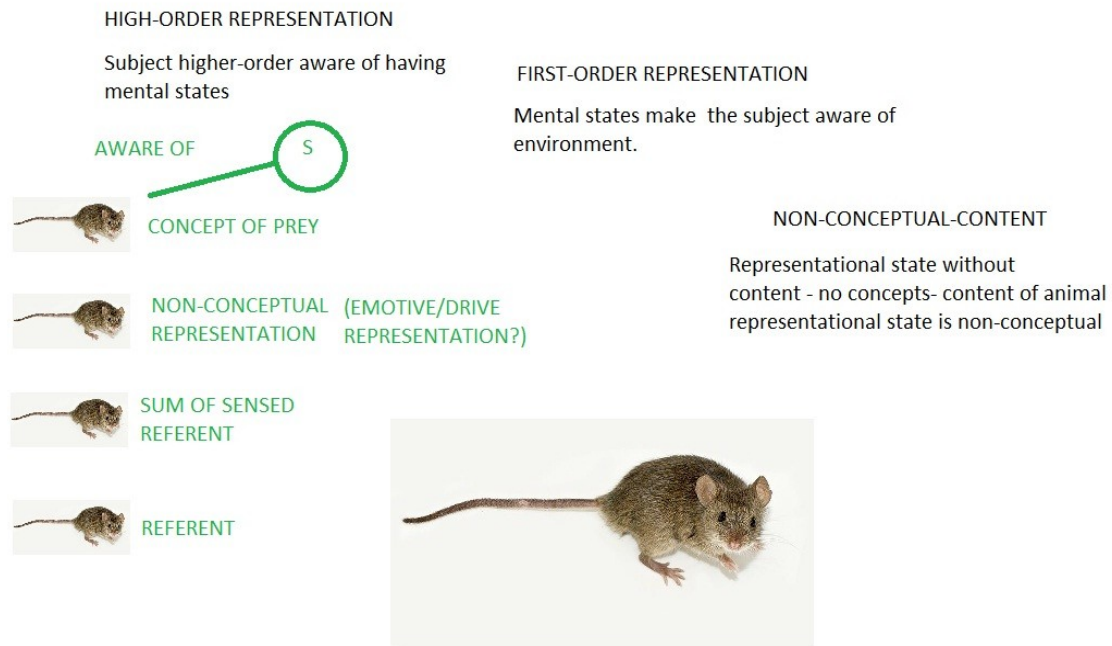
D

1. The movements can be interpreted as a “sign” of the fly’s presence. (Indexical sign)

The last example is an assigned sign – attributed semanticity, because the information is not conventionalised nor represented in a higher cognitive system – it all occurs fairly automatically. In a single vertebrate, in-coming information from the environment is processed at various stages firstly at level of stimulation without value, then as saliency in reference to immediate homeostatic values, only when it reaches the higher processing areas is it evaluated semantically as this requires association in a multimodal neural working space with memory input. The notion of a pre-linguistic semanticity requires a system of coding – perhaps a vocalization system. Throughout the production of meaning, there are also different levels of awareness. It has been said that animals do not attend behaviourally to more than one task – however it is conceivable that animals with vocalization systems correlate information with vocals. If we consider the Piaget model of object permanence where prey can be inferred from information that is not directly associated with structural cues of a prey (such as scent identification) – information would be a hole (though this is problematic as a hole has a lot of olfactory information – but we will ignore this for the moment) then the notion of a mouse is carried on in experience and reruns during sleeping. Here a cat and dog often vocalizes and moves as if the experience is live rather than recorded – and here one might relate the particular vocable to the object experienced and its correlates in the memory system.

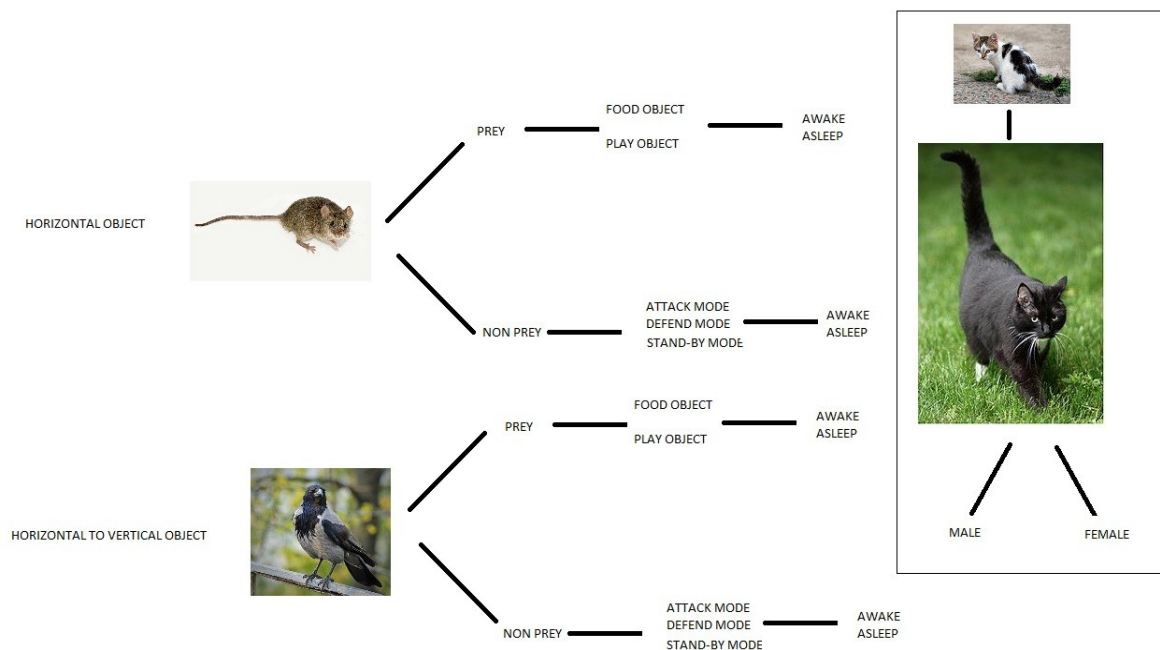


In the above diagram (from Carole Hackney “From Cochea to Cortex” In Roberts, David(edit), (2002) *Signals and Perception* London: Palgrave, (p. 30) pp. 29-40) we see the ascending pathway of the auditory pathway starting from the transformation of sound stimuli (relating here to the mouse) the placing of this in a tonotopic map at the level of the hair cell moving all the way towards the higher cortical areas. The question is what is meaningful at these levels if anything? What are the tests for meaningfulness? What about the memory of the mouse? It has been my argument that representation defers according to the stage in the pathway and is differentiated according to several dimensions beginning with peripheral reception, filtering, (here at level of responsiveness), moving onto another level of biological organization the hair cell where it is “mapped” – this mapping is not be confused with cognitive mapping (i.e., based on Tolman, 1948) , it is neural mapping. If we look at the flow chart, it is only in the auditory cortex where integration from other modalities take place that we can start to consider representation at the level of semantic. At this juncture we should situate the discussion of meaning in animal communication in a wider theoretical framework – discussion of semanticity within the framework of animal mind. Does semanticity require higher order representation? Can it get along nicely at the level of first-order representation – i.e. enriched perception?

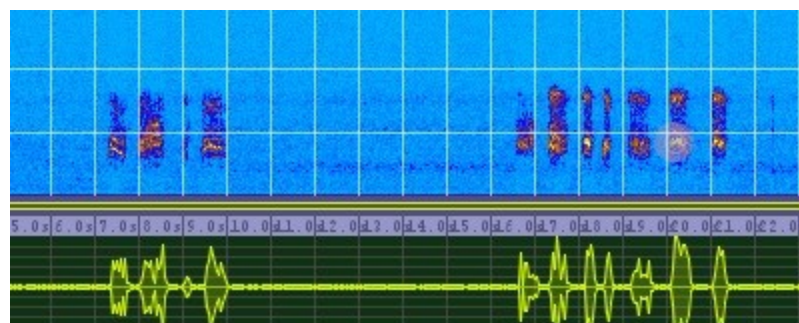
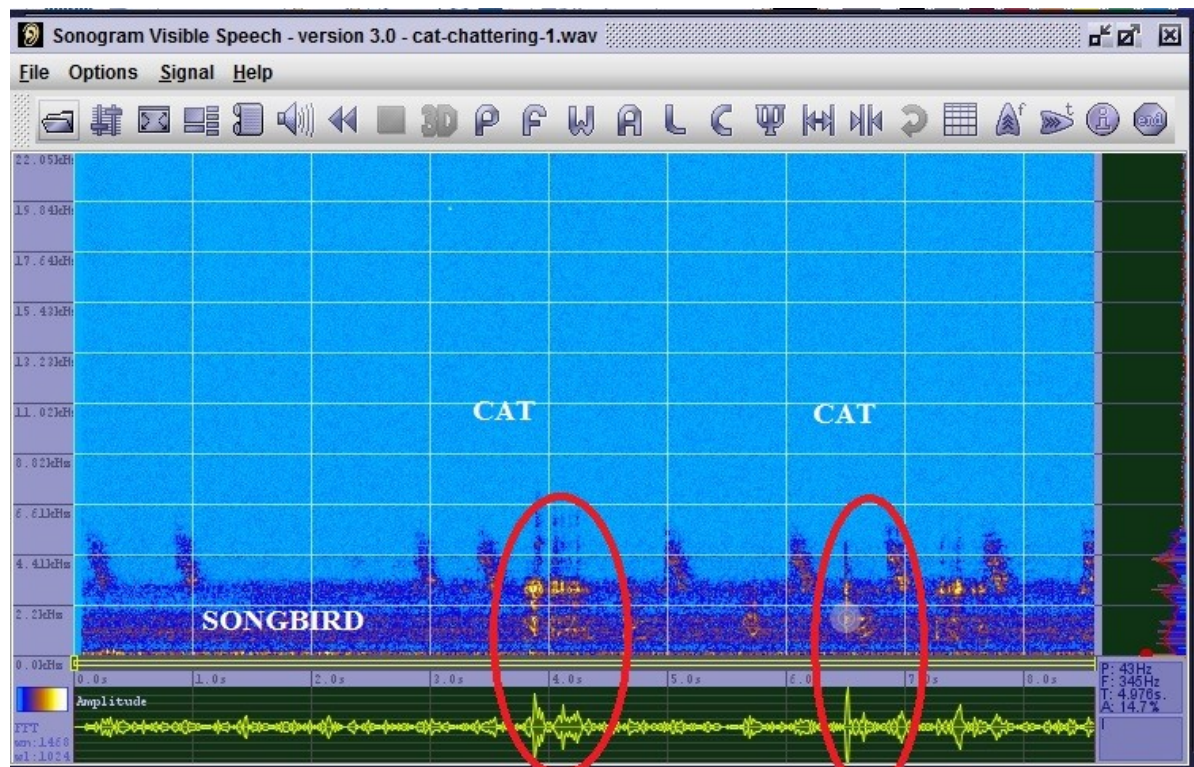


Lurz (2009)

When we look further at the question of semanticity we find there are numerous methodological issues to be dealt with. A mouse is viewed as an object in the world of the cat, its value dependent upon the environment of the cat. If the cat is on an island where the prey is preponderantly seabirds, then the value of the mouse is different – also in the case of a well-fed house cat versus a feral cat. On top of this we can ask developmental questions – such as how old is the cat – since the channels of communication and interpretation will be different from an adult cat. We can also ask what is its sex class. Is it male or female. Below I have added some of the dimensions that have a bearing on how we might infer semanticity or lack of it in a cat. There are here two standard or basic perceptual categories (horizontal – mammal) (vertical – bird) and then the further category of prey or non-prey. An example of non-prey could be due to the proximity of the object or its size (a larger prey is costly). The behavior of a domestic cat towards songbirds like a robin or a blackbird is different to its relations to members of the crow family. Of course if the cat is a large male it might be able to take on crows. The same is true of a cat with small mammals. Large rats are formidable foes and too costly for a domestic cat.



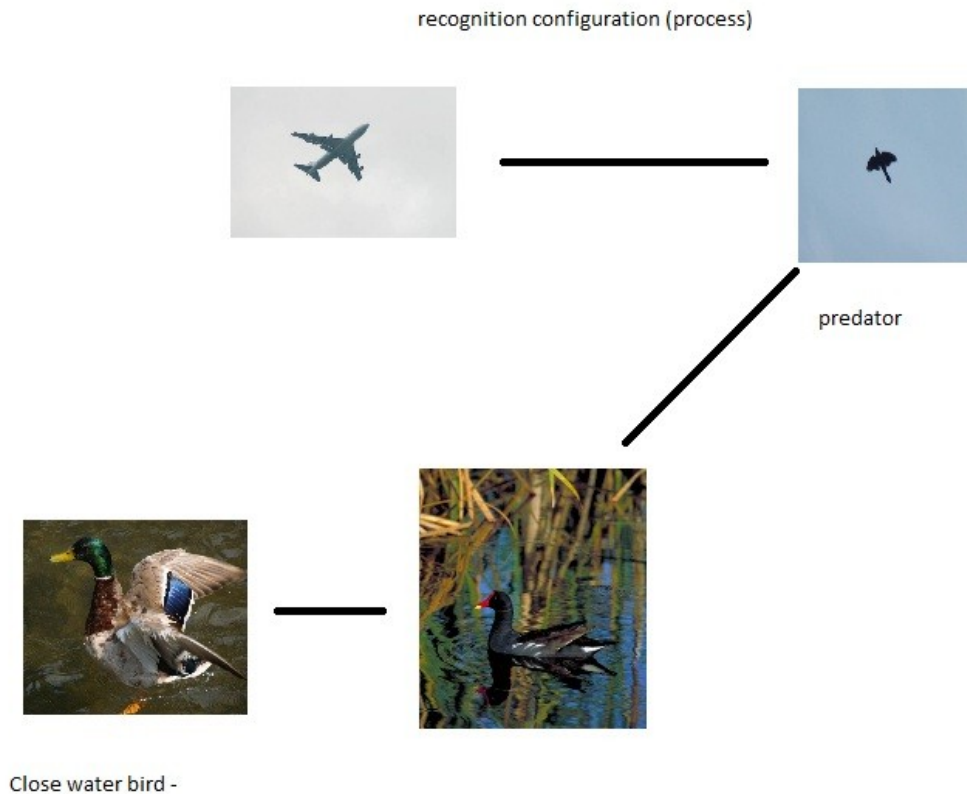
The domestic cat's behavior is also affected by human interaction and domestication. Its relationship to a mouse would be different from a feral cat. Also if we place the behavior in terms of Tinbergen's "Four Questions" then development for example is important. Here as a slight aside, often in cognitive experimentation, important factors that have a strong influence on the outcome and would skew a statistical analysis such as the age and gender of the animals, as well as its endocrinal state are very important. A lactating cat is likely to behave differently towards objects than a castrated male cat for example. At this juncture we can bring in a couple of case studies that exemplify some of the deeper questions of meaning or significance in non primate mammals. Let us further consider for example the case of cat chatter which they do when they see birds or flying animals. Here the cat chatter and its intensity defers according to many factors. From audio files available on the internet I did a sonogram analysis of a cat chattering in the presence of bird song. There was little if any correspondence between the chatter and the song, indeed the two seemed almost independent of each other, as if the cue for the chatter had been the visual rather than acoustic. (see first sonogram). However, when a member of the crow family interacts with a cat, there are several distinctive similarities – these due to the imitative nature of crows, but also it seems in the cat's vocalization. It seemed closer to the crows – there was evidence of vocal convergence. This is significant as it suggests that cats react different vocally to song birds and crows, and moreover, the intensity of the cawing and chattering which is deeply prolonged, seems to some extent satisfying to both animals. Moreover, during playback, a cat with no apparent experience of a bird of prey, would react differently than it would say to a seagull, duck, songbird and so forth. This suggests that cats have a local knowledge of birds within their range, and perhaps are hardwired to the sound of potential predators.



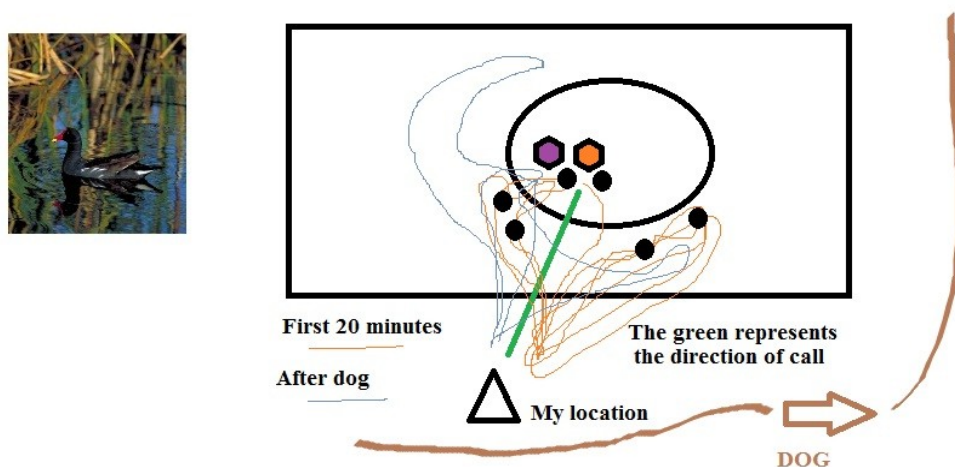
Crow cawing - several.

The theory that the cat chatter is an amplification of the sound it makes during the “killer bite” is interesting, but it would seem that if the cat is confronted with song birds and crows, its chatter is remarkably different, suggesting an internal categorization, and not a prerecorded sound that is programmed or triggered by birds. This is not to say that it has semantic memory, but a categorization system that is fairly plastic. There is an object differentiation as I stated above between the prey that is remote, close, horizontal or vertical.

A male moorhen is more territorial and takes greater risks against competitors and potential predators (of young) than a female moorhen. The state or disposition of an animal affects the level of representation. A moorhen primed by hormones to defend territory will attack readily attack objects that correspond to the silhouettes of crows and birds that have a similar appearance such as blackbirds. In this respect the moorhen has a hardwired identification or bird spotter’s guide similar to aircraft identification.



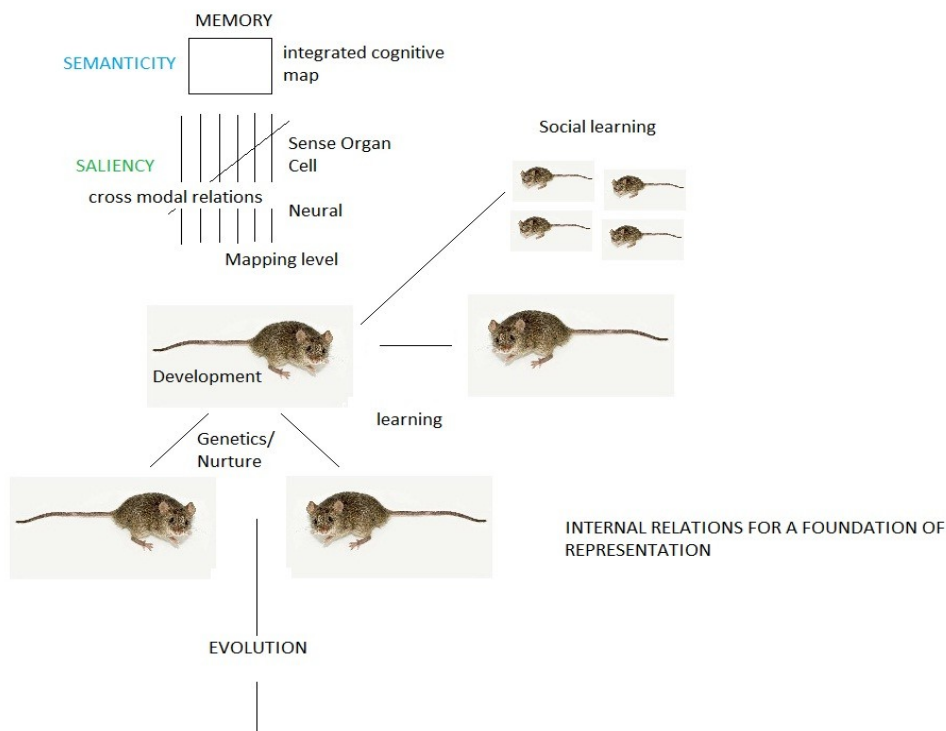
In the film aptly named “Father Goose” (1964) the hero Walter Eckland is rewarded according to the number of enemy planes he must accurately identify from a Royal Navy chart. However these “spots” must be confirmed by other spotters on other islands. In some ways the significance of information for a moorhen is cross-referenced by several sources. The most important is the conspecifics – particularly its mate. The mate is more reliable than the chicks who cheep almost automatically and in the early days for food and navigation. I saw for example when a dog came towards the bank of the pond, the size of the dog was assessed – the larger the dog, the more wary and alarmed were the birds, and the moorhen would rush to the small island with their chicks in tow. The memory or object permanence of a potential predator is seen in the following observation. I had “trained” the male moorhen from the year before to come to my call – of course it was always in expectation of food – so it was a primary conditioning, but be as that may be, it trusted me greatly and would come very close. I reasoned that during the season when it is looking after the young, it must seek food for them, and anything that is economical is to be preferred. However it has to attend to several things. Firstly upon hearing my click it left the island and assessed which of the chicks needed feeding first – a kind of algorithm at work – then it would swim, climb the bank and go into what I would call a kind of “begging” posture learnt from earlier times. Then return to feed, preen itself, return and repeat. This would change when a dog and owner came by.



In this diagram the moorhen were on the island. After my call (click sound) the male swam towards me (associating the click sound with food) then swam back and assessed which chicks needed food (chicks are black dots). Swam back to me collected more food and ignored fed chicks. Repeated (see orange). Later a dog and owner came by. The moorhen alarmed returned to the island. After a short while I clicked, and before the moorhen swam directly to me – he swam around the island to check whether the dog had moved completely away. This seems to me to be an example of Piaget’s object permanence. He then swam back and continued roughly the same pattern as earlier. More experimentation would be needed to see how the moorhen reacts to broken patterns of behavior – and if it shows plasticity or learning in these situations. Another interesting element in categorization of predator in terms of birds, is whether the predator is looking or has its head towards the birds. On my walks to the university I realized that different species take off at varying times. Crows have through closer contact with humans, a greater estimation of the threat than seagulls. When seagulls panic they fly off together, but a rook may keep on its eye on a jackdaw as a more reliable indicator of a threat. Also if a person walks towards rooks they will fly off if you look at them. The escape distance is shorter if you wear sunglasses, and if you turn your head – they will stay put. Eyes then play a great role in avian assessment of risk. These kinds of categories are hard-wired and the memories connected with them are not semantic. Moreover, I have been discussing mainly the top-end of animals – if look at insects we find similar behaviours: visual recognition in wasps of badges, set tasks according to the season and hormones, etc. The difference is the flexibility – the assessment and memory of prey or a predator. Insects mostly work with honest signals (chemicals) or use very stable and discrete acoustic signals. Whereas in the case of vertebrates often the information is less reliable – and therefore requires greater plasticity in responses and more extensive memorization of a higher order, and of course more learning in development. All of this is done through communication that is strictly speaking from a linguistic sense, meaningless, and might not accord either with

intentional models based on analytical philosophy. I certainly feel that so much is going on in animal communication and behaviour that one requires a whole new epistemology – and it should be based much as possible on the observation of animals, the analysis of their discrete vocal systems (if they have one), the study of visual and auditory configurations as observed by us – and the correlates in MRI scans.

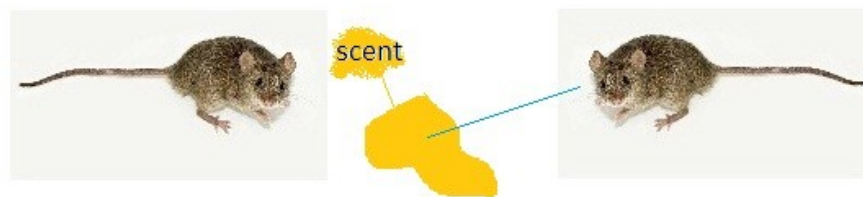
When we analyse the pathways and the relations in potential semantic communication, we see that many of them are hard-wired and inherited. Also even at the higher levels of cognition, the representation is inferred or attributed by humans – from brain mapping and learning tests. Suppose if I wanted to test whether a child knew the meaning of apple, I could use several methods – for example the mixing of food, so to see if the child can discriminate the apple from other oranges. I could ask the child to draw a picture of an apple. I could also interview the child. The range of testing for semantic knowledge is much varied, and not available to those in animal experimentation, since the communication systems do not in the most cases have language properties (see http://www.phon.ox.ac.uk/jcoleman/design_features.htm).



- i) meaning as signification as in the question "What does that sign mean?" (Type1)
- ii) meaning as intention as in the question "What do you mean by that?" (Type2)
- iii) meaning as purpose as in the question "What is the meaning of life?" (Type3)

DOES THIS MOUSE "KNOW" THE SIGNIFICANCE OF THE URINE?
DO THEY KNOW THE PURPOSE OF THE SCENT?

DID THE MOUSE INTEND TO LEAVE THE SCENT TO INFORM ANOTHER MOUSE?



Urine scent marking

Often communication between animals is chemical, as it is usually the most honest signal, it can convey many things to the receiver, such as the gender, age, possible location of sender (freshness), health, current sexual condition, and much more. Moreover since unlike other signals it lingers, then the scent can broadcast territory as well. A mouse moving into another's territory is likely to be more cautious. While the urine scent is honest in terms of giving kinship information etc., it is not specific. It is to all and sundry and the marking is often regulated by hormones. In this respect the mouse did not "intend" to leave a scent, if intention requires higher processing. The signification is processed at a lower level of representation, the purpose is biological. However, though the propagation and the reception of urine scents are fairly automatic, they do occur in a wider context of behavioural algorithms and goals. It is here where the possibility of semiosis is to be found – in a multimodal dimension of learning, remembering and vocal (internal) feedback.

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