Communication, Non-communication, and their Integration

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Abstract
The term 'communication' becomes meaningless if we cannot distinguish communication from what is not communication or if the notion of 'information transfer' is undifferentiated. The situation is complicated by the fact that some phenomena can be viewed as 'communicational' in some respects but not in others. A further complication is the range of phenomena which are similar to communication. Some suggestions are made for the distinction and for the range of intermediate cases. Apart from real-world events, our reasoning processes and mental models of reality, while communicable and exploiting information transfer are not communication. However, there is a danger that a dichotomy between communication and non-communication will divert attention from the integration of communication and non-communication in our understanding of reality.

Keywords: communication, non-communication, definition, signification, communication models, mental models.

Communication, non – communication et leur intégration

Résumé
La 'communication' est dépourvue de sens si l'on ne saurait distinguer la communication de la 'non-communication' et si le 'transfert de l'information' n'est pas différencié. Le problème est en partie une question définitionnelle. Il existe des processus qui sont similaires à la communication mais qui ne répondent pas aux critères de la définition. La distinction est compliquée par de divers facteurs. À part les états et les évènements du monde physique, les signaux de tous sortes sont objectifiés et entrent dans les processus de raisonnement pour former nos conceptions de la réalité. Ni les formes du raisonnement ni les 'modèles mentaux' font part de la communication, bien qu'ils soient communicables. Pourtant, en séparant la communication de la non-communication on risque de divorcer la communication de son rôle dans la construction de la réalité.

Mots-clés: communication, non-communication, définition, signification, modèles de communication, modèles mentaux

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1. Statement of the problem

We live in a world where virtually everything can be conceived of in terms of information transfer and communication. Thus, processes from synaptic connection and DNA-RNA reactions through animal signalling and electronic control systems to theatre performances, marketing and journalism are covered by studies in semiotics and communication theories, as a simple internet search will quickly show. The range is well illustrated by the list of semiotic disciplines in the *Wikipedia* entry for Semiotics (nd. online).The range is also well covered in the standard textbooks by Littlejohn (2002), Miller (2005), Chandler (2007), and de Vito (2009). However, it is important to remember that, if the concept of communication is to be useful, then communication must be distinguished from **non**-communication, i.e. that which is not communication, and this is rarely done. But without knowing what is *not* communication, there is a danger of seeing almost every act or process as

'communication' and to extend semiotics and communication theory to the point of meaninglessness. We need to know what is, and is not, communicational about any given phenomenon, and how the factual world and communication are connected. A fundamental question in any discourse is - are we discussing the processes and nature of information-transfer or are we discussing events, states, or processes which are *not* matters of communication? A further question is - are all cases of information-transfer matters of 'communication' or are there processes which are similar in some respects to communication, but which should in fact be distinguished? Clearly, much of this is a matter of definition, but a wider question is the extent to which the transmission of information (the communication process) and, in particular, our verbal conventions shape our construction of reality.

In all reasoning processes information about the physical and biological world is processed using indices (from a huge range of devices - thermometers, blood pressure monitors, pressure gauges, bee dances, lions' manes, ...) and those indices are combined with a range of textual material in the form of observational statements, rational and irrational arguments, mathematical formulas, experiential generalisations,... in order to build up our understanding of reality in all its diversit. It is that mental model (Johnson-Laird, 2006), which is not communication, but which relies on, and is constantly interacting with, information. In focusing on communication and separating it from non-communication, there is the corresponding danger of neglecting the synthesis of communication and non-communication in our construction of reality. We need to understand the integration of acts of communication and, more widely, sources of information with real world understanding in the developing process of mental modelling.

While any event or object might be used to gain information through a process of interpretation, we should guard against assuming that all interpretative acts are acts of communication and against assuming that the significance of an act, or statements (for example a scientific theory, can be seen only in a semiotic perspective of 'discourse'). The promulgation of a new law or the explanation of a scientific discovery are certainly acts of communication and their communicative features can be analysed, but communication is the means to their being known, not the central focus of the acts. In fact, the statement of a scientific law (such as force acting on a lever = weight x distance from the fulcrum) refers to a factual world of physical events and processes. Identifying the genetic code of the AH1N1 virus may take place in scientific discourse, but its purpose is to help save lives by describing a physical reality. The virus itself is a part of the factual world to which a scientific theory might refer. The validity of scientific statements is tested against a world of observable events and states as well as its internal consistency as 'discourse'. This is, of course, not to say that the discussion of the content or presentation of information from a variety of points of view is invalid or worthless, but it is to say that one should distinguish a communicational or semiotic point of view from other points of view.

The issue can be complicated by the fact that some real-world phenomena can be viewed either as physical events or as communicational interactions. Thus, birdsong can be viewed as a physical mechanism, a part of avian biology, or as a form of signalling. There can be numerous points of view. The range of other points of view, especially in human communication, includes logical and factual analysis, and ideological, social, and aesthetic perspectives. They build up into a construction of reality, for instance our understanding of the life of birds or the nature of viruses. Such understanding makes use of information, but also of logical reasoning. For example, the fact that birds, such as sparrows, feed together without singing, but sing in their territory, can be explained by attributing to sparrows a sense of what is, and what is not, their territory. Any signal (verbal or non-verbal) can be analysed from the point of view of its communicational-transmission properties or from the point of view of its information content (Rastall, 2006a).

One of the few theories with an explicit division of the universe of discourse into 'semiotics' and 'non-semiotics' was that of Hjelmslev (1975:10 *ff*). He defines a 'semiotic' as (def. 24) 'a Hierarchy, any of whose Components admits of a further Analysis into Classes defined by mutual Relation, so that any of these classes admits of an analysis into Derivatives defined by mutual Mutation' (capitals for terms defined in his theory). It is interesting that Hjelmslev does not make

reference to information transfer or to semiotic entities to distinguish semiotic systems from the rest of the universe. This allows the possibility that real-world systems meeting the definition (e.g. a military organisation of an army into corps, divisions, brigades, and companies, or complex chemical molecules such as ammonium phosphate, $(NH)_4PO_4$ divisible into components with 'mutation' of elements) can be seen as 'semiotics'. Part of the problem here is precisely that one must distinguish different points of view on the same things. Thus, military organisations consist of real-world people, but those organisations can be represented by organigrams expressing classes of people and their relations. So, distinguishing 'communication' from 'non-communication' must involve some notion of 'information-transfer'.

We should remember, however, that the notion of 'information transfer' is in need of analysis. The concept implies some change in the informational state of the sender and the receiver of a signal and, more widely, in the total informational state of the community or entity in which the signal takes place. In simple terms, if a government announces that the national growth rate has increased from 1% to 1.5%, then the receivers of the information know more than they did before, and must adjust their previous beliefs. Thanks to feedback, the senders of the information also have an increased informational state, and have relieved the need to transmit information. There is an increase in information in the wider society with knock-on effects, e.g. for the value of a currency or for investment decisions. Also, the internal state of a computer is changed by the input of information both in any specific file, such as a word document, and in the state of the electronic circuitry. The inputter also receives visual feedback of any changes. In biological and non-biological control systems signals, such as the release of hormones or electrical pulses from sensors, lead to changes of state, for example in heart rate or traffic lights respectively. The overall state of the body or mechanical system is changed.

However, there is a qualitative difference between an information transfer which leads to a predictable change of state which is entirely determined by physical or chemical processes and qualitative information transfer in which the change of state is not predictable or deterministic. Thus, one might distinguish between information 'handling' or processing and qualitative 'message-making' through information transfer (see also Chandler, 2007 on this). Where information transfer involves multiple factors in message selection and interpretation, there is unpredictable qualitative meaning. This is obvious in the case of natural language interactions, but it is also found in animal communication, where signals, such as reproductive signalling or begging for food by birds, are subject to selective responses. A female animal does not respond invariably to male sexual signalling- females of many species respond selectively to mating signals to choose the best mate. Also, adult birds vary their feeding of juveniles according to factors such as the degree of yellowness in the juvenile's throat and the juvenile's relative size and strength.

This distinction of predictable and unpredictable change of informational state is obviously connected to the distinction between quantitative and qualitative information, and to the type of relation between the signal and its content. In many cases of information processing, information can be quantified, but qualitative dimensions of information involve additional, often unpredictable, factors. In English, one can call a domestic feline animal a *cat,* a *pussy*, or a *moggy*. The quantity of information in the (simplified) subset is 0.33 in each case, but *moggy* is far less frequent, and has attitudinal and emotional overtones compared with the neutral term *cat*, as well as differences in collocation (usually with a depreciative adjective such as *blooming)*- the 'children's word' *pussy* tends to be avoided because of its (obscene) homonym. As the selection and interpretation of *pussy* and *moggy* depends on personal variables, the information transfer is not predictable and the notional information value of *pussy* and *moggy* is greater than its quantified value in the sub-set. One can also see that many forms of quantifiable information involve a natural or physical relation between the signal and the information content (e.g. symptoms of a disease), whereas qualitative information involves an unmotivated relation.

Furthermore, while it is clear that a physical phenomenon such as a virus or chemical processes in rock formations is part of a world of events that take place regardless of our

observation of them, and hence are not inherently communicational, our understanding of reality can depend to some extent on the (qualitative) ways we talk about it. Those ways range from the most objective and quantificational through to more everyday registers of popular science, and to literary, political, or social issues where some aesthetic or ideological standpoint for the understanding or construction of reality is affected by the verbal means by which information is conveyed. Metaphors, such as genes being called 'the building blocks of life' or DNA as 'the blueprint for life', affect understanding at a popular level. In political discourse, it is obvious that the expression and formation of attitudes is significant in the choice of lexis- e.g. we can speak of *withdrawal of labour, strike, walkout* with quite different emotive and ideological overtones about the same phenomenon, or we might describe the work of, e.g., Alexander Pope as *poetry, versifying*, or *doggerel*. This is clearly a further complicating factor and an important indication of how language and reality are intertwined in the construction of reality, but nevertheless there is an important distinction between fact and our view of it. That is, for the purposes of discussion, verbal products or text of any degree of complexity are objectified or 'reified' (Strawson, 1971; Mulder, 2011) as a necessary step in analysis: the verbal product in all its dimensions then *is* the phenomenon for analysis. This reification, however, is part of our reasoning process; i.e. signals, verbal and non-verbal, are reified as components in our reasoning along with factual information to construct our reality. In a more restricted form, animals also use indices to build up their pictures of reality, as when dogs build up a scent map of their environment. It is this process of reification which can be used to account for the integration of acts of communication and of interpretation (in 'signification') with mental models. This dynamic is a new area of study.

Apart from facts and physical events, such as supernovae, rainfall, or our own actions and internal processes, which are not in themselves acts of communication, there are at least four senses of 'non-communication'. The first two of the categories below are matters of definitional exclusion, while the second two are concerned with mental models as constructions of reality, including objectified signals as pieces of qualitative information. While the definitional matters may seem less important, their significance lies in the various types of information that can enter our reasoning processes. The classification of the various processes that are 'like communication' but excluded by definition is helpful in our understanding of semeiosis. They are:

- phenomena that fail to meet the definitional criteria for communication are, by definition, not 'communication'- although they may be similar to communication by meeting *some* of the criteria;
- failed communication attempts are not communication (this is a special case of failure to meet the criteria for communication where messages are not conveyed and so the process is incomplete), i.e. there is no information transfer and hence no communication. Incomprehension and miscomprehension have, of course, been extensively studied;
- our constructions of reality and the reasoning processes which are used to form them
- objectified signals viewed as pieces of information which can be components in a reasoning process.

2. Definitional issues

In the case of the first two possibilities, it follows that, if we are to make any progress in restricting the concept of 'communication', some definition is needed. In fact, many definitions have been attempted. Dance (1970) gives a classification of definitions and Rodriques (2000) gives a long list of definitions with a useful discussion of them. It is not the purpose of this paper to review all definitions available- most of which are very similar-, but to consider the key properties of *typical* definitions. Generally, definitions of communication are either wider (such as that of Shannon and Weaver) or narrower (such as that of Buyssens or de Vito) – see below – depending on the parameters included in the definition.

Definitions help us to determine what field of phenomena a term covers, i.e. what is included, and what concepts are needed in giving an account of them, but they also exclude. We

must be clear over what we are talking about. Specifying the field of study and its nature is more important than attempting to give a definition of a very abstract concept, such as communication. This is not a matter of verbal distinctions, but of how we represent reality. In making definitions, one must be careful to distinguish the general term 'communication' from individual communications or acts of communication. It is sometimes said, for example, that communication is irreversible, in the sense that a signal which has been sent cannot be unsent. However, that is a category mistake: it is obvious that what is irreversible is the act of communication, not the concept 'communication'.

Although one must be careful not to overstate the importance of dictionary definitions, it may be useful to start with some dictionary definitions to give an idea of the everyday uses of the terms 'communicate' and 'communication'. Everyday and scientific definitions do not necessarily, or even often, coincide, but a scientific usage of a term should have some connection with everyday usage as a matter of 'saving the appearances' (Lyons, 1972:7). The COD (1999, pp. 288-9) tells us that 'communicate' means:

- share or exchange information or ideas
- convey (an emotion or feeling) in a non-verbal way
- pass on (an infectious disease)
- transmit (heat or motion)

and that 'communication' means

- the act of communicating
- a letter or message containing information or news
- social contact[1]

From these definitions and ignoring the less relevant ones, we can see that, in everyday use, communication involves two or more participants in sharing or exchanging information or ideas (i.e. something outside the communication process) in some social context, and that communication might be non-verbal (including emotions or feelings). In the dictionary, communication is seen as an act or as the vehicle for that act (a letter). These statements help to clarify some of our intuitive use of the term. More precise definitions will normally contain some or all of such ideas. However, we can see that the act of communicating and the means of communication are different things. It is normal to distinguish the process of communication from the particular signals that are passed between participants. So, we need to know whether different types of information – verbal, non-verbal, emotional, etc. – should be distinguished. We might also ask whether communication has to be seen as an act or process, i.e. are there other ways in which 'communication' can be understood as a concept?

Here are some well-known and often quoted definitions from the literature of Semiotics[2], and Communication, which offer reasonably representative concepts of communication:

> 'La sémiologie peut se définer comme l'étude des procédés de communication, c'est à dire des moyens utilisés pour influencer autrui et reconnus comme tels par celui qu'on veut influencer' (Buyssens, 1967:11).

[1] Not all dictionary definitions are equally useful. The online entry for *communication* in *yourdictionar.com* reads 'the two-way exchange of opinions, news and information by writing, speech or gestures including body language and facial reactions'. This is too anthropocentric, vague, and restrictive.

[2] In the European tradition, semiotics or semiology are used to name the study of communication and that is how the terms are used here. In some American usages, there is an attempt to distinguish the two terms.

[Semiology can be defined as the study of communication processes, that is to say the means used to affect others and recognised as such by the one whom on wants to affect. PR]
And Buyssens goes on to explain (1967:12):

> 'L'acte de communication est l'acte par lequel un individu, connaissant un fait perceptible associé à un certain acte de conscience, réalise ce fait pour qu'un autre individu comprenne le but de ce comportement et reconstitue dans sa propre conscience ce qui se passe dans celle du premier. Quant à la signification de cette acte de communication, elle se définit comme l'influence que l'on cherche à exercer sur l'esprit de celui à qui l'on s'adresse'.

[An act of communication is an act by which an individual, knowing a perceptible fact connected with an act of awareness, produces this fact so that another individual may understand the purpose of this behaviour and recreate in his own awareness what is happening in the mind of the first person. The meaning of this communication act can be defined as the effect that is intended on the mind of the person addressed. PR]

> 'Communication takes place when one mind so acts upon its environment that another mind is influenced and in that other mind an experience occurs which is like the experience of the first mind and is caused in part by that experience' (Richards, *Encyclopedia Britannica*, online).

> 'The word *communication* will be used here in a very broad sense to include all of the procedures by which one mind may affect another. This, of course, involves not only written and oral speech, but also music, the pictorial arts, the theatre, the ballet, and in fact all human behaviour. In some connections it may be desirable to use a still broader definition of communication, namely one which would include the procedures by which one mechanism (say automatic equipment to track an airplane and to compute its probable future positions) affects another mechanism (say a guided missile chasing this airplane)' (Shannon and Weaver, 1975:3)[3].

> 'Communication occurs when one person (or more) sends and receives messages that are distorted by noise, occur within a context, have some effect, and provide some opportunity for feedback' (de Vito, 2009:12)

It will be clear that these definitions are broadly in line with the main points of the dictionary definitions and that all of them look at communication as a process. Buyssens defines semiology ('semiotics' in Anglophone countries) as the study of the processes of communication and then goes on to define those processes through the act of communication. His definition of the act of communication is very similar to that of Richards, except that the focus for Buyssens is on the signalling means whereas Richards' emphasis is on the effects of one mind on another. Buyssens' and Richards *imply* the existence of social relations, a context of communication, and some code or system for relating experiences to signals but they do not explicitly mention those factors in their definitions. Both Buyssens and Richards imply a theory of mind and their view of communications has a strong sense of the intentionality of communicative acts. Buyssens and Richards exclude some of the things in the dictionary definitions, while Shannon and Weaver include them and then add more possibilities.

[3] Shannon and Weaver's model is discussed in detail in Rastall (2015).

The definitions of Buyssens and Richards are very much concerned with relations between minds[4]. They thus greatly restrict the participants in a communication act, in effect to humans. De Vito's definition explicitly refers only to humans and thus excludes non-human interaction from the field of communication[5]. Thus, animal, human-animal, machine, human-machine interactions, or unconscious biological or mechanical control systems would not count as 'communication' because those phenomena would fail to meet the criteria of the definition. That in turn implies the need for a set of further definitions or concepts to account for the close similarity of many of the excluded phenomena. We see the dangers of defining too narrowly.

Shannon and Weaver, on the other hand, widen the definition to allow for virtually any interaction. All of the definitions refer to influencing or affecting some other through the process. One can see that there must be a sender or source of information, a receiver of the physical means of exchange, and something (experience, idea, etc.) which is conveyed in such a way that the other (receiver) is influenced or affected. Ogden and Richards take a similar approach and exemplify as follows:

> 'If we stand in the neighbourhood of a cross-road and observe a pedestrian confronted by a notice *To Grantchester* displayed on a post, we commonly distinguish three important factors in the situation. There is, we are sure, (1) a sign which (2) refers to a place and (3) is being interpreted by a person. All situations in which signs are considered are similar to this (1923 : 21)'.

Later they also discuss the role of the speaker in acts of communication, but their main interest is in the interpretation of signs by the receiver.

While the explanation offered by Ogden and Richards is clearly highly simplified, it allows us to see that communication situations involve a means of communication (signs), a connection with experience or need, and acts of interpretation requiring understanding of the signs being used[6]. Like Buyssens, they relate communication clearly to the 'real' world of events and states. The other definitions are concerned with the transmission of signals and their interpretation without reference to what the signals are about. However, by widening the definition, Shannon and Weaver and Ogden and Richards blur the clear differences between classes of phenomena. An electronic/mechanical control system, such as a sensor connected to traffic lights, is plainly to be distinguished from colouration in birds, or the detection of prey by means of movement or smell by various animals, or verbal interaction in humans. A danger in both approaches is an excessive dependence on an inexplicit and unexplained theory of 'mind'.

In considering the definitions above, it is important to note that 'communication' can be thought of in a general sense as a 'concept' (answering the platonic-style question 'what is communication?'), **or** as individual acts of conveying information. In the general concept, we are asking about what happens in any communication act, the necessary and sufficient conditions for us to recognise something as communication. Here we must remember that this will then be our way of understanding communication events and distinguishing communication from non-communication.

In the latter case we are concerned with the application of concepts to the understanding of particular events. For the latter, we may need the concept of a communication *system*. A 'system'

[4] In fact, a strong form of dualism is implied in these definitions. More modern versions might emphasise the continuity of the cognitive/biological processes up to the physical transmission of the signal in the sender and receiver so as to avoid commitment to an unnecessary mentalism with minds as causal agents.

[5] De Vito allows the possibility of communicating with oneself. This is a very opaque notion with unclear mentalist/dualist overtones. It is, however, clearly in conflict with the generally accepted maxim of Cherry that 'communication is a social affair' (1957:7).

[6] Further undefined terms are introduced here, of course.

may be a set of conventions or code for engaging in communication acts or it may be a set of participants linked by a process of transmission (see Rastall, 2006b), or network- in each case there is a class of entities with relations defined within the class (a 'self-contained set'). The term 'system' is used in both senses by communication theorists. The choice of one or other sense can be linked to the chosen perspective of the theorist.

The above definitions are useful in highlighting the factors that need to be taken into account, although none of the definitions is really satisfactory. De Vito's attempt is particularly restrictive. If any of the components of the definition are absent, then one would have to exclude the event as non-communication. It is unclear why an absence of noise or the lack of opportunity for feedback should lead to non-communication. De Vito also relies on the introduction of the undefined term 'messages' and it is also unclear how, or if, 'messages' differ from 'signals' (mentioned later in the same chapter of his book but not included in the definition). The encoding and decoding processes and the role of any code or naturally occurring system is absent from his definition. In all of the definitions, there is an over-reliance on rather unclear psychological concepts and, in some cases, excessive restrictions on the term 'communication' and, in other cases, excessive widening of the term. It will be best, therefore, to avoid commitment to unclear psychologism – and especially to strong forms of dualism -and to allow for the range of possibilities under the general rubric of 'communication but allowing for significant differences.

Finally, in this regard, all of the definitions involve the identification and connection of the analytical components of the communication process as discrete parts. The focus is on the agents and their interactions. There is no sense of communication as a totality linking components, organisms, or communities. In the case of a colony of ants, we might see the colony as a totality consisting of interconnected individuals linked by their mutual signalling. Human communication may be more complex, but it could- from the point of view of an alien observer- also be seen as the factor linking individuals into a wider social totality or functioning organism. *Communication would then be a property of a functioning social organism combining with real-world actions and needs for the purposes of the totality, rather than a purely individual activity of information exchange.*

3. Wider and narrower senses of communication

The definition of Shannon and Weaver and the concept of a 'sign situation' in Ogden and Richards' work allow far more possibilities than those of Richards, de Vito or Buyssens as 'communication'. The view of Shannon and Weaver is wider because the criteria for recognising communication are fewer and so more types of information-transfer are allowed under their definition. This blurs the distinctions between the different types of signalling but does give an indication of the range of possibilities. Shannon and Weaver were moving towards that general science of signs (semiology) that Saussure had in mind, in which language behaviour (among other things) would be one of many phenomena to be accounted for in social contexts- 'une science qui étudie la vie des signes au sein de la vie sociale'[7] (Saussure, 1972:33)- but it needs to be balanced by a differentiation of types of communication.

The description of sign situations in Ogden and Richards is taken from the perspective of the receiver and it also includes any form of interpretive process linked to any sort of signal. The general term, 'semeiosis', coined by Sebeok (1986:152) is useful to cover any form of information-transfer activity, although one must bear in mind that he uses 'sign' in the very wide sense employed by Peirce and by Ogden and Richards. Otherwise, 'semeiosis' would be inappropriate for natural indices etc., noted above. The views of Richards, de Vito, and Buyssens effectively limit communication to human, intentional, and conventional behaviour, although rare cases of animal interaction or human-animal interaction might be included, depending on the extent to which the behaviour involved conscious reflection. As noted, their definition is narrower than that of the dictionary. Shannon and Weaver's definition is wider than the dictionary's.

[7] 'a science which will study the life of signs at the heart of social life' [PR]

While the set of events we may wish to consider should be wider than only those involving human interaction, that does not imply that all events (animal interactions, machine interaction, biological and mechanical control systems) should be considered 'communication'. Mice, for example, emit pheromones as part of their mating behaviour, but they also emit bodily heat, which is used by snakes to prey on them. While mice might be said to communicate to each other by means of pheromones (thus using some type of natural index), they can hardly be said to communicate their presence to the snake (which uses the mouse's heat as another type of natural index of its presence). The difference appears to be that the mice are linked in a social totality, whereas the snake is outside that totality.

The problem with the Ogden and Richards approach is that all the emphasis is on the interpretation by the receiver regardless of other factors. One must distinguish a signal in a social interaction from the exploitation of an environmental factor (natural index). Thus, principled sub-divisions of the field with different labels are needed according to the types of semiotic entity involved, as in the approach of Mulder and Hervey (1972) or Mounin (1970). That is, we can have sign systems as well as those involving partly conventional symbols and those with natural indices of various sorts. However, we should note that many systems contain combinations of entities. Thus, the expression $x + y = z$ contains the wholly fixed conventional signs + and = as well as the symbols *x, y*, and *z* used for variables whose interpretation varies from case to case. Classification by semiotic type is helpful, if complex, but it presupposes the concept of 'communication', since any semiotic entity must be a component of a communication process or system.

It is important to consider which criteria we employ in defining our concept of communication. The same considerations would apply to any other set of definitions we might find. As we can see, the different interests of researchers can lead to rather one-sided views of communication and its classification.

As noted above, we also need to remember the difference between definitions of communication and definitions of 'communication system', comments on, or descriptions of, communication, as in the remarks by Mulder and Hervey (1972:13).

> '*Language* is said to be a communication system, i.e. a system of entities that convey information. It is, however, not the only communication system. There are innumerable others, natural as well as artificial, non-conventional as well as conventional ones. But the prerequisite for something to qualify as a communication system is that it should contain entities, at least two [one of which may be "zero"], by which information is conveyed.'

A definition should state an equivalence between the 'definiendum' (here 'communication') and the 'definiens', here the statement of the necessary and sufficient conditions for something to count as 'communication'. The definition should allow the unequivocal identification of the entity in question. Mulder and Hervey say some interesting and important things about communication, but they do not offer a satisfactory definition in this case. In the above quote, they are emphasising the principle that information implies choice, which is fundamental to any form of communication, and is the principle for establishing a communication system. They thus identify a necessary but not sufficient condition of communication (the principle of choice). One would need to explain the concept of 'information' independently of the principle of choice, and to show the contexts in which communication takes place, to arrive at a sufficient condition[8]- a 'system' is only a part of the communication process. The influence of a signal on another communicator cannot take place unless the receiver of a signal recognises a difference in behaviour which is somehow significant. Any difference in behaviour or state involves the signal as opposed to its absence, so information

[8] We are left with the undefined terms 'system' and 'information'. Furthermore, the terms 'system' and information-bearing entity are intimately connected: (presumably) there is a 'system' if there are at least two information-bearing entities, but information-bearing is a function of a 'system' of choices. This looks almost circular.

transfer requires at least two possible states of affairs[9]. Their approach is, however, less restrictive than others; it also allows for different sorts of communication, which may occur simultaneously, as when natural indices in facial expression or voice quality combine with verbal signals. Furthermore, their approach allows for a classification of semiotic systems based on the classification of semiotic entities, and a distinction between semeiosis involving wholly or partly conventional signs and interpretative acts with natural indices (Mulder and Hervey, 2011). One should remember, however, that a classification of semiotic systems is not a classification, or definition, of 'communication'. In particular, one cannot define communication through the occurrence of 'communicative entities' or 'information-bearing entities' (signs, symbols, indices, etc.), since that would lead into an obvious circularity- such entities are defined in terms of their communicative and informational roles.

4. A general model

Various writers have set up visual representations of the communication process. The earliest attempt was that of Saussure, whose speech circuit[10] has most of the key features we would normally include in human interaction. It is a two-way model, unlike that of Shannon and Weaver, which must be extended to account for interaction. Other models have emphasised the encoding and decoding processes more than the transmission process, and Bühler's <Organonmodell> (1934) focuses on the functions of the speech act. Nevertheless, differences of emphasis or foci of attention scarcely justify claims that there is a fundamental difference between those who adopt a transmission or process view of communication and those who adopt a 'semiotic'[11] view concerned with the construction of meaning (e.g. and among others Fiske, 1990). Transmission is a necessary condition of a semiotic process, and conversely encoding and decoding meaning are the purpose of the transmission. Transmission is not a sufficient condition of decoding, but it is a necessary one. In general, causality is a *necessary*[12] component of any communication process (see Rastall, 2006b:15*ff*) - causation is necessary for energy transfer.

It is obvious that it is very easy to extend Shannon and Weaver's model. When made to allow for two-way communication, it is remarkably similar to Saussure's, but it is also important to extend the model to allow for the social context and the connection between the experiential situation of the participants and the communicative system in use.

One should bear in mind that Shannon and Weaver were concerned with the quantification of information in the context of communications engineering. Thus, for them, 'message' and 'signal' are in a one-to-one relationship and are discrete units. Messages can then be quantified on the basis of their probability of occurrence. This approach is of great usefulness in engineering applications. However, Shannon and Weaver were quite explicit in *not* dealing with semantic information, which cannot be quantified in this way, as we have seen. Furthermore, not all semiotic units are discrete. Nevertheless, their work contains a number of very important points for the wider study of communication. They include the basic principle that communication implies choice

[9] One must distinguish simple absence of a communicational entity from 'zero' as a 'choice' in a system, where zero carries the information of whatever remains in the universe of discourse when positive entities are excluded. Thus, *tasty* is simply not present in *the food* with no further implications, but *plural* is also absent with the information *non-plural/singular reference*, because here a choice must be made.

[10] Considering Saussure's call for the establishment of a general science of signs ('semiology') it is slightly odd that his model applies only to acts of speech and that he did not (apparently) think to have a more general model of which the speech circuit would be an instance.

[11] The term 'semiotic' to describe the emphasis on the construction of meaning is somewhat bizarre. Saussure's concept of the semiotic, or semiological, included both the process and the encoding and decoding phases as necessary components of a semiological act.

[12] Causality should not be excluded from our models – as writers have often done- on the grounds that it is not a *sufficient c*ondition.

and that the probability of a unit is in inverse relation with its information value. It is also clear from their work that redundancy is an important property of all communication as a means to overcome 'noise'[13].

The following model contains the key components of a communication process.

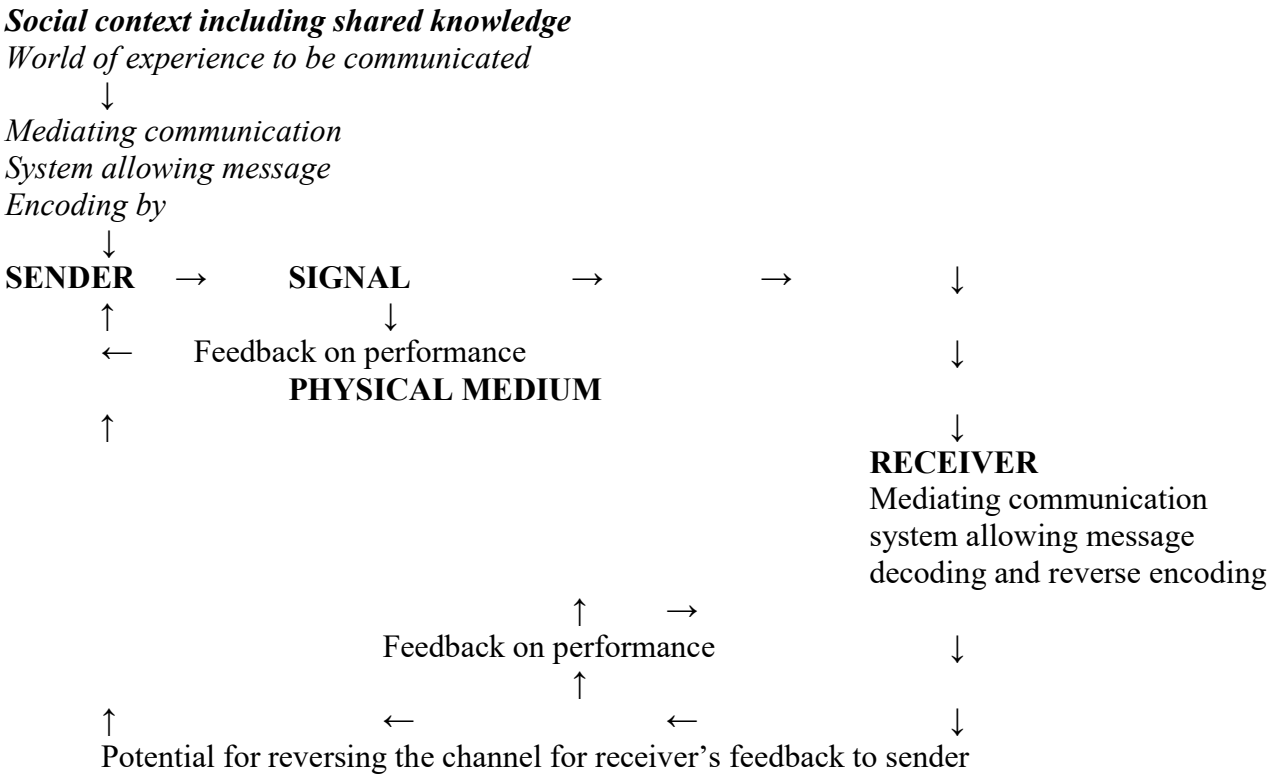


Diagram 1. A linear/temporal model of the communication process in a social situation

This linear/temporal model of communication is an extension of the Saussure/Shannon and Weaver approach. It has a number of components which can be taken as conditions in a definition of 'communication'. They are:

1. A **social relationship** between at least two living organisms in a specific context for the information transfer. A social relationship occurs when two or more individuals existing in a community are engaged in interactions which are part of a wider organisation or community.

[13] We must distinguish between the frequency of occurrence of a unit, such as a word or letter, in a text, and its probability as a function of the number of choices in the system. Either approach can be used for measurement and their comparison is informative. Very frequent words such as *the* or *do* or *thing* are felt to be relatively less informative than less frequently encountered words such as *every* or *encapsulate* or *dinosaur*. These feelings are partly to do with the probabilities of words in subsystems. The set of articles is closed and relatively small, so the probability of a particular article is high, whereas in open classes such as main verbs or nouns (i.e. classes whose extension can be increased) with large numbers of words in them, the probability of a given word in a system is low. However, it is obvious that not all words have an equal probability of occurrence, so probabilities are affected by the context of communication. *Dinosaur* is much more common in elementary science books for children or in a natural history museum. *Dextrose* is common in certain types of biochemical discussion. *Every* occurs in the same class as *the* (the words are mutually exclusive) but it occurs far less frequently and is not a required part of the utterance in the way that *the* often is. The quantification of information cannot be directly, or even very usefully, applied to natural languages, but the principles certainly have cross-disciplinary resonance.

Social relations imply some interdependence of the parties as well as shared awareness of the community and their roles in it. Social relations imply that cooperative interaction is ultimately in the interests of both parties for the satisfaction of individual needs and the community. This implies that machines do not 'communicate'- they are programmed control systems, and that human (or animal) interactions with machines used as tools are also not 'communication'[14]. They are manipulation through information processing. On the other hand, some (not biologically determined) animal interactions, and some human-animal interactions are included (as dog owners will testify), although the information processes are often matters of 'signification' rather than 'communication'. Similarly, voluntary gesturing and the use of conventional visual signs (e.g. on maps) is included by the definition.

2. An **experiential context** (context of situation), part of which is prioritised by the transmitter, including perceptions, memories, universes of discourse. This factor would exclude such things as territorial marking or singing (in birds) which are biologically driven.
3. An **act of encoding** selected aspects of experience using a communication system by a sender[15]. This excludes *involuntary* biological mechanisms, such as 'badges' to display sexuality or readiness for mating, and it also excludes instances of interpretation where there is no sender (signification) as in predicting the weather from the state of the sky, and cases of involuntary signalling (such as blushing or sweating) and innate gestural reactions, such as the facial disgust response.
4. An **internal transmission** to activate physical movements for a given channel (speaking, gesturing, writing,….) – this is a necessary mechanism and is also not a 'communication system' but a biological control system (along with other biological control systems involving stimulus and response).
5. **Transmission via a given medium** – visual, auditory, tactile… All information transfer requires a physical medium and changes in the internal state of the sender and receiver to exploit the medium. Thus, this factor cannot differentiate between types of information transfer, but can be a form of classification according to medium, where the informational capacities of media vary. One aspect of this classification is the relative complexity of the internal transformations of the signal. In speech, for example, electrical signals in the brain must be transmitted by the nervous system to muscles to produce mechanical energy for movements which cause sound energy. Reverse processes occur inside the receiver. Those internal mechanisms are matters of biological information processing leading to physical effects outside the body by the sender and change of information state in the receiver. At least for humans, smell is less useful for information transfer than sound or sight. Of course, if there is no transmission, e.g. a deliberate decision not to transmit a signal, then there is a case on 'non-communication'. This may occur with or without encoding.
6. A **feedback mechanism** for monitoring the signal internally and externally by the transmitter. Any sender or transmitter that is not affected by such monitoring, such as warning lights or alarms, which must be turned off is not 'communicating'.
7. **Physical reception** of the transmission by the receiver(s). As we have said, where a transmission is not received, there is no communication- it is a case of communication failure- see below.
8. An **act of decoding and interpretation** using a communication system and other systems in relation to the context of situation. This excludes any deterministic changes of state or automatic biological responses, such as homeostatic systems, e.g. internal bodily temperature control. A failure of decoding- incomprehension or miscomprehension- would be 'non-communication'.

[14] At least until such time as computers develop independent consciousness.

[15] But note that this does not imply an act of 'mind'.

9. A **perceived change in the context of situation** as a result of the act of communication for both the transmitter and receiver. This excludes any purely quantificational information transfer.
10. **Feedback to the transmitter**. This is the corollary of point 1, i.e. it is a matter of the social relationship, but it does not imply that the *same* medium or system is used by the receiver for transmitting feedback. Nodding can be used to signal agreement to an utterance, and a dog's tail-wagging can be a response to a verbal signal by a human.

One should note that the terms 'sender' and 'receiver' imply agency on the part of the participants and that they are not really suitable for involuntary signalling, or mechanical or biological control systems, where it would be better to speak of a source or trigger and a destination or responder. Furthermore, it should be clear that the receiver might or might not be the addressee of a signal. While there must always be a receiver for communication to take place, there might or might not be an addressee. Territorial singing in blackbirds is not, in general, directed at specific addressees but at any potential interloper, although birds can engage in competitive singing in disputed territory, in which case the singing is directed at the competitor. Verbal expressions of personal joy or dismay etc. are not, in general, addressed at anyone, but they are communicated, if received.

On the other hand, we can also see that the linear model can be used either wholly or in part to describe the different forms of interaction. It will be used in its entirety for human verbal interaction. In other cases, only some criteria are met. Where there is a stimulus/response mechanism or either biological or mechanical control, it would be wrong to speak of encoding and decoding, since codes are not involved and there is no intelligent response to experience. Rather, one should speak of programming and the 'context' here is a physical environment. In the case of a natural index, there is no sender. There is only an event or state which is used as a source of information for interpretation. There is, of course, no encoding and no signalling. Thus, the linear model can be used for different forms of semeiosis with appropriate awareness of the differences, but we should be note that there may be multiple, simultaneous channels of signalling ('multi-modal communication'), e.g. speech with facial or bodily gestures and non-verbal voice features-that is several communication channels at once which are ultimately integrated in interpretation.

5. Classification of communication processes

Approaches to the *classification* of communication typically take into consideration the components of the model given above, and adopt one or more mutually exclusive pairs of criteria. Thus, communications can be classified:

- By the media or senses involved in communicative acts (Poyatos, 1979): sight, sound, touch, smell, taste, and more recently electronic transmission (or a combination of them where several channels are combined simultaneously or linked serially). In this sense, communication can be seen as a kind of energy transfer which may or may not have social significance. One can extend this point to the nature of the feedback mechanism, if any, in the communicative act – the feedback may or may not take place and it may or may not be in the same medium.
- By the direction of information transfer as one-way or bi-directional. We can extend any pair to a set of pairs in a group to allow for networks of communication as opposed to the interaction of two individuals.
- By the sender or receiver as human or non-human (including animal or mechanical interaction) – or a combination. This also includes the question of whether we can describe the communicative act as social or not.
- By the intention of the sender as voluntary or absence of intention in involuntary behaviour (including physiological responses and unconscious internal bodily processes)
- By the encoding/decoding mechanism as

- shared or not shared
- learned through experience or part of the biological inheritance ('innate')
- as verbal or non-verbal,
- open class or closed inventory,
- with feedback using the same or a different system,
- an artificially and explicitly constructed code or as a naturally occurring system of socially-determined tacit conventions.

Thus, the communication of a female dog to a male by means of pheromones to indicate sexual readiness can be classified as olfactory, one-directional (the male does not emit female pheromones, but does emit male pheromones), animal, involuntary, stimulus rather than code), innate, non-verbal, closed inventory, with feedback from the male (using other media) but not from the signal, and naturally occurring. This can easily be compared with the features of speech communication or applied to other situations such as the programmed link of a temperature sensor to a switching device in a central heating system.

(We can also classify systems by the type of semiotic entity they contain (wholly conventional signs, partly conventional symbols, natural indices, etc.). This is the method of Mulder and Hervey (1972). As noted above, it raises a number of questions, but they are not the subject of this paper and have been extensively discussed by many writers. Clearly, the classification of communication types correlates to a large extent with the types of semiotic entity involved.)

In considering any case of information transfer, it is important to apply all of the above criteria in order to identify the type of information transfer in question. One should be careful not to apply only one criterion or to think that any one criterion is somehow more fundamental than others. In some approaches, communication is described as either human or not, or as either verbal or not. It should be obvious that, by ignoring so many other possibilities, much accuracy is lost and much confusion is the result. It should also be obvious that a classification – however useful- is not a definition, so any definition of 'communication' restricted to voluntary, human, verbal acts, as we find in the definition given by Richards or de Vito (above) will be unsatisfactory. Equally unsatisfactory will be any definition (such as that of Shannon and Weaver), which embraces all classificatory criteria without sub-division.

Now, it should be obvious that any transmission of information ('semeiosis') requires some physical mechanism connecting at least two participants. Without any physical mechanism of signalling, there is only telepathy. However, we can imagine that there might be no sender of information or that the source is involuntarily displaying some feature of an internal state. That is, information in such a case is *an act of interpretation by the receiver or observer* of some change or variation in the environment, or in a person or animal, which is involuntary and which indicates some useful indication to the observer. The same possibility exists, *mutatis mutandis*, with apparatus for sensing physical changes in the environment. In such cases as freshness in the wind indicating the likelihood of rain, or redness in the face indicating embarrassment, or the heat emitted by a mouse, it is clear that there is no voluntary sender (but only a source) and, hence, there are not two participants in the semeiosis. The same is true of apparatus such as barometers for sensing environmental change as an index. There is either not a sender at all (the wind, atmospheric pressure) or there is no intention to communicate (blushing, the mouse). It should be clear that there are many involuntary human gestures in the latter category and they include also some features of voice quality, such as those which show that the speaker is male or female, adult or non-adult, or show the speaker's emotional state or regional or class or ethnic origin. Such cases are covered by the definition given by Ogden and Richards (above), which is taken to be the defining characteristic of all communication. In such cases, we should not speak of 'communication' but of 'signification' or 'interpretation' through the use of natural indices. One of the problems with the approach of Ogden and Richards or Shannon and Weaver is that both voluntary and involuntary behaviours and both genuine signalling as well as interpretative acts are all included under the heading 'communication'. They have very different characteristics and should be separated.

In dealing with interaction between animals, it is clear that we must determine whether a signal is voluntary or involuntary, and this is not always easy. One of the reasons for difficulty is that we are not inside the communication circuit of the animal and must make judgements from observation. However, for most animals signalling behaviours are clearly not learned (although animals may improve with practice, as in the case of songbirds) but innate and involuntary. This is obvious in such cases as 'badges' like the red and blue colouration of the male chaffinch or the mane of the male lion which display sexual maturity and maleness. In Hockett's (1958:578) example of the mating behaviours of the stickleback (fish), it is obvious that the fish can behave in no other way and that they are not in control of their signals. Sexually mature females develop a red stripe on their sides. This is a sexual stimulus to the male. The male directs the female to a nest site by nuzzling her and making zigzag movements. This acts as a stimulus to the female to produce eggs which the male can fertilise. Similarly, juvenile birds beg for food by fluffing out their feathers, flapping their wings and opening their beaks to display a yellow throat. Adult birds respond by feeding the open mouth. They will attempt to feed even an artificial open mouth with a yellow throat. In these cases, there are two participants, but clearly the behaviours are involuntary and not learned. We should here speak of stimulus-response mechanisms rather than 'communication'. On the other hand, Buyssens (1967:16) points out that dogs can (occasionally) use learned, conventional gestures such as scratching a door to signal the need to go outside.

In the foregoing cases, there are no 'codes' or systems of conventions involved in encoding and decoding.

Where the 'participants' are mechanical devices, such as automatic navigation systems on planes controlled by satellite, or ground-based information and transmission systems or, in simpler cases such as 'governors' in steam engines to control pressure without human intervention, or in thermostatic control, there is obviously programming of devices for fixed purposes. The interaction is involuntary and non-biological, although system changes can be described in terms of informational states. There is no conscious or intentional communication between the devices and there is no social context of interaction. Of course, it is possible to implant electronic equipment into the body (such as heart 'pace-makers' or hearing devices) to interact with bodily functions. In all of these cases, it is better to speak of control (or cybernetic) systems rather than communication systems. That is, most students of communication would recognise the importance of control devices, but would exclude them from the study of communication, and thus disagree with Shannon and Weaver's very broad definition. Similarly, there are biological control systems (such as those controlling digestion, heart-rate, blood-sugar levels, muscular control etc.) which show similar features but which are not mechanical. Those too, while important and interesting, can be excluded from communication. In the cases of one-way communication in street signs, traffic lights, or advertising, it is difficult to specify the sender with any precision. There is a complex process of planning (encoding) involving many parties before a traffic light is set up or an advertisement is released in the media. The sender in such cases is a faceless communicator, 'the authorities' or 'the company' and it is important to remember that the street sign or traffic light is a signalling device and an advertisement is a complex set of signals (not the sender or source). One should remember also that in many cases of one-way communication, there is neither performance monitoring on the signal nor feedback from the receiver. This factor allows a distinction between the one-way communication involving such things as traffic lights and advertising, where both types of feedback are possible.

As noted above, all views of communication imply a process of interaction in which information is conveyed or transferred. This may include multiple control systems in the encoding, signalling, and decoding processes as energy is transformed. There is, of course, no implication that information is received exactly as it was sent. The linear model of communication above includes the social context and allows for multiple factors in encoding and decoding. Thus, information as sent and as received are constructs. The fact that any verbal signal can be considered from multiple points of view accounts for the non-deterministic nature of the received message and the feedback to the sender. It is for this reason,

along with the many possible associations of any utterance, that the direction of discourse is unpredictable. One can determine which factors are relevant only *a posteriori*.

6. Real-world states of affairs or events and reasoning as not communication

We can learn something about the weather by looking at the sky and using our knowledge and experience, but the state of the sky is just a fact of nature. The sky is not trying to communicate with us. One might be able to derive information from a slap across the face, but a slap itself is not an act of communication; it is an act of violence. So facts, events, and states of affairs are not in themselves communication, and interpretation using indices, while similar to communication, should be thought of as something different (many scholars follow Mounin (1970) and Mahmoudian (1969) in calling this 'signification'). 'Signification' depends on the receiver. Ogden and Richards' much used example (1923:59*ff*) of the scrape of a match interpreted as a likely succeeding flame (and much else in their discussion of sign situations) is centred around the receiver's interpretation. In other words, when interpreted for information, real-world states or events lack some of the factors involved in communication and so are covered also by the second point above. The sky would be the same even if there were no one to see it.

It should be clear that acts of interpretation involving the signification of real-world events or states may not be 'communication' in a strict sense, but they are central to a very large portion of our reasoning and understanding of the world. Whether we are using litmus paper to determine whether acid is present in a liquid or judging that someone is embarrassed because of their blushing, we are using a feature of the real world- a change of state correlated to other facts- to draw a conclusion. In each case there is an implied reasoning process (usually of the *modus ponens* or *modus tollens* type). Embarrassed people blush; this person blushed; therefore this person was embarrassed (*modus ponens*). Litmus paper turns red in the presence of an acid; this paper did not turn red; therefore the liquid is not an acid (*modus tollens*). Of course, the reasoning may be more complex or involve guesswork. For example, in the autumn I find holes dug in the lawn. Sometimes, there are nuts in the holes. I have seen a squirrel in the garden. Knowing the behaviour of squirrels burying nuts, I conclude that a squirrel was responsible for the holes. The perceptual signals – indices- are combined with my mental model of squirrel behaviour to reach a likely explanation, although some of the holes might have been dug by a rat or solitary bee. My explanation is added to my existing mental model of the garden. The mental model and logical processes are not forms of communication, but they involve a dynamic interaction of the exploitation of signals with an existing mental model.

In a more complex case, such as the use of a blood pressure monitor, there are sensors in the monitor which measure systolic and diastolic pressure in the arteries of the arm- a biological phenomenon is the index for the sensor. The sensor is programmed to calibrate pressures against numerical measures, which in turn are represented as numbers on the screen (e.g. 120/70). This visual information must then be interpreted by the user against a scale to determine whether the pressure is below, within, or above the normal range. This process adds to the user's knowledge, but presupposes a wider mental model in which blood pressure is related to cardio-vascular health and a general understanding of the human cardio-vascular system. We can see that different forms of semeiosis are combined. The visual signal is objectified and forms part of a reasoning process related to our mental model of cardio-vascular health and systems. The conclusion (e.g. that the blood pressure is normal) adds to the understanding of the user and may then form the context for further communication. What is important here is the way in which signals are objectified from the point of view of information content and related to our mental models of the world through reasoning.

The perceived changes of state in each of the above cases have signification for us. Similarly, we can reason from verbal products. Any verbal product, as we have noted, is reified and can then be used as part of a wider discourse. If I assert that Pope was not a poet but a writer of elegant doggerel, then that assertion can be part of a rational critique of Pope's poetry and can itself be subject to discussion and critique. You may well guess my attitude towards Pope's work.

Similarly, the statement that avian plumage is brighter in the spring in many birds is linked to our overall understanding of the processes of avian courtship and reproductive behaviour. As the philosopher, Karl Popper, pointed out (1972:70ff) our construction of rational arguments, and critique of them, is achieved largely through verbal means. This implies that there is a function of language beyond the communication or representation of perceived reality and beyond the social functions of language. It is the construction of our sense of reality and rational discussion of it (his 'argument function'). Naturally, reasons and reasoning can be communicated, but the processes of reasoning (such as the *modus tollens*) and our verbally constructed understanding (mental models) are not matters of communication. Popper was concerned only with rational argument in the natural sciences, but our reasoning and construction of reality through the reification of verbal products and their comparison and analysis are concerned with many facets of our experience- social, aesthetic, ethical, ideological, literary, etc. Again, those 'worlds' can be communicated, but worlds of ideas are not 'communication' any more than is the 'real' world of physical states and events. (See Rastall, 2017, for a discussion of Popper's ideas and their implications for linguistics.) Buyssens (1967:66*ff*) also distinguished communication from knowledge.

7. Summary

a. Missing factors

While a broad definition of communication, like that of Shannon and Weaver, is useful in showing us the similarities between communication and its near relatives, the criteria are insufficient to allow a focussed approach. Narrow definitions of communication require it to be:

- Voluntary behaviour
- Intentional acts
- Organic, learned behaviour
- Social behaviour
- Conventional or 'coded' behaviour

If any of these features is absent, then we are not dealing with 'communication' but rather with something which is *similar to* communication. It is 'non-communication' in the sense that the phenomenon is not covered by the narrow definition of communication. The definitions of Richards and Buyssens are too narrow in that they imply (in effect) that communication takes place only between humans and is almost entirely verbal communication (excluding some voluntary and conventional gestures as well as non-verbal symbolic systems). We should allow for communication in some cases in advanced animals and also for human-animal communication with the above features, although we must be careful to note that even in advanced animals much interaction is not voluntary, learned or conventional- as is also the case with some human interactions.

b. Communication failure

Another sense of 'non-communication' is failure in the transmission process. This is due to some breakdown or interference which prevents the receipt of a message and is often called 'noise'. It is obvious that the transmission of a spoken message might be prevented by loud background noise or that a radio signal could be could be affected by background emissions which cause audible noise on the link. The term 'noise' is taken from such cases and used metaphorically for other barriers to communication. However, it should be obvious that not all communication uses sound as a medium, and that physical noise may not be the barrier, and that the causes of transmission failure might occur *at any point* in the transmission process. Thus, in visual communication, lack of light or obstructions in the environment can prevent transmission and, in sound communication, the barrier may be simply one of distance – the sound energy is too weak to be clearly perceived at a great distance from a speaker.

Communication failure may relate to:

- the encoding stage

- the execution of the signal by the sender
- difficulties or obstruction in the medium
- the physical reception of the signal by the receiver
- the decoding stage
- the absence or inadequacy of feedback to the sender from the signal
- the breakdown of feedback from the receiver to the sender
- differences between the sender and the receiver in their relation to the communication context or environment

Speakers of foreign languages have varying degrees of competence in their second languages and can serve as examples of the inability in some cases to encode (and decode) messages. Similarly, those afflicted with certain forms of aphasia may be unable to encode messages appropriately. Even unimpaired speakers make errors in encoding (and frequently correct themselves or restart messages as a result of a failure of encoding). There can be no decoding of writing in an undeciphered script (such as Mycenean Linear A). It is also conceivable that there are things which are either unsayable in a given language or which are difficult to encode. This is certainly true of restricted codes, such as logical calculi or mathematical symbols, where requests, promises, complaints, and other speech functions cannot be expressed. In natural languages, unsayability is more difficult to demonstrate (because of the 'universal purport' of natural languages), but there are inevitably some translation losses between languages. In some societies, a polite enquiry on meeting a friend might be to ask 'where are you going?' or 'have you eaten yet?' which is similar to 'how are you?' but there is an obvious cultural gap in the translation. In Malay, a 'thank you' might be supplemented by a well-known fixed phrase *daun keladi, jika ada, tambah lagi* – 'taro leaf, if there are any more, add them as well'. This expression is related to context and has no obvious equivalent in English- it is the same sort of phenomenon as the English *easy-peasy lemon-squeezy*. Again, in English if someone thought he had done something, but actually had not done it, someone might use the fixed response, *you know what thought did, he only thought he did,* which- like other fixed phrases- could at best be translated by translation equivalence in other languages. Sometimes, there are corresponding fixed phrases between languages reflecting a commonality of experience, but the cultural point of view may be lost in translation. In English, we speak of *taking coals to Newcastle* and in Russian of *taking steel to Tula*. The untranslated element is the difference in the references and the cultural backgrounds that are experienced by the speakers. Moreover, there can be 'lexical gaps' where no obvious item of lexis exists, e.g. there is no obvious verb in English to express the action of pressing the top of a ballpoint pen to release the tip for writing- what is the *x* in *she x-ed the pen*?

Language differences, whether of this extreme variety or of the more obvious type in which lexical items or fields, or grammatical distinctions do not correspond, are, of course, the main evidence for the conventionality of languages. In Malay, but not in English, one must distinguish rice on the plant (*padi*) from uncooked rice (*beras*) and cooked rice (*nasi*). In Chinese, one distinguishes lexically elder brother (ge^1 *ge*) and elder sister (*jia* ^{3}*jie*) from younger brother (di^4 *di*) and younger sister (*mei* ^{4}*mei*). On the other hand the English distinction of definacy and indefinacy with a nominal (*the/a*) is not found in either Malay or Chinese. Obviously, if you do not know the conventions of a code (e.g. the morse code, or a natural language), you cannot encode (or decode) messages using it.

In the execution stage of the communication process, it is clear that errors may be due to inattention, inebriation, physical impediments (such as an anaesthetic to the tongue or 'losing one's voice') or some inadequacy of performance (in the case of visual signalling, for example). Similar physical causes might affect the reception stage (deafness, blindness, etc.).

The signal can be acoustic, visual, tactile, or olfactory (taste or smell). It might be too weak, drowned out by more powerful sources in the same medium, or obstructed in some way. All media have their advantages and disadvantages.

It is interesting that, where a sender (speaker) is deprived of feedback from his or her own signal (is in a state of sensory deprivation), the ability to signal rapidly breaks down and hence can be a cause of communication failure. An important, and relatively unexplored, aspect of verbal behaviour is the process of self-checking to ensure that the verbal signal corresponds to the intended message in meaning and speech characteristics (loudness, intonation, stresses, etc.). Pilot lights on equipment can perform a similar function.

The feedback from the receiver can also be absent or inappropriate. People speaking on the standard telephone have no other means of feedback from the receiver than sound. It is a common experience that, if there is no sound from the receiver, the sender will have to check whether the receiver is receiving signals by asking *are you still there?* Without that reassurance communication breaks down. Where the feedback is unexpected or inappropriate, the sender may believe that there has been a misunderstanding and communication will be interrupted until mutual understanding is restored. In two-way radio also it is normal to check that a message has been received and understood before proceeding to the next transmission. If the receiver does not 'come in' and confirm receipt, the sender will keep trying but communication cannot continue without feedback that the communication mechanism is operating.

Finally, senders and receivers can prioritise, or have different understandings of, different parts of the speech context or social environment and may therefore misunderstand each other's messages. The received message may not correspond to the intended message.

In all of the above cases, there has been 'non-communication' in the sense that the transfer of messages did not take place or did not take place satisfactorily. The causes can all be called (metaphorically) 'noise'.

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Communication in the narrower sense excludes factual events, failures of transmission, and those events which share some characteristics of the definition but not all of them. By requiring that communication should be voluntary, intentional, social, learned, and conventional (coded) behaviour, one can distinguish it from similar events and behaviours which do not have the full set of features. There is a range of possibilities under the general heading of semeiosis which do not meet the definition of 'communication'- including signification, programmed non-biological control systems, biological control systems, and stimulus-response mechanisms. Finally, we have seen that the construction of reality takes place using communicative means, but is not in itself communication, but a process of reasoning drawing on many forms of semeiosis. While the processes of 'meaning-making' through semeiosis are the legitimate concerns of communication theory, there is a further issue of how signals and meanings are combined with reasoning processes to create our sense of reality. This is a matter of viewing verbal or non-verbal signals as objectified entities from the point of view of their information content. Such objectified entities are part of the non-communicational world of our understanding- 'realities' considered as if they were parts of the physical world for the purposes of reasoning and taking their place in our mental models. We share the use of objectified signals with other animals, and our human communication is, like animal communication, a property of our social totality.

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