

## *Constraints on 'Message Construction' for Communication with Extra-Terrestrial Intelligences*

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### *Short Abstract*

This paper introduces arguments in favour of considering communication as a form of behaviour and thus constrained by general cognitive principles. The notion of message is critiqued and supplanted by a more subtle notion of behaviour carrying a semiotic burden. Contextualization is shown to be a vital factor. It is argued that aesthetics and altruism are necessarily potentiated by cognitive functioning exploited for communication. It is also proposed that these arguments permit constraints to be imposed on possible 'message construction' for communication with extra-terrestrial intelligences (CETI), but do not determine what such 'messages' should be.

### *Long Abstract*

When thinking about CETI it is necessary to make some assumptions; the nature of these can range from the minimalist to the fanciful. The minimal assumptions made here are that the 'physics' of the universe is knowable locally, and that some general cognitive principles have universal applicability. Additionally, it is assumed that some aspects of cognitive functioning are necessary, and thus universal, corollaries of intelligent behaviour: intentionality and distributed cognition. It is further assumed that the sensory apparatus of beings in the universe must deal with the dimensionality of existence, physical/chemical stimuli and the electro-magnetic spectrum. Some form of taste/smell, touch, and 'auditory' perception must all be possible (even if the 'biophysics' is radically different from ours, and ETs are, say, primarily 'aquatic'). Likewise sensitivity to the electro-magnetic spectrum must be presumed, both in terms of general sensors (we think of these as heat sensors) and two dimensional arrays of sensors (imaging sensors for converting three dimensional distal stimuli into two dimensional proximal stimuli).

It is *not* assumed that systems of explanation or of knowing are the same as ours, merely that what is explained or known must be about the same universe – thus it can be supposed that the electro-magnetic spectrum is 'known' in a way which matches our knowledge, and some basic concepts of mathematics/information must be generally known (the directions and emphases taken by basic research in physics/chemistry/mathematics arguably must eventually cover the same ground, although not necessarily with the same historical or intellectual routes). It does not seem necessary to assume much more sophistication than this in order to construct a scenario for behaviour which can be communicated reciprocally by intelligences to establish the bases for more comprehensive communicative behaviour. Note, no claim is here being made about the (im)possibility of establishing linguistic communication with ETIs. If space permits this will be discussed in the full paper.

The full paper will work these points/arguments into a coherent account with, it is hoped, a strong sense of inevitability. Suffice to say here that general cognitive principles have been proposed (see Edmondson 2000, cf. Chomsky 1980) which deal with the sequential imperative: the need for atemporal cognitive entities to be mapped into and out of the sequential organization of behaviour. Intentionality is required to constrain such mappings

when they are not driven by physical contingencies, and such intentionality is readable by others. The sequences constituting behaviour are often semiotically free and thus can serve to carry arbitrarily determined meanings (this can be layered, as noted by Hockett (1965) in his 'double articulation' language design feature). Aesthetics is potentiated in such a system as yet a third layer of articulation, akin to pragmatics in the narrowly linguistic sense.

A requirement of communication is contextualization. Information is the distinction between what is and what might have been, and contextualization is required both for the determination of 'what is' and the relevant 'might have been's. The notion of a message and its transmission, as a model of communication, is flawed on pragmatic grounds (see, for example, standard accounts in linguistics texts (e.g. Akmajian et al, 1984)) but remains common (Hauser 1997). Importantly, successful contextualization depends upon situation awareness and at least the implicit exploitation at some level of distributed cognition (see Hutchins 1996). In this account communication is a participative endeavour constantly exploring the limits of shared understanding.

For CETI what is required is to establish scenarios which permit participation and engagement rather than witness and deduction – we need participants not detectives. Time and space present problems, of course, but one way (perhaps the only way) to overcome the difficulties is to assume an intention to communicate and to begin an interaction, and to do this it is *necessary* to announce one's presence. CETI should begin there. Going further, one should strive to locate oneself because that is necessary if any presumed interlocutor is to respond in a way which establishes contextualization possibilities (if this is obscure think only of the need to declare location in telephone conversations, illustrated in UK by the ubiquitous "I'm on the train" of mobile phone conversants). Using stellar objects known as pulsars provides the possibility of explaining to an ETI one's location in space in absolute terms, thus knowingly and knowably giving expression to the need to help one's interlocutor by thinking of their needs. This establishes shared understanding of the need to share references, and on this basis other aspects of 'message construction' can be elaborated. This will be explored in the full paper.

This pattern of reasoning readily evokes the prospect of altruism (in the sense 'thinking of others') perhaps because the more noble sense of this concept itself derives from or reflects a heightened state of situation awareness. Likewise, it can even be taken for granted that an aesthetic appreciation of the products of behaviour will be perhaps inevitable in any communicating intelligence. However, to go much beyond these observations seems likely to lead to fanciful notions of communicating the nobility of humanity (a doubtful premise) or the beauty of Bach (a pointless phantasy grounded in ignorance of the cultural and physical relativities involved in human existence – we would have great trouble explaining even what the well-tempered scale is all about, let alone conveying the details required to get the pitch right, or explaining the transfer function of the auditory mechanism, or the notational system used to guide a performer). In a similar vein, the search for certainty in explanation of our world might be more readily explained than the particular forms such certainties take in the religions found on Earth. Once again, the potentiality is unproblematic, but the precise details of expressions of the potentiality are bedevilled by the details of species specificity and cultural relativity. That one's ET interlocutor could know beauty in an artefact or behaviour is probably not in doubt, but that they could know why a human finds a Caro sculpture or a Rembrandt etching or a Berlioz opera... movingly beautiful, or come to share that appreciation, is deeply improbable. Knowing this limitation is an additional and important constraint on 'message construction' which will also be explored in the full paper.

*References*

- Akmajian, A., Demers, R.A., & Harnish, R.M. 1984. *Linguistics: An Introduction to Language and Communication*. MIT Press.
- Chomsky, N. 1980. *Rules and Representations*. Basil Blackwell.
- Edmondson, W.H. 2000. General Cognitive Principles and the Structure of Behaviour. Technical report CSRP2000-13, School of Computer Science, University of Birmingham. Available at: <http://www.cs.bham.ac.uk/~whe/seqimp.pdf>
- Hauser, M.D. 1997. *The Evolution of Communication*. MIT Press.
- Hockett, C.F. 1965. The Problem of Universals in Language. In *Universals of Language*, edited by Joseph H. Greenberg, 2nd edition. MIT Press. See also Hockett's 1961 paper: Linguistic Elements and Their Relations, *Language* **37**, pp29-53
- Hutchins, E. 1996. *Cognition in the Wild*. MIT Press.