
IS ‘HADD’ OR ‘SEARCH FOR MEANING’ PART OF THE FACULTY OF LANGUAGE AND CAUSE FOR THE UBIQUITY OF RELIGION?

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(Received 11 December 2015, revised 2 March 2016)

Abstract

The most influential theory of the evolution of religion is that it is a side-effect of the evolution of a hyperactive agency detection device (HADD). HADD is probably a necessary component for language acquisition. Humans, especially young children, assume that there is intention and meaning to everything: sound combinations as words, and systematic changes in words as grammatical constructions. The urge to understand those meanings is necessary for learning language. Hyperactive agency detection may have evolved from the primitive agency detection or predator avoidance of most mobile animals. Predator avoidance of *Drosophila* is mediated by the nicotinic acetylcholine neuroreceptor gene *Da7*. The several corresponding *CHRNA7* genes of humans have evolved extensively within the last few hundred thousand years compared to the chimpanzee in a manner reminiscent of the evolution of the established language gene *FOXP2*. Hyperactive agency detection and search for meaning and intention may be two sides of the same coin, and the ubiquity of religion may be a consequence of the evolution of the faculty of language.

Keywords: hyperactive agency detection, search for intention, *CHRNA7* function

1. Introduction

Religion is specific for humans, found in all known human societies [1]; other species show only traces of religious behaviour, such as ‘superstition’ in pigeons [2] and primitive ‘theory of mind’ in chimpanzees [3]. Religions are extremely diverse, with many gods, one god or no god, with or without pervasive animism, with or without laws and moral prescriptions. Most may give descriptions of what happens after death. The gods may be benevolent or vindictive, highly moral or prone to all human foibles [1]. There are numerous theories about the possible evolution of religion [4-7]. They fall into two large categories: religion as a by-product of the evolution of other human traits, or religion itself as an adaptation. Put in another way: what did religion evolve from, or how might religion help humans survive and reproduce. In adaptation

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theories religion enhances group cohesion, altruistic behaviour, and the general smooth functioning of society [8-10]. In recent years many have seen religion as a by-product to the evolution of the general cognitive processes of humans, especially agency detection. It began with the formulations of Guthrie [4], Boyer [5], Atran and Norenzayan [11], and several others [12,13]. Barrett coined the terms the 'Hyperactive agency detection device' [6] and the 'Hypersensitive agency detection device' [14]. This hypothesis of the evolution of religion has now become so common that it has been called the 'Standard Model' of the evolution of religion [15].

It is the thesis of this note that the HADD is actually a component of the language faculty. The HADD motivates children to acquire language and makes it possible for them to infer the meanings of new words and grammatical constructions.

2. The language faculty

Language and language acquisition is found in all human societies; it is the major difference between humans and animals. The language acquisition device [16,17], the language faculty [18], or language instinct [19], evolved somewhere between 100.000 [20] and a million years ago [21]. There are many theories about how language evolved [22-26], but resolution is still in progress [27]. The language faculty must have evolved from already existing traits in ancestor species. By comparing the very limited linguistic ability of other species with that of humans it might be possible to deduce which basic animal abilities might be foundational for the human language faculty [28]. Language does have genetic components as shown by the examples of the FOXP2 [29, 30] and CNTNAP2 [31] genes. In other organisms the FOXP2 language gene has different functions related to sound processing such as song-learning in birds [30] and echo-location in bats [32]. The FOXP2 gene has been exposed to intense evolution/positive selection since humans and chimpanzee separated [29, 31]. One would expect other language related genes to show similar evidence of accelerated evolution.

Several group living animals, such as dogs [33, 34], bonobo chimpanzees [35, 36], and parrots [37] can learn to operate with several hundred words, although they are not able to acquire grammar, syntax and morphology. Animals do not learn language spontaneously. Teaching language to animals requires long sessions of intensive training, involving rewards in the form of contact and treats [33-37]. Young children are intrinsically motivated to learn language. They act as if they suppose there are meanings in the noises around them [38-41], and they search for those meanings, using all kind of cues like direction of gaze, pointing, and direct questions. Children learn and remember new words quickly, after one or very few presentations, a phenomenon called 'fast mapping' [42, 43]. The rate of acquisition is 10-15 new words a day, so that a high school graduate has a vocabulary of up to 100.000 words [39, p. 13].

Children also automatically learn grammatical constructions during the first decade of life with no apparent effort, and they act as if there must be hidden meanings in the ways words are changed or combined. If there is no grammar available as in mixed pidgin speaking communities like Hawaii a hundred years ago with migrant workers from many countries, children create creole language with grammar [22, p. 43; 44; 45]. Deaf children in Nicaragua created grammatical sign language over little more than a decade when they were brought together in a large group. This process was documented by language psychologists [46, 47]. The children apparently assumed that there had to be more than simple meanings to the signing and 'agreed' in the group on the meanings of grammatical constructions.

3. Hyperactive agency detection

Meaning is used in many different ways in religion and Psychology [48, 49]. The search for meaning seems similar to the hypersensitive reaction of young children to all kinds of cues for the meaning of words and grammatical constructions. Perhaps this search for meaning in vocalizations is the primary, original manifestation of the hyperactive agency detection device [6, 13, 50]. Hypersensitive agency detection could very well have evolved from agency detection/predator avoidance observed in most mobile animals [51, 52]. Agency detection operates under error management [53, 54] or the 'smoke detector principle': better err on the safe side. A false alarm is a nuisance, but absence of an alarm is fatal; act as if there are always (malevolent) intentions everywhere; rather bolt once too often than get eaten by the tiger. Likewise, hyperactive agency detection seems to work under the 'assumption' that there is meaning and intention in everything, until the opposite has been ascertained.

Piaget showed that young children act as if everything is alive and has meaning and intentions [55]. For very young children everything is alive, for older children moving things are alive, and for still older children only self-propelled things (including rivers) are alive. Children assume that things are made by somebody for a purpose, illustrated by their incessant line of questions, 'what is that? - what is it for? - why?'. This teleological bias is investigated by Kelemen and her group [56-59]. Both children and adults [60, 61] tend to believe that things have purpose, intentions and meaning.

Possible genes for the hyperactive agency detection device could well have evolved by modification of genes for agency detection/predator avoidance in ancestor species. In *Drosophila* predator avoidance is mediated by the nicotinic acetylcholine neuroreceptor *Da7* [62, 63]. Inactivation of the *Da7* gene prevents the fly from escaping from a looming danger. The normal *Da7* seems to function as a panic button. Humans have a number of genes of this group: the *CHRNA7* genes [64]. They are sitting in a very unstable region of chromosome 15, prone to copy number doublings, microdeletions, inversions and other mutations [65]. Mutations in *CHRNA7* may lead to several psychiatric diseases, particularly [64, 65] schizophrenia and autism, but also depression, ADHD and

epilepsy. Animal models with mutations in CHRNA7 are used in searches for new medicines for treatment of schizophrenia and depression [66, 67].

The CHRNA7 genes have undergone extensive positive selection or accelerated evolution compared to the chimpanzee within the last few hundred thousand years [65]. This accelerated evolution is reminiscent of the accelerated evolution of the established language gene FOXP2 [29, 31]. The nicotinic acetylcholine receptors basically function as calcium channels, but it appears unknown what the general function of a normal, non-mutated CHRNA7 is. What is known, is that mutations in CHRNA7 often lead to disturbances in the perception of intention and meaning characteristic of autists and schizophrenics.

The normal function of the CHRNA7 genes may be hyperactive agency detection.

4. Conclusions

The hypersensitive agency detection device (HADD) may be identical to the ‘search for meaning’ and search for intention central to the perception component of the language faculty. An immediate use of the search for meaning is the automatic selection of the salient meaning of homonymous articulations. But the search for meaning pervades all aspects of life. For a young child the search for meaning is unconscious and uninhibited; adults, however, are often painfully aware that the search for meaning does not always turn up concrete answers.

Our hypothesis is that the HADD may be a probable cause for the ubiquity of religion. This claim does not dismiss religion as a ‘nothing but’ endeavour, however. One could just as easily claim that it is the cause for the science quest, the urge for logic and rationality and the inevitability of conspiracy theories. Regardless of the cause of religion or Science, whether a by-product or a direct survival function, one can assess their validity when they resolve societal problems rather than exacerbate them.

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