# GIOVANNI D'ANGELO AND PARASHURAMAN SEETHARAMAN

## THE DESCENT OF LANGUAGE.
## A CONVERSATION BETWEEN TWO JOBLESS BIOLOGISTS

*1. Intro  2. Language is a medium  3. Language and Information*
*4. Language and perpetuation  5. The descent of language*

**ABSTRACT:** *Seen from the perspective of a biologist, the issue of the origin of language contains an inherent ambiguity. On the one hand, one might think to explore the cognitive features or even the anatomical structures related to communication through the peculiar medium called verbal language, a characteristic property*



*emergent among the Homo sapiens. On the other hand, if one decides to restrict oneself to the formal definition of language as a system of signs for encoding information, then, the human-specific nature of language becomes less convincing and the temptation to look into non-human languages allows a provocative question. Was human verbal language an invention or a discovery? In the following two biologists informally discuss about the concept of non-verbal biological languages.*

> *If man had not been his own classifier, he would never have thought of founding a separate order for his own reception.*
>
> Charles Darwin

## 1. *Intro*

At about 9:30 P.M. of a frightful winter evening Parashuraman Seetharaman (hereafter referred to as Parashu) knocked on my door

bearing a bottle of Bordeaux while in the kitchen a pot of broccoli was diffusing an inviting smell all through the small flat. After having set our table for the dinner, Parashu got a small notebook out of his backpack, opened it, and read aloud a question he had written down some time before.

"What is a language?" – He asked.

This was, in the end, what we were supposed to talk about, though for months we had avoided to approach the issue so directly. The subject had stemmed from a number of non-systematic chats about information transfer and perpetuation within and among cells. The moment deserved a glass of Bordeaux.

"What do you think it is?" – I returned back.

He sipped from his glass and stated – "It's a medium to perpetuate information".
The definition appeared to be quite appropriate to me too, thus we decided to build on it.


## 2. *Language is a medium*

At this point I come out with the following –

"A medium can be defined as an intermediate object that occupies a midway position between two extremes. In human verbal language this medium intercalates between the information the speaker (Sender) is willing to convey and the meaning the hearer (Receiver) is able to get".

"The nature of the medium, by the way, is peculiar with language as it consists of a set of signs or sounds that signify for a meaning" – said Parashu.

So I asked – "Where is the meaning coming from?"

This simple question raised an excruciating point. Namely, given a sequence of signs, who decides what that sequence codes for?

At this point Parashu said – "the meaning is decoded by the Receiver".

This last statement was sort of hard to swallow as, the way it was said, made the Sender completely impotent towards the meaning of his production. I was in need, then, of an example for that being the case.

"If you ask me – how many glasses are on this table? – and I reply 10, then it depends on you to decide how to read my answer" – Parashu said.

"Meaning?" – I asked.

"Well if you are using a decimal numeric alphabet for you – 10 – will be ten. But if you rely on a binary numerical alphabet – 10 – will be two; in a ternary three, and so on" – Parashu replied.

"I see. Thus, the Sender, in order to properly convey an information, has to know how the Receiver will read it" – I said.

"Well, at least they (Sender and Receiver) have to agree on the language to use" – He replied.

This last couple of considerations introduced a new concept. Language is *conventional*. Indeed it appears that this *medium* could be considered completely disjointed from the information it is supposed to convey. The neutral nature of the language towards the meaning could be (and it has, indeed, been) heavily questioned[1], nevertheless for all practical purposes and for the time of our dinner we agreed to overlook this complication.

I lit a burner on the stove and set some water to boil and, while doing it, I reasoned aloud:

"Thus language is a conventionally arranged set of signs used to transmit a message from a Source to a Receiver".

Parashu continued: "Conventionality is embedded both in the way signs are assembled and in the meaning that a given assembly has been decided to have".

I was frozen by this last statement, as it had some obvious implications I had never thought about.

Thus I asked: "What if a Sender and a Receiver agree on the way signs have to be assembled but not on the meaning of the assemblies?"

Parashu returned: "Then we'll have a *meaningless language*".

It was clear to both of us, at this point, that given some creative power and time we might have been able to invent an infinite set of *meaningless languages* just by choosing an alphabet

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[1] For a deep discussion about this issue the reader can refer to Marshall McLuhan, *Understanding Media, The Extension of Man*, McGraw-Hill, New York City 1964.

and imposing some rules to combine the different signs belonging to it, but would these *meaningless languages* be "languages" according to our original definition?

Well, if language were a medium to perpetuate information, then meaningless (i.e. information-free) languages would not fit in this definition. We agreed.

"What will an ancient language (whose meaning has been lost) would then be?" – I asked.

"What would a Receiver-less language be? You mean" – Parashu returned.

"Exactly" – I said.

"It would not *function* as a language until you find a way to read it. Until, indeed, you have a Receiver for it" – He said.

"And, what if we have agreed on the meaning of the assemblies but not on the way to assemble them?" – I asked.

"Well we still have a chance to assemble signs randomly with very little probability for our assemblies to have any meaning" – He replied.

"Very little indeed, but still, given an infinite number of tries, we might end up coding for all the information of the Universe" – I replied.

"Right. As *'[a] half-dozen monkeys provided with typewriters would, in a few eternities, produce all the books in the British Museum'*[2] – He, quoted.

"Well, but, again, the information here is not *transmitted* from the Sender to the Receiver. It is rather *deduced* by the Receiver from a set of signs which was not intended to bear any information, indeed" – He added.

"Then, this is not what language is" – I stated.

"A language is, indeed, the in-between object resulting from two conventions agreed by the Sender and the Receiver. The first pertains to the production rules for the sequence of signs assembled by the sender (call it syntax); the second to the meaning decoded by the Receiver to such assemblies (call it semantic)" – He concluded.

In the meanwhile the water was boiling vigorously and I added some salt and pasta to it.

"Is this all we need to know about language?" – I asked.

"We have not properly defined what we mean by information. What is this thing that is transmitted by language?" – Parashu asked.

### 3. *Language and Information*

"The information is the message. I suppose" – I replied.

"Agreed, but what is the nature of this message?" – He asked.

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[2] From Jorge Luis Borges, *La biblioteca total* (The Total Library), in «Sur», 59, 1939, translated by Eliot Weinberger, *Selected Non-Fictions*, Penguin, London 1999.

"Information is something that you did not know before and then you end up knowing" – I said.

"Good. It seems that information is the passage from uncertainty (not knowing) to certainty (knowing)" – He returned.

"Well, if so, then information might be defined in physical terms" – I said.

"I see what you mean. If we go from uncertainty to certainty, we, then go from disorder to order" – He said.

"And if information is a decrease in disorder, then a physicist could claim that information is nothing but a decrease in Entropy"[3] – I added.

"Thus language is a conventional medium that is used to pass a reduction in Entropy (disorder) from a Sender to a Receiver" – Parashu claimed.

"Can information exist in the absence of language?" – He suddenly asked.
"I presume it can, if information is seen as a lower entropic state compared to noise or randomness or uncertainty. And continuing with this line of logic it would mean information *resolves* uncertainty" – I said.

"Agreed. For sure there are natural conditions where we can observe a reduction in uncertainty with no need for a language to be there. Indeed if I toss a coin and I see it comes to be tail,

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[3] See also C.E. Shannon, *A mathematical theory of communication*, in «Bell System Tech Journal», 27 (1948), pp. 379-423.

this has resolved my uncertainty with no need to communicate that information to anybody" – He added.

"Thus information exists before language" – I come to say.

"Fine, so any resolution of uncertainty or information that exists in the absence of language can be "perceived", but it cannot be transmitted/conveyed in the absence of language" – Parashu commented.

"All this implies that a reduction of entropy can be described by a sequence of signs" – I added.

"Not only described, but actually passed from a Sender to a Receiver" – He said.

"What is the nature of this passage?" – I asked.

## 4. *Language and perpetuation*
At this point the pasta had boiled for some time and we decided that it was properly cooked, thus I dressed it with some broccoli sauce and served it to my friend.
While sitting in front of each other and exploring with our forks the cloud steaming out of our dishes Parashu said: "It's a kind of passage that does not destroy its template".

"Meaning?" – I asked.

"I refer to the fact that the original copy of the information is preserved while it is "transmitted" to the receiver. At the end of the process the information will be with the Receiver, but it is

also with the Sender, who does not lose it. Thus, I would say, that information is *perpetuated* through language, and not simply transferred" – He replied.

"Is it always the case?" – I asked back.

"Is there an example of a language where information transmission is actually information *transfer*?" – He asked.

"The Odyssey, for example, was originally propagated verbally, but does it mean the original still survives?" – I asked back.

"At least it survived till the *immediate* copy was made or at least till the information *perpetuated* from the sender to the receiver." – He replied.

"Agreed, but, language or not, can information transfer happen without perpetuation?" – I asked.

"That is a conundrum. If we consider that information transmission can happen only via a language and if language perpetuates information then all information transmission have to be perpetuation" – Parashu replied.

"Thus we are back to our original definition. Language is a medium to perpetuate information. The medium consists of a set of signs conventionally arranged, whose meaning has been agreed to by both the Sender and the Receiver. The information conveyed by language is a reduction of uncertainty, which is propagated and not simply transferred from the Sender to the Receiver" – I summarized.

"These are the properties we have agreed to ascribe to language. Now the question is when an object with these properties appeared on the planet for the first time" – He posed.


## 5. *The descent of Language*

The wind was shaking the windows while the radiators were working at full rate. By this time we had finished our pasta and the bottle of Bordeaux was already half empty. I got some cheese out of the fridge, cut it in tiny slices and served it to my friend.

"Well, at some point some human or quasi-human primate should have invented a medium to express and transmit information in a way to satisfy all the requirements we have imposed for it to be a language" – I said.

"Are we sure that, animals for instance do not use some similar devices to perpetuate information?" – Parashu asked.

"It is clear that social insects, for instance, communicate with each other. Ants and bees use some codes, which involves the movement of their antennae or some flying pattern to transmit information among individuals" – I replied.

"Are these signs (say movement of the antennae, or flying pattern), a language as we defined it?" – Parashu asked.

"They are for sure conventional as they are different with ants belonging to different ant nests, and used to convey information from a Sender to a Receiver. Also, if one individual is to communicate say *presence of food*, it does not lose this notion while transmitting it to a different individual. Indeed it can convey repeatedly this information to several Receiver

individuals. Thus this is a case of information perpetuation via a conventional code" – I said.

"So it is a language, though primordial" – Parashu concluded.

"If so language is 700 million years old, which is about the time insects appeared during evolution, and thus predates the appearance of vertebrates (and among them humans) on the planet" – I reasoned.

"Still this implies that language-using living beings need to have some cognitive power" – He posed.

"Are we sure about that?" – I asked.

"We both know the answer" – He said.

"Of course, humans use language and by the criteria we have used, even lower animal communication should be classified as language. Even if we leave aside sentient beings, cells exchange information through hormones they secrete, which are then *read* by specific receptors on the Receiver cells" – I commented.

"And this communication is also conventional as hormones (which we might consider as words of a cellular language) are purely conventional entities whose meaning is given only by the receptor able to *receive* them" – He added.

"Thus, for instance if some cells perceives the presence of glucose they transmit this information to other cells by secreting insulin. The molecule of insulin is by no mean structurally related to glucose, still it is able to bind a receptor on other

cells, which will respond by eating up excessive glucose from the environment" – I said.

"Even more a single celled organism has information content in the form of DNA, to consider the simplest case, that is used to encode a protein" – He added.

"Here, probably we have the most striking example of non-human language" – I commented.

"It is, indeed, an example that includes information (in this case is genetic information present in the DNA sequence), which is then transcribed into a messenger molecule called messenger RNA (mRNA). The message is, then, translated by molecular machineries called ribosomes into a protein, which is nothing but a sequence of aminoacids. Each aminoacid in a protein is encoded by a three bases (signs) in the mRNA sequence according to a fully conventional code, namely the genetic code" – I added.

"Even the words that we biologists use to describe this process, viz. transcription, translation and coding highlights the linguistic nature of this process" – Parashu added.

"And to add more to that, the information contained in the DNA, that is used to build the living beings is perpetuated through generation of an almost identical copy via a process we call replication" – I said.

"I can see the perpetuation of information here, but our definition requires a *medium*... What could be the medium and can we classify it as a language?" – he asked.

"Medium should technically be the machinery involved in replication, where the parent DNA is copied onto a daughter DNA. Thinking about the simplest case of a virus, the interesting thing is that here the Sender is the information itself and the Receiver is also the information itself" – I said.

"Then comparing it to a human language, it is like a human reproduces herself/himself using language! That's weird" – Parashu stated.

"Life has no dearth of weird things... So we can say processes that fit the definition of language happen even in the simplest of living things - virus, but how far can we go to find processes similar to language? Did language exist before life?" – I asked.

"Information exists in the inorganic world but can it perpetuate? Taking analogy from the example of DNA, self-perpetuation of any molecule in the inorganic world should be a language. Does such a thing exists?" – He asked back.

"Even if it exists... how is it different from self-replicating genetic material?" – I asked.

"Do you mean that any molecule or material, irrespective of origin, if it shows the properties of the language we discussed should be considered to be alive?" – He asked.

"In other words, language in a sense recapitulates a fundamental property of life, reproduction. This interpretation also leads other interesting aspects of language" – I said.

"Like..." - Parashu muttered.

"Our discussion would suggest that language in its basic form starts with the origin of life" – I said.

"Or language is one of the basic characteristic of life!" – He commented.

At this point the Bordeaux bottle was empty, the storm had considerably decreased its power, and the flat was over warmed. I opened the window to let some fresh air in. It was around midnight and I could even see some stars shining up in the dark sky.

"There is something that does not convince me Parashu" – I said.

"What?" – He asked.

"We have defined language according to our logic, and I see no big deal with what we have concluded. We have extended the concept to its extreme consequences and we ended up including the entire life phenomenon into our Language theory. But, here it is. We have applied Language metaphor to the way humans, animals, and even cells communicate. In a way this is like applying mathematics to physical phenomena. It is a way to describe events, not the event itself. Thus maybe humans did not invent language, but for sure they formalized Language theory, somewhat like they devised numbers to describe the multiplicity of objects, which was there even before numbers were invented" – I said.

"Thus language is a human discovery, not a real invention. In the sense that humans developed a sort of consciousness about their way to communicate and called it language" – Parashu said.

"It may be so" – I tiredly said.

"It is late Giovanni" – Parashu said.

"At least too late for this discussion to go on, and the weather is getting better. Parashu let's go out and enjoy the night" – I said.

Thus we went out to see the stars.

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