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The Emergence of Symbolic Communication: From the Intentional Gestures of Great Apes To Human Language

> And how did we make the evolutionary transition from the grunts and howls of our apelike ancestors to the transcendent lyricism of Shakespeare?[1]

Human language greatly differs from animal communications. Some scientists, including Tomasello, claim that chimpanzee gestural communication is the closest type of communication to human language, mainly because it is the only type of communication among animals, which is undoubtedly intentional. This view is reinforced by evidence from observations, experiments with primates communicative skills as well as from neuroscience.

In this paper we present a general overview of the idea that human language evolved from gestural communication, which is also

[1] V.S. Ramachandran, *The Tell-Tale Brain. A Neuroscientist's Quest for What Makes Us Human*, W.W. Norton & Company, New York – London 2011, p. 171.

present in great apes and draw on this basis some philosophical conclusions regarding language and the issue of normativity of meaning.

1. Introduction: animal signalling

There are many faces of communication, generally defined as transmitting information from a sender to a receiver. One of these faces is a communication between living beings. In their natural environment, many animals communicate with their conspecifics by performing various displays or actions or emitting various chemical compounds. Mating dances, facial expressions, postures, gestures, roars, songs and even pheromones, like sex pheromones, which attract an individual of the opposite sex, are common examples of communications among animals. Certainly the most distinctive kind of communication is human natural language, which differs from other animal communication systems in various regards. Let us summarize the most fundamental of these differences.

First of all, every animal communication, compared to human natural language, is strongly limited. According to current knowledge, animal communication consists only of *signals*, which are defined by semioticians[2] as signs whose meaning is determined, usually genetically (that is by natural selection) and thus clear for all members from the same species. Other sorts of signs – *symbols* and *icons*, which are the most "core" elements of human language – have more or less conventional meaning, therefore individuals have to share at least a part of the same convention to effectively communicate by means of icons and symbols. A sign is an example of icon if there is a topological similarity between the form of the sign and its meaning. In human languages, prototypical examples of icons are onomatopoeias (like *bang*), whose sounds resemble their meanings. Symbols are

[2] See for instance T. Seboek, *An Introduction to Semiotics*, University of Toronto Press, Toronto 1994, pp. 22–38.

just far more conventional – there is nothing in their form which resemble their meanings, and that is the case with the majority of words in human languages.

Although animals do not need to learn the meanings of their species-specific signals – because all members of the same species are genetically equipped with the same repertoire of signals – while humans do have to learn meanings of symbols, animals are unable to use their signals in the novel way. That means, as Bickerton summed up, that "no ACS [animal communication systems] can be used to talk about the weather, or the scenery, or your neighbor's latest doings, let alone to plan for the future or recall the past,"[3] while this limitation certainly does not apply to human languages.

This very general account of animal communication does not specify whether a sender has any knowledge about the receiver or his potential mental states. Sender also does not need to perform his communicative acts intentionally – the sender's action, which transmits an information that triggers some kind of respond from receiver, could be just genetically fixed responses to some kind of stimulus which is perceived by the sender. Any motives of communications do not matter from that general (biological) point of view, as Tomasello explains:

> For biologists, communication comprises any and all physical and behavioural characteristics that influence the behaviour of others – from distinctive colorations to dominance displays – regardless of whether the signaler has any intentional control over the signal (or even knows it is affecting others). And for biologists, the proximate motives of the communicator, cooperative or otherwise, simply do not matter.[4]

[3] D. Bickerton, *Adam's Tongue: How Humans Made Language, How Language Made Humans*, Hill and Wang, New York 2010, p. 17.

[4] M. Tomasello, *Origins of Human Communication*, MIT Press, Cambridge – London 2008, p. 13.

However, from the evolutionary perspective, the question whether some type of animal communication is intentional or not is crucial, because intentionality is one of the most distinctive features of human communication. According to some scientists, including Tomasello, intentional communication was the basis of more complex social interactions, like cooperation, which played a crucial role during human evolution. Tomasello remarks that,

> In intentional communication, the behaviour of the sender must involve a goal and some flexibility in the means for attaining it. As in all intentional behaviour, this suggests that alternative means may be used toward the same end, the same means may be used toward alternate ends, and some new exigencies may be flexibly accommodated. Intentional communication specifically involves, for example, an individual using the same signal flexibly in different communicative contexts, using different signals within the "same" communicative context, and the capability to inhibit a signal when it is to its advantage to do so.[5]

Therefore, because of "high cognitive requirements" of intentional communication, Tomasello suggests distinguishing between two forms of communication based on signals: i) *communicative displays*, which are "prototypically physical characteristics that in some way affect the behaviour of others, such as large horns which deter competitors or bright colors which attract mates,"[6] and ii) *communicative signals* which are "produced by individual organisms flexibly and strategically for particular social goals, adjusted in various ways for particular circumstances."[7] This flexibility means that communicative signals have to be intentional, that is an individual "controls

[5] M. Tomasello, J. Call, *Primate Cognition*, Oxford University Press, New York – Oxford 1997, p. 243.
[6] M. Tomasello, *Origins of Human Communications*, *op. cit.*, p. 14.
[7] *Ibidem*.

their use flexibly toward the goal of influencing others."[8] Almost all animal communication is based on communicative displays; communicative signals are used (apart from humans), probably only by primates or even only by great apes. The meanings of these intentional signals, as we will see later, are also determined (so they are still signals, not icons or symbols), but not directly by genes and natural selection – instead they are ontogenetically "ritualized".

Let us now take a closer look at some examples of animal communication, so that we can more precisely point the differences between communicative displays and intentional communicative signals and, at the same time, we could address two other important aspects of communication, like syntax and reference.

2. Syntactical dimension and the external reference in animal communication

One of the most popular examples of communication in the literature on animal communication is the "waggle dance" performed by honeybees. As Hillix and Rumbaugh explain:

> Honeybees communicate the location of distant food sources by a "waggle dance" on the hive. The direction of the dance relative to the top of the hive indicates the direction of the source relative to the sun's position. The length of the run indicates the distance, and the intensity of the dance indicates the richness of the food source.[9]

The most distinctive part of this short description of bee communication systems is the presence of some kind of grammar – the movements of bees, by which these insects communicate the loca-

[8] *Ibidem*.

[9] M. Hillix, D. Rumbaugh, *Animal Bodies, Human Minds: Ape, Dolphin and Parrot Language Skills*, Springer, New York 2004, p. 26.

tion of food sources, are governed by some universal rules. These rules have been deciphered by Karl von Frisch, which in effect brought him the Noble Prize in 1973. The presence of that *grammatical* (or syntactical) dimension of bee "waggle dance", however, does not mean that this kind of communication has to be flexible or intentional. In fact, bee communication is completely determined, so that they are unable to refrain from performing a waggle dance when they return to the hive; it is also limited to the present – a bee cannot "tell" its conspecifics where it collected food a week ago or in which place it will be collecting nectar tomorrow. In Tomasello's terminology, the "waggle dance" is a clear example of a communicative display.

Another interesting communication system is that one used by vervet monkeys (*Chlorocebus pygerythrus*). These primates have three types of natural enemies in their environment: snakes, birds of prey (eagles) and ground-predators (mainly leopards) and each of these type requires specific avoidance behaviour. Thus there was evolutionary pressure that selected in vervets three different alarm calls (one of them has two: male and female variants), each corresponded to specific type of predator:

> Males make a deep barking call for a leopard and females make short, high-pitched chirps in the same circumstance. A chutter-like call is made for a snake and a single cough-like call for an eagle.[10]

Consequently, when a vervet monkey spots a specific kind of enemy, it warns precisely, by means of a specific alarm call, other members of its social group, about the danger they will have to face. In effect, each monkey knows how to react in appropriate way to avoid the danger. Thus:

[10] L. Rogers, G. Kaplan, *Songs, Roars and Rituals: Communications in Birds, Mammals and Other Animals*, Harvard University Press, Cambridge 2002, p. 44.

> to a leopard alarm they run for the trees; to an eagle alarm they look up in the air and sometimes run into the bushes; and to a snake alarm they look down at the ground, sometimes from a bipedal stance.[11]

There is strong evidence that these avoidance reactions are really triggered by alarm calls. For instance, Cheney and Seyfarth made few playback experiments which demonstrated that vervet monkeys engage in appropriate avoidance behaviour after hearing an alarm call, even if there is no real predator in the surroundings.[12]

There are also even more interesting observations of vervets' communicative skills. Cheney and Seyfarth also discovered that these primates are able to learn the 'meanings' of alarm calls made by another species – superb starlings (*Lamprotornis superbus*), birds which live in the same environment. Starlings, apart from various songs, also produce specific alarm calls if they spot the presence of an eagle or ground-predator. Cheney and Seyfarth found in another experiment with playback technique that:

> When the starling's eagle alarm call was played over a loudspeaker, the [vervet] monkeys looked up; when the starling's ground-predator alarm call was played, most of the monkeys ran to the trees. No response was given when the starling's song was played back, and that was a control for the experiment because the song does not indicate the presence of any predator.[13]

Thus, the system of communication used by vervet monkeys seems to be referential, which means that their calls contain information about external referents. Referential communication could be easily described in the terms of communicative displays, however, and is for sure not limited to vervet monkeys. For instance, scientists

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[11] M. Tomasello, J. Call, *Primate Cognition*, *op. cit.*, p. 250.

[12] See R.M. Seyfarth, D.L. Cheney, "Meaning and Emotion in Animal Vocalizations", *Annuals of New York Academy of Science* 1000 (2003), pp. 32–55.

[13] L. Rogers, G. Kaplan, *Songs, Roars and Rituals...*, *op. cit.*, p. 44.

found that even "domestic chickens and ground squirrels give different alarm calls to different predators and respond in unique ways to playbacks of those calls."[14] This suggests that we should rather try to analyze communication from the perspective of intentionality rather than from the perspective of the presence of any external reference, if we are to find the roots of human-specific communication.

So, is the communication of vervet monkeys intentional? To answer this question, we should consider how vervet monkeys developed their species-specific system of communication and how they learnt to decipher the alarm calls of superb starlings. Their abilities resemble genetically fixed actions and learning by conditioning. Even the existence of that sophisticated communication system does not require that individuals posses any understanding of the values of communication or the goals of communicative acts. The species-specific alarm calls of vervet monkeys could be a product of an involuntary reaction on spotting specific type of danger. Natural selection probably selected each of the alarm calls alone, as each of them increases the level of fitness of this species. Thus the communicative cooperation among vervet monkeys could be rather a by-product of these signals, than the very goal of using them. In Tomasello words, in this case these alarm calls would be communicative displays, rather than intentional communicative signals. However, the "understanding" alarm calls of superb starlings could be developed by every individual during its ontogeny, for instance by instrumental conditioning. Vervet monkey may learn that the appearance of a predator is proceeded by specific noises (made by superb starlings) and after some time a monkey starts to engage in specific avoidance behaviour after it hears the sound even though it did not spot the predator.

There is no conclusive evidence, however, that supports one position – some evidence indicates that vervet monkeys' communication is non-intentional, some other suggest that it is rather, at least partly, intentional. The first position is supported by observations that indi-

[14] M. Tomasello, J. Call, *Primate Cognition*, *op. cit.*, p. 252.

viduals continue to produce their specific alarm calls even if the rest of the group has already spotted the predator, started to produce alarm calls and even already found shelter. On the other hand, if a vervet monkey stays alone, apart from the rest of the community, it produces alarm calls more rarely– like it would be aware of the fact that there is no one who ought to be warned.[15] As Tomasello and Call remark,

> These audience effects would seem to indicate the voluntary quality of vervet alarm calls, as well as a comprehension on the caller's part that the function of the call is communication with others. One must be careful in interpreting the cognitive underpinnings of these phenomena, however, because several nonprimate species also give alarm calls differentially depending on the presence of others and differentiate kin from other conspecifics.[16]

One alternative hypothesis is that each type of call is tied to specific emotional states, and a different emotional state occurs when a monkey spots different type of predator (as well as the presence of the audience may influence the caller's emotional state). It also seems plausible that each alarm call is involuntarily triggered just by specific social conditions. The question is still open, however, and we do not lean toward any of these positions. More important is that this case help us to better understand the details of chimpanzee communication.

3. Natural chimpanzee communication

Natural chimpanzee communication consists of vocalizations, gestures, facial expressions and postures. Although the repertoire of facial expressions and postures is particularly rich (for instance, re-

[15] D.L. Cheney, R.M. Seyfarth, *How Monkeys See the World*, University of Chicago Press, Chicago 1990.
[16] M. Tomasello, J. Call, *Primate Cognition*, *op. cit.*, p. 252.

searchers have counted up over 250 different facial expressions),[17] however, there is no evidence that chimpanzee postures or facial expressions are something more from the cognitive perspective than typical communicative displays that are also present in many other species. If one tries to seek the roots of human linguistic communication in chimpanzee communicative abilities, he should instead take a closer look at the vocalizations and gestures used by these great apes.

a. Vocalizations

Chimpanzees live in dense forests with limited visibility, thus their vocal signals are for them a basic tool of communication. Slocombe and Zuberbühler, who investigated chimpanzee communication in the acoustic domain in the Budongo Forest, Uganda, enumerate the following different chimpanzee vocalizations: pant-hoot, whimper, scream, squeak, bark, waa-bark, cough, grunt, rough grunt, huu, pant grunt, pant and laughter.

Based on observations of the circumstances in which callers use each of these vocalization, as well as the reactions of receivers, researchers have tried to decipher their meanings. They concluded, for instance, that whimper is produced by distressed individuals, usually youngsters, when they are lost or separated from their mother. Hearing whimper, adults often try to somehow calm vocalizing youngster down. Pant grunts, in turn, are produced when individuals approach food and at the beginning of feeding on a preferred food source. Waa-bark is produced "during observation of an agonistic interaction, as threats to other species including baboons

[17] M. Jensvold, L. Wilding, S. Schulze, "Signs of Communication in Chimpanzees", in *Biocommunication of Animals*, G. Witzany (ed.), Springer, Dordrecht – Heidelberg – New York – London 2014, p. 8. For complex overview of chimpanzee facial expressions, see: L. Parr, "Understanding the Expression and Classification of Chimpanzee Facial Expressions", in *The Mind of Chimpanzee*, E. Lonsdorf, S. Ross, T. Matsuzawa (eds.), University of Chicago Press, Chicago – London 2010, pp. 52–59.

and bush pigs and as threats to distant opponents, most often by victims of aggression after the aggressor has retreated."[18] Screams indicate that an individual is involved in confrontation and is usually trying to recruit aid.

In some cases, the way the vocalization is performed could also specify its meaning. For instance, the intensity of rough grunt depends on the value the caller assigns to the food he found. Some playback experiments suggest that trained individual can figure out from heard vocalization the kind of food the caller found, and this ability probably allows chimpanzee to use this information to search for preferred food more effectively.[19] There are also some variations in screams – according to the role of the caller during the confrontation and how severe the particular act of aggression is.[20]

Chimpanzee vocal communications is undoubtedly very sophisticated, but none of the mentioned observations and experiments suggest that they could be classified as intentional communicative signals. A simpler explanation – that chimpanzee vocal communication is just a system, albeit quite complex, of communicative displays – seems to be more plausible. In this context, Tomasello argues that every ape species has very little voluntary control over their vocalizations. He stresses that:

> • within any monkey or ape species all individuals have the same basic vocal repertoire, with essentially no individual differences in repertoire;
> • monkeys raised in social isolation and monkeys cross-fostered by another monkey species (with very different vocal calls) still produce their same basic species-typical vocalizations (and not those of the other species);

[18] K. Slocombe, K. Zuberbühler, "Vocal Communications in Chimpanzees", in *The Mind of Chimpanzee*, *op. cit.*, p. 198.
[19] See *ibidem*, pp. 202–203.
[20] See *ibidem*, p. 204.

> • the connection between a vocal call and its eliciting emotion or situation is mostly very tightly fixed; non-human primates do not vocalize flexibly by adjusting to the communicative situation; and
> • human attempts to teach new vocalizations to monkeys and apes always fail, and attempts to teach them to produce their own vocalizations on command either fail or take many thousands of trials to work only a little.[21]

Some individuals are able to refrain from producing vocalizations under specific circumstances: when they are alone or no kin is currently present (this ability, however, is not limited to chimpanzees), but it is the only trace of flexibility in chimpanzee vocalization. Some scientists hypothesize that the lack of higher flexibility is caused by the fact, that the chimpanzee vocalizations are tightly tied to emotions. Jane Goodall, for instance, remarked that "the production of a sound in the absence of the appropriate emotional state seems to be an almost impossible task for a chimpanzee."[22] This, according to Tomasello, suggests that each chimpanzee call has been separately selected evolutionarily because it somehow contributed to the fitness of its users. Nothing indicates that vocalizations are influenced by any cultural factors or that they have any conventional meaning. The link between emotions and vocalizations also explains why the way vocalization is performed could carry information. Namely, the more an individual is emotionally aroused (because he found preferred food or he is a victim of an extremely severe attack), the more impulsively he vocalizes.

Another important, although quite obvious, aspect of chimpanzee vocal communications is the fact that the calls are broadcasted to every individual in the surrounding area. It brings some benefits (for instance the caller is able to attract more allies during fights at the

[21] M. Tomasello, *Origins of Human Communication*, *op. cit.*, pp. 16–17.
[22] J. Goodall, *The Chimpanzees of Gombe. Patterns of Behaviour*, Harvard University Press, Cambridge 1986, p. 125.

same time), but it is also far less demanding from the cognitive point of view and thus does not create evolutionary pressure for the development of cognitive abilities.

All these facts suggest that chimpanzee vocal communications does not consist of intentional communicative signals, but of communicative displays, which seems to be mainly just "individualistic expressions of emotions, not recipient-directed acts." Thus, Tomasello concludes, chimpanzee vocal displays "with their genetically fixed and highly inflexible structure, would seem to be a very long way from human-style communication."[23] As we will see next, gestural chimpanzee communication is a far better candidate for a role of a close predecessor of human language.

b. Gestures

Chimpanzees use many gestures in their natural communication to affect another individuals' behaviour. Tomasello distinguishes between two classes of gestures: *intention-movement* and *attention-getters*. Using a gesture from the first class

> occur when an individual performs only the first step of a normal behavioural sequence, often in abbreviated form, and this first step is already enough to elicit a response from a recipient (i.e., the same response that would normally be given to the entire behavioural sequence).[24]

The following gestures, inter alia, fall within this category:

- Arm-raise – sender raises his arm toward receiver, usually to initiate play;

[23] M. Tomasello, *Origins of Human Communication*, *op. cit.*, p. 20.
[24] *Ibidem*, p. 22.

- Touch-back – sender (usually a youngster) touches receiver's back and starts climbing on, which express a request of ride-on-back;
- Hand-beg – to request food, sender places hand under receiver's mouth and tries to take food;
- Head bob – sender starts "bob and weave" in bowing position at receiver. This interaction initiates play;
- Arm-on – sender places arm on receiver's back and starts pulling him at one direction, which initiate tandem walk.[25]

Those gestures are signals, because their meanings are not conventional, but determined, although not genetically fixed. Typically, as Tomasello explains,

> such displays are "ritualized" phylogenetically; for example, wolves who conspicuously prepare for biting by baring their teeth and growling have an adaptive advantage, as do wolves who respond to this preparatory behaviour by withdrawing before the actual biting comes. Over evolutionary time, this results in the genetic fixation of intention-movement displays performed invariably in specific emotional and/or social circumstances.

Chimpanzee intention-movement are "ritualized" differently. Namely, these gestures are ritualized during ontogenesis. Tomasello explains how the ritualization of arm-raise gesture could proceed:

> (i) initially one youngster approaches another with rough-and-tumble play in mind, raises his arm in preparation to play-hit the other, and then actually hits, jumps on, and begins playing;
> (ii) over repeated instances, the recipient learns to anticipate this sequence on the basis of the initial arm-raise alone, and so begins to play upon perceiving this initial step; and

[25] *Ibidem*, p. 24.

> (iii) the communicator eventually learns to anticipate this anticipation, and so raises his arm, monitors the recipient, and waits for her to react – expecting this arm-raise to initiate the play.[26]

According to Tomasello, there is no evidence that chimpanzees acquire those gestures in a different way to ontogenetic ritualization, for instance by imitation. This hypothesis is supported by observations of individuals who use idiosyncratic gestures, and other members of their communities do not acquire these new gestures. It may seem quite surprising that even frequent receivers of those idiosyncratic gestures do not acquire them (and thus use them as senders). However, we have to realize that this kind of communication is "unidirectional", which means that the sender and recipient "learn it in terms of their own role only – without knowing the role of the other"[27]. In other words, the sender "would not recognize the gesture as «the same» as his own if someone directed it at him."[28]

The second class of chimpanzee gestures are *attention-getters*, which serve to attract the attention of another individual and initiate some kind of social interaction. Various actions, such as slapping the ground, slapping by the sender of his own hand or wrist, throwing something at a recipient or putting their back in the face of the recipient by sender, could serve as attention-getter gestures. As Tomasello explains:

> What happens in the prototypical case is that the youngster is in a play mood – which is apparent from her mood-induced "play face and posture" display and the attention-getter serves to draw attention to the display. Another example is when male chimpanzees who are in the mood for sex engage in *leaf-clipping* behaviour, which makes a sharp, loud noise that attracts the attention of females to their erect penis.[29]

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[26] *Ibidem*, p. 23.
[27] *Ibidem*, p. 26.
[28] *Ibidem*, pp. 26–27.
[29] *Ibidem*, pp. 27–28.

In other words, by performing these gestures the sender tries to focus the recipient's attention on something (usually a sender's involuntary communicative display), which could affect recipient behaviour. The whole communicative act consists of both attention-getter gesture and communicative display. The meaning of this act as a whole is then still determined, not conventional, and strictly connected with a particular display.

How do chimpanzees learn to use attention-getter gestures? Tomasello claims that they cannot be ritualized (like intention-movement gestures), because they are not connected with any particular social interactions. Instead, according to Tomasello, these gestures are learned while an individual, who performed various behaviours like throwing something or slapping the ground for non-communicative reasons, noticed later that those behaviours naturally attract the attention of other individuals. Consequently, the individual begins to use those gestures to intentionally attract the attention of recipients.

Both types of gestures, intention-movement and attention-getters, are used very flexibly – chimpanzees perform them in various social contexts and to achieve various goals. Chimpanzees are even able to string them together in longer gestural sequences in, however, no specific order (so there is no evidence that they have any "grammatical" or "syntactical" dimension). The second class of gestures is surely more demanding – from a cognitive perspective – because it requires some understanding of the attention of another individual (his *social attention* and *referential attention*, in Tomasello's terminology). Tomasello speculates that those gestures are probably confined to great apes (and maybe other primates) and even does not hesitate to call attention-getter gestures "the closest thing we have to a «missing link» between non-human primate communication and the sophisticated attention-directing and attention-sharing characteristic of human referential communication."[30]

[30] *Ibidem*, p. 29.

This statement applies, however, only to chimpanzee natural communication.

4. Apes and artificial symbolic language

In recent decades, more and more efforts have been made in the field of teaching apes to communicate through an artificial symbolic language, created by humans. After several endeavours to teach apes, mostly chimpanzees, to speak had failed,[31] scientists started to teach apes to communicate in a different than sound modality. The first choice was American Sign Language (ASL) and some researchers allegedly managed to train a few great apes (for instance, the female chimpanzees Washoe, Moja, Lucy, the male chimpanzee Nim Chimpsky, female gorilla Koko or male orangutan Chantek) in using even above a hundred ASL signs, mainly to request preferred food, to describe their emotional state or to reveal their short-term intentions.

These experiments were crucial from the perspective of (bio)semiotics, since those trained apes acquired using symbols (or at least icons, in some cases) – signs with conventional meanings – in communicative goals. Not all scientists agreed that the skills of those trained apes could be described as "communicative," let alone "linguistic." However, some researchers, inter alia Herbert Terrace, leader of one of these scientific projects, stressed that those apes did not learn how to communicate via symbols, instead they learnt how to react, by performing various gestures, to various stimuli, in order to gain an award (usually preferred food). The skepticism was, at least partly, grounded on the theory of Universal Grammar, given by Noam Chomsky, which implicates that animals have no linguistic skills.

Currently, however, this skepticism is less popular, as is the theory of Universal Grammar, at least partly because of the results of

[31] For details, see, for instance: W. Hillix, D. Rumbaugh, *Animal Bodies, Human Minds…*, *op. cit.*, pp. 53–58.

another research project concerning ape language – the Yerkish project. Yerkish is another artificial symbolic language which consists of so called lexigrams – abstract geometric symbols corresponding to words of spoken English. Apes communicate in Yerkish by pointing or pressing the appropriate lexigram on a special electronic keyboard which contains a set of all lexigrams so far acquired by the specific chimpanzee. Current Yerkish (which rather significantly differs from the first implementation of this language, created by Ernst von Glasersfeld[32]) allows trained apes to precisely express their requests, intentions, and even to communicate with other individuals and thus to cooperate in order to achieve common goals. The most skillful non-human Yerkish user is a male bonobo Kanzi (born in 1980), who spontaneously acquired the basis of Yerkish during his childhood, much like how a human child acquires their mother tongue – by observations and participation in communication, not because of attending laborious training. Kanzi is also an amazingly competent listener – he repeatedly showed that he understood many sentences in spoken English (researchers often communicate with him by both lexigrams and speech).[33]

From the perspective of this paper even more enlightening is the case of two male chimpanzees – Austin and Sherman – trained in Yerkish by Sue Savage-Rumbaugh before Kanzi's birth – during the late 1970s. Both chimps finally managed to acquire several dozen lexigrams, and started to communicate each other, but only after scientists created the conditions in which "listening" (paying attention) to other's communication became essential in order to achieve a (common) goal. For instance, during a certain experiment,

> one of the chimpanzees would be allowed to see a favorite food or drink put into one of several metal boxes, which was then locked with

[32] See: E. von Glasersfeld, "The Yerkish Language for Non-Human Primates", *American Journal of Computational Linguistics* 1979, [online] <http://clair.eecs.umich.edu/aan/paper.php?paper_id=J79-1012#pdf>.

[33] See, for instance, S. Savage-Rumbaugh, S. Shanker, T. Taylor, *Apes, Language and the Human Mind*, Oxford University Press, New York 2001, pp. 68–69.

> a specific tool – among them, a wrench, a key, a lever, and a magnet. Each box, once closed, could be opened only with the correct tool. Sherman and Austin were highly motivated to learn the names of their tools so that they could extract the prized incentive from a box. Once extracted, the food then had to be shared so that each was rewarded for his role. But only one chimpanzee saw the box into which the food was placed, and only that chimpanzee knew which tool was needed to open the box. That chimpanzee had to request the necessary tool of the other chimpanzee, which had in his possession the tool chest that contained all of the tools. The chimpanzee with the tool chest had to comply with a request conveyed through use of lexigrams on a keyboard. If the chimpanzee with tools provided something other than the one requested, the ape making the request would reaffirm his request by pointing at the word-lexigram.[34]

What lesson should be drawn from the Yerkish project? The first conclusion is that great apes really are cognitively capable of acquiring symbolic communication. This communication, however, is not very complex – chimpanzees often use single lexigrams, rarely combine them into longer sequences (and even then elements of those sequences follow no specific rules, so there is no "grammatical dimension" within this communication). The second conclusion is that appropriately motivated chimpanzees are able to cooperate, and this cooperation requires communication between individuals, but only if they realize that this cooperation will result in achieving a common goal. The relation between cooperation and linguistic skills is probably crucial, since previous attempts to teach apes symbolic communication when they were not motivated to use the language to cooperate, failed.

The fact that apes are really cognitively capable of acquiring some form of symbolic communication raises the question of why they do not communicate via symbols in their natural environment.

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[34] D. Rumbaugh, D. Washburn, *Intelligence of Apes and Other Rational Beings*, Yale University Press, New Haven 2003, pp. 116–117.

5. Why do chimpanzees not use symbols in their natural communication? The emergence of human language

According to some scientists, like Donald, Tomasello or Arbib, human language evolved from communication primarily based on intentional gestures, which, as we could see, is also present in contemporary great apes (at least chimpanzees). These scientists generally agree that the next stage, of the evolution of human-specific communication was pointing and pantomime.[35] This view is coherent with what is suggested by observations and experiments. For instance, great apes in their natural environment neither point nor pantomime, although apes trained at communicating through symbolic language, like Yerkish, rather spontaneously begin to point,[36] which suggests that the ability to point is based on the same cognitive mechanism that also seems to be crucial for more advanced communication. Speech (consisting of vocal signs with conventional meanings) according to these scientists, subsequently emerged once our ancestors had gained more complex control over their vocal organs.

From this perspective, human linguistic communication, especially with its grammatical dimension, should be seen as primarily a cultural invention, not as a specific biological adaptation. It is, of course, deeply rooted in human biology, but not as any "language module" (for instance Universal Grammar module), shaped by biological evolution based on genetic variation and natural selection. Instead, as Tomasello argues, human language emerged during cultural evolution which occurred because humans possess a unique form of cultural transmission which lets them accumulate cultural inventions over historical time. This unique form of cultural transmission is, according to Tomasello, primarily based on the ability and tendency to learn by imitation (and on the ability of intentional

[35] See B. Brożek, *Granice interpretacji*, Copernicus Center Press, Kraków 2014, p. 116 and following.

[36] S. Savage-Rumbaugh, R. Lewin, *Kanzi: The Ape at the Brink of the Human Mind*, John Wiley & Sons, New York 1994, *passim*.

learning). Tomasello argues that imitation creates a peculiar "cultural ratchet," which allows the next generation to possess the cultural inventions (in broad sense) made by their parental generation. In that way, the new generation could make their own "improvements" to these inventions. This is how so called cultural cumulative evolution works.

Cultural inventions, especially such sophisticated ones as symbolic communication, obviously require advanced cooperation between many individuals, and the tendency to cooperate is another, besides imitation, human innate feature.[37] This suggests the answer as to why non-humans did not invent symbolic communication: they prefer competition over cooperation (probably because it is very hard for great apes to realize that cooperation leads to achieving common goals) and apes rarely (or even not at all) imitate. Even if non-human primates do not lack creativity to make some cultural inventions, they lack some form of social transmission to spread these inventions to their conspecifics. The inventions made by great apes perish with their creators so that next generations have to create these inventions from scratch. For these reasons, cumulative cultural evolution seems to be impossible among non-human primates. This is probably why chimpanzees often ritualize certain gestures in the wild and are even able to learn symbolic communication (like Yerkish) in laboratory experiments, but have not developed symbolic communication in their natural environment.

Michael Arbib created a similar theory from the neuroscience perspective, based on the mirror neuron system. Mirror neurons, discovered firstly at motor cortex of macaques[38], later at humans[39], are (at least) bimodal neurons which discharge when an individual per-

[37] See: M. Tomasello, *Why We Cooperate*, The MIT Press, Cambridge – London 2008.
[38] G. di Pellegrino, L. Fadiga, L. Fogassi, V. Gallese, G. Rizzolatti, "Understanding Motor Events: A Neurophysiological Study", *Experimental Brain Research* 91 (1992), pp. 176–180.
[39] See, for instance, L. Fadiga, L. Fogassi, G. Pavesi, G. Rizzolatti, "Motor Facilitation During Action Observation: A Magnetic Stimulation Study", *Journal of Neurophysiology* 73 (1995), pp. 2608–2611.

forms a specific action (mostly gesture) or just observes the same action performed by another individual. Arbib and Rizolatti claim that mirror neurons firstly allowed individuals to recognize anothers actions, which let them imitate those actions and to recognize other's intentions.[40] Although mirror neurons are present in non-human primate brains, there is evidence that the human mirror neurons system is far more complex, and the ability to imitate (as well as the intention recognition ability) may originate from this complexity.[41]

Subsequently more and more complex actions, according to Arbib, led to the development of the *language-ready brain*. He means that the brain circuits which are crucial for language, were shaped before symbolic language was culturally invented (according to Arbib, for instance grammatical schemas are rooted in brain's action's schemas). Meanwhile, the evolution of the brain allowed humans to voluntarily control their vocal organs, leading to the emergence of speech.[42]

Arbib's theory is one of the few according to which human language, as well as the other parts of human cognitive system, is rooted in the brain's motor schemas (similar theories were created for instance by Vittorio Gallese and George Lakoff,[43] Friedemann Pulvermüller[44] or Michael Corballis[45]). These views are part of the current

[40] G. Rizzolatti, M. Arbib, "Language Within our Grasp", *Trends in Neuroscience* 21 (1998), pp. 188–194.

[41] Some scientists claim that also more demanding cognitive skills are based on the mirror neuron system – for instance theory of mind (mindreading). See, for instance, M. Iacoboni, *Mirroring People: The Science of Empathy and How We Connect with Others*, Picador, New York 2009.

[42] See: M. Arbib, *How the Brain got Language: The Mirror System Hypothesis*, Oxford University Press, New York 2012.

[43] See: V. Gallese, G. Lakoff, "The Brain's Concepts: The Role of the Sensory-Motor System in Conceptual Knowledge", *Cognitive Neuropsychology* 22(3/4) 9 (2005), pp. 455–479.

[44] See: F. Pulvermüller, "Semantic Embodiment, Disembodiment or Misembodiment? In Search of Meaning in Modules and Neuron Circuits", *Brain & Language* 127 (2013), pp. 86–103.

[45] See: M. Corballis, "The Mirror Neurons and the Evolution of Language", *Brain & Language* 112 (2010), pp. 25–35.

paradigm of cognitive sciences of the mind embodied, enacted and embedded in culture.[46]

6. Philosophical conclusions

According to the presented view, natural selection did not directly create language to solve any adaptive problem – on the contrary, it rather created a set of conditions where language had the possibility to be culturally invented and transmitted to next generations. The emergence of human natural language was probably based on i) the ability to intentionally communicate with conspecifics through ritualized signals (gestures), ii) the ability to set common goals, iii) the (at least partly innate) tendency to cooperation in order to achieve common goals, iv) the creativity which allows to create some cultural inventions, v) the ability (and innate tendency) to learn by imitation. All these prerequisities allow to spread cultural inventions among conspecifics. Many of those abilities were probably based on vi) the capability to recognize actions and intentions of other individuals, followed by vii) the ability to perceive another individual as an intentional being. It seems that the mirror neuron system is the basis of at least some of these abilities.

The study of animal communication, especially of bees and vervet monkeys, as well as research in the field of vocal chimpanzee communication, suggest that intentionality is one of the most distinctive features of human communication. The intentionality of communication is naturally connected with the realization of goals – in the meaning that the sender intentionally communicates with the recipient in order to achieve a goal. The main difference between intentional and non-intentional communication is that in the inten-

[46] For a general overview of this paradigm, see for instance J. Kiverstein, A. Clark, "Introduction: Mind Embodied, Embedded, Enacted: One Church or Many?", *Topoi* 29 (2009), pp. 1–7, and other articles in this issue.

tional communication a sender previously set the goal and acts voluntarily in order to achieve that goal, while in non-intentional communication a sender rather performs an involuntary act which is genetically determined.

These deliberations lead us to the issue of the normativity of communication. There is actually an ongoing debate concerning the issue of the normativity of meaning[47], however, here we would like to limit ourselves to few general remarks.

First of all, what does the term "normativity of meaning" mean? As Brożek argues,

> The notion of the normativity of meaning is rendered in various ways. One can say, for example, that meaning is normative because there exist criteria for the correct use of linguistic expressions; or that there exist rules governing the application of those expressions; or that there exist right and wrong (correct and incorrect) ways of using language; or that there is a way in which one should use words; or that "what you mean by a word determines how you ought to use that word."[48]

From the perspective presented in this paper, we could conclude that if one is going to address the issue of normativity in animal communication, he has to acknowledge that the meaning of animal communication is "intrinsically" normative. As we can see, the meanings of animal signals are ritualized phylogenetically or ontogenetically, so it is impossible for an individual to use a signal in an "incorrect" meaning. Even if quite complex rules governing the animal communication (like in the bee "waggle dance") exist – an individual (a bee, for instance) simply cannot ignore these rules or follow different rules, because in that case a display would lost its communicative dimension (would be meaningless to a receiver).

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[47] See: B. Brożek, "The Normativity of Meaning", in *The Many Faces of Normativity*, J. Stelmach, B. Brożek, M. Hohol (eds.), Copernicus Center Press, Kraków 2013, pp. 147–156.

[48] *Ibidem*, p. 147.

The situation changes if we consider communication based on symbols (for instance lexigrams). Apes who were taught Yerkish intentionally use some symbols in order to achieve a certain goal – let it be obtaining something (for instance preferred food or other award), or affecting another's behaviour, knowledge or mental state. Those linguistic expressions (that is sequences of lexigrams produced by apes) serve as tools a sender uses on some purpose, like his other "typical" actions. Moreover, the similarity between communication and performing action is further reinforced by neuroscience: some research involving neuro-imagining indicates that the same part of the brain cortex (motor cortex area) is active both when performing real actions, as well as linguistic expressions involving actions are processed. This led some scientists to offer a theory of so-called cognitive simulation[49] which is also coherent with Arbib's hypothesis of the evolution of the language-ready brain. In the context of normativity of meaning, it suggests that linguistic rules could be derived from some pre-linguistic patterns of behaviour, which means that on some kind of "basic level," it is impossible to distinguish between linguistic and non-linguistic rules. This is exactly what Brożek called "rudimentary rules."[50] More abstract rules, however, for instance linguistic rules which add grammatical dimension to communication, are just a further product of cultural evolution and were invented to increase the precision of communication.

[49] B. Bergen, *Louder Than Words: The New Science of How the Mind Makes Meaning*, Basic Books, New York 2012.
[50] B. Brożek, "The Normativity of Meaning", *op. cit.*, pp. 172–176.