CHIMPANZEE (*Pan troglodytes*) MATERIAL CULTURE: IMPLICATIONS ON TAXONOMY

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RESUMEN

El presente trabajo propone una revisión de la actual taxonomía de los chimpancés (*Pan troglodytes*). Basado en la cultura material, y otros factores, como la información genética, es argumented la inclusión en el género *Homo*.

Existen varias referencias sobre el uso de herramientas de chimpancés. Depués del hombre, es le chimpancé que muestra el mayor repertorio de herramientas.

El uso de herramientas no es innato, se aprende y se transmite entre generaciones. No todas las poblaciones de chimpancés exhiben la misma gama de herramientas, lo que demuestra la presencia de una cultura material.. La manipulación de herramientas muestra la existencia de capacidad cognitiva, por ejemplo, entender lo que es una herramienta, y su funcionalidad.

El género Homo se caracteriza por una gran capacidad craneana, locomoción bipedal, idioma, posesión del humano agarre de precisión, la construcción y manipulación de herramientas. Este estudo analiza estos criterios aplicados para el caso do chimpancés.

ABSTRACT

In this paper it is suggested a review of the current taxonomy of the chimpanzee (*Pan troglodytes*). Based on the material culture, and others factors, such as genetic information, it is argued the inclusion in the genus *Homo*. There are several references concerning the use of tools by chimpanzees, which all together show that, after man, they exhibit the biggest repertory of tools. The use of tools is not innate, it is learned and socially transmitted between generations. Not all chimpanzee populations exhibit the same range of tools, demonstrating the present of a material culture, when an ecological explanation is lacking. The manipulation of tools may indicates the existence of complex cognitive capacities. The genus *Homo* is characterized by a large cranial capacity, bipedal locomotion, language, related possession of human-like precision grip, construction and manipulation of tools. This study discusses these criteria applied to the case of the chimpanzees.

Palabras Clave: *Pan troglodytes*. Herramientas. Taxonomía. *Homo troglodytes*.

Keywords: *Pan troglodytes*. Tools. Taxonomy. *Homo troglodytes*.

1.- Introduction.

The dogma that only man uses tools no longer is followed (Goodall, 1986; Panger, 1998; Tonooka, 2001). Currently it is well known the use of tools by non-human animals, including the chimpanzee (Beck, 1980; Brooks *et al.*, 2002; McGrew, 1992; Scothern, 2006). The chimpanzee offers the broadest range of tools compared to other non-human animals, and these are regularly built and handled in many activities, especially in the feeding context (Brooks *et al.*, 2002; Goodall, 1986; McGrew, 1992; Scothern, 2006).

There are various definitions of tools, but the one followed in this paper, was formulated by Beck (1980: 10): "To be a tool an object must be free of any fixed connection to the substrate and must be outside the user's body but it can be a body by-product. The tool may or may not be animate. The user must hold or carry the tool during or just prior to use and must establish the proper and effective orientation between the object and incentive." And tool manufacture is the modification of an object to obtain greater optimisation of the tool. This change can be caused by the individual who will enjoy the tool or may have been made by a conspecific (Beck, 1980).

The fact that exist variability in the construction, and in the repertoire of tools available in various chimpanzee's communities raises the question of the presence of a material culture (McGrew, 1992; Hicks *et al.*, 2005). There is no consensus on the definition of what is culture. For cultural

anthropologists in addition to the social transmission, the language has a key role in the culture. This idea continues to demarcate the existence of culture only in humans (McGrew, 1992; Whiten *et al.*, 1999). On the other side the biological sciences sees culture as the product of two factors: genetics and social transmission (Whiten *et al.*, 1999). Although the genetic information has a certain weight on behavioural skills, this does not explain regional differences in the case of tools. These differences are possibly a product of the cultural process,such as innovation, inter-generational transmition, imitation, social learning, diffusion (Carel and Knott, 2001; Carvalho, 2007; Goodall, 1964 and 1986; Witen *et al.*, 1999 and 2003).

The man displays a tendency to categorize living beings. The first know classification was made by Aristotle (Siva *et al.*, 2000). In 1758, Lineu presented the binomial system, where the various living beings are in a hierarchy according to an ascending order of traits in common. However, the first formal code of the hierarchy of species only emerged in 1842 in the British Association for the Advancement of Science. Since then the taxonomy of species has changed over time due to the knowledge of new species, and the taxomomic school followed (Collard and Wood, 1999; International Commision on Zoological Nomenclature, 1999).

This study follows the cladistic principle: hierarchical organization of living beings - from the lowest taxa, to the highest one - should be established by the degree of phylogeny they share; and the species belong to the same genus if they have a more recently common ancestor, in comparison with other species (Wildman *et al.*, 2003).

The actual taxonomy the chimpanzee and man are placed in different genus, *Pan* and *Homo*. The question is whether this classification remains a anthropocentric vision. Man and chimpanzee share with each other anatomical features, psychological and behavioral characteristics, use and build of tools and have 98% of the same genetic information (Diamond, 1991). For that reason both of them should belong to the same genus.

In this papper it is analyzed chimpanzee material culture and the cognitive skills involved in its use and construction compared to man, questioning the actual taxonomy, suggesting the inclusion of chimpanzee in the genus *Homo*.

2.- Tools use and cognitive capabilities.

The various tools used by chimpanzees are presented according to their purpose (Table 1). Chimpanzees show various tools used for different purposes, but they are mostly used in the feeding context.

Chimpanzees understand what a tool is, and for what it serves. Besides that, they comprehend the cause/effect that arises from the interaction between objects, like a leaf and water (Byrne, 1997; Goodall, 1986; Tonooka, 2001). This interaction can go from the relationship between two objects - a branch and ants - up to the use of four elements - hammer, anvil, nut and a stone under the anvil to create stability - leading to the hierarchy analysis that Matsuzawa proposed as a result of his observations in a chimpanzee population in Guinea (Carvalho, 2007; Matsuzawa, 1991; Scothern, 2006; Sugiyama, 1997). The relationship between two objects are descrived as level one, and the one with four objects is level three, being the most complex observed in natural habitat. Tools from level four were designated by metatool by Matsuzawa (1991), and was defined as “a tool that improves the function of another tool that is insufficient or ineffective to complete a desired task” (Sugiyama, 1997: 26).

The association between tools shows that chimpanzees have intelligence associated with a control engine, which allows the use of several objects to achive a purpose (Sugiyama, 1997).

Chimpanzee have the capacity for planing a future action, that is evident in the selection of an object for a particular purpose, and this can occur in a distance from the place the tool will be use (Beck, 1980; Carvalho, 2007; Goodall, 1964; Tonooka, 2001).

To the same purpose, for example termite fishing, chimpanzee populations may not use the same tool, or the technique applied can be different, depending of the termite consumed (Humle and Matsuzawa, 2002).

They evidence cognitive capability to discern that from the same raw material is possible to construct different tools, and that is possible to obtain the same tool from different raw materials (McGrew, 1992).

Carvalho (2007), whose study was about chimpanzee nut-cracking, says that the use of a tool exibits a *chaîne operatóire*. This is an operational behavioural sequence while dealing with tools, since the selection of raw-material, construction, use, re-use, until they finally are discarded. These steps are sometimes performed in a different way, depending on the individual, showing that chimpanzees have flexibility, adaptation and optimization during a tool activity. This

Purpose	Tool/Function	Sources
Feeding	Nut-cracking	Carvalho (2007), Goodall (1986)
	Termite-fishing	Beck (1980), Goodall (1986), Scothern (2006)
	Ant-dipping	Goodall (1986), Humle and Matsuzawa (2002)
	Honey dip	Goodall (1986), McGrew (1992), Scothern (2006)
	Insect expelling	Goodall (1986)
	Perforating termite mound	Goodall (1986)
	Enlarging nest entrances of birds and bees	Goodall (1986)
	Gathering resin	Goodall (1986), Whiten *et al.* (1999)
	Alga-scoop	Whiten *et al.* (1999)
	Hunting	Pruetz and Bertolani (2007)
	Harvest of storage organs of plants	Hernandez-Aguilar *et al.* (2007)
	Leaf sponge	Goodall (1986), Whiten *et al.* (1999)
	Leaf spoon	Beck (1980)
	Leaf folding	Tonooka (2001)
	Pestle pounding	Whiten *et al.* (1999)
	Container	Goodall (1986)
	Mopping food	Goodall (1986)
Body care	Napkin	Goodall (1986)
Investigation	Termite probe	Goodall (1986)
	Ant probe	Goodall (1986)
	Investigatory probe	Goodall (1986), Whiten *et al.* (1999)
Intimidation	Aimed throwing	Goodall (1986)
	Club	Goodall (1986)
Playing	As toy	Goodall (1986)
Accommodation	Stepping-sticks	Alp (1997)
	Seat-sticks	Alp (1997)
	Fly whisk	Whiten *et al.* (1999)
	Leaf cushion	Hirata *et al.* (1998)

Table: 1. Some examples of wild chimpanzee tool repertoire

demonstrates that they are able to establish a mental organization, antecipate and repeat behaviours associated with tools (Carvalho, 2007), which is transmitted to the young chimpanzees.

3.- Material culture expressions.

When comparing the repertoire of tools of all communities of chimpanzees it is observed a variation in the presence/absence of some tools, as well as in the way tools are made (van Schaik and Knott, 2001); Goodall, 1986; Hicks, 2005; McGrew, 1992).

A tool can exist in various populations, like the ant-fishing, or be exclusive to some populations, like the case of the nut-cracking. This tool is observed only in the subspecies *Pan troglodytes verus* from West Africa, and is not visible in the eastern chimpanzee communities (Hicks, 2005; Whiten *et al.*, 1999). The observation of the presence/absence of nut-cracking shows three conclusions. First, this is not an innate behaviour, because not all populations show the nut-cracking behaviour (van Schaik and Knott, 2001). Second, there are stones and nuts in East Africa, so the absence of nut-cracking is not due to environmental constraints (Hicks, 2005; Scothern, 2006). Finally, it shows the possible presence of cultural differences. The genetic information and morphology also have some weight on these behaviours, but to a lesser extent, because it is necessary also a prehensile hands to handle the tools (Beck, 1980).

The emmergence of a tool-use behaviour is possibly due to a innovation of an individual, but this is not enough to endure this behaviour. For the maiintenace of a new tool-use behaviour in the group there should exist an inter-generational transmission, which operates by social learning through observation, imitation and practice (Beck, 1980; Casanova *et al.*, 1995; van Schaik and Knott, 2001; Goodall, 1986; Whiten *et al.*, 1999).

In chimpanzees populations it is observed that the youngest individuals usually are close to their

mother and other adult members while they are using a tool (Beck, 1980). The youngster during this time observes, take contact with objects during their plays, imitate and practise until they are able to perform the behaviour with the same perfection as the adults.

After man, chimpanzee is the species that demonstrates greater variability in behavioural patterns (Whiten *et al.*, 2003). So it can be affirmed that the difference between chimpanzee and man is not in the presence or absence of a material culture, but in the accumulative processes and its evolution. The tool behaviours have not change much over time in the case of the chimpanzee, due to the fact that they have more limited psychological mechanisms compared to man (Whiten *et al.*, 2003).

4.- Discussion.

Chimpanzees presents the biggest repertoire of tool-use, after man. They understand what a tool is, and that through them they can achieve a certain goal.

The use of tools is not innate and the differentce that exist between populations is not due to environmental constrains. It is a cultural behaviour socially transmitted between generations, as it is in humans.

There are other non-human primate species that uses tools, like *Pongo sp.*, *Cebus sp.* and *Pan paniscus*. But unlike chimpanzees they use it more in captivity than in natural habitat (van Schaik and Knott, 2001; Fragaszy *et al.*, 2004), demonstrating that they have similar cognitive abilities to the chimpanzee. But besides of showing fewer tools in natural contexts, they also present a larger phylogenetic distance to man which does not justify a taxonomy approximation, like the one it is proposed for the chimpanzee. Of course that is not the case of the Bonobo, that shows a 0,7% difference of genetic information from the chimpanzee (Diamond, 1991), justifying also its inclusion in the same genus as man, and the common chimpanzee (Diamond, 1991).

The argument of the existence of a material culture in chimpanzees alone is not enough for their inclusion in the *Homo* genus. It has to be taken into consideration their anatomy, genetic information and social behaviour. The genetic information is the argument with more weight, since chimpanzee and man share 98% of this information. But, in some taxonomies chimpanzees are place as being more close to gorilla than to man, although they only share 97,7% of the genetic information, less than with man (Diamond, 1991).

The idea of putting man and chimpanzee in the same genus is not original (Casanova *et al*, 1995; Diamond, 1991; Goodman *et al*., 1998; Wildman *et al*., 2003). Since the genus *Homo* arose first in the taxonomy classifications, in this present paper it is suggested that chimpanzee should be included to this genus, and therefore referred as *Homo troglodytes*, instead of the man being included in the genus *Pan* (Diamond, 1991).

The characteristics of the genus *Homo* are, greater cranial capacity, manufacturing of tools, language and modern human-like precision grip (Collard and Wood, 1999), tendency for bipedal locomotion and exhibition of a greater confidence in cultural adaptations rather biological ones.

Chimpanzees have a smaller cranial capacity (400cm³) than man, but higher than *Homo floresiensis* cranial capacity of 380 cm³. In their relation with tools they show cognitive capabilities, such as the planning a future action and demonstrate that they have a material culture that approximates to man.

Like man, tools have an important role in chimpanzee survival, since they are used mostly in the feeding context.

Chimpanzees don't have an articulated language as humans do, because of morphological constrains. But still they are able to communicate through gestures, vocalizations and emission of pheromones (Casanova *et al.*, 1995). This kind of communications have an important role in cultural transmition between generations.

The bipedal locomotion is usually associated with a human innovation trait, since only us have this type of locomotion. In the year 2007, Hope *et al.* (2007) questioned if the bipedal locomotion wasn't a derived feature, but ancestral, possible present in the common ancestor between Pongid and Hominid. This question was elaborated from orang-utan locomotion observations. They move on the trees with theirs arms in the branches and an erected posture. So, according to this theory the modified quadruped locomotion or knucle-walking of the chimpanzees would be a derived feature, differing from man. This fact alone is not enough to justify chimpanzee exclusion in the *Homo* genus.

The preensil grip ability has a key role in the handling and construction of tools. The chimpanzee has a preensil grip, but that is not equal to humans, since they do not have precision handling with tools and a firm precision pinch grip, that are important in the tool construction. But from the observations made in *Homo habilis*, they also did not have the necessary morphology and the grip prehensile capacity as *Homo sapiens* do have (Marzke, 1997).

The most recent common ancestor between chimpanzee and man lived between 5 to 8 milion years (*Brooks et al.*, 2002). They share more or less 98% of genetic information (Diamond, 1991; Matsuzawa, 1991). Despite these informations chimpanzees are not place in the same genus as man, demonstrating an anthropocentric vision in the actual taxonomy (Casanova *et al.*, 1995; Diamond, 1991).

In his book, *The rise and fall of the third chimpanzee*, Jared Diamond (1991) says that cladistic classification do not use the same criteria for all species. He exemplifies the comparison of the *Pan sp.* and *Homo sp.* with *Hylobates sp.* classification. Gibbons have between them a bigger genetic distance than chimpanzee and man, but are all placed in the same genus, *Hylobates*.

This paper demonstrates that the current anthropocentric view in taxonomy should be abandon and the chimpanzee be included in the genus *Homo*.

The inclusion of chimpanzee and bonobo in the genus *Homo*, implies the inclusion of others hominins in this genus, like the *Australopithecus sp.*.

In this study it is also suggested the creation of subgenera, like the study of Goodman and colleagues (Goodman et al., 1998; Wildman et al., 2003). This authors suggested a creation of two subgenera, *Pan* and *Homo*, in the *Homo* genus. The subgenera *Pan* would include the bonobo and common chimpanzee, and the *Homo* subgenera would include all the hominins. The division in the two subgenera is because the hominins share between them a more recent common ancestor than they do with chimpanzees and bonobos. The present paper suggest the creation of more subgenera because in hominins there exist several recent common ancestors.

It is proposed that the actual genus pass to the category of subgenus. So it will be maintain the same order that they have but in another level of analysis. Only the names that end with *-pithecus*, as the case of *Ardipithecus sp.* and *Australopithecus sp.* should be replaced to the terminology *-anthropus*, because *-pithecus* means monkey. So with their inclusion in the genus *Homo*, they would be called *Homo (Ardianthropus) sp.* and *Homo (Australanthropus) sp.*.

5.- Conclusion.

Homo sp. are characterized by their high brain capacity, exclusive bipedal locomotion, modern human like precision grip, use and construction of tools and greater dependency on culture.

The chimpanzee displays small cranial capacity compared with man, but that is bigger than *Homo floresiensis*.

They do not have a precision grip like humans, just like *Homo habilis* don't have. But chimpanzees have a precision grip that allows them to manipulate tools.

Chimpanzee uses the modified quadruped locomotion, and sometimes adopt a bipedal posture. Although the bipedal locomotion have a important weight in the *Homo* characterization, it is suggested that the importance of this criteria be reviewed, because *Homo habilis* do not presented a exclusively bipedal locomotion, like the chimpanzees.

The three last criteria are not enough to justify the exclusion of chimpanzees from the *Homo* genus.

Chimpanzees like *Homo erectus* do not have a articulated language like *Homo sapiens*, but are capable to communicate during their social relations and cultural transmition between generations. After man, chimpanzees are the species showing the biggest repertoire of tools. They are also dependent on their material culture in their daily lives, and show cognitive capabilities associated with the use and construction of tools that approach them to humans.

The data debated in this paper together with genetic information justify the inclusion of the chimpanzee in the *Homo* genus.

This taxonomic change involves a reshuffle, such as the inclusion of others hominins - like *Australopithecus sp* .- and the bonobo in the *Homo* genus, being suggested the creation of several subgenera. The current genus would become the subgenus, with *Pan* being the subgenus of bonobo and chimpanzee, and *Homo* the subgenus of *Homo erectus* and *Homo sapiens*.

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