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Legacy Trees in Sicily. A Heritage of Stories

Trees are tall plants that can live a long time. They mutely attend events of humans for many years, even centuries, and millennia. A forest or a single tree can survive many human generations. When they get old, they can perform the social role as a monument, reminding the value of time and the environment. The present paper is dedicated to the Monumental and Legacy Trees in Sicily. It aims at showing the nexus between the necessary care of veteran trees and the cultural values that the entire society can achieve through their conservation for the present and the future. After the definition of Monumental Trees, the paper deals with the multiple meanings that even a singular tree has in religion, mystics, education, environment, heritage, and also in tourism. The paper gives geographical knowledge on the principal Sicilian Monumental Trees, deepening the fascinating stories of some of the more typical of them. The olive tree is a millennial symbol of the Mediterranean landscape; the almond tree remembers the eternal springtime of Sicily with its very early blossoming in February; oak trees, holm oak, cork oak, and chestnuts are gigantic monuments of the holiness and boldness of Sicilian mountains. The author argues that future life of old trees depends on policies regarding both environment and cultural tourism.

KEY WORDS: *Monumental Trees, Heritage, Stories, Cultural Tourism.*

And out of the ground the Lord God made to spring up
every tree that is pleasant to the sight and good for food.
The tree of life was in the midst of the garden,
and the tree of the knowledge of good and evil.

(Genesis, 2:9)

Introduction: Trees and the Society

Over the past 650 thousand years, there have been seven cycles of glacial advance and retreat. Scientists attributed those climate changes mostly to very small variations in Earth's orbit and the change in the amount of solar energy for the planet. The modern climate era began near 10 thousand years ago, after the last ice age. During this period humanity produced a variety of civilizations, and yet an increasing environment change, not always perceived in negative terms as pollution. The atmospheric carbon dioxide had always been below the limit of 300 parts per million until the mid of the 20th century. After this turning point, the average concentration of carbon dioxide and other gases increased very fast in a narrow lap of

years. The atmospheric warming nature of carbon dioxide has been demonstrated in the mid-19th century (Fleming, 2005). Today, the climate change on a global scale is both a scientific and a public concern. People show an increasing sensitivity towards nature and the environment, giving greater attention even to global and local forests as a resource for limiting climate changes. Trees and forests increased in importance, besides their socioeconomic features, as an environmental issue. Yet, they are also fundamental as a cultural heritage.

The world total forest area is today 4.06 billion hectares, covering 31 percent of the total land area. Each living person has a 0.52 hectare of forest area, even though forests are not distributed equally among the world's peoples or geographically. Forests are located more in the tropical area (45 percent), and then in the boreal, temperate and subtropical regions. The 54 percent of the world's forests is in only five countries, the Russian Federation, Brazil, Canada, the United States of America, and China. Only the 5 percent of the global forests stands in the European Union. Nevertheless, European Countries have continuously expanded the forest area for over 60 years, contrary to what occurred in the less developed regions of the world. Yet, the EU is a 'forest' land, being the 42% of its area covered by trees; forests and other wooded land cover, respectively, 155 million and 21 million hectares (FAO, 2020). Unfortunately, there is no European common forest policy, which still remains in the power of the Member States. Nevertheless, in the EU there is a long history of national and regional laws and regulations based on long term forestry activities. Thus, many EU measures supporting certain forest-related activities, within a Forestry Strategy adopted in 1998, have been oriented to sustainable forest management and the enhancement of multifunctional forests (Aggestam, Pülzl, 2018).

Throughout history, humanity have recurrently cut forests to have more farmland. In parallel, researchers claimed for the conservation of forest areas, their protection, and sustainable management. Policymakers began to consider forests even before agriculture as a multifunctional activity, capable of offering logs jointly to environmental protection and recreational services (FAO, 1995).

Scholars paid a special attention to the bio-ecological importance of ancient and venerable vegetal formations and the necessity to preserve them for scientific and social purposes (Asciuto *et al.*, 2015; Zapponi *et al*., 2017). Today, the category of 'monumental' tree and forest is accepted by common sense besides scholars and policymakers. Thus, when placed in the cultural heritage realm, trees will have higher respect, especially when they are of particular aesthetic or historical, and memorial interest. Humanity made that through religion and culture over time and space. All civilizations worshipped some trees as sacred objects, performing a cultural role for their powerful pattern or story.

Today, the shared concept of cultural heritage is broader than just its juridical definition. It tends to include goods of cultural, historical, architectural, archeological, geological, natural, and only 'local' value. The pure link to a specific art piece, or a singular historical-architectural monument, is overcome by the inclusion in the heritage category of urban and rural buildings, archeological areas, historical places, monumental gardens, and even intangible values of local traditions. Moreover, the significant increase of the travel and tourism industry may give added value to some destinations that offer narratives and histories of green giants, testimonies of very past times. The local meaning of a 'monument' can be transferred to a larger spatial scale, diffusing and sharing culture, and linking people with friendship.

This paper aims at shedding some lights over big trees of Sicily, a land which was very rich of forests in ancient time. Today, the total forest area of the Island is just more than 500 thousand hectares, not equally distributed in the geography of Sicily (Regione Siciliana, 2010). Nevertheless, Sicilian forests conserve their fundamental role in furnishing multifunctional services to the entire territory and society. Moreover, monumental trees testimony the patterns of tradition in farming, forestry, and rural-urban relationships. They are located in rural, urban, and forest areas, in the plains, and the mountains, within all provinces of the region. Each of them has a story to tell. Some humans collected them in oral and written forms. Some of these stories are here reported to link them to the cultural heritage embodied in the trees. For this purpose, the rest of the text is organized as follows. The next section deals with the nexus between wood, myths, and symbols, as retrieved from literature. The third section reports the definition of 'monumental tree', listing the main fifty of them located in Sicily. The fourth section deals with the stories of some typical Sicilian Monumental Trees, olive trees, oaks, almond trees, and chestnuts. The final section gives some suggestions for the future life of old and veteran trees in Sicily, possibly a prospect for all monumental trees in the world.

Trees, Wood, Myths and Symbols

Trees have great utility for people, and are culturally notable for their habits and habitats, size, or longevity. The diversity of forms and functions is a direct consequence of the complex and flexible organization of their growth in response to environmental and biological conditions. They grow up in a myriad of striking forms, sizes, and environments. Besides material functions for everyday life, trees have a great significance in mythology, legends, symbolism, and religion. The association between trees and mythology works in a very profound way. Trees offer a sense of mystery, probably due to being the largest plants, and the association with particular

myths takes place not only on a species level but also in geographical terms or with individual trees (Burkert, 1998).

Both human scientific curiosity and mythology deal with the capability to discover the secrets of the real world, the meaning of life, and so trees offer humans a living reminder of happy or terrible events or even so marvelous as to be beyond human comprehension (Cloke, Jones, 2020; Rolston, 1998). The long life of trees allows humans to imagine they witnessed ancestral happenings, then being sacred to religious rites. Legends are a different phenomenon to Myths, these latter being less based on real facts or merely fictional stories. The legendary story of Robin Hood is fully known, yet his true identity fades in the mists of past time, but his relations with the woods are well clear and told in several television fictions, movies and novels (Holt, 1960).

Trees are symbol of boldness, being capable to live even in the most extreme conditions. A tree has three parts in terms of symbolism, roots, trunk and branches which have large meanings in many cultures and popular traditions. When humans decide to dwell in a place, they are rooting their life in the ground, in a territory. When leaving, they eradicate their culture from a place and migrate to a foreign land. The trunk is the core of the human body, and means stability, resistance, and boldness, sustaining the head (the thinking) and the arms (the making). Canopy ramification into branches is the symbol of a family relationship, of transmission through generations of genes, culture, traditions, and habits of honor and nobility. Planting trees is the renounce to immediate revenue in favor of future generations; it reveals a social attitude more than a private interest. A good family man should plant trees for the nephews.

> "For a human character to reveal truly exceptional qualities, one must have the good fortune to be able to observe its performance over many years. If this performance is devoid of all egoism, if its guiding motive is unparalleled generosity, if it is absolutely certain that there is no thought of recompense and that, in addition, it has left its visible mark upon the earth, then there can be no mistake." (Giono, 2007, p. 3).

Different cultures traditionally plant trees in honor of an important rite of passage such as a graduation, wedding, retirement, the birth of a child or in memory of relatives lost in wars. In recent times, trees have become a powerful symbol of capability of aging and reliability, being the logo of many businesses involved in long term investments or in life insurance.

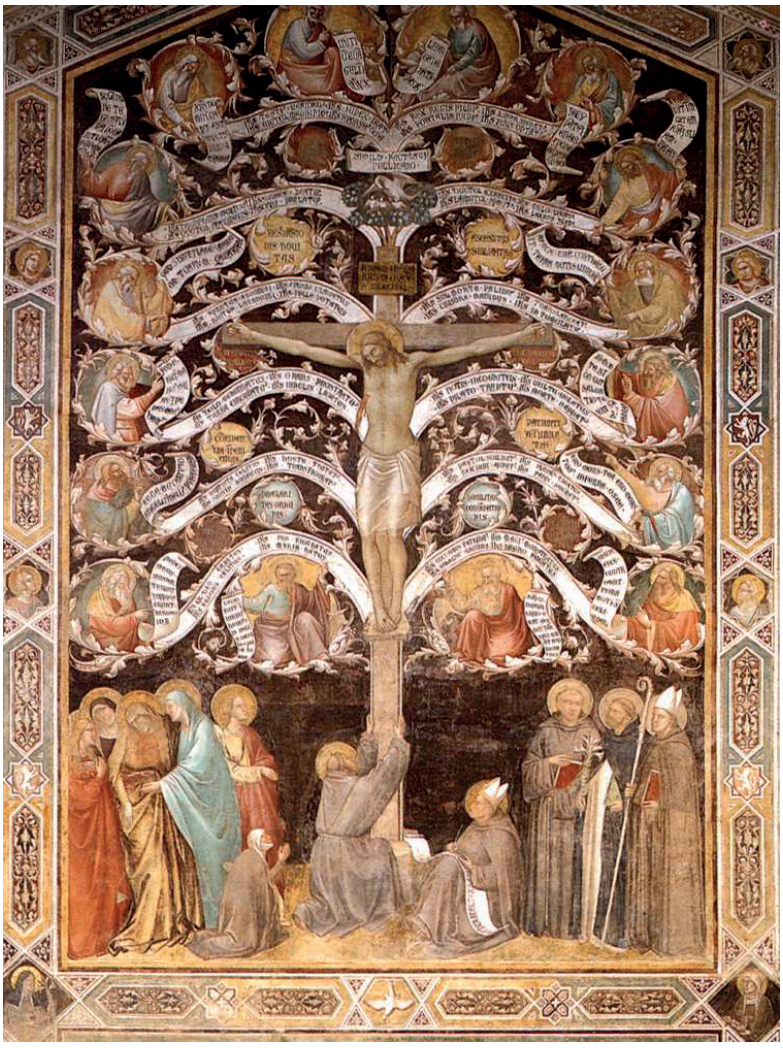
For the Muslims, sacred trees had divine powers being the graves of their saints, and possessed miraculous powers because they are the dwelling place of the soul. In ancient pagan religions, some particular trees were regarded as sacred and became the focal point for worship. In Northern European cultures, the Druids did value

the trees considerably and even planted trees to form groves in which they could worship. They avoided celebrating religious rites inside a temple enclosed by walls and a roof. Their sacred tree was the oak, with trees planted in a circular enclosure. Many early Christian churches took on this shape, and the circle was even the basis for the orientation design of great Christian cathedrals (Burckhardt, 1987).

Pic. 1. Charles Knight, The Druid Grove, 1845.

Christianity embraced by Pagans the symbols of the tree, even in other ways. First of all, in the sign of the cross where Christ suffered and died. It was roughly hewn from a tree and often appears to grow organically from the ground. The prevalent union of the human figure and the tree appears a deliberate correlation with Christian symbolism where the tree can represent either life or death (Ryken *et al*., 2010). Jesus Christ was born to a carpenter and was a carpenter himself working with wood. His life ended hanged on a cross made with wood, planted in the ground like a tree.

Even today, the symbolism of trees finds its way into human expression, especially in labeling people who have achieved great age and even great wisdom. As the numbers of older people in Europe continue to grow, maybe the symbolism of trees will find new resonance.



Pic. 2. Taddeo Gaddi, Allegory of the Cross, 1330s, fresco in Basilica of Santa Croce, Florence.

Pic. 3. Georges de La Tour, Joseph the Carpenter, 1640s, Louvre Museum.

Giant and Veteran Tree in Sicily

Arguably many have seen the picture of giant sequoias in the Mariposa Grove, in the southern part of Yosemite National Park in the United States. One of the most impressive images is that of the Wawona Tunnel Tree, with cars going through the cut in the trunk of sequoia. This noted tree fell in 1969, due to heavy load of snow, and remained in the place as a tourist attraction. In the Park, the giant sequoia named Grizzly Giant is probably the elder, being more than 2000 years old. One can argue that these sequoias are 'monumental' in a circular way, namely for their reputation and notoriety.

There is not a legal definition of a veteran, legacy or monumental tree, while private and public census initiatives are numerous worldwide. The website *Monumental trees*[1] is an online private action for gathering quantitative data from all over the world. Its base is in Belgium, and the administrator is a passionate volunteer. This website demonstrates the increasing interest of people in monumental trees, and on forests and environmental culture, in general. It is possible to surf the site and get the page of links containing connections to Institutions that have care of monumental

[1] https://www.monumentaltrees.com/en/

trees in the following countries: United Kingdom, the United States and Canada, Belgium, the Netherlands, Italy, Hungary, and Poland.

A monument is something that reminds us, commemorating a fact, a person worthy of being kept in memory. An isolated tree in the countryside is a landmark, a sign of spatial orientation, an indication for travelers. A giant tree is a sign of longevity. A monumental tree is a tree with a story.

In Europe, many Countries care about monumental trees, and made a census of them, whereas a shared definition is still lacking. Italy adopted the very first act for protecting monumental trees in 1939 (GU, 1939). Today, the essential guidelines are absorbed in the Code of Cultural Heritage and Landscape (GU, 2004), lastly modified in 2008 (GU, 2008). The older law stated that a monumental tree should be paired to a natural beauty, a beautiful landscape, a superb panorama, thus to be protected in itself. In 2004, the so called *Codice Urbani*[2] reorganized the State and Regional responsibilities about protection of landscape, devolving powers and planning decisions to local authorities. Thus, the Italian Regions inherited the responsibility for the protection of monumental trees within their competencies of landscape planning.

The Italian State Forest Body[3] began a full census of monumental trees in 1982 (Alessandrini *et al*., 1990). They detected 1255 big trees, of which 240 in Southern Italy. Many Regions began the local census as well. In Sicily, the Regional Department of Cultural and Natural Heritage and Permanent Education instituted the Register of Sicilian Monumental Plants on September 29th, 2005[4]. The whole regional knowledge is still fragmented, yet the Sicilian Region Agency of Forestry promoted many studies and inventories and edited some relevant books on the topic (Schicchi, Raimondo, 2007).

The Agency stated the definition of 'monument tree' in view of the specific survey and registration. First of all, dimensions matter, both in height and girth. These parameters and the age of the tree are usually linked. Other considered parameters are pattern, habit, and the linkages with art, literature, history, mythology, legends, local stories, rarity, and the surrounding landscape.

Table 1 shows the list of fifty big trees in Sicily, selected for aging and location. Among them, the paper will take the story of some individuals, relevant for their botanical species, story, legend, or myth, and the relation with a specific landscape.

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[2] From the name of Minister Giuliano Urbani, promoter of the law.

[3] Today the State Forest Body in under the Carabinieri military forces.

[4] D.D.G n. 7358, 29 Sept., 2005, namely a decree of the General Manager of the Department.

Tab. 1. List of Selected 50 Monumental Trees in Sicily

				Province of Agrigento*
	Local Italian Names	*Scientific Name*	*Estimated Age*	*Municipality*
1	Olivastro di Inveges	*Olea oleaster*	700-800	Sciacca
2	Carrubo di Giove	*Ceratonia siliqua*	300-400	Agrigento
3	Olivo della Kolymbetra	*Olea europaea*	600-700	Agrigento
4	Ulivi della Concordia	*Olea europaea*	500-600	Agrigento
5	Olivo del Tempio di Giunone	*Olea europaea*	500	Agrigento
6	Mandorlo di San Crispino	*Prunus dulcis*	170-180	San Giovanni Gemini
7	Roverella di S. Rosalia alla Quisquina	*Quercus congesta*	400-450	S. Stefano Quisquina
				Province of Caltanissetta
8	Carrubo di Milena	*Ceratonia siliqua*	300-400	Milena
9	Mandorlo di Milena	*Prunus dulcis*	300	Milena
10	Sughera Mosaica di Niscemi	*Quercus suber*	400-500	Niscemi
11	Sughera di contrada Pisciotto	*Quercus suber*	300	Niscemi
				Province of Catania
12	Ulivo millenario di Motta S. Anastasia	*Olea europaea*	1000-1200	Motta S. Anastasia
13	Ilice du Carrinuo Ilice du Pantano	*Quercus ilex*	500-600	Zafferana Etnea
14	Roverella di Monte Arso	*Quercus congesta*	400	Bronte
15	Castagno dei Cento Cavalli	*Castanea sativa*	2000	Sant'Al fio
16	Castagno di S.Agata o Castagno Nave	*Castanea sativa*	1800	Mascali
17	'U Zappinazzu	*Pinus nigra calabrica*	200	Linguaglossa
18	Betulla di Santa Maria	*Betula aetnensis*	500	Randazzo
19	Acerone di Monte Colla	*Acer pseudoplatanus*	500-600	Randazzo

[to be continued]

				Province of Enna
20	Corbezzolo di Villa del Casale	*Arbutus unedo*	150	Piazza Armerina
21	Sughera di contrada Sugherita	*Quercus suber*	350	Cerami
				Province of Messina
22	Olivo grande di Predica	*Olea europaea*	1500	Caronia
23	Olivo di Santa Venere	*Olea europaea*	1000	S. Stefano di Camastra
24	Roverella di San Piero Patti	*Quercus virgiliana*	400	San Piero Patti
25	Cerro di Scavoli	*Quercus cerrsi*	400	Alcara Li Fusi
26	Tasso grande della Tassita	*Taxus baccata*	700	Caronia
27	Acero montano di Bosco Tassita	*Acer pseudoplatanus*	600-700	Caronia
				Province of Palermo
28	Frassino di Saltaloro	*Fraxinus angustifolia*	400-500	Castelbuono
29	Cipresso di San Benedetto “Il Moro”	*Cupressus sempervirens*	426**	Palermo
30	Sughera di contrada Cava	*Quercus suber*	450	Geraci Siculo
31	Leccio Grande di Piano Zucchi	*Quercus ilex*	800-900	Isnello
32	Roverella grande di Rifesi	*Quercus virgiliana*	500-600	Palazzo Adriano
33	Roverella di Macchia del l’Inferno	*Quercus virgiliana*	1000	Castelbuono
34	Pioppo nero di Fiume Grande	*Populus nigra*	650-750	Palazzo Adriano
35	Rovere di Sempria	*Quercus petraea austrotyrrhenica*	650-750	Castelbuono
36	Acero minore di Catagiddebbe	*Acer monspessulanus*	400-500	Petralia Sottana
37	Acerone delle Madonie	*Acer pseudoplatanus*	900	Castelbuono

[to be continued]

				Province of Ragusa
38	I lentischi della Foce del Fiume Irminio	*Pistacya lentiscus*	200	Ragusa
39	Carrubo di Cava Palombieri	*Ceratonia siliqua*	600-700	Modica
40	Carrubo di Caschetto	*Ceratonia siliqua*	900-1000	Modica
41	Carrubo di Iozia	*Ceratonia siliqua*	600	Modica
42	Olivo di Palazzelli	*Olea europea*	1500	Ispica
43	Olivo di Lippia	*Olea europea*	800-900	Acate
				Province of Siracusa
45	Carrubo di contrada Candelaro	*Ceratonia siliqua*	900	Noto
46	Carrubo di Favarotto	*Ceratonia siliqua*	1700-2000	Rosolini
47	Olivo di contrada La Gebbia	*Olea europea*	1300-1600	Avola
48	Olivo di Busulmone	*Olea europea*	1300-1500	Noto
				Province of Trapani
49	Roverella del Castello della Pietra	*Quercus virgiliana*	200	Castelvetrano
50	Roverella di Baviera	*Quercus virgiliana*	300	Salemi
* The term Province is still in use even if the official names of local administrative bodies changed. From 2014, the Sicilian Region abolished Provinces and instituted the Metropolitan Cities of Catania, Messina, Palermo, and the Free Municipal Consortiums of Agrigento, Caltanissetta, Ragusa, Siracusa, and Trapani (Regione Siciliana, 2014). ** Dated by La Mela Veca (2006).				

Source: selected and processed by the author from Schicchi, Raimondo, 2007.

Olive Trees and Other Sicilian Trees With Stories to Tell

The Mediterranean landscape can find its unity in the bordering of vegetational areas. On this, geographers Claval and Jourdain-Annequin (2017) remind us of the ideas of past eminent scholars. Botanical geographer Alphonse de Candolle (1855) stressed the difficulty of delimiting a vegetational area considering only a singular species, instead of a botanical formation. Nevertheless, Vidal de la Blache noted that olive tree, vine, and fig tree were a characteristic feature of the Mediterranean coastal zones. They give a vegetation likeness to the unity of the historic theater, where ancient people lived and developed (Vidal de la Blace, 1873). Claude Braudel (1987) enlightened that all around the sea, people had learned to grow grains (wheat or barley), olive tree, and vine, in the so-called Mediterranean food trinity.

Actually, the Sicilian vegetational landscape is substantially Mediterranean, even varying and reflecting the climate and the geopedology of the island. Throughout history, humans have transformed it through millennial farming, animal husbandry, and forestry. Yet, Sicilian landscape is characterized by both native vegetation and traditional agricultural cultivations. So, forests, bushes, shrubs, steppes coexist with more or less extensive agricultural crops. Intensive crops (orange and other fruit orchards, horticulture) are located mainly in the coasts and the close inner areas, or along the main water streams. In these areas, monumental trees are isolated at the margins of farmlands. In the north-eastern side, within the Peloritani, Nebrodi, and Madonie mountains, and on the Etna slopes, to the east, the landscape is characterized by forests of oaks, cork oaks, holm oaks, and chestnuts. Everywhere, the olive tree designs colors and patterns of Sicilian plains and hills.

The Mediterranean area is the ‘place’ for olive tree cultivation and the location of its mythology and religion. Olive tree is both pagan and catholic, it is sacred both to Athena and to Jesus Christ.

About cultivated olive tree, first testimonies go back to ancient times (Baldoni *et al*., 2006). Since the Roman Age, farmers cultivated olive trees in the entire Mediterranean basin. It identified civilizations and people’s daily economic, social, and cultural features. It was the determinant of the rural landscape, the principal source of fat, an exportable product, a sacred symbol of deities. Today, it conserves near the same features, both in religious and civil issues. The olive groves can grow in low fertility lands, on steep slopes, in shallow soils, having limited water provision. In the ancient Sicilian rural landscape, this tree probably was the main visible element.

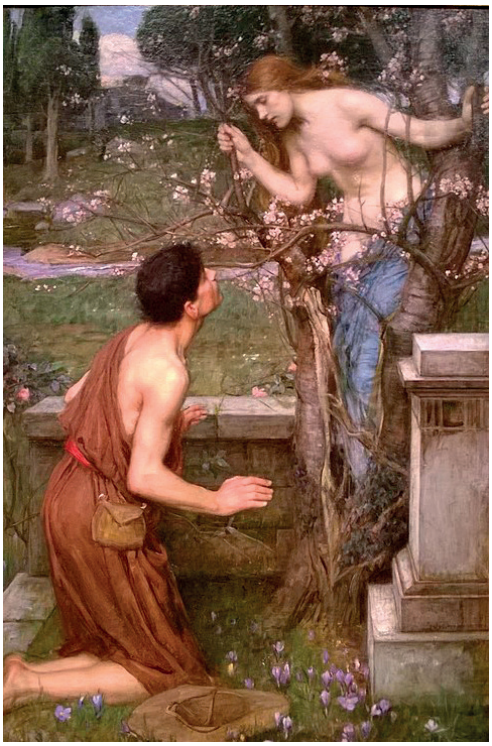
Amongst Sicilian monumental trees, more ancient testimonies are properly about the olive tree (Barbera, Cullotta, 2014). Besides those of Caltanissetta and Trapani, they are located in all the Sicilian provinces (see tab. 1). Moreover, they are among the very veteran trees, often aging more than a thousand years. Many Sicilian writers, such as Leonardo Sciascia, Salvatore Quasimodo, Andrea Camilleri

named them as *olivi saraceni* (Saracen olive trees), a suggestion first used by Luigi Pirandello (Marci, 2017). The olive trees in Sicily are Saracen because they came from very past times, and eastern far regions, and because they have a very particular pattern: a convoluted and twisted trunk, which always rebirths from the base with new shoots that grow overlapping the old wood. Nobel laureate Luigi Pirandello wrote in a tale:

> "At the beginning of the three flowered plains, before the villa, since more than a hundred years, there was a Saracen olive tree, whose robust trunk, full of lumps and knots, grew sideways, and seemed to stand with pain the many branches that rose from one side only, straight, by their own." (Pirandello, 1966, p. 827, my translation)

In the Kolymbetra garden, within the archeological area Valley of the Temples close to the city of Agrigento, some monumental olive trees have grown together with other veteran species, such as carob and myrtle trees (tab. 1). The archaeological remains are in an exceptional state of conservation, including a set of primary Doric Temples of the Hellenic period. In this location, the oldest tree is an olive tree, with a canopy of 5 meters in height, and a trunk of 6.4 meters in circumference. It could be even 800 years old, giving a visual sense to the sacred story of the place.

Pic. 4. Olive tree of Juno Temple, Valley of the Temples, Agrigento.
https://www.monumentaltrees.com/en/ita/sicily/agrigento/11766_valledeitempli/23008/



Pic. 5. John William Waterhouse, Phyllis and Demophon, 1897, oil on canvas.

The same Valley of the Temples is the place of a spectacular blossoming during each springtime. Here, almond trees blossom very early, in February and March, coloring the landscape by myriads of petals from pure white to the innumerable degrees of pink. Visitors consider it the symbol of Sicilian eternal springtime, actually being a cultural event attracting tourists from everywhere.

The almond tree's blossoming has its mythology coming from ancient Greek culture about the idea of hope. The origin of the tale is in the love story of Phillis and Demophon, this latter often confused with his brother Acamas, and son of Theseus, King of Athens. Demophon entered the city of Troy in the belly of the wooden horse, the tricky weapon invented by Ulysses. Before, he had married Phillis, yet leaving the day after the wedding to fight the Trojans. He forgot to come back, and Phillis died after waiting for her lover ten years on the seaside front. Goddess Athena transformed her in an almond tree. When Demophon finally came back and knew the transformation of her woman, he embraced the almond tree that soon started blossoming. Eternal love rebirths every year with hope and faith in the future.

In the Province of Agrigento, there is the reportedly oldest almond tree of Sicily. It is named *Mandorlo di San Crispino* (Almond of Saint Crispin) after the name of the locality, near the village of Mussomeli. It is 170-180 years old and is very robust and in good health, 11 meters of height. Two meters from the ground, the trunk splits in four branches of a meter in circumference. The canopy is ample and has a conic shape. The tree is owned by a private farmer, with no heritage ties.

Within the territory of the municipality of Santo Stefano Quisquina, province of Agrigento, in the locality named Serra, there is Saint Rosalia's Oak. Rosalia is the patron saint of Palermo, the capital city of Sicily. She was born there, daughter of a Norman, Sinibald, Lord of Roses and Quisquina, and thus a descendant of Charlemagne. Still young, she left the mundane vanities to God and retired to live as a hermit in a cave on Mount Pellegrino, where she died alone about in 1160, unknown to the world. Her body was discovered in 1625, during the pontificate of Pope Urban VIII. Her feast day is September 4th, and in Palermo, the *Festino di Santa Rosalia* is held each year on 14-15 July. On her feast day in September, a crowd of devotees performs a barefoot climb to Mount Pellegrino, honoring the Saint for a vote or grace received.

The legendary oak tree is close to the St. Rosalia Quisquina Hermitage, near the cave where the saint lived. The legend says that Rosalia used going near the oak to pray and dry her long air in the sun. Indeed, the place is famous for being humid and cold over many months, as the toponym Quisquina means a dark and obscure place. The tree has a height of 22 meters, with a big trunk of 5.2-meters girth, divided into two branches of 2 meters in circumference, at the height of 3.5 meters from the ground. The canopy is dense, intricate, and spherical. The trunk is covered by colored green-orange likens. The tree will worth a cultural tourism enhancement even for the vicinity of the Hermitage. This sanctuary is linked to another one located at the Mount Pellegrino near Palermo by the *Itinerarium Rosaliae* (Domina *et al*., 2018). This is a trekking road tracked by the Regional Forest Service following a panoramic walkable trail, even not the original way made by Rosalia in her time.

The actual protagonist plant of the spontaneous Mediterranean vegetal landscape is the holm oak (*Quercus ilex*), an evergreen oak spread all over the sea basin. The tree has a spherical canopy, with rich branches, and a robust trunk, having a deep root apparatus. The leaves are thorny, with dark green in the upper face, and silvery grey in the lower one. They often give a dark and shadowy color pattern to the landscape when are in dense forests. This landscape was a very diffuse shape of ancient Italy in sub-coastal and mid-mountain areas. Italic people considered it as a divination sign of the heavens and chose where to dwell if there was a big holm oak. Their leaves were the emblem of brave military service, used to make the civic crown (*corona querquensis*) on the head of a soldier who had saved the life of a Roman citizen.

Pic. 6. Route signal of the *Itinerarium Rosaliae*, photo by Giuseppe Geraci.

The fruits, acorns, are sweet and used to prepare in past time a frugal oak-bread, and moreover to feed pigs. Thus, the holm oak forests were a perfect place to sustain human settlements.

In Sicily, the holm oak has its optimal vegetative conditions between 400 and 1200 meters above the sea level, on northward exposed slopes, affected by wetland currents from the sea. Nevertheless, it spreads in lower and higher lands, and especially in the Madonie mountains, where there are holm oak formations even at higher altitudes. These forests are usually mixed, with oaks, beeches, and holly trees. A notable holm oak is grounded in the Municipality of Zafferana Etna, in the Province of Catania. It is 500-600 years old and has the nickname of *Ilici di Carrinu*, the *ilex* of Carlino, the old owner of the place. It is the eldest holm oak in the Mont Etna. It is 25 meters tall, and the canopy has a diameter of 30 meters, with a trunk of 5 meters in circumference. In the past, many charcoal-burners crowded the area to make their charcoal-posts. Remains of this activity are still detectable.

After the holm oak, cork oak is the tree species that characterize the typical vegetational landscape of Mediterranean Italy. The plant is famous since the very past time for the useful qualities of its barks. Lovers of bottled wine know that very well. Civilized communities have known the cork oak since antiquity, as mentioned in Aeschylus' tragedy *The Libation Bearers* written in 5th century BC:

> "For children are as voices that prolong
> The dead man's fame; like corks they float the net,
> The flaxen line upbearing from the deep." Aeschylus, *Choephori*, 506/507[5].

[5] From Swanwick (1865, p. 101).

Cork oak is a typical Mediterranean plant with leaves resembling those of the holm oak, and the canopy is frequently not regular and broad, particularly when the plant grew isolated. The ancient scholars Theophrastus and Pliny the Elder reported about it, even confounding among species or melding the description of different trees. It is present in Sardinia and Sicily; in this latter, it lives in consortiums of pure species in warm and dry locations. The Sicilian corn oak forests cover an area of near 15 thousand hectares, being the largest ones on the Nebrodi and Moadonie mounts, in the *Ficuzza* Forest close to Palermo, in the territory of Caltagirone, Province of Catania, and in Niscemi, Province of Caltanissetta. Close to the village of Niscemi, there is one of the largest and oldest cork oak of Sicily and Italy, the *Sughera Mosaica*¸ 400-550 years old, namely as old as Moses. It is located in the inner zone of the Natural Reserve of *Sughereta di Niscemi*. This cork-tree grove is the relic of past very much larger forests, which have been degraded due to the concession of common use to residents. Today it is about 5 hundred hectares.

Near the villages of Geraci Siculo, Palermo, in *Bosco Sugheri* locality, and Nicosia, Enna, on the *Monte Coniglio*, the cork oak can live beyond the altitude of 1000 meters above the sea level, due to particular humid and foggy micro-climate mitigating the aridity. In the territory of Geraci Siculo, in the locality of Bosco Cava, there is a gigantic cork oak, of 20-meters height, trunk 5 meters in circumference at the base, and 5.10-meter girth, without out the cork bark. The place-name *Cava*, meaning quarry, is related to ground excavation by a couple of legends. The first tells of a young shepherd who dreamed voice saying to come back tomorrow one hour before the dawn to dig and find a treasure at the base of the tree. The boy waked up and soon went calling a friend to dig all the night long. Finally, they found a vault containing only charcoal. The voice again said: "You heard me, you said the secret to some other, you came back too early!". The scared two boys flew away, leaving a large hole in the ground resembling the entrance of a quarry. The second story narrates of a farmer who was tilling the soil, and heard a voice from the ground that said: "Dig, dig!". The surprised farmer continued tilling down to found a canvas painted with the image of the Annunciation of Mary. Reportedly, the picture is today in the Mother Church of Geraci Siculo, after being in the abandoned church of Santa Maria Della Cava, located in the grove.

The certainly most famous Sicilian tree is a chestnut located on the slopes of the Etna volcano. Its distinctive name is 'Hundred Horses Chestnut'. This tree is colossal, 22 meters high and 50 meters of base trunk in circumference. It is situted in the locality of Tre Castagni, in the Municipality of Sant'Alfio, within the Province of Catania. It is said that it is 3 thousand years old, yet not a singular tree, but a combination of three plants grown together. First information about the chestnut dates back to XVI century, and geologists argued the local pedoclimatic conditions favored the large dimension of the tree and its aging (Gemmellaro, Silvestri, 1989; Recupero, 1815).

Pic. 7. Jean-Pierre Houël, Hundred Horse Chestnut, gouache and black chalk, 1776-1779, Louvre Museum.

The chestnut owes its nickname to an intriguing popular legend. A Queen was traveling with her royal retinue of a hundred ladies and knights, during a hunting party. After a sudden storm, she found shelter under the canopy with all the suite. The storm didn't stop, and the Queen stayed under the chestnut all night long, with one or more knight lovers. Many are the ladies reputed to have been that libertine Queen, such as Joanna of Aragon, Isabella of England, the third wife of Frederik II, or even Joanna I of Naples. Arguably, none of them spent a night under the Chestnut, and the story is quite a traditional tale. Moreover, it inspired many poets, novelists, and painters (Schicchi, Raimondo, 2007). This tree is still rooted, well vegetating, good in health, and visited by hundreds of tourists coming from several parts of the world.

The Tourist Future of Veteran Trees

Increasing interest for monumental trees has, arguably, a mix nature. People show an increasingly deep sentiment towards nature, its components, and environmental issues. They want to know more than in the past and wish to be active in the improvement of personal awareness about the state of the entire earth. Increasing revenues and leisure time help people to cultivate their environmental interest also by travelling. More tourists searching for destinations dense of stories and not yet famous are emerging. On the other side, local authorities might implement international guidelines and national policies for the protection of the environment and singular components. Climate change is a topical concern and forests, and trees are reputed to be capable of mitigating the earth warming. Ecotourism in protected areas is increasing as well as interest and the knowledge on role of veteran trees. They are today testimonies of the natural and cultural history humans have behind the shoulders. Not only the giant sequoias of Yosemite Park in the United States but also the hundreds of big trees in Italy and Sicily in the studied case, worth a journey and an educational experience.

Surely, the ongoing increase of cultural and experiential tourism depends on the global market evolution, with large supply and demand behavioral changes. As well as the rest of society, tourists show an evident increase in schooling, a higher knowledge of foreign cultures and languages. They also pay more attention to the quality of perceptions and experiences during their leisure time and vacations. Tourists benefit from a greater diffusion of travel services, decreasing costs of spatial mobility, more accessible way to information necessary to make decisions. Not being yet the majority, *new tourists* express physically active behaviors. They are intellectually vivid, eager to move for visiting and knowing destinations, places, territories, landscapes, which are relatively less known, and potentially apt to be enhanced.

This specificity pertains to destinations capable of offering a bundle of natural and cultural resources, joining historical and cultural heritage with a tidy environment and warm hospitality. The nexus between the cultural exploitation of places and tourism should be better considered within the design of development models, not only in the Sicilian Region.

Hospitality can profit from the pre-existing linkages between economic activities, the environment, and the local culture. Any promoting policy of the tourist system is based on the coordination of different administrative levels. In other words, it is necessary to know and organize all the territorial components. They are natural and cultural, material and immaterial, such as local culture, symbols, names, brands, denominations, human resources, and stories of a local system.

Cultural tourism, if tourists are aware, is very close to the *Otium* of ancient Romans, today called serious leisure. This leisure time dedicated to the study of difficult topics and self-building of personality can help tourists achieving higher levels of psychological satisfaction. A trip throughout Sicily searching and studying environmental and cultural topics of monumental trees is a double faced activity. It has economic aspects, and it is a recreational activity, in the very sense of rebuilding the body and the soul of the traveler. Resting under the shade of a Monumental Tree, you can taste the real meaning of the Roman *Otium*.

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Stakeholder Evolution: describing humankind towards addressing global challenges

Classifying people into different categories on the basis of many different features (e.g., skulls, race, language, culture, race, genes, and most recently big-data) has been common practice in the anthropological sciences. Furthermore, human beings have also been placed into different categories through the application of boundary terms, such as the term "stakeholder". This term is now widely used in several different sectors: from business, politics, environmental programmes, to sustainability initiatives and governance of the United Nations (UN). However, its current utilization and interpretations within the framework of ongoing global crises and challenges affecting humankind have not been extensively discussed within current transformations at the societal and individual levels. The paper aims at providing an overview of the different meanings attributed to the term, starting with its initial use (in the gambling realm), its consolidated application in the corporate/business world, and current widespread use in UN activities and governance frameworks addressing global challenges. Building on this background, the paper calls on anthropologists to define a more dynamic and adaptive meaning of the term "stakeholder" which will enable to identify the immense diversity of humankind so as not to leave anybody behind when addressing global challenges.

KEY WORDS: *Stakeholders; global challenges; boundary term; United Nations; anthropology.*

Introduction

Classifying people into different categories on the basis of many different features (e.g., skulls, race, language, genes, archaeological remains, and most recently big-data) has always been a common practice in many scientific fields and definitely in anthropology. Boundary terms have also been used to group people; amongst such terms there is "stakeholder" which is, nowadays, widely used in many different realms and sectors: from business, politics, to environmental programmes and sustainability initiatives (see e.g., Clayton, 2014; Spini, 2020). It is also extensively used by the United Nations to the point that it has become a buzzword in the UN jargon, as exemplified by the repeated occurrences of the word in UN documents (e.g., the "Transforming our world: the 2030 Agenda for Sustainable Development" [hereafter referred as the 2030 Agenda; UN, 2015a] refers to the term in 22 instances; Spini, 2020). However, the present usage and interpretations of the term within the framework of current global crises and challenges (including the so-called "super

wicked problems", *sensu* Levin *et al.*, 2012[1]) affecting humankind have not been widely addressed from an anthropological perspective with the objective to identify potential future developments in the applications of the term.

The paper aims at providing an overview of the different meanings attributed to the term starting with its initial usage, its consolidated application in the corporate/business world, and current widespread use in UN activities and governance frameworks addressing global challenges, with the ultimate goal to call for anthropology to define new adaptive interpretations of the term and related applications in light of social transformations. This will be achieved by unpacking the word and its different interpretations, illustrating how stakeholders are identified also within current efforts to address global challenges, and by calling on anthropologists to delineate a more dynamic and adaptive meaning of the term "stakeholder" which will enable to identify the immense diversity of humankind so as not to leave anybody behind in global challenges.

The term "stakeholder" and its interpretations

It is reported that the word "stakeholder" is first utilized in the 1708 within the realm of gambling (see e.g., Clayton, 2014). The origin of the word in this context is reflected by the fact that the term, in American English and in some dictionaries, is also defined (as a second meaning) as "a person who holds the bets placed on a game or race and who pays the money to the winner" (OLD, 2020).

The first meaning, and sometimes the only one reported in dictionaries, is that relating to the business/corporate world, and it is in fact in this context, that the term "stakeholder" starts to be used in ways which we mainly refer to, today. In some accounts on how the term was adapted to the business/corporate world (see e.g., Clayton, 2014), it is usually reported that the concept of "stakeholder" was already present in the 1930s-1950s in the corporate world, but that was only in 1963 that the word was officially presented by the Stanford Research Institute (now SRI International[2]) by referring to "those groups without whose support the organization would cease to exist" (quoted in Freeman, 1984; and quoted in Donaldson and Preston, 1995).

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[1] They define problems as "super wicked" if comprising four key elements: "time is running out; those who cause the problem also seek to provide a solution; the central authority needed to address it is weak or non-existent; and, partly as a result, policy responses discount the future irrationally" (Levin *et al.*, 2012, p. 1).

[2] See SRI International, 2020.

This first official use of the term "stakeholder" is thought to be triggered by changes in how people perceived the impact of businesses and corporations on their lives and surrounding environment (Freeman called these "turbulent times"; Freeman, 1984), as also discussed in the landmark book *Silent Spring* (Carson, 1962) and reflected in the establishment of organized environmental movements and Non-Governmental Organizations (NGOs) such as the WWF in 1961 and Friends of the Earth in 1969 (see e.g., Kovarik, 2020). These are the times in which the world becomes more interconnected also thanks to further international trade (see e.g., WTO, 2008) and to key advances in telecommunication (e.g., founding of Intel in 1968, the beginning of the Internet in 1969, and Motorola's work delivering the first words from the Moon to Earth in 1969; ITU, 2012). Scientific discoveries crossing boundaries and local contexts (e.g., outer space explorations getting humans beings on the Moon for the first time in 1969; UNOOSA, 2020) furthered public consciousness that Planet Earth is an interconnected entity despite all the post-war geo-political divisions. This background can be also seen as the enabling environment for people to start asking more questions about what they buy and consume (see e.g., USA President John F. Kennedy's speech on 15 March 1962 on consumer rights[3]) and for the corporate world to become conscious that it should not just take into account those who have shares (or stocks) in a company (the shareholders or the stockholders[4]), but also those who have a stake – an interest – in the activities conducted by the company.

This distinction includes many different nuances of labeling individuals, groups, or organizations as stakeholders. In fact, it is important to highlight that stakeholders (whether individuals, groups or organizations) can have a dual role or impact with respect to the business/corporate world, as specified for instance in one of the earlier definitions of the term by Eric Rhenman: "we shall be using the term stakeholders to designate individuals or groups which depend on the company for the realization of their personal goals, and on whom the company is dependent" (Rhenman, 1968; quoted in Freeman, 1984, p. 41).

This dual role of the stakeholder vis-à-vis the corporation is reflected in the so-called landmark definition of the word by Freeman, namely: "any group or individual who can affect or is affected by the achievement of the organization's objectives" (Freeman 1984, p. 25). But there are many other definitions, as reported by Fontaine *et al*., (2006), and great debates on the stakeholder concept and stakeholder theory (see e.g., Donaldson & Preston, 1995). What is consistent amongst these definitions

[3] See Fleming, 2019.

[4] It is to be noted that shareholders/stockholders can also be considered as stakeholders; see e.g., Freeman, 2004 referring to "narrow definition" and "wide definition".

is that stakeholders are defined by a "focal entity" such as "the company", "the organization" and "the corporation". The business/corporate world studies and discusses the term and the concept also by addressing it in relation to its Corporate Social Responsibility (CSR[5]), up to even suggesting the integration of the two approaches as "Corporate *Stakeholder* Responsibility" (Freeman & Dmytriyev, 2017).

In the 1980s-1990s, increasing globalization and further transnational approaches to both business and global governance as well as consolidation of the CSR approaches may have provided the fertile ground for the word "stakeholder" to shift to other sectors, including politics and development cooperation (Spini, 2020). This is reflected in how some dictionaries define the term by including a more general meaning of the term, as exemplified by the three definitions in the *Merriam Webster Dictionary*: " *(1) a person entrusted with the stakes of bettors; (2) one that has a stake in an enterprise; (3) one who is involved in or affected by a course of action*" (MWD, 2020). This is very much in line with identification of "stakeholder" in the broader sense as a "boundary term" which enables to identify other individuals, groups and organizations which may affect or be affected by a certain activity (also, in line with the 1984 Freeman's definition).

In the early 1990s, this "borrowing"[6] is particularly visible in the work of the World Bank (see e.g., MacArthur, 1997), and the term is also slowly making its way in the official documents and the jargon of the United Nations (see Spini, 2020). This shift is probably linked by the opening of these international organizations to non-state actors, including the private sector, within the implementation of development cooperation projects, but also within international dialogues on issues of global concern (see below, and Spini, 2020). This borrowing was mostly done by English speaking communities which eased a broader adoption and uptake (without too much questioning about the meaning, as it has to be done when translating a concept into another language); however, it has led to misperceptions of the actual meaning and ensuing applications of the term.

This is obvious when the word is translated in other languages as within multilateral/intergovernmental contexts of the United Nations or the European Union. In fact, if we examine translations, we can see that the translations used, even in

[5] CSR is defined by the United Nations Industrial Development Organization (UNIDO) as "Corporate Social Responsibility is a management concept whereby companies integrate social and environmental concerns in their business operations and interactions with their stakeholders." (UNIDO, 2020).

[6] While the term "borrowing" is usually applied from a language to another language (see e.g., Hoffer, 2002); here, we refer from a jargon (business) to another jargon (UN and development projects).

official UN documents, do not particularly align with the above-mentioned possible dual role or impact of stakeholders as spelled out in the 1984 Freeman's definition including "affecting" and "being affected". Some English-Italian translations report "stakeholders" as "*parti in causa*" (UN, 2015b), "*parti interessate*" (EC, 2020a) or as "*portatori di interessi*" (Accademia della Crusca, 2020[7]). Translations in Spanish refers to "*partes interesadas*" (EC, 2020b), and in French, "stakeholders" become "*parties prenantes*" (EC, 2020c). As we can see from these few translations, there is no clarity on how to translate the word in a comprehensive way, to the point that the Italian *Accademia della Crusca* – the reference entity for research on the Italian Language – suggests that, in the long-term, the word in English may be retained in the Italian language (Accademia della Crusca, 2020).

While it is beyond the purpose of the paper to provide better translations for the term; we consider important to underline these difficulties in translating (and thus in interpreting) the actual meaning of "stakeholder" as it may lead to obstacles towards identifying stakeholders, and, mostly towards enabling people to gain ownership of the term and to identify themselves as stakeholders. Here, it is worrying that the UN System has not adopted an internationally agreed definition for this term which is now widely used not only in developing and implementing its projects, programmes and partnerships and but also in defining non-state representation in its official inter-governmental fora.

On the other hand, there is a wide variety of definitions (see Table 1, below); hence, building on *ad hoc* definitions delineated by reports and programmes, we can say that "stakeholder" is applied as "boundary term" which define individuals (as individuals *per se*), individuals representing organizations/entities, groups and organizations, in many different ways.

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[7] "*Stakeholder è chiunque sia portatore di interessi nei confronti di un'attività o di un progetto economico: chi cioè possa direttamente o indirettamente godere di benefici o subire danni da quell'attività*." (Accademia della Crusca, 2020); (literary-translation by the author: "Stakeholder is anybody who is holder of interests with respect to an activity or an economic project, i.e., who could directly or indirectly enjoy the benefits, or be subjected to damages ensuing from that activity").

Table 1. Examples of definitions of "stakeholder" in international organizations' documents and guidelines[8]

Organization	Examples of definitions (verbatim)	Source / Reference
Food and Agriculture Organization of the United Nations (FAO of the UN)	"A stakeholder is a person who has something to gain or lose through the outcomes of a planning process or project. Stakeholders can be organisations, groups, departments, structures, networks or individuals. Stakeholders include interests groups who are affected by the issue or those whose activities strongly affect the issue; those who possess information, resources and expertise needed for strategy formulation and implementation; and those who control the implementation of the various responses."	FAO, 2007 (p. 1)
Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)	"[...] stakeholders will act as both contributors to and end-users of the Platform and will be individual scientists and knowledge holders as well as institutions, organizations and groups working in the field of biodiversity and ecosystems services that can: (a) Contribute to the activities of the work programme through their experience, expertise, knowledge, data, information and capacity-building experience; (b) Use or benefit from the outcomes of the work programme; (c) Encourage and support the participation of scientists and knowledge holders in the work of the Platform."	IPBES, 2015 (Annex II, Para 8)
International Organization for Standardization (ISO) / ISO 2600 "Social Responsibility"	"stakeholder: an individual or group that has an interest in any decision or activity of an organization."	ISO 26000: 2010 (Clause 2.20)
Nuclear Energy Agency (NEA) Forum on Stakeholder Confidence (FSC)	"A stakeholder is defined as anyone with a role to play or an interest in the process of deciding about RW [radioactive waste] management."	NEA, 2020

[8] These are just some examples; there is no single internationally agreed definition definition applied for the UN System (see Spini, 2020).

UN/DESA (2018 World Public Sector Report)	"[...] stakeholder will be used to designate an individual or a representative of a formally constituted group or organization that has or is thought to have a collective interest and can affect (e.g., informing decisions, voicing views and interests) or is affected by a policy process or action taken by herself or others that impact policy."	UN/DESA, 2018 (p. 64)
United Nations Development Programme (UNDP)	"Stakeholders are persons, groups, or institutions with an interest in the project or the ability to influence the project outcomes, either positively or negatively. Stakeholders may be directly or indirectly affected by the project. The range of potential stakeholders is diverse and may include target beneficiary groups, locally affected communities or individuals, national and local government authorities, civil society actors, including non-governmental organizations (NGOs) (both domestic and at times international), indigenous peoples, politicians, religious leaders, the academic community, private sector entities, workers organizations, UN agencies and donors, and other special interest groups. Importantly, stakeholders may include groups opposed to proposed interventions. The "stake" that each of these different groups has in the project will vary."	UNDP, 2017 (p. 8)
World Bank	"Stakeholders are people or organizations who either (a) stand to be affected by the project or (b) could 'make or break' the project's success. They may be winners or losers, included or excluded from decision-making, users of results, participants in the process."	WB, 2009

However, such a diversity of definitions, as seen also for the business/corporate world, still encompasses the presence of the focal entity (e.g., "planning processes or project", "the Platform", "the organizations" and the "policy process"). Therefore, it is clear that the actual identification of stakeholders depends on how the focal entity proceeds in recognizing the stake(s) and stakeholders, and then in identifying their roles (taking into account that stakeholders can also hold multiple identities at the same time, and/or their roles can also change over time). It is to be noted that this process may also emphasize the divide between the focal entity and those who are not the focal entity (i.e., the stakeholders) by emphasizing a negative notion of "otherness"; hence, implying a power structure between the focal entity and those classified as stakeholders.

Identifying and engaging stakeholders

There are "standard" methods to ensure comprehensive, fair and inclusive identification of stakeholders, such as conducting a Stakeholder Analysis which is "a tool for assessing different interest groups around a policy issue or intervention, and their ability to influence the final outcome" (FAO; 2007, p. 1). It is mostly structured around three main phases: defining the issue; listing all the possible stakeholders and then mapping them in order to identify clusters of stakeholders (and related interests, influence, impact, and powers) (e.g., FAO, 2007).

Many of these processes imply first the identification of some main categories in which to classify stakeholders, namely the primary/secondary stakeholders and the internal/external stakeholders. For instance, an example of internal stakeholders could be the employees of the organization which is also focal entity. Then, stakeholders are defined as primary or as secondary according to level of impact which they could apply, or be subjected to, within a given context; hence, it is to be noted that primary stakeholders are usually considered the most vulnerable.

Through the analysis one can identify several sub-groups and clusters, for instance by defining many segments of society with respect to gender, age, professions, and many other features and characteristics (e.g., wealth, sexual orientation, and religious groups). However, the overall analysis is subjective to the focal entity's representatives conducting it. In fact, as happened in other classifications of human beings into defined categories, the lists and maps of stakeholders can also be influenced by conscious/unconscious biases and stereotypes of those who perform the Stakeholder Analyses. Thus, it is important that those performing Stakeholder Analyses become aware of possible stereotypes and biases that they translate into them, in order to ensure an objective process, and eventually also to include groups of stakeholders which they do not consider as legitimate (e.g., "terrorists", "rebels" and "armed groups"), as also underlined by Freeman, 1984.

Hence, experts including anthropologists and other multidisciplinary scientists can provide a great added value in conducting Stakeholder Analysis, by taking into account possible biases and stereotypes, by applying an intersectionality lens[9], and by building on their knowledge of human social interactions, the human/environment interface, and recent (and increasing) human/robots interactions.

An inclusive account of stakeholders is particularly important when addressing policy, processes and projects relating to issues which have a more global nature (global challenges and crises: e.g., confronting a pandemic, combatting global cli-

[9] Intersectionality is an "analytical tool for studying, understanding and responding to the ways in which sex and gender intersect with other personal characteristics/identities, and how these intersections contribute to unique experiences of discrimination" (EIGE, 2020).

mate change, and attaining sustainable development) as this requires a comprehensive analysis of humankind with its rich and immense diversity, vulnerabilities and agencies.

Surprising the UN has not fully addressed this issue at the global scale and with a systematic approach, but it has been working with some selected categories of stakeholders mostly ensuing from key events on environmental challenges and sustainable development (Spini, 2020). The key landmark event to be recalled here is the 1992 United Nations Conference on Environment and Development (UNCED, also known as the Rio Summit or Earth Summit). In fact, its outcome document, the Agenda 21, (UN, 1992) not only refers to the term "stakeholder" (even if only twice), but most important it provides an overview of the major societal groups to be engaged by the UN in its implementation. In fact, Section III of Agenda 21 "Strengthening the Role of the Major Groups" even describes those groups, nine "Major Groups", which have to be engaged in the process, namely: (i) Women; (ii) Children and Youth; (iii) Indigenous Peoples; (iv) Non-Governmental Organizations; (v) Local Authorities; (vi) Workers and Trade Unions; (vii) Business and Industry; (viii) Scientific and Technological Community; and (ix) Farmers (UN, 1992).

The categories do not show any particular cross-cutting denominator (apart from representing groups of human beings), as some are defined by demographic features ("Children and Youth"), others by economic sectors (e.g., "Farmers"), some by their origins (i.e., "Indigenous peoples") and some by governance-related issues (e.g., "Non-Governmental Organizations"). From interviews and documents, it appears that these categories/labels were almost identified at random – as those categories which were thought of at the time (Spini, 2020). Yet, at that time (1990s), since then, these categories have been taken up for representing those actors which can be considered stakeholders in different UN fora and organizations (e.g., Commission on Sustainable Development [CSD]; e.g., UN, 2020a). However, the term "stakeholder" is still not present in this context and is not yet a buzzword in the UN fora.

Later on, in the 2000s, starting with the establishment of the UN Global Compact (launched in 2000; UN Global Compact, 2020) and the 2002 World Summit on Sustainable Development (also known as the Rio+10 Summit) held in Johannesburg (South Africa), an enabling environment is created for private sector entities to interact more frequently and in a more structured way with the UN[10], and for business and UN jargons to cross-fertilize. In fact, it is in the 2010s, with the post-2015 negotiations and, in particular with the negotiations of the 2030 Agenda that the term "stakeholder" becomes fully institutionalized in UN intergovernmental pro-

[10] This was reflected in the fact that the partnerships involving different types of actors were recognized as "Type 2" outcome for the Summit (type 2 vis-à-vis the first type of outcome which is of an intergovernmental nature; ENB, 2002).

cesses like the High-Level Political Forum on Sustainable Development (HLPF) (see e.g., Spini 2020). The above-mentioned nine "Major Groups" become "Major Groups and Other Stakeholders" for the HLPF, thanks to the UN Resolution 67/290 which specify along with the Major Groups, the wording "other stakeholders" in its paragraph 16 (UN, 2013). Thus, the list of categories of stakeholders starts to expand on the basis of references to other constituencies in UN documents (for instance, amongst the new Stakeholder Groups, there is the Stakeholder Group on Ageing) or thanks to self-organized groups such as the LGBTI Stakeholder Group (for more details on other groups, see e.g., Spini, 2020).

There is no limit to the number of groups and there are many other types of categories of people in UN documents (Spini, 2020); while there is no mechanism to monitor and ensure that the UN process interacts with all the Stakeholders relevant to the attainment of sustainable development: there are only some Rules and Regulations which needs to be followed to participate in the debate at the UN. The fact that there are no procedures in place to identify who has been left behind in the identification of stakeholders is also reflected in many documents – such as the above-mentioned 2030 Agenda – which have been using wording such as "and other stakeholders" "and relevant stakeholder" and "other relevant stakeholder" to preempt listing all those who should be recognized as stakeholders (Spini, 2020).

The widespread use of the word "stakeholder" in the UN processes has also changed the way in which the intergovernmental processes interact with these people or groups, with an increased space for stakeholders to engage in global governance. One can say that there is a transition from the original *modus operandi* of the private sector in "managing" stakeholders, to stakeholder engagement in the UN. This has been particularly visible in the United Nations work on sustainable development and its High-Level Political Forum on Sustainable Development (HLPF) being open to engagement with stakeholders, while retaining an intergovernmental nature (see e.g., Spini, 2020). But there has also been a proliferation of many multi-stakeholder events in the UN (e.g., Multi-stakeholder Forum on Science Technology and Innovation for the Sustainable Development Goals; UN 2020b) and many multi-stakeholder partnerships such as the Great Apes Survival Partnership (GRASP, 2020) (for a comprehensive list of partnerships, see UN, 2020c; and see also Andonova, 2017, and Stibbe & Prescott, 2020).

While all these and many other frameworks have been fostering further engagement of stakeholders in global endeavors; they have not proved particularly effective in ensuring that all those who have a stake (or more than a stake) are represented, and if so, represented fairly, equally and in an inclusive way. There has not been a system to ensure ownership and understanding of the word by all the people who should be engaged. This has been seen in the stakeholder engagement process of the Intergovernmental Science-Policy Platform for Biodiversity and Ecosystem

Services (IPBES) where some communities would not identify themselves with the term "stakeholder" (Esguerra *et al.*, 2017). The *status quo* must evolve, and the term "stakeholder" needs to adapt to current challenges and crises.

Adapting the term "stakeholder": a call to anthropology

One may assume that intergovernmental fora with a stakeholder engagement component and global multi-stakeholder dialogues ensure representativeness of the immense and rich diversity of humankind within the overall category of stakeholders, but this is rarely the case. This could also be induced by the fact that it is unclear how to recognize the focal entity which should facilitate the identification of stakeholders: in fact, while the intergovernmental body should be the one to facilitate the identification, current mechanisms enabling self-organizations of the groups, induce a situation in which there is no overall structure to conduct a global stakeholder analysis (Spini, 2020).

Yet, an inclusive representation of humankind is necessary to validate that we all have a stake in the global challenges, as we have become interconnected and interdependent. In fact, while retaining some tribal structures and local and national realities, humankind is now living in the so-called "global village" where people have become "global citizens". These major societal transformations should be considered in defining and applying the term "stakeholder" within the context of addressing global challenges (e.g., climate change, pandemics, and poverty) and global solutions. In fact, while the concept "stakeholder" appear to be mostly effective within limited and circumscribed initiatives and projects by the United Nations, NGOs and other similar organizations (e.g., building a well in a village), the application of such a term with respect to global challenges and "super wicked problems" has not proven effective to ensure a comprehensive representation of humankind.

First in many global governance frameworks there are lists of categories of stakeholders – as we have seen for the above-mentioned High-Level Political Forum on Sustainable Development (HLPF) – but there is not a common interpretation on how the categories are identified and a common meaning and understanding of the word "stakeholder". Furthermore, many groups are definitely left voiceless, left behind, and unrecognized by the governance framework. In addition, the categories used in these terms reflect an old way of understanding and classifying the global society; of course, the demographic and sectors-based categories are still valid (as the one mentioned for the Major Groups), but there is a need to identify groups who have to be given a voice. For instance, within the HLPF there is no dedicated Stakeholder Group representing the "people living in poverty and extreme poverty", despite the priority attributed to the eradication of poverty in the 2030 Agenda

(Spini, 2020). Furthermore, the different stakeholder groups should also be shaped taking into account intersectionality; at the moment there is no mechanism to ensure that concerns from intersectionality-related groups (e.g., young indigenous women with disabilities) are engaged in a systematic way (with the exception of *ad hoc* initiatives organized by the stakeholders themselves, such as the events and statements of the Women's Major Group) (Spini, 2020).

In other words, humankind is described and represented through very traditional labels not representing the segments of the global society. For instance, there is no mention to generational differences (there are groups for Children and Youth, and on Ageing, only; there is no category for middle-aged people, for instance), despite the fact that sustainable development has an intergenerational dimension. Generation-type classifications (e.g., Generation X, Millennials/Generation Y, and Zoomers/Generation Z) which are widely known and owned by the general public and also used by some governmental agencies as reference (even if there are not perfectly describing the global society) (e.g., Lyons, 2020) could be an interesting crosscutting view to look at how humankind is changing and reacting with respect to global challenges and crises[11].

In light of major social transformations at both global and individual levels, categories should become more adaptable, flexible and dynamic to ensure that humankind is represented fully in global policy processes related to global challenges. Building on its multidisciplinary expertise (inclusive of social and natural sciences), current practices in Stakeholder Analysis in anthropological sciences (e.g., ASA, 2020), as well as know-how in classifying human beings (and non-human primates), anthropology should be called to further adapt the term "stakeholder" within venues and contexts addressing global challenges, and in particular to:

> (i) make proposals of different types of groupings for human beings as stakeholders within global policy processes (also taking into account cultural and sub-cultural contexts, inter-generational differences, and ongoing social transformations affecting individuals and his/her social interactions), also building on lessons-learnt from Major Groups and Stakeholder Groups;
> (ii) foster the application of the intersectionality lens to the defined groups, also towards delineating interactions and power-structures amongst stakeholder groups; and
> (iii) draw attention to transformation in stakeholders' interactions with the non-human world, namely with the bio-physical environment and with

[11] Of course, it does not fully reflect the diversity at the individual level, but it can facilitate some further ownership of the term "stakeholder" by different groups of people.

non-biotic entities (incl. artificial intelligence and social/humanoid robots), and related impacts to stakes and stakeholders.

This process may also allow to create further awareness of the term "stakeholder" amongst people – a necessary action to ensure an inclusive use of the term. The COVID-19 pandemic – a "super wicked problem" – has shown that all members of the human family can affect, and (and not "or" as in the 1984 Freeman's definition) are affected by, the spread of the virus and pandemic-related policies. In fact, this "super wicked problem" has unveiled the fact that we are all stakeholders within global challenges. However, it has also confirmed that each individual recognizes different stakes (e.g., health and wellbeing, job security, and family) and that does not always recognize the overarching stake (i.e., the survival of humankind on Planet Earth) in global challenges. Reconciling the individuals' stakes within the overarching stake should be supported by the anthropological sciences.

Anthropologists should be the science/policy brokers by facilitating policy-makers and decision-makers in identifying stakes and stakeholders within a fast-changing world. This could also provide a less anthropocentric perspective of the term stakeholders, by eventually identifying non-human beings (e.g., animals, as also highlighted by Smart, 2019) and non-human entities (e.g., social/humanoid robots) as stakeholders – a viewpoint which could give a further shake on understanding human beings' place in nature, as well as defining a more dynamic and adaptive meaning of the term "stakeholder" which will enable to identify the immense diversity of humankind so as not to leave anybody behind, when addressing global challenges in an interconnected and interdependent world.

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Concrete terms and generic names in the history of languages. Some parallels in ontogeny and history

Especially in the period between 1880 and 1940 it was common in linguistics to describe parallels between the languages of children and those of archaic peoples. This effort was by no means unsuccessful. Nevertheless, the great monograph, which presents these parallels systematically and from the basics, has probably not been written by anyone. Of the many parallels, the following work only examines the phenomenon of the absence of generic names in archaic languages. Research attributed this absence to the lack of abstract and logical thinking in archaic cultures. Basically, developmental psychology shows that even children do not initially have an understanding of generic names and abstract concepts and therefore systematically misinterpret them when confronted with them. It is therefore obvious that the absence or lack of generic terms and abstract terms in primitive languages is due to the peculiarities of children's thinking. Consequently, the phenomenon is rooted in the peculiarities of archaic thought, which is largely identical to the thought of children.

KEY WORDS: *Generic terms, abstract concepts, individual terms, history of language, foundations of linguistics, developmental psychology.*

Introduction

It has been repeatedly observed that abstract terms and generic names are missing or rare in so-called archaic languages. Luria and Vygotski (1992), among others, have believed that they were able to prove that archaic languages only contain words which have a reference to perceptible objects and activities and that they therefore do not know abstract terms. More, authors such as E. Cassirer (1925: 27), G. Romanes (2017) and F. Schultze (1900: 65-100) held similar views. All of these authors attributed this peculiarity of archaic languages to a lack of ability of archaic peoples to reach the level of abstract thinking.

The child of modern society finds himself in a different situation. He speaks the language of modern adults, which includes generic names and abstract terms. Developmental psychology has shown, however, that the pre-school child initially has no understanding of the logic and structure of generic names and abstract terms. Initially, he only understands words that refer to concrete objects and activities. Only when thinking has reached a certain level of logic, abstraction and ability to classify is the child able to understand generic names and abstracts and distinguish them from individual names.

From this it can be concluded that the complete or at least extensive absence of generic names in archaic languages is due to peculiarities of thinking which are predominant in the psychology of the pre-school child. This observation is by no means isolated. The language of children between the ages of two and four and that of archaic peoples show further parallels. They only know main clauses and no subordinate clauses. They know mostly only presence and no other times. They know neither passive nor plural. They tend to use onomatopoeia and duplicate syllables. Obviously the psychology of the child explains the peculiarities of archaic languages and thus also the historical development of language in the last few millennia and centuries. Obviously developmental psychology (Piatelli-Palmarini 1980) plays a greater role in the foundation of linguistics than logic (Chomsky) and than evolutionary psychology do (Knight, Huddert-Kennedy & Hurford 2000).

1. Concrete terms and generic names in child development

The child in modern society learns a developed language in which abstract concepts and complicated grammatical structures are anchored. However, when the child learns abstract terms and generic names, it does not initially understand their particular nature. Rather, it does not distinguish them from names for individual phenomena. Children first learn word series such as chair, table, cupboard, sofa and shelf without any effort. However, it does not understand the term *furniture* and cannot use it as a general term to which the words mentioned above could be subordinated. Without effort the child learns shirt, cap, boots and trousers. However, the term *clothing* initially causes him difficulties and he does not understand that *clothing* is the general term to which the aforementioned items of clothing must be subordinated.

According to Vygotski (1981: 264-269), the child initially understands only concrete terms, i.e. names and words that denote concrete objects or activities. Words such as furniture or clothing, however, do not designate concrete objects, but encompass a wide variety of objects. Although these different objects do have things in common, they do not reveal themselves to the child's perception in a direct way. One must grasp these commonalities in thought and thus abstract them. Vygotski distinguishes between the concrete-visual thinking of the small child and the verbal thinking of the older child. Only verbal thinking enables the understanding of general terms and generic names. Series of words such as chair, table, cupboard and sofa are words in a horizontal plane that only refer to sensually given objects. Words such as clothing and furniture move vertically and express a relationship of generality to specificity. "The investigation shows that this movement in the vertical plane, these

relations of generality between terms, are inaccessible to the child at all at a certain stage in the development of meaning of the child's words. All terms represent only terms of a series which are coordinated, without hierarchical relations, directly related to an object and completely separated from each other according to the model of the things represented in them." (Vygotski 1981: 265, transl. by G. O.)

Now, one could think that the child therefore initially only uses names for individual species or for individual objects and that it does not use generic names. However, as the child absorbs the language of the adults, he does not easily have the option of using only words that better suit his thinking. Thus, he learns general terms and generic names such as flower, clothing or furniture at an early age, but he uses them differently and understands them differently from adults. He uses the word *rose* for many flowers in the same way as he may use the word *flower*, but he does not use the word *rose* or *flower* as a generic name. Both words are used concretely and not abstractly. Only the older child understands that the word *flower* is the general term to which the word *rose* is hierarchically subordinated (Vygotski 1981: 264; Piaget & Inhelder 1973; Kutzner 1991; Stern 1987: 195, 236, 326).

The prerequisite for these developments is the recognition that every single thing has a name. This realization, the meaning of which has been compared to learning to walk, is a first step in the conquest of word meanings. The child now uses proper names for individual phenomena (Mama for mother or Ralf for uncle) and other words for a multitude of objects (Pipip for all things that fly). However, at first neither *mother* is an individual term nor *pipip* a generic term. For this, the child would have to understand that each word has a certain definable field of meaning. "The child would have to be able to compare the different applications of the word with each other, either to determine their identity (individual terms) or to emphasize the common ground by abstracting from the differences (generic terms). In order to compare, however, it would have to remember the earlier cases of use. The child is not yet capable of all this. In the case of a present utterance of speech, earlier experiences do not participate as memories and objects of comparison, but only under the threshold as founders of more or less firm associations and as originators of a feeling of familiarity connected with word and perception; and purely associatively, the child reacts to a present experience with a word, because once before this or that characteristic contained in the experience had appeared connected with the same word." (Stern 1930: 121, transl. by G. O.)

Just as at first all men can be called *daddy* or *uncle*, so at first all four-legged animals can be called *dogs* and all sweet-tasting food can be called *candy*. The son of de Villiers took the word *nunu* for dogs and other small animals, *moo* for cows, horses and other large animals, *you* for ducks and other birds, and *turtle* for a rearing duck. However, children tend not only to over-generalize, but also to over-discriminate.

Food can be used for bread, vegetables and meat, but not for cookies and ice cream. A *tomato* is not seen as a plant, but as food. Word fields and word meanings are therefore not yet fixed (Grimm 1998: 720).

Against this background, it is clear that an opposition of individual and generic terms cannot exist in earliest stages. First of all the individual terms are formed. *Kwa-kwa* is perhaps first the term for a duck, then for everything that swims and finally for everything that is connected with water. At first it changes its field of meaning continuously by pure association. But then, at an advanced stage of thinking, the term is narrowed down to ducks. *Uncle* encompasses then no longer all men, but Uncle Otto only. *Doll* is no longer every toy, but the specific doll that the child can find among the other toys. "In place of the word "Papa", which Hilde had first used without a discrimination between her father and other men, at 1;7 a division was made in such a way that *Papa* was reserved only for the father, whereas all other men in pictures and in reality were called *Onke* (uncle)." (Stern 1930: 338, transl. by G. O.)

The development of generic terms is much more difficult. The application of *Pipip* to all flying objects is at first purely associative and not at all conceptual and definite. It is a long way until the awareness has matured that flying objects are general terms to which flies and birds as species are subordinated. First of all, it is not yet possible to speak of the existence of generic terms at all, because for this to be the case, the hierarchical relationship of species terms to generic terms would have to be understood. Nevertheless, *Pipip* is in a sense a general term and not an individual term. The child now knows that *horse* does not only mean this one horse, but concerns a variety of animals that look like other horses that have been seen before. "It now already places each new specimen, recognizing the similarity, next to the many others it has previously seen, but it does not yet place all specimens under the general term." (Stern 1930: 337, transl. by G. O.)

A prerequisite for the emergence of general terms is the emergence of the plural. The plural arises when sequences are understood and the similarity of specimens of a species or genus. First of all, the child who encounters several snails in the garden does not think that these snails occur in plural. It does not yet have a sense for the difference between singular and plural. He does not know and does not ask himself the question whether there are several snails there or whether he encounters the same snail again and again, which is only always placed in different places. It cannot answer the question because it does not ask it at all (Piaget & Inhelder 1969, 1973). "Pointing at a door, Günther asks: 'that?'; we said 'door'; and as if to convince himself that the same naming would occur again and again, he ran to the second and third doors of the room, repeating his question. He did the same with the seven chairs in the room. Here, then, the child is trying to form a plural term even before the cor-

responding word is included in his vocabulary." (Stern 1930: 338, transl. by G. O.)

In order to develop an understanding of general, generic and abstract terms, several prerequisites must therefore be met. A certain level of thinking must be established. Thinking must overcome its pictorial character in favour of abstract concepts. It must be capable of abstracting general features from various concrete individual phenomena. And it must have developed an understanding of logical relationships in order to be able to differentiate between generic and subordinate concepts and to be able to make hierarchical assignments.

However, the child cannot initially classify according to logical criteria. He does not classify objects according to classes, but according to practical contexts. He does neither classify plants and animals according to living beings nor divide his toys according to whether they are made of plastic or metal. Only at the end of the first decade of life does the child understand that horses belong to mammals and mammals to vertebrates. Hence, that there are more mammalian species than horses and more vertebrate species than mammalian species (Piaget & Inhelder 1973).

Piaget and his co-workers interviewed a Swiss boy aged eight years: „Who are the Swiss? – *They´re the people who live in Switzerland*. – Is Fribourg in Switzerland? – *Yes, but I´m neither a Fribourgeois nor a Swiss*… - What about the people who live in Geneva? – *They are Genevois*. – And the Swiss? – *I don´t know... I live in Fribourg, it´s in Switzerland, but I´m not Swiss. Nor are the Genevois*… - Do you know any Swiss? – *Very few*. – Are there any Swiss at all? – *Yes*. – Where do they live? – *I don´t know*." (Piaget 1959: 163)

In the first stage, the children believe that cities, cantons and Switzerland are like three neighbouring cities. They do not understand, however, that these are hierarchical structures, i.e. first and second order nesting. They do not understand that the city is part of the canton and the canton is part of the country. In the second stage, the children understand that the city and canton are within the country. But they still do not understand that they are part of the country. They lie within the country but are not part of it. It is only in the third stage that they understand that, as a Genevan, one is always Swiss and that not every Swiss citizen is a Genevan. This stage is only reached at the end of the first decade of life.

Against this background, it becomes clear that generic and general terms are understood only very late. It also becomes clear why children at first find it difficult to grasp abstract concepts such as nation, honour or bravery, and are not even able to define them (Vygotski 1981).

2. Some psychological preconditions for the lack of generic terms in archaic languages

Adults of illiterate, pre-industrial cultures also have problems in fixing fields of meaning and word boundaries and in understanding generic words. No statement is made here about the proportion of archaic languages among the languages spoken in illiterate pre-industrial cultures and the proportion of people in the respective cultures who have no understanding of generic names. The evolution of generic names and abstract terms is a very gradual transformation within the history of language, which has been uneven and gradual. The fact, however, that even illiterate Kashgarians in Uzbekistan in 1931/1932 - i.e. descendants of a high-ranking medieval Islamic civilization - had no understanding of generic names and definitional word field boundaries, despite their inclusion in the Soviet modernization, can be seen as a first indication that the above-mentioned phenomena of a child's understanding of language can be found in the history of language with a not inconsiderable expansion and far into recent history.

A. Luria (1982) carried out an empirical survey among Kashgarians of Uzbekistan in 1931/1932 in order to gain insight into the thought structures and ways of thinking of pre-industrial cultures. His results consistently show that illiterate adults do not differ from the competence structures of pre-school children in the areas of problem solving, word comprehension, classification, definition, reflexivity and logic. Their elementary thought processes and thought structures remain at the level of the child´s mind. Although Luria knew that his test procedures came from developmental psychology, he had not realised that his test results actually prove of these parallels between children and archaic adults (Oesterdiekhoff forthcoming; 2016 a, b; 2011: 63-75).

Luria's survey shows that illiterate adults do not correctly understand and use word boundaries or generic names. The interview partners were shown drawings of saws, axes and hammers and were asked to answer questions about word meanings and generic names.

> "Subject: Mirza Shiral., age fifty-seven, peasant from village of Yardan, barely literate. Groups together a hammer, saw, log, and hatchet and calls them ´asbob´ (tool).
> Question: what other things do you call tools?
> *Answer: an ax, a hatchet, a saw, two men with a saw – they´re all tools.*
> Question: Can you really call people tools?
> *Answer. No, but all life comes down to one thing: people join together to work.*
> Question: Can you call a log a tool?

Answer: Yes. All these things belong here. If you use the ax to chop the log, it will split.
Commentary: Applies the terms to objects that function together to perform a job.
Question: But if I split the log with my hands, could I call my hands a tool?
Answer: Yes, of course! They´we got power and it´s with this power that we split wood.
Question: What else can you call a tool?
Answer: A tractor, bulls with an ax, grain – we can nourish ourselves with it. Everything that goes into our stomach is a tool. First a man uses his strength to plant a seed, then it grows, and then we eat the grain that ripens…
Khaid, age forty-eight, illiterate Kirghiz from Mashalyana. Groups together a hammer, saw, log, hatchet and terms them ´asbob´.
Question: what other things can you call tools?
Answer: an ax, a saw, a knife, a razor, an awl.
Question: Can you call the string you thread an awl with a tool?
Answer: Yes, because it´s used for things.
Commentary: Includes in concept a broad range of accessory items.
Question: Is a donkey a tool?
Answer: Yes, because you need him for travelling.
Question: And firewood?
Answer: Of course! Firewood´s the most important tool. This [picks up a clump of manure] is also a tool, because I can light a fire with it.
Question: Name some other tools.
Answer: Cocoons, they´re also necessary, land – that´s the most important tool. Grass, rope, a skullcap – to protect you from the heat, a head, a person – we´re all things that live." (Luria 1982: 94-95)
The interview transcripts show that the persons do not have a detailed understanding of word boundaries and fields of meaning, but rather that they associate in the way younger children do. Furthermore, they do not understand generic terms and cannot relate general terms to individual terms. Therefore, they do not classify objects into general categories, but arrange them into groups characterized by the depiction of a situation or by practical contexts of use. „The responses indicate that in attempting to define the abstract, categorical meaning of a given term, subjects began by enumerating items that did in fact pertain to the designated category. Nonetheless, they soon exceeded its limits, including objects that are simply encountered together or that can be considered useful." (Luria 1982: 97-98)
This corresponds to the fact that these persons cannot assign objects to gen-

eral classes and therefore make no distinction between individual terms and generic terms. When asked to form classes, they assign objects to practical situations and uses in a similar way to pre-school children. However, they do not form classes according to logical criteria and therefore do not have the ability to classify hierarchically.

"Rakmat., age thirty-nine, illiterate peasant from an outlying district; has seldom been in Fergana, never in any other city…

We pick up with the original group: hammer – saw – log – hatchet.

Question: which of these things could you call by one word?

Answer: How´s that? If you call all three of them a ´hammer´, that won´t be right either.

Commentary: Rejects use of general term.

Question: But one fellow picked three things – the hammer, saw, and hatchet – and said they were alike.

Answer: a saw, a hammer, and a hatchet all have to work together. But the log has to be here too!

Commentary: Reverts to situational thinking.

Question: Why do you think he picked these three things and not the log?

Answer: Probably he´s got a lot of firewood, but if we´ll be left without firewood, we won´t be able to do anything.

Commentary: Explains selection in strictly practical terms.

Question: True, but a hammer, a saw, and a hatchet are all tools.

Answer: Yes, but even if we have tools, we still need wood – otherwise, we can´t build anything…

Mirzab., age thirty-three, uneducated; works in a village; has been in Fergana once, never in any other city. Is shown drawings of glass – saucepan – spectacles – bottle.

Answer: I don´t know which of the things doesn´t fit here. Maybe it´s the bottle? You can drink tea out of the glass – that´s useful. The spectacles are also useful. But there´s vodka in the bottle – that´s bad.

Commentary: Uses principle of utility to classify objects.

Question: Could you say that the spectacles don´t belong in this group?

Answer: No, spectacles are also a useful thing.

Commentary: Subject is given a complete explanation of how three of the objects refer to the category of cooking vessels.

Question: So wouldn´t it be right to say the spectacles don´t fit in this group?
Answer: No, I think the bottle doesn´t belong here. It´s harmful!
Question: But you can use one word – vessels – for these three, right?
Answer: I think there´s vodka in the bottle, that´s why I didn´t take it… Still, if you want me to… But, you know, the fourth thing [spectacles] is also useful.
Commentary: Disregards generic terms.
Answer: If you´re cooking something you have to see what you´re doing, and if a person´s eyes are bothering him, he´s got to wear a pair of glasses.
Question: But you can´t call spectacles a vessel, can you?
Answer: If you´re cooking something on the fire, you´ve got to use the eye-glasses or you just won´t be able to cook." (Luria 1982: 57-58)

The interviewees lack an understanding of the relationship between individual terms and generic terms and an understanding of the relationship between species and genera. Thinking has not yet reached the abstract level at which classification according to logical criteria would be possible (Oesterdiekhoff forthcoming). Luria explains the test behaviour of his test subjects as follows: „Every attempt to suggest the possibility of categorical grouping met with protest: ´that´s wrong. Some stupid fellow told you that, he doesn´t understand anything.´ Even when we pointed out that ´similar´ objects belonged in one category, these subjects were unconvinced; they interpreted the instruction to ´group similar things´ to mean select ´necessary´ or ´suitable´ objects. References to general terms (asbob – tools; idish – vessels) did not overcome their tendency to group objects in concretely effective ways. They either disregarded generic terms or considered them irrelevant, in no way essential to the business of classification." (Luria 1982: 77)

3. Concrete terms and generic terms in archaic languages

The absence of generic names and general terms in many so-called primitive languages has been noted by a large number of ethnologists and linguists. "The more the state of mind of a social group approaches the pre-logical form, the more the conceptual images dominate. Language then testifies to this by the almost complete absence of generic names which would correspond to the actually general ideas, and by the extraordinary abundance of specific terms, i.e. those which denote beings or objects of which a particular and precise picture is given when they are called." (Lévy-Bruhl 1921: 144, transl. by G. O.)

Native Australian and Tasmanian languages are said not to have generic names such as bird, tree and fish, but only proper names that refer to specific species or subspecies of birds, trees and fish. B. Malinowski noted that the Trobrians he studied have no names for agriculture, harvest or garden, although nothing is as important to them as their plantations. They have no words for work, effort or skill, although they are aware of the importance of these characteristics (Malinowski 1935, vol. 2: 66). It is even said of Californian Indian languages that they have no names for species: Each oak, each pine and each herb has a specific name. The languages of the Indians of South America allegedly have no words for abstract things like plant, animal, colour or clay. The Klamath Indians do not have generic names for fox, squirrel, butterfly, frog, etc., but for each subspecies of fox, etc. Accordingly, the number of nouns in such languages is immense (Lévy-Bruhl 1921: 142-148; Romanes 2017; Cassirer 1925). "The hunter tribes of America have names for the individual animals such as beaver, bear, wolf, but none for 'animal'; the same applies to the Australians; terms and words such as fish, bird, tree, etc. are foreign to them." (Schultze 1900: 80, transl. by G. O.)

However, a distinction must be made between the absence of general names and abstract concepts. If some languages do not even have generic names, such as oak or pine, then this is remarkable. In any case, general names and generic names are much more likely to develop in the history of development than abstract terms. For the generic name like "oak" or "raven" corresponds to a concrete image. Abstract concepts like "honour" or "faith", however, do not correspond to concrete pictures. They are distant from concrete actions and must have formed later therefore. In many primitive languages the abstract words such as death, life, time, world, mind, will, honor, hope, faith, gratitude, etc. are missing (Schultze 1900: 75; Lévy-Bruhl 1921: 142-148; Everett 2005: 622).

Tasmanians are said not to have words that express abstract properties such as hard, sweet, warm, cold, long, short and round. Hence, instead of "hard" they would say "like a stone", for "high" they use "big legs" and "round" they express with "like the moon", etc. (Werner 1959: 203; Lévy-Bruhl 1921: 145).

In many primitive languages one will not find any names for the basic colours, but only visual-graphical names. The focus on the primary colours already requires a capacity for abstraction and therefore the primary colours are missing at first even in pre-school children. Preschool children and archaic adults do not concentrate on the primary colours but on the saturation level of the colour. They name the colours of objects by saying "like blood", "like a crow", or "fox colours" (Luria 1982; Oesterdiekhoff 2011, forthcoming; Lévy-Bruhl 1921).

"By thus expressing everything through conceptual images, that is, through a kind of drawing in which the slightest characteristics are recorded - and this is true not only for the natural species of living beings, but for all arbitrary objects, for all

movements, for all actions, for all states, for all the characteristics that language expresses - it follows that the vocabulary of these primitive languages must be of a richness of which ours merely give us a very weak suggestion." (Lévy-Bruhl 1921: 146, transl. by G. O.)

In archaic cultures, language resembles drawings of concrete objects and situations. "The savage perceives all the individual and special features of everything so precisely that he perceives almost everything as an individual and specific thing, as something different from every other thing, and even from that which belongs to the same species and is closely related to it. He sees more the individual differences of things than the similarity of them. Thus, for him each thing is isolated from every other thing, and every tree is a different structure to him, just because it has branches of a different shape, etc. He overlooks the fact that in the things that we count as belonging to one species, the main parts are identical, quite accepted by the sensual impression of individual differences. Thus he does not arrive at the formation of abstract concepts which only hold on to what is equivalent and drop the specifics." (Schultze 1900: 78, transl. by G. O.)

The lack of abstractions corresponds to the wealth of vocabulary. Conceptual images are communicated by a kind of drawing, either through real gestures or through oral language. The more developed a culture is, the more abstract and conceptual thinking is now developed. If the generic names and abstract concepts take up space, then people express themselves with more economical means. This corresponds to a loss of the graphic accuracy of the description. "The progress of abstract and conceptual thought is accompanied by a reduction in the descriptive material of words and signs, which formerly served to express thought when it was more concrete... This progressive impoverishment, which is the rule, shows that the particular expressions and the precision of language, which takes into account all details, do not come from a former, deliberate effort and conscious attention, but simply from a necessity imposed by the mode of expression." (Lévy-Bruhl 1921: 149, transl. by G. O.)

According to Luria and Vygotski, words have developed in the history of language in three main stages. At the lowest level they are simply proper names for concrete phenomena. At the second level, words that can denote groups or families also appear. Now individual objects can be assigned to general groups. However, these general groups do not contain any abstractions, but express a generality that is already identifiable in sensory perception. This includes, for example, names of species such as fox, oak, horse, etc. Only on the third level do abstract terms appear. According to Luria and Vygotski, primitive languages do not yet operate at this third stage of language development.

„As we have seen, the language of primitive man contains large numbers of proper names and tends to specify to the maximum extent each individual property and object. In this case the actual way words are used also determines the mode of

thinking. This is why, in primitive man, the operation of memory takes precedence over thinking. The second stage in the development of the use of words occurs when they function as an associative symbol not of an individual object, but of a set or group of objects. Here the word becomes a sort of family or group name. Besides its associative function, it also performs a mental operation by helping classify different individual objects, placing them together in a set. The resulting new combination, however, still remains a group of separate concrete objects, each of it, on joining it, retains all its individuality and uniqueness. In this phase, words are a means for the formation of sets. Our family names are a typical example of this function. When I talk about a family name, say, Petrov, I use that word to designate a certain group of actual people, not because they share some common feature, but because they belong to a certain common group. A set differs from a concept by virtue of the relationship between the individual object and the group name. By looking at an object I can say with full objectivity whether it is a tree or a dog, because ´tree´ and ´dog´ serve as the designations of concepts – in other words, generic groups to which, by virtue of substantive features various individual objects belong. I cannot, by looking at a man, tell whether or not he is a Petrov, because in order to do so it is simply necessary to know, as a matter of fact, whether he goes by such a name. The individual thus remains, as such, in the set, but the set comprises different elements, united not by some inherent, substantial connection, but by an actual, concrete affinity which exists as a matter of fact. To a large extent primitive man is at this stage of set-based thinking. His words are proper names or family names, that is, signs for separate objects or signs for sets. Primitive man thinks not in concepts but in sets. This is the most substantial difference between his thinking and ours… All the peculiarities of primitive thinking may ultimately be reduced to one basic fact: primitive man thinks in sets, not concepts. As Werner has put it, ´any primitive concept is at the same time a visual picture´." (Luria & Vygotski 1992: 69-70)

4. Further similarities between children's language and archaic languages

The absence of generic and abstract terms in primitive languages is anchored in the concrete ways of thinking of the people of archaic cultures. In research on developmental psychology based on Jean Piaget, this way of thinking is classified as pre-operational. Pre-operationality is the stage of thinking of the pre-school child and partly also of the primary school child. In more than 1.000 empirical studies, cross-cultural psychology has established that pre-modern cultures remain at the stage of preoperational and concrete-operational thinking and do not reach the stage of adolescence, i.e. not the stage of formal operations that is established in modern

cultures during the second decade of life (Oesterdiekhoff 2011, 2013 a, 2016 a, b, c; Tulviste 1977; Werner 1959; Hallpike 1979; Dux & Rüsen 2014; Ibarra 2007).

Against this background, the parallels to the child's use of language become clear, the peculiarities of which were described in chapter one. The modern child, absorbing the adult language, learns generic names and abstract terms, but does not understand them and therefore uses them like individual terms and names. The archaic person, on the other hand, initially only has the language that corresponds to his or her mental development. It is only through contact with higher developed languages, for example as a result of colonialism and contact with Western civilisation in recent centuries, that he comes into the situation that the modern child knows when he internalises the adult language. The situation of the Germanic peoples when they came into contact with the Latin language may have been comparable. It is known that both the European languages, such as Germanic (in the last 2.000 years), and the languages of the primitive peoples of the South (in the last 100-150 years) have changed as a result of the clash between archaic and European languages. The simple languages have gradually assimilated the elements of the full grammar languages. The old Indonesian, for example, is divided into an archaic and a progressive variant. The latter was created by colonialism and is now used for correspondence and business, while the archaic language is still spoken by the majority of the people in their daily life (Oesterdiekhoff 2018 a, b; Osterloh 1974: 332-355).

The similarities between the language of children and that of archaic cultures naturally go far beyond the lack of generic names and abstract terms. It is only a small element of commonality in the abundance of proven parallels. The observation that primitive languages have commonalities with the language of children was widespread in research in the period 1880 - 1940 (Romanes 2017; Cassirer 1925). Whether these parallels have been described in a monograph in a coherent and systematic manner by now, however, may be doubted. Schultze (1900) and Romanes (2017) took important steps in this direction, but their efforts only cover a few areas and not the whole range of phenomena. In 2018 I published two essays in which I described the commonalities in greater depth and breadth. However, even these more recent articles do not cover the full range of commonalities.

Obviously there are far-reaching similarities between the languages of archaic peoples and the language of children between the ages of 2 to 4. That the parallels

are located at this very elementary level is certainly surprising. On the other hand, parallels at this very elementary level can also be found in other areas of thought and worldview. The modes of counting children between the ages of 2 and 4 apply are almost identical with those of primitive peoples. The pre-school child's strong belief in ghosts and monsters, witches and wizards is closer to the thinking of archaic peoples than the, in contrast, already half-enlightened thinking of the primary school child. Preschool children believe in metamorphoses (transformation of specimens of one species into another) just as archaic peoples do. Primary school children, however, have already lost this belief. In short, pre-operationality, the stage of thinking of the preschool child, covers the largest part of the thinking of primitive peoples (Hallpike 1979; Dux & Rüsen 2014; Ibarra 2007; Oesterdiekhoff 2011, 2013, 2016 a, b, c; Werner 1959).

If six-year-old children usually already have a good command of a wide range of grammar such as tenses including conditional, future tense, passive, plural, regulated word order and subordinate clauses, then children between the second and fifth years are in the process of acquiring these elements of grammar (Grimm 1998). The languages of primitive peoples, however, are largely characterized by the features that are also found in children between the ages of two to four or five. This means that the mental development of the pre-school child provides the theory needed to explain the language of the indigenous peoples. The pre-operational thinking of the primitive man provides the explanation for the characteristics of the language he masters. Exactly this was finally shown in this essay using the example of the absence of generic names.

Like the little child, primitive peoples know only the main clause without subordinate clause. Therefore a reasonable word order is mostly missing. Native peoples know only the presence and no other times that could express past or future. Just like the small child knows only the present tense at first. Children's language and archaic language know neither plural nor passive. Both forms of language tend to use onomatopoeia and to duplicate syllables. A small or larger part of the vocabulary of archaic languages is characterised by these two peculiarities which are so characteristic of the two-year-old child (Oesterdiekhoff 2018 a, b; Everett 2008; Schultze 1900).

It is claimed that the full grammar languages with subordinate clauses, tenses, plural and passive first emerged in Mesopotamia as a result of the invention of writing. From there they penetrated the languages of the Mediterranean region, e.g. Greek and Latin. Latin, in turn, then changed the Germanic languages during late antiquity and medieval times, which in turn modified the languages of the archaic peoples of the South in the wake of European expansion (Oesterdiekhoff 2018 a, b). This global

and historical change in language forms corresponds to the transformation of ways of thinking and cultures. For, these have gradually changed from archaic to modern, industrial cultures. Thus, correlations can be established between the development of material culture, psychological stages and language forms. It is to be hoped that in the future a monograph will be worked out that will present these parallels from the basics and in coherence. And that linguistics will understand that developmental psychology provides the basis for explaining the ontogeny and history of language.

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1921. Otto Zdansky discovers the Peking Man Fossil

It is common to praise archaeologists for their major discoveries, this is how the name of Otto Zdansky (1894-1988) is linked to that of the Peking Man he discovered at the end of the summer of 1921 in China, 48 km from Beijing (Peking). Less often mentioned is the interest given by the inventor to research undertaken on the fossil isolated teeth of this *Homo erectus* from China that he unearthed on the Zhoukoudian site (formerly Chou-kou-tien). These teeth of *Sinanthropus pekinensis*, which he had sent to Uppsala University of Sweden, had also become important in 1980 for me who was then trying to understand how ancient men lived. The three original isolated teeth discovered and described by Otto Zdansky, held at Uppsala in the ZKD (Zhoukoudian) collection since 1923 : Right upper M3 (1921) Left lower P3 (shipped in1923) Right lower P4 (1952), are reflecting the expanding interest of the1920s in the traces of the "peripheral" human evolution in China [Black 1926; Zdansky 1927, 1952]. In January 1980 I contacted Otto Zdansky (figure 1) to include their study; using a method I had started in 1976 to carry out an analysis of the wear of teeth examined under the microscope of populations in order to deduce the different food choices. This and excerpts from Otto Zdansky's letters reproduced in bold italics bring to life this story of the discovery of the first fossilized remains of Peking Man.

KEY WORDS: *Peking Man, Zhoukoudian, Homo erectus, Sinanthropus, Beijing, letters, Otto Zdansky, China, Teeth.*

The romance of archaeologic research

From a two years relationship (1980-1981) there now remain the letters that were published in academia.edu, a free and open repository of articles, in which Otto Zdansky relates how he came to China in the summer of 1921 after "*Prof. J.G. Andersson (1874-1960) who was the instigator and manager of the Swedish investigations suggested that I should go to Chou-Kou-Tien, where he had worked at a small pillar of terra rossa, left standing by the quarry-man, when working the limestone. It contained lots of small bones of rodents, and work there would afford me an opportunity to become acquainted with conditions in China.*" (Puech, 1983; Puech, 2018).

J.G. Andersson came to China in1914 with a contract as a mining adviser to the National Geological Survey inaugurated in 1912 by the "Republican China" government and had made numerous discoveries in geology (mining resources) and in paleontology. He took cognizance of the fossiliferous potential of Chou- Kou-Tien en 1918 and started to investigate the "Chicken Bone Hill" (Jigushan) which now termed Zhoukoudian Locality 6 (Andersson, 1919; Wikipedia, Johan Gunnar

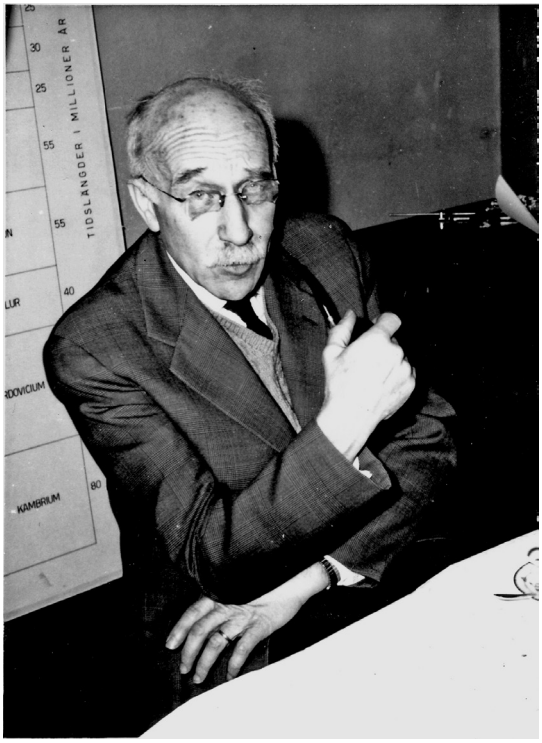


Figure 1: Otto Zdansky.

Andersson). To undertake the full excavations he asked Carl Wiman (1867-1944), Professor of Palaeontology at Uppsala, to send him a scientist who will lead the collection of the fossils. Otto Zdansky had made a stage from spring to autumn of 1920 in the Department of Palaeontology and, after a return to Vienna during winter to defend a thesis under the supervision of paleontologist Othenio Abel for the PhD. in Paleontology with the dissertation on March 21st, 1921: "About the temporal region of the turtle skull," he was back in the spring of 1921 to clean and consolidate the specimens of Chinese fossils sent by J.G. Andersson to Uppsala. He then was asked if he «*would be prepared to go to China for 3 years in order to take care of the collecting. The material so far received bore witness of the fact that it had been collected by persons unfamiliar with the necessary technique.*»

The place where Otto Zdansky was to discover the *Sinanthropus* teeth is on the southwest of Pekin (Beijing), along the River near the town of Zhoukoudian at the feet of the Western Hills in the North Chinese Plain. Zdansky easely reached the site by the way J.G. Andersson did, with the aid of a railway branch line that connects

Chou-kou-tien with Liuliho junction on the Peking-Hankow. Andersson had been, the 22-23 March 1918, accompanied by his wife to examine the deposit of fossil bones and as the professor McGregor Gibb had indicated him many of them well preserved and apparently mostly belonging to birds as wanted by the denomination of the quarry of "Chicken Bone Hill". The period of the year was cold and the weather very dry but this was not the case three years later in August 1921 when he visited Otto Zdansky on the occasion of a joint excursion undertaken with Walter Granger (1872-1941) the chief palaeontologist working in China with the American Museum expedition. That time it rained and it was very hot. Zdansky, who familiarized with the life of the Chinese village, had set up a camp in a local temple (now used as a local school) on the eastern bank of the river at Zhoukoudian where the visitors found him at work. From there they went to the laterite pillar left standing during the past quarrying "Chicken Bone Hill" operations (Andersson J.G. 1922). « *While we were all three at my working place a quarryman came and wondered why we were spending our efforts in this place as there were much bigger bones in an old quarry nearby.* […] *He led us to the place, where I was to find the first tooth of what became known as Peking-man... The clay was mostly soft and easily worked, but locally impregnated with calcareous sinter and quite hard. Fossils were numerous*.»

The sequel to this August 1921 visit is so unusual that it was narrated by Boaz *and al*. (2004a) as follows in detail: «Indeed, the very morning after the initial exciting discoveries at Longgushan (Dragon bone hill in Chinese), great clouds covered the sky and then unleashed torrential rains. The little Zhoukou River flowing through town overflowed its banks and washed away the bridge, cutting the scientists off from their new site. Andersson and Granger could not get to the railway station. Andersson relates that he and Granger "were hopelessly flooded in, for the little stream which flows out into the Chou K'ou Tien valley, and which during the preceding days had been an insignificant purling rill, was now a wild foaming mountain stream that nobody dared to cross so long as the cloudbursts continued to hurl new masses of water into the valleys." For three days the scientists huddled in the temple, telling stories and drinking, until the rains let up. To escape Zhoukoudian on the fourth day, Andersson and Granger had to wade across the river "almost naked," holding their clothes and shoes above their heads, undoubtedly to the twitters of many townspeople. Some saw in these events the power of the dragon, which had stopped the foreigners in their tracks and had made them retreat ignominiously from Zhoukoudian.» Chinese grew out of the fertile river silt, and in that same silt, men were buried when the river overflowed its banks.

China is the country of continuities.

From his arrival in China, J.G. Andersson « *had become interested in the fossil bones (« dragon bones ») sold in the pharmacies for medical purpose and by patient investigation succeeded to trace the source of the bones*.» He had succumbed to the charm of the mythical Chinese dragon and its bones as we can see from reading his 1925 paper on the archaeological history of Chinese dragons were he reported that « He paid especial attention to reports of « dragon bones » because , mindful of Haberer's and Schlosser's earlier findings, he knew they could lead to fossil sites » (Boaz *and al*., 2004a). "Descendants of the dragon" could almost become a synonym for "Chinese people»: «*He also obtained some informations from Swedish missionaries in the province of Homan. In possession of these informations he started a collecting campaign, doing some work himself, but much of the collecting work was carried out by Chinese in his service. By his connections in Sweden he succeeded in the constitution of the Swedish China Committee with the aim of further development of the collecting of Chinese fossils*.» He made a preliminary description of the bone deposit at Chou-Kou-Tien first in 1919 that had attracted the Scientifics as we can read it in the report made by Boule in 1921 (English translated in 1923) in his general conclusions concerning "Fossil men elements of Human Palaeontology".

The British Academy had issued in 1920 a series of advice to collectors of natural history specimens in which G.F. Hill recalled that the object of archaeological excavation is to collect new information to amplify and correct what we know now, to make our knowledge of the past more complete and useful. Ideas about prehistoric man were in progress since Eugène Dubois described in 1891 Java man with a cranial capacity of 950 cm^3 (halfway between chimpanzees and modern humans) as a prehuman even more prehuman than Neanderthal. Marcellin Boule thinks at the time that: «We know almost nothing of Asiatic human palaeontology, apart from a few archaeological facts, which are, nevertheless, of great interest. But, from the point of view which is of particular interest to us, great efforts still remain to be made on this continent. If, by some magic art, we could divest it of its great covering of superficial deposits, what discoveries of prime importance we should be called upon to record. According to the latest work of geologists, the great continental formation of "yellow earth," or loess, is not simply the result of recent wind action. Like the Pampas formation of South America, it represents a complex formation of layers of different origins, the earliest of which, dating from beyond Quaternary times, contain abundant remains of various mammalian faunas. There is every reason to hope that these faunas comprise human or prehuman beings which, one day or other, science will be able to study.»

Zdansky and his two Chinese assistants searched all summer 1921 the paleontological deposits of the vast pocket at the north-facing slope of the outcrop at a high stratigraphic horizon in the cave deposit (known as locality 1) which was than part

of an ancient cave. It was from these deposits, later termed "Locus A," that the type specimen of *Sinanthropus pekinensis* Black 1927 was to be recovered. The caves turn out to be nothing less than a paradise for an ambitious fossil hunter like Zdansky. He excavated several fossils of extinct vertebrates, but in the late summer of 1921 he won the jackpot for good: here Zdansky finds his greatest treasure to date – a find whose outlines he instinctively sense. While the Austrian was aiming at the layers of soil he hewn and scraped off, to his amazement, his attention was drawn to the protruding petrified edge that unmistakably resembled a human tooth. Perhaps this is the very proof that the human species has an origin in China, he slipped the tooth in his pocket – knowing that he may have found the oldest trace of a man from the past. In an oral communication to Tore Frängsmyr (2012), who was professor of history of science at Uppsala University in1982, Otto Zdansky precised that he assured the obscurity of the tooth that was a right upper third molar in packing it among pig teeth from the excavation that were shipped back to Uppsala: «*Understanding that the announcement of the find would create a considerable stir and fearing that the description of the whole cave fauna would be taken from me and entrusted to somebody else I kept the find secret.* […] *Returned to Peking I set out for Chou-K'ou-Tien for a second time and continued the excavation until I was informed that the funds of the Swedish China Committee were exhausted and that for this reason the activities had to come to an end. That was late in the autumn of 1923. Towards the end of November I returned to Europe by the Transsiberian railway.* […] *I found that the preparation of the material from Chou-K'ou-Tien collected during my first visit had yielded a second hominid tooth which I took care of and hid together with the first found tooth.*» This tooth is an unerupted lower permanent premolar and this astonishing discovery was announced on October 22, 1926 by J.G. Andersson at a meeting held in Peking in honour of the Crown Prince of Sweden Gustaf Adolf (later King Gustav VI) then visiting the city. At Uppsala Wiman had asked Otto Zdansky to describe the still unpublished paleontological findings to give a greater scientific interest to this special event of the Geological Survey of China. Davidson Black, a professor at the Peking Union Medical College, immediately published a short note in *Nature* and *Science*.

The enthusiasm for Zdansky's discovery is so great that intensive investigation of the Choukoutien cave was organized supported by a grant from the Rockefeller Foundation, and in the spring of 1927 Birger Bohlin was engaged for a two year period to take charge of the field palaeontological work. He recovered the left lower molar tooth upon the morphological characters of which it became possible to distinguish the generic status of *Sinanthropus.* The tooth show thick crown enamel but slight evidence of a cervix and have extensive crown pulp cavity. It was from the same stratum from which came the lower premolar discovered by O. Zdansky, and was identified as derived from the same jaw of a juvenile (Boaz *et al.*, 2004b; Black, 1927a; Black, 1927b; Black, 1933 cited by Colini, 1933).

From 1928, Locality 1 at Chou-k'ou-tien produced other remains until Japanese troops occupied a large part of mainland China and moved in 1937 to Beijing. All the collected fossils, that is to say perhaps 48 individuals, but except for the teeth in Uppsala, disappeared from view on December 8, 1941 (Jia and Weiwen, 1990). The fossils of Pekin Man had been sent « *south with the Peking-Hankow railway and that it is fairly certain that they arrived at the Yangtze river. What happened then is a mystery.» «After Black, Weidenreich and von Königswald published papers on the Peking-man. Prehistorical fossil anthropology not being my line I dealt no more with the fossil except describing a third tooth which I found after my return to Uppsala in 1952 when going over material that Wiman had stored away as uninteresting duplicates. This tooth I described in a small paper (4 February, 1952) "Zoologiska Bidrag från Uppsala".*»

There are in Uppsala three teeth recognized by Otto Zdansky (figure 2) and a fourth tooth recovered in 2011, untouched since it was dug up in the 1920s, in a wooden box bearing the letters ZKD (acronym for Zhoukoudian), stored in the basement of the Evolutionary Biology Centre at Uppsala (Kundrat *et al*., 2015). So that the Zhoukoudian Pekin Man teeth held in the Palaeontological collections, Museum of evolution Uppsala University (PMU) are today PMU M3550, the first tooth (Uppsala 1 right upper third molar); PMU M3549, the second tooth (Uppsala 2 left lower third premolar); PMU M3887, the third tooth (Uppsala 3 right lower fourth premolar) and PMU 25719, the fourth tooth (upper right canine).

Figure 2: Peking Man three teeth discovered in 1921-23 by Otto Zdansky.

How teeth reveal our past

The prehistoric study of the first Hominids having shown that the construction of a paleoecological model was essentially based on the determination of dietary preference and due to our lack of knowledge of the use of flora and fauna, we have developed an approach based on the reconstruction of food from dental micro-wear analyses. I had undertaken comparisons of the marks present on the dental surfaces of humans during their evolution from Homo erectus having occupied very different geographical sites. After comparing the results given by Mauer Man, around 680,000 years old, having lived in the shelter of the nearby forest on the banks of a tributary of the Neckar near Mauer and Tautavel Man, dated 450,000 years old, unearthed in a cave on the slopes of a massif overlooking a vast plateau on the banks of rivers, our propose was to compare the results with those that we will obtain on the teeth of Peking Man, dating from 500,000 to 230,000 years ago, collected by Otto Zdansky (Puech et al., 1980; Wu *et al*.,1995).

The "Peking Man" discovered by Otto Zdansky, in 1921 from Zhoukoudian Locality 1, is an emblematic hominine now usually lumped into the *Homo erectus* taxon. *Homo erectus* recognized at Zhoukoudian is widely distributed in China and regroup many fossils found in Africa, Asia and Europe. Due to a vast spatial distribution and a fairly long maintenance of the species, *Homo erectus* fossils exhibit a polymorphism that could be explained by the various migrations and by the evolutionary longevity of the species. Regional traits have been used, ever since Weidenreich's classic studies of "Peking Man" (1937a, 1937b) as to prove incontestably that there is no appreciable difference between *Pithecanthropus* and *Sinanthropus* except the post-orbital depression according to Weidenreich (Black, 1934; Boule, 1937; von Koenigswald *et al*., 1939).

To have more information concerning Pekin Man through the study of the three original hominid fossils preserved at Uppsala, I went to the laboratory which preserves the teeth where Otto Zdansky had given me an appointment in April 1980. This specific anthropological research that I wanted to undertake had the task of identifying the teeth past history by closely examining their surface damage characteristics. Teeth were first examined by naked eye; they show the dental features that have been proposed in previous studies as typical of East Asian Middle Pleistocene *H. erectus* such as moderately convex buccal surfaces and robust "column-like" dental roots. After having cleaned the teeth and examined their surface under low magnification I obtained positive epoxy and negative nitrocellulosic varnish peels on selected places of the originals. These transparent imprints allow to examine surface damage by binocular microscope (x20, x30) and if the surface of the replica is metallised at a scanning electron microscopic level (SEM) to observe surfaces

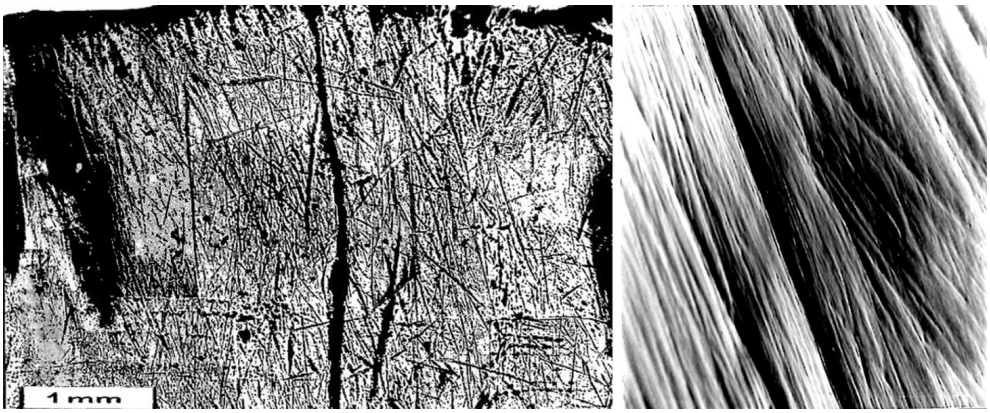


Figure 3: Uppsala 3, Palaeontological collection of the Museum of evolution at Uppsala PMU M3887. Buccal enamel surface microwear x 20 on the left and scanning electron microscopic level on the right x 1800.

damages at an higher magnification (figure 3) in the form of the following types of marks: flakes, pits, micro-pits, scratches, gouges and wear polish that have various origins (Puech, 1977; Puech *et al*., 2014).

None of the Zdansky's three discoveries he reported in 1927 and 1952 are in alveolar bone and for this simple reason we have to examine the surfaces remains in order to determine and score taphonomic damage added to the normal tooth wear produced during life. The Zhoukoudian hominid assemblage as a whole has many taphonomic signatures, the first and most obvious at first glance is that of assemblages modified by animals which left bite marks or produced fractures and the probable causes are rodents and hyenas (Pei, 1934). An opinion confirmed by comparative studies of the prewar faunal remains from the site that have assesed the dominant roles of scavenging animals (Binford *et al.*, 1985; Binford *et al.*, 1986). « Consideration of spatial and contextual associations of hominid skeletal remains in Locality 1 also assists interpretation of the taphonomy of the site. Such associations argue persuasively against generalized cave roof collapse and sedimentary crushing to explain fragmentation of fossils (for example, Locus I). This locus shows a pattern of bone dispersal that fits well with an interpretation of hyaenid scavenging of hominid remains. [...] Another preservative pattern of the hominid remains—isolated teeth lacking their corresponding mandibular or cranial bone—may be explicable on the basis of hyaenid bone modification as well. [...] A third, more probable explanation for this pattern of fossil deposition is rodent gnawing, evidence of which we and others (e.g. Pei, 1938) have observed on non-hominid fossil bone from Zhoukoudian (Boaz *et al.*, 2004 b). »

We observed that the very root tips of the upper right M3 (Uppsala 2, PMU M3550) and of the lower right P4 (Uppsala 3, PMU M3887) are missing on the cemento-dentine flanks and unusual broad and shallow indentations named gouges of unknown origin, but we have found no evidence of marks of animal tooth action. This despite the fact that the activity of scavenging animals has been proved to be an important factor affecting the fossil distribution at Zhoukoudian. Tooth marks are well identified, on some *Sinanthropus officinalis* teeth collected by von Koenigswald, as marks of the porcupine that accumulates bones in caves from China (Puech *et al.,* 1991). Any scratches produced by paramasticatory activities or trampling on the ground are less regular in size and direction. The enamel well oriented striations show the path traveled by the food bolus compressed by the cheeks, they are well oriented on the crown sides of the teeth by food drived in circular motions during chewing and linked directly to the abrasive particles ingested. If we admit with Binford *et al.* (1985) that «We do not know what their diet was or what use they made in the cave» and that inferences from use-wear studies must be accepted with care, a striae analyzes point to analog use of teeth at Zhoukoudian and Tautavel who like all human nomads or semi-nomadic are largely fond of meat from hunted animals which have included in their menu significant quantities of plants, whereas a different arrangement of striae in Mauer suggests a somewhat different diet (Puech, 2016).

The cradle of Chinese civilization.

Finally, among the questions concerning representation and interpretation that are always part of the paleoanthropologic research, it seemed useful to include the Peking Man in person. It's frustrating to go around this topic without a picture of the ancestor constitutive of a common world (Wang et al., 2000; Wu *et al*., 1995; Puech, 2019). Despite the loss of the original Zhoukoudian hominids bones, the plaster reconstruction of a Sinanthropus skull made in 1937 by Franz Weidcnreich (1937 b) and his assistant offers to look forward for the understanding of the Peking Man that has become an icon. We utilized this representation to produce a guessed facial morphology in a reconstructed scene down the river at Zhoukoudian.

May this presence sharpen our curiosity and our thirst for knowledge and lead us to reopen the archaeological archives of Otto Zdansky and visit the Peking Man at Zhoukoudian via the Beijing Museum Pass. At the time of its discovery, the Peking Man pushed back the timeline for studies of human evolution and put China in the field's limelight (Cheng, 2017; Etler, 2006). The vast majority of Chinese know that China has been and remains. The teeth brought to light by Otto Zdansky are an invitation to travel into China's past, into the sedimentation of millennia which connects

each one to a reality vaster than his own, the one of China. Through the portrait of the *Sinanthropus* on the banks of the Zhoukoudian river, the imagination and reality of the new China mingle.

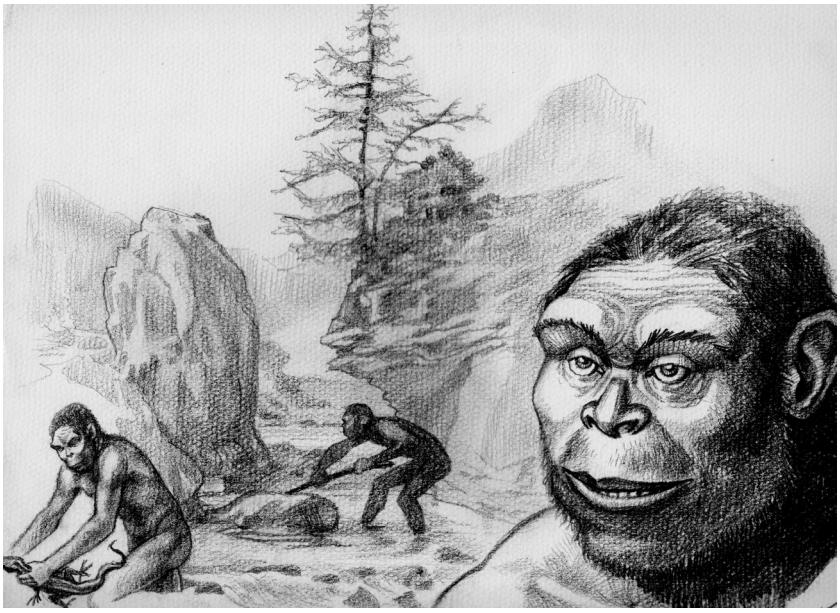


Figure 4: *Homo erectus* down by the Zhoukoudian river.

Upsala, Jan. 28, 1980.

Dr. Pierre-Fr. Puech,
2, Rue Saint-Antoine,
Nîmes

Dear Sir,

Thanks for your letter of Jan. 15 and the reprint of your paper which I found highly interesting, it being the first time that I have come into touch with a type of investigation that seems to be very promising.

Now to your demands. I am sending you a photograph of myself. It is far from being recent, but the only one I have available.

Now to the circumstances connected with the first discovery of the so-called Peking-man. I came to China in the summer of 1921. Prof. J. G. Andersson who was the instigator and manager of the Swedish investigations suggested that I should go to Chou-K'ou-Tien, where he had worked at a small pillar of terra rossa, left standing by the quarrymen, when working the limestone, It contained lots of small bones of rodents, and work there would afford me an opportunity to become acquainted with conditions in China. Some days after my arrival in the place came Prof. Andersson together with Dr. Walter Granger of the Amer. Mus of Nat. Hist. While we were all three at my place of work there came a quarryman and wondered, why we spent our time there, since much larger fossil bones were found in another relinquished limestone quarry nearby. So we went to the place, borrowed ladders from a quarry and found the information correct. Andersson and Granger left for Peking the same evening, and I transferred my activities to the new pace. It was then one day that I found a molar which I recognized on the spot as belonging to a hominid. - At a later date - I think it was in the late summer of 1923 - I went once more to Chou-K'ou-Tien. You might wonder, why I kept the discovery of the human tooth a secret. The reason is that I had engaged myself in the whole work without remuneration and that only on my threat of refusing to go I had been promised that I should be permitted to study and describe certain parts of my finds. As I foresaw that my divulging

My find would create quite a stir and perhaps result in the withdrawal of the verbal promise given to me, I preferred to keep the secret to myself until such a time that I could safely let the cat out of the bag. That happend in, I think, 1926, when the Swedish crown-prince, later king Gustavus Adolphus VI, who had been the protector of the Swedish activities in China was visiting China. In his honour the Geol. Survey of China was to arrange an extraordinary meeting, and Prof. Wiman with whom I then was working here wondered if I had nothing to give additional glamour to this meeting. Ar this time I have found another tooth of the Peking-man among the cleaned material and had already described it for my monograph of the whole fauna of Chou-K'ou-Tien. Under these cicumstances I agreed to the publication as a preliminary report, describing it a Homo sp. It did not feel justified for doing more than this. Dr. Davidson Black of the Peking Union Medical College was less reticent and made my two teeth the type of Sinanthropus pekinensis which, however, has not survived later investigations. - The stir which I had foreseen came and the Rockefeller Foundation made pssible a continuation of the excavations at Chou-K'ou-Tien. Plans existed that I should return to China for this purpose, but I had in the meantime accepted a job at the Egyptian University in Cairo.

On my return from Egypt to Upsala I went through material from Chou-K'ou-Tien which had been packed down as less interesting and on this occasion found a third tooth which I have descibed in Zoologiska Bidrag från Upsala.

Well, this is a brief account of what I have had to do with the Peking-man. I hope, that is what you wanted.

Sincerely yours

Otto Zdansky

Upsala,Dec.16,1980.

Dear Dr.Puech,

Thanks for your letter.Herewith I am sending you what I hope will be what was wanted.As I did not think that a complete curriculum vitae was demanded I have given only very few facts beyond what refers to my collecting in China.If the Editor of the journal does not want them,he can just exclude them.Alltogether I give the editor full liberty to rewrite my notes,excluding what he thinks redundant.

In case the planned article is printed I should appreciate some reprints,if that is feasable.

I remain,

With the compliments of the season

Yours sincerely

Otto Zdansky
Prästgårdsgatan 15 B
75230 Upsala,Sweden

1

Otto C.J.Zdansky, born 1894 in Vienna. Studked Civil Engineering from 1912 to 1914. 1914-1918 military service. In the autumn of 1918 I gave up Civil Engineering and started to study Zoology, Botany, and Paleobiology. In the spring of 1920 I came to Uppsala with a group of Viennese students, invited in a humanitarian action by the Union of Upsala students. I presented myself to Prof. C. Wiman, the head of the Dept. of Palaeontology and was given the possibility of working there. I continued to prepare a small paper on the temporal region of the turtles. Part of the night I was engaged in preparation work of Chinese fossils sent to Uppsala by J. G. Andersson. This gentleman, a geologist, went to China in 1911 as mining adviser to the Chinese Govt. He had become interested in the fossil bones ("dragon bones") sold in the pharmacies for medical purposes and by patient investigation succeeded to trace the source of the bones. He also obtained some information from Swedish missionaries in the province of Honan. In possession of these informations he started a collectiing campaign, doing some work himself, but much of the collecting work was carried out by Chinese in his service. By his connections in Sweden he succeeded in the constitution of the Swedish China Committee with the aim of further development of the collecting of Chinese fossils. The then crownprince, later king Gustavus Adolphus VI assumed the honorary chairmanship. Funds were supplied by wealthy donators. The total amounted to roughly 30,000 Swedish crowns.

I stayed in Uppsala until the autumn of 1920, then returned to Vienna. In the spring of 1921 Prof. Wiman asked if I would be prepared to go to China for 3 years in order to take care of the collecting. The material so far received bore witness of the fact that it had been collected by persons unfamiliar with the necessary technique? As I was to receive no remuneration I made it a condition that I should have the right to study and publish part of my collections. This being agreed to I started in late spring of 1921, taking my way via Uppsala to London, thence by steamer to Shanghai. From there by rail to Peking, where I contacted Andersson who acted as manager of the enterprise.

It was decided that I first should go to Chou-K'ou-Tien in order to become acquainted with the country. The place is easily reached from Peking by railway. The area is covered with limestone quarries, and in one of them Andersson knew of pillar of laterite left standing during the quarrying operations. The laterite contained a great amount of bones of small mammals, mostly rodents. One day, while I was working there, Andersson and Walter Granger of the Amer. Mus. of Nat. History came out to see me. While we were all three at my working place a quarryman came and wondered why we were s spending our efforts in this place as there were much bigger bones in an old quarry nearby. He led us to the place, where I was to find the first tooth of what became known as Peking-man. The locality was a quarry that had been abandoned when the workingmen had exposed a great cave filled with clay upon which rested the collapsed roof of the cave. Fossil bones, evidently from the clay-filling lay at the foot of the limestone wall below the cave. Ladders were borrowed from still working quarries, and I mounted to the cave which was to be my working place for the time to come. The clay was mostly soft and easily worked, but locally impregnated with calcareous sinter and quite hard. Fossils were numerous. One day I found a molar which I immediately recognized as being of hominid nature. This was the first find of Peking-man. Understanding that the announcement of the find would create a considerable stir and fearing that the description of the whole cave fauna would be taken from

me and entrusted to somebody else I kept the find secret.

After some weeks' work in the place I returned to Peking from where I set out to a place called Mien-Chih-Hsien in Honan province in the plain south of the Yellow River. The. There Andersson had, following information from the local missionary station found mammalian fossils in a red clay belonging to the Upper Pliocene as shown by the study of the fossils. There I excavated the skeleton of a camel, the only I ever found in China.

After some time at Mien-Chih-Hsien I started northward, crossing the practically uninhabited hills forming the southern bank of the Yellow River. Crossed the river and landed at a town on the northern bank, where I established my quarter. The following day I crossed the river to the south bank, where I soon found a locality yielding Lower Tertiary fossils. Only teeth were preserved, but the find was interesting being the first of Lower Tertiary fossils in China.

Returned to Peking for fitting out the next expedition that was to take me to Pao-Te-Chou in NW Shansi near the border to Shensi province, the border being formed by the Yellow River. Railway from Peking to Tai-Yuan-Fu, the capital of Shansi, then the better part of a week by caravan. According to information obtained by Andersson considerable quantities of "Dragon bones" came from a village, called Chi-Chia-Kou, some hours march from the town. There the peasants had digging for fossils as their winter occupation. The excavations were actually mines, often quite long and considerably branched, driven into the hillsides. There were quite a number of them. One of them I rented for the time of may stay and exploited it with the help of Chinese helper sent with me by Andersson. Every evening during my stay the ~~peasants came to my quarters with what they had collected~~ during the day and I bought quite a number of fine specimens.

Returned to Peking. The next expedition took me to the eastern part of Kansu province. There I found a site which yielded a rich material of a giraffid.

The next trip brought me to the province of Shantung. In the collections of the Geol. Survey of China was found a block of grey sandstone containing bones which I recognised as belonging to a dinosaur. The object had been given to the Survey by a German mining engineer working in Shantung. After my arrival at a certain village the people showed me (against a small remuneration) two specimens of a dinosaur which I secured. When this work was carried out I moved northwards and struck a spot with Lower Tertiary mammals which I took care of.

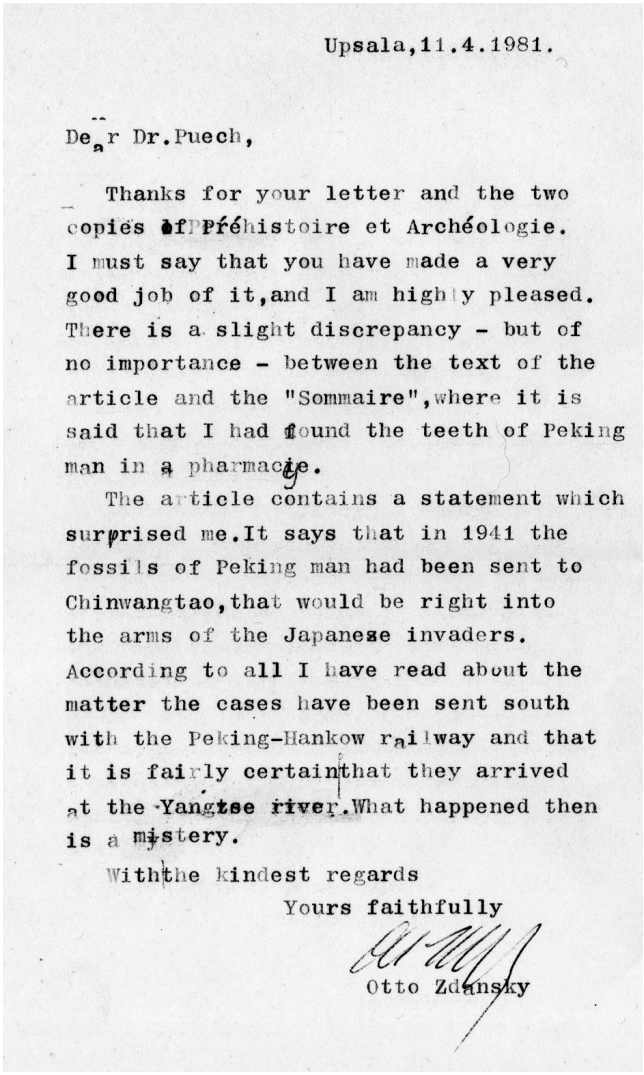
Returned to Peking I set out for Chou-K'ou-Tien for a second time and continued the excavation until I was informed that the funds of the Swedish China Committee were exhausted and that for this reason the activities had to come to an end. That was late in the autumn of 1923.

Towards the end of November I returned to Europe by the Transsiberian railway. After a brief stay in Vienna with my now widowed mother I continued to Uppsala, where I arrived by the middle of January 1924. There I stayed 3 years studying and publishing part of my collections. I found that the preparation of the material from Chou-K'ou-Tien collected during my first visit had yielded a second hominid tooth which I took care of and hid together with the first found tooth.

In the later half of 1926 the Swedish crownprince was to make a journey to the Far East, visiting also China. The Geological Survey of China was to hold a special meeting in his honour and Wiman asked me if I had not something that would give greater splendour to the occasion, By

that time my manuscript on the fauna of Chou-K'ou-Tien was practically ready for the press. I now told Wiman of the Peking man and it was decided that I should publish a preliminary notice to be read before the meeting. Both in the preliminary notice and in my monograph on the Chou-K'ou-Tien fauna a referred to the hominid as Homo sp., finding no reason to separate it from this genus. The matter was immediately taken up by Davidson Black, Professor of Anatomy at the Union Medical College of Peking. He proposed the name Sinanthropus pekinensis, a name which is now abandoned both for the Chinese and the Trinil fossils, both being now referred to Homo erectus. After Black Weidenreich and von Königswald published papers on the Peking-man. Prehistorical anthropology not being my line I dealt no more with the fossil except describing a third tooth which I found after my return to Uppsala in 1952 when going over material that Wiman had stored away as uninteresting duplicates. This tooth I described in a small paper in "Zoologiska Bidrag från Uppsala".

In January 1927 I was appointed Lecturer at the Egyptian University of Cairo, succeeding in the following year to the Chair. I left Cairo in 1951 and am now living in Uppsala.



Upsala,11.4.1981.

Dear Dr.Puech,

Thanks for your letter and the two copies of Préhistoire et Archéologie. I must say that you have made a very good job of it,and I am highly pleased. There is a slight discrepancy - but of no importance - between the text of the article and the "Sommaire",where it is said that I had found the teeth of Peking man in a pharmacie.

The article contains a statement which surprised me.It says that in 1941 the fossils of Peking man had been sent to Chinwangtao,that would be right into the arms of the Japanese invaders. According to all I have read about the matter the cases have been sent south with the Peking-Hankow railway and that it is fairly certain that they arrived at the Yangtse river.What happened then is a mystery.

With the kindest regards

Yours faithfully

Otto Zdansky

Since Otto Zdansky died a new find has been made from the 1920s boxes. In March 2011 a canine tooth was found and therefore four original teeth of Peking Man are in Uppsala.

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Non-human primates in J. M. Coetzee's works featuring Elizabeth Costello

John Maxwell Coetzee, winner of the Nobel Prize for Literature in 2003, is well-known for his references to animals in his fiction, and for his active engagement against cruelty enacted on animals. This inclination is particularly visible in those works featuring the character, Elizabeth Costello, the fictional Australian writer who is also a strong and well-known advocate against cruelties on animals. Many studies have been conducted on Coetzee's animals, from different perspectives from anthropological, philosophical and ecological, but less attention has been placed on focusing on the roles of particular species, or groups of species, described in his works (with few exceptions mostly on dogs). Hence, this paper aims at furthering the understanding of the role of non-human primates referenced in Coetzee's fiction, from bio-anthropological and ecological perspectives. In particular, it addresses Coetzee's fiction featuring Elizabeth Costello, namely, *The Lives of Animals* (1999), *Elizabeth Costello: Eight Lessons* (2003), *Slow Man* (2005), and *Moral Tales* (2017). By accounting and analyzing non-human primates (mostly great apes) and their settings (mostly anthropized), the research concludes that Coetzee exhibits a scientific knowledge of non-human primates and related ethical and conservation issues which allows him to contribute to the scientific debate on the place of human beings in nature.

KEY WORDS: *Non-human primates; J.M. Coetzee; biological anthropology; human beings.*

Introduction

John Maxwell Coetzee, winner of the Nobel Prize for Literature in 2003, is well-known for his references to animals in his fiction, and his active engagement against cruelty enacted on animals, also through his active engagement in the organization "Voiceless – The Animal Protection Institute"[1]. This inclination is particularly visible in those works featuring the character, Elizabeth Costello, the fictional Australian writer who is also a strong, outspoken and well-known advocate against cruelties on animals. Several studies have been conducted on Coetzee's animals mostly from a philosophical, literary, and anthropological perspective (e.g., Donovan 2004; Fuentes 2006; and Mulhall 2009), but less attention has been placed on exploring the roles and functions of specific species, or groups of species, maybe with the exception of dogs (e.g., George, 2009; and Philippou, 2016). Non-human primates have received

[1] See Voiceless, 2020.

some attention (e.g., Mulhall, 2009), but not the necessary attention and specific reading from a biological anthropology perspective. Given that Coetzee aims at blurring the lines between being human and being non-human, and that non-human primates are humans' closest relatives in evolutionary terms, it is important to further explore the role and functions of non-human primates in his discourse, in order to further our understanding of Coetzee's perspectives on the linkages between human and non-human world, and on human beings' place in nature.

This study focuses on Coetzee's works that feature the character Elizabeth Costello, the fictional Australian novelist and animal-rights activist, namely:

— *The Lives of Animals* (Coetzee, 1999) [hereinafter referred as LA]: an edited volume which includes Coetzee's two Tanner Lectures on Human Values held at Princeton University on 15–16 October 1997 (Coetzee, 1997), an introduction by the editor of the book, Amy Gutman, and four "reflections" (commentaries) to the lectures by four scholars: Marjorie Garber (literary theorist), Peter Singer (philosopher and animal rights activists), Wendy Doniger (religious scholar) and Barbara Smuts (primatologist). The Coetzee Lectures can be considered as an academic novella which includes metafictional and intertextual features (Garber, 1999) and can be considered at the borderline between an essay (what is was expected at Princeton) and a fiction (Iannaccaro, 2009). The Lectures are set in the USA.

— *Elizabeth Costello: Eight Lessons* (Coetzee, 2003) [hereinafter referred as EC]: a collection of eight stories (called "Lessons") plus a Postscript. Scholars had difficulties to define the actual genre, some have suggested a novel about the character Elizabeth Costello (e.g., Meffan, 2011), while in other cases, given that each episode/lesson can be read as a standalone piece this work by Coetzee has been defined as "a borderline novel" (Clément, 2016: 500). The Lessons are set in different places, including Africa, Antarctica, USA, and Europe.

— *Slow Man* (Coetzee, 2005) [hereinafter referred as SM]: with respect to the above-mentioned works, it can be more clearly classified as a novel, with – towards the end – a meta-fictional component induced by the appearance of Elizabeth Costello as both character and writer of the novel (see e.g., Iannaccaro, 2009). This novel is set in Australia – the country which has adopted Coetzee after he has left South Africa in 2002.

— *Moral Tales* (Coetzee, 2017) [hereinafter referred as MT]: a collection of seven stories (originally written in English) which have been published by Coetzee only in translations: first in Spanish as "*Siete Cuentos Morales*" (Coetzee, 2018a), then in French "*L'Abbattoir de Verre*" (Coetzee, 2018b) and then in Italian as "*Bugie*" (Coetzee, 2019). It can be considered a collection of seven Tales, some of which explicitly feature the character Elizabeth Costello (while in some others we can surmise her presence, see e.g., Spini, 2019). The Tales are set in difference places such as France and Spain.

Building on an in-depth account of all the animals in the selected works (Spini, 2019). The paper will first provide an overview of the non-human primates identified in those works by highlighting their provenance (e.g., real or fictional animals, intertextual references to literary or scientific animals) as well as context (e.g., captive settings or wild/natural habitat). Therefore, we conclude by discussing the role and functions of non-human primates, towards furthering our understanding of Coetzee's perspective on the linkages between human and non-human world, and on human beings' place in nature. It is to be noted that, while it is acknowledged that there are more political aspects to the analysis with respect to animal/human interface (including interface between non-human primates and humans) in Coetzee (e.g., analogies and metaphors related to the Holocaust and apartheid South Africa), they are beyond the scope of this paper[2].

Who are the non-human primates?

The Lives of Animals (1999) includes specific references to non-human primates, not just in Coetzee's Lectures – Lecture 1 "The Philosophers and the Animals", and Lecture 2 "The Poets and the Animals" – but also in one of the four "reflections" (i.e., the one by primatologist Barbara Smuts).

In this work, non-human primates are evoked by Elizabeth Costello by recalling non-human primates vs. human beings, and include a fictional ape which is an intertextual reference to a literary animal, as well as real apes (chimpanzees) which are intertextual references to animals described in the scientific literature.

In particular, in Lecture 1, Elizabeth Costello discusses the fictional literary ape, Red Peter, from Kafka's story "A Report to an Academy" (Kafka, 1917), and to real apes, the chimpanzees studied by psychologist Wolfgang Köhler who published his results in the book *The Mentality of Apes* (Köhler, 1921). There is an extensive space dedicated to the Red Peter and to Köhler's apes in the Costello's lecture, but we find a further reference to chimpanzees, within the conversation of the after-lecture dinner.

In Lecture 1, Elizabeth Costello early on in her lecture refers to the "educated ape, Red Peter" also recalling that she had already referred to Kafka's story some years before, but she conveys that she feels more like Red Peter this time than in that other situation which is illustrated in Lesson 1 (see Lesson 1/EC, below). The non-human primate is defined as an ape (and in plays is usually performed as an ape, e.g., some chimpanzee/gorilla-looking ape (as he comes from Africa, as stated

[2] For more information on these matters, please refer to e.g., Spini, 2019.

in both Kafka[3] and Coetzee) – even if both Coetzee's and Kafka's writing report that the ape has a tail (page23/LA)[4]. In her lecture, Costello reports only few issues from Red Peter's story, and in particular the capturing in Africa[5], and the ensuing humanizing training which enables Red Peter to deliver even a report to an academy. Here, the reference to Kafka's story is quite extensive and inclusive of many suggestions relating to the plights affecting apes (even if Costello specifically says that she will be "skipping a recital of the horrors of their lives and deaths", page 19/LA). In particular, she makes reference to shooting and capturing wild apes, also by referring to "Red Peter's little sister" (page 24/LA) – an issue in common with the other chimpanzees described in the same Lecture, i.e. the apes who are members of the Anthropoid Station of the Royal Prussian Academy of Science on the island of Tenerife[6].

Costello provides great details on the field station on island of Tenerife and on the cognitive experiments conducted by Wolfgang Köhler who initiated his experiments in December 1913 (Teuber, 1994) and who subsequently published his studies in a book *The Mentality of Apes* (1917/1921) – a seminal book in primatology and comparative psychology (Ruiz & Sanchez, 2014). The descriptions provided by Coetzee are inter-textual references to the Köhler's book and related photos/images of the cognitive experiments. While there is acknowledgement and description of a group of chimpanzees at the colony[7], the focus is placed on the chimpanzee Sultan which is defined as the "best of his [Köhler] pupils, in a certain sense the prototype of Red Peter" (page 28/LA). The detailed descriptions of the experiments include references to his history ("from the time his mother was shot and he was captured, through his voyage in a cage of imprisonment on this island prison camp", page 29/LA) and echoes of Sultan thinking of the experiments as well as of his "responsibility of representing apedom. The fate of his brothers and sisters may be determined by how well he performs" (page 29/LA) – in the same way as Red Peter has to perform his new part.

The descriptions provided by Costello about Red Peter and Sultan are different details of very similar stories which include the traumatic capturing in Africa,

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[3] In Kafka's story it is reported to have been captured in the Gold Coast.

[4] The word "ape" has also been referred to monkeys, such as in the case of Barbary Apes which are actually monkeys (*Macaca sylvanus*).

[5] Kafka's story reports that the hunting expedition was by the firm of Hagenbeck which may be probably be related to Carl Hagenbeck who was a German merchant of wild animals.

[6] For information on the founding of the primate stations, see Teuber, 1994.

[7] It is reported that Köhler used four chimps in his experiments, Chica, Grande, Konsul, and Sultan.

imprisonments, the "humanizing" captivity (one in the music-hall and one in a cognitive research colony), and the adaptation of the apes to the human context in order to survive. These similarities are so evident also by Costello's argument that Kafka may have read Köhler's book, as they were published at the same time, in 1917 when Köhler concluded his research and published his results in German in 1917[8].

There is another chimpanzee mentioned in the text: it is another intertextual reference to a chimpanzee used in scientific studies/experiments; yet we are not given details on the name of the chimpanzee, nor on the scientist conducting the experiment. The reference to this chimpanzee is made during the after-lecture dinner, and specifically when "Ruth Orkin, from Psychology" talks to Elizabeth Costello "about an experiment with a young chimpanzee reared as human"[9] also referring that when the chimpanzee was "asked to sort photographs into piles, the chimpanzee insisted on putting picture of herself with picture of humans rather than with the picture of other apes" (page 39/LA). This instance is developed into various interpretations on why the chimpanzee would behave this way (e.g., she feels like a human being; she makes distinction between those are free and those are not; she wants to please the keeper to say that they are alike). The conversation on this matter is wrapped-up with a sentence "A bit Machiavellian for an animal, don't you think?" – an utterance which could also be a meta-textual reference to the Machiavellian Intelligence hypothesis proposed and discussed by Byrne and Whiten (see e.g., Byrne, 1996; and Byrne and Whiten, 1988) and widely known at the time the Lectures were written and delivered by Coetzee at Princeton.

These stories of individual apes also trigger further reflections on apes and great apes in general; in fact, Costello, underlines that apes are the animals who are trying to reach out to us – to speak our language and to make us hearing them. The interest about whether they can speak or not is clearly underlined, also by the fact that Costello's daughter-in-law is currently writing "a review essay on language-learning experiments upon primates" (page 17/LA). In this context, there are also further speculations on the debate that "the great apes should be incorporated into a greater family of the Hominoidea, as creatures who share with man the faculty of reason"

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[8] It is to be noted that Coetzee refers to the very first edition of the monograph published (in German) in 1917, and not the second one published by Springer (1921) and generally referenced by other scholars (see e.g., Spini, 2019).

[9] There have been several experiments relating to chimpanzees reared by humans, hence it is not possible to identify the exact chimpanzee being mentioned here. This reference could have been a reference to Gua – a young female chimpanzee reared by Winthrop Niles Kellogg and his wife in 1930s (e.g., Nuwer, 2014)

and they should be given "human, humanoid rights" is also highlighted by underlining that "at least those rights that we accord mentally defective specimens of the species *Homo sapiens*: the right to life, the right not to be subjected to pain or harm, the right to equal protection before the law" (page 26/LA). Here, Coetzee adds also a footnote on the literature concerning these arguments, by referring to the Great Ape Project (Cavalieri and Singer, 1993).

In Lecture 2 "The Poets and the Animals", there are no specific accounts of individual non-human primates[10] , but still general references to "gorillas", "great apes" and "primates". For instance, during an academic Questions-and-Answers session, there are references to non-human primates when discussing ecology and Elizabeth Costello thinks that "isn't that what is so suspect in the whole animals-rights business: that it has to ride on the back of pensive gorillas and sexy jaguars and huggable pandas because the real objects of its concern, chickens and pigs, to say nothing of white rats or prawns, are not newsworthy?" (page 55/LA). This could be considered a subtle attack by Costello (and maybe by Coetzee) to the flagship species[11] approach in biodiversity conservation in which only cute and charismatic species – like the great apes, the pandas, and the big cats – are marketed to be saved.

In one of the questions, there is a particular reference to the distinction between *Homo* and other primates: "In your lecture you argued that various criteria – Does this have a reason? Does this creature have a speech? – have been used in bad faith to justify distinction that have no real basis, between *Homo* and other primates, for example, and thus justify exploitation." This leads to a discussion with extensive meta-textual reference to "Gulliver's Travels" by Swift (1726), taking into account the related dichotomy humans/horses – this induces Elizabeth Costello to summarize her answer by stating that we, humans, "are subequine primates, otherwise known as man" (page 57/LA) who have embraced the status of man which has entailed "slaughtering and enslaving other beings" (page 58/LA). Another reference to non-human primates is also within an answer by Costello to a question relating

[10] Other individual animals are accounted by Costello during Lecture 2; there are intertextual reference to literary animals (the jaguar and the panther) who were actually real zoo animals which have inspired poems (see e.g., Spini, 2019).

[11] A flagship species is a "species selected to act as an ambassador, icon or symbol for a defined habitat, issue, campaign or environmental cause. By focusing on, and achieving conservation of that species, the status of many other species which share its habitat – or are vulnerable to the same threats – may also be improved. Flagship species are usually relatively large, and considered to be 'charismatic' in western cultures. Flagship species may or may not be keystone species and may or may not be good indicators of biological process." (WWF, 2020). This approach is also known as the panda approach.

to Descartes. Costello replies also by underlining progress in the knowledge of animals, and higher primates, namely:

> "*Getting back to Descartes, I would only want to say that the discontinuity he saw between animals and human beings was the result of incomplete information. The science of Descartes's day had no acquaintance with the great apes or with higher mammals, and thus little cause to question the assumption that animals cannot think. And of course, it had no access to the fossil record that would reveal a graded continuum of anthropoid creatures stretching from the higher primates to Homo sapiens–anthropoids, one must point out, who were exterminated by man in the course of his rise to power*". (page 61/LA).

In addition, two of the four above-mentioned commentators, Peter Singer (1999) and Barbara Smuts (1999) are also very well-known for their knowledge and research on non-human primates; yet the philosopher and animal rights activist, Peter Singer, "father" of the Great Ape Project (Cavalieri & Singer, 1993) does not refer to primates nor to great apes – most likely an outcome of the fact that his arguments together with references (in footnotes) are already conveyed in the two Lectures.

On the other hand, Barbara Smuts, well-known primatologist, in her commentary refers to the baboons and gorillas (as well as other animals, e.g., her dog Safi). Here, she reports her experiences in studying primates, but mostly in interacting with them as non-human "persons". In her storytelling, about interactions and encounters with non-human beings, we can gather that sense of "individual" recognition of other beings with human attributed names, and specific characters and behaviours. She conveys that this type of recognition allows for developing personal relationships and for considering animals as persons (like humans) but of a different species. In this context, she underlines and remarks that the Lectures do not provide descriptions of any personal encounters with animals/primates. On the other hand, we can observe that her reflections lack references to the cruelty that primates are subjected in their natural habitat (e.g., bushmeat hunting and trade, pet trade, and habitat destruction) – this is especially surprising as she even refers to Dian Fossey who has been a victim herself of the plights affecting great apes.

In *Elizabeth Costello: Eight Lessons* (2003) references to non-human primates are only found in four lessons, two of which being the above-mentioned Lecture 1 and 2 from *The Lives of Animals* (LA) reproduced as Lesson 3 and Lesson 4, and the other lesson, being Lesson 1 "Realism" and Lesson 7 "Eros".

Lesson 1 "Realism" was also delivered as a lecture with the title "What is Realism?" by Coetzee in November 1996 (also with the metafictional approach as

in the above-mentioned lectures) and then republished in 2003 with some modifications so as to align with Lessons 3 and 4 with respect to the life of Elizabeth Costello. As we have seen in LA, even here there is a reference to the ape from Kafka's story (pages 18-19/EC and page 32/EC). The first reference to Kafka's story is used by Costello to open her lecture "What is Realism?". There are no really details as above on the actual history of the ape (here, the name Red Peter is not even mentioned); the story is used to make the audience reflect on the essence of the character, even if it is impossible to know what is real:

> "*We don't know. We don't know and will never know, with certainty, what is really going on this story: whether it is about a man speaking to men or an ape speaking to apes or an ape speaking to men or a man speaking to apes (though the last is, I think, unlikely), or even just a parrot speaking to parrots.*" (page 19/EC)

While the lecture is left without discussion on this particular story, the dialogue between Costello and her son – later on at the airport – resumes explaining the realism of Kafka's story when highlighting that Kafka also shed light on the character's life as a real ape. This message is also underlined by discussing that zoo animals are real animals with animal needs as exemplified by the fact that you cannot have a zoo of ideas (i.e., "A gorilla cage with the idea of a gorilla in it", page 32/EC). In fact, despite the relevance to a literary argument, one can surmise the fact that the similarities between apes and human beings are also underlined – this is also seen in that instance where monkeys are used to describe people ("monkeys […] picking away at typewriters", page 27/EC) – but also that we need to recognize and (most important) respect the real lives of the animals (not just the show they give us, either at the academy or in zoos).

Chimpanzees are briefly mentioned also in another lesson, namely Lesson 7 "Eros" in which animals are recalled in trying to describe sexual acts by gods (page 187/EC), but also in defining humans vis-à-vis gods. In fact, while discussing gods, Costello speculates whether gods are curious about us as we, human beings, are curious about "chimps" (page 190/EC). Here we can deduce some hierarchical linkages between humans, animals and gods; as well as the fact that chimpanzees have been the subject of long-term research and studies (e.g., Goodall, 1986) and triggered great general public curiosity.

Being a novel set in Australia, it is not surprising that *Slow Man* (2005) does not include much reference to non-human primates. The only reference is to marmosets (sub-family name Callitrichidae) which is made when describing a love-making scene as "a primitive experiment in biology – like bridging different species to-

gether to see if they will mate, fox and whale, cricket and marmosets" (page 107/SM). Referring to marmosets – non-human primates found only in South America – with other species from different geographic areas and ecosystems may indicate the melting-pot created by immigrants in Australia and may corroborate the feeling that *Slow Man* is a "migration-novel". The choice of the species is peculiar, but maybe Coetzee wants to accentuate the strangeness of the scene – by referring to a small monkey, from South America, and with the peculiarity of "cooperative breeding" (see e.g., Redmond, 2008).

In *Moral Tales*, there are no references to nonhuman primates – most of the animals are domestic and/or pets (e.g., dogs, cats), farm-animals or factory-farm animals, most likely to further the above-mentioned strong message opposing the "flagship species" approach.

Where are the non-human primates?

As accounted for other animals, non-human primates are not found in pristine and wild environment, as they are mostly in captive settings, anthropized environments and/or in metaphors/analogies (see Spini, 2020). There are only very few hints to wild habitat in Africa when referring to Red Peter's sister "Red Sally" and Sultan's mother in Africa (page 24/LA); and maybe when imaging the "pensive gorilla" (page 55/LA) can be assumed to be in a wild setting in Africa[12]. It is also interesting that there are no skews in terms of presence in the works towards primate species present in South Africa which is Coetzee's native land (there is no reference to no baboons, for examples).

There are more traditional captive settings in the selected works, such as zoos in both realistic, literal and metaphorical ways. For instance, the zoo is depicted in a metaphorical way in *Slow Man* when Paul Rayment suggests to Elizabeth Costello that she could get a zoo and put all the characters made up by her in cages for public's entertainment (page 117/SM). While there no reference to specific primates in zoos, but "a gorilla", as mentioned above, is referred to when discussing that zoos are real, with real animals. Otherwise, other captive settings are mostly those where scientific experiments are carried out, such as in the case of Sultan the chimpanzee (LA) or even of the marmosets (SM), or human settings (e.g. in the case of the human reared chimpanzees).

[12] Assumption made on stereotypes of images related to Africa and biodiversity conservation (*sensu* Wainaina, 2006).

Even if in the selected works, it has been reported that landscapes featuring animals are not really described in details (Spini, 2020), the settings of the two individual great apes (Red Peter and Sultan) are more fully described. This is particularly true for the Field Station on the island of Tenerife most likely due the detailed photographs available from scientific experiments (and related drawing in primatology textbooks)[13]. Coetzee also details realistic and detailed descriptions of the chimpanzee Sultan's captive settings and life on Tenerife island. It is also interesting to see that the settings are also depicted by imaging Sultan's perception of the experiment's design and venue with respect to the researcher's viewpoint and reality (something that researchers see and experience every day, but these are not issues to be published in a scientific journal).

Apart from description of cognitive experiments and language experiments, it is to be remarked that that there not specific description of laboratories testing on medicine/surgery on primates (there is only a reference to "drug-testing laboratories" [page 21/LA] hidden in the landscape[14]). It is true that Costello said in Lecture 1 (LA) that she would like to spare the audience with this component – physical cruelty in experiments or in factory-farm is mostly described for other animals, and in particular those in factory-farms and abattoirs or in Descartes' experiments in *Moral Tales*. The fact that the earlier works with more focus on great apes do not report on experiments on chimpanzees, is very peculiar given that in the mid-to-late 1990s there were many demonstrations against experiments on chimpanzees (e.g., for instance leading to the closure of the Laboratory for Experimental Medicine and Surgery in Primates (LEMSIP) of NYU in the late 1990s).

Discussion: Non-human primates and human beings' place in nature

From the analysis of the texts we report that Coetzee possesses a comprehensive scientific knowledge[15] of non-human primates and related ethical and conservation issues; from evolutionary theories and taxonomic classification, to cognition studies and theories, plights affecting conservation in the wild (e.g., illegal hunting and pet trade), and up to the ethical and animal rights debates (with particular focus

[13] For some photos, see MPI, 2020.

[14] This is a hint to the fact that in the academic world we all know that there are animal-testing labs on campuses, but we also know that there are not signposted to avoid demonstration by animal-rights activists.

[15] Such knowledge is to be considered in line with the scientific publications of the time the selected works were written.

on the Great Ape Project and Peter Singer's work[16]). We can definitely assume that Coetzee has a particular interest in further understanding great apes, and in particular with respect to their language ability.

In fact, the issue of understanding the language ability of great apes appears very prominent in the text[17], building on the fact that throughout the selected works animals are reported to have their own language (but they are silent in front of humans) (see e.g., "'An albatross,' she remarks to the woman, speaking softly. 'That is the English word. I don't know what they call themselves.'", page 56/EC). Great apes are even depicted as being able to speak to humans, as exemplified in literary way by intertextual reference to Kafka's story about Red Peter, and recalled by reference to language-learning experiment. This focus is probably to reduce the aspect of "otherness" and convey similarities between apes and humans or maybe to highlight the need for linguistic communication to really understand what animals feels and think (so as to really empathize and sympathize with them). This is supported by the many studies focusing on showing great apes ability to learn to speak/communicate with humans via American Sign Language (ASL) or via pictograms/keyboard (examples are: the gorilla Koko, e.g., Patterson & Linden, 1981; and the chimpanzee Washoe e.g., Fouts & Fouts, 1999).

This "ambiguity" on the issue of language learning of great apes further blurs the line between animals (incl. non-human primates) and human beings, as clearly depicted in the description of Red Peter from Kafka's story:

> *"For all we know, the speaker may not "really" be an ape, may be simply a human being like ourselves deluded into thinking himself an ape, or a human being presenting himself, with heavy irony, for rhetorical purposes, as an ape."* (page 18/EC)

Apes are the closest evolutionary relatives of human beings belonging to the order of Primates, and hence from a scientific perspective we can interpret the abovementioned passage also as a reminder of the fine line separating humans from animals. Such a fine line is also reflected in the fact that we find zoomorphism applied to people as well personification and anthropomorphism applied to the description of the non-human primates (great apes). The description of Red Peter is definitely anthropomorphised, but also Sultan the chimpanzee's behaving and thinking are an-

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[16] To be noted both Coetzee and Singer are engaged with the organization "Voiceless – The Animal Protection Institute" (Voiceless, 2020).

[17] The issue of language – the language of "The Other" – is a recurrent theme in the selected work by Coetzee (Spini, 2019).

thropomorphised by Köhler and, in a way, also by Coetzee[18]. This is also explicitly underlined by Elizabeth Costello, as follows:

> "(*In the copy of Köhler's book I read, borrowed from a library, an indignant reader has written in the margin, at this point: 'Anthropomorphism!' Animals cannot march, he means to say, they cannot dress up, because they don't know the meaning of march, they don't know the meaning of dress up.)"* (page 30/LA)

Here the application of anthropomorphism is meant to "place animals closer to us than to machine" (de Waal, 2006: 63) and hence to remind us that animals are living beings just like humans. In fact, the selected works do not convey a feel of *scala naturae* in the way in the way human beings are presented vis-à-vis primates and/or other animals (despite reference to evolution and taxonomic classification of primates), as also exemplified by the expression with intertextual reference to the Gulliver's Travel: "we are subequine primates who slaughter and enslave other animals (57-58/LA). However, we surmise that in the selected works, the fact that non-human primates are described as our closest relatives and attributed a "more important role" than other animals as such they are much more able to communicate to us – hence they can advocate also for other animals. Yet, we still perceive some "fear" of the unknown with respect to non-human primates given difficulties in communicating – a fear that we clearly see with respect to the monkeys described by Coetzee in *Foe* (Coetzee, 1986) inhabiting the island where Crusoe lives – the monkey here are described as savages and dangerous in a natural environment[19].

This fear is counteracted through acquisition of knowledge about them via scientific studies strongly based on curiosity, as clearly detailed in Lesson 7:

> *"What she knows for certain about gods is that they peek at us all the time, peek even between our legs, full of curiosity, full of envy; sometimes go so far as to rattle our earthly cage. ... are they curious about us, their anthropological specimens, to the degree that we in turn are curious about chimps, or about birds, or about flies? Despite some evidence to the contrary, she would like to think, chimps.* (page 190/EC)

[18] It is to be noted that Coetzee also anthropomorphizes other species which are considered less "anthropomorphic" such as the chick in the Tale "The Glass Abattoir" (MT) which we can hear thinking (talking to himself) while he goes through the conveyor's belt in a poultry-hatchery.

[19] It cannot be said whether the monkeys on the island were endemic to the island, or introduced by human beings.

This knowledge also provides the basis for controlling and managing them, through our understanding of ecological systems and related decision-making powers. This is the strong distinction between non-human primates (and animals in general) and human beings. In fact, in *The Lives of Animals* humans are defined as intellectual beings and with the capacity to be the "manager of the ecology" with the power of life and death over the other living beings:

> *"We, the managers of the ecology, ... we understand the greater dance, therefore we ca decide how many trout may be fished or how many jaguars may be trapped before the stability of the dance is upset. The only organism over which we do not claim this power of life and death is Man. Why? Because Man is different. Man understands the dance as the other dancers do not. Man is an intellectual being."* (page 54/LA).

While Coetzee draws attention to many debates on how to define animals and how to distinguish them from human beings with most of the arguments and definitions are related to philosophical, religious, and literary perspectives, but also with some references to biological, psychological and behavioural sciences (with the exception of genetics, due to time-frame of the selected work) – the real distinction seem to be that human beings can control their environment and the other living beings.

Such a position on the place of human beings in nature is definitely accurate in the light of the current viewpoints that we live in the Anthropocene. In fact, all the plights affecting great apes described in the selected works are still very much occurring after 20 years from the Tanner Lectures (see e.g., GRASP, 2020). However, since that definition of humans being able to understand "the dance" of the earth system, should be eventually revisited in light that COVID-19 pandemic has demonstrated humans cannot understand "the dance" of viruses. Maybe we should consider more appropriate the definition that the we are "subequine primates" allowed to "slaughtering and enslaving other beings" (page 57/LA).

In conclusion, the science-based fiction (borderline essay) writing by Coetzee, featuring Elizabeth Costello, enables to convey scientific messages related to biodiversity conservation, nature protection and animal rights to the broader public by providing different perspectives on non-human primates and our role and place in nature. Let's hope that this will allow to reflect on how we can become "gardeners of the forest" (*sensu* Redmond, 2014) like the great apes, more than ineffective "managers of the ecology".

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The Unit of Time and the Mesoamerican Calendar

A hypothetical rational process of establishing a unit of time with a meaningful connection to both, the length of the day and that of the tropic year, would lead to a natural candidate which represents the average error per year in a cycle of 365,2422 x 128 = 46751.0016 days, that is: 0.0016/128 = 1/80,000. However, if we multiply that unit by the number 1.08 we obtain: 80,000 x 1.08 = 86,400, that is the actual unit of time.
The odds are that such a process was done by an ancient unknown civilisation which influenced on one side the Eurasian continent, where the second and a trigonometric system on base 60 were adopted and the number 108 and its multiples and submultiples (54, 108, 216, 432, 86400 etc) represent the scientific, mythological and sacred numerology of all ancient civilisations. On the other side central America, where a numerical system on base 20 was adopted and a calendar based on the cycle of 128 years. It can be demonstrated that it belongs to a family of 18 calendars, characterised by an ever rolling week and an auxiliary year which together with the solar year are submultiples of an auxiliary century. There are precise relations between all these units, allowing to design astronomical "clocks" with the same characteristics of the central American calendar for whatever length of the week.

KEY WORDS: *Central American calendars, 128 years cycle, length of the day, tropic year, units of time.*

The units of time, heritage from a distant past

Often ancient civilisations seem to have had capabilities and knowledge that are difficult to explain on the base of the supposed scientific and technological level of their time, so that we are led to assume that they were inherited from a previous unknown civilisation, much more advanced.

For example the existence of renaissance maps (Piri Reis, Oronteus Finnaeus, Mercator…) with longitude accuracies considered impossible at that time, and the representation of Antarctica as it appeared at the end of Pleistocene, was so inexplicable that a scientist like Charles Hapgood postulated the existence, sometime before 8,000 years ago, of an unknown civilisation able to chart the whole world with extreme precision.

But it's not necessary to look for challenging knowledge and capabilities in order to find evidence of that kind. Indeed knowledge and figures still currently used can provide straightforward evidence that they originated in a very distant past by

an unknown civilisation, whose technological level was much more advanced than that of all known ancient civilisations.

Here we consider something apparently insignificant and devoid of any hidden meaning: the presently used unit of time, the second. It's a unit used throughout the world, which characterizes every instant of our life and is fundamental for the description of every physical phenomenon. We can hardly underestimate its importance, and yet we ignore what is the origin and the meaning of this unit, that we have inherited with no indication whatsoever about the author, the epoch and the reasons that determined the choice of its magnitude.

The current opinion is that it originated by the ancient Sumerians because of their sexagesimal accounting system. In fact 86,400 is a number clearly connected to that system, as it can be divided into 24 hours of 60 minutes, each minute consisting of 60 seconds. Same origin can be hypothesised for the convention of dividing the circle in 360 degrees, each one of 60 minutes of 60 seconds of arc.

The problem is that we don't have the faintest idea how and why the Sumerian sexagesimal system originated. It's more likely, on the contrary, that it was that particular unit of time that originated such strange, almost absurd, accounting system. And in any case, we don't know what the magnitude of this unit of time represents. Was it a casual choice or instead a length of time with a meaningful connection to some particular astronomical magnitude? Was it invented by the Sumerians or instead the Sumerians inherited it by a previous civilisation, as we did by them ?

The scientific definition of the second

Usually a unit of measure is established on the basis of some significant characteristic of our planet. For example the unit of length, the meter, has been obtained by dividing the circumference of Earth by 40,000,000, which presupposes a knowledge of its actual length.

We can reasonably expect that the unit of time, the second, also represents a magnitude somehow related to the time of Earth's rotation around itself and around the Sun, that is of the solar day and the tropic year. And in fact this is how the modern scientists have intended it and defined it.

The second represents the $86{,}400^{th}$ part of the day. Which day? The length of the solar day, that is of the time-span between two successive zenithal passages of the Sun, is not a constant, due to the fact that the Earth's speed around the sun is not constant, because of its elliptic orbit and Kepler's laws. The second is a fraction of the "mean" solar day during a whole tropic year. Therefore, in order to establish this unit of time it is necessary to know exactly how many solar days are contained in a tropic year.

But, again, which year? The ratio between day and year is not a constant, because Earth is continually undergoing a deceleration caused by the braking action of the tides. That's why modern scientists were forced to chose a particular date to which attach their definition of the unit of time. The definition ratified by the Eleventh General Conference on Weights and Measures in 1960 is:

"The ephemeris second is the fraction 1/31,556,925.9747 of the tropic year for year 1900 January 1 at 12 hours."

Which means that the length of the tropic year on the 1st of January 1900, at 12 o'clock, had been previously calculated in 365.24219878125 (= 31,556,925.9747 x 86,400**)** solar days. Usually this number is rounded to the fourth decimal as 365.2422.

However, this is a definition "a posteriori", and it doesn't say anything about the real meaning of that unit and which was the reason for the choice of this particular magnitude, which does not seem to be related in a meaningful way to the length of the year. Whoever established that unit, instead, sometime in a very distant past, had to know a priori the exact number of solar days contained in a tropic year, and he choose its magnitude with the purpose of having a unit with a significant meaning in relation to both of them.

In other words, the value of the fundamental unit of time, the second, suggests evidence that an unknown advanced civilisation existed in a distant past, capable of measuring the length of the year with a precision that we have reached only at the end of the 19th century. This can be demonstrated just tracing back the process necessary to establish in a rational way a unit of time derived from the magnitudes that it is supposed to measure, that is the length of the day and of the year, in a non-arbitrary or accidental way.

The natural unit of time, U

Let's see how a unit of time, strictly related to both the mean solar day and the tropic year, should be established in a rational way.

Since man started to solve the problem of measuring the time, he looked at the sky, trying to find out the precise relation between the day and the solar year. This, in fact, is the main problem at the base of every calendar system. Inevitably he discovered that the pace with the sun could be maintained by adding one day every four years of 365 days, thus having a year lasting exactly 365.25 days. This is called the "Julian year", because it was introduced in the present calendar by Jules Caesar, on 44 b.C.

The Julian year is 0.0078 days longer than the actual length of the year, assuming as precise, as we said, the length of 365.2422 days. So, after 1/0.0078 = 128.205

years we have a full day in excess. Therefore the most precise possible calendar could be obtained by adding one day every four years of 365 day, except on the 128th, thus establishing a cycle of 128 years.[1]

Now, in a cycle of 128 years we have: 128 x 365.2422 = 46751.0016 days. With a calendar based on this cycle we would have an average "error" of 0.0016/128 = 0.0000125 = 1/80,000 days per year. This fraction is the natural candidate to become our unit of time.

As 1/0.0016 = 625, assuming that the ratio between the solar day and the tropic year be constant (which actually is not), we would have a full day in excess only after 625 x 128 = 80.000 years. In theory, then, if we add one day at the end of the 625th period of 128 years, we could have a cycle of 80,000 years with a zero average error per year. It's impossible to imagine a more precise calendar.

It looks natural and quite logical to define the "natural unit of time" as the fraction U = 0.0000125 of the average solar day (for a year of exactly 365.2422 days). Therefore the mean solar day contains exactly 80,000 of these units.

80,000 is a round figure very convenient for the division of the day in equal parts, each one with the same number of units U and identical subdivisions, down to the unit U. For example 10 hours of 8,000 units each one and subdivisions of 400 and 20 units, as $8,000 = 20^3$. From this an accounting system on base 20 could naturally be derived, which would affect also the structure of the calendar, with the division of the year in months of 20 days each and so on. Precisely as in the accounting systems and in the calendars of Central America.

Of course the fact that the mean solar day contains exactly 80,000 natural units, U, is only an accidental chance. What cannot be considered accidental, however, is the way how the magnitude of this unit was established, because it requires a precise knowledge of the length of the tropic year. And definitely we cannot consider accidental the transformation of the natural unit U into a more manageable unit of time, the second, by means of a precise multiplier.

The fundamental unit of time, the second

The most important property of a unit of measure is its ability to be used as a multiple and sub multiple of magnitudes of different size. The unit U which divides the solar day in 80,000 parts is convenient, but not the best possible, because this

[1] We should remind that the cycle of 128 years was discovered by the Russian astronomer Glasenapp at the end of the 19th century, when the technological and scientific progress allowed to measure the length of the year with a precision up to the fourth decimal. He proposed to revise the Gregorian calendar accordingly, but without success

number is divisible only by 2 and 5. A number divisible also by 3, could be more flexible and useful.

This can be achieved very easily by dividing the natural unit U by 1.08, thus establishing a new unit of time which value is S = U / 1.08. In this way the mean solar day is divided in 80,000 x 1.08 = 86,400 parts, a number more convenient for measuring parts of days and years.

We therefore define the "second, S," as the fraction 1/1.08 of the natural unit of time U.

To conclude, the second is not a span of time established by chance, but it's a magnitude with a very precise relation with the length of the average solar day and the astronomical cycle of 128 years. We can prove, in fact, that the multiplier 1.08, which transforms the natural unit in a second, far from being casual, is the result of a precise choice made sometime in a distant past, in order to render more practical and flexible the division of the day and the structure of the calendar.

Dating when the unit second was originated

It's important to note that the natural unit of time, U, was not established on the basis of the number of full days contained in a cycle of 128 years (say 46.751 days, a figure that in theory an ancient civilisation could have found out just by counting the days between the solstices for a time long enough), but only on the basis of the excess of 0.0016 days in a period of 128 years, that is 0,0000125 = 1/80.000 days per year; a precision impossible to achieve without a technological and scientific knowledge comparable to those reached by our civilisation at the end of the 19th century.

One might object that the figure 0.0016 is the result of an approximation of the length of the tropic year to the fourth decimal, a choice that could be deemed arbitrary. The length of the tropic year, as we said, has been measured, for the 1st January 1.900 at 12 o'clock, in 365,24219878125 days, that is 0,1053 seconds shorter than the one considered in order to obtain our units of time.

The modern scientists were forced to fix the length of the year for a very precise date, because this magnitude decreases gradually, as we said, due to the braking action of the tides and to other not well known factors. On the basis of ancient observations of solar eclipses, it was possible to calculate the average deceleration of Earth in about 1.4 milliseconds per century. A simple operation allows us to calculate that the length of the tropic year was exactly 365.2422 solar days about 7,500 years ago.

A civilisation able to measure the length of the year with absolute precision around that date, would have found precisely that number and therefore would have

had a strong indication and motivation to establish the natural unit of time. This, although not a proper evidence, is in any case consistent with the asserted ancient origin of that unit.

We can conclude with a high degree of confidence that the actual unit of time, the second, is the result of a deliberate choice made by a civilisation able to calculate with great precision the length of the tropic year. An unknown civilisation from which all the ancient civilisations have been originated, or at least influenced. Clear evidence of this is provided by mythological figures and sacred numbers left by the latter all over the world.

Sacred and mythological numbers of ancient civilisations

The introduction of the "second" establishes a cycle of 86,400 years strictly connected to the natural cycle of 80,000. Both of them contain a round number of cycles of 128 years, and all the magnitudes characteristic of one of them can be transformed in equivalent magnitudes of the other through the multiplier 1.08.

They are perfectly equivalent, but they give origin to very different structures of the calendar and different accounting systems. In one case an accounting system on base 20, a division of the year in months of 20 days and so on are endorsed; in the other case an accounting system on base 60 and subsequent divisions of the day and the year.

Both figures, 80,000 and 86,400, with their multiplier 1.08, can be expressed in forms of extreme elegance, which makes them very intriguing and significant from a mathematical and numerical point of view, namely

$80{,}000 = 128 \times 625 = 1{,}600 \times 50 = 2^7 \times 5^4$
$86{,}400 = 80{,}000 \times 1.08 = 128 \times 675 = 1{,}600 \times 54 = 2^7 \times 3^3 \times 5^2$
$675 = 625 \times 1.08 = 5^4 \times 1{,}08 = 3^3 \times 5^2$

and so on, forming a very impressive set of numbers.

The probability that all of this could be the result of a chance can be deemed as almost nil.

Whoever is familiar with ancient calendars and accounting systems, and with sacred numbers and mythological figures, would realize that numbers like 80,000, 86,400, 1.08 and their multiples and submultiples, represent the mathematical and astronomical knowledge and the mythological numerology of the whole ancient

world, both on one side and the other of the Atlantic. In two well characterised areas: America belongs to the area of the natural unit of time, U, having adopted a calendar and an accounting system based on number 20. Europe and Asia, instead, belong to the area of the second. Evidence of this is provided by an impressive set of figures handed down by ancient civilisations, several of which still in use today (just for example, the division of the day and of the circle).

In particular 108 and its multiples and submultiples (54, 216, 432 and so on) appear to be figures endowed with an undoubtedly sacred meaning, although nobody, so far, was able to explain in a convincing way the reason of it. We find them from one side to the other of the Eurasian continent and in the most disparate situations.

They are among the most common figures in the sacred architecture. For example the temple of Angkor Vat, in Cambodia, has 54 towers, 108 statues along the entrance alleyway, 540 effigies of the gods Deva and Asura and so on; the temple of Baalbek, in Phoenicia, had 54 columns; in the holy town of Lasah, Tibet, there were 108 temples; 108 were the chapels of the Padmasambhava temple; and so on. They are also recurrent figures in ancient literature: the Sumerian king Enlil presented Aadamu with 108 perfumes; king Gudea employed 216,000 workers to build the temple of Ningirsu; he used to offer his guests 108 different kinds of food; and so on.

And they are also widely present in a long series of cosmic cycles, mythologies, religions and so on: the Indian cycle called Manvantara is made up by 64,800 (108 x 600) years; the Kalga cycle, also Indian, lasts 4,320 (108 x 40) millions of years; the time span of the antediluvian reign in the Babylonian mythology is made by 432,000 years; 108,000 in the Sumerian; the Buddhist and Hindu rosary is made by 108 pearls and the catholic rosary is made by 54 pearls (plus 5 outside the ring); the sacred Tibetan books of Khagiur consist of 108 volumes; the Rig Veda has 10,800 verses, each one with 40 sillabes, for a total number of 432,000; the Valhalla of northern mythologies had 540 doors, and from each of them 800 warriors got out, for a total of 432,000. And so on, see for about a hundred cases, Patten and Spedicato (2002).

All these figures are related to the 128 years cycle through the units of time established on its base. It was a secret knowledge transmitted in ancient societies amongst the priestly class, which had the task to measure the time. Whoever controls the calendar, in effect, controls the society. It was a tradition still alive in the Middle East 2,500 years ago. As a demonstration we can quote such an authoritative and well known source like the Bible. In Numbers 31, 32-47 we read:

"The spoils, the remainder of the booty captured by the soldiers, came to 675,000 sheep and goats, 72,000 head of cattle, 61,000 donkeys, and in persons, women who had never slept with a man, 32,000. Half was assigned to those who

had taken part in the war, namely 337,500 sheep and goats, of which Yahweh's portion was 675; 36,000 head of cattle, of which Yahweh's portion was 72; 30,500 donkeys, of which Yahweh's portion was 61, and 16,000 persons, of which Yahweh's portion was 32. ... As for the half coming to the Israelites ... this came to 337,500 sheep and goats, 36,000 head of cattle, 30,500 donkeys and 16,000 persons. From this half, Moses took one out of every 50 ..."

Figures like 360 and 72 are clearly derived from the solar calendar and we find them in all cultures of the world. But their connection with the 128 years cycle is not immediately evident. Numbers like 32 (=128/4) and 675 (= 86.400/128), instead, are strictly related to the 128 years cycle. Even numbers like 61, 30.500 and 50, apparently not belonging to it, appear to be instrumental for determining figures associated with that calendar. For example:

30.500 + 16.000 +72 + 61 + 50 + 36 + 32 = 46,751, which is exactly the number of entire days contained in 128 years (128 x 365.2422 = 46,751.0016).

Mere coincidence? Could be, but the odds are against this conclusion. The ancient Jewish priests who wrote these verses, probably in Babylon 2,500 years ago, knew the calendar based on the 128 years cycle and utilised this passage of the Bible as a "reminder"; probably encrypted in the text there are other information related to this calendar and its use.

This simple quotation from the Bible, under everybody's eyes, represents definitive evidence that ancient priests had scientific knowledge higher than those that we think possible for their epoch, which was kept secret, and that's why it got lost. Hints of their knowledge, however, have survived everywhere as figures that clearly betray their origin, down to the present civilisation, where they play a fundamental role in all the sciences and applications that make use of the unit of time, the second, and the units of trigonometry.

We can exclude that they were the product of ancient populations known to us, because they didn't have the technical means and scientific knowledge to do it. In order to establish the units of time and all the magnitudes connected to them, they should have known the length of the year with a precision up to the fourth decimal. From that knowledge the 128 cycle was established, which we didn't know before the 19th century.[2]

[2] The present civilian calendar, inherited by the Romans and fixed by pope Gregory XIII in 1582, is definitely not the most rational and even less the most precise of possible calendars. It only takes about 3,300 years for this calendar to accumulate a difference of one day with respect to the solar year. This time-span could be increased to 80,000 years if we adopted a calendar based on a cycle of 128 years, as it was proposed by the Russian astronomer Glasenapp at the end of the 19th century

We can therefore take for certain that such an insignificant magnitude like the second, apparently with no hidden meaning, is by itself living evidence that in a distant past a primeval civilisation existed, with a technological and scientific level as to allow very precise astronomical measurements and complex mathematical calculations. A civilisation which is at the origin of (or at least had influenced) both Old World and American known ancient civilisations.

The calendar of Central America

The evidence that we find in the calendars and the accounting systems of Central America is no less important than that of Eurasia, with a fundamental difference: they clearly derive from the natural unit of time, U, which is the 80.000th part of the day.

Aztec, Mayas, Toltec, and Olmec before them, had in common an accounting system on base 20 and a calendar based on an auxiliary year of 260 days (called "Tzolkin" by the Mayas), divided in 20 weeks of 13 days, and on an auxiliary century of 52 years. The solar year was divided in 18 months of 20 days each, for a total of 360 days, to which they added 5 final days considered inauspicious and therefore "non-existent".

Extraordinary importance was given to all combinations of numbers derived from the intertwine of the solar year with the auxiliary year, inside a period of 52 years. For example:

365 x 52 = 260 x 73;
360 x 52 = 260 x 72;
360 x 13 = 260 x 18

and so on in an extraordinary intertwine that deeply impressed the modern scholars who studied it.

This calendar played a fundamental role in central American societies, regulating their existence day by day in an overwhelming way. Obviously it exerted a strong fascination upon generations of scholars, who dedicated hundreds of publications to its study. Several attempts have been made to explain the origin of this numerical system and of this calendar, most of which look awkward and improbable.

A simple and immediate explanation is that they inherited them by the same previous civilisation, which had established the natural unit of time, U, and a calendar based on the 128 years cycle (we have to remember that 1/80,000 days is exactly the average error per year during such a cycle).

The fact that the cycle lasts 128 years is a lucky coincidence. 128 equals 2^7, which allows us to make in a very simple way families of perpetual calendars, all with the same average precision.

The procedure is the following:

1) We compute the time in weeks of n days each and years of 365 solar days.
2) At the end of a period S = 4n years (which we will call auxiliary century from now on) we add n days
3) At the end of a period of C = 128n years, that is 32 S, the n days are NOT added.

Whatever the value of n, at the end of a cycle of n128 years we would have the same astronomical situation that we had at the beginning (if it was a solstice it would be again a solstice). Besides, every cycle C will have a round number of weeks and years.

A small inconvenient of this (and whatever other) calendar is that the solar year cannot contain a round number of weeks (unless we put n=1). Easy to remedy by adopting, besides an auxiliary century, also an "auxiliary year", T, with a round number of weeks and a fixed ratio with the solar year within an auxiliary century.

If we adopted the natural unit of time, U, the most natural choice should be that of dividing the year in 18 months of 20 days each, plus 5 final days, and adopting an auxiliary year of 20 weeks of n days each. We would have, therefore, a family of 18 calendars, summarised in the following chart, all with the same properties and characteristics:

n (days) length of the week	**T = 20 n** (days) length of the auxiliary year	**S = 4 n** (solar years) length of the auxiliary century	**C = 128 n** (solar years) length of a complete cycle
1	20	4	128
2	40	8	256
3	60	12	384
4	80	16	512
5	100	20	640
6	120	24	768
7	140	28	896
8	160	32	1024

9	180	36	1152
10	200	40	1280
11	220	44	1408
12	240	48	1436
13	260	52	1664
14	280	56	1792
15	300	60	1920
16	320	64	2048
17	340	68	2176
18	360	72	2304

The following relations exist between the solar and the auxiliary year:

1) 360 x 4n = T x 72
2) 72T + (5x4n) +n = (72+1)T + n = 1461 n = (360 + 5) 4n + n

Relation 2) expresses the number of weeks of each auxiliary cycle (with the exception of the 32nd , which is one week shorter).

1,461 is known as the "sothic" number (from the Egyptian sothic period of 1461 years). It is the number of days in 4 Julian years (365.25 x 4= 1461) and represents a recurring figure in this family of calendars; an auxiliary cycle contains 1461weeks and 20 auxiliary centuries contain 1461 auxiliary years.

A complete cycle of 128 n years contains (1,461x32)-1 = 46,751 weeks, which is another characteristic figure of these calendars, because it's the number of solar days contained in 128 tropic years.

It's quite evident that the central America's calendar belongs to the family of calendars described by the above chart, precisely that one with a week of 13 days. Whatever other length of the week would give place to a perfectly similar calendar, with exactly the same "magic" intertwine of numbers, due to relations 1) and 2), and with the same characteristic figures.

The perennial astronomical clock

It remains to understand, now, why an advanced civilisation should have invented a calendar apparently so complicated. It is quite simple and rational.

The above family of calendars is very interesting not only for its precision, for the elegance of its structure, the impressive intertwine of numbers and the many possibilities that it offers, but also for the fact that it is characterised by a week which rolls indefinitely and is a sub multiple of both the auxiliary year and the auxiliary century. The solar year and the auxiliary year are in their turn submultiples of the auxiliary century. Therefore there are precise relations between all of these units.

This allows to make an astronomical "clock", valid for whatever length of the week, easy to use, and capable of keeping indefinitely the synchronism with the solar year. Not only: the same clock is a sort of perennial almanac, that keeps under control and represents in a very compact way all the astronomical magnitudes of some interest, from the hour of dawn and sunset, to the count of days, weeks and years, solar and lunar eclipses, movement of planets and constellations of the zodiac and so on.

Clock-almanacs of this type, in fact, have been carved on stone several times in pre-Columbian Mexico. In all likelihood they reproduce the front side of some mechanical devices, kept with the utmost care as sacred objects by the priestly class.

Of course this is only an hypothesis, as there is no information about the finding of one of such devices (which is most improbable, because either they were hidden in very secret caches, or they were destroyed by the Spaniards), that could prove beyond doubt this claim. But it can reach a very high degree of likelihood when we consider the process of making a clock based on this family of calendars.

The solar day

The basic mechanism is made up by a central disc, which represents the "sun", that is a solar day, with (at least) one hand that makes a complete turn in one day. Something similar to a modern clock, with hands that measure hours, minutes and seconds. With an important difference, however. In most central America's representations this central disc is divided in two parts by an horizontal line, which "obscures" the upper side of the disc (see following pictures).

The meaning of that line looks clear. Today's almanacs report for each day the hours of the dawn and of the sunset for a certain latitude and longitude. It's an information of great interest in everyday life, but none of the modern clock is able to provide it. And yet it's very simple to do it and very practical.

Let's see how. We divide the clock-face in 24 hours instead of 12. We fix a reference latitude and longitude. In this way a simple horizontal line will indicate the hour of the dawn (on the right) and that of the sunset (on the left), for that particular latitude and longitude. On the upper side of the line it's night, on the lower day light.

Malinalco

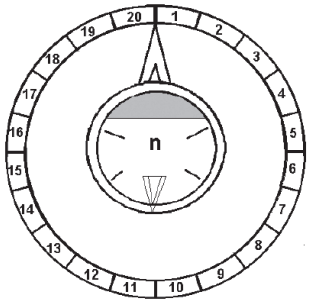
Acalpixcan

An ad hoc algorithm will move day by day the line up or down, according to the season, to maintain the synchronism with dawns and sunsets.

It's an extremely simple mechanism which would allow us to know day by day, with just a look, everything about the movements of the sun and the hours of darkness and light. Information that today is provided only by very detailed almanacs.

The auxiliary year (tzolkin)

The clock is based on relations 1) and 2) and therefore there is little choice on how it can be realised. The basic mechanism is a central wheel counting the hours of the day. An outer ring counts the days of the week, completing a full turn every week. The number of partitions of this ring varies according to the length of the week, selected with an ad hoc regulation. The same clock, in fact, works properly for whatever length of the week, that can be changed at will.



What does not change is the ring outside, divided in 20 parts, along which two hands are moving, one long and one short. The long hand counts the days and moves forward one step every solar day. The short hand counts the weeks and moves forward one notch every time the inner wheel has completed one week.

A complete revolution of the long hand equals 1 months of 20 days.

A complete revolution of the short hand equals 20 weeks of n days, that is 1 auxiliary year (T=20n).

Due to relations 1) and 2):
- the long hand completes 73 (72+1) revolutions every 4 years of 365 days.
- the short hand completes 73 (72+1) revolutions every auxiliary century, that is 4n years of 365 days.

At the end of the auxiliary century the two hands will be aligned on the zero, having the long hand made n more revolutions than the short hand. At this point, in order to re-phase the calendar with the solar year, n days, that is one week, must be added. This can be achieved in different ways; for example by stopping the hands for one week and rotating counter-clock-wise the ring of the 20 days. The new auxiliary century therefore begins with both hands on box n of the ring which becomes the new reference zero.

Notice that in this way 20 successive auxiliary centuries would be characterised by a different initial day, and each year of the n groups of 4 years of the century would begin always with the same day. So each one of the 20 centuries would be characterised by a different group of four days, which begins in turn every group of four years. It's only one of the many interesting characteristics and possibilities offered by this calendar.

The same operation is repeated for 31 auxiliary centuries (of 4n solar years each). At the end of the 32nd the mechanism will restart a new complete cycle of 32 auxiliary centuries, without the addition of the usual extra week. And so on indefinitely. At the end of every cycle we would have the same astronomical situation with regard to the sun.

The Counters

It is a simple mechanism, which provides all the magnitudes necessary to keep under control the flow of time:
— number of hours and days
— number of months of 20 days (revolutions of the long hand)
— number of auxiliary years of 20 weeks (revolutions of the short hand)

With these elements we can, by means of ad hoc counters, visualize all information of some interest in a calendar.

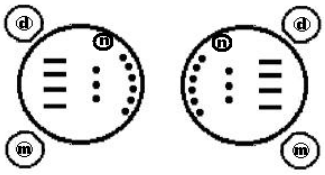
Let's see what they could be.

First, the actual date, that is the day of the month in the solar year and the day of the auxiliary year. They could be shown at the sides of the central mechanism on four small windows, two for the solar date, two for the auxiliary date. Then we have to position these dates in the calendar, counting the time elapsed since a starting date. Due to the use of an auxiliary year it becomes natural to first positioning the day inside the auxiliary century of 4 n auxiliary years. This inevitably is obtained by partitioning that period in smaller periods. For example, in today's civil calendar we often add to the actual date the progressive number of the day and of the week, and we divide the year in quarters and so on. Same divisions can be done in a much more rational way in this new calendar, descending from the relations existing inside an auxiliary cycle. An elegant division is prompted by the fact that 4 solar years contain exactly 72 + 1 months of 20 days (72 months of 20 days + 4 x 5 days). 72 can be divided in many ways, for example by 4, 3 and 6, that is each of the four solar years could be divided in three semesters. The counter therefore would show the number of the solar year in the bunch of four, then the number of the semester in the year (1-3) and finally the number of the month within the semester (1-6). Finally there should be an indication positioning the group of four years within the auxiliary century (1, 2 ...n). In this way our day is positioned precisely with respect to the solar year within the auxiliary century.

Then we should position our day with respect to the auxiliary century, what can be done with a counter identical to the first one, due to the fact that one auxiliary century is made up by 72 + 1 auxiliary years.

The same counters can be utilised to count the number of the day within a group of four years, and the number of the week within the auxiliary cycle, since four years contain exactly 1,460 days ((72+1).5x4) and one auxiliary cycle 1,460 weeks (plus one only at the end, in order to maintain the coincidence with the sun).

Our counters would look more or less like the following.

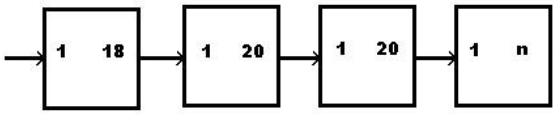


There is another information that is required from a "general purpose" calendar, that is the precise number of days elapsed since a starting date. This information is not really useful in everyday life, but it is essential for astronomers, historians and archaeologists. The instrument in use today for this purpose was provided by the French philosopher J. Juste Scaliger who on 1583 published the book "Opus novum de emendatione temporum", in which he established a "universal" calendar based

on the account of solar days since a particular date, which he chose to be the 1st of January - 4712 (Julian year) at midday.

This calendar is currently used by astronomers and historians to establish and compare the date of astronomical events (like eclipses, conjunctions etc) and historical events, comparing different calendrical systems. For example the Thompson correlation and all the others related to the starting day of the Mayan calendar are based on Scaliger's universal calendar.

The simplest way to count the days is through a series of registers connected to the long hand, which moves one position every day (from 1 to 20). A first register counts the complete revolutions of the hand from 1 to 18 (this number should be 20, but in this example we follow the same system of the Mayas), that is one year of 360 days. Once completed it starts again, while giving an input to the successive register, which counts from 1 to 20 years, for a total of 7.200 days. Its output goes to a third register, which counts 20 times the previous one, for a total of 144.000 days; and finally we have a register that counts n times the content of the previous one, completing a long cycle.



The total number of days elapsed since the start of the calendar is given simply by adding the content of each of the four registers and the number indicated by the long hand.

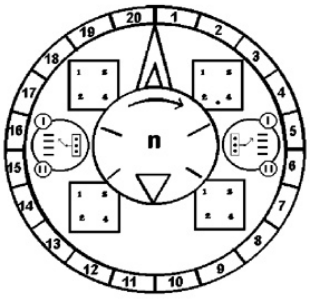
In this way the calendar provides a "short" count which gives the days, weeks, months and years within the auxiliary century (called by the Mayas the "calendar round") and regulates the entire life of the society, and a "long" count which gives the total number of days elapsed since the starting date.

The "long" count would divide the calendar into n periods of 400 years (of 360 days), each of them composed by 20 groups of 20 years and so on. A date of this calendar should report the day and the month of both the solar and the auxiliary year, together with the total number of days elapsed since the starting day of the calendar. This number is provided by the content of the different counters, exactly as in the following Mayan dates:

8 . 14 . 3 . 1 . 12 1 Eb 0 Yaxkin,
8. 11. 7. 13. 5 3 Chicchan 8 Kankin

The first date identifies the 1,253,912nd day of the calendar (8 baktuns, 14 katuns, 3 tuns, 1 month and 12 days) and the actual day of the solar and the auxiliary years. The second identifies the 1,233,885th day (8x144,000 + 11x7,200 + 7x360 + 13x20 + 5) and so on.

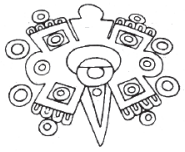
The central mechanism of our clock-calendar would therefore look more or less like the following:



In no way this is intended to be an interpretation of the precise meaning of the corresponding counters of the Aztec calendars. It's just an example to show what kind of information could be represented in the central mechanism of a calendar of this type and how it could be organised. Several representations of this mechanism have been found in Mexico and all of them show the same basic scheme; they should provide the same information about the solar and auxiliary years, although represented in different styles.

Sun Stone

Malinalco



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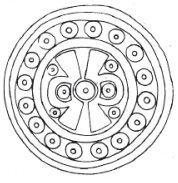


Xochicalco
(Morelos)

Teocalli

Xochimilco

Other astronomical magnitudes of the clock-almanac

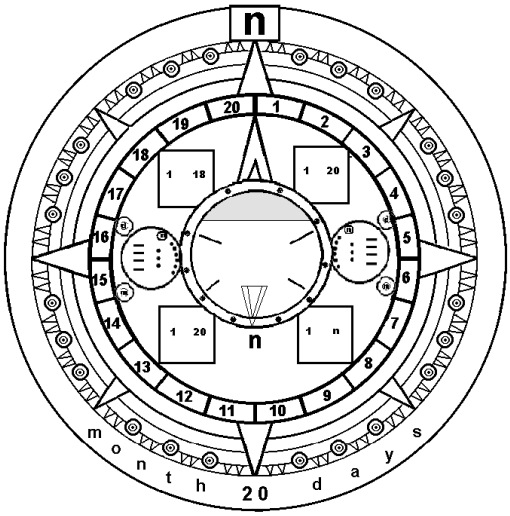
In our almanacs an information that is always represented is the phase of the lunar cycle, or month, with all that is related to it, that is solar and lunar eclipses.

Other elements are the movements of the sun in the zodiac, that is the signs of the zodiac, the movement of the planets and their synodic years, prevision of conjunctions, eclipses etc. All these information should be represented in our astronomical clock, so that we can have a complete vision of what is going on in the sky every day, and make prevision of future astronomical phenomena.

This information can be represented on external rings and windows around the central mechanism, that visualise astronomical and astrological phenomena and cycles which have a constant ratio with the solar or auxiliary years, like the position of the sun in the zodiac, the lunar cycles, the synodic years of the planets and so on. The precession too can be monitored, through a slow shift of the zodiac.

All of these magnitudes are independent from the length of the week, which however is the most important element in a calendar, because it has a major impact on the life of a society and determines the length of the auxiliary year and the auxiliary century (for example, a week of 8 days would determine an auxiliary year of 160 days and an auxiliary century of 32 years, instead of 260 days and 52 years for a week of 13 days).

The length of the week can be set and changed through an ad hoc regulator, so there must be on the clock the clear indication of the selected length of the week. The final aspect of our astronomical clock could therefore be the following.



Central American calendars

The aim of this long description is not to suggest a change to the civil calendar (unthinkable today), but to demonstrate the rational of the calendar used by Central American civilizations, Aztec, Mayas, Toltec, and Olmec before them. It was a calendar based on an auxiliary year of 260 days, divided into 13 months of 20 days (or in 20 weeks of 13 days), and on a century of 52 years. The solar year was in its turn divided into 18 months of 20 days + 5 end days.

It is evident that this calendar belongs to the family of calendars described above. We don't know what determined the choice of 13 as the length of the week. A likely reason could be that the auxiliary year of 260 days is well suited to keep under control some astronomical magnitudes, like for example the synodic year of Mars, which is exactly 260 x 3 = 780 days. The synodic year of Venus too, 584 days, has a round ratio with the solar and auxiliary years, as 584x65=260x146=365x104**,** (where 65 = 260/4). As a matter of fact, the Central American civilisations gave an enormous importance to the synodic year of the planets, in particular of Venus and Mars. Another reason why Venus was regarded as a very special planet could be the fact that 365/584=0,625= 80/128, which is a quite extraordinary coincidence.

A possible objection is that, according to most chronicles about that calendar (but not to all of them), there were no leap years. Most likely they added an entire week only at the end of every auxiliary cycle, as required by this type of calendar. They had the means to establish with precision the dates of solstices, which is proven by the extremely accurate alignments and the existence of gnomons in their temples. It's not likely that they ignored the shift of the solar year with respect to their calendar and didn't correct it.

At the end of each auxiliary century of 52 years, there was a delay of 13 days, that is exactly one week. These 13 days, added to the final unlucky 5 days of the year, formed an additional month of 18 days (like the number of the months in a solar year), which ended the cycle under the aegis of terror and death. It was the month during which, according to the traditions, the end of the world was expected. To avert this danger, the Aztec priests accomplished terrific slaughters. Thousands of prisoners were sacrificed, while the population remained barricaded in their houses, prey of terror. Those days were so inauspicious, that they were never named, neither accounted for: they didn't exist. No wonder that the chronicles of that period do not mention them.

Also the 5 days of the additional month at the end of each year, that was called by the Mayas "uayeb" (nameless), of which it was never found a representation, were considered non-existent. This is why the solar year was considered of 360 days.

There have been several attempts to explain the origin of such extraordinary calendar. But so far nobody succeeded in providing a likely explanation or finding out when and where it appeared for the first time. The only certitude is that it is very ancient and was used by the most ancient known civilisation of Central America. There is no trace witnessing a gradual evolution from a more simple structure, like, for example, in the Roman calendar. It starts from the beginning in its full capacity. On the contrary it seems that the capacity to utilize all of its initial characteristics and potentiality was gradually lost, due to a loss of knowledge for various reasons.

Who originated the central American calendars

It's quite evident that this calendar is based on the 128 years cycle and derived from the natural unit of time, U, which is the 80,000th part of a mean solar day. We have to assume therefore, that it was designed by the same people who originated that unit of time. People belonging to a technological civilisation advanced enough to measure the exact length of the synodic year.

Therefore they were certainly able to make astronomical clocks of the type so far described. For some reason this unknown civilisation has disappeared, but either directly or through survivors it transmitted its astronomical knowledge to the populations that started the ancient known civilisations.

We have to assume that the natural unit of time, U, and the second, were used by two populations, developed in the same cradle and belonging to the same cultural horizon, who wanted to differentiate from each other by means of two different calendric and numerical systems.

Evidently there had been immigrants or survivors, using the natural unit of time, that landed on the coasts of central America, thus originating, or influencing, the civilizations of that area. They must have had with them several astronomical clocks, of different complexity, from those very simple, providing only essential information in a plain way, to the most elaborated and artistic objects, with all possible astronomic information.

These objects had to be kept with the utmost care, but soon or later they had to stop working and most of them went rotten. Some of them, however, were regarded as sacred object and kept with extreme care and jealousness during a span time of several millennia. They were reproduced on the most important sites of the society, like the altars of the temples and the thrones of the kings, carved on the stone. That's why we have accurate images of them.

Probably the carvers did not know any more what was the meaning of the objects they were reproducing on the stone, and they did not understand the nature

of many of the indications of the object, either because it was corroded by time, or because they had never seen anything alike. In any case we have several representations of clocks of that type, some very simple and linear, others astonishingly elaborated. All of them, however, have the same basic structure, evidence that they all reproduce objects of the same category, with similar functions: clock-calendars.

The Teocally's calendar

One of the best kept and represented calendars is the calendar carved on a throne of the Teocally temple in Tenochtitlan. The central mechanism is quite schematic, with no representations of gods or animals. We clearly recognize the central clock, which indicates the day's hours, divided in day and night by a horizontal line. Outside there are two rings, one indicating the week, the other the 20 days month. And then the counters and registers organised exactly as in our example and in the large stone calendar that we'll see later. The outer rings represent astronomical cycles that we can only guess, surely connected with the moon, planets and zodiac.

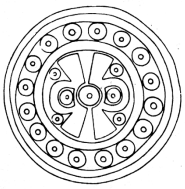
Teocalli
(Tenochtitlán)

The carver that made this sculpture was copying a real object, not just representing an abstract concept.

Objects of the same kind were reproduced in several places (the essential part being the central clock with its counters).

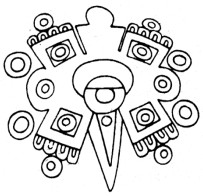
All of them present the same basic design of the central mechanism. They had to provide the same information.

Malinalco



Xochicalco (Morelos)

Xochimilco
(Distriti federal)



Acalpixcam

The Aztec Sun Stone

The most beautiful, elaborated, complete and artistic representation of an astronomical clock was carved by the Aztecs a few years before the arrival of the Spaniards, discovered only on December 1790, buried in the "Zocalo" (the main square) of Mexico city.

It is known as the Aztec Calendar, or the Sun Stone, a huge monolith, with a diameter of 12 feet, a thickness of 3 feet and a weigh of 25 tons, an amazing indication of the importance of the object that it was intended to reproduce.

The Sun Stone

First, we note, at the top of the disk, in all evidence, the number 13, that establishes the length of the week and, as a consequence, the length of the auxiliary year (called Tzolkin by the Mayas). In the middle it's clearly recognisable the mechanism of the astronomical clock, with the "god" sun right in the centre, representing the hours of the solar day and the days of the week. Two hands, long and short, point to a first external ring, divided in 20 section, one for each day of the month of the auxiliary year. Around the central clock there are counters and registers that show the relevant information about the actual date in the short and long count. Outside the ring with the 20 days of the month there is another ring divided in 40 rectangles, each with 5 units inside. We have therefore 200 units, that might represent the 200 synodic years of Mars contained in 600 auxiliary years of 260 days.

The successive ring is divided in 8 sectors, each one containing 10 divisions. It might indicate the 80,000 years of a great cycle (128 x 625), or the 80 synodic years of Venus contained in a cycle of 128 solar years or some other astronomical magnitude of some interest. For example, if we suppose that the ring represents a cycle of 1664 (32 x 52) years, each of the 80 divisions represents a period of 20,8 years, that is exactly 13 synodic years of Venus, a figure quite significant, coincident with the "scale" of this calendar.

The successive ring is divided in 32 sector and the final one in 64, both numbers related to the 128 years cycle. Very interesting is the symbol that appears six times on the external ring, a sort of rectangle with five units inside and 3 notches on top. It might represent magnitudes related to the lunar cycles, like for example the 3 x 33 lunar months and 5 Venus' years contained in 8 solar years.

Then there are 12 animal-like figures, that could represent the 12 signs of the zodiac. The final band contains 20 sections, each with 5 notches ; possibly some magnitude related to the long count.

Of course, these are only wild guess, or better simple examples of what could be the information provided by the various sections of the clock. Most probably even the Aztec priests were no more able to understand all of its details. In any case it is quite likely that the Aztec carver had faithfully reproduced, almost like in a picture, a real mechanic object, to the point that we could make an astronomical clock perfectly functional, identical to the representation of the Sun Stone. All we have to do is deciding what information we want to provide in its various windows and rings.

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