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In the Jaws of Time: First Reflections of Episodic Memory in Human Beings

Keywords: episodic memory, modern humans, Palaeolithic ornaments, Palaeolithic burials

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Introduction

Human beings are characterized by different types of memory. In identifying the difference between modern humans and extinct human species, episodic memory is of particular interest. Together with the semantic memory it forms a declarative memory (Šešok, 2006). Episodic memory is important because it makes possible mental time travel, which enables us to remember our personal past and plan for our personal future. Such memory probably did not completely evolve until the appearance of Modern humans. Together with language, it distinguishes us from animals and extinct human species (Suddendorf, Corballis, 1997, 2007; Gardiner, 2001; Tulving, 2005). In Palaeolithic archaeology the most obvious evidence of episodic memory are permanent ornaments, art and ritual burials. All of this only flourished with Modern humans in the Upper Palaeolithic, although some rare flashes might have also been known in the earlier human species, especially in the Neanderthals.

Episodic memory

Episodic memory can be roughly equated with autobiographic memory, which refers to the past experiences, remembered as personal and related to a specific time and place. Meanwhile, the semantic memory, which people share with some animals, is not associated with time and is not bound to autonoesis. It enables us to realize that something has happened, but it does not allow us to remember when this event was (Tulving, 2005). Only beings who have episodic memory can recall past events, because they are capable of a mental time travel (Gardiner, 2001, 1351). Episodic memory offers us autobiographical information about our personal past, and because of that provides the basis for the emergence of our personal identity and autonoetic consciousness (Petru, 2016, 12).

Because of the episodic memory we remember our personal past and can consciously recall it. Through the memory of important past events we are constructing awareness of our existence in the past, and due to the ability of mental time travel we can also project our mind toward the future. We are able to plan what we would like to happen in the future, and we try to direct our energy toward that goal.

If people have common memories or common plans for the future, they can form strong connections, even if they are not related. If we have experienced something important with someone, we can assume that this person also remembers it. Therefore, a large part of the human conversation consists of a shared recollection of the past events. Common memories are the basis for a large and complex social network that goes beyond the family ties and is typical of our species (Petru, 2016, 15; see Suddendorf, Corballis, 1997, 137).

Both animals and humans have the ability to be aware of the world in which they live. They both are also able to know that some things have happened in the past. The basic difference is that animals just know that something exists in their world, while human beings remember that they have personally experienced something in a certain place and at a certain time (Petru, 2016, 14; see Tulving, 2005, 40–42).

Owing to our improved cognitive abilities, we humans have mentally distanced ourselves from animals so much that we have difficulty to figure out what is happening in their minds. However, experiments suggest that some animal species may have a memory that resembles human episodic memory. Because of this similarity, it is called "episodic-like memory". It is likely that in those animals the memory of the personal past events is developed to a certain extent. Such knowledge of the past helps them to decide how to plan their future activities. This was observed in western scrub-jays, which during experiments learned to consume cached food according to how perishable it was. They ate worms quickly, and saved more durable nuts for later occasion. It seems that they remembered when they stored the food, since they first ate the worms which had been cached earliest, and then continued eating according to the age of the cache. This behaviour convinced the researchers that western scrub-jays' memory can be at least partially comparable to human episodic memory (Clayton et al., 2003). Apes and dogs might also have episodic-like memory (Martin-Ordas et al., 2010; Fugazza et al., 2016).

It is likely that such or an even more advanced form of memory already existed in early humans, and that there was at least a potential for the development of what is now called an episodic memory. The ability of mental time travel, or chronesthesia, was probably evolving together with episodic memory, and it gradually became an increasingly complex component of human thinking.

It is difficult to determine when exactly episodic memory and chronesthesia developed. Planning of future actions represents the beginning of an awareness of time, but it does not necessarily prove the presence of an episodic memory, since semantic memory can be sufficient for planning basic actions, which do not involve autonoesis. The first signs of planning in human evolution occurred when people did not produce tools only where the suitable raw material was present, but they started to carry the raw material with them for future use. Such orientation towards the future appears early in human evolution, and was one of the necessary conditions for the development of technology and perhaps also for the development of mental time travel.

Complex language is an ideal tool for sharing information, so the evolution of such language "might be connected to our ability of mental time travel and the desire or even need to share our personal memories and experiences with others" (Petru, 2016, 16). Today, modern apes held in captivity are able to communicate with symbols, but they use them just to fulfil their wishes. Complex language is not required for such simple communication, so apes and possibly also the earliest human species did not have the need for it. On the other hand, humans want to inform each other not just about wishes, but also about a lot of other things, such as physical and mental states and expectations. Through verbal communication we also transfer knowledge to others. In doing so, we adapt to the people we are talking to and try to understand them (Tomasello, 2014, 105–106). As Dunbar (2016, 18–19) suggests, story-telling, along with religion, is a cultural aspect that is present only in humans and not in other species.

In his book *The Descent of Man*, Darwin well described the consequences of episodic memory, when he denotes man as a moral being who is separated from animals mainly by contemplating his past actions and evaluating them as positive or negative (Darwin, 1951, 97). Siberian Yukaghirs have a similar opinion about morality. They believe that the devil has no sense of the past or the future, so lives only in the present. He is therefore careless and incapable of taking responsibility for his actions (Willerslev, 2007, 92). Beings who live only in the present also do not have any need for rituals in order to provide security and a better life in the future (Petru, 2012, 274). Chronesthesia allows human beings to think about past and future events, what eventually led to the emergence of metaphysical concepts such as fate, supernatural, the origin and the meaning of life (Petru, 2016, 16). The basis of most religions are stories that describe the rules of behaviour in the community and what are the advantages if these rules are taken into account, or what is the punishment if the members of the community oppose them. In addition to moral principles, powerful ancestors and supernatural beings who laid down these principles also appear in such stories. Occasionally, some individuals with life experiences exceeding the average

have probably appeared in human groups. If such experiences were transformed into stories that were retold over the course of several generations, these individuals were eventually changed into "superhumans", from which ancestoral beings or possibly even beings with supernatural abilities could have developed.

Faith connects people who perform the same rituals and have the same beliefs. In the Palaeolithic joint experience of emotionally powerful rituals, accompanied by music and dance, which took place in unusual spaces, such as painted caves, together with the regular renewal of the memory of these events, connected the participants on emotional and mental levels. Such connections among people enabled the creation of wider communities, whose members were willing to cooperate with each other.

Animals also became part of the supernatural world, because they had an important role in the lives of Palaeolithic hunters, who had to be well aware of their behaviour and properties for survival. Because of skill, power, or other enviable qualities, animals became special beings in the human imagination and their stories, and sometimes even merged with man into beings with mixed identities or therianthropes, as known from Palaeolithic art.

Vision is the most important human sense, and because of that not only verbal but also visual communication is very significant to us. Together with the evolution of a complex language, the need for lasting visual communication, nowadays called "Palaeolithic art", also appeared (Figure 1). Such lasting communication can be transmitted from generation to generation, but it needs episodic memory for its existence, since this enables the stories that such communication transmits to become part of the collective memory.

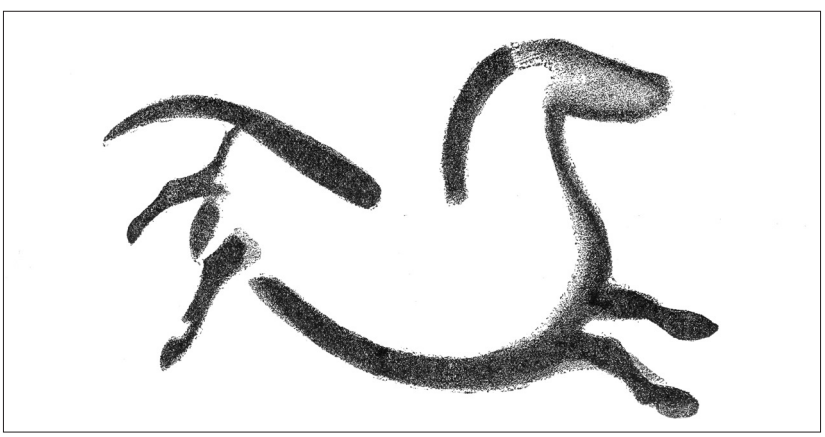

Figure 1: Palaeolithic parietal art: Breuil's depiction of a horse from the Spanish cave Altamira (Kühn, 1922, p. 44).

Creation of permanent "art" is one of the fundamental characteristics that separates us from other beings. Through "art" the Late Pleistocene people were able to record their knowledge for other people and future generations, who did not have physical contact with the creators. Modern humans are the only creatures who have begun to record their life stories for the future. No animal does this, and even for extinct human species there is little evidence of such activity. Perhaps the abstract signs accompanying images of animals on cave walls are the first attempts at writing, the abstract form of communication that connects people who are temporally and spatially distant.

However, the ability of a mental time travel also has its negative side. Since our mind is focused on constant time travel we must "force" ourselves to be here and now – that is, to live in the present. For such state of mind, which is normal for other beings, we have to make an effort to interrupt the constant flow of thought in our brains in order to relax. That might be the reason why humans have developed under certain conditions the ability to experience altered states of consciousness. In such states of mind it is possible to turn off the constant reflection on the past or the future. "Since those moments rarely happen, they are in some ways 'magical' and might therefore be one of the foundations for the emergence of faith in the supernatural." (Petru, 2016, 17)

Activities that could be reflection of episodic memory in the Upper Palaeolithic, or maybe even earlier, are production of jewellery and ritual burials.

Jewellery

Jewellery could initially have been an instrument used to increase the effect in display of physical power (Kuhn, Stiner, 2007, 42), and only later did it become a form of decoration that gained an important social role. Neanderthals may have decorated the body with bird feathers (Peresani et al., 2011), pigments and shells (Zilhão et al., 2010) or with bird of preys' talons (Romandini et al., 2014; Radovčić et al., 2015) to increase their body volume and become more threatening in their encounters with others. But mostly their jewellery was not durable, and after it had served its purpose was rejected and disintegrated quickly. It was different with the jewellery of Modern man. Along with his expansion around the world, durable jewellery began to appear around 40,000 years ago in the archaeological record of all inhabited continents (Kuhn et al., 2001; Balme, Morse, 2006, 802, 805). At that time jewellery became part of the material culture, which was then transmitted from generation to generation (Bouzouggar et al., 2007, 7642). People began to use mollusc shells as well as teeth, mammoth ivory, bones and soft rocks to decorate their bodies (Figure 2).

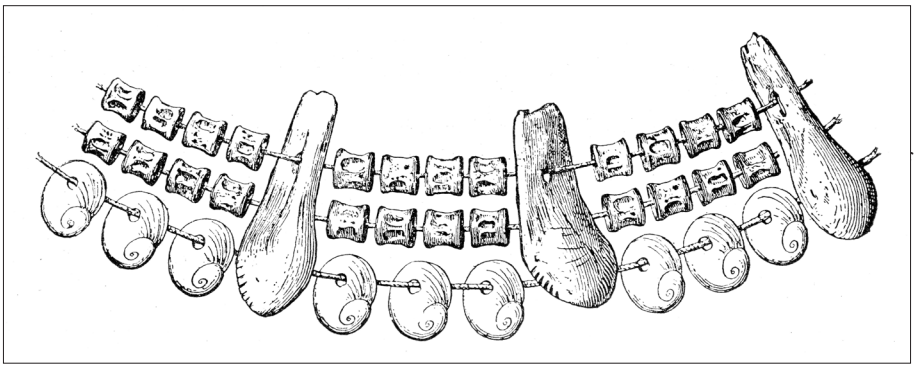

Figure 2: An Upper Palaeolithic necklace made from durable materials: marine molluscs, fish vertebrae and deer teeth. Barma Grande, Italy (Macalister, 1921, Fig. 89).

Burials

Burials are a typically human behaviour, but reactions to death are already known in animals. Signs of mourning at death have been observed in apes (Pettitt, 2011, 11–40), as well as in other animals. According to some researchers, the first burial practices appeared around 400,000 years ago in two caves with similar finds – Rising Star in South Africa and Sima de los Huesos in Spain (Berger et al., 2017; Arsuaga et al., 1997). In both sites, a large collection of fossil bones belonging to archaic humans was found in small, hard-to-reach chambers. Due to the abundance of fossils, it was suggested that in both caves human remains represent intentional, perhaps even ritual burials (Carbonell, Mosquera, 2006; Dirks et al., 2015). Other researchers call for caution and suggest there is a possibility of natural accumulation of bones in both sites (Val, 2016; Egeland et al., 2018).

Some of the Neanderthal burials are more convincing, but even in the case of Neanderthals it cannot be accepted without reservations that they buried their dead (Petru with references, 2016, 70–75). There is no unambiguous evidence that their burials included grave goods, which would convincingly demonstrate their faith in a life after death, in which the dead person would benefit from such goods. If Neanderthals buried their dead it was probably an momentary action, one that was the result of an emotional shock caused by the loss of the group member. Bodies of the dead might also be buried solely for hygienic reasons, or in order not to attract predators and not because of a belief that personal identity would survive after death, which would indicate the existence of an episodic memory and personal time that persists even after death. A deliberate burial could be a proof of time awareness, but grave goods could

present much more convincing evidence of thinking about the future and life after death (Tulving, 2005, 45). With the evolution of episodic memory, the dead did not represent just bodies, but turned into ancestors with power to influence the living from the afterlife. The past thus began to have a powerful influence on the present (Petru, 2016, 18).

Th first undoubted burials with grave goods started to appear in Europe after the arrival of Modern humans. They have been found mostly in the Gravettian and Epigravettian (Riel-Salvatore, Gravel-Miguel, 2013, 325). The Gravettian burials are concentrated mainly in two areas, in central Europe and Italy (Figure 3), but a few of them appear elsewhere in Europe too. They are characterized by rich grave goods. From the Upper Palaeolithic, jewellery made from human teeth (Le Mort, 1985) is also known, which suggests that parts of the human body might have been transformed into relics.

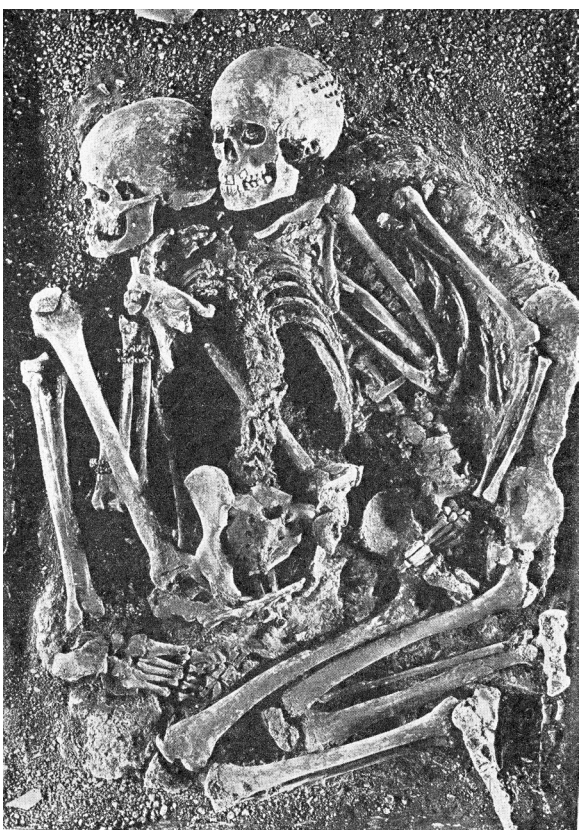

Figure 3: Double Upper Palaeolithic burial with grave goods from the Italian site Grotta dei Fanciulli (Osborn, 1916, Fig. 133).

"The rarity of the ritual burials indicates that they were not the main practice for removing the body. Perhaps they were reserved for those who were for various reasons 'special' during their lifetimes (Formicola et al., 2001, 378), while the bodies of 'normal' persons" did not get such attention. (Petru, 2016, 100) A number of skeletons, especially skeletons from graves with grave goods, are deformed or otherwise damaged. One of the skeletons of the famous triple burial in the Czech site of Dolní Věstonice is so deformed, for example, that it is difficult to determine anatomically what was the gender of the deceased person (Formicola et al., 2001, 372). Similarly, rich grave goods that point to a special, ritual treatment, are present in the grave of a young man from the Italian site of Arene Candide, who died of severe injuries to his lower jaw (Mussi, 2001, 257).

The need for special posthumous treatment of people who had been wounded or mutilated, indicates a belief that the dead might harm the living if they are not appropriately "removed" from the world. It seems that in the Upper Palaeolithic people were thinking about the influence of the dead on the future of the community which reflects their ability of mental time travel. In addition to the social significance of consolidating the ties between members of the community, rituals probably also had a psychological impact – they relieved the fear of the future, since people had the assurance that at the time of their death the rest of the community would provide for their safe transition to the afterlife with an appropriate ritual.

Manipulation with human relics also reflects the revival of the memory of the deceased and the desire to preserve their identity. One of the most interesting occurrences of Palaeolithic relics and human manipulation with them are 14,700-year-old artificially modified skulls from the English site Gough's Cave, which were probably used as skull-cups (Bello et al., 2015). After consuming the brains skulls were not simply discarded, but were modified into useful objects, which probably also had symbolic and sentimental value, and reminded the users of the deceased. Modified skulls were also found in other Western European sites of similar age (Figure 4a, Figure 4b), which suggests that the practice of transforming skulls into skull-cups was widespread in a larger area, rather than tied to only one site.

Conclusion

It is not well understood why episodic memory evolved, but because of it we are able to remember what happened to us and can relive past experiences. This makes it easier for us to plan for the future, since the past, which is experienced as personal, enables intense learning, and therefore easier imagining of different scenarios for future actions. Such imagining ensures more safety, since various scenarios could be processed mentally, without the need to physically gain experience and knowledge in certain situations.

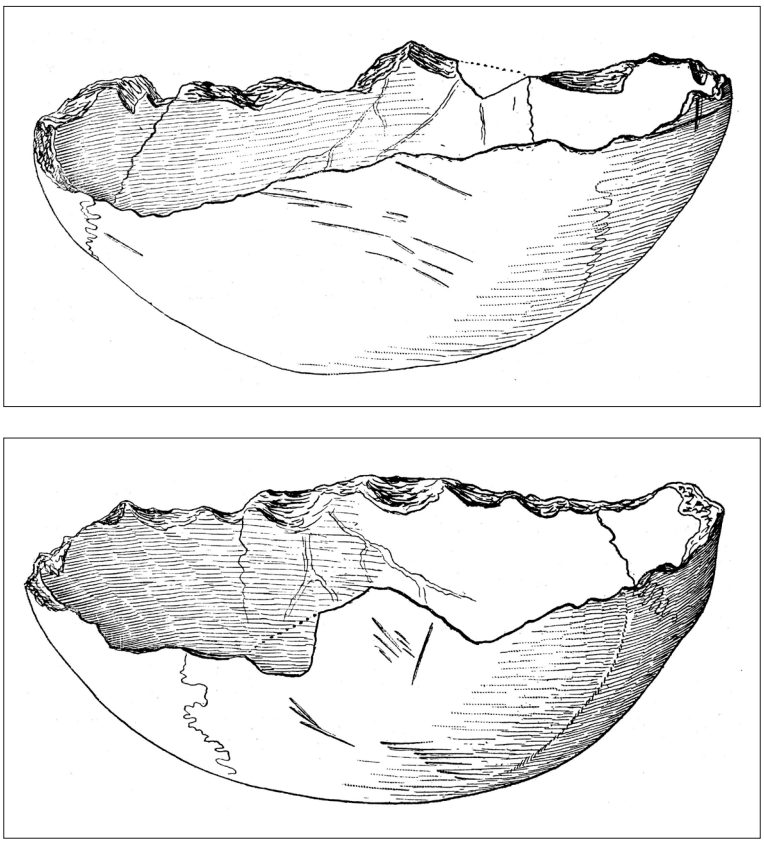

Figure 4a, Figure 4b: A skull from the French Upper Palaeolithic site Placard which was modified into a skull-cup (Macalister 1921, Fig. 113).

With the development of mental time travel a window opened up into the personal future, and with it came the knowledge about the transience of human existence. With awareness that life is terminated by death, the fear of loss of the personal identity, which death entails, arose. In order to overcome this fear of annihilation, people began to think of death as a transformation that enables the continuation of some sort of life even after death. Early evidence of personal identity that continues after death might be a find in Border cave, where a 74,000-year-old skeleton of a child was found together with a shell that had traces of colour on the surface (d'Errico, Backwell, 2016). It is possible that the shell was a personal object, which would have served the child in the afterlife. If it was a grave good, it indicates that those who put it in the grave thought about the child's future and tried to ease his transition from the world of living to the realm of the dead. The child therefore had an identity and also an expectation of a personal future in the afterlife.

The fear of death may have dictated some of the funeral practices that appeared in the Upper Palaeolithic and were focused primarily on the special, ritual burial of people who deviated from normal, and therefore may have provoked unease in others. Because of the fear that the deceased might want to harm them from the afterlife, other members of the group performed rituals at the time of the death of such a person. Rituals were supposed to ensure that the dead are placated and that their defects would not spread to the living.

Episodic memory has greatly changed human perceptions of time and the environment. It enabled mental time travel and made us remember in a personal way the experiences that happened to us in the past. It also might be one of the important reasons for the development of complex language, because people wanted to share what happened to them with others. Because of episodic memory and language Modern humans became an extremely communicative and interacting species and invented technology to communicate not just with people in their immediate vicinity, but also with others all over the world. That is something utterly unthinkable for other beings.

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Simona Petru

V zobeh časa: prvi odrazi epizodičnega spomina pri človeku

Ključne besede: epizodični spomin, moderni ljudje, paleolitski nakit, paleolitski pokopi

Spomini na osebno preteklost se nam zdijo nekaj samoumevnega, saj določajo našo identiteto in vsaj deloma tudi naš značaj. Takšno dojemanje preteklosti nam omogoča dobro razvit epizodični spomin, zaradi katerega lahko mentalno potujemo v osebno preteklost in si zamišljamo svojo prihodnost. Živali te oblike spomina nimajo ali pa je pri njih precej slabše razvita kot pri ljudeh. Če sklepamo po arheoloških najdbah, se je epizodični spomin do današnje oblike razvil razmeroma pozno v človeški evoluciji, šele s pojavom modernega človeka. Arhaične človeške vrste za seboj namreč niso pustile materialnih ostankov, kot so obstojni nakit in nedvoumni ritualni pokopi, ki bi odražali moderno dojemanje časa in željo po ohranitvi osebnih spominov iz generacije v generacijo.

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Memories of the personal past seem to be something natural for us, because they determine our identity and, at least partly, our character as well. Well-developed episodic memory, which enables us to mentally travel into our personal past and imagine our personal future, makes such perception of the past possible. Animals probably do not have this form of memory, or it is much less evolved in them than it is in humans. Archaeological finds suggest that in human evolution episodic memory evolved to the present extent relatively late, probably not until Modern man emerged. Such a conclusion can be made because archaic human species did not leave behind any material proofs, such as lasting jewellery and unambiguous ritual burials that would reflect the modern perception of time and desire to preserve personal memories.