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Language Genesis*

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Abstract

Language is a specifically human mental function, although some neurobiological adaptations associated with communication can be found in other primates, in other mammalian orders, and even in other kinds of animals (*evolutionary trend*). Exposure to language is necessary for its acquisition (*culture*), there are specific alleles of some genes for human language (*gene*), and the brain circuits for language are mainly lateralized towards the left hemisphere (*brain lateralization*). However, some data suggest that the crucial factor for human verbal language, which originates in childhood in both, ontogeny and phylogeny, must be of motivational nature, and have at least the same importance as other genetic, brain or cultural factors. So, this article proposes that language was promoted by the building of love, and that it was maintained by hominid women as proto-language during some hundreds of thousands years through the maternal-filial interaction, until the first permanent settlements of the current human species, between 40,000 - 10,000 years ago. Also, that it was then when the woman transmitted speech to the man (it is further suggested that this may have been the *Original Sin* of the biblical *Genesis*), signalizing this transmission with the beginning of the symbolic thought, thus promoting the first artistic displays, like sculptures, painting or music, which were associated with the expansion of love and speech to the relationship between the sexes, with the consequent diversification of languages, mainly in the last 10,000 to 5,000 years. Love caused and causes human speech in both, phylogeny and ontogeny.

Keywords

Love, Language, Language Origin, Language Evolution

1. Introduction

The **debate on the origin of language** has never been more alive (Haak et al., 2015). The new findings and theories from a number of disciplines provide sufficient arguments to all perspectives, although, paradoxically, seem to be radically opposed to each other (Dor et al., 2014; Dunn et al., 2011; Hauser et al., 2002; Hauser et al.,

*To Cristo Santana Pérez (1966-1999), young psychobiologist and friend, in memoriam.

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2014; Pinker, 2004; Pinker & Jackendoff, 2005; Yang, 2013).

There is plenty of evidence supporting the different theories about the causes of human language: some emphasizing a more **innate** (Bickerton, 1966—a language bioprogram, Fitch et al., 2005; Wexler, 1990) and some the more **cultural**—for example, socio/perceptual/ecological (Zukow, 1990), functional (Dent, 1990) or based in general learning processes (Christiansen & Chater, 2008)—perspectives.

However, from the current understanding of the effect of interaction between genes and environment on mental functions, especially since the discovery of the FOXP2 gene beginning this century (Fisher et al., 1998; Lai et al., 2001), and other genes already associated with language (Ocklenburg et al., 2011, 2013; Pinel et al., 2012; Graham & Fisher, 2013), it seems evident that the search for the origin and cause of language—perhaps from a "comparative biolinguistic" (Benítez-Burraco & Boeckx, 2014)—should be fully integrated into a comprehensive explanation—a necessity in interdisciplinary collaborations (Christiansen & Kirby, 2003)—, of the origins of the humanity. Really, **the main question** is "*where do human minds come from*?" (Deacon, 1997) or, in other words, "*What makes us human*?" question proposed by Calcagno & Fuentes (2012), and with several answers from outstanding authors (in the *Journal of Evolutionary Anthropology*, 21, 183-194).

Excellent short reviews about some hypotheses on the evolution of language include those of Lindenfors (2013) and Deacon (2010), between others. Kuhl's (2000) work perfectly explains the main points of **consensus**, while Hauser et al. (2014) meticulously summarize those major **remaining issues**. About the genetic continuity in animal communication, see Graham et al. (2015).

This article proposes that **language was promoted by the building of love**, and that it was *maintained by women as proto-language during some hundreds of thousands years* through the maternal-filial interaction, until the first permanent settlements of the current human species, between 40,000 - 10,000 years (kyr) ago. Also, that *it was then when the woman transmitted speech to the man*, signalizing this transmission with the beginning of the symbolic thought, thus promoting the first artistic displays, like sculptures, painting or music, which are associated with the expansion of love and speech to the relationship between the sexes, with the consequent diversification of languages in the last 10 to 5 kyr.

So, the evolutionary **prolonged ecstasy among the emergence of our species and the spread of linguistic families may be explained**, as well as the close relationship between language and childhood, the almost simultaneous start of all arts about 40 kyr ago, the development of certain lithic industries associated with new diets, and numerous genetic and gender peculiarities relating to language. Even, the time elapsed between the first signs of art and the spread of Indo-European languages, identified by the spread of love and language between the sexes. All these aspects, and others, are discussed in the following sections.

2. Love Caused Human Language: Some of the Reasons

Supported by other proposals (Falk, 2004; Sheridan, 2005) of the emergence of language in the mother-child relationship, **here, love is the direct cause of human language**. In addition, this proposal fit those characteristics—brain, genetic, anthropological, cultural, and diet—, that have been associated with language, and which are discussed in the next points. Although other factors usually considered—tools, hunting organization, violence, sex, distribution of roles, etc.—have been essential in the development of language *after its emergence* and in the subsequent human evolution, in this article a central role of love and women in the emergence of human language is proposed.

2.1. There Is an Evolutionary Trend towards Communication

The evolutionary trend for human language may be based on a variety of evidences, for example, in the heritability of language delay (Dale et al., 1998), as well as in some **brain asymmetries** associated with communication. Some genetic factors responsible for subcortical brain structures are beginning to be known (Hibar et al., 2015), although a recent genome-wide-association study did not found common genetic variants for individual differences in receptive language of 12-year-olds (Harlaar et al., 2014). It is known that interhemispheric asymmetry in human temporal plane, which is also found in the brains of chimpanzees (Taglialatela et al., 2007), is an anatomical substrate of language which was as already lateralized in the common ancestor of chimpanzees and humans, about 8 million years ago (Gannon et al., 1998).

Together with the finding of similar brain asymmetries in birds (Moorman et al., 2012), other evidences suggest that the trend towards human communication can be placed even earlier. Many animals have shown outstanding communicative abilities—primates such as *Nim* (Hess, 2008), *Koko* (Patterson, 1987), *Washoe* (Fouts, 1998) and others, parrots as *Alex* (Pepperberg, 2000), prairie dogs (Slobodchikoff et al., 2009), dolphins (Herman et al., 1984), and others. In fishes, although a certain correlation has been found between sounds production and hearing abilities in some species—for example, *Trichopsis vittata* (Ladich & Yan, 1998)—, it appears to be less related to the optimization of acoustic communication (Ladich, 2000). Usually, the sounds produced by animals are not generated without being determined by an **emotional or motivational state**. Such must have been the cause of the sounds of proto-language, and the leading cause of early language development.

2.2. Emotions in Communication Are an Essential Requirement for Language Acquisition

The **rhythmic structure in the production of human language**, which seems to be universal across all cultures, independent of the particular language, might be found in ancestral primates, prior to the appearance of the evolutionary line of the human species. Tests on infants and monkeys revealed similarities in their perception of the prosodic cues of speech (Ramus et al., 2000). Detailed studies of the production of grimaces with the lips exhibited by monkeys support the suggestion that the rhythm of human language evolved from the rhythm of facial expressions of our primate ancestors prior to the separation of the evolutionary line that gave rise to the *Hominidae* (Morrill et al., 2012), and is currently placed in the Pliocene African hominoid *Ardipithecus ramidus* (Kimbel et al., 2014).

Also, it has been found that orangutan clicks and faux-speech confirm the importance of rhythmic speech antecedents within the primate lineage, and highlight potential articulatory homologies between great ape calls and human consonants and vowels, showing that **motoric control that great apes exert over their vocal structures**, both laryngeal and supra-laryngeal, may be much higher than hitherto presumed (Lameira et al., 2015). This should be also truth for earlier hominids.

Prosody is associated with **emotional communication**, which is the main cause of animal communication with sounds. In the initial human language learning in both, ontogeny and phylogeny, emotional and prosodic components are essential, more than grammatical and syntactical components. 4-day old newborns, e.g., discriminate the mother native language, according to their prosody—intonation and rhythm—(Mehler et al., 1988), which is also essential in emotional communication, as well as promoting language learning later at 6 moths (Shukla et al., 2011). Emotions and language learning are closely linked.

Intercultural studies show that, in adults, there are known gender differences in emotional control (Koch et al., 2007), and authenticity influences emotion recognition vs. play-acted (Jürgens et al., 2013), presumably based on acoustic cues (Jürgens et al., 2011) and on brain response differences (Drolet et al., 2012). This could account for the **importance of emotions in the learning of language** (Clément et al., 2013): they indicate the veracity of oral communication. Moreover, the language could have improved the inhibitory control of emotions (Jablonka et al, 2012).

Complex verbal language is not developed in species without emotional content to transmit but, on the contrary, those intense emotional states should have been **the main motive, if not the only one, to generate speech production.** Even in utero, exposure to language is an essential factor for its acquisition, mainly through prosodic components (Mehler et al., 1988; Moon et al., 1993; Moon et al., 2013; Shukla et al., 2011), perhaps stimulating several language brain circuits.

2.3. Emotional Brain and Language

The emotional component of language is prepared and deployed by the activity of a brain circuit constituted by the bilateral ventral striatum and its connections with the temporal poles—but with a preferential responsibility of the left temporal pole for naming, and a particular tie to semantic integration for the right temporal pole (Gainotti, 2007, 2011)—and the anterior insula. In contrast, cognitive and motor aspects of the **preparation and production of emotional prosody** are reflected more in the activity of the dorsal striatum (Pichon & Kell, 2013), which is also activated by beloved-related information that is attended (Langeslaq et al., 2014). The cortical activity of the right hemisphere in prosody may be limited to the posterior superior temporal sulcus (STS), which is also associated with the perception and understanding of prosody, studied with fMRI (Pichon & Kell, 2013) and magnetoencephalography, in the processing of crossmodal emotive signals (Hagan et al., 2013).

In this area of the right hemisphere there is **female superiority** (Sowell et al., 2007), but many other differences between genders on emotional processing are known, for example, increased amygdale activation in men with fearful stimuli (Derntl et al., 2009)—this is the brain structure that has been most associated with fear (Johansen et al., 2012)—, or that increased pubertal testosterone disrupts amygdale-orbitofrontal cortex coupling, which may contribute to developmental increases in threat reactivity in some adolescents (Spielberg et al., 2015), this contributing to the peculiarities of this critical period of brain development (Burunat, 2004). An excellent integrated model of the role of both hemispheres into emotional processing has been recently proposed (Shobe, 2014).

Also, a common neural substrate has been found that is used both for mentalizing and the affective component of sentence comprehension (Hervé et al., 2013). This highlights the **importance of the emotional component of language in the attribution of mental states**, which is an essential quality in the construction of the human mind at both phylogeny and ontogeny.

The cultural evolution of language may have recruited pre-existing brain systems to facilitate its use (Deacon, 1997; Christiansen & Chater, 2008) just as reading and writing appear to rely on prior neural substrates (Dehaene & Cohen, 2007). So, genetic research has found no evidence for effects of FOXP2 single nucleotide polimorphisms on variability in neuroanatomy in the general population (Hoogman et al., 2014).

However, a numerical simulation suggests that **humans have evolved a flexible learning system to follow rapid linguistic change** (Baronchelli et al., 2012). This is in exquisite agreement with recent research demonstrating marked effects of the human form of FOXP2 gene on learning and striatal neuroplasticity, including an NMDA receptor-dependent form of long-term depression (Schreiweis et al., 2014)—as long-term potentiation, perhaps one of the main physiological ways to modify brain circuits.

In humans, the recognition of native phonemic categories is established during a pre-linguistic "babbling" stage, allowing further development of subsequent prefrontal and linguistic circuits for sequential language capacity. This, implies action of the neural mirror system (Levy, 2011), which is likely to be accompanied by other neural systems, and for example, dorsal and ventral streams (Arbib, 2010). A special issue of *Brain and Language* about this topic is 112(1); for example, see Hickok (2010). In short, the involvement of various neural systems responsible for executive functions and mentalizing, not only **strengthen the role of prosodic components** in language acquisition, but the evidence also suggests a similar role in human mind development.

2.4. Childhood Is a Specific Hominid Trait

Childhood is a period exclusive to human life; primates do not have a comparable period of childhood. The vital step between weaning and puberty **has been increasing in the evolutionary line of hominids** (Rozzi & Bermúdez, 2004). Weaning occurs earlier in the current human species than in the other extant primates (Smith et al., 2013), and it has been also appearing earlier in the hominid evolutionary line (Smith et al., 2010), with the consequent prolongation of childhood. Recent data from the Spanish site of Atapuerca show evidence of the existence of a prolonged childhood in *Homo antecessor* that is, similar to the present, about 900 kyr ago, long before the emergence of our species (Bermúdez de Castro et al., 2010).

Given that language is a cognitive trait that inconveniently left no fossils, many have tried to present a gradualist perspective in the human phylogeny/ontogeny that is analogous to that of other primates (Hurford, 2011; Tomasello, 2003; Terrace, 1979), although theories that postulate a sharp discontinuity in syntactic abilities across species (Hauser et al., 2002) appear more plausible (from Yang, 2013). Thus, there is a widespread assumption that language acquisition in the child should systematically differ from language evolution in the species, and attempts to analogize them are misleading (Pinker & Bloom, 1990).

However, given that **human verbal language is only acquired in a uniquely hominid evolutionary stage**, its acquisition is not possible in the primate evolutionary line, and *the ontogeny of language cannot be equated with their phylogeny, outside the evolutionary line of hominids*. Language arises in the mother-child relationship (Falk, 2004; Sheridan, 2005), and only in hominid childhood.

Childhood has been made possible by the construction of an **extraordinary maternal motivation** for food, care, transportation and protection of human offspring, in other words, as summarized elsewhere (Burunat, 2014a) by the construction of maternal love in the human evolutionary line.

2.5. Language Is Mainly Acquired in Childhood

Human speech is learned throughout childhood; once puberty is reached, the acquisition of language becomes, if not impossible (Kuhl, 2000), extremely difficult. While this has been tested with several known cases of feral (savage, wild) children, —"never learning language, never having much human contact, *never receiving love*" (Newton, 2004, emphasis added)—, this is also evidenced in that learning a second language, has different consequences for the cortical thickness of temporal lobes, depending on the age of acquisition (Klein et al., 2013). Of course, this does not to preclude **the existence of brain plasticity post puberty**, which has been shown in recent research on neural plasticity in adults acquiring a second language (Yusa et al., 2011).

Before pronouncing the first word, which requires baby's exposure to language and occurs around the first year of life, babies will gradually generate speech sounds, babbling in a context which reproduces the context of intonation adult speech (Locke, 1989; Majorano & Odorico, 2011; Saaristo-Helin et al., 2011).

Also, before starting to speak, babies begin to use gesturing with communicative purpose, showing and offering other interesting objects, by giving information with the head or pointing with his finger. At twelve months, babies begin to show an understanding of the meaning of bidirectional signaling (Behne et al., 2012). Again, spontaneous remark does not usually refer to objects with neutral emotional valence, but rather known toys and flashy objects, gestured towards with the head (Fusaro et al., 2012) and with fingers. Emotions are **associated with human communication, even before the verbal language**.

2.6. Language Ontogeny and Maternal Love

In the first years of life, **language learning is extremely fast**. Thus, the number of words spoken increases with rapid strides already known (Pinker, 1994; Fenson et al., 1994; Hoff, 2006; Clark, 2010), but there are also increases in the number of words understood, from 6 - 9 months (Bergelson & Swingley, 2012). The amount of words learned daily by the infant during certain periods is amazing; in the first months after his first word uttered, after about the first year of learning, a child learns an average of 10 words per month until he/she has accumulated about 50 words. After this, there is an acceleration in learning to about 30 words per month (Goldfield & Reznick, 1990). No other living animal species have this extraordinary ability, which is accompanied by an increasing syntactic and grammatical complexity, making language a uniquely human ability. So, the main consequence of the new developmental stage of childhood is the learning of speech.

Some of the **rules of language learning** by infants have started to become known, and show, for example, that infants are predisposed very early in life to hypothesize that words are aligned with prosodic phrase boundaries, thus facilitating the word learning process (Shukla et al., 2011). Such prosodic rules may have been acquired intra-uterus, through listening to the prosodic components of maternal voice, allowing the babies, even newborns, to differentiate the native language from others (Mehler et al., 1988; Moon et al., 1993; Nazzi et al., 1998; Shukla et al., 2011).

Although there are alternative interpretations, some recent research supports the suggestion that mandibular coordination follows **a developmental continuum from earlier emerging behaviors,** such as chewing and sucking, through babbling, to speech, which emerges latest among the behaviors studied (Moore & Ruark, 2014).

Given that **motivation is considered the main factor for speech acquisition** (Bickerton, 1999), the learning of speech can be considered, perhaps the main consequence of maternal love in the hominid evolutionary line. So, parental positive behavior during a critical period from 2 to 3 years old is an important support to multiple domains of children´s adjustment relevant to success at school and later life (Waller et al., 2014). In human phylogeny, as in ontogeny, maternal love also must have promoted language through *infant directed speech*/*motherese* and *maternal scaffolding behavior* (**2.14**). Thus, maternal love was responsible for the maintenance of a common protolanguage to all mankind for hundreds of thousands years, and its dissemination and diversification over the last 40 - 10 kyr. Then, when love was extended to the relationship between the sexes (**2.15**), also had to promote-as at present (Pancsofar, 2008)—the use of a larger vocabulary by *both parents* towards their children.

Notably, human infants also produce whoops, pleasure cries and hics when tickled (Scheiner et al., 2002), vocalizations that seem to be absent in the apes (Davila Ross et al., 2009). Therefore, the vocalizations of language are not the only sounds emitted by humans, and maternal love is also decisive in other vocalizations of their children, for example, human laughter.

2.7. Laughter of Joy and Happiness, Is an Exclusive Hominid Trait

An example of the influence of love on early communication between the mother and baby is the emergence of laughter and other vocalizations. This can also be studied in other primates, given that the production of sounds by chimpanzees (Taglialatela et al., 2011) provides useful information on the evolution of language (Mequerditchian et al., 2014). While in other primates laughter is associated with fear—there is a comparative study of laughter in young orangutans, gorillas, chimpanzees, bonobos and children (Davila Ross et al., 2009)—, **in the genesis of human spoken language the association of laughter with happiness must have played a key role**. Its association with maternal-filial love is further supported by the fact that both laughing and infant crying, cause a higher response in the brains of women than of men (Sander et al., 2007).

Laughter can arguably be traced back as a vocalization type to at least the last common ancestor of modern great apes and humans, approximately **10 to 16 myrs ago** (Davila Ross et al., 2009). It has been suggested that laughter has been a preadaptation that was gradually elaborated and co-opted through both biological and cultural evolution (Gervais & Wilson, 2005), mainly thanks to its physiological benefits (Wilkins & Eisenbraun, 2009), but surely also thanks to the psychological ones.

Duchenne laughter became fully ritualized in early hominids **between 4 and 2 myrs ago**, as a medium for playful emotional contagion (Gervais & Wilson, 2005). So, it has been suggested that the emotional component, known as mirth, has a close relationship with language function (Yamao et al., 2014) although perhaps, the evidence may not be sufficient (McGettigan, 2015). In any case, maybe for at least a million years ago, laughter may have accompanied and promoted the primordial protolanguage of mankind.

Here it is proposed that **the reversal of smiling and laughter, from fear to joy, was associated with the influx of love in the maternal-child relationship**. Thus, the slower development of the baby and the emission of smiles and laughter in children were gathered together, before the eruption of teeth, maintaining the habit later in the new period of human evolution of childhood, and into adulthood. In this context, regarding the investment of *smiles and laughter to be a sign of the emergence of love*—not of fear—, should also to be taken into account the peculiarity that, the smiles and laughters show the upper gum, especially in women, and less in men—the so called *gummy smile* appears to be a predominantly female characteristic (Peck et al., 1992), although this gender difference may vary, depending on race (Liang et al., 2013).

The **pleasure (2.8) and the resulting emotional impact of the use of new sounds**, gurgling, moaning, laughter and tears, and words, were the result of the previous occurrence of love into the hominid evolutionary line, and were determinants for the maintenance and the development of speech.

2.8. Pleasure and Happiness, Motivated the Beginning of Speech

The cause of new vocal sounds added to facial expressions, such as gurgles, whimpers and babblings, are motivated by pleasure (mainly through the activation of the dopaminergic reward system), which has recently been demonstrated as occurring in human communication (Tamir & Mitchell, 2012), playing a part in a spiraling linguistic addiction in the mother-child communication, and being the main speech instigator (*why we speak*). Even in birds (*Sturnus vulgaris*), it has been shown the role of the D1 dopamine receptor in singing behavior (Heimovics et al., 2009), which associates the brain reward system with communication, also in birds. The role of dopamine in prefrontal cortex at various species has been specifically reviewed, showing that dopaminergic systems are highly preserved across mammalians (Puig et al., 2014) and, presumably in previous hominids, as well.

Dopamine is involved in pair bonding in laboratory animals (Aragona et al., 2003, 2006), and, in birds, it has been also shown the importance of dopamine for the development of long-lasting social bonds (Iwasaki et al., 2014). Therefore, *there is an answer to the question of why the language began*, beyond being essential to the survival of offspring, which had already been previously proposed (Falk, 2004; Sheridan, 2005): The language is pleasant, and strengthens the attachment through their brain effects, thereby **language causes an addictive spiral in communication and mother-child attachment**, which are responsible for its maintenance over time.

2.9. Brain Consequences of Love and Language Evolution

It is a fact that the pleasure that often-abused drugs and addictive behaviors can generate has a cerebral substrate in common with that generated by love, namely, the dopaminergic mesolimbic system (for a detailed brain substrate of love, see, for example, Fisher, 2004; Bartels & Zeki, 2000, 2004; Fisher et al., 2006, 2010; Aron et al., 2005; Ortique et al., 2007, 2010; Cheng et al., 2010; Kim et al., 2009; Xu et al., 2011; Acevedo et al., 2012; Cacioppo et al., 2012), which is **the main brain reward system**.

Thus, as previously shown (**2.8**), the emission of vocalizations was reinforced by its pleasant character, and **associated with maternal-filial love**. So, longer breastfeeding duration is associated with a happy bias, in infants' brain responses to emotional body expressions (Krol et al., 2015). Furthermore, it has been proposed that both love (Burunat, 2014a), and social attachment (Burtkett & Young, 2012)—for example, when participants imitate gestures of the own gender vs. the other gender, the brain reward system is activated (Reynolds-Losin et al., 2012)—, may be understood as behavioral addictions, implying other brain systems and molecules, i.e., neurotransmitters and hormones, also involved in language.

Regarding **brain areas**, temporal cortex could be stimulated by maternal-filial interactions by several ways. For example, soft touch, i.e. caresses, transmitted through CT fibers (Olausson et al., 2002), causes the activation of the posterior superior temporal (pSTS) cortex in the right brain—and left insula, amygdale, anterior cingulate cortex, prefrontal medial cortex—(Gordon et al., 2011), with a female-specific increase in sensitivity in the pSTS (Björnsdotter et al, 2014). So, this soft and pleasant touch causes the stimulation of some cortical areas also implied in verbal language, and more in women. In fact, it has been proposed that vocalizations may be as important as touch for the neuroendocrine regulation of social bonding in our species (Seltzer et al., 2010), perhaps, through mirth (Yamao et al., 2014), which is on debate (McGettigan, 2015).

Regarding **molecules**, for example oxytocine enhances brain reward system responses in men, when viewing the face of their female partners (Scheele et al., 2013). Oxytocine, a neurohormone related to attachment in social bonding, and between mothers and their young, is released more after vocalizations (Seltzer et al., 2010). A recent review on oxytocine, which may be effective in the treatments of drug abuse (McGregor & Bowen, 2012; Pedersen, 2014), is that of Veening et al. (2014). Maternal love experience is essential in social bonding (Riem et al., 2014), as oxytocine (Neumann, 2008).

In short, the brain reward system and some molecules are closely associated with vocalizations and language, and also with the mother-child attachment. **Love is the common factor** involved in all of them.

2.10. Early Protolanguage and Human Face

So, in the evolutionary line of Hominids, **love and pleasure were the fundaments of the addictive spiral of verbal language.** Because of this, language becomes a reality in those already human species, perhaps culminating at the time when the mutation or mutations that matched both segments of the human vocal apparatus took place (Lieberman, 2011). This could have happened previously to the appearance of current human species, given the shortening of the face in the Zuttiyeh fossil (Freidline et al., 2012), and the similarities between the subnasal anatomy of ATD6-69 *H. antecessor*—800 to 900 kyr ago—and *H. sapiens* (Lacruz et al., 2013), and also given the existence of the human-like basicranial anatomy in *Ardipithecus ramidus* 4 myrs ago, which shows that the shape of basioccipital from *Ar. ramidus*, and the lateral placement of the hypoglossal canal, are strikingly similar to the configuration in *Au. afarensis* (Kimbel et al., 2014).

It had been previously found a hypoglossal nerve channel similar to that existing in current humans around 400 kyr ago (Kay et al., 1998). This should allow for the diversity of sounds used in the current speech in our species, and surely **similar sounds, in some previous human species**, but not, for example, in the 3.3 myrs-old juvenile *A. afarensis* discovered in Dikika (Alemseged, 2007). Other anatomical and physiological reasons have been recently reported (Morley, 2014).

About the unknown language capabilities of other hominids, it must be mentioned the recent finding in primates of a production of "vowels-like" and "consonants-like" calls, with the rhythm of speech, emitted by orangutan—*Pongo pygmaeus*—(Lameira et al., 2015). In this sense, a gradual language acquisition as proposed by **the gradualist hypothesis may be considered reasonable, but only since 1myr ago** in the human evolutionary line.

2.11. Maternal Love Is More Important Than Brain Lateralization to Initiate Speech

Brain laterality can refer to three terms: hemispheric dominance for language, hemispheric asymmetry for non-language skills, and the new concept of *hemisity*—to describe the binary thinking, learning, and behaving styles, of a person (Morton, 2013). According to the **current neurobiological models**, the syntactic-grammatical language is essentially assigned to the left brain hemisphere. It has been recently confirmed that the *planum temporal* shows the strongest sexually dimorphic asymmetry of any cortical region (Guadalupe et al., 2015).

However, **this left brain lateralization may not be as crucial as commonly thought for language acquisi-**

tion in humans, and in special circumstances the expressive language area can be located in one hemisphere and the receptive area in the other (Kurthen et al., 1992).

As language may be acquired by small-brained babies, and even by individuals with pathologically small brains (Lenneberg, 1967), **language is clearly independent of crude brain mass** (in Hauser et al., 2014). This that not precludes that there can be found cognitive and language effects as a result, for example, of extremely preterm birthing, which causes delayed myelination, mainly in boys (Skiöld et al., 2014).

The cases of children subjected to left hemispherectomy for the treatment of epilepsy, to which left-brain structures considered essential for production and comprehension of language are removed, demonstrate that language and speech can be settled smoothly into the non-dominant hemisphere. **Some children can learn to speak again** and may show only a slight linguistic affectation (Obler & Gjerlow, 1999). Recent reviews about techniques and/or effects/outcomes of hemispherectomy are from Pinto et al., 2014; Ramey et al., 2013; Bahuleyan et al., 2013; Bulteau et al., 2013; and Englot et al., 2012.

For example, Moosa et al. (2013) found that younger age at epilepsy onset correlated with poor reading skills but not with spoken language skills. Detailed study of the linguistic ability of two clinical cases suggests that the right hemisphere is critical for normal picture naming, whereas the left hemisphere is critical for normal semantic generation of action-related knowledge (Esopenko et al., 2011). An fMRI research on a 14-year-old adolescent who underwent a left hemispherectomy at the age of 2.5 years suggest that **his solitary right hemisphere followed a left-like blueprint of the linguistic network**, but with a stronger frontal recruitment (Danelli et al., 2013).

Another study on five pairs of children, who underwent hemispherectomy, strong supports that each isolated developing hemisphere, has the potential to acquire a grammar embodying and constrained by highly specific structural principles defining human language (Curtiss & Schaeffer, 2005). Some results after hemispherectomy provide no evidence on hemispheric differences, with persistent mild dysarthria after left or right hemispherectomy (Liégeois et al., 2010). During childhood, **the lone left and right hemispheres have a similar potential** to acquire an adequate level of receptive vocabulary (Liégeois et al., 2008).

There are some neuropsychological data supporting the hypothesis of innately more bilateral distribution of receptive than expressive language (Hertz-Pannier et al., 2002), and those visuospatial functions allegedly programmed to the right hemisphere seem to be able to move to the left hemisphere, i.e., **interhemispheric reorganization of function may be bidirectional** rather than a feature unique of the left hemisphere for language (Levin et al., 1996). From the theory of reasoning, although reasoning tasks are typically associated with left hemisphere activation, the results have recently been mixed (Goel, 2007), with many studies showing activation in both hemispheres (Heit, 2014).

Thus, the distribution of linguistic functions in either cerebral hemisphere does not seem an attribute or requirement of essential character for language acquisition. On the contrary, *human physiological brain plasticity appears to be the only main reason for language acquisition*. The ability to adapt to new conditions, depending on demand and the continued stimulation (**2.9, 2.14**), is the crucial factor responsible for language settlement in the human brain. Such a prolonged **maternal stimulation was essential in language evolution**. Not only in children with typical development, but for example, also in children with autism maternal linguistic input accounted for later vocabulary growth (Bang & Nadig, 2015). And it was associated with the development of language in a closer way than previously imagined, as detailed at the next point.

2.12. Maternal Survival Could Be the Cause of FOXP2 Positive Selection

Female longevity is superior to that of the male in every society (Wingard, 1982; WHO, 2013a, 2013b; Seifarth, 2012). Its physiological reasons, mainly hormonal, are already known, and the longevity of Korean eunuchs, promoted by male hormones depletion, has been recently confirmed (Min et al., 2012). However, the evolutionary reason for the different life-expectancy between a man and a woman is less understood as it does not seem to occur in other similar species, such as chimpanzees where the female dies shortly after reaching menopause, both in wild life (Emery Thompson et al., 2007) and in captivity (Herndon et al., 2012). It has been previously proposed that **prolonged maternal love should promote the survival of children** and grandchildren, with a subsequent dissemination of genes associated with love. By increasing its diffusion—e.g., given the FOXP2 association with maternal behavior (Bowers et al., 2013)—, this was surely related to the superior survival of women over men (Burunat, 2014a).

Natural selection of genes related to offspring survival must be frequent in the evolution process. So, it has been recently demonstrated that a similar **selection of genes associated with male parental care exists** in primates (*Cebidae*); these are, the oxytocin (OXT) and the oxytocin receptor (OXTR) genes. Furthermore, paternal care seems to have evolved independently at least four times in the radiation of the primate order (Vargas-Pinilla et al., 2014). Really, the evolution of the OXT-OXTR system was probably an essential component of the genesis of the eutherian signature (Yamashita & Kitano, 2013). In human evolution, a "*cooperative breeding hypothesis*" has been proposed (Hrdy, 2011) which could have co-evolved with slower maturation and larger brain sizes by **1.8** myrs ago (Hrdy, 2012).

In the same way, there is recent evidence on the possible association of love and female longevity with language-related genes. The **first known relationship between the FOXP2 gene and female longevity** has recently been established. So, decreased expression of FOXP2 may be associated with malignant forms of breast cancer with poor survival (Cuiffo et al., 2014). Breast cancer is the most common tumor in women—in 2012, 1.7 million women were diagnosed worldwide, 11.9% of the total cancers, and causing 522.000 deaths; it is one in four of all cancers in women (IARC-WHO, 2013)—, and it can be assumed that in the past, it has been a major limiting factor for female longevity in our species.

Therefore, it is proposed here that this amazing protective role of FOXP2 in malignancy of breast cancer may be the main effect to be considered in positive selection of FOXP2 in female humans, through the survival of mothers—and surely of grandmothers, with effective consequences on childhood survival and development (Hawkes, 2012)—. **Following the theory of the antagonistic pleiotropy** from George Williams (1957), perhaps the *main phenotypic effect* of *humanized* FOXP2 is female—and children-survival, and brain plasticity for language *only a pleiotropic effect* of the gene. But, it is not the only one.

For example, given the interaction between FOXP2 and breast cancers malignancy (Cuiffo et al., 2014), and with the MAOA gene (Park et al., 2014b) of the X chromosome—the MAOA gene encodes an enzyme participating in metabolic pathways of several monoaminergic neurotransmitters—, it is not irrational to attribute to FOXP2 *another pleiotropic effect*, such as a possible influence on the **development of mammary glands in our species** by allowing its growth, through the limiting of the risk of malignant tumors. Thus, briefly, in relation to new diets at permanent settlements (**2.16**), it has been shown, in experimental animals, that the prenatal administration of the indolamine precursor-tryptophan-causes significant increases in both, pituitary prolactinomas and mammary adenomas in the female offspring when adults (Santana et al., 1999). In short, the relationship between FOXP2 and breast cancer protection, could have some other consequences in human evolution, such as those above suggested, never before suspected.

2.13. Women Have Fewer Language Disorders

There are known **gender differences in language pathologies**—even at the kindergarten level (Tomblin et al., 1997)—such as stuttering (Suresh et al., 2006; Prasse & Kikano, 2008; Yairi & Ambrose, 1999), or disorders that include language pathologies such as autism (Stone et al., 2004; Cantor et al., 2005; Lai et al., 2015), dyslexia (Truong et al., 2013; Evans et al., 2014), and others. A recent review of language pathologies is that of Newbury & Monaco (2010). These have been usually associated with—small and depending on age (Hirnstein et al., 2013)—gendered brain differences in language, which have been also shown by Shaywitz et al. (1995), Clements et al. (2006), Phillips et al. (2013) and Hu et al. (2013), between others, and have been earlier reviewed, for example, by Kanzaku & Kitazawa (2001). Developmental dyslexia has also been recently reviewed (Scerri & Schulte-Körne, 2010), as well as other language pathologies, which have shown gendered brain differences. All of these language disorders usually affect men more than women.

Differences in language between men and women are based on cortical and subcortical developmental differences with **hormonal** (Savic, 2014; Hollier et al., 2014; Herting et al., 2014; Hu et al., 2013), **genetic** (Pourcain et al., 2014; Ocklenburg et al., 2013; Ngun et al., 2011; Han et al., 2014), **anatomical** (Gannon et al., 1998; Harasty et al., 1997; Ruigrok et al., 2014, Guadalupe et al., 2015) and **functional** (Weiss et al., 2006; Kaushanskaya et al., 2011, 2013) bases. They also may have consequences on language acquisition, and many of these differences being favorable to women, or especially concerning women.

By detailing some, the female advantage is evident, for example in verbal fluency test, as a result of the different strategies employed by both sexes, those employed by women are the most effective (Weiss et al., 2006), and females are more likely than males to recruit native-language phonological and semantic knowledge during novel word learning (Kaushanskaya et al., 2011, 2013). The functional difference between genders could be based on already known anatomical differences between men and women (Harasty et al., 1997), females having larger volumes of the right planum temporal than males (Ruigrok et al., 2014), and males showing stronger leftward planum temporal regional lateralization than females (Guadalupe et al., 2015). Some of such differences have also been found in chimpanzees, such as, the larger the parietal plane in females (Taglialatela et al., 2007). Also, **FOXP2 gene is more expressed in** 4 years-old girls than in boys (Bowers et al., 2014), and left hemisphere brain structures activated during emotion processing are language-related (Shobe, 2014).

In the context of the proposal presented in this article, **women have fewer language and speech disorders than men for two main, simple, reasons**: 1) they have spent many more hundreds of thousands years practicing into the maternal-filial relationship, and 2) the motivation for building speech has been much more intense in women. The main underlying factor was the construction of love on the mother-child relationship, responsible for the gradual construction of the new life stage of childhood in the human evolutionary line.

2.14. Mothers Taught Their Children the Language

The building of maternal-filial love in the last 1 myr is supported by the progressive extension of childhood in this period (**2.4**). **It cannot be a coincidence** that this also seems to coincide in time with the re-arrangement of laryngeal anatomy into a form essentially indistinguishable from that of modern humans, along with development of the neurological control over pitch, intensity, contour and duration of sounds produced by it. This appears to have taken place at some point(s) over the 1-million-year or so, the period of the evolutionary development of *H. erectus*, from *H. ergaster* to the common ancestor of Neanderthals and ourselves (Morley, 2014).

Language addressed to infants plays a crucial role in language acquisition—and also for babies' survival (Falk, 2004)—. The universal speaking style used by caretakers around the world when they address infants has been shown to be preferred by infants over adult-directed speech, given a choice (Fernald & Kuhl, 1987). Moreover, the exaggerated stress and increased pitch typical of *infant-directed speech* (**IDS**) assists infants in discriminating phonetic units (Karzon, 1985). Perhaps one of first prosodic analysis for the phonology from linguistic is that of Waterson (1971).

Adults often use the IDS when talking to infants; it has been recently found that the right caudate nucleus processes experience and task-dependent interactions between language and emotion in the mothers' IDS (Matsuda et al., 2014). Furthermore, mothers with preverbal infants showed enhanced activation in the auditory dorsal pathway of the language areas, although increased cortical activation levels were not found for fathers, non-parents, or mothers with older children (Matsuda et al., 2011). **It is an exclusive feature of the mothers' language towards their own children.**

Significantly greater activations were observed in the frontal area *when infants listened to IDS produced by their own mothers, rather than IDS from unfamiliar mothers* (Naoi et al., 2012), showing the special role of the mothers, but not just any women, in speech instruction to their babies. The difference is only the maternal motivation, that is, maternal love. The **mother seems to have a peculiar brain activation that enables her in language instruction** and that are lacking in men, and women who are not the mother. Therefore, the brain circuits of maternal love seem to modulate the activity of brain circuits for language. This female predisposition facilitates language acquisition in girls: they consistently outperformed boys in multiple measures of language, in general (Kaushanskaya et al., 2013), or at specific stages (Bornstein et al., 2004).

On the other hand, **maternal scaffolding behavior**—associated with verbal IQ for very low birth weight preschoolers, and with the Gift Delay Peek test for the normal birth weight group (Lowe et al., 2014)—appears to be uniquely associated with emotion regulation (Erickson et al., 2013), whilst mothers' emotion language with infants is not sensitive to child factors, but is associated with social contextual factors and characteristics of the mothers themselves (Garrett-Peters et al., 2008). This should be considered especially to understand the impact of permanent establishments and the first cities, in the evolution of proto-language (**2.16; 2.17)**. In the beginning of the development of verbal language in the evolutionary line of hominids, such a continued stimulation by the **mothers still had to be more important for language acquisition (2.9)**.

2.15. The Woman Transmitted Speech to Man

Because of verbal language arises from the maternal-child relationship, females also should play a key role in the promotion and propagation of language to the men. There is evidence of the **role of female primates in the transmission of phenotypic traits** associated with emotional states.

From a **comparative perspective**, in the nearest primate species, the bonobo (*Pan paniscus*), yawning and its mechanism of contagion were investigated—a recent review about yawn is that of Guggisberg et al. (2010)—. It was found that yawning in females is more effective for transmission that yawning in males, which supports the hypothesis that adult females not only represent the core of decision and relationship in the bonobo society, but that they play a key role in the emotional states of others (Demuru et al., 2012). This evidences the **importance of females in this species for social cohesion and for the stabilization of the emotional state** of the group.

As a function located before the separation of human and chimpanzee lineages, 6 - 8 myr ago, it is feasible that in subsequent extinct hominids, this feature was maintained and probably was linked to other emotional states, and to **communication-related functions**, such as verbal language. Furthermore, the role of vocal behavior seems to be central in bonobos, in which loud calls are important for female communication and function in party coordination (White et al., 2015).

This argument is also supported by **functional**, **genetic and neurobiological data**. Females appear to be more implicated in emotional transmission within the group, and this must have been also truth for language transmission in the hominid evolutionary line. An extensive recent study has confirmed that girls are slightly ahead of boys in early communicative gestures, in productive vocabulary, and in combine combining words (Erickson et al., 2012). Women also have a greater emotional involvement than men, in sex (Jones & Paulhus, 2012) and love (Soller, 2014). As previously discussed, there are also gender differences in FOXP2 expression and language pathologies **(2.13)**.

From a more **cultural viewpoint**, in many societies, the speech of men is different from women, for example in the Caribbean Indians of the Lesser Antilles, and Japan. There are also differences in pronunciation—in the use of "g" and "h" in the United States, or use the "l" in Montreal. In addition, there are gender differences in intonation, and the use of phrases and sentences. There are also differences in termination, for example, between Native Americans in Koasati, Louisiana (Ember et al., 2002). While these differences have been interpreted in socio-cultural terms, and in relation to power, it might still be suggested that these subtle gender differences in language are evidence of the existence of an incomplete transmission of the language from women to men, in recent times in some cultures: more than cultural differences, may have been timing differences in the acquisition of speech and vocabulary the responsible.

Finally, an additional factor to the proposition that it was the woman, who passed on the speech to men, comes from **paleontological data** suggesting that it was the woman who moved to new groups, who provides the necessary genetic renovation that avoided inbreeding in populations (Lalueza-Fox et al., 2011). In fact, results obtained from chromosome Y analysis have shown that males are genetically less mobile than females, probably because at marriage they migrate a shorter distance, on average, than females (Cavalli-Sforza, 1997). The woman could introduce into those new group skills that she had learned in her original group, thus transmitting, perhaps between remote locations, a limited amount of spoken language, which she had kept for thousands of years in the mother-child relationship.

Summed up with all the previous points, it may be stated that, **sometimes and repeatedly, throughout hominid evolution, women passed proto-language to the men**. Mainly in recent times (40 to 10 kyr), the two new environmental conditions (permanent settlements and an enriched diet, **2.16**), and reproductive success (development of the social brain, **2.17**), could have promoted widespread consolidation of language in some settlements and groups, and the extension of love to the male-female relationships.

2.16. Permanent Settlements and Language Spread: Diet Changes

Diet changes in new settlements must have had consequences on all human sedentary groups, not only at childhood—for example, it has been reported that the type of breakfast that children eat can potentially have a long-term influence on cognitive development (Taki et al., 2010)—but **also into adulthood** (Leist et al., 2014). About alloparents and fathers helping care for and provision young, see Hrdy (2011). This perhaps could have enabled the sporadic development of certain lithic industries, such as that of the lithic culture with fire at Pinnacle Point Cave 13B, on the south coast of Africa, which has also provided the earliest archaeological evidence for the exploitation of marine shellfish, dated to 164 kyr (±12) (Marean et al., 2007; Marean, 2010)—fish and sea foods are the richest dietary sources of docosahexaenoic acid [22:6(n-3)] which is the most abundant (n-3) fatty acid in the mammalian brain (Innis, 2007)—, but also, a punctual language development at other locations.

Improving **maternal nutrition during pregnancy** could furthermore have had spectacular consequences on brain development of their children, promoting, for example, delayed puberty—which is commonly cited as a crucial factor in the window of plasticity of the brain to language—and also promoting the extension of maternal-filial love, to the relationship between the sexes.

Prolonged breastfeeding has known consequences on language development (Angelsen et al., 2001; Horwood et al., 2001; Jain et al., 2002; Gibson-Davis & Brooks-Gunn, 2006; Dee et al., 2007; Mahurin-Smith & Ambrose, 2013; Nyaradi et al., 2013; Park et al., 2014a), although the role of milk on neurodevelopment of children with very low birth weight may require additional studies (Koo et al., 2014). But in any case, it has been recently proposed that the power supply (and not the pelvic diameter) was the **limiting factor of the increase in brain development** in both pregnancy (Dunsworth et al., 2012) and human phylogeny (Fonseca-Azevedo & Herculano-Houzel, 2012).

There is abundant evidence on the relationship between intrauterine malnutrition—not the only postnatal malnutrition (Proos & Gustafsson, 2012)—and the advance of puberty. **Puberty is associated with maturation and cortical thickness in several brain areas** and affecting differently to boys and girls (Bramen et al., 2011, 2012). Larger studies have shown that girls born small for their gestational age—which may be caused by chronic malnutrition in the uterus, causing an altered neurodevelopment (Keenan et al., 2013)—were on average 5 months earlier in their pubertal development (Persson et al., 1999), and may also show other developmental disorders (Woelfle, 2008; Jung et al., 2014).

The consequences of the advancement of puberty on brain and cognitive development are also beginning to be known, for example, reduced frontal white matter volume (Klauser et al., 2014); then **the opposite must necessarily be accepted**. A **delayed puberty could also have a facilitator action on the FOXP2 function**, given that one of the main effects of human FOXP2 in the brain of transgenic animals is the increasing of connections between frontal lobe and basal ganglia (Enard, 2011).

The physiological consequences of rich and varied diets are innumerable. To cite only one, they could have influenced the development of secondary sexual characteristics in women. New diets high in power and nutrients could have caused the **previously unknown accumulation of fat in hips and breasts**. For example, the increase of amino acid tryptophan in the diet, this is known to increase the levels of luteinizing hormone and prolactin (Martin et al., 1997). Also, it is only after approximately 35 kyr ago that people with more gracile, fully modern morphology make their appearance (Rightmire, 2009). This could explain that, suddenly, the first sculptures of women—Venus—were made, associated with the emergence of love in men, and also, impelled by other effects of diet and by the growth of groups, on the male brain (**2.17**).

The first stable sites, cities, accounted for **more, new and better nutrients with impact on brain development in a few generations**. Indeed, when studying human migrations, a variety of demic expansions has been detected in almost every major region, almost always due to some important technological development favoring the generation of, between others, new or more food (Cavalli-Sforza et al., 1993).

2.17. Permanent Settlements and Language Spread: Social Brains

Although multiple brain changes resulting from the new diet were favored by the stabilization of the first cities—a complete recent analysis of nutrients effects is of Nyaradi et al. (2013)—, the effects of enriched diet on the rapid population growth must have been even greater.

Enriched diets and the increase in social groups could have had multiple cognitive effects—as in the “social brain” hypothesis (Lewis et al., 2011; Reynolds-Losin et al., 2012)—, such as spreading of the languages, and also physical. They must have incited love and language between the sexes through several ways. For example, they may have **allowed, accompanied and promoted, increases in the lexicon in the infancy and adulthood**, which are necessary to designate new roles and social relationships. So, regarding lexicon, it has been recently found the first genetic factor in the one word stage of language, *the beginning of the lexicon*, in infancy—that is *rs7642482* on chromosome 3p12.3 near ROBO2 gene (Pourcain et al., 2014)—, and also, that concrete nouns activate more anterior prefrontal areas (Moseley & Puvermüller, 2014), affected by FOXP2. Thus, some language specific alleles could be quickly selected only depending on better brain development… and of childhood survival.

For all these processes, the functional optimization of brain circuits implicated in language also must have been involved, through the better myelination of nerve pathways, as recently demonstrated (Deoni et al., 2013). Furthermore, gray matter volume in the medial orbitofrontal cortex and the ventral portion of medial frontal gyrus, varied parametrically with both, competence in mentalizing and the social network size (Lewis et al., 2011).

Experiences also can interact to produce unexpected plastic changes in other mammalian brains—laboratory animals—and mainly in prefrontal cortex (Kolb & Gibss, 2015; Kolb et al., 2012, 2013). But there are many other consequences, related to the emergence of the human mind.

For example, recent research has found that **self-esteem** is related to the connectivity of frontostriatal circuits, and suggests that feelings of self-worth may emerge from neural systems integrating information about the self with positive affect and reward (Chavez & Heatherton, 2015). On the other hand, frontotemporal connections recently shown may explain the cognitive recovery of **episodic memories** (Barredo et al., 2015), which suggests a neuroanatomical circuit implied in the timing of events and, perhaps, in the building of the verb tense—past, future—, with the consequent expansion of human mind. So, the construction of the human mind is reinforced by a whole set of factors acting synergistically, in ontogeny and phylogeny.

In short, several language-related areas of the brain are affected by intrauterine nutrients, the prolongation of breastfeeding, improved child feeding practices, and delayed puberty, but also, by the extent of group size and the new social relationships, in a synergic and explosive cooperation. More than genetics—also—, **language evolution may be a comprehensible example of epigenetics**—given that the trait is now heritable for subsequent generations, perhaps through altered histone or DNA methylation patterns at nuclear receptors (Ozgyin et al., 2015), in a heritable manner, as epigenetics has been defined (Dressler, 2008), and tested for some maternal behaviors in laboratory animals (Champagne, 2008)—, **being love a crucial factor:** In families with higher levels of marital love when children were 12 months of age, mothers and fathers used a more diverse vocabulary with their 24 month-old children (Pancsofar et al., 2008), as presumably later, and also thousands of years ago.

So, the leap from protolanguage to the language could have occurred in relatively few generations. Over the whole world, perhaps a few thousand years were required. Although it cannot be compared, the lingua franca—sort of protolanguage-developed in Hawaii, gave such jump in a single generation (Bickerton, 1999).

2.18. Love Caused Symbolic Thinking, Lithic Cultures, and the Arts

It has been recently proposed, based on an experimental research on the efficacy of transmission of Oldowan tool-making skills along chains of adult human participants, that **transmission improves with teaching, and particularly with language**, but not with imitation or emulation (Morgan et al., 2015). The authors suggest that this could explain the approximate 700 kyr stasis of the Oldowan tool making skills—from 2.5 myrs—until the Acheulan technology, which further suggests that teaching or proto-language may have been pre-requisites for the appearance of Acheulan technology. This work, following the authors, "supports a gradual evolution of language, with simple symbolic communication preceding behavioral modernity by hundreds of thousands of years". Also, the **punctual and sporadic development of some cultures**, as in Pinnacle Cave Point previously cited, and others, could be similarly explained.

Love, usually considered an emotion associated with sexuality, does not meet the characteristics required to be psychologically considered an emotion (Gonzaga et al., 2006), but a physiological motivation (Burunat, 2014a, b), such as hunger, thirst, sleep, or sex drive. It is here proposed that this extension of love and language to the relationship between the sexes, made between 40 and 10 kyr, in the later Palaeolithic period, when humans made the **transition from functional tool making to art and adornment,** could explain the delayed dissemination of verbal language and the existence of such an enormous interval between the onset of the current human species—between 200 kyr ago (Rightmire, 2009), or 195 ± 5 kyr ago for Kibish hominids (McDougall et al, 2005), and 160 kyr ago (Crow, 2008), also 160 - 154 kyr ago in Middle Awash (White et al, 2003)—and the origin of the first recognized symbolic thinking, that is, the most direct samples of art, just over between 40 and 10 kyr.

The **extension of love to the relationship between the sexes in the superior Paleolithic period,** was the essential factor in the explosive spread of speech and symbolic thought, with the first sculptures, cave paintings and musical instruments—and pets, cats, 10 kyrs (Vigne et al., 2004), and dogs, 16 kyrs (Pang et al., 2009). Only 20 - 30 kyrs were spent between the extension of love to the relationship between the sexes, which is marked by the beginning of arts, and the diffusion of linguistic families.

The oldest art samples show an **amazing temporal coincidence**. For example, the first sculptures (35 kyr ago, Conard, 2009), art painting, that is, parietal rock art in Europe (Spain, 40.8 kyr, Pike et al., 2012), and Indonesia (Sulawesi, 39.9 kyr, Aubert et al., 2014), and also music, namely the first instruments (Germany, 40 kyr, Conard et al., 2009; Higham et al., 2012; Morley, 2014). It has been recently shown that **music induces universal emo-**

tion-related psychophysiological responses (Egermann et al., 2015), as presumably did in Paleolithic period, and it has been also proposed that music and speech are closely interlinked with the musical aspects of speech that conveying emotional information (Snowdon et al., 2015).

In general, the arts show at least some important mental tools, such as those that were physically used for the manufacture of musical instruments, or for carving sculptures, or to painting the caves e.g., the basic cognitive-perceptual principles of categorization (Cheyne et al., 2009), and also, will and maintaining executive attention—a frontal lobe function—, the spatial mental manipulation of the goal to achieve—a parietal lobe function—, but above all, an extraordinary motivation previously inexistent in human evolution, which is proposed here it was love between sexes.

The languages have diversified in the last 10 kyr, **the most extended languages over the world are those derived from the proto-Indo-European,** which diversified in at least two waves, from near the Black Sea, the first from the south, from Anatolia (Turkey), 9.5 - 8 kyr ago (Bouckaert et al, 2012), and the second, based on strong archaeological and linguistic evidence, from the northeast, from the Ponto-Caspian steppes, a few thousands of years later (Anthony & Ringe, 2015; Callaway, 2015). These were presumably associated with dairy farms and the selection of lactase persistence in Europe (Bersaglieri et al., 2004) but, of course, they could have been accompanied by other important additional reasons—for example, see Diamond (1997)—paleoclimatology (Maslin et al., 2015), the invention of the wheel (Bakker et al., 1999), and others.

So, in Europe, the different frequency distribution patterns of three chromosome Y subhaplogroups (SNP S21/U106, S145/L21 and S28/U152) belonging to haplogroup R1b-M269, shows peaks in northern Europe, Brittany in France and in the south of England, and southern France and northern Italy, respectively (Lucotte, 2015). Although basically this distribution coincides with that reported by other authors (Myres et al., 2011), the existing data and tools are insufficient to make credible estimates for the age of this haplogroup (Busby et al., 2012). Surely, this chronology will light on next years. Genetic, linguistic and archaeological research is in progress, e.g., there is a forthcoming issue of the journal *Brain and Language* on the subject *Genes, Brain and Language*.

The determining role of love between men and women in the development of speech is also supported by the fact that, at all stages in the evolution of artistic creativity, stylistic changes must have been due to rare, highly gifted individuals (Morriss-Kay, 2010). However this was certainly **not in an emotional vacuum**, but in many cases, it was motivated by love, which is the cause of the most intense emotions that humans can experience: *artists know that love is their main source of inspiration*. Furthermore, it has been hypothesized that the biological roots of art reproduce aspects of our ancestry, specifically animal courtship displays, where signals of health and genetic quality are exhibited for inspection by potential mates (Zaidel, 2013). This is in agreement with the proposal here exposed that, **was the building of love between sexes**, **from the women to men,** but not just sex, the leading cause of both symbolic thinking and the spread of arts and human speech.

3. Conclusions

Without attempting to summarize the history, or the vast amount of existing evidences and hypothesis about the origin of language, this article aims only to offer a meeting point for this evidence, providing a new perspective on human evolution based on the construction of love—perhaps, the X-factor of Bickerton (2009)—in the evolutionary line of hominids (**2.2; 2.3**) and **highlighting the role of women and love in the preservation and dissemination of speech.** This proposal expands the proposal made by Dean Falk a decade ago (Falk, 2004) and commonly accepted (Sheridan, 2005), about the emergence of language in the mother-child relationship.

Love is a physiological motivation that emerged during the human evolutionary process (Burunat, 2014a). During the vital period of childhood, initiated a million years ago, before the appearance of our species, a basic speech and language were developed, promoted by love (**2.11, 2.12**) and depending only on a continuous maternal stimulation (**2.6 - 2.9**). Love was the cause of human language in the mother-child relationship in all those human species (**2.4, 2.5**), where childhood was slowly increasing.

In earlier species of hominids, perhaps many (Bokma et al., 2012), maternal love must also have been the mainly responsible for other, more primitive communication systems, such as gestural (Corballis, 2002, 2010), guttural, mime, caresses and a very basic universal proto-language that was, mainly restricted to maternal-filial interaction. It was mainly the woman (**2.11 - 2.13**) who was the responsible for its dissemination, maintenance and transmission to all humans (**2.14, 2.15**), keeping this innate ability in an evolutionary ecstasy of perhaps several hundred of thousands years, as a female proto-language common to all mankind and accompanied by other types of communication systems, oral - laughing, crying - or not—e.g., tears: female tears decrease testosterone levels and sex drive in men (Gelstein et al., 2011).

The emergence of the first settlements and cities about 40 - 10 kyr ago, with new food (**2.16**) and cultural complexity (**2.17**), with enormous consequences on brain development, was the responsible for the explosive growth of vocabulary and syntax in different populations, and the origin of different languages that diversified until today. New environmental conditions, new social organization, new foods, and not only through fermented beverages or stimulant or hallucinogenic plants, as already proposed (McKenna, 1992), along with an extraordinary plasticity of the brain, all of them promoted the extension of love towards the relationship between the sexes (**2.15**), and the parallel diffusion of the arts and speech (**2.18**) in the current linguistic families.

It was **a spiral process in crescendo,** as in drug abuse and other addictive behavioral processes (**2.8**), because of that emotional communication causes pleasure, involving the dopaminergic brain reward system (**2.9**). Its rapid dissemination—in association with dairy farms and the selection of tolerance to lactose in Europe (Berja-Pereira et al., 2003; Bersaglieri et al., 2004)—explains the wider dissemination of the Indo-European derived-languages with regard to other linguistic families.

So, it is here proposed that hominid women retained a primordial protolanguage for hundreds of thousands years and, as a result of the neurobiological impact, **in our own species**, of new steady feeding sites, they recently transmitted oral language to man, with the subsequent expansion of human mind, symbolic thought, art, and love between the sexes.

The transmission of knowledge from the woman to the man is an ancient proposal that is in a sacred text, the Bible. Nothing like language allows for the expansion of the mind, knowledge of good and evil, the body and nudity awareness. Such transmission is also associated to a location with plenty of food that, in the proposal here presented, would be the first permanent settlements—the biblical *Garden of Eden*—, coinciding roughly in time with the first sculptures, paintings and musical instruments. **This proposal clearly matches with the episode of the *Original Sin* exposed in the biblical *Genesis*** (GENESIS, 3:5-3:7), and this amazing coincidence must be mentioned here, with the greatest respect to believers.

In short, this article, which summarizes a recent book by the author—and focused on the role of love in human evolution (Burunat, 2014b)—proposes that, the hypothesis of **the social/cultural origin** of the current oral languages is perfectly valid for the increase and diffusion of language since the establishment of the first settlements/cities and the dissemination of the main linguistic families, 10 - 5 kyr ago.

At the same time, the **biological/innate root of human language** seems sufficiently supported, in terms of human brain plasticity, and motivated by love in maternal-filial relationship. Love has accompanied and reinforced the extraordinary invention of childhood by natural selection through the last million year, being the mothers responsible for the maintenance of a primordial protolanguage, which was common to all mankind.

Thus, those seemingly contradictory theories on the **cultural and biological bases of language can be reconciled**, explaining each, a particular stage of language evolution, and being the love the essential common factor at both stages.

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