



KEYWORDS: *Indigenous Amazonia – Anthropogenesis – Pareidolia – Exaptation*

WHAT IS ANTHROPOGENIC? ON THE CULTURAL AETIOLOGY OF GEO-SITUATED VISUAL IMAGERY IN INDIGENOUS AMAZONIA

Raoni Valle, Gori-Tumi Echevarría López,
Poani Higino Tenório Tuyuka and Jairo Saw Munduruku

Abstract. This article focuses on the problem of how native Amazonian peoples perceive and construct visual imagery on geological landscape and theorise on its causes and origin. Many native theory-building strategies seem to intertwine anthropogenic markings on lithological surfaces with systems of knowledge regarding geological and biological phenomena as a whole. When native Amazonian perceptions and theories are taken into account, it is not only graphic imagery, as a discrete entity, that is under consideration, but rather complex epistemological articulations between visual graphic expression and geo-environmental context. These cognitive articulations conceive geological phenomena just as culturally and intentionally constructed as rock art is considered in a Western perspective. The neuropsychological phenomenon of pareidolia is examined as a perceptual-cognitive trigger that intertwines geological features with sensorial constructs affording cultural responses. This phenomenon is exemplified by presenting evidence on the entanglement of rock art and geomorphic features in head representations with facial elements, which occur diversely and consistently throughout Amazonia and the Andes. The aim of this article is to explore the relational nature between Indigenous knowledge and geological phenomena, considering eventual consequences upon the ways native Amazonians conceptualise causal agency in geo-situated visual imagery. When geological phenomena are qualified as human-made, or made by ancestral, spiritual or animal/vegetal non-human persons, or are themselves considered as persons, this posits a basic question: what is anthropogenic?

Introduction

This article focuses on the problem of how native Amazonian peoples perceive and construct visual imagery on geological landscape and theorise on its causes and origin. Therefore, it brings a discussion on the Amerindian aetiology (philosophy of causation) of phenomena such as landscape and rock art. In that sense, non-Western notions regarding what constitutes anthropogenic and natural processes are re-examined in order to cast some light on the aetiological problem of how Amazonian Indigenous minds construct theories regarding the origins and causes of geo-situated visual imagery.

A shared aspect of some of these native theory-building strategies seems to be the intertwining of anthropogenic markings on lithological surfaces with complex systems of knowledge regarding geological and biological phenomena. It means that not only rock art or graphic phenomena are under consideration as discrete entities, but rather complex epistemological articulations between cultural imagery, graphic

behaviour and geo-environmental context. A basic character of these cognitive articulations seems to be that they conceive geological phenomena just as culturally and intentionally constructed as rock art is considered in a Western perspective. For some Indigenous groups geological phenomena are construed as living bodies that are potentially self-endowed with intention, agency, human-like mind states and behaviours.

Some rock art evidence and ethnographic references from Amazonian sites and Indigenous groups (Fig. 1) are superficially presented in order to expose the idea that cultural perception of geological features exerted, and exerts, an important role in Amazonian rock art production and perception. The cultural exaptation of pareidolia (e.g. Guthrie 1993), a particular neuropsychological phenomenon generally characterised by experiencing pattern in random stimuli, is examined as a perceptual-cognitive trigger that entwines geological features with conceptual constructions, thus affording an agency towards the

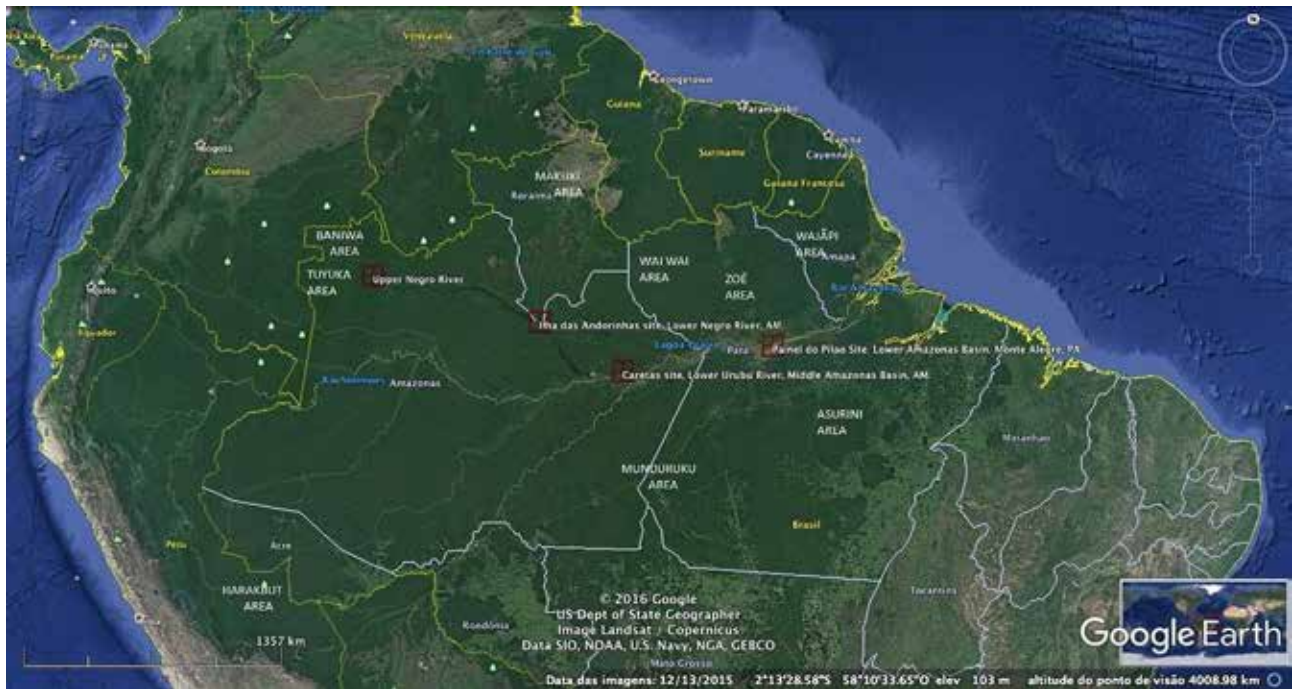


Figure 1. Map of South-American lowlands, Amazon basin, showing some of the sites (red markers) and the location of Indigenous areas mentioned in the text (capitalised white lettering). Source: Google Earth.

creation of visual imagery, graphic or not, on geological landscape, i.e. geo-situated visual imagery. The agency of this phenomenon is particularly observable in the rock art category of head representations (*cephalomorphs*; Cavallini 2013), which occurs diversely and consistently throughout Amazonia, the Andes and Caribbean regions, in many cases sharing a general widespread visual identity (Williams 1985; Dubelaar 1986; but see Pereira 1996, 2003).

Finally, a specific hypothesis is presented in order to exemplify a possible way through which pareidolia associated to geomorphic patterning can lead to the perception of facial resemblance on natural surfaces and features and then exert an influence in the aetiology of a widespread although heterogeneous morph-thematic pattern of anthropomorphic head-face visual imagery on Amazonian geological landscapes.

The aim of this article is to explore the relational nature of Indigenous geological knowledge, or ethnogeology (e.g. Semken and Morgan 1997; Murray 1997; but see the geontological proposal by Povinelli 1995 and 2016), its connections with pareidolic neuropsychological processes and with ancient visual imagery construed/constructed on landscape. Also considered will be the eventual consequences of the ways native Amazonian people conceptualise causal agency in such visual phenomena as rock art.

The idea of cultural anthropogeny or the processes through which human or non-human things and processes were culturally fabricated is thus analysed as an aetiological problem (e.g. Bednarik 2016a; see also Davis 1986; Anderson 2012; and Hodgson 2000 on natural geomorphic models for graphic behaviour).

This approach leads to question the notion of anthropogeny grounded on Western practical reason (Sahlins 2003) when applied to the study of non-Western perceptions of visual imagery on landscape, past and present. When geological phenomena are qualified as human-made, or made by ancestral or spiritual animal/vegetal non-human persons, or are themselves considered as persons, this posits a basic question: what is anthropogenic?

Geomorphic pareidolia

The concept of geomorphic patterning utilised here refers to an apophenic process characterised by perceiving pattern, organisation, order, sequence, connection, meaning or iconic resemblance in random geological phenomena (e.g. mimetoliths in Dietrich 1989). It can be defined as a neuropsychological and neurophysiological response to the way information about the geological world is interpreted by the nervous system resulting in the active perceptual patterning in the awareness of the geosphere.

The notion about an intentionally fabricated geomorphic design that can be found among some native Amazonian groups seems to arise from an apophenia phenomenon in which long-term memory is likely to play an important role. Such mnemonic connections can lead ultimately to the attribution of culturally framed meanings to apophenically perceived patterns, generally establishing a sense of relatedness with something else attached to an intense emotional response (e.g. Conrad 1958; Gombrich 1972; Bustamante 2007; Fyfe et al. 2008; Meschiari 2009; Nazaruddin et al. 2017; but see the concept of hyperimage in Helvenston and Hodgson 2010, which emphasises the role

of emotional arousal). Sometimes, it is materialised on a 'pre-form' that resembles something, which will be technically emphasised or modified a posteriori; sometimes, it demarcates a graphic field on a certain surface, or niche with its particular relief, where an image is constructed (Fig. 2). The point in question is that these processes suggest that before any anthropogenic modification of the geological surface, its natural features, textures, colours, volumetric signatures were already meaningful to observers/users.

It follows that the meaningfulness of such geomorphic features could be posited as a cognitive trigger that afforded (Gibson 1979; Hodgson 2000, 2003) the later creation of graphic images in those particular areas, or nearby, taking symbolic 'advantage' of their pre-existence by 'exapting' them. In other words, natural geomorphic features become active parameters for the structuration of visual imagery on landscape. For examples of application in Amazonian rock art, Pereira (2012) and Cavallini (2013) present informative samples. For Upper Palaeolithic cave art Hodgson (2003) has proposed a similar consideration on the role of 'implicit trigger cues' in rock art production, and also Clottes and Lewis-Williams (1998) raised related questions pertaining to their hypothesis on shamanism and rock art.

Another way to evidence such relationships comes through what Bednarik (2011: 59) defines as 'modified iconicity' that consists in 'natural forms whose iconic qualities have been emphasised by anthropic modification'. The perception of likeness in such cases follows the track once problematised by Gombrich (1972: 182–183) when dealing with the issue of visual illusion and psychological projection:

What we read into these accidental shapes depends on our capacity to recognize in them things or images we find stored in our minds. To interpret such a blot as, say, a bat or a butterfly means some act of perceptual classification — in the filling system of my mind I pigeonhole it with butterflies I have seen or dreamed of.

This process pertains to a known subject in neuro-cognitive approaches to visual imagery studies and anthropology called pareidolia (e.g. Guthrie 1993; Helvenston and Hodgson 2010; Bednarik 2011, 2016b).



Figure 2. *Incised cephalomorphic petroglyph intentionally executed below a weathered geomorphic fracture on a sandstone wall. Note a faint incised semicircular line that completes the lower contour of the fracture forming an overall circular demarcation around the cephalomorph, rendering quite clear the cognitive response to the fracture. Boa Vista Site, Prainha municipality, Pará State, Brazil. Image: RV, 2013.*

Pareidolia is a variation of apophenia that acts upon visual and auditory stimuli and could be described as 'experiencing meaningful patterns in random stimuli' or 'perceiving visual similarities between non-iconic entities (rocks, clouds or whatever) and their referent' (Bednarik 2011: 58) and credited to neurophysiological and neuropsychological processes through which 'meaning is created purely within the brain of the "interpreter"' (Bednarik 2016b: 167). However, as brains are also culturally fabricated artefacts (Mithen and Parsons 2008) and culture can be conceived as a social network of learned behaviours and knowledge, it happens that pareidolic experiences are quite prone to be merged within a given cultural framework active in the fabrication of sensorial reality. In other words, despite being created in individual brains, meanings are sociocultural renderings.

The coupling of pareidolia with culturally meaningful responses may have connection to a type of projective imagery which Helvenston and Hodgson (2010) called 'hyperimage'. This last phenomenon stems from intense emotional arousal, culturally and socially articulated, that can cause the projection of internal subjective imagery over sensorial reality. As the authors put it: 'When this occurs, and especially during heightened emotional stimulation, the individual can misconstrue internal subjective images for reality — such an intensely charged, subjective emotional image has a powerful salience when experienced and is referred to here as a hyperimage. Although related, this is different to what is termed pareidolia, which is simply seeing things in amorphous objects, e.g. faces

in clouds.' (ibid.: 69).

In spite of its differences, the relatedness and articulation between these phenomena can be of interest given the possibility that pareidolic processing can act as a trigger to hyperimages and to rock art. Similar articulations were already proposed as an aetiological explanation for some Upper Palaeolithic cave art and elsewhere (e.g. Clottes and Lewis-Williams 1998; Hodgson 2000, 2003; Helvenston and Hodgson 2010; for southern South America see Bustamante 2006, 2007). It is suggested here that this also holds true for some Amazonian rock art.

As some authors have demonstrated (e.g. Clark 1998; Clark and Chalmers 1998; Mithen and Parsons 2008; Malafouris 2008, 2010), the human nervous system and cultural phenomena are intertwined in deeply reciprocal manners. This reciprocity implies a feedback loop relationship into which not only brain-body-genes mould cultural evolution, but also cultural learning and experiences with material world severely affects the human nervous system's development, organisation and functioning. It follows that this neuro-cultural reciprocity (e.g. *cultural neurosciences* in Malafouris 2010) affords that pareidolic processing becomes a potential source for those types of sensorial information that initiate strong emotional responses leading to cultural meaning construction and subsequently knowledge production and transmission.

Precisely because of this last observation, pareidolic and apophenic processes that may be operating in geo-situated visual imagery production and use should not be confused with a perceptual-cognitive error, neither a *misconstrual*, in the observation and understanding of physical causality. Rather, it should be seen as a result of evolutionary process (e.g. see error management theory [EMT] in Haselton and Buss 2000). This mechanism has been culturally exapted in many ways, for instance to become rock art. By the same token, and as a side effect of this first statement, Indigenous apt use of pareidolia ascribing pattern and meaning to naturally random lithological structures should be regarded as a process of cultural-cognitive anthropogeny of landscape. In other words, it should be posited as a type of pareidolia-derived imagery (perhaps hyperimagery) operating as a landscape domestication (or familiarisation) mechanism that creates cognitive affordances to rock art and other geo-situated visual imagery production and theory-making.

On geological ethnographies

It is worth pointing that many native Amazonian groups often make no discrete distinctions between natural geomorphic features and ancient anthropogenic markings, in many cases endowing both of them with similar perceptual qualification and meaningfulness. This is also observed elsewhere, for example, 'it is instructive to recall that Australian Aborigines, who have provided most of the world's credible ethno-

graphic information about rock art, traditionally do not distinguish between natural and anthropogenic rock markings' (Bednarik 2016c: 96). For Amazonian contexts, Silva (2002), Valle (2012), Cabral (2014), Valle and Saw Munduruku (2015) and Echevarría López (2015) present some ethnographic evidence for a similar situation, suggesting that this is a global-scale phenomenon. Furthermore, there is a widespread correlated notion that rocks were soft, malleable, in mythic past when petroglyphs, polished grooves, basins and other markings, even non-anthropogenic ones, were made (e.g. Stradelli 1890 [2009]; Young 1992; Bednarik 2016c: 96). In this regard, Jane Young (1992: 121) informs about Zuni people, in southwest North America that 'most Zunis believe the figures were drawn on the rocks during the time when the rocks were still soft — back in the time of the beginning, before the earth was hardened ... *'awitelin kabin*, meaning "raw earth" ... All the animals and bugs used to speak way back then.' This reinforces the idea about a set of global-scale ethnogeological parameters that developed far back in early human diaspora being transmitted and reinvented since then. Notwithstanding, such considerations are beyond the scope of this analysis and will require further investigation elsewhere.

It does not preclude, however, referring to the case of the Munduruku's (Tupian language family) sacred landscape called Daje Kapap, or literally, the 'Passage of the wild boars', on the middle Tapajos River, southern central Amazonia. It is a geological set of features characterised by an extensive crack (about 50 m in length and 8 m in width) between two huge igneous riverine outcrops (each about 40 m high) surrounded by thick jungle, forming a 45° rocky slope towards the river's right margin inside a canyon-like context. It is a sacred place to the Munduruku people because a specific unfolding of their mythic history involving actions of their main cultural hero took place there. Their main demiurge, Karosacaebu, was seeking to recover one of his sons that had been kidnapped by non-human pig-persons which went down through that geological formation, leaving behind as an index of their passage a sequence of 'pig tracks' imprinted on a rock surface (Karo and Kirixi 2015). Despite the fact that a first superficial glance at the site failed to locate any rock art, a more intensive survey may potentially reveal anthropogenic markings in a Western archaeological sense. Nevertheless, due to the sanctity of the place, its accessibility is extremely restricted and an archaeological in-detail examination would be very likely prohibited by Munduruku cultural norms. In any case, the so-called pig tracks could be an interesting phenomenon to observe in order to determine its chain of causality and development, its aetiology. Human, geological or non-human pig-person? Unfortunately, by the time when one of the authors' visited the place the pig tracks were underwater and could not be examined.

Western-oriented archaeology would consider this place as a 'non-site' location, without archaeological vestiges. Despite this, the Mundurucu consider the place as, technically, an archaeological site according to their perspective. That is, a place where non-human cultural actions took place, leaving behind perceptible residual-indexical marks of such behaviours. Therefore, Mundurucu people possess specific knowledge that allows some of them to perceive, identify and theorise about these indexical vestiges and consequently about the place itself. Then, situations like this suggest that the way archaeology treats the process or the phenomenon of anthropogeny (human-made issues) is in disagreement respective to the ways native Amazonians theorise on issues of agency, intentionality, fabrication and authorship. This has a paramount implication in how one can conceptualise Indigenous archaeology in Amazonia and consequently questions the universality of cultural anthropogeny issues grounded on Western practical reason (Sahlins 2003).

It is argued here that the cultural use of pareidolia as a strategy to produce geosituated visual imagery by human groups is a type of *exaptation*, less in a strict biological sense than as a bio-cultural 'metaphor', which ended up as a functional device of cultural landscaping, that is domestication or familiarisation of environment. Evolutionary biologists would call an exaptation a trait, a character or property of organisms selected and fixed through evolutionary process in response to certain pressures, which in the course of phylogenetic and ontogenetic history gained uses and functions different from those naturally selected for (e.g. Gould and Vrba 1982). That is one way of putting things regarding the cultural reconstruction of pareidolia phenomena: a cultural-cognitive exaptation towards the symbolic use of visual ambiguity in favour of semiotic niche construction strategies, as for example, seeing a face in a random arrangement of three natural holes on a rock surface (pareidolia). Subsequently that rock and place may become the embodied presence of an ancestor's spirit or its house, institutionalising it as a sacred landmark with myth-ritual, political and territorial implications, which would constitute a highly plausible course of geo-cognitive event-actions considering Amazonian geontologies.

When one faces the phenomenon of Indigenous uses of pareidolia, for example, attributing sacredness and human mental states to a rock outcrop because it looks like a human face to certain observers, no external action of making/constructing whatsoever is taking part in the equation, only a cognitive move

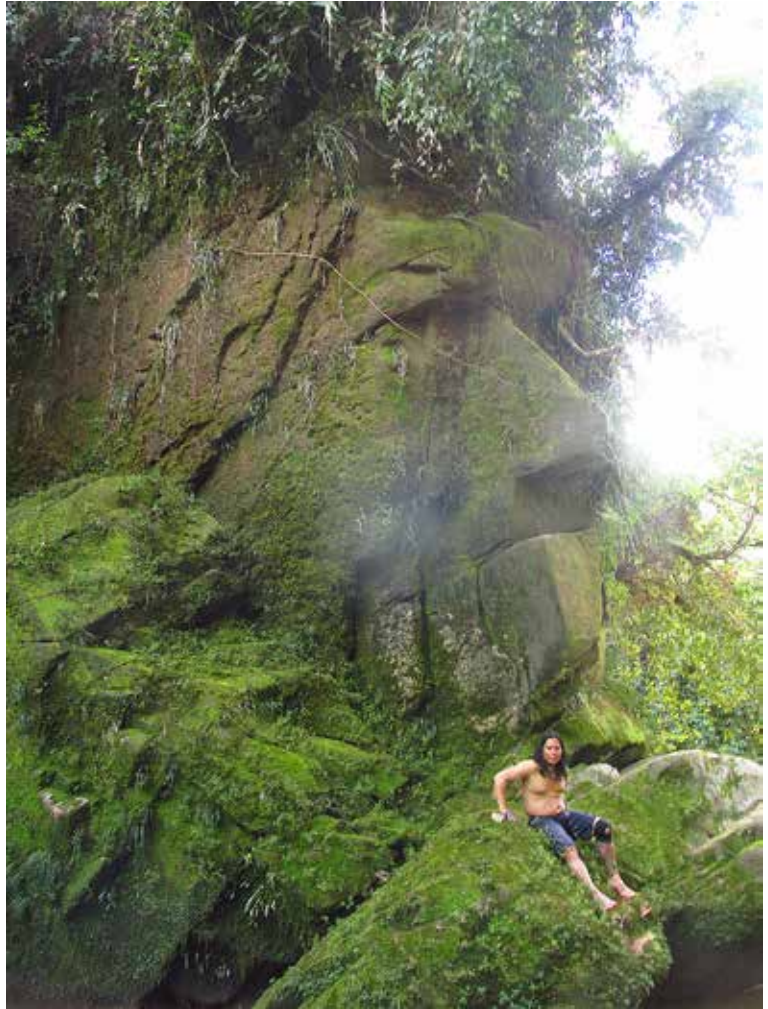


Figure 3. *The Harakbut Amana, the sacred ritual place of the 'Rostro'.*
Image GTEL – APAR 2015.

characterised by an internal mind action. There is no technically mediated material engagement changing the constitution, the shape, or any physical property of the external sensorial world. In a similar direction, Hodgson (2000) has pointed out the occurrence of a convergent category of non-anthropogenic material culture defined as '“naturally occurring artefact” — i.e. the Makapansgat jasperite cobble; a found object which, although not in a strict sense an artefact, became one by virtue of perceptual projection which transformed the object into a semblance of a face!'

This seems to be the case at the sacred place called Amana (Fig. 3) by the Harakbut people, an Arawakan group from the Madre de Dios River, Peruvian Amazonia (Echevarría López 2015). In this sacred place there is a sedimentary outcrop traditionally acknowledged as 'El Rostro' (The Face). This structure fulfils the myth that explains several other 'big heads' in the Harakbut territory, representing the image of the ancestors. The Harakbut people affirm that these heads were made by Toto, an old and powerful spiritual being. Notwithstanding, the observations conducted in the site under a Western analytical and forensic perspective by one of the authors of this present work

confirmed an initial impression that the lithological structure was made by geomorphological processes.

In this case, it seems that there was an internal move towards thinking in a special way out of pareidolia, perceiving pattern and giving cultural, territorial and political meaning to previous geomorphic randomness. This is clearly an instance where first order pareidolic pattern was transformed into a second order apophenic, meaningful association that gained the status of a hyperimage, with its full load of emotional arousal attached to that socio-culturally rooted semantic interpretation. It became socio-culturally and/or ritually sanctioned as cultural knowledge. Harakbut ritual specialists have cognitively 'domesticated' a rock outcrop, randomly shaped by natural processes into a semblance of a tridimensional facial sculpture in a highly visible geomorphological context, with an important role in their mythological history and cosmology. Any physical or spatial proximity to the place must be prevented with specific rituals of protection and purification using tobacco smoke. This is analogous to what Tukanoan *kumuã* (ritual specialists) in the Upper Negro River region calls *bahseré* (in Tuyuka language), which in this case is preventive medicine constituted by a spiritual healing ritual that prepares and protects the body of a neophyte and also of initiated men to enter sacred places. 'Blessed' tobacco smoke is of utmost importance in these preparatory rituals.

That is the point in question: geo-situated imagery does not have to be technically fabricated outside the mind of the observer to be acknowledged as an extant perceptual and meaningful construct. Then it is considered here that Indigenous apt use of geomorphic pareidolia should be regarded as, first, a process of cultural-cognitive exaptation imbued with specific cultural meanings; and second, as instances where cultural-cognitive pareidolic experiences may have given room for geo-situated visual imagery production and use just like rock art.

The possibility of considering geomorphic pareidolia in Indigenous perspectives as cases of cognitive domestication of natural geological structures needs to be clarified. By Indigenous cognitive domestication/familiarisation of pareidolic perceptual outcomes is meant a cognitive response that attributes meaning, agency, reflexive-consciousness and theory of mind (e.g. Premack and Woodruff 1978; Call and Tomasello 2008) to certain places and natural features regarded to be in many cases 'sacred', 'dangerous' or 'meaningful' in non-Western cultural traditions. In this regard, one of the most powerful examples in ethnographic literature is the one offered by Povinelli in her 1995 article 'Do rocks listen?' on the issue of territorial claims by Belyuen people from northern Australia, epitomised by the Darri-ba Nungalinya, or the Old Man Rock, a very sacred geological structure. These semiotic niches (Hoffmeyer 2008) are being construed through highly intense emotional attachment and response

to geological phenomena, which could stem from the perception of order, pattern and/or meaningful organisation in random geological *stimuli* ending up in the generation of translation, identity and theory-making processes (see hyperimage in Helvenston and Hodgson 2010).

Under these assumptions it is proposed to rethink the significance of such structures, places and features – and the cognitive processes attached to them – as a different way (at least to Western perspective) of looking at visual imagery production, use and theory-building. Accordingly, we propose a different phenomenological category of visual imagery on landscape, defined as non-anthropogenic Indigenous geo-sites (and/or geofacts), or simply put, non-human geo-sites (and/or geofacts). Among many interesting consequences, it opens the possibility for non-human rock art, which is rock art made by non-human agencies, a reality for native Amazonian connoisseurs, another fascinating problem that will demand treatment elsewhere. Although bearing no human-made physical modifications these places possess meaningfulness, sacredness, cosmological and ritual significance to Indigenous people; they possess cognitive life. The point is that, heritage laws in South American countries must acknowledge these places as important as rock art sites, with symmetrical and reciprocal status between them, deserving equal protection and preservation priority. Important examples of such a category are the ethnographic cases of Daje Kapap (Mundurucu people) and Amana (Harakbut people).

These instances seem to be broadly neglected by mainstream archaeology in South American countries, maybe considering them less scientifically important than 'proper' archaeological sites because of the absence of technical anthropogenic markings that are recordable and measurable cultural physical and/or chemical alterations on geological surfaces. However, a change in perspective of that order would have great impact in the protection of meaningful and sacred Indigenous places that remain of absolute importance to Amazonian cognitive domestication of environment, past and present.

Regarding this last point, it is also intended to emphasise the need to merge Western rock art theoretical parameters into Indigenous cognitive-epistemologies as a tentative procedure to move towards a permanent awareness regarding the decolonisation of the discipline. It is assumed here that, in great part, mainstream South American archaeology misunderstands rock art phenomena in its cultural-cognitive entanglement with Indigenous knowledge in the context of ethnographic present; something also discussed from the perspective of terminological parameters (Echevarría López 2013, 2016).

It seems that Western archaeology generally expresses disregard or refuses to acknowledge myth-historical Indigenous narratives as historically accurate. In consequence, cultural and/or territorial

claims from present Indigenous groups over part of the archaeological record, sites and landscapes (many of them absolutely sacred spaces), even when inside traditionally occupied Indigenous lands, are considered historically questionable. This happens quite often in Brazil, in Perú and other peripherally emergent capitalist political economies (e.g. *The Cochabamba Manifest*; AEARC et al. 2015).

It is suggested here that this misunderstanding is grounded on the simplistically and technologically biased assertion that those groups did/do not make image designs on landscape, rock art nor other archaeological sites occurring in their 'present' territories. Therefore, they do not possess direct culture-historical relationship with the archaeological record or with the landscape's deep history (Heckenberger 2011). This statement is an epistemological absurdity. It profoundly denies non-materialistic ways of constructing (construing) the world, its cognitive domestication. That is, the intangible cultural heritage of Indigenous groups in Amazonia and elsewhere regarding geo-situated visual imagery is being downplayed, treated as a picturesque curiosity, while it should be recognised in heritage law and within jurisprudence in order to increase protection to those places.

Taking this perspective for granted implies not only a measure to protect sites but, of equal importance, to protect the cognitive life of those places (e.g. Malafouris and Renfrew 2010), which is constituted by the intangible cultural knowledge Indigenous people have been producing for millennia regarding cultural imagery, rock art and landscape. In that sense, Amerindian graphic testimonies on Amazonian landscapes should be considered intangible cultural heritage of present-day Indigenous groups, besides archaeological evidence.

Native Amazonian epistemological systems, so far minimally understood in their geontological dimension (Povinelli 2016), encapsulating graphic visual imagery on landscape seem not to set a clear divide between what is human-made and what is not. They have different sets of criteria to separate and/or conjoin 'geo-bio-socio phenomena' in terms of causal relationships. The cultural uses of pareidolia phenomena seem to be an index for a tentative understanding on how this may have worked.

Zo'é Indians, a Tupi-Guarani group from Northern Amazonia, emphasise this state of affairs in a quite clear manner. They say that '*kisi*', which is a simple trace that can be exemplified by a cut caused by a machete on a tree trunk, could be also associated to *Bahyra* people when settled on a riverine rock surface. These are nonhuman persons that live underwater in the rivers and are acknowledged by Zo'é as the petroglyph authors (e.g. Cabral 2011). Zo'é consider *Bahyra* to be an altogether different people, the first settlers of their land, not related to their identity nor to any other people in the region dominated by Karib language

family speaking groups. This non-human agency is sometimes attributed to natural fine linear groove features on igneous surfaces, especially on the bedrock of rapids and cascades or riverine outcrops. Two or more *kisi* arranged can structure a form, a drawing or a writing (*kusiwet*). For example, this happens when two natural crossed lines forming an X shape on a granite surface are identified as a *kusiwet* but also a petroglyph nearby receives the same qualification (*tié kusiwet* — a drawing on the rock surface).

According to Hodgson (2006) this process can be explained by a specific stimulation of the mirror neuron system caused by the perception of a natural referent (e.g. a weathering pattern) that creates an empathic bond with the observer affording somatosensory simulations or adding on the naturally pre-existing forms. It is possible that this sense of empathy, although not necessarily related to pareidolia, can then lead to the reciprocity in ontological status between natural and cultural forms, which is implied by the *tié kusiwet* case, where technological fabrication, design and intentionality extends beyond humans embracing geological and life processes.

Similar cases are found throughout Indigenous Amazonia and Andes. In the Quechua language family, for instance, there is the concept of *quilca* (i.e. graphic phenomenon; Echevarría López 2013, 2016), which is an open category that includes all kinds of culturally determined graphic and image phenomena, irrespective to their origin, material or manufacturing processes. That is, in some instances it does not clearly differentiate between human and non-human constructs. Thus a Western anthropogeny criterion is not a definitional parameter to the *quilcas*' cognitive system, as well as in Amazonian cases. For example, Silva (2002) informs that among Asurini of Xingu (another Amazonian Tupi-Guarani group) there is a spiritual entity called *Mahyra*, which was responsible for the sharpening grooves and natural geomorphic features like potholes made when rocks were soft. For example, the impressions of *Mahyra* buttocks can be two polished, conjoined round basins. The relationship with petroglyphs remains unclear but is, notwithstanding, very likely. The Asurini's *Mahyra* has a culture-historical and linguistic relationship with the Zo'é's *Bahyra* (e.g. Cabral 2011); both are related to rocks and river and to the marks on those rocks. *Bahyra* may possess a more emphasised character of sociological unit, while *Mahyra* seems to be more easily understood as a personified single non-human entity. However, the sense of otherness attributed to rock markings greatly vary between these two Amazonian Tupi groups. While Zo'é see no connection whatsoever between *Bahyra* and themselves, separating their histories and markings, Asurini consider *Mahyra* as a demiurge or cultural hero, connected to the origin of their mythic-history. Asurini *Mahyra* is an *emic* being while Zo'é *Bahyra* seems to be an *etic* state of being.

Cabral (2014) has pointed out that among Wajãpi

Indigenous people (also Amazonian Tupi-Guarani language family), some natural geomorphic features are loaded with meaningfulness analogous to adjacent anthropogenic abrading marks, archaeologically associated to the sharpening grooves of stone axes production and maintenance. As with the Asurini and Zo'é, the Wajãpi case also points to a further interesting characteristic quite pervasive among Amazonian ethnogeological systems and elsewhere, the understanding that those marks were made when rocks were soft (e.g. Stradelli 1890[2009]; Silva 2002; Valle 2012; Cabral 2014).

These cases indicate that native minds extended over the Amazonian biome assume diversified historical morphologies. However, when it comes to the entanglements between visual imagery and geology (e.g. rock art), there is no sharp separation between human-made (in a Western sense), spirit-made, non-human-made and natural-made (in a Western sense). This brings the following question: how do Amerindians construct their notions on cultural anthropogeny, if there is any?

Cultural anthropogeny is taken to be ideas regarding the human cultural origin of things, or its fabricated nature through techno-cultural means. Here, it also expresses the culture-environmental aetiology (causation) of human ideas, things and behaviours. Perhaps, the most parsimonious Western definition to the term anthropogenic is 'constructed by humans', or 'human-made'. Two concerns are introduced with this expression, one with the concept of 'human' (the authorship) and other with the concept of 'made' (the action). Taking for granted Amazonian perspectives, not only humans are capable of agency, intentionality, theory of mind and point of view. So, in terms of visual imagery on landscape, humans cannot be credited as the sole authors. Then, investigative questions in this line would be, besides humans, who else is making and using cultural markings on rock surfaces? Are non-human entities engaged in rock art production/use? How is that?

As an illustration of that first concern, in 2010 one of the authors, which is a Tuyuka knowledgeable man (who considers himself a *Kiti Masigu* — more or less like a wise man — in this Tukano language, but expressly not identifying himself as a *kumu*, a ritual specialist) reported a part of a mythological account about the agouti (*Dasyprocta variegata*), a Central/South American rodent. Specifically, about how it used the teeth as a tool to produce grooves on rock surfaces in mythic times, when rocks were soft (e.g. *ita-yaquirá* in Rio Negro Nheen-gatu dialect, meaning young, malleable rocks [Stradelli 1890[2009]; see also Valle 2012]). The agouti, as the culture bearer it is, treated those grooves as a conscious production of his behaviour and kept cognitive bonds towards them. This was possible to deduce by the context into which this Indigenous connoisseur presented the idea on how the agouti related himself to that bio-mechanic

intervention on geological surfaces, and because the subject matter of the discussion when he stated that was how petroglyphs were made. The second part of the expression, signalling the action ('made'), relates to the above observations regarding pareidolia and its cultural exaptation. It suffices to say that Indigenous visual imagery on rock surfaces is not only a matter of making, and the technological paradigm has limits, that is, a materialist and tangible threshold in the ways it can afford answers to the phenomenon (e.g. taphonomy, Western perception and epistemology). What has to be accounted for is that the focus on making (material fabrication) renders an incomplete, and maybe poor statement regarding the cultural aetiology of geosituated visual imagery.

Who made it? How it was done? When was it made? These are quite common questions in archaeological enquiry, but two other actions are obviously meaningful and important aspects of what constitutes visual imagery's cognitive life: using and thinking. Therefore, interesting ethnographic questions could be 'for what reasons are those people using rock art images? Moreover, how do they relate to and what are their thoughts about such images?

Considering Amazonian cosmologies, graphic expression on landscape is not a human business, at least, not exclusively of humans, because many intentional, sentient agencies must have produced and used it — actually still are producing and using it. That is, graphic production exists in several onto-ecological perspectives. For example, jaguar (*Felix onca*) paw marks resulting from claw scratching on rock surfaces would stand for jaguar's image production, that is, the marked rock becomes part of the jaguar's *Umwelt* (Uexküll 1934[2010]) signalling behaviour socially communicable to other jaguars (e.g. Valle 2012; but see Reichel-Dolmatoff 1996). The concerns about these graphic perspectival landscapes and ecologies are not only centred on the technology of making. They also encompass the intangibility of their symbolic economy (symbolic use) and epistemological strategies (theory-making) pertaining to the ways graphic expression works as a tool for and as a process of cognitive domestication of the environment; that is, as a semiotic niche construction strategy (e.g. Laland et al. 2001).

What is anthropogenic?

In native Amazonian thinking many other beings, as well as humans, are able to make things in a fashion that would correspond to cultural fabrication. In that perspective, virtually all biological forms, spiritual beings and some non-biological material entities are endowed with complex 'human-like social life', with cultural behaviours and cognition. Therefore, they are simultaneously cultural fabrications of some order but are also fabricating their own social material worlds. Some expressions in anthropological terminology attempt to give sense to this idea, or ontological category

of cultural agents, such as 'other-than-human persons' (Hallowell 1960), 'non-human persons' (e.g. Santos-Granero 2009a; Hugh-Jones 2009), 'non-human selves' (Khon 2013). Indigenous knowledge refers to such agencies by many expressions such as *Wai Mahsā* (pers. comm. Tenório Tuyuka 2016), *Bahyra* (pers. comm. Kwai Zo'é, 2013, 2015) or *Okoymoyana* (pers. comm. Xamen Wai Wai 2014, 2016). In common, they bring the idea that what Western-oriented materiality, or practical reason, considers as produced or constructed by human agency differs from a widespread process of social life construction and organisation that lies beyond the limits of what is considered strictly human, in a Western perspective.

The frontier between human and natural 'cultures' became blurred in the sense that other life forms are engaged in cultural ways of being. Humans may have first identified cultural phenomena in humans, but it does not mean that it is only there, or even less that it is older or more complex in humans. So, native Amazonians have been experiencing for at least 13 000 years of observation, classification and understanding of life and consciousness phenomena in the cultural history of the Amazonian biome.

Interestingly, in 2012, Western cognitive ethologists and neuroscientists publicly acknowledged animal consciousness in *The Cambridge Declaration on Consciousness* (Low et al. 2012). Although this document should be evaluated cautiously, based on the understanding that consciousness may not be monolithic in nature and structure, and several types and levels of conscious processes may operate in different beings, it takes to another epistemological level the issue of non-human consciousness and the possibility for complex interspecific theory-of-mind, communication and knowledge transmission. According to its proponents:

Convergent evidence indicates that non-human animals have the neuroanatomical, neuro-chemical, and neurophysiological substrates of conscious states along with the capacity to exhibit intentional behaviors. Consequently, the weight of evidence indicates that humans are not unique in possessing the neurological substrates that generate consciousness. Nonhuman animals, including all mammals and birds, and many other creatures, including octopuses, also possess these neurological substrates (Low et al. 2012: 1).

This perspective gives a much more complex picture than what would be supposed by a metaphoric application of human cultural models over nature, as a cognitive-epistemological strategy of human mind to explore the world. It is plausible that humans have socially learnt from other life forms how to behave and think culturally as much as from other humans. That is, how to learn from environmental sources of sentience and knowledge through apt reconstructions of sensorial reality and interpretation of other consciousness.

One prominent consequence of the above scenario is the disentanglement of the iconic relationship

between anthropogenic and 'human-made'. Taking Indigenous perspectives in Amazonia for granted, this 'human-made' character, as an exclusivity of humans, seems to be an absent idea, at least in the light of the available ethnography. Then, the very notion of cultural behaviour becomes a potentiality of biotic and abiotic life, and this constitutes another related topic: some non-living things to Western perception may be eventually alive and possess consciousness in native Amazonian sensorial worlds, to an extent that the human-made notion in itself disintegrates.

The notions of 'culture', 'technology' and 'human-made' conflate in the Western concept of anthropogeny, but this operation would hardly make sense in Amerindian thinking. The adoption of the term 'cultural' before anthropogeny, less in terms of cultural origins of humans (e.g. Tomasello 1999), actually expresses here the idea that what a subject considers to be anthropogenic (or made by a subjective culture-like agency) depends on the cultural background of the subject and is not an absolute or given type of observation on social reality. It is a culture-dependent construct. In short, what is understood as human-made or culturally constructed will depend on the diversity of cultural concepts of being human and how these might be extended, compared, related or learnt from other types of subjects.

Therefore, it is considered here that anthropogeny should be apprehended more in terms of cultural processes than in terms of humanness. Coherently, cognitive ethology acknowledges that culture is a widely shared phenomenon, within *mammalia* class and beyond (e.g. Griffin 1984; Tomasello 1999; Sebeok 2001; Low et al. 2012), while humanness is a more restricted bio-cultural construct. In that sense, cultural anthropogeny is being utilised here as the process of making 'things' through cultural ways. By cultural ways are meant processes of constructing knowledge, behaviours and material things through the application of socially mediated learnt dispositions. Hence, cultural anthropogeny can be conceived as the aetiological study of the conditions, expressions and consequences of different cultural conceptions on fabrication of human/non-human constructs. So, two questions to start gaining insight on the Amazonian anthropogeny of visual imagery on landscape are: how was it made? Who made it?

These questions, although simple, are about the status of sentience, intelligence, intentionality, self-reflexivity and theory of mind of the causality systems behind what Westerners divide as natural and cultural processes and constructs. Nevertheless, they are not about humanness. Tuyuka/Western 'interepistemological' insights on that matter were shared between two of the authors in direct conversations during visitations to petroglyph sites (*utã woritire* in Tuyuka language). These insights indicated that *Wai Mahsā* (powerful zoomorphic spiritual beings or non-human persons) could and should possess their

own marks or signs (petroglyphs) and ethno-geological knowledge. In effect, *Wai Mahsā* constitutes an agentive and intentional ontological category; they are subjects, even constituting sociological units, a type of people. Similar cases can be observed in the case of the *Bahyra* people, in Zo'é cosmology, or with *Okoymoyana*, the *Cobra-Grande* (anaconda) people, which are also related as the old makers of rock art and other visual imagery on landscape by Wai Wai and Cashuyana ethnic groups (pers. comm. Jaime Xamen Wai Wai 2016; pers. comm. Juventino Cashuyana 2016). Furthermore, they actually live at certain geological formations, in many cases near rock art locales.

Western practical reason algorithm is a limited, non-universal epistemological strategy in terms of human and non-human cultural-cognitive diversities. The anthropogeny that emanates from the cultural use of pareidolia, for instance, cannot be exclusively posited as a neurological imposition of the human mind over the environment but as a reciprocal interaction with environmental affordances to human perception (Gibson 1979; see also *hyperimage* in Helvenston and Hodgson 2010). Therefore, external nature actively makes available a background of possibilities and limitations for creative arrangements of things and processes constructed by the mind in the process of its own evolvement. Hence, it is possible that feedback loop structures encompassing mind and nature constitute a basal meta-pattern of knowledge production by sentient life systems (Bateson 1980; see also Ingold 2000; Maturana and Varela 2001; and Margulis and Sagan 2002).

The idea embraced here is that nature created mind as a sort of cognitive phenotype of sentient life, an evolutionary exaptation that ended up as complex cultural behaviour. It is possible that this cognitive phenotype became fixed in an ancestral population of organisms by giving optimised manageability to the increasingly more dynamic and complex amount and array of sensorial information constructed by brain out of proprioceptive input, in varying degrees along mammalian neurological evolution, just to frame in an immediate biological context. This seems to be the case with consciousness phenomenon as pointed out by Erra et al. (2017). Although, restricted to human scale, their study on the entropy values associated to levels of conscious awareness indicated that 'consciousness could be the result of an optimization of information processing' (Erra et al. 2017: 1); suggesting that consciousness meta-patterns evolved from increased and patterned levels of entropy in information processing.

Therefore, mind and culture are evolvments of nature as side effects of specific biological trajectories. However, what *Homo* has done with sensorial information in the course of, at least, the genus history seems to evidence the rise of cultural selection as an important source of evolutionary change besides natural selection (e.g. Tomasello 1999; Bednarik 2011). When mind was

reinvented by artificial, cultural means of selection, it turned its sensors to nature again and transformed those first order sensorial representations into second order metarepresentations (Sperber 2000), just like rock art, shamanism and mathematics. An analogous process to that is theorised by Donald (1991, 2010) as the inception of exograms and external information storage, and that by Hodgson (2000) when treating art as a non-functional evolutionary by-product of information processing.

Theory of mind and self-reflexive consciousness phenomena (e.g. Tomasello 1999, 2008; Call and Tomasello 2008; see also Colonnello and Heinrichs 2016, on the role of neuropeptide oxytocin in self-consciousness) can help in the understanding of the above idea. First, in order to see other humans (or primates, other life forms, things, geological features etc.) as intentional beings as the self, it requires a previous development of self-reflexive consciousness, that is, the subject's sense and knowledge of its own existence as a subject with specific cognitive characteristics and perspective. Second, for this first order cognitive apprehension becoming a second order representation about the other's mind, that is, a representation about the sensory-emotional world of another subject (a meta-representation, *sensu* Sperber [2000] — MR here on), implies the transference, or the projection, of the insights gained by self-reflexive experiences towards other subjects. In human ontogeny, this second upheaval in consciousness seems to start with imitative behaviour well established around 18 months of life after birth, leading to full theory of mind and perspective taking a little later, as indicated by observations on Western experimental subjects (e.g. Tomasello 1999, 2008).

It is suggested here that mind was fabricated by nature as a processor of first order representations of the sensorial world, and therefore, in its aetiological origin it is not a human cultural construct but a biological artefact. First, in the evolution of mind, the nervous system seems to have gained consciousness of itself as a 'being' in the cosmos. Then, this cognitive 'invention' was applied as an algorithm to translate other's (out of the self-organised entity called individual organism) behaviours and predict other's intentions. Complex sociality was thus invented through social and cognitive processes like joint attention, 'mind reading', shared intentionality and perspective taking applied not only by humans (e.g. Call and Tomasello 2008; see also Dunbar 1998 and Stiller and Dunbar 2007). Therefore, theory of mind is treated here as MRs of sensory-emotional worlds of other subjects. When cultural minds (human and non-human) look back at nature seeking patterns, intentionality and agency, they find out the world's own minds in a plethora of perspectival inter-subjectivities.

The idea of cultural anthropogeny presented here explores the different theories on the fabrication of the sensorial world pertaining to native Amazonian visual imagery on landscape. Therefore, it refers to the

process of fabricating ideas on fabrication processes. How did things, processes and beings originate? Origin and concepts of making, constructing or fabricating are being considered here as conflation, in great part because in native Amazonian cosmologies the idea of a given *ex-nihilo* origin is often replaced by constructional processes, not without exceptions (e.g. Hugh-Jones 2009).

The ontological status of the image makers could be indexically associated to image itself. For example, to Zo'é people, petroglyphs were made by the *Bahyra's* agency, therefore it is out of Zo'é's anthropogenic range. *Bahyra's* ontological status is of non-human persons from ancient times, presently inhabiting river bottoms. Riverine outcrops with rock art (*tié kusiwet*) are the *Bahyra's* indexical vestiges, par excellence. They were made and left a long time ago, as stated in the expression: '*Bahyra' kuriri za'po!*' ('Bahyra made a long time ago!'; pers. comm. Kwai Zo'é 2013). Furthermore, during an ethnographic situation experienced by one of the authors, an anthropomorphous petroglyph was directly interpreted by two Zo'é men as a *Bahyra* subject himself. Therefore, it suggests that the ontological status of the identified authorial agency can be transferred to rock art as a type of authorship embodiment.

The references so far discussed here and in previous examples (Valle 2012, 2015; Echevarría López 2015) carry many indirect and implicit allusions, sometimes explicit references, indicating that rocks contain different kinds of power, are endowed with different types and levels of subjectivisation, intentionality and agency (e.g. Santos-Granero 2009a, 2009b), suggesting a pan-Amazonic animistic lithosphere

(Århem 1993; Descolá 1996). Moreover, they also indicate that geology is potentially perspectival, that is, besides animistic rocks and rock graphic expression, it should be considered as possessing self-reflexive consciousness and, as a cognitive extension, points of view (on the Amerindian notion of point of view see Viveiros de Castro 1998, 2004; and also Carneiro da Cunha 1998). In its turn, archaeological evidence (e.g. geomorphically patterned rock art) suggests that rocks are being cognitively 'exapted' or 'familiarised' (e.g. cultural geomorphism) prior to image making, and this is an onto-epistemological reaction to the meaningfulness of lithological structures in native Amazonian ecologies of mind (Bateson 1972).

Visual imagery and rock art evidence

Head representations with facial features are a common phenomenon in ancient Amazonian visual imagery (e.g. Williams 1985; Dubelaar 1986; Pereira 1996, 2003, 2012; Valle 2012; Cavallini 2013). Three-dimensional head/face sculptures, or bas-reliefs, although less common, are also present in known cases, as with the Harakbut people (Echevarría López 2015). Based on the regional consistency of this head-face pattern of synecdoche (almost an obsessive consistency), it served in rock art classification as one 'cultural marker' for the preliminary definition of a more or less discrete taxonomical entity, bearing in some of its elements a recognisable visual identity. Denis Williams (1985; see also Dubelaar 1986, for another synthesis) summarised this sense of formal identity, proposing the Guiano-Amazonian tradition of rock art, encompassing mainly petroglyphs distributed along northern South America and Caribbean regions.



Figure 4. Complex arrangement of head motifs presenting the combination of natural features, like holes and cracks, and petroglyph grooves and cupules delineating contour and facial traces. Pitanga site, Prainha, Pará State. Photo RV 2013.



Figure 5. Closer view of a detail of the Pitanga main panel where it is possible to observe the complex intertwining of geomorphic features and anthropogenic technical scars in the structuration of the head motifs. Photo RV 2013.

Later, Edithe Pereira (1996, 2003) restated the problem, sophisticating the approach and proposing the Amazonia tradition of petroglyphs, more frequent in South American lowlands (Figs 4, 5 and 6). For one of the sampled areas discussed here, Monte Alegre rock art complex, she proposed a more specific phenomenon characterised by pictograms defined as Monte Alegre style (Figs 7 and 8), without clear relations with the Amazonia tradition. In all these proposals, cephalomorphic 'obsession' coupled with intentional exploitation of geomorphic features were important characteristics.

The cultural perceptions of geological surfaces and their geomorphic layouts and features are fields from where pareidolia can be exapted to become a source for visual imagery through geomorphic patterning. Here is presented some evidence that suggests how this process may have happened and



Figure 6. Another example of a complex intertwining of natural holes, petroglyph grooves and pounded scars heavily weathered by fluvial erosion, combined in the structuration of head motifs. Caretas site, Urubu river, Amazonas State. Photo montage courtesy by M. Cavallini 2013.



Figures 7 and 8. Painel do Pilão site, Monte Alegre, Pará. Red pigment applied around natural holes forming a possible head-like motif. Note that the perception of the separated holes corresponding to the eyes (Fig. 7) depends on the angle of the observer, suggesting anamorphism besides pareidolia. Comparing both photos taken at different angles it becomes particularly perceptible how the intentional manipulation of the geomorphic feature combined with the application of pigment under a specific spatial disposition of observation renders effective the illusion of separated eyes.

Photos RV 2016.

Hypothetic classification for cephalomorphic phenomenon → ↓	Criterion A – visual categories (results) →	1 – Two-dimensional graphic representation of a head-face pattern on a quasi-flat surface.	2 – Hybrids between 2D and 3D renditions, combining geomorphic relief with technical marking.	3 – Three-dimensional (sculpture-like) representation of the entire head, or just of the face, naturally or anthropogenically constituted.
Criterion B – anthropogenic degree/type (processes) →		I – Fully natural, without any technical intervention.	II – Hybrids between technical markings and geomorphic patterns.	III – Fully artificial, that is, cultural, an entirely technological materialisation upon raw sources.

Table 1. Possible ways of classifying cephalomorphic phenomena according to visual categories (consequences) and to anthropogenesis (causal process), as discussed in this work (after Cavallini 2013).

influenced some visual imagery production and perception in Amazonia. The evidence is focused on just one morpho-thematic class characterised by head representations (commonly showing facial traits), and in recent literature called ‘*cephalomorphs*’ (Cavallini 2013). Cephalomorphs are anthropomorphous or zoomorphic synecdoches (or metonymies, in a sense) which seem to consist of a part of the anatomy that stands for a syntactical representation of the whole conceptual body; that is, when a part assumes the symbolic ‘control’ of the totality, being the entire head or just the facial elements, without demarcation of a head contour.

The general pattern of head representations with facial traces in Amazonian lowlands comprise at least three different visual categories. Two of them can be set in terms of graphic presentation and another non-graphically codified: (1) two-dimensional; (2) hybrids between 2D and 3D renditions; (3) full 3D (sculpture-like). The first category, two-dimensional, is constituted by a graphic form (a motif), a pictogram or a drawing on an almost plain surface without volumetric variations. In the second category there are several intermediate types, hybrids in between 2D and 3D. Its range varies from petroglyph itself, based on the volumetric rendition of its technical elements, considering penetration under the rock surface, up to petroglyphs and pictograms that fully employ the natural surface relief, colour, texture and/or shape in the image construction, sometimes to volumetrically emphasise its structural shape. It always denotes an active interaction, a reciprocity between technical mark and natural geomorphism. The third category is a full three-dimensional (sculpture-like) representation of a head with facial traits or just from the face features on a boulder or cliff surface, natural or anthropogenic.

Therefore, in terms of an inclusive classification (see Table 1) the three categories fit in a broad perspective of cephalomorphs. The first two categories can be described as varying from full graphic (bi-dimensional) constructions to situations allowing for simultaneous graphic and geomorphic renditions of the image, at

different levels and types of interaction. The Western anthropogenic character is implied by the technographic structuration of such images, involving in different degrees the application of graphic techniques. The third category, however, is characterised by its full three-dimensionality and although part of visual imagery, it is not necessarily graphic. Its representational potential stems from broad iconic or indexical connections that can be fired against sensorial reality inputs, in expense of any anthropogenic technographic material modification (in the sense of marks drawn, incised, pounded, abraded or painted on rocks).

A broad definition for the cephalomorphic representational phenomenon would imply any sensorial *stimuli* that resemble to human observers the shape of a human or animal head, with or without facial traits, irrespective if it is anthropogenic or not. The three categories described can be triggered or affected by pareidolic agency in different levels and ways, but specially in categories 2 and 3, geomorphic patterning through pareidolia exerts observable participation.

Another important way of organising the sample of observed cases is taking as a parameter the degree and type of anthropogenic modification applied. That is, the nature of the human technical and material intervention. This implies taking for granted the process of its becoming and not its final result, i.e. how it became two and/or three-dimensional? The process of constructing awareness of the environment seems to result in ‘virtual reality’ reconstructions intertwined to several degrees of ‘integration’ between natural features and anthropogenic technical markings. These range from (I) the pure natural type, not technically reconstructed in any aspect (Figs 3, 9 and 10); passing through (II), partially reconstructed types also keeping visibility of natural features like hybrid shapes (Figs 6, 7 and 8); until almost entirely reconstructed ones (III), as plain virtual reality entities sometimes still keeping a less evident participation of geomorphic patterning (Figs 2, 4 and 5).



Figure 9. Holes in a riverine clay bluff caused by acari fish nidification (*Hypostomus affinis*). Natural model for seeing face-like arrangements on geological surfaces. Green Lake, Alter do Chão, Pará State. Photo RV 2016.



Figure 10. Closer view of acari holes suggesting face-like arrangements. Photo RV 2016.

Hypotheses

The human face is one of the most impressive sources of information regarding the social and emotional worlds of humans (e.g. Guthrie 1980, 1993; for a straightforward reflection of this assumption in the rock art realm see Watson 2011). It attains a possible generalised perceptual tendency towards anthropomorphism in human *umwelt* (Uexkül 1934 [2010]), which presumably stems from the central role in social interaction during primate evolution

for the decoding of socio-emotional information from facial expressions and in facial individual identity, mainly eyes and mouth (e.g. the importance of eye gaze perception in great apes; Tomasello 1999, 2008). Along the evolutionary trajectories of the primate nervous system, social relations and socially mediated learning became increasingly powerful sources of neurobiological change. It seems that complex social relations affect brain evolution towards neurological complexity with direct impact on animal intelligence (i.e. 'the ability to respond flexibly to new or complex situations, to learn and to innovate'; Van Schaik and Burkart 2011: 1008), as pointed out by some studies (e.g. Dunbar 1998; Tomasello 1999, 2008; Reader and Laland 2002). Therefore, very likely it affects perception of environment and the perception of the self, and the understanding that the self is a viable cognitive model to interpret the others (i.e. theory of mind), including rocks (Povinelli 1995).

What is interesting to note here is that, to native Amazonians, the idea of the self is not confined to the human domain, which is why Khon (2013) applied the expression 'non-human selves' in his study of the cosmopolitics of the rain forest in the perspective of the Runa people, a Quechua-speaking group from Ecuadorian Amazonia. Therefore, humans can reciprocate souls with jaguars and agoutis, which are as cultural as humans are. This operation cannot be subsumed to behavioural metaphors, from humans to animals, at all. These are Amerindian cognitive-ethological statements regarding reciprocity among sentient life as a whole, including the geosphere. As an extension of this and general hypothesis, it is considered here

that to some Amazonian perspectives, humans can cognitively reciprocate with quartz, feldspar, chert and other minerals, rock types and geological phenomena.

In convergence with Bednarik's observation that '[T]he possibility that pre-Historic people observed natural rock markings, were intrigued by them and sometimes added petroglyphs to them, such as cupules, is very real as has been demonstrated at numerous sites' (Bednarik 2016c: 96), we propose here a more specific hypothesis as an example of how

pareidolia and geomorphic patterning can entangle and lead to graphic imagery. This consists of the possibility that the natural phenomenon of the clusters of holes on riverine clay or silt bluffs probably caused by acari fish nidification (*Hypostomus affinis*; Figs 9 and 10) — as acutely pointed out by Amazonian fishermen, and visible during low waters/dry season throughout the Amazon basin — could have worked as cognitive triggers (natural models) for the perception of face-like arrangements on riverine geological surfaces. These, in turn, could have influenced the creation and dispersal of a common rock art pattern in Amazonia, the so-called head-face representation of Guiano-Amazonian tradition. This has been suggested by cases where such features were used in the structuration of cephalomorphic graphic representations, as demonstrated by Cavallini (2013) in Caretas petroglyph site, lower Urubu river, middle Amazonas basin; and with the pictograms of Monte Alegre area, lower Amazonas basin, studied by Pereira (e.g. 1996, 2003, 2012).

This hypothesis stems from the understanding that a simple way through which natural geomorphic features can be iconically codified as a face pattern is through the specific positioning of natural holes or depressions on rock surfaces. When arranged in certain spatial dispositions and numbers, forming an overall triangular inclusive field among three hole features, this arrangement is prone to be visually interpreted as resembling a face with eyes and mouth. This corresponds to a relatively simple manifestation of the known face-pattern phenomenon in visual imagery studies (e.g. Gombrich 1972; Guthrie 1993; Helvenston and Hodgson 2010; Bednarik 2011; Watson 2011). Furthermore, face-pattern pareidolia can be conceived as an important cognitive strategy of sensorial world disambiguation for humans.

Face recognition, or individuation, is a relevant neurological task and there is in brain architecture a specialised system or cortical network importantly involved in the processing of that visual stimuli, centralised in the anterior region of the fusiform gyrus (Nestor et al. 2011). Therefore, the hypothesis draws on neuropsychological and ethnographic information to analyse formal, patterned and intentional interactions between technological anthropogenesis and geomorphological randomness in the constitution of visual imagery on landscape in ancient Amazonia. Proposing that the role of natural geomorphism in *graphic-scaping* (e.g. Valle 2015; the surrogate [re] construction of environment through graphic means) is important and precedes any materially and technically mediated process of extending mind over environment.

To test the proposed specific hypothesis it will be necessary to explore three lines of data-gathering:

(1) Ethnographic checking for native cosmographic accounts regarding those particular biological and geomorphological conjoined structures and see the elements they bring. For instance, any type of

association between the home of the acari fish and non-human persons living under water, or inside rocks would be informative.

- (2) Perceptual-cognitive checking out for spontaneous psychological responses of diverse observers exposed to those structures, paying attention if the face identification patterning comes out in those experiences, and how often this perceptual response does emerge; as well as, its possible engagements with sociocultural, linguistic or other types of bias.
- (3) Ancient visual imagery evidence constructed upon such natural contexts and features, as in the Caretas site (Fig. 6) and in the Monte Alegre and Prainha areas (Figs 2, 4, 5, 7 and 8).

This techno-cognitive chain of transformative operations can be seen today in its full culture-environmental scale, from the natural model passing through several kinds of hybrid shapes up to fully anthropogenic (in the Western sense) graphic units. The process involved seems to stem from native Amazonian animistic-perspectival ontologies and relational epistemologies (e.g. Bird-David 1999; Viveiros de Castro 2002) regarding strategies of cognitive domestication of geo-environments. The cultural exaptation of pareidolic phenomena on geological structures, via geomorphic patterning seems to have played an important and preliminary role in the development of subsequent visual imagery on landscape.

Open discussion

Considering Indigenous South American perspectives, visual imagery construction on landscape is a matter of a wide geo-environmental contextualisation and is not only about graphics, nor any constructed image. There is limited chance of a possible understanding of that ancient visual imagery without its ethnogeological background, or as Povinelli (2016) proposed, its geontological background. Ethnogeology is a cultural-cognitive constructionist process oriented to translate and rebuild the geo-bio-physical world as a second order metarepresentational reality structured by means of cosmographies, cognitive maps, landscape designs, rock art and other mind constructs pertaining to the brain and geo-environment interface (e.g. BAI in Malafouris 2008; but see Povinelli 1995 and 2016), or as Meschiari (2009) puts it, pertaining to an Amerindian *landscape mind theory*.

These cultural fabrications of sensorial realities are understood as niche construction strategies through which the natural, dysteleological world is 'terraformed' by human and non-human intentional agencies into more 'familiar' environs, respective to each ecosophical perspective (Århem 1993). Then, environment becomes extended cognitive phenotypes of several different life forms (e.g. Dawkins 1982); it becomes landscape. This perspective implies considering the production and use of visual imagery on landscape as a process of cognitive domestication of the environment. It occurs

on a cosmological or planetary scale and should be regarded as a process of cognitive 'terraformation'. In minimal scale, it is a means through which rocks (and other environmental information) are being familiarised by sentient beings and becoming sentient beings themselves in the process. This understanding derives from the idea of *familiarisation* as the process of acquiring and fabricating, by taming or softening wild animals, spiritual beings, enemies and others, turning them into pets (*xerimbabos* in Nheen-Gatu language) or companions in native Amazonian societies (e.g. Walker 2009; but see Fausto 1999).

This idea of turning rocks, or geological landscapes into *xerimbabos* (or as Munduruku would call them, *wunca* – animal or plant individuals transformed with special care and continuous attention into companions), performing its familiarisation by means of visual imagery construed/constructed on landscape, is particularly interesting and deserves an in-depth treatment elsewhere. However, for now, an ethnographic example would suffice as clarification. In 2009, a Makuxi professor (Karib language family, northern Amazonia) studying at the Inskiran Intercultural Program of Roraima's Federal University, made an insightful observation during an informal conversation with one of the authors. He stated that based on oral tradition passed on by his father, the upper giant pictograms, executed at more than 20 m above ground level on the rock walls of the huge granitic inselberg called Pedra Pintada were *xerimbabos* of shamans, more or less like their pets. There is a relationship of familiarity and maybe companionship among some pictograms, the high walls of that rock formation as a sacred geo-site and shamanic agency according to this Makuxi perspective. It seems that in Makuxi understanding, the topographic positioning of an image on a rock surface has to do with power, specifically channelled through shamanic agency. In other words, the higher on the wall a pictogram is, the more powerful is its familiar owner, the shaman, who 'flew up' there in order to familiarise it (a sort of Amerindian cognitive taming), or to perform other purposes in connection with his or her graphic *xerimbabo*, borrowing its powerful companionship whenever necessary.

Terraformation, domestication and familiarisation processes have been used here as related to cultural anthropogenesis, taken to be strategies of cultural-cognitive fabrication of reality. Their differences as such are more in degree than in type. While terraforming concerns an environmental domestication process on the largest scale (literally planetary), familiarisation does not render environments or life forms ecologically or biologically dependent on humans, though it generates mutual dependency in some degree on ontogenetic scale. However, in specific terms, how would such processes of engagement between brain-body and geo-environment result in visual imagery on landscape?

It is suggested here that the processes of making and using geo-situated visual imagery conform into a dialogical and reciprocal process of semiotic niche construction operating between brain-body and environment. The articulation of this process can be formulated in a sequence of cognitive-environmental steps tentatively schematised in the following sequence:

- 1 – Sensorial perception of geological random surfaces in environment.
- 2 – Differential attention on geomorphic features after repetition, regularity or symmetry detection, or detection of regularity in other physical properties like morphology, texture or colour; pareidolic patterning seems to start here.
- 3 – Pattern formation strategy evolves together with iconic and/or indexical surrogate preliminary associations departing from initial sensorial ambiguity (Clark 2010; Bednarik 2011); mnemonic and emotional associations start, leading to an outline of connectionist meaning.
- 4 – Cultural meanings and intellectual elaborations are developed upon such relational ambiguities hybridising indexicality and iconicity in the symbolic unfolding of these operations; when perception consciously (i.e. self-reflexively) evolves to knowledge construction, and first order association evolves to second order, full metarepresentation of sensorial reality. Pareidolia affords hyperimagery inception (it is possible that steps 3 and 4 could be conflated into a single one).
- 5 – The construction of landscapes through cultural visual imagery production and use occurs as a physical manifestation of these former metarepresentations, processed as part of sensorial reality simulations of meaningful aspects of the environment coupled with mnemonic re-integration and emotional arousal. Thus, creating patterned responses will ultimately lead to cultural landscaping behaviour in the form of intersubjective (semiotic) niche construction in environment, being gradually converted into familiarised, domesticated and terraformed landscapes (e.g. turning rocks and pictograms into *xerimbabos*).

It would be reasonable to assume that once an anthropogenic mechanical mark (in the Western sense) is inserted on a geological surface it attracts the cultural mind in different ways, becoming a propeller of natural geomorphic affordances, enhancing attractiveness for further markings, further geo-situated thoughts. It seems to operate as a less ambiguous demarcation (except in case of severe taphonomic alteration) between intentional agentive action-thoughts and non-intentional, dysteleological phenomena. The latter, in a sense, would be less attractive as 'food for thought', at least to Western geologically untrained minds. Then, rock art becomes an instance of socially learnt thinking and behaviour imprinted in the landscape able to permit further optimised social learning and

cultural transmission. By reducing sensorial ambiguity, it empowers cognitive control over environment through the enhancement of familiarisation or domestication techniques applied as terraforming stations and engines of environmentally extended minds (Clark and Chalmers 1998).

However, Amazonian Indigenous perspectives challenge an important articulation in the above proposition: cultural markings on rocks enhance human perception of geo-environmental phenomena, making them more evident and attractive as triggers to further cultural behaviour. That is, natural geomorphic features are less attractive than anthropogenic markings, or any cultural alteration, as 'food for thought'

in terms of landscaping. This assumption faces difficulties when analysed under the scope of available Amazonianist ethnography, at least on two levels. On the first level, although acknowledging an important semiotic role for graphic expression in constructing landscape narratives, it does not necessarily imply that it is the only way, or a better way of communicating information pertaining to the cultural aetiology of an environmental parcel to further observers and users. Therefore, graphic imagery previously established on landscape does not necessarily enhance perceptual-cognitive reconstructions of nature, nor necessarily turn environment into a more attractive entity for cultural transmission of environmental perceptions in the form of semiotic niches. These processes cannot be naturalised as neurological automatic responses in the face of environmental/perceptual *stimuli*. They will also depend on active choices of culture-historical trajectories and their respective cognitive terraformation processes (beginning with the brains themselves, as cultural artefacts; e.g. Mithen and Parsons 2008).

Considering the second level, it has been sustained here and in previous works (Valle 2012, 2015, 2018) that native Amazonian ethnogeologies are a fundamental part of Indigenous theory-making regarding graphic construction on (of) landscape, like rock art. Through that perspective, natural geomorphic features reciprocate meanings with anthropogenic markings (human-made). In some cases of first-hand observation of native Amazonian subjects interacting with rock art panels, most of them ritual specialists, the action of gently touching the geological surfaces with the fingers was an important manner of perceiving reality (Fig. 11). These occasions of touching the petroglyph grooves

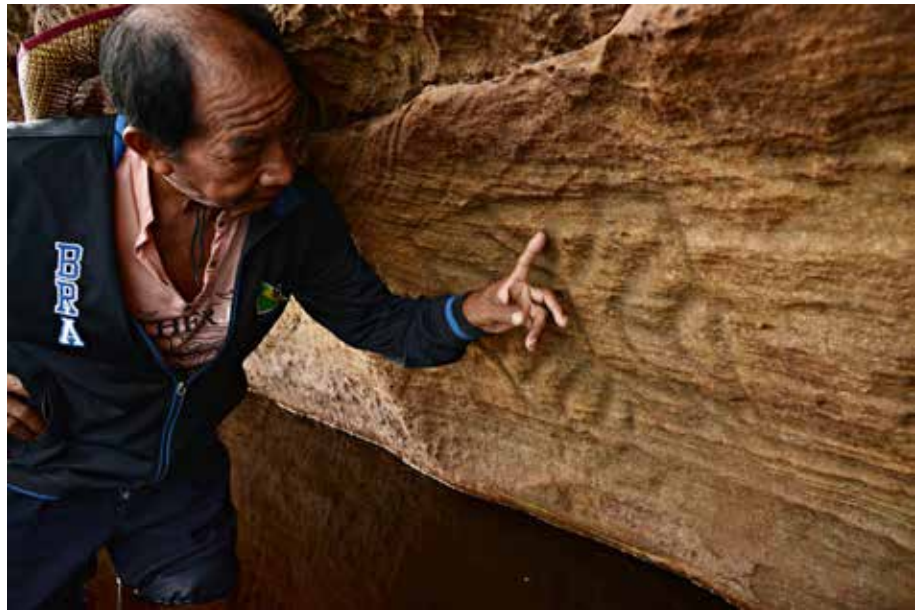


Figure 11. Co-author PHTT, a Kiti Masigu from Upper Negro River, theorises on rock art extending his mind through his fingertip. Ponta do Iaçá site, Lower Negro River. Photo RV 2016.

and shapes were accompanied by phenomenological comments on formal properties like symmetry, depth or smoothness of the markings coupled with elements of mythological narratives elicited as causal theories to such rock art, rock and place characteristics. In detail, it was possible to observe that when the fingertips of these subjects were 'scanning' natural features besides technical markings, the form and the content of the narratives, commentaries and general behavioural display did not change. That is, when touching a petroglyph and a natural crack or protuberance besides it or nearby, no alteration in behaviour and in knowledge elicited was observed. It seems that, depending on circumstances, the 'cognitive layout' and 'ritual etiquette' can remain the same in the face of a petroglyph or a weathering pattern. This indicates that there might exist a kind of perceptual-cognitive reciprocity, or continuity, between technically and geologically 'made' images — as if, the petroglyph groove was a 'natural' extension of the geomorphic groove, and vice-versa, the geomorphic marking a cultural fabrication beyond the human.

Many places in Amazonian sacred cosmographies, such as the Mundurucu's Daje Kapap, mentioned before, are apparently devoid of graphic visual imagery and are of enormous significance, because they were constructed by non-human intentional agencies in mythic past times, and the indexes of such cultural aetiologies of landscape are epitomised in geological features. Graphic imagery seems to be just one more index of past agencies, which may render the cultural fabrication of the environment more evident, in some circumstances but not necessarily. Therefore, in that sense, both natural geomorphic features and anthropogenic cultural markings present an almost

equal ontological status in many experienced instances in Amazonia.

In some cases, the presence of graphic visual imagery can trigger an exact opposite reaction, that is social avoidance of those places. This seems to be the case in the prescriptive avoidance by women and children regarding direct visual/physical contact with rock art associated to Koway's agency. Koway (the son of Nāpirikoli, the main demiurge to northern Arawakan groups) is directly related to a sacred flutes-based myth-ritual complex widespread in northwest Amazonia, as in the Baniwa, Curripaco and other Arawakan perspectives of the upper Rio Negro (e.g. Wright 1998; Vidal 2002; Xavier 2008; Valle and Costa 2008); likewise, Koway is associated with disease, poison and shamanic healing (Wright 1998). In that sense, one of the authors had the opportunity to observe fire scars on granite surfaces near petroglyphs, damaging some of them, firstly interpreted as non-Indigenous vandalism. Later on, another version of this narrative emerged, implying that the fire was intentionally set near a group of motifs related to Koway's narrative by some knowledgeable elders as a prevention against diseases in female children that were caught playing nearby those petroglyphs at Yandu Rapids, Baniwa territory, Middle Içana River, a tributary of Upper Negro. So, possibly the fire was set to counter potential pathogenic agency of some petroglyphs (Koway's cognitive extensions) over the children. What was first interpreted as vandalism through a Western perspective, was indeed Indigenous preventive medicine.

Native Amazonian perceptual-cognitive realities keep on producing complex thoughts regarding visual imagery on landscape, as part of their social-cognitive lives. These processes follow cognitive tracks settled in deep history and, although a time measurement in years (e.g. an absolute dating of a myth) is not possible, tentative approximations to relative chronological sequencing of image production on landscape inside myth-historical cycles or narratives are plain possibilities (when do cultural markings on rocks appear inside a mythological tradition? When does it begin to be made and by whom?).

In some cases, as with Munduruku historical knowledge, it is possible to understand when *wuyta'a ybararakat* and *wuyta'a surabudodot* (intentional drawings and writings on rock surfaces equivalent to petroglyphs and red pictograms, respectively, and possibly natural geomorphic features) were made. However, running the risk of imposing a linear Western arrangement of time on such narratives, in the Munduruku case it is reasonable to think otherwise. Rock art is associated to the agency of the cultural hero *Muraycoko* that lived after the origin of the first humans and their animal transformations (*Peresoatpu* time), and before the period of wars and migrations (*Karodaiby* time), working like a relative dating for the phenomenon. Therefore, *wuyta'a ybararakat/surabudodot*

origin is situated in the middle of their historical trajectory, inside a sort of 'mythological stratigraphy' (Valle and Saw Munduruku 2015).

Native Amazonian narratives regarding visual imagery on landscape, such as rock art, have a self-evident importance as intangible cultural heritage of living Indigenous people, but also pertaining to insight-making strategies on how cultural imagery was contextually produced and used by past Indigenous cognitive experiences. That is, Indigenous knowledge or intangible cultural heritage about instances of visual imagery constructed, or construed, on landscapes should be addressed, besides its cognitive-epistemological importance to living Indigenous groups, as a source of insight on past processes of cosmological knowledge construction. As Schaafsma (1997: 13) has already indicated: '[I]t is quite safe to assume that a similar outlook spiritually integrating people with the natural environment was shared in prehistory as well'.

Concluding remarks

The symmetrical attitude proposed here (Indigenous knowledge = rock art theory and historiography) should be acknowledged as a tentative effort towards theoretical decolonisation of graphic phenomena and rock art studies in Amazonia. Indigenous myths and oral tradition about image creation must be regarded as native historiographic theory. This is a response to the asymmetrical reciprocity, or lack of reciprocity, between the Western notion of archaeological site based on the presence of human-made markings and other material remains, and those places in Indigenous cosmographies without archaeologically measurable anthropogenic manifestations, but possessing spiritual connections with geo-environmental phenomena. These connections are culturally rooted in time and readily visible in the landscape to those who possess the proper knowledge to decode such entanglements. Having established these dichotomous terms, the asymmetry tends to set a reductionist, detrimental ontological competition: rock art archaeological site (deserves protection) vs Indigenous sacred geo-site (protection open to debate, not readily acceptable, questionable). It is therefore necessary to rethink this in South American countries, where up to the present this issue was not satisfactorily settled in Heritage laws.

The discussion presented here has to be considered not only as an ontological perspective on native Amazonian geo-situated visual imagery, but also has a bearing on elements for phenomenological and terminological reflections and consequences. Phenomenologically, cases like the Harakbut Amana and Munduruku Daje Kapap cannot be described as rock art phenomena, nor rock art sites based on Western anthropogenic criteria — notwithstanding their ontological and cosmological importance to Indigenous history, memory, sense of place and landscaping. It follows that, terminologically, the rock art concept is restrictive (petroglyphs, pictograms and

Geo-situated visual imagery
1 – Cultural geomorphism: natural geological forms/features imbued with cultural-cognitive meaning (non-anthropogenic cultural geo-sites/geofacts).
2 – Hybrids: cultural geomorphism + anthropogenic markings.
3 – Anthropogenic markings: anthropogenic markings on rock surfaces (pictograms, polished grooves and basins, petroglyphs etc.).

Table 2. *Alternative classification scheme for geo-situated visual imagery, which is phenomenologically and ontologically more inclusive than rock art, mindful of Indigenous perspectives.*

geoglyphs) and does not encapsulate the diversity of other interrelated examples of Indigenous geo-situated visual imagery that cannot be measured by Western anthropogenic parameters.

The point is: non-anthropogenic cultural geo-sites and rock art places are tools and instances of Amerindian cognitive-epistemologies on landscaping and should be acknowledged by Western research as possessing a symmetric ontological and legal status, despite being considered as non-reciprocal constructs and phenomenologically separated in Western perspective.

This presents two alternatives: (a) broaden the concept of rock art, accommodating other categories of phenomena discernible under the same terminology, including 'decolonising' categories not dependent on Western anthropogeny criteria (e.g. Indigenous sacred sites without 'rock art', or cultural geo-sites/geofacts, imbued with semiotic meaningfulness to collectives of human and non-human subjects). From this perspective, cultural geo-sites and geofacts are considered as constructs that are absorbed under a larger process headed by rock art phenomena. In short, it means considering non-anthropogenic cultural geo-sites as a type of rock art site. (b) Propose an alternative phenomenological category, separated from the existing rock art conceptual range, but still connected through the more inclusive concept of *geo-situated visual imagery*; expressing the essential notion of geo-environmentally constituted images, or visual ideas on landscape (from geomorphic patterning to *cultural geomorphism*, which is the cultural-cognitive appropriation and reformulation of geomorphic features). According to this alternative, geo-situated visual imagery is a more symmetric and inclusive phenomenological class encompassing cultural geomorphism, rock art and its hybrid intertwines (see Table 2).

Both alternatives may have problems. For example, in the first, there is a risk that broadening the concept of rock art will contribute to its analytical emptiness, due to increased ambiguity based on contradictory criteria (if Western anthropogeny is considered a universal parameter, it cannot accommodate non-human causes, so, for example, non-human rock art cannot be called 'rock art'). Furthermore, although hybridising Indigenous and Western parameters, it maintains Indigenous perspectives somehow domesticated into

a Western intellectual scheme, that is, Indigenous knowledge is applied, nevertheless, constrained inside a Western cognitive idiom of rock art. In the second case, proposing that rock art and cultural geomorphism are two different ways of producing geo-situated visual imagery may downplay and weaken their aetiological reciprocity and ontological correspondence, in Indigenous perspectives. In any case, moving towards this rethinking (from an ontological level to a classificatory one, and/or vice-versa) constitutes a significative step in order to turn Western rock art archaeological narratives more coherently and respectfully connected to Indigenous cognitive-epistemological parameters and systems in Amazonia, the Andes and possibly elsewhere.

Acknowledgments

The authors are enormously thankful to Mr Kwai Zo'é, Mr Juarez Muybu Saw Munduruku, Mr Adriano Aponpu Saw Munduruku, Mr Francisco Bará, Mr Teodoro Makuna, Mr Tarcisio Tukano, Mr Alberto Baniwa, Mr André Baniwa, Mr Juventino Cashuyana, Mr Xamen WaiWai and many other Indigenous knowledgeable men, our professors on native Amazonian rock art epistemologies. We are much indebted to archaeologist Marta Cavallini who kindly lent us an important piece of evidence and to Dr Adília Nogueira, who kindly undertook a first coarse grammatical revision on a previous version of the manuscript. Many thanks to Dr Edithe Pereira and to her colleague, Hannah Fernandes, for clarifying the precise designation of an important site mentioned in the text. Many thanks to Robert G. Bednarik for important observations on pareidolia issue. We are also grateful to the five anonymous RAR referees for their important remarks that greatly improved the final manuscript. All remaining mistakes are exclusively the authors' responsibility.

Post Scriptum: the inclusion of Indigenous authors in this article is due to their enormous contribution in sharing many aspects of their knowledge with the non-Indigenous author. Without their higher order contributions, this work could not have been achieved. The traditional anthropological jargons of Indigenous informants and interlocutors are simply not enough, and even disrespectful, to correspond to their role in this research, being as they were/are active and creative theory-builders and authors of innovative non-Western ways of thinking. By the same token, the term Indigenous, as a de-colonial tensioning respective to the term 'Western', is maintained capitalised through all this text.

Professor Dr Raoni Valle
Programa de Antropologia e Arqueologia
Universidade Federal do Oeste do Pará
Brazil
figueiradoinferno@hotmail.com

Gori-Tumi Echevarría López
Universidad Nacional Mayor de San Marcos
Asociación Peruana de Arte Rupestre (APAR)
Peru
goritumi@gmail.com

Poani Higino Tenório Tuyuka
FOIRN - Federação das Organizações Indígenas do Rio Negro
Secretaria Municipal de Educação, São Gabriel da Cachoeira, Amazonas
Brazil

Jairo Saw Munduruku
PAHYHYP – Associação Indígena Munduruku do Médio Tapajós
Brazil

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