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Original synthesis article

Information management and cultural evolution in Aboriginal Australia

(In light of the cultural heterochrony hypothesis)

George F. Steiner

Scientific Commission on the Intellectual and Spiritual Expression of Non-Literate Peoples (CSENP), Capo di Ponte, Italy. Correspondence: georgesteiner@gmx.net

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Abstract - Following a recent re-evaluation of evidence from an archaeological site in SE Australia, the possibility of a 120 thousand years (ka) old human presence in the Fifth Continent has been suggested. However, the commonly accepted date for the peopling of Australia remains within the range of 50 - 65 ka. Even if the newly proposed date were halved, an uninterrupted 60 ka continuity in the same territory would raise a few questions regarding the transmission mechanisms that have enabled the retention of the massive amount of knowledge acquired during such an extended period, especially when considering the lack of demographic strength, which is believed to be a prerequisite for effective social learning. I argue that the emergence, developmental rate, and extent of Australian culture reflect an 'additive' evolutionary strategy centred on a ritually regulated feedback loop between the volume of information flow and the level of social elaboration. The model forwarded in this paper is at odds with current theoretical approaches to cultural evolution in which Aboriginal traditions are often portrayed as living examples of Pleistocene cross-cultural universals.

Keywords – art, exograms, geomythology, heterochrony in culture, knowledge, medial cultural evolution, niche construction, punctuated equilibria, ritual behaviour.

Introduction

In a previous article published in this journal (Steiner 2020a, to which this paper is a sequel) I have challenged the common understanding according to which the rules that govern the evolution of cumulative culture are observed in all modern societies and whether the model- and content-based biases that affect the successful 'ratcheting' (Tomasello 1999) and efficient transmission of innovations (Boyd and Richerson 1985; Henrich and McElreath 2003) have transcultural veracity. *

In gene-culture coevolution theory an additional stress is placed on demographic strength, the absence of which would render small and isolated populations vulnerable to the 'treadmill effect', the inevitable consequence of impaired social learning (Shennan 2001; Henrich 2004). In my questioning the ubiquity of the theory, I have brought up ethnographic examples of small groups of isolated hunters and gatherers who devised intricate risk-reduction networks that do not necessarily proliferate technological innovations and function only in low demographic settings (Wiessner 1977; Woodburn 1982; Cashdan 1980). With merit and abilities equally distributed within these populations, the model-based and conformist biases that influence the mechanism of social learning in gene-culture coevolution theory become pointless. In their stead, elaborate 'levelling mechanisms' seem to have been at work, aimed to inhibit the acquisition of status and prestige (Woodburn 1982).

Yet, the fiercely egalitarian culture of these societies is apparently driven by the very mechanisms and biases postulated for hierarchically organised cumulative cultures, except that they act in reverse and result in markedly antithetical outcomes. Thus, the case of egalitarian hunters and gatherers seems to be the 'exception to the rule' that confirms the postulates of gene-culture coevolution. However, and contrary to the predictions of the theory, immediate-return hunters and gatherers do not seem to be plagued by cultural loss and, instead of hopelessly running the treadmill and live in poverty, they have developed egalitarian and, to an extent, 'affluent' societies (*sensu* Sahlins 1972).

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* To read the article click/type https://www.ajol.info/index.php/ijma/article/view/201870.

To resolve this apparent paradox, I have introduced the hypothesis of ‘cultural heterochrony’, which would also support one of the central claims of gene-culture coevolution theory – namely that cultures also evolve through a Darwinian selection process – in which the cultural equivalent of biological heterochrony, that is, shifts in the extent, rate, and timing of development must also be acknowledged. The objective of the hypothesis is to conceptualise a set of bio-cultural coordinates within which the entire diversity of human culture can be accommodated, and thus complement and enlarge the framework provided by gene-culture coevolution and niche construction theories.

In the model – which will be expounded in the paper at hand – the culture of immediate-return/egalitarian societies is defined as a post-displacement (‘starts later’) with a shorter development at decelerated rates. The outcome of this type of evolution is cultural hypomorphosis (achieved through subtractive cultural strategies, which are conducive to material disentanglement [Woodburn 1982]). This is in stark contrast to elaborate agricultural and industrial civilisations, which started their development ‘before time’ (pre-displacement) and, as such, had an extended period of cultural evolution, but at accelerated rates. This is cultural hypermorphosis (the outcome of cumulative cultural strategies, which also display a high degree of material entanglement [Hodder 2012]). The models of gene-culture coevolution reflect precisely the mechanisms that drive ‘hypermorphic cumulative cultures’. However, the standard should be modelled on the cultures of most tribal societies and small-scale subsistence agriculturalists, which commenced ‘on time’ and, albeit moderately cumulative in character, they have developed at stable rates. Although the general rules of gene-culture coevolution are observed in many instances, their implementation varies from culture to culture and cumulative cultural evolution seems to be only one of many possible directions (Steiner 2018).

At the end of my paper, I have concluded that egalitarian societies – despite their simple (immediate-return) mode of subsistence – are not the vestiges of an ancestral/universal stage from which more complex (delayed-return) economies would linearly evolve, but a relatively recent and idiosyncratic achievement through what I have tentatively defined as ‘subtractive cultural evolution’.

Most anthropologists recognise a broad distinction between hunters-gatherers with elaborate social and economic systems and those who are technologically less sophisticated, but socially more egalitarian. Contrary to the widespread layman belief that the majority of hunters-gatherers belong to the latter category, a surprisingly small number of societies can be defined in every practical sense as egalitarian (Woodburn 1982; Price and Brown 1985; Kelly 1995). Out of these, only the Mbuti Pygmies of the Congo (Turnbull 1965), the !Kung (Ju/'hoansi) Bushmen (San) of southern Africa (Marshall 1976; Lee and DeVore 1976), the Batek Negritoes of South East Asia (Endicott 1974) and the Hadza of East Africa (Woodburn 1972) were documented in a rigorous manner.

Woodburn's (1988) inclusion of 'some' Australian Aboriginals in the list of simple and egalitarian societies was met with scepticism by Layton (2005), who sees them as part immediate-return and part delayed-return, and only superficially egalitarian and, as such, anomalous in both typologies. Similarly, although it is commonly believed that Australian Aboriginals were exclusively hunter-gatherers, recent research (White 2006) strongly suggests that in some areas land was prepared for the purpose of planting Colocasia (taro) and this may have been associated with more settled communities.

Indeed, a mosaic of simple/complex cultural configurations, egalitarian/non-egalitarian social organisation and, as argued here, cumulative/ 'additive' modalities of cultural evolution make the lumping together of modern and contemporary Aboriginal cultures into one category impossible. Aboriginal culture, although 'archaic' in some respects, is anything but 'simple' and its diversity is only vaguely addressed in the anthropological discourse.

The unique environmental, developmental and social circumstances that have shaped the contents of Aboriginal cultures were side-lined in my previous article, where the enquiry was restricted to the few cases where there is unanimous agreement regarding both the subsistence strategy and the social structure of 'simple' hunters and gatherers. Although I have attempted to explore the peculiarities of Australian hunter-gatherer cultures elsewhere (Steiner 2020b), my approach to the topic has only scratched the surface. The paper at hand corrects this imbalance and is dedicated to the distinctiveness of Aboriginal traditions, their rapport to text-book models of cultural evolution, and their suggested position within the coordinates of cultural heterochrony.

In addition to the simple/complex anthropological dispute, the antiquity of human presence in Australia is also a hotly debated topic. According to a re-evaluation of evidence from the Moyjil site in Victoria, the possibility of a 120 thousand years (ka) old human presence in the Fifth Continent cannot be dismissed (Bowler *et al.* 2018). However, in lack of additional evidence, the commonly accepted date for the peopling of Australia remains within the range of 50 - 65 ka (Clarkson *et al.* 2017), which is an already impressive demographic continuity. Moreover, the patterns of human colonisation are also differently interpreted, with hypotheses ranging from a single to multiple and 'tri-hybrid' waves of settlement models and isolated continuity vs. external contacts debates (Windshuttle 2002; Rowland 2018).

After continent-wide colonisation, strong regional patterns seem to have developed and these have survived despite substantial climatic and cultural changes during the late Pleistocene and Holocene. Remarkably, there is evidence for the continuous presence of populations in discrete geographic areas dating back to around 50,000 years ago, in agreement with the notable Aboriginal Australian cultural attachment to their country (Tobler *et al.* 2017).

A recent multidisciplinary study (Crabtree *et al.* 2021) has attempted to locate and date the likely migration routes across the Australian continent. The modelling was based on data from archaeology, anthropology, genetics, climatology, geomorphology and hydrology and, commendably, the results will be compared with the oral histories of Aboriginals, including Dreaming stories, as well as rock art and linguistic features of most languages spoken by Aboriginal Australians. The new models suggest that the first people may have arrived in the Kimberley region about 60,000 years ago, and had settled across the continent within 6,000 years. After an application of statistical demographic methods to Australian ethnographic and genetic data, Williams (2013) suggests that a founding group of 1,000 - 2,000 individuals at 50 - 60,000 years ago would have resulted in a population high of approximately 1.2 million at the time of European contact.

In spite of the anthropological and archaeological ambiguities, there is a wide consensus in regarding the traditions of the First Australians as the oldest continuous human culture. This has encouraged some anthropologists (e.g., Hayden 2003) to assume that the present of Aboriginal culture reflects past cultural configurations that can be projected on the Palaeolithic ancestors of all living humans.

From a strictly material perspective, the retention of Mode 3 industries until the Holocene (Foley and Lahr 1997; Moore 2011) seems to justify such misinterpretations. On the other hand, the social complexity that characterises the modern and contemporary culture of Aboriginal Australia cannot be a 'simple' Palaeolithic leftover but, as I argue in the text, more likely an achievement facilitated by tens of millennia of 'additive' cultural evolution with strong ritual support. Conversely, the cultural diversity briefly mentioned above seems to be the aftermath of a significant cultural/behavioural 'update' during the Holocene (Williams *et al.* 2015a).

The first part of this synthesis addresses the peculiarities impeding the inclusion of Aboriginal (and some other) non-technologically oriented traditions in the classical models of cultural evolution, anthropological taxonomy and archaeological narratives. This is followed by a quest for the identification of elusive and materially 'non-utilitarian' innovations, which could elucidate the reasons behind the usually misconstrued retention of an 'archaic' material culture in Aboriginal Australia. Next, the impetus for the elaboration of rather non-material than technological skills is explored, followed by an in-depth analysis of the neural underpinnings of ritual behaviour and art-like expression, the domains in which – as I argue – such skills may be detected. An entire section deliberates on the nexus between ritual, art and knowledge, with a stress on the cognitive ability for external memory storage and its role in the management of an increasingly complex knowledge inheritance system, as expressed in the Australian-specific niche construction and landscape socialisation practices. The transitional section to the second part of the synthesis discusses and interprets the continent-wide cultural updates emerging concomitantly and in an apparently punctuated fashion during the mid-Holocene.

In the second – rather theoretical and appendix-like – part of the paper, the rapport between punctuated and heterochronic evolutionary models is debated. Next, together with other compatible models, they are tested in the cultural field of evolution, which leads to a concise formulation and graphic illustration of the cultural heterochrony hypothesis. Suggestions regarding the placement of Australian Aboriginal cultures within its coordinates further the understanding of the similarities and disparities between the cultural landscapes of Aboriginal Australia, San southern Africa and 'civilised' Eurasia, which are summed up in the concluding section of the paper.

Material and non-material innovation

Not by the treadmill alone

Cognition has played a major role in the shaping of the Australian cultural landscape. Cognitive innovations are often referred to as 'non-utilitarian' (e.g., rock art, the only archaeologically preserved cognitive 'artefact'). However, considering the sheer volume of knowledge acquired during ~ 60 millennia of demographic presence in the Fifth Continent and the intricate social and spiritual solutions devised for its retention – despite low population density and small group-size – the cognitive innovations of Pleistocene Australia were not less 'utilitarian' than the strictly material innovations on which archaeological narratives are constructed. Yet, in both traditional and cognitive archaeology the nexus between demography and complexity is overstated.

Although the demography/complexity connection was first suggested by Shennan (2001), it is not his model that became famous but the more anthropologically contextualised 'treadmill model' introduced by Henrich (2004). Henrich posits that the cultural transmission of skills and information requires imitation that is usually imperfect when only a limited number of a population masters the knowledge. The model suggests that a minimum population size and a basic level of social complexity and interaction with other similar groups is needed to ensure sufficient innovation to compensate for a constant drain due to errors in the retrieval of cultural information. He argues that when group size becomes too small, the rate of loss will outstrip replication and innovation. The result is flawed transmission and failure to outrun the treadmill. This can lead to maladaptive losses and depletion of technologies and knowledge, compromising a society's evolutionary prospects.

Henrich attempts to explain a major 'puzzle' in anthropology with the help of his model: the apparent cultural 'devolution' of Tasmanian Aboriginals during the Holocene. On the face of it, the Tasmanian case study appears to be ideal for testing the model, for two reasons. Firstly, because of the assumption that a drastic drop in the number of potential imitators must have occurred when Tasmania became isolated from mainland Australia. Secondly, because the Tasmanian tool assemblage appears to have decreased in complexity. However, several convincing counterarguments to Henrich's use of the 'Tasmanian case' for the illustration of the 'treadmill' model were listed by Andersson and Read (2016 and references therein). The authors also identify an unavoidable flaw in cultural evolution research, namely the strong focus on technology, which clearly stems from the fact that technological skills can be tracked archaeologically.

But, what if groups with low technological complexity invest their inventiveness in developing complex non-technological skills? Timothy Taylor, in his book *The Artificial Ape* (2010), observes that cultures can be expected to pursue either of two trajectories with respect to investment in technology. The first is the one that we tend to expect, where the functioning of the body is augmented with complex material technology. However, reliance on material technology also has the effect of entangling individuals in various requirements (*sensu* Hodder 2012). This indicates that, under certain circumstances, it might be more beneficial to go in a direction that minimises the dependence on material culture, replacing it with non-material skills instead. Taylor argues that the Tasmanians, with their *simplified* toolkit, show clear evidence of having pursued such a trajectory in their development of cultural strategies. This would mean that their low technological complexity at the time of contact says little about the complexity of the skills they maintained in general.

Elusive innovations

I would suggest that the non-material skills mentioned by Taylor can be recognised in the technologically non-utilitarian 'palaeoart' traditions of Aboriginal Australia. Palaeoart is a term defining early, prehistoric art-like productions of pre-literate societies for which ethnological access to meaning, purpose, or cultural significance is lacking (Bednarik 1994). Most of the world's surviving palaeoart occurs in the form of abstract and iconic rock art. Although the current evidence suggests that figurative depiction was introduced only during the Holocene, some Australian rock art has been attributed to the Pleistocene by direct dating methods, and its nature implies that a significant portion of the surviving corpus may also be of such age (Bednarik 2014a).

Palaeoart, in addition to rock art, would have also included archaic forms of rhythm and music, dance, recitations, and other non-material cultural components. Which, as a behavioural kit, is known in anthropology as *ritual*. This raises the question whether human ritual behaviour and artistic expression have a common aetiology.

Although in the archaeological discourse material culture is regarded and treated as an isolated development, technology, ritual, and the various modalities in which 'art' was expressed apparently share a common ancestry in a Pleistocene *techné*, the neural underpinnings of which will be explored at large in the next section where it will become clear that, far from being non-utilitarian 'pastimes', Pleistocene art and ritual were rather elaborate *techniques* conducive to effective information storage and management.

Notwithstanding its 'archaic' nature, Australian ritual behaviour – contrarily to denoting stasis, as it is often misunderstood – increased in complexity and efficacy during tens of millennia of stable cultural evolution and it played a decisive role in the construction of the particular cultural landscape in which Aboriginal life evolved. With palaeoart becoming the repository of a massive amount of accumulated knowledge, understanding the origins and unique nature of Australian ritual and artistic traditions may serve as an indicator of cultural evolution which is not less informative than archaeologically preserved traces of material elaboration.

The insights provided by rock art research (Taçon 1989) and cognitive archaeology (Brumm and Moore 2015), augmented with those from anthropology and ethnography (Berndt and Berndt 1988) may shed a light on the spiritual and social complexity of an ancestor population that cannot be fully reconstructed and understood by relying on material finds alone. By the same token, I posit that the retention of Mode 3 toolkits until relatively recent times, instead of being a sign of technological backwardness, should rather be construed as a purposeful ritual restriction that allowed for the development of other complex non-material skills.

Ritual, art and knowledge

Exograms and mnemonic convergence

The nexus between palaeoart and knowledge becomes evident when considering Bednarik's (2014b) understanding of parietal and portable rock art as 'exograms', that is, memory traces stored outside the brain (akin to internally stored 'engrams' [Semon 1921]).

I have addressed the role played by *memory* in ritual behaviour elsewhere (Steiner 2020b, 2024 [in press]), but with ritual taking such a central place in Aboriginal culture, the topic begs for a more detailed explanation. Externally stored memory traces are not limited to abstract/iconic engravings/paintings on rock surfaces, objects and the body, but they also permeate the contents of oral recitations, melodies, dances and other activities that, together with rock art, are the integral parts of ritual. Moreover, memory traces are also stored in the landscape, which becomes impregnated with exogrammatic *meaning* (see Langley 2013, next section).

During the period when Mode 3 industries prevailed world-wide – and when the first humans arrived in Australia – our big-brained and already 'modern' ancestors devised 'mnemonic techniques', such as controlled and contextual vocalisations (Bickerton 2000), meaningful mimetic and acoustic progressions (Donald 1991; Morley 2003), and abstract markings on rocks and bones (Bednarik 2003, 2014b), which were applied synchronously, in a proto-ritual context (Steiner 2024 [in press]). Phenomenal memory traces could thus be stored outside the brain and accessed at a collective level, as causally-sequenced 'information packages' meant to stabilise either adaptively-advantageous, or strictly cultural perceptions/constructs of reality. The cognitive ability for external memory storage seems to have initiated an orchestrated 'mnemonic convergence’ (Coman *et al.* 2016). Ritual pursues precisely such a mnemonic convergence, in which a cultural construct and the information it pertains become ‘real’ and thus, accessible to an entire community.

The neural underpinnings of ritual behaviour and art-like expression

Given the almost unlimited probabilities in the re-sequencing of subjective memory traces (engrams) stored in various parts of a large and complex brain, the solution to add detectable durability to specific configurations that memory traces can assume is to adjust them to an objective causal sequence. This becomes necessary because individual memory trace combinations are not stable, they are perpetually re-formatted and re-constructed, with slight variations between successive consolidations (Thum *et al.* 2007; De Jaeger *et al.* 2014). As such, subjective memory is not reliable, it plays tricks on us and the narratives it constructs depend heavily on emotional states that are present at the time of reconstruction, or on shifts in subjective values and attitudes that have developed during the time elapsed between the experience and its reconstruction. A long-term consolidation of an engram cannot occur as long as memory traces are in such a state of ambiguous superposition (Gabora 2003; Cohn-Sheehy 2021) and as long as each retrieval results in slightly different and unreliable configurations (Schacter 2002). The only way to add durability and stability to specific configurations is, as suggested above, to embed them according to an objective causality that serves as a conceptual point of reference for a *shared narrative*.

The benefits of external memory storage also lie in the ability to overcome the risk of a potential downfall of information processing, which would be the inevitable outcome of trying to compute the ever-increasing amount of memory traces that had to be stored in the neural recesses of the First Australians – and all other big-brained archaic and modern humans – and could have easily resulted in a combinatorial explosion of possibilities (Gabora 2003).

To recapitulate, objectivity implies an external and agreed-upon *rule of sequencing*, which would render memory trace configurations accessible to others (*sensu* Block 1995). However, such a ‘rule’ must in its turn become mastered and internalised through various techniques of social learning. Its acquisition also necessitates well-developed conceptual sequencing and communication abilities (Docherty *et al.* 2000). In other words, consciously constructed information packages that follow a communally agreed-upon objective causality can be distributed and stored outside the brain in rock art, dance, music and stories, and passed on as a compact body of knowledge, from one brain to the other and from one generation to the next. Considered from this perspective, Cameron's (2015) question whether Australian 'rock art' is "art or knowledge?" becomes pertinent.

In such a context, knowledge would not be confined to the mind, but also embedded in the landscape ('Dreamspace', which becomes the *bio*-cultural niche [see below]) and The Lore, and the individual initiated in exogrammatic skills could tap the information provided by the natural and cultural environment. In the Australian case, the volume of information acquired during tens of millennia in the same territory asked for complex transmission mechanisms, which explains why ritual sophistication and social elaboration became favoured over technological innovation. With every tool and technique also embedded in ritual, the retention of Mode 3 industries until the Holocene becomes less of a puzzle.

Thus, having in mind the low population density of Aboriginal Australia, ritual and social sophistication took apparently the role of technological innovation, as an alternative modality to compensate for the demographic weakness. Indeed, instead of the exchange and spread of *novel* technologies – on which the postulates of gene-culture coevolution theory are constructed – the social networks elaborated by Aboriginals specialised in the territorial distribution and exchange of *traditional* ritual objects, songs and stories (Williams *et al.* 2015a). The circulated material and non-material 'artefacts' fulfilled, in a sense, the functions that were documented by Wiessner (2018) in the case of *hxaro* gifts exchanged between the San of southern Africa, which have also served as 'mnemonic devices' storing information about their provenance: the *hxaro* partner, the natural and human history of the source and the stories and songs of the place of origin. *Hxaro* however is a Holocene development and, similarly, the marked continuity of religious ideas and stories throughout Australia, with some songlines crossing from one side of the continent to the other (Berndt and Berndt 1988; Williams 2015b) are attributed to a Holocene cultural punctuation – to which I will return later.

Landscape socialisation and niche construction

Socialised landscapes vs. landscape socialisation

Before discussing the Australian Aboriginal cultural niche and its peculiarities, the important distinction between the concepts of 'socialised landscapes' and 'landscape socialisation' must be clarified (following Langley 2013). While both concepts address aspects of social interaction and are thus related, they are also distinct when considering their different signatures in the archaeological record.

(i) *Socialised landscapes* are people-to-people interactions woven into networks mapped *onto* and over the physical landscape and which unite various locales through *physical* paths and tracks. Such networks connect individuals and groups to each other or, as Gamble put it (1998: 440–441), "[these] paths, rather than the surface area territories which surround them, are the important elements in the forager's socially constructed landscapes." This quote captures the central difference between social landscapes and landscape socialisation: the former is woven over the physical structure of the landscape in order to make connections between people, whilst the latter impregnates meaning into features of the territory which then becomes 'landscape' or 'place' (Thomas 2001).

(ii) *Landscape socialisation*, in this case, is the direct social interaction between people and topography where *meaning* is imbued *into* the physical features of the terrain by its inhabitants. The process of landscape socialisation "[begins] when a population enters a new geographical area" (Langley 2013: 615). These people embark on the process of 'learning the country' through 'naming' its features, which helps in locating the distribution of resources and in assessing their abundance and availability. The resources are thus associated with discrete *loci* (sites) in the landscape. Having located the resources, the incoming people then begin developing a ritually-regulated social relationship with each 'site' by projecting meaning on each location and its resources which, in turn, becomes conducive to the elaboration of *rules and stories* tied to each specific site. This process also allows for the regulation of access to both resources and locations. Each of these sites – whether resource locations or landmarks – as well as the wider region in which multiple *loci* are located become then 'landscape' or 'place' in the consciousness of the incoming people.

In addition to regulating access to resources, this technique of *story construction* tied to 'place' also facilitates the dissemination of the added-up knowledge of that landscape and the relations of particular individuals and/or groups to each site, or to the wider landscape.

This uniquely human behaviour of landscape socialisation is also referred to as the 'domestication of nature' by Ingold (1986). Our innate ability to attribute meaning, emotional value and human or animal characteristics to the physical features of the world allow for a spiritual bond with our environment and transform an unfamiliar landscape to 'home' (Taçon 1994).

Niche construction and information management

Following the landfall of the First Australians, the newly discovered and unfamiliar land was 'named' and a causal order that was communally devised in their minds became projected on the physical environment – which, through landscape socialisation and a ritually-orchestrated mnemonic convergence became perceived as 'Dreamspace'. The cultural approach was followed by a cognitive and behavioural *adaptation* to their own construct of reality. That is, although Ingold's (1986) 'domestication of nature' is a fitting description of what landscape socialisation implies, the human inhabitants of a landscape that was socialised become, in their turn 'domesticated' – as a result of the cultural landscape becoming their selective environment (*sensu* Bednarik 2008).

The paragraph above could be re-written by resorting to the basic postulate of niche construction theory (NCT) as a model, which states that humans can modify their selective environments through cultural activity, thus feeding back to affect selection (Odling-Smee 2003). NCT complements the basic tenets of gene-culture coevolution theory and both recognise that certain cultural environments have completely eliminated the natural component and, as a result, there is an inherent risk of selecting for maladaptive traits that only benefit survival in the specific cultural niche, but may affect negatively biological fitness.

Indeed, this seems to be the case for complex technology-oriented cumulative cultures, as I also state and illustrate in my 2020a paper. However, to stay with Australian traditions, the niche constructed with the support of ritual behaviour and landscape socialisation (Dreamspace) should be understood as rather *bio-cultural* than entirely cultural in its texture, which would also eliminate some of the risks of cultural evolution predicted in classical gene-culture coevolution and niche construction theories.

Odling-Smee also observes that within the constructed niche, cultural processes add a second knowledge inheritance system to the evolutionary process through which socially-learned information is accrued, stored, and transmitted between individuals both within, and between generations. Ritual, as I describe it in this paper, offers precisely such a knowledge inheritance system.

The specific causality of Dreamtime became illustrated on portable 'rock art' meant to 'fix' in stone and wood the blueprint of Creation. *Tjuringas*, also known as (material) ‘mnemonic devices’, are typical examples of external memory storage. They tell Dreamtime stories that can be easily ‘read’, ‘told’ and ‘mimicked’ by those initiated in exogrammatic skills. That is, the ‘readings’ become supported by ‘non-material mnemonic devices’ – or rather techniques – like music, dance and song. Every such communal recapitulation of the causal order upon which Dreamspace/time were mentally constructed re-consolidates the prescribed sequencing of *collective* memory traces and transmits the information to those who participate in a ‘coroboree’ or – through meticulous initiation rites – to the next generation.

Ritual is also characterised by its rigid and conservative nature, which is important for a high-fidelity transmission of knowledge and, implicitly, for reducing the risk of loss which becomes inevitable when transmission relies on mere copying/learning in small demographic settings. By the same token, repetitiveness becomes instrumental in the embedding of the specific causal order (protocol) upon which ritual is constructed. Ritual also lends to a causal calibration of reality the durability that is necessary for its perception, representation, transmission and, last but not least, *adoption.* Similarly, landscape socialisation ceremonies periodically ‘refresh’ the cultural landscape which, as a result, cannot ‘disintegrate’ in lack of the mandatory care prescribed in The Lore.

Ritual rigidity and ‘The Law’ inhibit improvisation and the slightest ‘innovation’ in the sequencing of collective memory traces is punishable. ‘Reality’ is kept ‘alive’ thanks to ritual behaviour – that is, ritual reconstructs, re-consolidates, stabilises, and preserves the specific order of conceptual sequencing that shape Dreamspace and transform the bio-cultural niche into a tangible environment that cannot be recognised or experienced as such by cultural aliens.

Dreamspace and Dreamtime evolve together, they feed back on each other. Although the additively expanding knowledge becomes secured against loss, the very amount of it renders it fragile. Complex initiation rites and socially conditioned distribution methods become the *techniques* employed for the high-fidelity retention and transmission of such a vast amount of knowledge. Information becomes partitioned and small units are ‘inherited’ as songlines and custodianships. Ritually partitioned and inherited information packages are compatible with each other and ‘holographic’ – in the sense that each fragment reflects the whole. Each individual is responsible for a territory and its information (‘dreaming’) and for keeping the land – read *Dreamspace* – in the ‘perfect’ state that it acquired at the time of its (conceptual) creation becomes the foremost duty of the custodian.

However, the efficacy of such Pleistocene ritual techniques was put to test during the environmental upheavals that had radically altered the (physical) texture of the bio-cultural niche starting with the Last Glacial Maximum and the global deglaciation period following it.

Environmental shifts and cultural transitions

Dreamspace 2.0

Australia sits between the heat engine of the tropics and the cold Southern Ocean, encompassing a range of rainfall regimes and falling under the influence of different climatic drivers. Despite this heterogeneity, broad-scale trends in climatic and environmental change are evident over the past 30 thousand years (ka). During the early glacial period (~30 - 22 ka) and the Last Glacial Maximum (~22 - 18 ka), rainfall became sparse and temperatures dropped significantly. The subsequent deglacial period (~18 - 12 ka) was characterised by glacial recession followed by markedly higher temperatures after ~12 ka, resulting in a Holocene climatic optimum (9 - 6 ka). Patterns after ~6 ka become similar to present conditions. (Petherick *et al.* 2013).

These major climatic events were accompanied by demographic changes, most notably during the Last Glacial Maximum (LGM), when the population fell by about 60 per cent (Williams 2013). A number of models propose that during the LGM Aboriginal Australian populations contracted to *refugia* (e.g., well-watered ranges and major riverine systems) in response to climatic instability. Point dispersal pattern analysis by Williams and colleagues (2013) indicates a reduction in occupied territory of nearly 80 per cent in this period. Williams *et al.* (2015b) also show that population growth, stasis and even decline occurred in phase with terminal Pleistocene/Early Holocene climatic fluctuations, which they see as a coupling of past demography with climate until mid-Holocene. However, over the last 5,000 years, increased population levels, greater territoriality, technological solutions to stress, and social and ritual innovations allowed for a de-coupling of the nexus between climate and demography. The greatest increase in population occurred in the Late Holocene, but in contrast to existing intensification models, changes in demography and diversification of economic activities began much earlier.

A continental-scale model of Holocene Australian hunter-gatherer demography shows a delayed expansion and settlement of much of Australia following the termination of the Late Pleistocene until after 9,000 years ago. The onset of the Holocene climatic optimum (9 - 6 ka) coincides with rapid expansion, growth and establishment of regional populations across ~75 per cent of Australia, including much of the arid zone (Williams *et al.* 2013).

Construing Dreamspace as the bio-cultural niche discussed before, the environmental changes must have affected not only its very texture, but also the accuracy of the ritually-managed information that sings Dreamspace to life, namely the Pleistocene Dreamtime stories. This was likely accompanied by behavioural changes – when considering behaviour as a sum of 'techniques' (*sensu* Ellul 1964) devised to facilitate adaptation to the demands of a constructed niche.

As a consequence, and out of necessity, certain ritual restrictions on technology and the protocol of ceremonies were likely lifted/relaxed/forgotten. On the one hand, the Pleistocene level of 'sufficiency' could not be maintained by only relying on a Mode 3 toolkit in a changing and hostile environment. On the other hand, the new climatic, hydrological, geomorphological and biogeographical realities (Sniderman *et al.* 2019) had to be *added* and adapted to the body of an already bursting knowledge inheritance system without discarding old and apparently obsolete information (presuming that the entirety of knowledge – and not only fragments of it, which is more plausible – had survived a 60 per cent population fall and an 80 per cent reduction in occupied territory during the Last Glacial Maximum [Williams *et al.* 2013]).

Geomythical sequels and cultural updates

Aboriginal memories of the Dreamtime portray a landscape of place and events that has widely been regarded as being grounded in observation and experience of considerable antiquity (Berndt and Berndt 1994; David 2002). The nature of remembered Aboriginal history and geography is conveyed intergenerationally through stories, songs, dances and, more broadly, 'The Law' of particular Aboriginal groups into which younger members become ritually initiated. With specific regard to Aboriginal oral traditions ('stories'), these were traditionally passed on both as narratives and as myths; with narratives being described as 'profane stories' and myths as 'sacred stories' (Berndt and Berndt 1988). The profane stories are generally part of a narrative body that tells of places within the environment and events that take place there. Conversely, the sacred mythology tends to focus more on changes in the landscape and the ways in which these affected its resident populations.

Sacred stories tell of a time when the former coastline of mainland Australia was inundated by rising sea levels. In most instances it is plausible to assume that these accounts refer to events that occurred more than about 7,000 years ago, the approximate time at which the sea reached its present level around Australia (Nunn and Reid 2016).

Additionally, Australian geomythology also incorporates the remembering of events in the history and geography of Dreamspace that occurred long before the terminal Pleistocene/Early Holocene upheavals. Indeed, the memory of such geographical/geological events (e.g., Pleistocene volcanic outbursts, meteorite impacts, etc.) is still preserved and recited/enacted as an introduction to the stories that relate Dreamings of relatively recent environmental processes like desertification and rise in sea level – which became *added* to the initial oral histories and adapted to their specific progression as 'geomythical sequels' (Hamacher and Norris 2014; Hamacher *et al*. 2023).

An apparent 'updating' of both spiritual and material cultures in Australia occurred during the mid-Holocene (Williams 2013). Although pertaining information about past environmental realities and events – and, as such, largely 'obsolete' – the surviving fragments of old knowledge were not discarded and thus the body of information and the length and contents of the oral histories that had to be transmitted increased *additively* (not to be confused with *cumulatively*, where old knowledge and/or technologies are replaced with innovations that, although incorporating parts of the old elements, result in the loss of the components which are not incorporated and of the associated memory and/or skills). On the other hand, and having in mind that in all probability only parts of a large body of pre-LGM geomythical information were preserved, it is very likely that the renewed Holocene landscape socialisation process incorporated fragments of 'irrelevant' knowledge in the 'updated' narratives. Which points towards a short-lived *cumulative spike* in an otherwise stable *additive* cultural orientation. Considering the 'sudden' and widespread emergence of novel technologies and artistic styles at the same time, the possibility of such a cumulative punctuation must be acknowledged.

Indeed, the punctuated equilibria model (Eldredge and Gould 1972; Gould and Eldredge 1977) posits that evolution is concentrated in very rapid events of *speciation* and not in slow gradual development. For all that the model recognises gradual change as a meaningful and predominant pattern in developmental history, significant modifications are however ascribed to short and sudden periods of evolutionary activity – *sudden jumps*

– separated by much longer intervals of stability – *stasis* – in which additive changes are practically negligible (except when the stasis lasts for extremely long periods).

Although the hypothesis was conceived to illustrate the underpinnings of biological evolution, it has gradually gained traction in cultural studies and it also concurs with the main postulates of gene-culture coevolution (Henrich and McElreath 2003) and cultural heterochrony (Steiner 2020a, and expanded in this synthesis) hypotheses, both of which extrapolate biological models to cultural evolution. Moreover, in another publication (Steiner 2018) I have explored and illustrated the world-wide occurrence of Holocene 'cultural speciations' (see **Fig. 7**), which is reinforced by the sudden 'pulse' detected in the trajectory of Australian Aboriginal culture during the terminal Pleistocene/Early Holocene, as discussed in this section.

Following the cultural pulse, and with a Mode 4 toolkit providing 'sufficiency' on the material level, 'efficiency' became reserved again for the social and spiritual components of culture. Relying heavily on Pleistocene mnemonic techniques, the ritual activities devised to safeguard knowledge became likely more diversified, in synchronicity with a growth in the complexity of social distribution techniques, that is, a further partitioning – between genders, moiety-specific, profane and sacred, secret and overt.

The intensity of social networking did also increase and ritual objects (e.g., 'mnemonic devices'), novel rock art styles, innovative technologies, augmented songs and stories started to be 'traded' on a continental level, in an unprecedented fashion. The Holocene climatic optimum likely facilitated long-distance travel and cultural diffusion as well. Which raises the question of how did communication take place and whether the adoption of a *lingua franca* was also one of the (non-material) innovations ascribed to the Australian Holocene cultural pulse?

The language of Dreaming

The First Australians communicated with each other in multiple ways. The 600 distinct tribes spoke between them about 200 different languages (Dixon 2010), many people were multi-lingual, and language was used in a variety of forms (Breen 2023 [in press]). Writing about Tasmanian Aboriginals, Shayne Breen (ibid.: 123) remarks that "[people] were skilled in the use of gesture and mimicry, forms of communication that did not rely on spoken language. They used geometric symbols as an abstract language to communicate religious beliefs and cultural identities and they were also skilled exponents of an ancient method of memorising information that involved associating myths and stories with key places and natural phenomena." Having in mind that Tasmanians had never transitioned to Mode 4 industries and that their rock art traditions bear marked similarities to those of Pleistocene (Mode 3) Australia (Bednarik 2014a), it would not be far-fetched to suggest that – similarly to rock art – pre-Holocene mainland Aboriginal communication techniques were not so different from those retained in Tasmania until European contact. This is also reinforced by Bindon (1997), who documents specific examples of the association between geological features, stories and myths, with the latter not always spoken, but also illustrated, danced, mimicked and sung (see also Berndt and Berndt 1994). Pleistocene landscape socialisation must have also relied on communication which, in addition to spoken language, was also likely boosted by the non-verbal techniques listed by Breen and explored in this essay.

However, despite the extremely long history and ethnic diversity of the Aboriginals in Australia, the language which is spoken today by 90 percent of the Aboriginal peoples is only ~ 4,000 years old! At the time of contact, the Pama-Nyungan language family covered all of Australia except for the southeast and Arnhem Land (Dixon 2010). Contrary to those who see this as evidence for what was a second mass migration of people speaking this language into Australia (e.g., Windshuttle 2002), Williams *et al.* (2015a) believe that a 'ghost-like' group of internal Aboriginals who diffused from isolated terminal Pleistocene *refugia* across the continent around that time were responsible for the linguistic and cultural linking of Australia's indigenous peoples during the mid-Holocene.

The synchronous spread of pan-continental archaeological signatures at this time – e.g., Panaramitee rock art style and backed blade technology (Williams 2013) – accompanies a marked continuity of religious ideas and stories throughout the country with some songlines crossing from one side of the continent to the other (Berndt and Berndt 1988). Pama-Nyungan languages, which spread concomitantly, were likely used in this context as a *lingua franca* and must have played a key role in the dissemination of additional religious ideas and stories and of the novel rock art styles and material innovations mentioned above. Indeed, Bouckaert *et al.* (2018) suggest that coeval changes in the archaeological record, together with a lack of strong genetic evidence for Holocene population expansion, point towards the Pama-Nyungan languages being carried as part of an expanding package of cultural innovations which probably facilitated the adoption of the language by resident hunter-gatherer groups.

By 4,000 years ago, with the geomythical ‘update’ of Dreamspace and Dreamtime accomplished, the modern ritual, social, linguistic and technological map of Aboriginal Australia became likely established.

Heterochrony in cultural evolution

Not by punctuations alone

After having reviewed the peculiarities of Australian cultural traditions, in this rather theoretical and appendix-like second part I offer a brief, step-by-step presentation of the cultural heterochrony hypothesis, the understanding of which will become necessary in the attempt to place Aboriginal cultures between its coordinates (cf. Steiner 2018, 2020a, 2020b).

The punctuated equilibria model was already introduced in the previous section. Initially forwarded by Gould and Eldredge (1977) to address certain aspects of biological evolution that cannot be explained by resorting to the conventional gradualist concept, I have applied the hypothesis in a cultural setting, a possibility that I have also experimented with in the publications cited above. But, to stay with Gould, his (1982) volume *Ontogeny and Phylogeny* explores the role played by *neoteny* in hominin evolution and offers a list of juvenile features retained in adulthood, which are the main morphological signatures of *pedomorphism*, another designation for neoteny.

According to Gould, evolution occurs when ontogeny is altered in one of two ways: 1) when new features are introduced at any stage of development with varying effects upon subsequent stages, or 2) when features already present undergo changes in developmental timing. Together, these two processes exhaust the formal content of phyletic change; the second process is *heterochrony*, with neoteny being one of its two – or three, if development at ‘normal’ rates is also considered – possible expressions (Bogin 1999, see below).

Ashley-Montagu (1989) argued that part of the variation seen in the morphology of modern humans can also be attributed to different rates of ‘neotenous mutations’ in their early populations. Thus, the Caucasian skull is less pedomorphic than the East Asian and African, with the Australian Aboriginal cranium still less than the European, and with the Neanderthal skull even less neotenous in appearance than that of the Australian Aboriginal. Observing the Bushmen (San) of southern Africa, he identifies several characteristically neotenous traits relative to other humans. Additionally, McKinney and

McNamara (1991) have remarked that African Pygmy and Asian Negrito populations also display highly neotenous features. Understanding neoteny in this larger context, Thiessen (1997) argues that *Homo sapiens* is more pedomorphic than *Homo erectus*, and the latter even more than *Australopithecus*. In the same vein, Ashley-Montagu suggests that juvenile australopithecine skulls would have had a closer resemblance to those of modern humans than to those of the adult forms of their own species.

Yet, as Hulse (1962) pointed out, neoteny is not the only dimension of heterochrony that plays a role in human diversification. He brings up the example of western Eurasians and Australian Aboriginals, who have both retained similar skeletal and craniofacial characteristics to those which most people possessed in earlier times (*gerontomorphic* characteristics, as opposed to the *pedomorphic* traits displayed by the Kalahari Bushmen).

Youthful features denoting neotenous traits were also observed in relation to animal domestication (see Byelayev 1969) where, in addition to physiological changes, the behavioural effects of neoteny (e.g., docility) were also highlighted. Docility is also a behavioural trait associated with human *self-domestication* (e.g., Bednarik 2008; Benítez-Burraco *et al.* 2016), where the ‘domestication syndrome’, i.e., the acquisition of gracilised juvenile features through cultural selection becomes expressed in phenotypic appearance.

With self-domestication being a culturally-induced development, the nexus between biological and cultural evolution becomes established and further elaborated in gene-culture coevolution and niche construction theories (Henrich and McElreath 2003; Odling-Smee 2003) which both recognise that certain cultural selective environments have completely eliminated the natural component and, as a result, there is an inherent risk of selecting for maladaptive traits that only benefit survival in the specific cultural niche, but may affect negatively biological fitness. However, it is not always the adaptation to the cultural environment that results in gracilised features but, in some cases – and as detailed in my previous paper in this journal (Steiner 2020a) – the psychological side-effects of neoteny determine the contents of the constructed niche.

As Bruce Charlton (2006) argues, what looks like ‘immaturity’ – or in his terms, “[the] retention of youthful attitudes and behaviours into later adulthood” – is, actually, a valuable developmental characteristic, which he calls *psychological neoteny*. Highly educated people and eminent scientists demonstrate more neotenous psychological traits. The same applies to ‘natural people’ and children. In fact, the ability of an adult human to learn is considered a neotenous trait. Biological neoteny in humans had as a side-effect psychologically neotenous manifestations, such as curiosity, playfulness, affection, sociability, and an innate desire to cooperate (see also Bjorklund 1997).

Apparently, the presence/absence of heterochronic processes in evolution may sway the trajectory of a gradual evolutionary line and/or increase/decrease the amplitude/frequency of the pulses that punctuate it.

Informed by the punctuated equilibria model and the various expressions of heterochrony in biological evolution, and further augmented with the postulates of gene-culture and niche construction theories, the hypothesis of cultural heterochrony applies them in synchronicity in the cultural theatre of evolution, where developments are construed as 'natural' extensions of evolutionary processes sourced in biology but acting in a cultural selective environment.

The biological theatre of evolution

A simple but remarkable insight bearing the potential to unify the evolutionary concepts enumerated above was envisioned by the Romanian philosopher Lucian Blaga, who dedicated an entire volume to the subject of evolution, part of a trilogy promoting historical and cultural theories. In *Anthropological Aspects* (1976 [1943]) Blaga outlined a 'new approach' to evolution, with suggestions that became confirmed only decades later, when some of the authors cited in the previous subsection started to consider questions already posed – but only partly answered – in Blaga's book. I will refrain from addressing the subtleties and implications of the approach – which I already did elsewhere (Steiner 2018) – and limit myself to the basic specialisation/generalisation framework which I adopt as a loose frame of reference (not as a rule, but as a 'ruler') to guide my discussion.

Blaga was striving for a model in which certain evolutionary particularities, like the problem of what he perceived as human 'primitivisms' could be credibly explained, without recurring to the then widely accepted gradualist, teleological and linear concepts. His 'new approach' placed evolution in a field defined by two coordinates within which *life* became subjected to evolutionary tendencies that took distinct orientations, namely: (i) towards specialised and optimised organisms, or (ii) towards generalised and autonomous life forms.

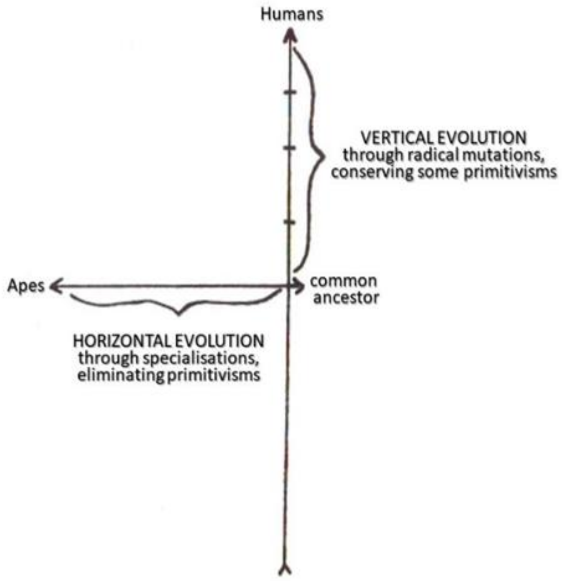

Fig. 1
Blaga's original illustration of
his 'new approach' to evolution
(1976:120), translation by Poenaru (2019: 11).

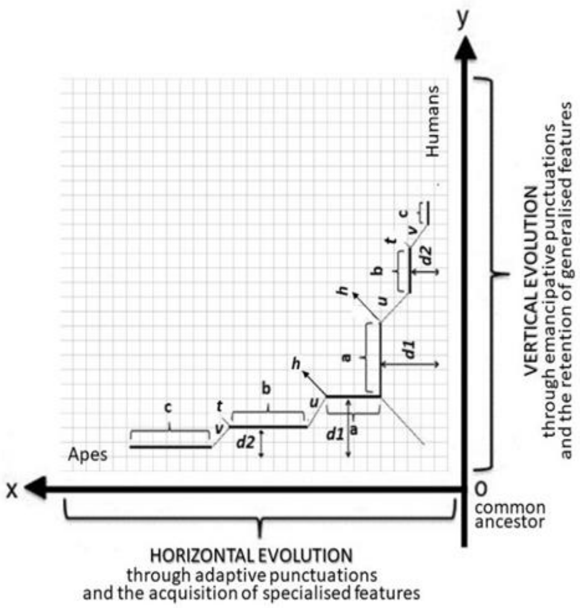

Fig. 2
The Blaga coordinates augmented with
the punctuated equilibria model (Steiner
2018: 27).

Enlarged with the postulates of punctuated equilibria, Blaga's graphic model also highlights that the temporal continuity (stasis) of a species specialised on the horizontal will be increasingly longer, the more optimised to its environment it is. *Over-specialisation* results either in the development of hypermorphisms, or in such a high degree of rigidity that the organism cannot respond to novel environmental challenges, and thus the danger of extinction becomes imminent. On the other hand, the stable phases of species that stay generalised on the vertical will decrease in time, and their high level of autonomy would also increase their flexibility in dealing with environmental fluctuations or voluntary changes of habitat, which could result in a wider geographical distribution.

Let us then summarise the essence of horizontal and vertical tendencies in biological evolution:

Table 1 – Biological specialisation (left) vs. generalisation (right)

Horizontal biological evolution (o-x):	*Vertical biological evolution* (o-y):
– The alternation of horizontally-positive stable phases (a, b, c) with vertically-negative transitional phases (u, v). – The horizontal phases are the temporal distribution (stasis, duration) of a species, whilst the vertical ones represent transitional forms. – The vertically-negative stages are characterised by the permanent adoption of specialisations, which result in increased adaptive rigidity and environmental dependence (hypermorphisms). – The closer a species is to the horizontal, the higher the chance of it being 'captured' and that no further vertical tendencies would occur ($d2 < d1$). – The vertically-negative phases (u, v) represent 'sudden jumps' that become increasingly shorter and negligible in time (until they only resemble smooth transitions) the stronger the attraction of the horizontal ($v < u$). – The horizontally-positive phases (a, b, c) become increasingly longer in time, until they only resemble smooth transitions ($a < b < c$). – The closer a species is to the horizontal coordinate, the weaker the influence of the vertical axis. – Minimal vertically-positive tendencies may also occur: the closer to the vertical coordinate, the higher the possibility of their transformation from tendencies to phases. Thus, new lateral evolutionary lines may speciate (h, but not t).	–The alternation of vertically-positive stable phases (a, b, c) with horizontally-negative punctuated phases (u, v). – The vertical phases are the temporal distribution (stasis, duration) of a species, whilst the horizontal ones represent transitional forms. – The horizontally-negative stages are characterised by the permanent adoption of reductions, which result in increased adaptive flexibility and environmental autonomy (pedomorphism). –The closer a species is to the vertical, the higher the chance of it being 'captured' and that no further horizontal tendencies would occur ($d2 < d1$). – The horizontally-negative phases (u, v) represent 'sudden jumps' (understood as mutations by Blaga) that become increasingly shorter in time, the stronger the attraction of the vertical ($v < u$). – The vertically-positive phases (a, b, c) become, likewise, increasingly shorter in time (until they only resemble smooth transitions: $a > b > c$); apparently, biological evolution works faster on the vertical than on the horizontal coordinate. – The closer a species is to the vertical coordinate, the weaker the influence of the horizontal axis. – Minimal horizontally-positive tendencies may also occur: the closer to the horizontal coordinate, the higher the possibility of their transformation from tendencies to phases. Thus, new lateral evolutionary lines may speciate (h, but not t).

Blaga was tempted to explain the persistence of ‘primitive’ features – read *juvenile*, given that his listing of such features coincides with Gould’s (1982) – on the vertical by enrolling Bolk’s (1926) rudimentary understanding of neoteny. However, he refrained from Doing so because of Dollo’s (1893) ‘law of irreversibility’, which states that an organism does never return to a former developmental state (but see *contra*, Gould 1970). This is often misconstrued as evolution being an irreversible teleological process in which lost traits cannot reappear in the same form by devolution. However, there are several case studies the results of which dispute the validity of Dollo’s Law (e.g., Pagel 2004; Collin and Miglietta 2008) and show that shifts in developmental timing (heterochrony) may indeed result in recapitulative phenotypic change, that is, in ‘primitivisms’. Ignoring then Dollo’s Law, Blaga’s generalised (vertical) mode of evolution can easily accommodate heterochronic processes in human development, where they assume a key role in the inhibition of tendencies towards specialisation. It must however be noted that, although evolution along the vertical coordinate may indeed be coupled with pedomorphic (hypomorphic) tendencies, heterochronic processes can also occur in horizontal evolution where, conversely, they become expressed in a propensity towards the acquisition of gerontomorphic (hypermorphic) features (see Hulse 1962 and below).

Having already introduced the commonly used terminology in the description of heterochronic processes, let us illustrate them for a better understanding:

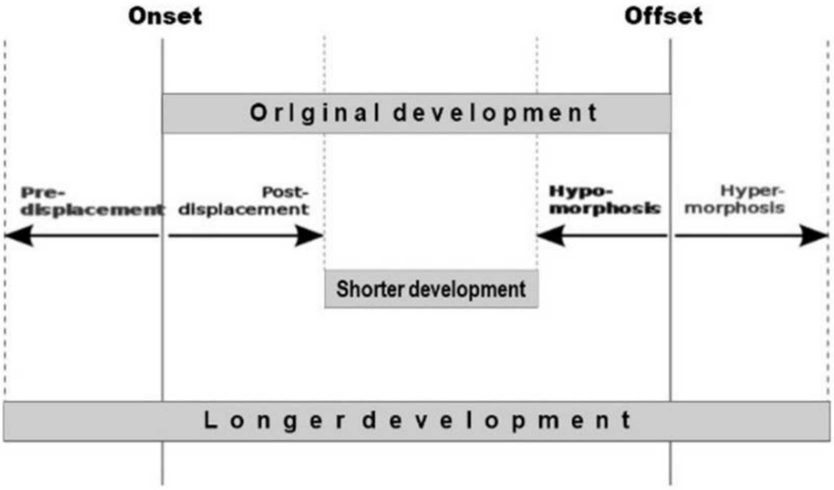

Fig. 3 – The six types of shift in heterochrony, a change in the timing and rate of embryonic/genetic/phenotypic development (Steiner 2020a: 203). Predisplacement, hypermorphosis and acceleration extend development (= peramorphosis, resulting in gerontomorphic phenotypes), whilst postdisplacement, hypomorphosis and deceleration truncate it (= pedomorphosis, resulting in neomorphic phenotypes).

Heterochrony may alter the *rate* of development through (i) acceleration (faster) vs. (ii) deceleration (slower) and its *extent*, through (iii) hypermorphosis (further) vs. (iv) progenesis (not as far). It may also affect its *timing* through (v) predisplacement (begins earlier) vs. (vi) postdisplacement (begins later). There are two tangible phenotypic and/or genotypic evolutionary changes that result from heterochronic processes (Bogin 1999):

1) *Peramorphosis* (gerontomorphism), where a descendant incorporates all the ontogenetic stages of its ancestor, including the adult stage, in its own ontogeny, so that the adult descendant ‘goes beyond’ its ancestor. This occurs by acceleration, hypermorphosis, or predisplacement.

2) *Pedomorphosis* (or neomorphism, neoteny), where a descendant retains only the juvenile stage of its ancestor in its ontogeny, so that the adult descendant ‘does not go as far’ as its ancestor. This occurs by deceleration, hypomorphosis, or postdisplacement.

The cultural theatre of evolution

The question of what happens when a species with a long history of vertical evolution ‘touches’ the o-y axis of the biological coordinates must be posed at this stage of the discussion. Blaga had cogently suggested that, in such a case, the respective hominin species would enter a new evolutionary dimension and become ‘historic beings’ (as opposed to mere ‘biological existences’). However, in Blaga’s vision – and in accordance with the spirit of his time – human biological evolution would reach at this point its teleological destination and subsequent developments would be divorced from any biological underpinnings. I would suggest that the moment when our anatomically still archaic but cognitively already modern ancestors entered the cultural theatre of evolution – which, for most of its extent was set in a pre-Historic context (cf. Bednarik 1994) – was a ‘singularity’ triggered by the rate of cultural innovation taking over that of biological change. Let us attempt a reconstruction of this *singularity* and then illustrate it graphically.

Within the Blaga coordinates, pre-historic industries (stones) and hominin species (bones) may be followed in parallel and correlated with the punctuated equilibria model. Thus, technocomplexes are more stable – last longer and change slower – the closer a hominin species is to the horizontal. Conversely, hominins placed 'higher' on the vertical coordinate develop technologies at a faster rate, the duration of the industries becomes markedly shorter, and the frequency of punctuations denoting innovations increases in time.

Comparing the 'stones and bones' one can notice that in the biological field defined by the o-x/o-y coordinates, the rate of cultural change lags behind that of biological speciation. Or, to put it simplistically, old bones use old stones (*H. erectus* paired with the Acheulean); transitional bones keep the old stones (*H. heidelbergensis* still associated with the Acheulean); new bones use new stones (*H. neanderthalensis* coupled with the Mousterian). The Upper Palaeolithic industries follow in quick succession and with ever-decreasing time spans. The emergence of novel technologies could be explained with the inventiveness that, as seen, is a psychological side-effect of neoteny – new bones display pedomorphic traits when compared to old bones (as in Ashley-Montagu 1989). The 'rule' is observed up to the point when culture takes the lead, and biology starts lagging behind it (that is, when old bones must 'catch up' with new stones). Such a switch was undertaken by all human populations with the difference that, in West Eurasia it had occurred in a quite precipitated fashion, due (mostly) to environmental stress. In southern Africa, on the other hand, it was more gradual and its impact less severe. In Australia, for reasons that were already mentioned, Mode 3 industries persisted longer and the 'switch' was also not technological in nature – nonetheless, the ancestors of Aboriginal Australians had also effectuated it, albeit on a cognitive and social level.

In western Eurasia – where the period is extensively documented – the Middle/Upper Palaeolithic punctuation witnesses the onset of a 'new beginning', a crucial moment in our cultural evolution, which I would designate as the Upper Palaeolithic 'singularity'. This was the tipping point when cultural change became faster than biological development. Roughly around the time of the Eurasian behavioural and technological punctuation, our ancestors – world-wide – were catapulted into a new evolutionary dimension that, in its turn, became defined by tendencies towards specialisation and/or autonomy, very much like in Blaga's biological theatre of evolution.

Having in mind that since the 'singularity' our biological and cultural evolution cannot be followed within the biological field proposed by Blaga, a complementary set of coordinates defining evolutionary processes best understood by recurring to the postulates of gene-culture (also known as bio-cultural) coevolution and niche construction theories must be introduced.

A ninety-degree mirroring of the biological field to the right illustrates the same tendencies within the new cultural theatre of evolution, with an o'-x' coordinate following cultural strategies that would eventually result in rigidity and specialisation through material (and other) accumulation/entanglement and an o'-y coordinate along which cultures retain their flexibility and autonomy through material (but not only) reductions/disentanglement. Our conditioned understanding would prefer to 'correct' the illustration and place the 'civilised' contexts on the vertical, and the 'tribal' contexts on the horizontal. Like that, a continuous and linear biological and cultural evolutionary vector would present a teleological continuum. However, the field defined by the complementary coordinates was not entered in a linear fashion, as illustrated in Fig. 4. Additionally, the ancestors of both 'savage' and 'civilised' undertook the cultural jump that had propelled them deep *into* the field defined by the o'-y/o'-x' coordinates. Once in the cultural field, 'vertical' and 'horizontal' re-orientations commenced again, with their respective outcomes mirrored in the richness of human cultural diversity.

As said, the coordinates of the cultural field (**Fig. 4**) start from a hypothetical point (o') representing an 'ideal' stage that was purportedly reached on the vertical coordinate of the Blaga coordinates at the time of the Eurasian Middle/Upper Palaeolithic punctuation. A perpendicular line that illustrates tendencies towards cultural specialisation splits off to the right (o'-x'), and a vertical coordinate (o'-y) – which is a continuation of the biological vertical – follows cultural tendencies towards flexibility and generalisation (but not towards 'complexity', as some would expect). Vertical orientations within the complementary coordinates should not be construed as a linear continuation of the biological vertical, but rather as a re-orientation from an already incipient stage of cultural specialisation common to the last cultural ancestors of all modern cultures.

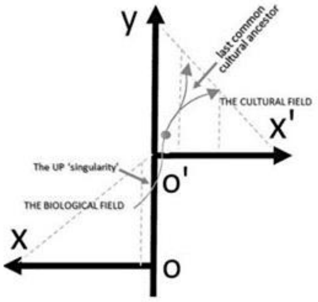

Fig. 4
Entering the cultural field
(Steiner 2018: 32).

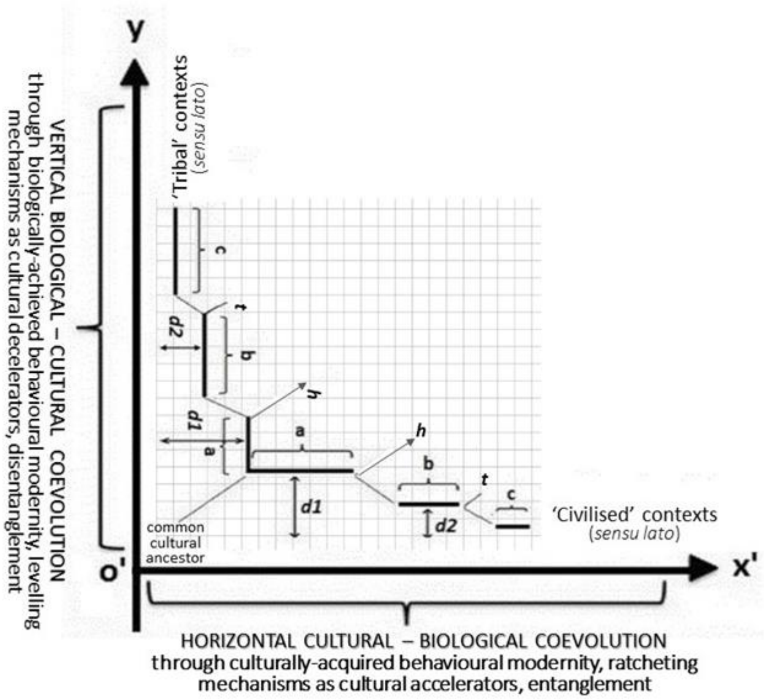

Fig. 5
The complementary cultural coordinates
(Steiner 2018: 33).

In the figure above one can notice that the swift vertical biological evolution becomes *decelerated* on the vertical coordinate of the cultural field, whilst the slow specialisation process on the biological horizontal becomes an *accelerated* cultural adaptation on the o'-x' coordinate. Culture becomes the main selective environment on o'-x' (the cultural - biological coordinate), whilst on o'-y (the biological - cultural coordinate) selection criteria are rather *bio-cultural* in nature.

Again, let us summarise the essence of horizontal and vertical tendencies in cultural evolution (Table 2):

The idealised coordinates run from the tentative date mentioned above (o') to the present (x'/y). At this stage, the chronological frame is arbitrary, but in the next subsection it will become clear why the Middle/Upper Palaeolithic singularity is not the factual starting point of the divergence between horizontal and vertical cultural orientations, but only the beginning of median – but still not 'medial' – cultural tendencies.

Table 2 – Cultural specialisation (left) vs. generalisation (right)

Cultural - biological coevolution (o’-x’) [adapting biology to culture]	*Biological - cultural coevolution* (o’- y) [adapting culture to biology]
– Characterised by specialisation to culturally-defined and selected-for objectives and a loss of cultural flexibility/autonomy. Biological evolution starts lagging behind the progressively faster rates assumed by cultural change and adapting by deleterious ‘shortcuts’ to the accelerated pace of cultural innovation, which results in pseudo-neotenous phenomena, like the ‘domestication syndrome’ (gracilisation).	– Characterised by technological (and other) *subtractions* and the presence of a biological - cultural continuum, including ongoing phenotypic and cultural neotenous processes. Hence, both biological and cultural flexibility are successfully retained.
– The vertically-negative stages are characterised by the permanent adoption of cultural specialisations, which result in increased degrees of *entanglement* and rigidity.	– The horizontally-negative stages are characterised by the permanent adoption of reductions, which result in increased degrees of *disentanglement* and cultural autonomy.
– The horizontally-positive phases (a, b, c) decrease in time (a > b >c): cultural evolution assumes *faster* rates on the horizontal coordinate.	– The vertically-positive phases (a, b, c) become increasingly longer and stable in time (a < b < c): apparently, cultural evolution works *slower* on the vertical than on the horizontal coordinate.
– Cultural manifestations last less and less in time (a > b > c) and there is a marked tendency to elaborate and *accumulate* technology that does not serve immediate needs (by recurring to ‘ratcheting mechanisms’ [Tomasello 1999]). Hence, the rift between biology and culture becomes increasingly wider.	– Cultural manifestations become stabilised and last longer in time (a < b < c) and there is a tendency to *reduce/simplify* unnecessary elaboration and allow biology to ‘catch up’ with culture (with the help of ‘levelling mechanisms’ [Woodburn 1982]).
– With cultural change becoming *accelerated*, a false sense of ‘advance’ is perceived and attributed to the horizontal cultural process.	– With cultural change becoming *decelerated*, a false sense of ‘stasis’ is perceived and attributed to vertical cultural evolution.
– Minimal vertically-positive tendencies may also occur: the closer to the vertical coordinate, the higher the possibility of their transformation from tendencies to phases. Thus, new cultural speciations may occur (*h*). In case such a speciation is effectuated immediately after the split between horizontal and vertical tendencies, a long-lasting and almost ‘median’ evolutionary line may emerge and develop in a gradual fashion, with cultural pulses separating prolonged periods of stasis and without any noticeable acceleration or deceleration in the rate of cultural evolution.	– Minimal horizontally-positive tendencies may also occur: the closer to the horizontal coordinate, the higher the possibility of their becoming cultural speciations (*h*). In case such a speciation is effectuated immediately after the split between horizontal and vertical tendencies, a ‘close to median’ evolutionary line may emerge and develop in a gradual fashion, with short-lived cultural pulses separating prolonged periods of stasis and without any noticeable acceleration or deceleration in the rate of cultural evolution (see Figs 7,8).

In gene-culture coevolution theory ‘divergent cumulative cultural evolution’ occurs when the cultural and biological evolutionary trajectories become autonomous in rapport to each other. This takes place when a strong cultural niche becomes an artificial selective environment (Odling-Smee 2003, Richerson and Boyd 2000). Genetic and cultural evolution are interacting parallel processes which optimise biologically-inherited and/or socially-learned information in a population. In this context, two effects have been suggested with respect to the long-term implications of social learning: (i) the ‘hiding effect’, which occurs when *sufficient* learning shields genetics from selection pressure, thus *slowing down* the cultural evolutionary process (Marriott and Chebib 2016), and (ii) the ‘Baldwin effect’, which takes place when *effective* learning stimulates genetics by increasing particular selection pressures, and thus *speeding up* cultural evolution (Baldwin 1896, Sznajder *et al*. 2012). A hiding effect occurs in a ‘simple’ cultural niche with moderate selection pressures that allow for the genetic inheritance to keep the pace with cultural change, without inhibiting ongoing biological evolution. Conversely, the Baldwin effect can be observed in a ‘complex’ artificial niche that supplants the biological environment and in which the genetic inheritance cannot keep the pace with the ever-increasing selection pressures and it becomes ‘derailed’, which may result in the acquisition of culturally adaptive, but biologically deleterious traits. In biological evolution, the rate of development may also ‘speed up’ or ‘slow down’ through heterochronic processes. Hence, it is safe to theorise that, like in biological evolution, in addition to developmental shifts that affect the rate at which cultures evolve, the timing of the onset/offset of various cultural trajectories and the extent of their elaboration may also be affected by heterochronic shifts (Fig. 6).

When applied to the cultural theatre of evolution, we may consider the following heterochronic developments:

1) *Cultural peramorphosis*, where the texture of a specific cultural configuration incorporates the contents of all previous cultural stages, including the ‘adult’ (‘goes as far’) stage in its further development, so that the culture ‘goes beyond’ its cultural ancestor (by resorting to ratcheting mechanisms). This occurs by accelerating the rate of technological and/or social entanglement and results in maladaptive cultural hypermorphisms (accompanied by gerontomorphic features). Such cultures also begin earlier (predisplacement), because of environmental dictates asking for compensatory cultural elaboration.

2) *Cultural pedomorphosis*, where the texture of a specific cultural configuration retains an earlier ('juvenile') cultural content in its further development, so that the culture 'does not go as far' as its cultural ancestor (by resorting to levelling mechanisms). This occurs by decelerating the rate of technological and social entanglement and results in cultural hypomorphosis (accompanied by neotenous features). These cultures also begin later (postdisplacement), because of environmental dictates asking for the reduction of obsolete elaborations inherited from an earlier stage.

Let us sum up this lengthy discussion with a diagram depicting heterochronic processes and their expressions in cultural evolution:

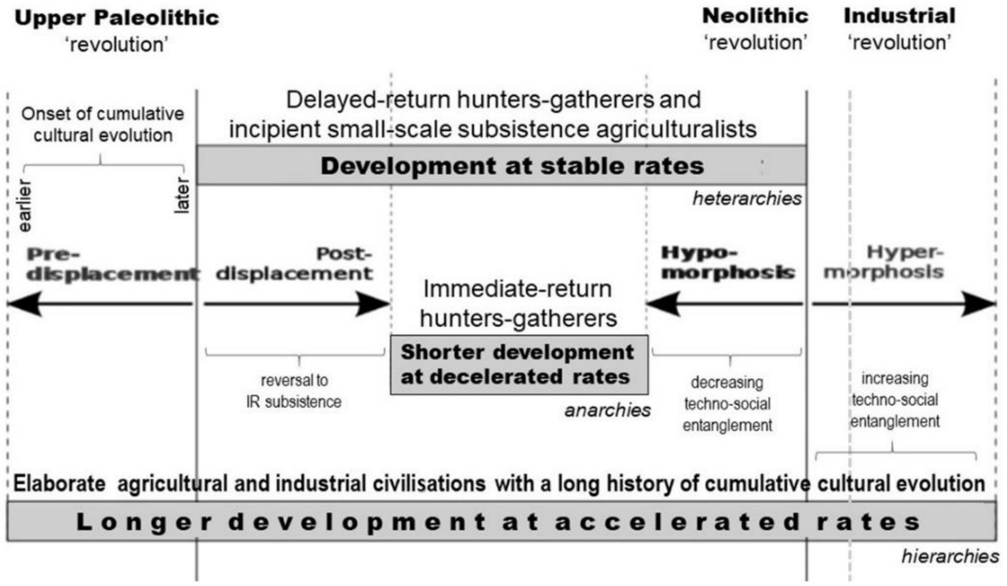

Fig. 6 Cultural heterochrony (Steiner 2020a: 222).

The six types of shift in heterochrony, a change in the extent, timing, and rate of cultural elaboration. Predisplacement (earlier onset of cumulative culture), hypermorphosis (through entanglement with biologically maladaptive cultural elaboration) and acceleration (through ratcheting mechanisms) extend development (= peramorphosis); postdisplacement (offset of cumulative culture), hypomorphosis (through disentanglement from moderate to sufficient cultural elaboration) and deceleration (through levelling mechanisms) truncate it (= pedomorphosis).

Indeed, the classic examples of cumulative culture addressed in gene-culture coevolution theory seem to have had a precipitated onset – 'running ahead of time', as Vishnyatsky (1994) has cogently observed. This cultural predisplacement took place between 60 to 40,000 years ago (Richter 2000, Richerson and Boyd 2000) in western Eurasia. Conversely, the examples of subtractive cultural evolution reviewed in Steiner 2020a commenced with their neomorphic cultural development at a relatively late date, with the cultural postdisplacement taking place between 10 to 8,000 years ago (Morris 2002, Stynder 2006). This still leaves us with the open question of where would we place indigenous Australian cultures in the heterochronic evolutionary framework outlined above. Let us recapitulate some of the observations made in the first part of this synthesis with a focus on the antiquity, developmental rate and extent of Australian Aboriginal culture.

Medial cultural evolution

Cultural pulses, transitions, updates, and speciations

As I have shown in the text, Aboriginal culture – with its complex cognitive and social landscapes elaborated to secure and manage knowledge – looks back to a noticeably longer evolutionary history than that of immediate-return hunters and gatherers, or of most other tribal and small-scale agriculturalist societies. Although its origin is roughly coeval with that of Pleistocene Eurasian traditions and its extent spans the same time-frame, the developmental rate of Aboriginal culture is clearly not accelerated, and it also cannot be described as strictly 'cumulative'. With its aetiology pointing towards a cultural predisplacement – which explains the presence of cultural hypermorphisms and the high degree of social entanglement developed in its long history – the placement of Australian traditions in the vicinity of the similarly gerontomorphic civilisations that 'follow' the o'-x' coordinate in the theatre of cultural evolution (**Fig. 5**) would seem natural. Yet – and here lies the crucial difference – the Aboriginal bio-cultural niche (Dreamspace) did not eliminate the natural components, as the niche in which cumulative culture evolves did. Moreover, with the stress on information management and the ritual techniques devised to secure an additively growing knowledge inheritance system against loss – at the expense of material accumulation – Australian traditions did not take a cumulative turn and maintained a slow, but steadily 'advancing' medial transition, roughly parallel with an archaic pre-cumulative (median) evolutionary path. Mode 3 technology was similarly retained, but not returned to from a Mode 4 stage – the return to an already overhauled stage characterises subtractive cultures, which the Aboriginal is certainly not (and yet, the 'Tasmanian case' addressed in the first section suggests the possibility of subtractive strategies being adopted by some isolated Aboriginal groups). Additive cultural evolution (z) – as illustrated in **Fig. 7**, below – had likely 'speciated' from a cultural ancestor shared with that of cumulative culture, about 60,000 years ago (for the first signs of transitional pre-cumulative cultures see Richter's (2000) paper on late Neanderthal 'social memory units').

The Holocene cultural pulse *updated* the archaic Mode 3 material culture – but did not discard it entirely – and *novel* rock art styles and continent-wide social networks specialising in the exchange of *traditional* ritual artefacts – emerged in unison. Geomythological sequences were added to the already bursting amount of social memory and the social complexity needed for the distribution of an ever-increasing quantity of information increased accordingly. Ritual behaviour became likewise more nuanced. However, this cultural *pulse* should not be interpreted as a cultural speciation: punctuations do not always result in speciation. The necessity of a 'cultural update' points towards a long-lasting period of a balanced rapport (equilibrium) between the speeds assumed by cultural change vs. biological adaptation.

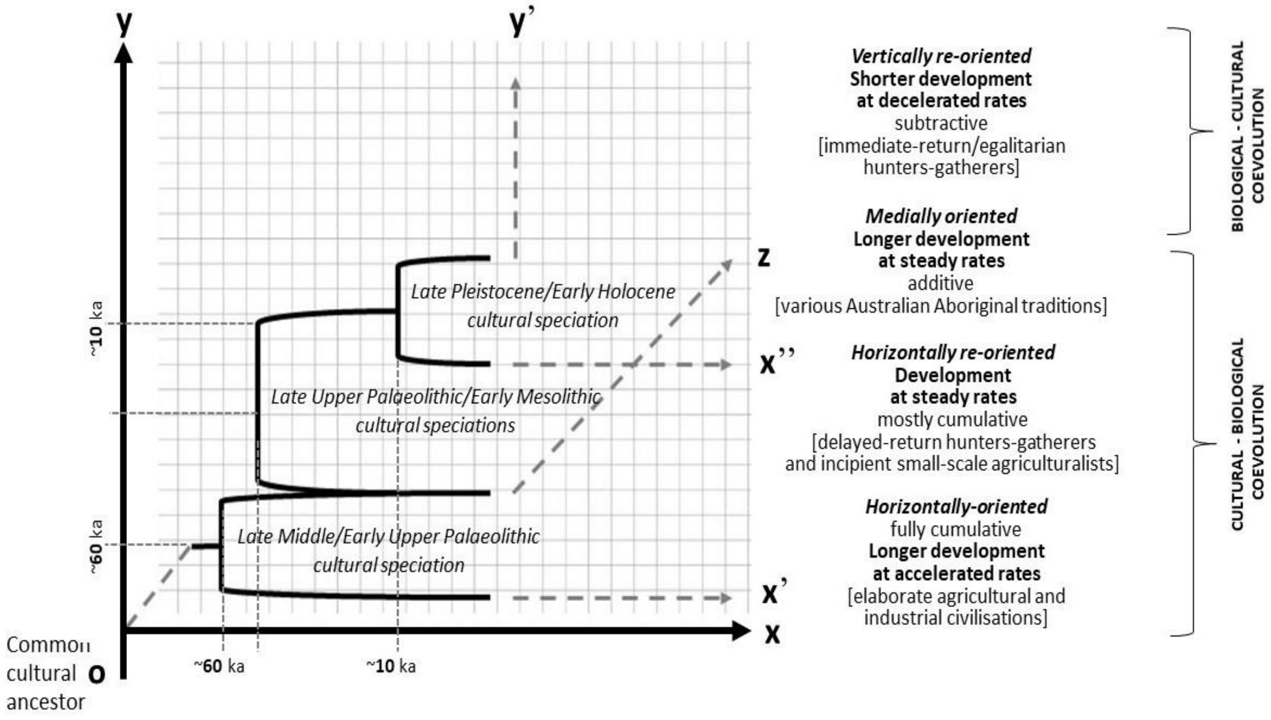

Fig. 7 – Pleistocene and Holocene cultural speciations and re-orientations.

Diagram depicting the hypothetical aetiology of modern cultural configurations, to which dashed lines showing vertical, medial and horizontal evolutionary directions are added. Note that this is only a rudimentary illustration meant to emphasise the evolutionary processes reviewed in the text.

Holocene cultural speciations did however occur, world-wide. One outcome was the subtractive culture practiced by immediate-return/egalitarian societies (y' in the illustration), which was explored at large in my previous article in this journal. Note however the relatively recent (Late Holocene) origin of this vertically *re-oriented* culture (Morris 2002; Stynder 2006), which contradicts layman exaggerations and misbeliefs regarding its antiquity.

The *medially-oriented* line followed by Australian traditions (z) is also parting the cultural field in two: in the lower triangle one can follow (horizontal) cultural-biological coevolution, whilst the only subtractive example is located in the upper triangle, which corresponds to (vertical) biological-cultural coevolution. Again, Australian traditions are neither this nor that, but an anomaly in both cases, which has impeded the anthropological attempts undertaken for their classification – as pointed out in the introductory notes of this paper.

The horizontally re-oriented cultural trajectory of delayed-return hunters-gatherers and incipient farming communities – as they are referred to in **Fig. 6** and illustrated as x'' in the diagram above – is another outcome of the Holocene cultural speciation. The Neolithic 'revolution' is also part of this world-wide Holocene cultural re-orientation phenomenon (speaking of which, White's [2006] 'Neolithic problem' in Australia comes to mind and, like in the case of the Tasmanians mentioned above, the possibility of various cultural experimentations in Aboriginal Australia must be considered and explored).

Cognitive plasticity

The key role played by neoteny on the vertical coordinate of both biological and cultural evolution becomes further reinforced by an exploration of the psychological dimension of pedomorphism. *Psychological neoteny* (Charlton 2006), i.e., the retention of youthful attitudes and behaviours into later adulthood is a valuable cognitive asset displayed not only by artists and scientists, but also by 'natural people' and children (see Bjorklund 1997). Regarding art and science, the first part of this synthesis has addressed the common aetiology of both and tracked it back to a Pleistocene *techné*, the neural underpinnings of which also explain the emergence of hominin ritual behaviour. With the nexus between cognition, (palaeo)art and ritual already acknowledged, this subsection enquires their effect on the specific – horizontally-, vertically-, or medially-oriented – trajectories adopted in the cultural theatre of evolution.

For a better understanding of the relationship between psychological neoteny and ritual I must return to the case of egalitarian societies. Although Woodburn (1982) has recognised the need to explore the manifestations of egalitarianism and disentanglement in religious belief and practice, he has stopped short from Doing so. However, Lewis-Williams (1988) and Dowson (1994) undertook the enquiry and concluded that the spiritual practices of these societies were – in addition to being affected by egalitarian principles (summarised in Steiner 2020a) – also reflecting the cognitive plasticity displayed in all other walks of life.

As an expression of their pedomorphic features, these hunters and gatherers also display high degrees of cognitive flexibility, which becomes manifest not only in their unorthodox religious belief and practice (Lewis-Williams 1988; Marshall 1989 [1959]; Dowson 1994), but also in their 'childish' and life-affirming attitudes in everyday life – e.g. curiosity, playfulness, affection, sense of fairness, sociability, and an innate desire to learn and cooperate – which, as seen, are the very signatures of psychological neoteny. Ritual and religious behaviours are non-committal, which makes them very fluid and tolerant in character (Chidester *et al.* 1997). In addition to being recognisable in cultural values, psychological neoteny also becomes conspicuous in the 'attitudes' of immediate-return hunters and gatherers which, unfortunately, were misunderstood and misinterpreted in the anthropological literature of the 19th and early 20th centuries. As Chris Low (2004: 57) has summarised it, "[the] cognitive attitudes of natural people were considered to be 'childish', with cause and effect randomly sequenced in a world of probabilities that was also able to accommodate contradictions that were not recognised and 'corrected', and in which the spiritual side was not a stranger to reality."

These observations on the cognitive plasticity of egalitarian societies seem at first sight not to have anything in common with the Australian Aboriginal ritual behaviour addressed in the first part of this paper, where the emphasis is on its rigid and orthodox character. Furthermore, Aboriginals cannot be described as pedomorphic, but quite the opposite, which is gerontomorphic (Hulse 1962; Ashley-Montagu 1989). Nonetheless, the 19th century anthropologists mentioned by Low have still described them as 'childish' and living in a world accommodating logical contradictions. Let us not forget however that these 'contradictions' existed only in the European anthropologists' minds and not in the Aboriginal construct of reality which, as I have also pointed out in the first part of the paper, had a very elaborate and ritually managed causal order. To clarify this apparent paradox, I must compare the various degrees of cognitive tolerance in the cultural niches inhabited by the southern African San, the Australian Aboriginals and the European anthropologists who had designated them as 'childish'.

The biological field revisited

Before returning to the topic of cognitive plasticity, a recapitulative illustration of the main concepts introduced so far and the posing of new questions become necessary. Let us first come back to the biological theatre of evolution, as envisioned by Blaga. One of the shortcomings of the model is that it construes evolution as an accomplished process that does not accommodate the last 50 millennia of human development. Blaga's 'new approach' – although conceived to explain evolution in general – becomes severely limited in its illustration (see **Fig. 1**), where the biological field is confined to a Humans/Apes set of coordinates that – until the existence of Yowies or other 'ape-men' is not confirmed – must not account for the possibility of 'median' evolutionary tendencies. Since in the 1940s (when Blaga conceptualised his model) Neanderthals were still perceived as 'ape-men', Blaga did not think twice before placing them within the coordinates of his biological field.

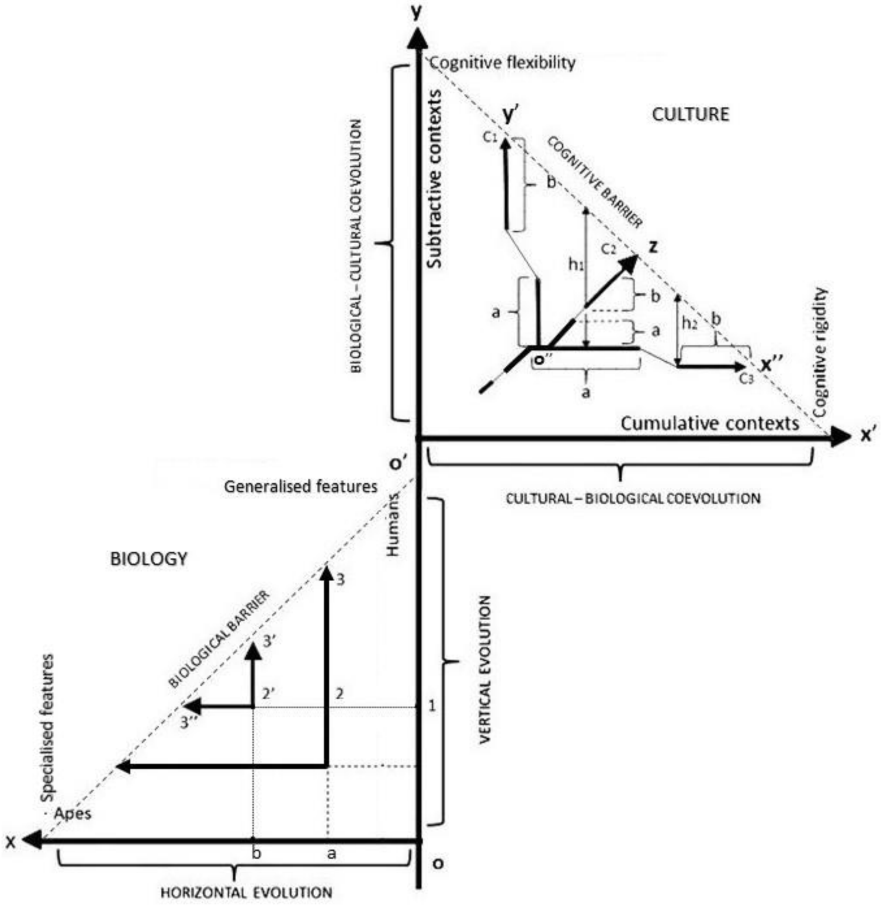

Fig. 8 – Blaga's 'biological barrier' principle (left, adapted from the original [1976]). In the cultural field (above) the 'principle' becomes expressed in various degrees of cognitive plasticity, as detailed in the text.

In the rigid vertical/horizontal understanding of speciation, new species emerge by either following a convolute path at right angle turns, or a linear – strictly horizontal or vertical – evolutionary course. For example, in **Fig. 8** (lower left quadrant), speciation from a vertical evolutionary line occurs by either taking the straight 1-2-2'-3'' path (leading to a horizontally oriented specialisation), or the 1-2-3 trajectory (resulting in a parallel vertically-evolving and thus less specialised species). Alternatively, the 1-2-2'-3' evolutionary stages may be followed (the outcome of which would be a fairly specialised, but not excessively optimised unnamed ape). Note that such speciations occur only when initiated from points located on the lower half of the vertical coordinate, or the right-hand half of the horizontal (a, b) – at points beyond these, the attraction of the horizontal would already be too weak to allow for specialisation or, conversely, the proximity to the horizontal would impede the realisation of vertical mutations. Blaga has thus visualised gradually unfolding new sets of coordinates nesting in each other like Russian dolls.

The areas of these secondary, tertiary, etc. evolutionary fields become thus incrementally reduced (e.g., the triangle formed by 2'-3'-3'' is considerably smaller than that outlined by o-y-x). This is due to what Blaga defines as the 'biological barrier principle' which, in his model, limits the extent of both vertical and horizontal evolutionary lines – in other words, secondary or tertiary speciations occurring within the primary o-x/o-y coordinates will never become more generalised (or specialised) than the species evolving (or devolving) along the primary coordinates.

The augmentation of Blaga's hypothesis with the punctuated equilibria model (**Figs 2, 9**) rectifies some of the drawbacks listed above. Most importantly, it would not exclude the possibility of an almost 'median' evolutionary line, provided that the speciation occurs at a time roughly coeval or shortly after the original vertical/horizontal split. Yet, once on a well-established vertical (or horizontal) course, the possibility of 'oblique' transitional phases becoming speciations – without the danger of their being swayed by the pull of the horizontal (or vertical) – must also be considered (as illustrated in **Fig. 9**). Such occurrences must however be construed as realisations of evolutionary probabilities that cannot be located within the specific Humans/Apes coordinates formulated by Lucian Blaga.

However, in case these are renamed and Blaga's model (together with its augmentation) set in a field thus defined by *Homo* (o-y)/*Australopithecus* (o-y) coordinates, a new picture emerges, in which the initial field proposed by the Romanian philosopher becomes the top similar triangle of a larger Humans/Apes triangle with the 'biological barrier' being the hypothenuse of both (**Fig. 9**). Moreover, in such a restricted field, oblique speciations can be easily accommodated, e.g., the evolutionary line of *Homo erectus*. In view of its location in the upper half of the evolutionary field, the line shuns away from the pull exercised by the horizontal and can maintain a steady and long-lasting trajectory occasionally interrupted by evolutionary 'pulses' (unpunctuated equilibrium).

The inclusion of *Homo erectus* and *H. neanderthalensis* in the biological field and their conspicuous absence in the cultural theatre of evolution does not mean that they were not 'cultural beings'. As evidenced in the palaeoanthropological literature (Bednarik 2014a; Rodriguez-Vidal *et al.* 2014; Hoffman *et al.* 2018), these archaic humans were in the full possession of symbolic abilities, like language and (palaeo)artistic expression. However, their steadily evolving and temporally extended cultures (Mode 2 Acheulean and Mode 3 Mousterian) did not accelerate to the point at which biological evolution would have been left lagging behind culture and catching up by punctuations – which, as specified, is the main signature of the Upper Palaeolithic 'singularity' that propelled our ancestors into the cultural field. Notwithstanding, there is a hypothetical possibility that, Neanderthals too, had effectuated such a precipitated 'sudden jump'. Although not unanimously endorsed, the evidence pointing to a suddenly accelerated rate of cultural change occurring in a period when only Neanderthal-like humans were present in western Eurasia was rigorously reviewed by Bednarik (2007 and references therein), who suggests that not only the Châtelperronian and other 'transitional' industries clearly associated with Neanderthals, but also the Bohunician, the Szeletian, the Uluzzian, the Uluzzo-Aurignacian, the Proto-Aurignacian, Aurignacian, and the Altmühlian might all relate to humans other than the so-called 'moderns'. In view of the modest area occupied by the hominin evolutionary field within the markedly larger hominoid theatre of evolution and of the proximity of the Neanderthal line to the vertical coordinate of both (see figure below), the possibility that some archaic humans might have also entered the cultural field cannot be outrightly dismissed (cf. Steiner 2018).

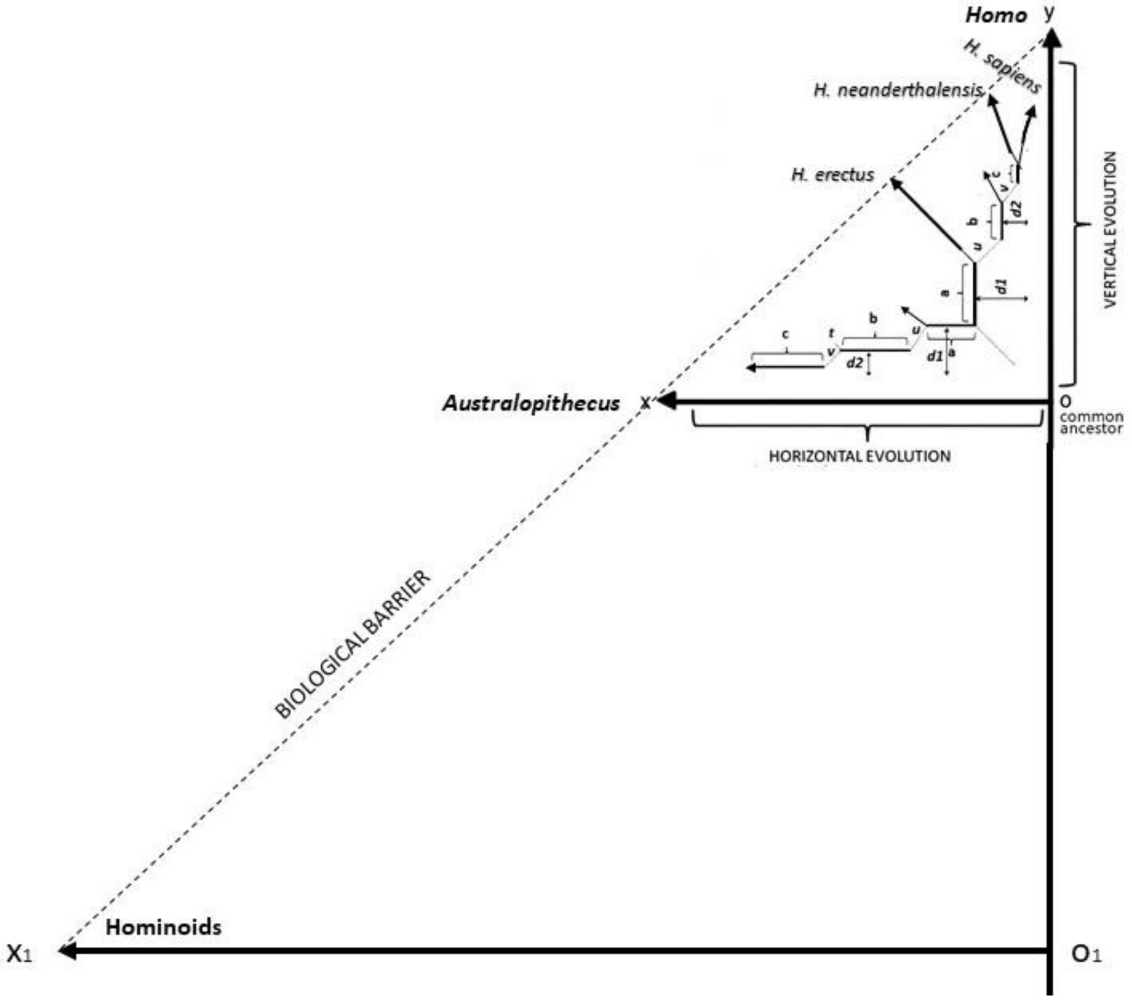

Fig. 9 The rectification of Blaga's original model in which the hominin evolutionary field delineated by the Homo/Australopithecus coordinates and augmented with the possibilities offered by punctuated equilibria is construed as the top similar triangle of a markedly larger hominoid evolutionary field, with the 'biological barrier' being the hypothenuse of both.

For all that the punctuated equilibria model posits that significant modifications occur in short and sudden periods of evolutionary activity separated by much longer intervals of stability, it also recognises slow and gradual transitions as a meaningful pattern in developmental history (Eldredge and Gould 1977). In such a case, additive changes would be practically negligible, except when the transition lasts for remarkably long periods of time. The evolutionary line of the long-lasting *Homo erectus* subscribes well to such a specification and, indeed, in Fig. 9 it appears to be the median of the top similar triangle formed by the two coordinates of the hominin field of evolution and the 'biological barrier'. However, at closer inspection, the line is rather 'medial' (to o-y) than ‘median’, given its initiation from an already vertically-oriented stage and thus from a position above the true median, which should begin at the point of origin (o), coevally with the split between vertical and horizontal tendencies in hominin biological evolution. From the perspective of the punctuated equilibria model and as hinted to above, such a *medially*-oriented evolutionary trajectory may become a temporally-extended shift unaffected by either horizontal or vertical punctuations, with the pull exercised by o-x/o-y neutralising each other (with the strong support of the equally long-lasting and efficient Acheulean, the discussion of which would already take us to the cultural realm).

Finally, in regard to the ‘biological barrier principle’, the possibility of a punctuated – but still biologically explainable – ‘sudden jump’ effectuated from an advanced position on the vertical coordinate could not have been predicted by Blaga in 1943, who preferred to call it an ‘ontological mutation’. However, given the combined biological and cultural evolutionary impetus that precipitated the Upper Palaeolithic ‘singularity’ (see **Fig. 4**) the constraints of the principle were likely circumvented.

Contextual focus and the cognitive barrier

After the precipitated ‘sudden jump’ that took our ancestors to the new cultural theatre of evolution, Blaga’s ‘biological barrier’ becomes irrelevant – as seen, the onset of specific cultural configurations occurs at different times, they develop at dissimilar rates and their temporal span varies as well. However, bearing in mind the central place occupied by ritual in Australian Aboriginal culture and its conservative character – especially when compared to the unorthodox ritual behaviour of the Kalahari Bushmen mentioned in the subsection on cognitive plasticity – I would suggest that, although not culture as a whole, but the degree at which certain cultural aptitudes and attitudes become expressed may, indeed, vary from culture to culture and be conditioned by the specific orientation – vertical or horizontal – followed in the cultural field. Having associated cognitive plasticity with psychological neoteny and ascribed both to the vertical coordinate of the field in which culture evolves, a horizontal cultural orientation would, conversely, display less cognitive plasticity and, as such, fewer displays of behaviours associated with psychological neoteny. Therefore, an equivalent of the ‘biological barrier’ conditioning the extent of evolutionary flexibility – as posited by Blaga for the biological field – may also be visualised for the cultural field, as a ‘barrier’ regulating the extent of cognitive plasticity exhibited by various cultures.

Liane Gabora's (2003: 434) 'contextual focus hypothesis', namely "[the cognitive] capacity to shift between associative – conducive to forging new and random concept combinations – and analytic thought, which is conducive to manifesting them in an ordered, reciprocally understandable fashion" may prove instrumental in the detection of such a 'cognitive barrier'. According to Gabora, at the divergent end of the continuum there is a defocused, intuitive and associative mode that finds remote or subtle connections between 'memory traces' that are correlated but not necessarily causally related. At the other – convergent – end of the operational range of the contextual focus is a rule-based, analytic mode of thought that analyses relationships of cause and effect. Insights, creativity and new ideas germinate in a defocused state in which one becomes receptive to the possible relevance of many dimensions of a situation. They are refined in a focused state, in which 'irrelevant' dimensions are filtered out and only the causally consistent ones are condensed.

The paragraph above reiterates in a concise fashion what was said thus far about the aetiology of ritual behaviour and links it to the cognitive plasticity displayed by the 'childish natural people' living in a world that accommodates logical contradictions (Low 2004). On the one hand, Pleistocene ritual 'zoomed in' on the convergent/analytic end of the operational range of the contextual focus whilst, on the other hand, modern and contemporary ritual 'zooms out' to the divergent/associative end of the range (cf). Gabora's coupling of 'insights, creativity and new ideas' with the latter underlines the role assumed by the psychological dimension of neoteny in art and ritual which, as repeatedly emphasised in this synthesis, share a common neural foundation. On the same note, the observation that in the divergent cognitive state the meanings of concepts change in ways that violate the rules of classical logic explains the bewilderment of the late 19th and early 20th centuries anthropologists – the exponents of a culture stuck in the convergent/analytic end of the operational range of the contextual focus – when confronted with the cognitive plasticity exhibited by 'natural people'.

Hence, understanding the various amplitudes assumed by the operational range of the contextual focus in specific cultural orientations as a 'cognitive barrier' acting in the cultural theatre of evolution would not be far-fetched and – following and replicating Blaga's model – the tracing of an imaginary line between the apices of the coordinates defining the cultural field could offer new insights into the principles guiding the evolution of human-specific culture.

Fig. 8 (upper right quadrant) is updated with details that were not included in the illustration of the cultural field offered in Fig. 5. Firstly, it depicts a third 'coordinate' (o'-z), an approximately median – or, more precisely, *medial* to o'-x'– line that parts the field in two roughly equal halves, as already suggested in Fig. 7. Secondly, the 'cognitive barrier' addressed above is also marked in the figure.

As proposed in a previous subsection, the medially-oriented line following a cultural orientation that cannot be described as either 'subtractive' or 'cumulative' – and repeatedly referred to in the text as 'additive' – splits off from an already pre-cumulative (true median) cultural tendency. This is an educated guess based on numerous observations that were detailed in the text. The developmental history of both medially- and horizontally-oriented cultures includes that of the pre-cumulative common ancestor and, as a result, it is substantially longer than that of the Holocene re-orientations depicted in Fig. 7, where the common aetiology of horizontal and medial orientations is also highlighted and attributed to a Late Middle/Early Upper Palaeolithic cultural speciation. As already specified in the discussion of Blaga's biological field of evolution in the lower left quadrant of Fig. 8, the augmentation of the cultural field with the punctuated equilibria model allows for the possibility of an early medially-oriented cultural speciation. But, as emphasised in Table 2, a speciation that would remain unaffected by either vertical or horizontal pulls cannot commence at a later stage, i.e., from a point that is too close to the vertical or, respectively, to the horizontal coordinate. Hence, the evolutionary line cannot 'advance' by punctuations which would inevitably sway its course, but only by modest 'pulses' or smooth transitions separating increasingly stabilised phases (b > a). This prolonged 'unpunctuated equilibrium' must however not be confused with stasis: the punctuated equilibria model allows for slow and gradual transitions in which additive changes would be practically negligible, except when the transition lasts for remarkably extended periods of time. Sixty millennia were indeed a long enough time to result in a massive amount of such additive changes which, complemented with Holocene cultural updates – not punctuations which would have altered the roughly median (or rather medial) orientation of Australian Aboriginal culture and sway its course – have modified its texture in a substantial fashion.

Let us conclude with a discussion of the 'cognitive barrier principle' and of how it operates in the cultural field illustrated in Fig. 8. For evident reasons, the cognitive plasticity of egalitarian/immediate-return hunters and gatherers is marked with C_1. That is, the operational range of the contextual focus (marked as h_1 and h_2, with $h_1 > h_2$) is at its highest in the proximity of the vertical and at its lowest in the vicinity of the horizontal. However, there is a limit set by the cognitive barrier – the zooming out of the contextual focus to its topmost range would lead to a combinatorial explosion of possibilities; in other words, to a state of undecided superposition. Such a complex state would be difficult to maintain and a potential downfall of processing in an associative mode could occur (Gabora 2003). Pleistocene ritual behaviour and mnemonic convergence – common to the ancestors of all three cultural orientations surveyed here – was meant to avoid precisely such an adaptively perilous risk entailed in unproportionate hominin encephalisation.

To illustrate what I mean by the maximal range to which the contextual focus is allowed to zoom out I must cite the accounts of Lee (1968), Marshall (1969) and Biesele (1978) for parts of the Kalahari in the 1950s and 1960s when about half of the men and one third of the women in any camp were ‘shamans’ – in other words, they could enter trance (read ‘the divergent/associative end of contextual focus’) at will. This is supported by Dowson’s (1994) interpretation of San rock art and his conclusion that sharing was apparently not restricted to meat or objects, but it was also a common practice in the spiritual realm, where the benefits of trance were shared with the other half of the men and two thirds of the women who could not enter the divergent cognitive state at will.

Compared to the Kalahari Bushmen, the cognitive plasticity of Australian Aboriginals is rather moderate ($C_2 < C_1$), but still allowing for the zooming out of the operational range of the contextual focus and for accommodating contradictions that violate the rules of classical logic, which prompted anthropologists to describe them as ‘childish’ and living in a world accommodating contradictions. Indeed, they do inhabit such a world: as I have already pointed out, Dreamspace (the bio-cultural niche) is a tangible environment that cannot be recognised or experienced as such by cultural aliens. Moreover, the at first sight ‘logically inconsistent’ progression of some Dreamtime stories becomes essential for an efficient storage of the huge amount of information that could not be accommodated in a single causal dimension.

The horizontal coordinate is associated in the figure with cognitive rigidity (C_3), in other words, the operational range of the contextual focus is permanently blocked in ‘classical logic’, i.e., in the analytic end of the continuum. Institutionalised and/or sectarian religions constitute the only logically inconsistent manifestation of cognitive plasticity, and only artificially-induced altered states of consciousness allow for minimal, but frowned upon ‘zoomed-out’ experiences.

To sum up, cultures evolving in rigid artificial cultural niches (in the lower, roughly isosceles triangle of the cultural field formed by o’-x’-z in **Fig. 8**) display reduced degrees of cognitive plasticity, whilst those located in the upper triangle (y-o’-z) evolve in bio-cultural niches and are characterised by higher levels of cognitive flexibility. Again, the ‘Australian case’ is located in-between: although essentially conservative – considering that the o’-z leg of the triangle is medial to o’-x’ and not clearly median in the larger triangle of the cultural field – the niche is not artificial and it also makes use of the ability to shift the contextual focus in order to store information in more than one causal dimension. Similarly, by reason of its conservative nature, the medial orientation of Aboriginal culture shuns away from punctuations that would bend its trajectory and expose it to a horizontal pull.

Regarding the o’-y coordinate, the distinctiveness of the cultural practices of immediate-return/egalitarian societies that follow it was explored in my previous contribution to this journal (Steiner 2020a). The peculiarities of cumulative cultural evolution along the o’-x’ horizontal coordinate were addressed in another publication (Steiner 2020b). With the idiosyncrasies of the medially-oriented (o’-z) culture of the First Australians reviewed in the synthesis at hand, the three dominant tendencies in the cultural theatre of evolution are thus open for comparisons and interpretations. I must however admit that, by virtue of the Australian cultural diversity, my approach may seem too generalised in its presentation of Aboriginal traditions as a monolithic continent-wide cultural block. For all that, I have also repeatedly pointed out that regional reductive and cumulative cultural punctuations did in all likelihood occur and that these should be investigated in targeted, less theoretically-inclined papers.

Conclusions

Although anthropologists recognise a broad distinction between hunters-gatherers with elaborate social and economic systems and those who are technologically less sophisticated, but socially more egalitarian, the portrayal of Australian Aboriginals as part immediate-return and part delayed-return, and only superficially egalitarian makes their inclusion in either category problematic. In addition to the simple/complex ambiguity, the antiquity of human presence in Australia and the patterns of human colonisation are also hotly debated topics. However, the commonly accepted date for the peopling of

Australia remains within the range of 50 - 65 thousand years, an impressive demographic continuity originating in a single wave of colonisation.

There is also a common understanding in regarding the traditions of the First Australians as the oldest continuous human culture, which has encouraged some anthropologists to assume that the present of Aboriginal culture reflects past cultural configurations that can be projected on the Palaeolithic ancestors of all living humans. In this article I challenge this assumption and, after drawing parallels between the 'Australian case' and text-book illustrations of cultural evolution (e.g. gene-culture coevolution and niche construction theories) I suggest that although the 'rules' are roughly observed in all modern and contemporary societies, their application has varied from culture to culture and that the outcome of specific configurations can be attributed to the diverse techniques devised to manage the inherent risks of cultural evolution.

Considering the antiquity of human presence in the Fifth Continent and that through its long developmental history Aboriginal culture became centred on ritual activities with a heavy bias on information management, I consider the – even if only partial – retention of knowledge accumulated during such an extended period a remarkable achievement.

In the exploration of the cognitive mechanisms that link ritual, (palaeo)art and knowledge, the paper addresses some of the neural underpinnings which became conducive to the emergence of human-specific ritual behaviour and artistic expression and I discuss their use in Pleistocene Australia.

The enquiry is further informed by the hypothesis of cultural heterochrony which proposes – in full accordance with the postulates of gene-culture coevolution theory – that cultures also evolve through a Darwinian selection process in which the cultural equivalent of biological heterochrony, i.e. shifts in the extent, rate, and timing of development must also be acknowledged and explored. Surprisingly, within the coordinates of the hypothesis Australian Aboriginal cultures and complex agricultural/industrial civilisations cluster together in the hypermorphic (gerontomorphic) area of cultural diversity. However, with some minor but far-reaching differences which have resulted in such antithetical outcomes that, at first impression, the two gerontomorphic cultures seem to be completely unrelated.

Although in the cultural heterochrony hypothesis they are both construed as cultural pre-displacements, the accelerated *technological entanglement* in hypomorphic cumulative cultures is substituted in gerontomorphic additive cultures with an initially long-lasting incremental – but, during the Holocene, an *apparently* punctuated – *social entanglement*.

Additionally, 'civilisation' has completely eliminated the natural component from the texture of its cultural niche, whilst in Aboriginal additive cultures the *bio*-cultural niche *is* the natural environment. Notwithstanding, both hypermorphic cultures are *over-specialised* to their respective constructs of reality, hence the presence of cultural *hypermorphisms*, the inevitable outcome of *prolonged* cultural adaptation. Yet, the adaptation to a bio-cultural niche prevents the acquisition of biologically maladaptive traits that are the inevitable parts of an accelerated specialisation to an entirely artificial niche.

Last, but not least, with a Mode 3 toolkit providing for tens of millennia 'sufficiency' on the material level, 'efficiency' became reserved for the *social* and *spiritual* components of culture, unlike in other parts of the world where cumulative technological innovation became increasingly 'efficient' and the stress in cultural evolution shifted towards the *material* and *mental* components of culture. Consequently, cultural hypermorphisms manifest themselves in the technological and mental domains of cumulative civilisations (with less complex social and spiritual domains), whereas social and spiritual hypermorphisms accompanied by less 'cultivated' rational and material components characterise gerontomorphic tribal cultures.

The social and spiritual complexity needed to sustain a constantly expanding body of knowledge may explain why Aboriginal cultural evolution did not follow a strictly *cumulative* or *subtractive* trajectory but adopted instead a 'median' strategy. I would suggest that the early emergence, mostly incremental developmental rate and the extent of social and spiritual entanglement in Australian Aboriginal cultures reflect an *additive* evolutionary strategy (with occasional and short-lived cumulative *pulses*) centred on a ritually-regulated feedback loop between the volume of information flow and the level of social elaboration.

Although the consensus view attributes the intricate mechanisms devised for efficient information retention and exchange to a Holocene cultural spike, this paper proposes that the transition – which was paralleled by similar discontinuities world-wide, including those resulting in subtractive outcomes – was an environmentally- and demographically-determined update and *refinement* of traditional Pleistocene information management techniques and that only the coeval technological, linguistic and artistic developments should be viewed as novel additions to an already well-established archaic – but far from 'simple' – Pleistocene cognitive/ritual complex.

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