

for example, of the Americas, where complete aDNA sequences of >12,000-year-old skeletons from Anzick in Montana (USA) and Hoyo Negro in Mexico's Yucatan peninsula now provide direct evidence of the genetic ancestry of Native Americans (Chatters et al., 2014). It is difficult to keep up with such a rapidly moving field.

These are impressive volumes, with the authority that only such a distinguished list of contributors can confer. Long gone are the days when a sole author can digest and comprehend the vast scope of world prehistory and present it in a detailed and systematic manner. Inevitably, however, one ends by wondering what the target readership will be. The printed volumes are handsome products, but one suspects that the key consumers will be students and academics who will consult individual chapters and download them in PDF format from Cambridge Histories Online (the digital platform accessed through an institutional subscription). That also offers the opportunity for the progressive updating of individual chapters, without the need to reprint the entire set, although for the present the link between the printed and digital versions appears firmly established. There is no doubt, in any event, that this will remain an essential work of reference for years to come.

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Robin Ian M. Dunbar, Clive Gamble and John A.J. Gowlett, eds. *Lucy to Language: The Benchmark Papers* (Oxford: Oxford University Press, 2014, 536pp., 59 illustrations, hbk, ISBN 978-0-19-965259-4)

In 1873, Herbert Spencer evidenced that humans, at the same time, are the final problem of biology and the initial factor of sociology, suggesting that the latter was

definitely rooted in the former. Much later, a milestone in studies of the natural history of human societies can be found in Eibl-Eibesfeldt's human ethology

(Eibl-Eibesfeldt, 1989). According to this comparative perspective, universal behaviours shared by all human populations regardless of culture and history betray underlying biological and possibly selection-based components. Such innate behavioural and cognitive structures, at individual or at societal level, represent a phenotypic result of our evolutionary history, and must be interpreted considering a long-term scenario, according to necessities and environments which may have been far different to our current condition. On the one hand, such intrinsic levels of organization justify our evolutionary coherence in terms of primate adaptations and ecological fitness. At the same time, such indelible imprints can seriously constrain our possibilities and responses in terms of social and cultural plasticity. Such limits may become more apparent when cultural changes are decoupled from the actual functional range of the biological systems.

The natural history of human social structure is the central issue of the Social Brain Hypothesis (SBH), put forward and firmly promoted by Robin Dunbar over the last twenty years (e.g. Dunbar, 1992, 1998). The hypothesis is deeply rooted within a quantitative fact: brain size in primates, expressed in terms of neocortex ratio, shows an outstanding correlation with the size of the social group. The correlation issue is a relevant and determinant factor in the whole history of SBH. A correlation, whenever properly tested and confirmed, is a fact. It reveals the existence of a relationship, whether or not we have a clear interpretation of the reasons behind it. The degree of correlation is also a fact, expressing the force of that relationship. SBH, like many of its research branches that have flourished thanks to a noticeable investment of Dunbar's teams and colleagues, is therefore based on facts, and in particular on quantitative facts. This is

extremely important in an evolutionary context, in which quantitative approaches are not always suitable and, in some cases, even not always appreciated. SBH integrates comparative primatology, human evolution, and sociology, by using a wide array of conceptual and analytical tools from archaeology, paleontology, psychology, and physiology. Looking for correlations among factors and parameters in living primates, SBH attempts then to fit observations and inferences on human brain evolution into the framework of that quantitative, probabilistic, evidence. In my opinion, the main strength of this perspective is the correlation-based approach. Correlation is used as a signal, a witness and an indication, direct or indirect. We can debate the origin of the correlation but, if confirmed, the existence of a correlation should not be undervalued and should be properly exploited. For example, Eiluned Pearce and Chris Stringer, together with Robin Dunbar, have recently evidenced a correlation between orbit size and occipital lobe size in primates, making inferences about the Neanderthal brain (Pearce et al., 2013). In this case, correlations between soft and hard tissues can be useful to develop an 'indirect paleoneurology'. These quantitative and comparative approaches are welcome, mostly in fields like paleoanthropology and neurobiology which often must rely only on descriptive approaches because of limits in the sample size.

The project of the British Academy 'Lucy to Language: the Archaeology of the Social Brain' was developed between 2003 and 2010 as a multidisciplinary integration between prehistoric archaeology and evolutionary psychology. SBH was the background of the project, with a clear paradigm: comparative primatology supplies the key to understanding the natural history of modern human societies and, by interpolation, of the social

structure in extinct hominids. Please note the interpolation issue: inferences are made within the same zoological and phylogenetic model, namely primates.

The most representative papers that originated under that project are now contained in this book: *Lucy to Language: The Benchmark Papers*, edited by Robin Dunbar, Clive Gamble and John Gowlett. There are twenty-one articles, mostly review papers, several previously published in journals or edited volumes, which provide a comprehensive integration of SBH with topics in lithic technology, ape biology, neurobiology, phylogenetic dynamics, social structure, molecular biology, human ecology, climate, language, or kinship. The apparently fixed social hierarchical structure associated with our intrinsic and stable cognitive capacities is discussed in the light of very different factors and behaviours, giving a full overview of the successes and limits, applications and discoveries, questions and answers, that currently characterize Dunbar's hypothesis, which is indeed undergoing a notable diversification.

This is a pretty complete reading for those who want to, at once, step into the issue of the social brain. The field is vast and heterogeneous, and this collection of articles supplies the possibility to have a comprehensive base to begin with. Through this book, the reader can have an updated view of the main perspectives associated with current research in brain evolution and social structure in primates. Group size seems the pivotal and crucial node, generating adaptations and constraints, and representing the principal ecological and cognitive problem. Brain size and group size influence and constrain each other, channelling evolutionary possibilities and responses. Time budget is presented as a fundamental ecological and behavioural component, and social relationships are structured onto neural

limits and biochemical moderators, mediating bonding patterns and innate psychological needs. When comparative data fade into speculations, these are generally supported by multiple sources of inferences, generating reasonable perspectives which are necessary to develop further and orientate successive researches.

Sometimes I have the perception of an excessive adaptationism to explicate traits and processes. After a long period in which evolution has been interpreted as a linear, gradual, and progressive sequence, now most perspectives suggest that not everything is necessarily 'adaptation', and things can be a bit fuzzier. As in other aspects of biology, behaviour also is structured according to networks of factors, integrated variables, and modular elements. Accordingly, some changes are direct adaptations selected because of a positive effect on fitness, but others can be simply neutral secondary consequences, or even negative drawbacks linked to some hidden positive factor.

Within this articulate network of evidence and inferences, it may be strange to note that the book is characterized by a limited consideration of the fossil record. Ethology and sociology are the basic pillars in SBH, and less attention is devoted to the 'hard evidence' of fossil remains. Brain size is generally the main and only variable for which anatomical and morphological information from fossils are mentioned. This can be the result of a certain separation between the aims of SBH and the targets currently promoted by many paleoanthropologists. For example, most of the papers in the book developed on SBH largely or totally skip most of the phylogenetic debates which continuously shake the paleoanthropological scenario. This is, in my view, probably a sane attitude. Most of those debates are irrelevant to the general patterns investigated by SBH, or at least they

are (maybe too audaciously) tuned to a finer level which cannot be considered through the quantitative approaches necessary to evaluate the SBH parameters. It is not surprising that many paleoanthropologists used to more talkative approaches have criticized the previously mentioned quantitative model on the hominid orbits and occipital lobes, giving more importance to specific causal interpretations than to the actual results or to the method itself. Traditional paleoanthropology is not generally used to quantitative models, and this can represent a barrier which can limit fruitful interactions.

Beyond brain size, however, fossils supply some paleoneurological information that may be worthy of consideration within the context of SBH. There is now evidence suggesting that modern humans experienced a change in the brain's spatial organization, with changes in the relative brain proportions and in the underlying patterns of connections (Bruner et al., 2003; Gunz et al., 2010). Such changes in brain proportions probably involved deep parietal elements, such as the intraparietal sulcus and the precuneus (Bruner et al., 2014). These areas are crucial for visuospatial integration processes, namely the coordination of the inner and outer environment through the interface of the body and the use of material culture (Bruner & Iriki, 2015). Functional neuroanatomy is generally considered within SBH only according to those areas strictly associated with specific behavioural social performances, such as language or within-group individual recognition. Nonetheless, taking into account the importance of the changes supposedly put forward by the social brain processes, we must consider the possibility that specific and active behavioural aspects may be rooted onto more general cognitive reorganizations. For example, within the

framework of parietal evolution, the intraparietal sulcus shows areas which are specific to modern humans, and also has a pivotal role in eye-hand coordination. This is particularly important when recognizing that touching has a fundamental role in social interaction and social structure, which is mediated by the release of endorphins (Machin & Dunbar, 2011).

Such functions represent a link with the emerging field of cognitive archaeology. Levels of intentionality (namely the capacity to build hierarchical cognitive constructs), so important through the whole SBH scenario, are intimately related to recursive capacities associated with working memory processes, which are widely investigated in that field (Coolidge & Wynn, 2005). The visuospatial integration functions described for the parietal evolution and the embodiment issues lead also to theories of extended mind (Malafouris, 2010). In this direction, Coward & Gamble (2008) supplied a pioneering and stimulating reading in order to integrate issues in social cognition and material culture. This direction is surely promising, representing the actual link between SBH and the ecological, neural, and cognitive niches coordinated through the interfaces of body and culture (Iriki & Taoka, 2012).

It must be stressed that, although SBH has a marked evolutionary framework, its importance goes well beyond the strict knowledge of our natural history. Understanding the evolutionary principles that structure our intrinsic social attitudes is essential to understand the dynamics of our societies. Such information is pivotal to the comprehension of our limits and possibilities. Furthermore, such information is extremely delicate, being available and usable to support the development of the community as well as to achieve personal benefits against shared advantages. That is, the same rules

underlying the social networks are crucial to solve problems, or to generate them. Our primatological background is extremely consistent, shaping, and constraining our social behavioural responses. We can maybe say that persons are very similar to gas molecules: it is almost impossible to predict the behaviour of a single one, but the more there are the more their responses can be predicted with apparently simple equations. That is why the knowledge of those rules is a serious and sensible issue. Putting all that evidence together into a single comprehensive perspective is, no doubt, a major challenge of evolutionary anthropologists, and a crucial responsibility.

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