



*For*

# Symmetry of STRUCTURE

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Abstracts

II.



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**THE EMERGENCE OF  
SYMMETRY PERCEPTION  
AND  
THE ASYMMETRY IN MORPHOLOGY  
IN EARLY MAN (HOMININAE):**

**AN APPRAISAL OF THE EVIDENCE  
AND INSIGHTS ATTAINABLE BY A FORMALISTIC APPROACH TO  
THE CONCEPT OF SYMMETRY**

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**Extended ABSTRACT**

**I**

Misia LANDAU (1984) has shown that most accounts of human evolution are morphologically structured like Russian folk tales. In order to avoid such a literary construct, a more objective approach to human evolution must be presented.

Several approaches can be adopted; they can be considered genuinely scientific if they present consistent data and/or predictions.

The two genera of hominids (bipedal walkers) are presented: *australopithecines* and *hominines*. The currently assumed phylogenetic relationship (DELSON 1987) is presented, along with a discussion of the dating of the fossils upon which such a classification rests. The emergence of symmetry perception in early hominines is intimately interconnected with this classification and therefore a careful presentation is important. Biochemical analysis of present *pongids* (chimpanzee, gorilla, orang utan) is related to fossil evidence to further substantiate the evolutionary rates. (PILBEAM 1987)

Fossil evidence is an empirical structure; hypotheses must complement it. A modern approach to viewing humans in their ecological context is presented. In the last few years, paleoanthropology has moved away from presentations reminiscent of LANDAU's description. (Topics such as "Man the Hunter", "Man the Social Animal", "Women the Collectors of Herbs", "Man the Maker of Tools", "Man the social Animal" are becoming rarer in professional circles.) Instead, one attempts to describe the differences that are consequences of the paleoenvironment (FOLEY 1984,1987). Humans interact with their environment, just as all other animals (!) do: changes in microclimate, fauna, flora, drainage patterns, etc. may necessitate a change in diet or in food acquisition. This description attempts at correlating bipedal evolution with mental evolution: the documentary evidence is tools, tool sites, living floors (ISAAC 1977, M. LEAKEY 1971 1976, etc. ). A more formalistic, rigorous approach is perhaps desirable. Too many interrelations between environment and early man's reactions are postulated. It is not clear which of such reactions are independent variables, which are consequences of the independent others. A model analogous to a thermodynamic system with a finite reservoir and non-linear feedback is suggested. Population studies in the animal kingdom have been made (MOUNTFORD 1988, HASSELL 1987) and these predict chaotic behavior. Chaotic behavior is nonpredictable in detail, but not random. It is expected that such behavior will be demonstrable for paleoenvironments as well. It seems that the discrepancies in the fossil evidence may be exhibiting such chaos.

## II

The analysis of tool sites in East Africa is necessary for conclusions about human mental abilities to be drawn. The quantity and quality of the tools sites are compared and their outstanding characteristics is noted. OLDUVAI, KOOBI FORA, OLOGESAILLE, KILOMBE, ISMILA are certainly very important, because they permit a mathematical investigation of human mental abilities (cluster analysis, symmetry mapping, etc.). The review of the archeological evidence begins with a presentation of stratigraphy, dating, tool abundance and distribution.

The concept of tool culture for such early sites is a very delicate issue. The concepts implied by the nomenclature are reminiscent of classifications made by French archeologists in the previous century for European tool sites that were much more recent. When the nomenclature is extended back into older times, many personal views expressed by archeologists may mask the objectivity of the evidence. Tool cultures at this early stage are named OLDOWAN, DEVELOPED OLDOWAN and ACHEULEAN. The description of these cultures is not independent of tool fabrication and faunal context of tool use. Many new insights into tool use, tool genesis and tool culture distribution (for example: domed KARARI scrapers) have been gained by empirical evidence gleaned from tool manufacture in present times at the original sites (TOTH 1987). Until recently, the debate centered around the use of the large tools; now it has given way to a

reappraisal of the importance of the microflakes which had often been considered debris. However, the morphology of the larger tools (for example: handaxes) have now acquired a new importance because their existence reflects the mental abilities of shaping (due to their symmetry), the mental ability of anticipation (due to their collection at places far from their ultimate use), and the knowledge of manufacture (due to the statistics of their material composition).

The classical discussion of whether the OLDOWAN was possible before *man* (i.e. beyond 2 million years ago) is compared with the discussion of whether *homo habilis* is a valid taxon (JOHANSON et al. 1987). The ACHEULEAN appears quite suddenly in the archeological record; dating the transition and distribution evidence are discussed. The interpretation of the ACHEULEAN as a culture achieved by *homo erectus* is attractive. The reasons for this preference to other explanations is presented and critically reviewed.

### III

The controversy whether the ACHEULEAN and DEVELOPED OLDOWAN coexisted at OLDUVAI is the crucial stepping stone at comprehending the evolution of man's mental abilities. The ACHEULEAN requires much more advanced cognitive abilities. ACHEULEAN handaxes exhibit remarkable symmetries, the axial symmetry being the most conspicuous. The discussion of modern formalistic symmetry concepts is presented: it is an extension of metric analysis of tool artifacts by GOWLETT (1984,1988). It follows that the emergence of the ACHEULEAN and the emergence of symmetry perception are inextricably linked. The emergence of symmetry perception therefore becomes historically datable.

### IV

Modern particle physics has coined the term "*symmetry breaking*". The expression is somewhat misleading. It actually means a symmetry present at a higher energy state that is not present at a lower energy state. An analogy for anthropology is developed: mirror symmetries exist in general skull morphology, a detailed metric analysis reveals a "*broken symmetry*" (PROSSINGER, current research). The "*symmetry breaking*" in skull morphology is correlated with the *asymmetry* of brain functions. Paleoanthropology has analyzed brain asymmetries in *hominines*, *australopithecines* and *pongids* (HOLLOWAY 1982) and attempted to correlate them with the emergence of mental abilities (HOLLOWAY 1969).



We can now perceive how a discussion of symmetry and asymmetry in paleoanthropology offers a well-rounded perception of ourselves: the detection of the emergence of symmetry perception enables us to conclude the emergence of other mental abilities that make homo sapiens possible. It is to be noted that the formal concepts of symmetry necessary for such a description are different from the mirror symmetry perceived by early hominines - thereby satisfying FOLEY's postulate of describing our ancestors in ways adequately different from ways of describing ourselves.

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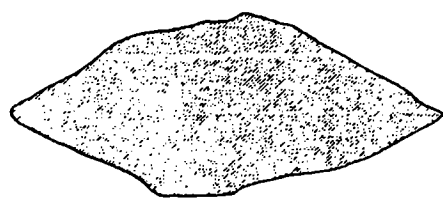
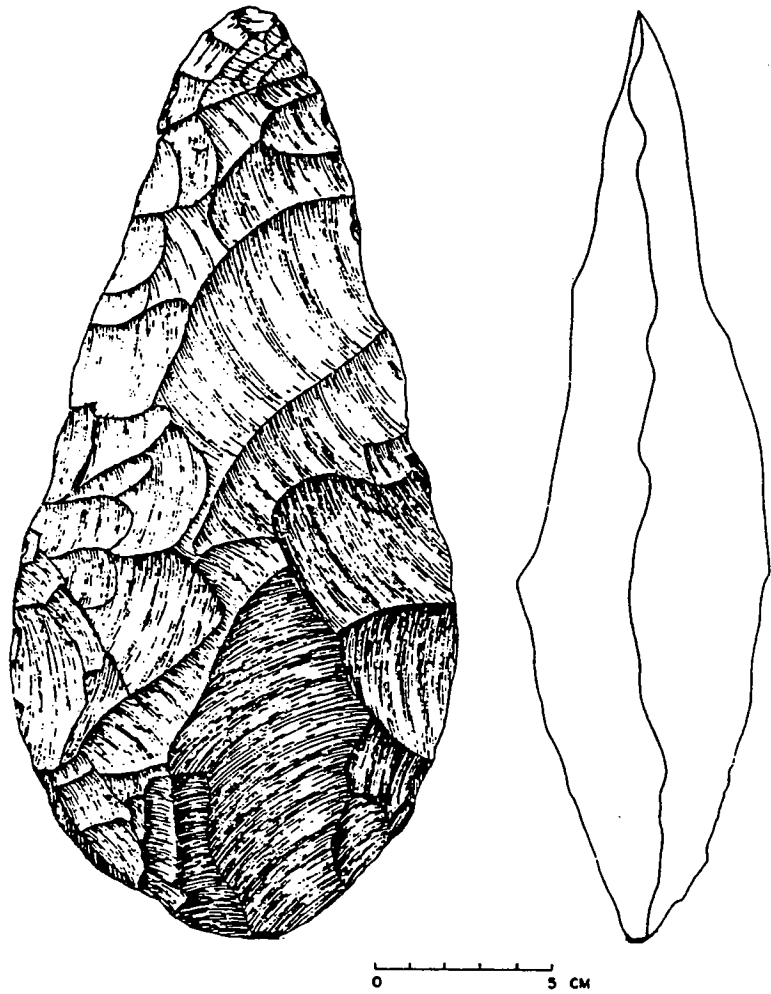
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