

## Metric versus configurational framing of space

*Jacques Paillard*

CNRS-NBM, Marseille, France

The way in which space relationships are represented in the brain and intervene to organize our vision of a stable world in which we orient our motor behaviour has been the topic of enduring debates. In an earlier study we proposed to introduce a segregation between a '*location space*' ('*un espace des lieux*') and a '*shape space*' ('*un espace des formes*') (Paillard 1971). This distinction was, of course, consonant with the then emerging dissociation between 'two visual systems' (Ingle 1967; Schneider 1969; Trevarthen 1970; Held 1970) and with a functional dissociation between 'identification' and 'location' processing of visual information.. The model was derived from a study of the frog's visuomotor behaviour by Ingle (1967) and of the hamster by Schneider (1969). These studies dissociated the role of collicular structures in orientation and localization from that of cortical visual areas in the perceptual discrimination and recognition of visual forms. More than ten years later was realized that both systems were corticalized in primates and man (Ungerleider and Mishkin 1982) thus leading to the present well known dichotomy between the "*Where*" and "*What*" processes with their distinctive parietal and temporal routes .

This dissociation has since been confirmed by neuroanatomical, neurophysiological, and neuropsychological evidence. Emphasis was placed on the distinction between an '*object channel*' and a '*space channel*', the first dealing with the analysis of the various features of the object (including its shape) and the second with spatial problems (more specifically, the extra-personal space where objects are located). The distinction initially proposed between a shape space and a location space drew attention to the fact that visual identification and location processes both had to solve spatial problems, but within two different reference frames: one in an '*object-centred*' co-ordinate system, the other in a '*body-centred*' one, the first being most involved in the perception and categorisation of form , the second chiefly concerned with specification of places in a spatially oriented environment .

We will give here a special emphasis on a **motor-oriented approach**. It assumes that the principal metric for coding spatial relationships is derived from the body's own movements in space: that is, the spatial relationship between two locations can be coded in terms of the movement required to get from one to the other. This approach can account for the structuration of sensori-motor action-spaces based on a body-centered **vectorial encoding** of place in a location space (Paillard 1971) and to the elaboration of cognitive map at the representational level. The location space corresponds to the taxon systems ( later described by O'Keefe and Nadell 1978). To what extent the object-centered **configural encoding** of gestalt in a shape space at the perceptual and representational level may also require some kind of *scan path* process (Norton & Stark 1971) still raises open questions, as well as how it may lead, through their centrally encoded image configuration, to shaping motor action in order to reproduce the spatial configuration like in drawing or more generally in expressing postural attitudes or spatio-temporal dynamic of movements configuration bearing some innate or acquired signification in social interchanges ( by verbalisation, vocalisation or emotional expression ). Thus we suggest to segregate *topokinesis* from *morphokinesis* as two modes of driving action, each requiring separated encoding process and neural networks.

We shall demonstrate that the first are mainly dependent on innate or acquired feedforward schemas derived from self-induced proprioceptive reafferent information generated from *body-centred goal oriented movements* whereas the second depend on the extraction of invariant configurational properties from exteroceptive sensory information derived from *object-centred exploratory and palpatory activities* .

Several aspects of this problem will be illustrated in the following experimental approaches:

- the **topokinetic** properties of reaching vs **morphokinetic** predispositions of the hand grip posture
- the **palpatory activities of central vision** through the head-free retino-centric small saccadic system vs the egocentric saccadic eye/head **foveal acquisition of the object**. (Frost & Pöppel 1976)
- **pointing** to body place vs **matching** the position of two body segments in position sense studies
- the double dissociation between **body schema** and **body image** in centrally and peripherally deafferented patients acknowledging the necessary distinction of these concepts in neurological studies .

Phylogenetic and ontogenetic aspects of these problems will be considered together with their potential underlying neural mechanisms

**References would be found in.** <http://jacquespaillard.apinc.org/pdf/207-framing-of-space-91.pdf>