Spatial Literacy and GIS Learning: Intersections

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In this poster we focus our attention on notions of spatial literacy within Geographical Information Science (GIScience) and Digital Geographies more generally. Spatial literacy has emerged as a key learning objective in recent times, but the term itself is rarely defined explicitly; rather it is more often discussed with reference to spatial abilities (Eliot and Smith 1983; Ishikawa and Kastens 2005; Linn and Petersen 1985) and spatial thinking (Ishikawa and Kastens 2005; NRC 2006). When one looks to understand the parameters of the concept of spatial literacy (and its associated terms) there is considerable ambiguity, despite a substantial body of research on the subject. Hence, 'There is as yet no clear consensus about spatial thinking and, therefore, spatial literacy' (NRC 2006, p26). An important factor influencing this is undoubtedly the fact that research is embodied in multiple disciplines, notably psychology, the geosciences and geography. One outcome of this rich but fragmented corpus of knowledge is that researchers have not reached consensus concerning names and descriptions of the various aspects of (spatial) ability (Black 2005, p402). The first role of this poster will be to propose a spatial literacy continuum based on a synthesis of research from psychology, the geosciences and geography, identifying the intersections between the practice of GIScience and the different elements of spatial thinking implicitly required to achieve this practice. By collating previous research from a number of disciplines it is possible to clarify terminology and to provide a meta-framework for spatial thinking. Synthesising and benchmarking spatial literacy is an important research step if we are to build consensus and understanding from further comparative studies on such a broad topic.

Spatial literacy can be considered a pertinent issue for GIScience from several perspectives. In educational terms, the fact that perhaps spatial literacy is so integral to many subjects results in the outcome that *'we sometimes neglect to make it explicit'* (King 2006, p26). This is certainly true of the GIScience curriculum to date, where, as more generally *'It is undeniable that visuospatial abilities* [one element of spatial literacy] *are required for many common activities'* (Hegarty & Waller, 2005 p 153). While we concur with Golledge *et al.* (1995) that spatial relations are a key element of geography, we also highlight important sub-disciplinary differences that might re-emphasise the visual in a GIScience context. For the GIScientist and Remote Senser, distributions, patterns and clusters are commonly identified by exploratory visual analysis for which further deductive evidence is sought; visual methods are generally used to highlight potential relationships. In the geosciences, this reliance of the visual is again stressed by Kastens & Isikawa (2006), who note for example that "*It seems that image displays allow the data interpreter's eye and brain to tap into a powerful ability to recognize significant patterns amid noise "*. This reliance on the visual is a pragmatic reality in GIScience today, although we note that audio and haptic alternatives can also be employed in pattern related tasks where accessibility of visual information is an issue for student or researcher (Rice *et al.*, 2005) . We also concur that there is also a more general strong case for making more of multi-modal representations of space and spatial digital data. One can be a good geographer without spatial visual ability, but the current world of GIScience and Digital NeoGeographies in particular is driven visually. '*Space is multimodal, but for many researchers, vision is primary'* (Tversky 2005, p25). With reference to an increasing use of digital Earth and GIS technologies, and a focus on visuospatial aspects of spatial literacy the poster secondly explores explicit relationships between GIScience, Digital Earth technology and spatial thinking in particular. This matters, both in order to maximise the spatial thinking benefits to society potentially afforded by the rise in digital neogeographies and secondly owing the inherently interdisciplinary nature of GIScience as a sub-discipline whose home base rests in part within geography and partly within computer science. Additionally, spatial metaphors in human-computer interaction vary in scale and as such the relationship between

manipulable (sic) space (GIS) and geographic space are of relevance (Mark, 1992). A high proportion of students attracted to the area of GIScience first attend the subject at Masters level following a wide range of first degree studies. That these students might require assistance to develop spatial literacy alongside their development of technical skills in order to make the most of their learning experience is rarely considered in geographical information science curricula.

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