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Final Paper

# "Virtual and metaphorical landscapes: a context for navigation"

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## 1 - INTRODUCTION

When I defined the title and the focus of this paper I looked for a comprehensive context in which navigation, landscape studies and theory of metaphor in geography could all be represented into a meaningful whole.

Those research fields can be considered separately, and on their own they are certainly central in the context of geographic research. Their intersection is however variably addressed in the literature. Landscape and navigation are not commonly found together because the term environment is preferred and symbolic space is commonly not considered as pertinent as physical or cognitive space (as conceptualized in Couclelis and Gale, 1986). Instead, landscape and metaphor have developed a strong synergy of meaning, as visible in recent research in the examples presented below. Finally, metaphor and navigation interact in more than one context, but mainly in the developing field of information visualization.

The idea of landscape has been borrowed from a literature that considers the cultural and artistic dimension of this geographical unit. The literature of navigation most often refers to the concepts of virtual environment and large-scale environment when considering the natural or built environment in which navigation takes place. Landscape is a term that is not used often in the discussions, and an attempt is made here to assess its relevance in the context of navigation and its significance beyond its original artistic conceptualization.

An analogy is also the focus of this paper. Virtual landscapes are the counterparts of real-world landscapes, and within this domain mapping, real-world navigation strategies can be extended to virtual landscapes. The transferability of concepts is debated in the literature (Vinson 1999), but this simply adds new dimensions of 1) seeing a virtual

landscape as an analogy of a real one, 2) seeing metaphor as a way to access this analogy, and 3) navigation as a mode of interaction that brings to life the inherent qualities of the landscape.

Metaphor is a fundamental mode of thought in geography and in the history of the discipline led to important theoretical advancement (Barnes 1992). Metaphor is also a concept that underlies certain spatial representations of non-spatial information, which are the outcomes of the so-called process of spatialization. Here the focus is on the metaphor starting from a linguistic perspective, and, expanding from this, on how metaphor is extended to provide meaning to landscape and navigation.

In the following pages I will try to give a working definition of the various terms and concepts used throughout the paper, to allow a better internal control on the topic. Concepts of metaphor and landscape will be presented separately, and the discussion on virtual and metaphorical landscapes will review several contributions to the topic. A final section will provide a summary aimed at assessing the interaction between the variables here considered, aiming at incorporating landscape and metaphor in the same context of navigation.

## 2 – OVERVIEW OF CONCEPTS

Navigation and wayfinding are central terms in the literature of behavioral geography. They respectively mean the procedure of plotting and following a course having defined an origin and a destination, and the process of finding one's goal while locomoting through an environment (Golledge 1999). Navigation is often a task carried out using instruments like compasses and maps, while wayfinding may be based on non-instrumental orientation and on forms of automatic unaided updating, such as in the case of the strategy of path integration (Loomis *et al*. 1999). Piloting is a type of navigation that is based on plotting a course using fixed landmarks in the environment.

An interesting perspective is given by the artificial intelligence approach of the so-called Computational Process Models (CPM) (Kuipers and Levitt 1988). According to that approach, navigation is the end result of a learning procedure of the environment that organizes environmental knowledge in a progression of sensorimotor, procedural, topological and metric representations. Such progression of qualitative levels of knowledge informs the process of navigation which can therefore be more accurate and allow for successful goal-oriented behavior. More importantly the approach defines navigation and wayfinding as essentially cognitive operations of expansion of spatial knowledge, of interpretation of environmental cues and of choice of most effective strategies. The large-scale emphasis contained in the Kuipers and Levitt article also defines the scale of the two processes. Large-scale environments are characterized by a structure that is at a significantly larger scale than the observations available at an instant, and therefore the observer needs to integrate observations in a cognitive map.

Metaphor is a concept that implies the fusion of two separate domains of meaning (Couclelis 1998), called the source and the target domains. A simple metaphor might be "a career is a journey". The target domain (journey) extends the characteristics of the source domain (career) by showing properties that are normally not accessible from the source domain alone. Metaphor exposes hidden meanings by producing associations between domains, which are deeper than analogy.

Landscape is a central issue in human geography, since it is located at the confluence of cognitive, cultural, aesthetic, artistic and visual research interests (Appleton 1996). Here it is considered as a unit that provides a framework for organizing perceptual cues from the environment, and it is used for representing non-spatial information and for signifying meaning and sense of place as an additional dimension.

Virtual landscapes are constructed in resemblance to real landscapes, and they might be natural or built according to the elements they represent. In this paper I shall focus on natural landscapes, which may be produced from real world data, and can be considered as models on which simulations can be carried out (Ware 1999).

Metaphorical landscapes can be intended in two ways. The first is the natural (or built) landscape that is imbued with meaning of a metaphorical kind (MacGreevy 1992) and therefore refers to the issues of the symbology of landscape (Cosgrove 1984). The second approach is to have a virtual landscape that is the construction in space of some form of non-spatial information, such as a corpus of documents.

These several definitions are not meant to be exhaustive but are aimed at placing the various elements in context. They are expanded in the following sections where metaphor, landscape and virtual and metaphorical landscapes are analyzed in turn.

## 3 - METAPHORS

Metaphor, according to Buttimer (1982), reaches a deeper level of understanding than literal knowledge, for it is a form of thinking related to the process of learning and discovery, and to those analogical leaps that stimulate the intellect by substituting the unfamiliar with the familiar. Metaphors have the power to convey in indispensable manner insights into the systems they represent (Black 1993). Metaphor as proposed by Lowenthal (1961) can be seen as a way of framing experience, either personal or shared, in a similar way that language actually shapes and fashions the framework in which our experience is contained.

Geographic language is metaphorical, if we consider for example the conceptualizations of regions as organisms, after the extension of Darwinian theory to geographic space; of industrial complexes as growth poles; of geographic places as mouth of a river, foot of a mountain, and so on. Buttimer (1982) states the existence of the so-called root metaphors, fundamental constructs that are responsible for the major world hypotheses that recently surfaced in Geography. Metaphors in Geography have in fact been at the core of theory building, and Barnes (1992) illustrates how the conservation of energy metaphor and the organicist-biological metaphor have been used for respectively neoclassical economics modeling and critical Marxist theory.

The concept of metaphor draws heavily on theory in linguistics and philosophy. Analogy and metaphor are often seen as somewhat related modes of thought. With respect of analogy, Anderson (1967) considers metaphor as a particular type of analogy of proportion, whereby a qualitative relationship, or a pseudo-ratio of degree of similarity, is established between the source domain and the target domain, so that the properties of one are extended to the other. Other views (Holyoak and Thagard 1995) regard analogy and metaphor as two distinct things, the former consisting in a similitude between terms, the latter in some sort of complete semantic fusion that extends the scope of the target domain beyond the limits usually imposed by analogy (Couclelis 1998).

Metaphors are primarily linguistic constructs, whereby a sentence defines a mapping between two semantic domains. For example the sentence "A career is a journey" allows a terminology designed for traveling (features in space, directions, navigation) to be meaningful in representing the experience of a career (Lakoff 1993). Different views on metaphor have been produced and are debated in the literature, but it is interesting to note that the comparison view first introduced my Aristotle (according to which the metaphor is just a compressed simile) is supported and contrasted for example to the interactional view, which defines an interaction between the two domains that iteratively reinforces and modifies the meaning of both (Black 1993; Glucksberger and Keysar 1993). Other issues include the effectiveness of metaphors and their relation with literal meanings, which can be visualized in graphical representations illustrating how the sentence meanings map to the metaphorical destination (Searle 1993).

In Geography the use of metaphor has received a wide attention in the context of cartography. The cartographic map itself has been object of study when considered as a metaphor for language, whereby textual elements like nouns, verbs, adverbs, languages and metalanguages are mapped into specific map elements with meaningful results (Andrews 1990). In this and other similar cases, however, metaphor was considered as a lower quality and power concept than analogy.

The central issue of cognitive mapping refers to using the cartographic map as a metaphor for the internal representation of spatial knowledge in human beings. At the extremes of the spectrum there are map-in-the-head theorists (Kuipers 1982), claiming that it is both useful and sensible to define such mapping between real-world cartography and internal representation, and researchers that instead consider the concept at the least confusing in that it fails to identify the true factors at work in cognitive mapping (Graham 1982). The latter considers the mental map as an "unfortunate metaphor" that is not an informative and generative metaphor. Also, the double metaphor (from real world to map and from map to cognitive world) is ruled out by a minimal knowledge of map-making process (Graham 1982). Downs (1981) downsizes the cognitive map from an analogy to a metaphor, and similarly considers the cartographic map as a model, that is reduced to an analogy when the observer is aware that the information contained in a map is not of immediate literal value.

The map-in-the-head metaphor implies that the internal representations are not asymmetric and patchy as cognized environments instead are. Also, since cartographic maps contain implicit information besides the actual symbols and map elements, internal knowledge should be as well a container of implicit information. Computational Process Models (CPM) are based on such metaphor and reconstruct cognitive processes using hierarchies of elements and environmental descriptions and procedures of incremental construction. (Kuipers 1982)

Metaphor is not strictly limited to support theoretical propositions, and in fact we can find it applied to more technical contexts. Metaphor can represent the method we use to access information. Ware (1999) presents several metaphors for spatial navigation used in virtual environments: World-in-hand, where the environment is controlled and moved as an object; Eyeball-in-hand, where the point of view can be moved around the environment with simple 3D translations; Walking, where the perspective is almost at ground level and is moved according to locomotion; Flying, which is similar to Eyeball-in-hand but is characterized by a mode of movement that resembles those of aircrafts, with banking and the possibility of only advancing. World-in-hand is judged to be good

for manipulating closed objects, but is not good for moving through an interior. Flying control is instead best for navigating through the interior but poor for moving around a closed object (Ware & Osborne 1990). In general, specifying a user interface for exploring virtual graphical environments is related to the problem of defining the viewpoint and the camera path through the virtual environment. Metaphors are useful in transferring meaning from the real world to solve this and other design problems.

## 4 - LANDSCAPE

Landscape is a way of seeing, and can be considered as a mediation of the external world through subjective human experience in a way that the concepts of region or area do not immediately suggest. The concept of landscape is positioned on the science/humanism divide, and also regards as central the subjective/objective differentiation of analysis. Theoretically, Geography has sought a concept capable of denoting the specificity and individuality of areas where a unity in diversity of phenomena may be studied. Landscape arguably provides such visual unit of investigation. In the history of the concept, landscape was first defined in a painting and artistic context no later than 1725 as a "View or prospect originated from one point of view" (Cosgrove 1984).

Landscape painting is one contribution to the overall meaning of the concept, but it is argued here that landscape is not limited to being a static view, but is instead a region where navigation in physical space is defined, and symbolic space is the additional dimension in which the aforementioned role of mediation by human subjects takes place. Landscape can be proposed as a unit identified by the succession of spaces types formalized in Couclelis and Gale (1986). Euclidean space provides the underlying geometry on which objects are arranged; physical space is the terrain and the built elements which compose the landscape; sensorimotor space implies some form of locomotion, and is physical-subjective in nature; perceptual space involves the concept of visual information, the theories of landscape perception such as prospect-refuge and habitat (Appleton 1996); cognitive entails the internal representation of space in human subjects, and is relevant to navigation; finally, symbolic involves the meaning attached to

places ("the sense of place"). Landscape combines all these spaces (physical structure, perceptual-cognitive implications and additional symbolic dimension) into a unit term which is probably more representative than "environment".

Landscape can be seen as a vast mnemonic system for the retention of group history and ideals (Lowenthal 1961). This seems to point to the interpretation of landscape as a social construct (Cosgrove 1984), but it is nonetheless interesting to see the systematic emphasis given to the concept. Landscape is not simply a view, but instead it is a device to store historical information and, arguably, of many other kinds. For example, a rural landscape can signify an economical and cultural dimension expressed in the form of objects and spatial relations, which actually store (or we might say "spatialize") the experience accumulated in the area.

The experience of landscape is mostly subjective in nature, and, as Lowenthal (1966) suggests, landscapes must be perceived and appreciated from people's eyes, not from an objective viewpoint. Lowenthal (1972) provides an account of the perception of the environment in a study that considers the process of conceptual identification of the daily outdoor experience, and produces correlations between attributes and structures of environmental associations. There is sometimes difference between the semantic association of attributes and the actual experience of the environment. In other words, we think the world in a way that is often not the way we see it. This issue of subjectivity comes into play when we consider landscape as a medium for communicating information, a medium that is likely not to be understood in the same way by all the respondents.

## 5 - VIRTUAL LANDSCAPES

By virtual environment it is usually meant a simulation of a natural or built setting such as a city or an open terrain. A virtual landscape retains the same connotation as virtual environment but draws on the elements that uniquely identify a landscape as a distinguished object of perception and knowledge. In this paper the term landscape is

limited to its "natural" definition, where, as a consequence, built elements are confined to an auxiliary role (e.g. defining the characteristics of the environment, such as in the form of artificial landmarks). Virtual landscapes are constructed graphically via real-time and desktop-based or immersive technologies that geometrically simulate the physical features of the environment (Darken & Sibert 1996), or, in non real-time conditions, via graphical renderings and recorded animations that are most often produced by GIS or other graphical software (Ware 1999)

Virtual landscapes are usually built as models of a real counterpart, or at least follow the same structural principles even if differing in actual details and implementation. It is interesting to investigate if the concepts about navigation and spatial learning developed for real landscapes can be extended to virtual landscapes. According to Darken and Sibert (1996), real-world wayfinding and environmental design principles are effective in designing virtual worlds supporting skilled wayfinding behavior. In particular the main contention is that our knowledge of wayfinding in the physical world is independent of the type of space and therefore can be applied to computer-generated environments. The design guidelines for a navigable virtual environment proposed by the authors included a hierarchical subdivision of areas so that each spatial unit could preserve *a sense of place*. This element suggests how important is to preserve a cultural and symbolic dimension of space even in virtual environments.

## 6 - METAPHORICAL LANDSCAPES

As indicated in the definition section above, metaphorical landscapes can be subdivided in two main types. The first type comprises natural and built landscapes that for their history, or appearance, or other contingent factor, have a symbolic meaning that refers to an external concept, which is expressed in the form of a metaphor. For example MacGreevy (1992) suggests that the Niagara Falls are a metaphor of death, whereby the individual elements of the Falls (the falls' brim, the void, the dark water at the bottom, the rainbow) are mapped into a system of meanings that is related to the Otherworld (respectively the moment of death itself, the fall into an unknown destination, the

condition of death, the salvation of paradise) and echoes in many cultural manifestations related to such dramatic landscape. In this case the object of the metaphor is a natural landscape, and the mapping is to a concept (death) that augment with meaning the source landscape.

The second type of landscape metaphor is more related to the issues of visualization and, or more properly, spatialization, whereby non-spatial objects are represented in a spatial context (Couclelis 1998). In this case a landscape, resembling natural features and characteristics, is created to represent information of various kinds. Geographic metaphors map geographic concepts like place, way and region into non-spatial features. In a current research project (Fabrikant 2000) the semantic similarity between a set of documents is considered as distance between points on a virtual landscape. Similarly, arrangement and scale issues on the landscape are defined by semantic properties of the source documents, such as theme. The landscape is still a metaphor as in the previous example with Niagara Falls. In this case though the object is a virtual environment and, instead of being augmented by an external concept, it actually augments the meaning and the accessibility of the source concept (i.e., the corpus of documents).

Two other example applications are the series of tools SPIRE (Spatial Paradigm for Information Retrieval and Exploration), and their last product Themescapes, which represent information as a topographical terrain (similarly to the example provided above). In fact in Themescapes proximity and relative position map into similarity relationships among documents in the database, while additional information (document themes, relative importance) is conveyed by geographic features (peaks, ridges, etc.) It is not clear though how the virtual topography can be analyzed like any other geographic landscape representation. Concepts like place, path and region (corresponding to the geometric entities point, line and area) have probably different meanings in spatialized contexts. In particular they refer to several image and action schemata, comprising container, part-whole relationships, link, and linear order (Couclelis 1998).

## 7 – CONCLUSIONS: NAVIGATION IN CONTEXT

The review of the concepts of metaphor and landscape, considered in their fusion in virtual and metaphorical landscapes, allows drawing some conclusions about the role of navigation in such context. At a first analysis it seems that the scope of navigation results greatly enlarged, mainly because of the interplay of the elements of landscape as a coherent unit, of virtual landscape as a model of reality, and of metaphorical landscape as a frontier for further development of meaning.

Metaphor is a fundamental mode of thought that embraces different disciplines from linguistics to philosophy, cognitive science and geography. Its main virtue is to permit to achieve mental leaps in representation and understanding, through offering a framework for thinking in terms of similarities between usually separated concepts. Metaphor is also valuable in its more technical incarnation in developing interfaces of exploration and navigation, and it has been used extensively in cartography and research in cognitive mapping to represent knowledge and suggest explanations, even if raising at the same time some validity concerns.

Landscape is a complex concept, and while developing from a predominantly artistic tradition is characterized by a meaning as a cognitive and symbolic unit of space.
The virtual landscape inherits its properties through a model-based or abstract representation, which, as a consequence, forms a new study environment for spatial relations and behavior. The metaphorical landscape, when considered as a particular type of virtual landscape expanded in meaning, develops at a different level and provides an entirely new context to represent our concepts of space and consequently navigation. Landscape can be used as a device of communication, especially in spatialized contexts, and in particular when considered a mnemonic information system has the role of storing elements of the real world as well as of metaphorical and virtual landscapes.

Navigation is a real-world activity that involves spatial learning, organization of knowledge and interaction with the environment. The secular experience of human

beings with techniques and strategies of navigation has made such activity highly meaningful as a form of spatial behavior. When navigation is extended to virtual landscapes it may actually become itself a metaphor that allows a higher degree of access to the landscape, a new mode of interaction that exploits human experience.

A step further is navigation as a method to access information represented by metaphorical landscapes. When we navigate on a metaphorical landscape we encounter elements (e.g. landmarks) that have meaning just like in the real world, for example in providing orientation cues. Such meaning is augmented by an additional dimension, which depends on the particular metaphor. In fact there are several levels at which symbol and metaphor can extend the meaning of navigation, and landscape and metaphor together define a context that brings navigation well beyond its literal real-world conceptualization, in ways still largely unexplored.

Metaphorical and virtual landscapes, supported by the source concepts of metaphor and landscape, do provide a new context for navigation. Such context extends our possibilities for both studying real world spatial behavior in an ideal virtual laboratory, and exploring the implications of navigation beyond the literal real world. The issues to be considered at this point are inherent to the design of the landscape itself and to the transferability of real world concepts to the virtual counterpart.

A study would investigate how a virtual landscape, charged by real-world meaning, can be used as storage of meaning and information in a metaphorical representation accessible by navigation. It would be along the same lines as the metaphorical landscapes considered above, but the landscape itself would be structured as its real world counterpart, and not simply as a terrain. Can we leave a trace on the virtual landscape, build houses, delimit areas with fences, and experience the beauty or the perceived danger of nature, while we intend respectively to record a history of our document searches, add an external element to the database, organize the contents and limit the exposure to interesting or misleading documents? And can we navigate this landscape, as

we would move in our analyses from one concept to the other? Landscape and metaphor, and perhaps much creativity, will probably provide the answers.

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