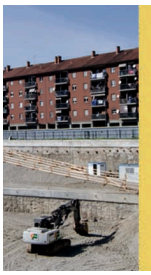

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City perception and distances

Visual strategies of urban anamorphosis

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The application of anamorphosis in cartography is often an useful tool in order to highlight, qualitatively or quantitatively, environmental anthropic aspects. Among these, anamorphosis is often used to focus the variation, both perceptual and objective, of the territorial lengths: then, the anamorphic transformation shows how can change distances between points dispersed on the real territory, defined as a function of time duration. Starting from that, the goal of the suggested paper is to analyze how some practical possibilities and strategies, applied to specific case studies, could be used in order to assess the morphological changes and their subjective and objective visualization of distances as perceived and run by different categories of users in urban areas, to arrange analytical comparison of views.

Keywords: anamorphosis, visualization, time duration

1. Introduction

According to Langlois (1997), mapping in anamorphosis consists in applying methods of cartographical deformation in order to bring a descriptive variable of territorial areas in the form of variable deforming the places themselves, thus defining a spatial metaphor.
Following Denin's viewpoint, according to which all thematic maps proceed to a intentional adaptation of quantitative information to better define a sinthetic view, it's possible find in anamorphic maps, such as those in isochrones, a role of communication, in which the form of a message, joined with its expressive power, are primordial (Denain, Langlois 1998). That's it the same to define models of the environment and realities that do not want to be his pretentious means of objectification, but the means of description of a phenomenon.
The history of anamorphosis applied to cartography is a relatively recent practice. Its first, significant applications can be traced back to the mid-80s of last century when the first algorithms were developed and usefully implemented on newly born Personal Computer (Cauvin, 1998).
However, as also shown in (Denain, *ibidem*) after about a decade, the use of anamorphic transformations in cartography showed its limits, that had effectively frozen further applications. These authors, however, recognized the difficulty to imagine - in all possible forms of digital anamorphosis with particular reference to vector type implementations - different applications to those used in order to study the accessibility of rail or aircraft traffic and related times duration. In order to understand if this statement is

a past inheritance or has still validity, I asked myself if is this concept whether cannot be extended to urban applications and used to make visualization of other issues within a city.
Answering to this question gives positive result. With regard to the anamorphosis' scope, studies of territorial anamorphosis to define isochrones maps related to public transport in urban areas born to define large-scale comparative its assessment, as a comparisons tool about the same type of trasportations or comparing different ones. From past 90s' applications on the high-speed French railways, we proceed to the most recent applications in smart cities of the Far East Asia (as used in Senseable Lab's Live Singapore project, Kloeckl, Senn, Di Lorenzo, Ratti, 2011).
However, essentially it is in transportation scopes that anamorphic methodologies and transformations have been applied. It is still unexpressed the opportunity to make visualization of other human factors having space-time relationship, such as the evaluation of the difficulty in moving between points in an urban area. Difficulties which may be evaluated in altered perceptions of space, for which the distance can be understood in terms of shortness of breath, sweat hot, sore muscles, even not referring to the metrical nor relational dimension (Toffanello, 1995 p. 40).
Therefore, there are other activities and issues involved in such assessments and joined to time duration and space associated with it. An example is represented by vehicular traffic that, beyond its causes, is a devastating for a city, sometimes so widespread as to invalidate the entirety of the road system, which involves the expansion of travel times, not only urban but wide scale and for which an anomorhic mapping could represent an alternative visualization. A different case, but for which an assessment of travel time durations could give significance to a state of well-being of a city, is related to the study of facilities and services offered, or not offered, to challenged users. In cities with difficulties, such as routine management problems and structural and infrastructural system instability, we can understand why, more than elsewhere, the daily life of a challenged user is complicated. The handicapped, the elderly men, young mothers with babies in tow feel personally difficulties in moving around within the urban net: transportation impractical, bumpy roads, bottlenecks in the pedestrian traffic etc..
If we compare with one of the two cases mentioned, describe the difficulties of moving related, visualize them in appropriate and synthetic views and use them with non-technical managers and, above all, the communities that may require you to understand the status of the territory they inhabit, may be, therefore, a primary feature of the power of urban anamorphosis.

2. A possible simplified projective model

How then anamorphic transformations can be used with that purpose? How to be able to define rigorous procedures but at the same time simplified, even for a possible spread of their practice not aimed at scientific applications?
The specialist literature provides theoretical models and several ways to solve this problem. In earlier accredited studies, the territorial anamorphosis was made through the implementation of analytical algorithms with the aim to produce maps of isochrones. The purpose was to define a thematic areal map in which shows the boundaries that are to be compared to the nodal points of a network, "temporally equally far" from such points. That is, briefly, the ratio is to identify the attractors, which are defined and referred to the other points by time duration and, finally, visualize: either looking at the territory with its morphological deformation or, in opposition, looking at the transformations preferring instead a representation layers superimposed on a canonical representation territorial.
Working for this purpose, the authors who promoted the anamorphosis for territorial studies were oriented to define digital processes for the determination of two different types of anamorphic maps (Langlais, 2003; Cauvin, 1996). The first, a vectorial approach, which exploits the possibility to define the spatial variations of points in their mutual relations with a gravitational model, useful for a synchronic analysis of an event. The second most targeted to define a diachronic footprint, carried out from variations in time or a defined value overlapped to the mapped area.
Most of the models at the transformation of cartographic territories born, according to the first of the two cases introduced, by the viewpoints and processes that operate on vector fields between nodes of a

displacement graph. That is like think that such models, exactly defined and characterized in their mathematics, require that, for the points concerned in the transformation as focus point (both in a monopolar or multipolar transformation), are associated with scalar operators. These operators are involved in the mathematical model selected. The outcome is therefore an analytical planar representation resulting from the application of transformation matrices in respect of the topological graph bonds and chart the result as the deformation of the starting geometries.
As the outcome of a transformation, it may investigate whether there is the possibility of applications of descriptive geometry to this problem. On the other hand, the representation of the reality that we do when we use Descriptive Geometry techniques is filtered by our mind and its rational codes (Toffanello, 1995, p. 40), the same actions to show perceptions as mentioned earlier: to make visualization of this filter can outcome to the issue.
A simplified application can then be implemented with the use of modeling 3d cads, according to transformation algorithms that go beyond an analytical implementation that focalize on the projective model of the expected result. Briefly, it is to proceed with a series of projections from a representation of an urban environment. Compared with a rigorous approach as previously described, is therefore conceivable an inverted algorithm, subject to the ultimate goal the obtaining just a anamorphic map. The idea is, in fact, to start from a thematic map of areal isochrones and to trace its conceptual configuration obtained by anamorphosis, taking advantage of the ability to project differently space on a plane to get driven
It is an approach designed to define urban scenarios and landscapes or concrete evidence in order to show possibilities or constraints felt in the movement of a single user. Of course, the model that we proceed to implement provides some basic assumptions. At first, assumed the need to verify the spatial perception of a point with respect to a sample area, the process is a monopolar one, for which a single point endows a nodal role, for which evaluate synchronies, perceived distances or related time durations.
When then we try to assess what is the spatial and urban configuration as well as perceivable by a single point, from the projective point of view one can proceed in different ways.
Furthermore, we could consider a portion of mapped area, belonging to a plane of a three-dimensional Cartesian system. This representation can be projected, by a center finite or infinite one, external to the plane that contains the same representation, on a surface arranged in the half space for which zenithal units are positive. Evidently, if this surface is a plane (in particular, parallel to that which contains the representation), with a point just would get a homothetic representation, a translation in the case of infinite point. The surface on which to project, however, can also be different from a plane: from a simple spherical cap to more complex surfaces, for which a transformation is defined a priori impossible to imagine. This last case could be the most probable, representing in fact a possible 3d map derived from a spatial analysis as in the model assumed.
The choice projective approach can be so described. We start from a map of an urban area, in this case as expressed in the examples is the urban fabric of the historic city center of Naples. We could imagine to project the mapped buildings by an infinite center orthogonal to the plane of the representation, on a conical surface with the vertex in the pole of the anamorphosis sought. This surface represents the linear relationship space / time in the polar-symmetric form referred to the displacement assumed: the z-axis the time, in the xy plane displacements are evaluated. As highlighted in Figure 1, a point on the xy plane can be considered as the spatial result of an ideal linear correspondence space / time, in which the time axis coincides with the z axis of the Cartesian reference. It is thought that the ideal path occurs at a constant speed, which is also plausible in practice in view of less effort for easy movement.

By hypothesis, moreover, it is considered that the time needed to travel the same stretch is greater than the optimum, realistic situation in case of impediment to pedestrian traffic or other generic critical situations (excessive slope of the road, instability in the pavement, etc..). That is to say that, for the same time, the space between the origin and the point felt as result, appears to be greater than the ideal condition, which leads to the definition of a curve different from the ideal. This condition of "expansion"

of perceived or taken time to reach a point from a source, is then implicitly readable if the dots on the curve of thumb above are considered to define the new spatial coordinate in terms of displacements.
Another constraint is described. In fact, if we intend to propose a transformation anamorphic urban regards the visualization of difficulty in walking, we can make some simplifying assumptions. The first is that a point (R_2) farther from the origin (O) with respect to one nearest to it (R_1) on the same radius, cannot be transformed into a point (R_2') that admits radius less than the second transformed considered (R_1'). This stems from the assumption that a user placed in the origin O of anamorphosis moves into the urban grid, with a constant speed. In the absence of obstacles, of course, the user walks in a linear way and reach the point R_1 before the point R_2. In the presence of obstacles, in opposition, the assumptions are two: the bulk of the impediments is located between the origin O and the point R_1 or between points R_1 and R_2. In the first case we have that the walk times will be longer to move in the first section, while the linear trend will resume in the second section, however, summing the delta time accumulated in the first section. In the second case, instead, one can imagine a trend that is linear and coincident in the first section and instead moved away from this in the final stretch. So, we never have that the surface derived from the linear correspondence generating the cone intersects with the generic surface derived from the spatial analysis.

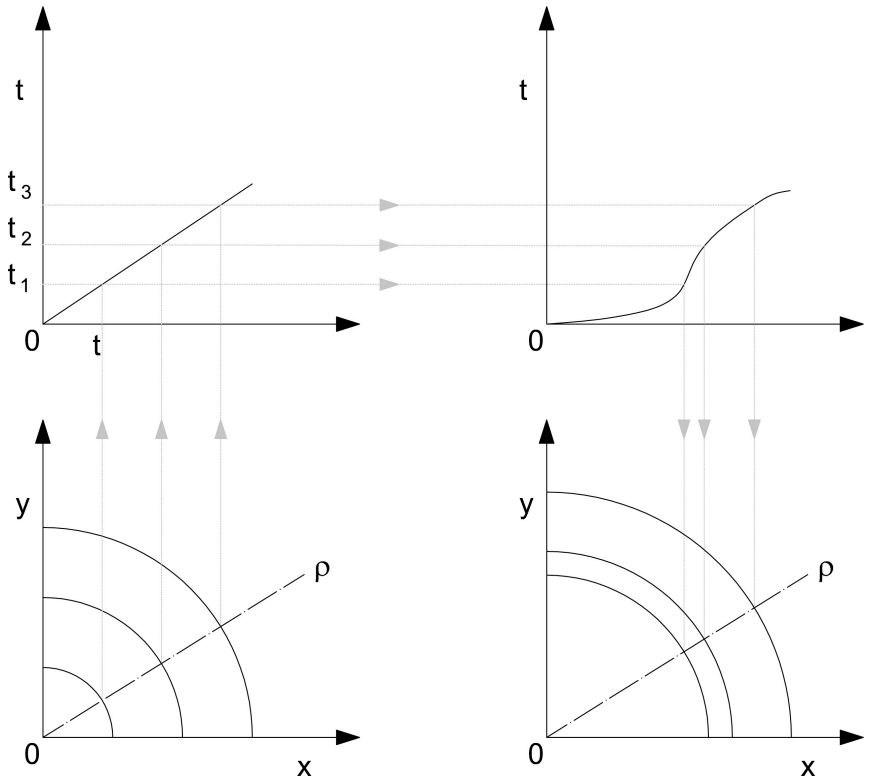

Figure 1. *Set of graphs describing the used algorithm*

The provided ratio can be implemented in a parametric solid model. According to this model, for each vertex of building represented, then it must be projected on the surface defined by the generic representation for continuous times perceived or empirically measured. In this way, we will get a new projection from the center of its own for each point / vertex lying on the cylinder from the value of the referred ordinate (time). Finally, the curves thus obtained are again projected onto the xy plane, which determines a "redraw" of buildings deformed respect to the starting condition (Figure 2).

3. Observation about the method

What has moved the present work is to proceed to a definition a system of urban representation that can be effective in a real-time presentation of the territory as previously understood. That is, proposed in its qualitative characteristics, purged of the fixity imposed by spatial urban geo-topography and which may arise in dynamic and movement, in order to identify the visualization from time to time most temporality significant of displacements of a specific user.

This part of the idea that such representations can contribute to a corpus of digital information that can be drawn continuously and in real time by users.

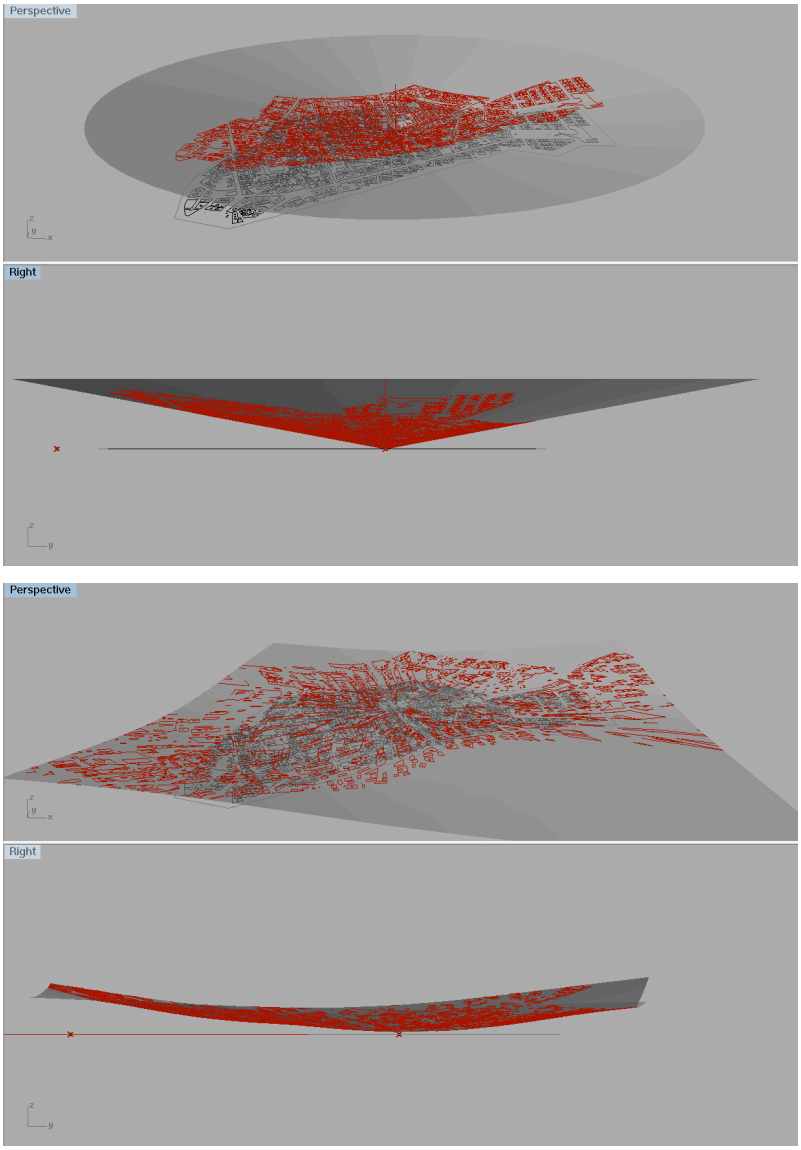

Figure 2. *Models of the projected map onto conic surface (above) and the consecutive projected map onto the generic surface (bottom) used for the anamorphic map (see Map 1)*

For example, it is possible that users may be interested in the evaluation of the status of a city or any part thereof or that a challenged user characterized by a deficiency in motion has in desire to understand what is the shortest route to go beyond obstacles that could occur (work in progress, bottlenecks, traffic disruptions, steep slopes, etc..).

However, that would be entirely in line with a full infographic representation, in which the outcome of interface is not static but dependent on the recipient, who can then select the information content without having to "go out" by all that his goal is a part. For all these tips and ideas, for which this paper is only an initial phase, tip of the iceberg in such issue. For a complete definition of the problem, it requires a significant set of test and specific real application, in order to compare the thesis and
Among the criticisms that may be referred to the territorial anamorphosis, in fact, the problem of possible geometric confusion and topological deconstruction maintains a preponderant position.

Figure 3. *a map visualizing the center of the city of Naples and some points of interest (above) and an anamorphosis derived by model application (bottom). Look at spatial expansion the of points of interest, evidencing a possible increase of perceived distances and time duration.*

The added value of infographics to anamorphic mapping is longer in the increase of productivity and quality due, without referring to the visualization goods. Rather, remain the fundamental problems of efficiency in the visualization. And this is more significant in particular when it is necessary to deal with the same effectiveness of the representation offered. This is particularly important when we should ask whether and how much a representation that falls outside the "normality" of territorial representation can equally be understood by a population or users not immediately familiar with the use of such representation. Or if, and this is related to what said earlier, it is possible and within what boundaries users could learn in real time the significance of such visualization. As reported by Denain, some risks derive, particularly it may be that the user is not "ready" to grasp the meaning offered by the reading of a map or

that, in parallel, it could use a similar cognitive framework – anamorphic transformations - in not significant and scientifically unfounded ways.

Personally, I think the risk is not to be ascribed to the difficulty in reading and understanding. The risk may be, in opposition, in the constitution of the map, both pathological and physiological. In pathological terms, i.e. those highlighted by Denain, relative to a nefarious use of the tools, the problem may be true if the result of the analysis wants to be quantitatively valid. But, offering the system to display a qualitative, even from data quantitatively achieved, the problem is resized, provided compliance with the only constraint of using a standardized coherent graphic scale.
For the problem physiological of mapping in anamorphosis, in contrast, may be more serious, and that is what may affect the topological differences between rule and rule geomorphology. And it is seriously joined to the human understanding of territorial and urban conformation.
What in both these cases, it should be noted is the role of helpful framework that can offer such a thematic map. Not infrequently, in fact, it is necessary that the events such as those described, require that they could be showed to a not trained user, not skilled in handling and reading numbers beyond the images, and it is therefore necessary to provide a synthetic representation that, sometimes even in a disruptive and unsettling, to be useful in making quantitative differences of phenomena. Testing this viewpoint is of course a priority.

It is clear that such an approach is intended as a method applicable for only qualitative thematic maps. It is understood that, acting a deformation of the area according to the practice described here it can be used in the field of thematic mapping but not in topographic applications, just as the photographic image of the human body is required in an atlas of anatomy, considered a simplified version that is often found in art (Kadmon, Shlomi, 1978). This metaphor can be read in the sense that a deformed image of the territory can be understood as the subject drawn in which is not the truth or the contours orthogonal matter, but the modification deformed or induced in the scale of which each point is proportional to some quantitative variable.

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