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Abstract. *The present paper aims to present a numerical method to assess consequences of the shrinking process on the perception of urban landscape in Detroit downtown.*

Keywords: isovist, sensory map, visualscape, shrinking city

Introduction

Many older industrial cities throughout the Great Lakes region have lost a substantial percentage of their population during past decades. This phenomenon is also occurring elsewhere in the United States and in Western industrial countries where population, industry and employement declines have been significant. As mentioned in (Hollander, 2010)[1], over the past 50 years, 370 cities throughout the world with populations of more than 100,000 have reported a decline in population of at least 10 percent.

Among all shrinking cities, one can mention Detroit, the motor city boosted by the Big Three Chrysler, Ford, and General Motors. Known as the world's traditional automotive center, its population fell by 60% in half a century (from 1.85 million inhabitants in the 50s to 0.71 million inhabitants in 2010). To develop new type of transit, the Detroit People Mover (DPM) was funded in the early 1980s. With a 4.7 km long light rail route which operates a loop encircling the central business district of downtown, it was intended to be the downtown distributor. Nevertheless, commensurate with the shift of population and jobs to its suburbs, the city's tax base eroded and funding was scaled back.

Nowadays, this fully automated rail system, which operates on an elevated, single-track, and one-way loop through the downtown area, is an important asset in the city center discovering. Indeed, it offers a cheap and effective solution to wander among high-rise buildings, in a sort of architecture walking tour[2]. It also provides a way to experience the gibsonian "motion perspective". As defined in (Gibson, 1950), this visual effect corresponds to "the gradual change in the rate of displacement of contour lines in the visual field." For easiness of implementation reasons, we will assume that (Sarradin, Siret, Couprie & Teller, 2007) assertion is true: motion perspective relates to the continuous transformation of the visual scene occurring between different static views.

In this study, part of a Master thesis (Bertrand, 2012), we propose a numerical method to analyse the visual dynamics of a moving observer on board of train (front part of train), with

1. Quoting a worldwide investigation made in 2007 by Büro Philipp Oswalt and Tim Rieniets (www.shrinkingcities.com/globaler_kontext.0.html?&L=1)

2. A 14 minutes video shooted from this sky-train travelling is available at: www.youtube.com/watch?v=gAGvxWiptpI

a constant speed and without any other freedom degree. We also propose to compare the visual impact of the changing direction in 2008. Thus, when the People Mover opened, it traditionally ran counter-clockwise. In August 2008, after 21 years, the system switched direction and is now running clockwise permanently.

Methodology

Assess openness in a systematic way through partial isovists field computation

As noticed by (Weitkamp, 2010), one way to link perceptual factors with spatial information is provided by the concept of isovist. According to (Davies, Mora & Peebles, 2006), the keyword isovist has its roots in the seminal work of (Gibson, 1979), who argued that "one can perceive surfaces that are temporarily out of sight". That is, by virtue of motion or deduction people can infer the existence of spaces beyond an isovist's occluding barriers.

An isovist (Benedikt, 1979) is the set of all points in an environment of opaque surfaces that are visible from a given point (the limit of the isovist is an artificial one functioning something like a horizon in the absence of any other intervening surfaces). Essentially, isovists describe local geometrical properties of spaces with respect to individual observation points and weight all the possible view directions equally. The appeal of the concept is that isovists are an intuitively attractive way of thinking about a spatial environment, because they provide a description of the space "from inside", from the point of view of individuals, as they perceive it, interact with it, and move through it (Turner, Doxa, O'Sullivan & Penn, 2001).

To quantify fields of vision in a more systematic way, (Benedikt, 1979) suggests that the way in which we experience a space, and how we use it, is related to the interplay of isovists. Therefore, isovists field records a single isovist property for all locations in a given area. The underlying aim is to assess the way corresponding features vary through space.

Owing to the specificity of the visual dynamics (obviously constrained by motion direction), we have decided to implement restricted view isovists as defined by (Conroy, 2001; Meilinger, Franz & Bülthoff, 2009). Therefore, our partial isovists consider only a restricted part of the theoretically available visual field: maximum vantage length is limited to 900 feets (275 meters) and aperture angle is limited to 104°.

Map of cumulative fields of view: a weighted coverage of the urban fabric

To represent the field of view all along the pathway in a synthetic way, we have decided to apply the method developed in (Leduc, Miguet, Tourre & Woloszyn, 2010), and to draw a map of cumulative fields of view. Therefore, the whole of circuit has been sampled and a field of view, oriented by motion direction, has been assessed every 30 feets (9.1 meters). Then, we have produced a weighted (by time) coverage of the resulting partial isovists field. Thus, in such a map, urban areas temporally "promoted" (that is, all those the observer is able to look upon for a long time) and all those that are "neglected" (almost outside his field of vision), are clearly exhibited.

Results and discussion

In a previous step of this Master thesis, a systematic sequencing of the visual walk has been achieved. The maps obtained through numerical approach (see fig. 1) have been checked according to *in situ* experience and the sequencing analysis.

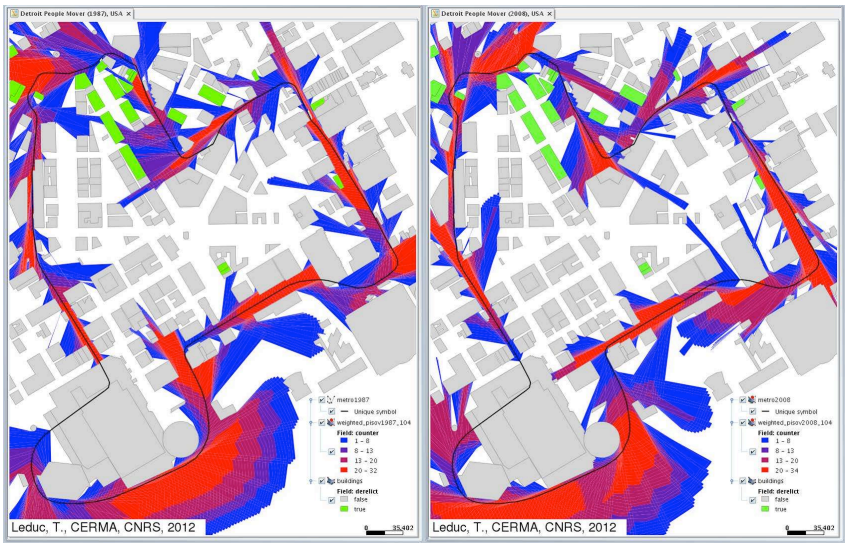

Figure 1. Maps of cumulative fields of view in counter-clockwise (left, before August 2008) and clockwise motion directions (right, after August 2008)

What appears obviously is that perceptions of urban fabric differ substantially between the two maps. Concerning the north-west part, before 2008, emphasis was put on strongly devitalized plots. Since direction modification, focus is stressed on Comerica Park (opened to public in 2000). The same way, in the south-east quarter, with motion direction modification, the renovation of Renovation Center complex of skyscrapers (by 2004) is much more prominently exhibited. This visual promotion process of the positive aspects of the downtown supplements the global revival process of the city.

Furthermore, to complement this qualitative result, geo-computations have been achieved so as to assess the cumulative length of abandoned facades. A side-effect of the motion direction modification is the quantitative decrease of this negative exhibition by 10%.

Conclusion

The method presented here provides an efficient solution to assess visibilities along a circuit through a built environment. Even if it is applied on Detroit downtown, one should admit that it could be transpose somewhere else or even used in urban planning context as an anticipation solution. To achieve an assessment even closer to the reality, we should assess visibility in 3D and adapt maximum vantage length and aperture angle to the surroundings in real time.

At last, concerning thematic maps we produced, we have decided to color visible areas in proportion to the time measurement spent seeing them. This mode of representation puts the emphasis on void in between buildings. An improvement would consist in coloring the opaque facades themselves insofar they correspond to visible saliences.

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