

# Developing a Methodology for the Study of Urban Transformation

## Abstract

There are certain limitations in studying urban development and transformation by depending solely on traditional media. The investigation of historical urban data, both architectural and site information, is difficult to analyze unless all of the urban elements can be visualized simultaneously. The application of digital media provides a model for reconstructing and analyzing certain architectural elements from the past. This paper describes a research project that focuses on the visualization of the historical development of an urban area. In general, our research is aimed at developing a model and Philadelphia is chosen as a case study. An emphasis is placed on identification, categorization and representation of information in a way that is useful for urban researchers for analysis.

**Osman Ataman**

oataman@unix.temple.edu  
Temple University, School of  
Architecture Philadelphia, USA

**Kate Wingert**

mwingert@thunder.ocis.temple.edu  
Temple University, School of  
Architecture Philadelphia, USA

## Resumen

*El uso de los medios tradicionales limita el estudio del desarrollo y las transformaciones urbana. La investigación de datos históricos urbanos, arquitectónicos y de lugar, es difícil de analizar a menos que todos los elementos urbanos sean visualizados simultáneamente. La aplicación del medio digital nos provee con un mejor modelo para reconstruir y analizar ciertos elementos arquitectónicos del pasado. Este manuscrito describe un proyecto de investigación enfocado en la visualización del desarrollo histórico de una área urbana. En general, la investigación esta dirigida al desarrollo de un modelo de análisis y la ciudad de Filadelfia es utilizada como un caso específico para su aplicación. Se pone énfasis en la identificación, categorización y representación de la información en maneras que son analíticamente útiles para los investigadores urbanos.*

## Introduction

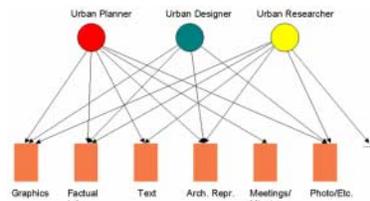


Fig. 1. The dispersion of urban information

Urban planners, designers and researchers look at the same information with different intentions. Each one of these groups, however, incorporates a wide diversity of information in their analyses results and solutions. In urban analysis problems occur because the wide range of information available is disorganized and in dispersed locations. Various forms of footprints of the buildings, free form of textual data (reports, articles, quotes, etc.), charts, drawings, still and moving pictures are typically stored in varied locations, and must generally be retrieved manually (see Figure 1). Most likely they are also difficult to access. Furthermore, traditional systems do not provide researchers with adequate access to data for unique analyses. Because of the inadequacy of these systems, selecting, organizing, and interpreting these data are difficult. Most importantly, since spatial information is not vertically coded, facilitating additional types of spatial analysis, and larger and more complex sets of data is not managed efficiently. Consequently, it may affect the productivity of the investigated study and/or misguide the researchers.(Figure 1)

The focus of this paper is the development of a methodology for studying urban transformation and the visualization of this transformation. In so doing, we attempt to address the problems as briefly outlined above. In general, our research is aimed at developing a prototype urban database model and an emphasis is placed on identification, categorization and representation of information in a way that is useful for analysis by urban researchers. The concept of creating an urban scale database is not new. Several studies do exist with various different research agendas, such as fractal-based approaches (Batty and Longley 1986; Batty and Longley 1987), information representation (Giger-Hofmann 1991; Marble and Amundson 1988; Yapa 1989), interactive urban databases (Fox 1993; McCullough 1993), and historical urban analysis (Dave and Schmitt 1994; Seebohm 1992; Skauge 1993).

## Approach

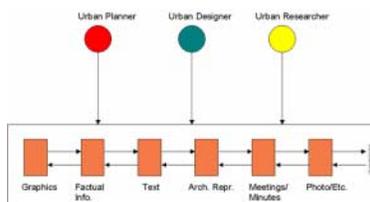


Fig.2. The proposed re-organization of the existing knowledge base

Our approach is to discuss the basic premises of a developing research project that aims to provide an opportunity to create a model that will aid urban researchers for archiving and visualizing information on an urban setting. Through the use of carefully structured 3D digital model and interactive database, we propose to create a tool for researchers, designers and planners that will surmount these problems (Figure 2). It is our hope that this model will re-organize the existing knowledge-base and improve the way information is stored, processed, analyzed and reported in urban scale projects.

There are several advantages of this approach. First, there is a real value in making three-dimensional ideas explicit and understandable. Second, it is extremely useful to be able to compose information from a diversity of sources in order to understand and to cope better with the existing increasingly complex position of urban design. Third, because of the scale and complexity of this information, computer-aided visualization can help in organizing, understanding, designing and communicating.

## The Reconstruction Of An Urban Area

The analysis of an urban area requires a careful examination of the elements, which form that area, and the forces that work upon it (Alkhoven 1991). We propose that any urban study dependent upon images and architectural history is best when contextual and can be put in a formal framework only if organized temporally. The transformation of an urban area can only be studied in relation to its past for the future. In studying urban architecture from the current condition backwards in time, we often see that a site that has changed drastically in its urban relationships has held on to specific local site conditions. Relationships such as building to square or facade to street, for instance, might remain constant, thereby prioritizing and holding critical aspects of 'site' in spite of an area's growth and change.

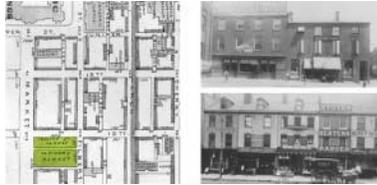


Fig.3. Market Street study

In a like manner, a study of the architecture of the city is best accomplished in relation to its context, i.e. the city plan. Ideal vision versus applied planning has an impact on the architectural formation of the city. The strength of a plan's major components forms its network in spite of these two often-conflicting goals. The characterization of the city as a network with individual works of architecture might therefore best be addressed by looking at the individual work in relation to its place in the city's overall plan. The comparison of the architecture/plan and history/context relationships through time would be best expressed by using a layered map showing the architecture and context, that gives a simultaneous view of the city's reconstruction through many periods of time. History and architecture in their respective contexts could, in a layered map, be carefully examined as changing elements.

## Case Study: Philadelphia

The city of Philadelphia has been chosen as a case study because it is one of a handful of American cities with a long and consistent history of transformation. The current city form was begun as an ideal city in 1683 and has been mapped and envisioned from its inception. The original plan was based on a grid composition and five major squares. This plan, although not complete until the 1800's, is primary and present in the city's image. The overall configuration of this Penn/Holmes ideal plan has been protected and is still visible.



Fig.4. Chinatown study.

As a precursor to this project, some preliminary tests of a Philadelphia historical model have been carried out. These include a two mile study of Market Street drawn from the first post-war mapping period (1950) (see Figure 3), a two mile study of North Broad Street in two time periods – 1875 and 1998, and a study of a ten block area of the city, searching for the origins of its name 'Chinatown' (see Figure 4). With maps, archival material, and images as the primary source material, each one of these studies was accomplished because there is enough historical information to visualize the city in different time periods (Warner 1968).

## Methodology

Our ongoing research examines the city in different time periods by working in small areas of the city and posing questions particular to these places, then collages these together to provide a multiple viewpoint. Time periods for architectural development include 1680/1700, 1770's, 1850/60's, 1870/90's, 1920's, 1950's, 1980's, current and future conditions. These correspond to periods of growth in the city and mark times when maps or atlases are available. In each instance, the Center City (ideal plan) acts as a reference base.



Figure 5: Digital model representations

The model operates in several levels based on a two-fold system structure: (1) 3-D Digital Model, (2) Interactive Database. Fundamentally, it contains a "shell" that allows urban researchers to contribute to the database simultaneously. A 3D-computer model of a selected urban area in Philadelphia is the core of this shell. This method is used to represent current and past typological elements, such as spatial types and morphological series and to explore and analyze historical transformations.

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This computer model is the point of departure in this investigation. It is created by using a digital modeling program Building models are created using architectural plans, 2D digital files, elevations as well as site measurements and photographs. The digital models of the investigated elements, such as buildings, zones, etc. are not single representations but rather three separate representation models: (1) Mass models, (2) Flatshaded models, (3) Texture-mapped models. (Figure 5)

The organization of urban information, including digital models is established by using a layering system based on architecture and time. The starting point of the layering system is the representation of different timeframes and each timeframe includes a subdivision of architectural information. At this stage, architectural information includes building types (residential, commercial and public), zones, recreation areas and transportation. (Figure 6)

The interactive navigation system is based on several components. One component is dynamic query and display of information from the database in both two- and three-dimensional formats. Another component is partially based on a theory and methodology called "Case-Based Reasoning." Case-Based Reasoning (CBR) is memory-centered cognitive paradigm within Artificial Intelligence based on the idea that people are good at figuring out what to do in new situations and adapt those cases to the current problem (Kolodner 1993; Schank 1982). In this study, CBR is integrated for interactivity to collect and utilize the case studies. This component allows urban researchers to make inferences and to see how certain transformations have occurred by comparing the cases.

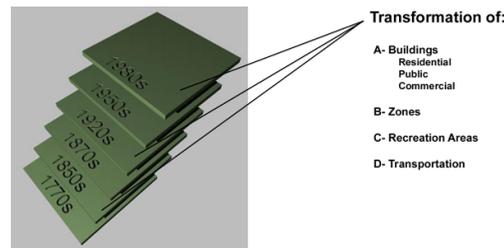


Fig.6. The organization of the studied transformations in different time periods

## Discussion

The application of knowledge organization and new visualization techniques provides a method for analyzing the transformations of an urban development and for posing questions about the history of architecture. The organization, visualization and interpretation of the non-visual material are major problems in architectural history research, especially in urban design. Our goal is to develop a prototype of an interactive digital urban model. Although this study uses Philadelphia as a case, the underlying framework of this model is generic and applicable to any urban area. We believe it will provide a model for archiving and visualizing information on a city and for analyzing urban transformations.

A number of considerations underlie this study. The first and most important is the need of digitizing the data and visualizing the urban information. Second, organizing that information in a digital form. Finally, building an interface to navigate and guide the researchers on this organized information. The objectives of this study have arisen from these considerations and questions. The main objectives of this study are: (1) to conduct a research about the urban scale models and databases; (2) to develop a comprehensive computerized 3-D model of Philadelphia; (3) to store and link all forms of information in a single work area, and (4) to create a flexible interface tool to interactively assemble and edit information.

We argue that the creation of a possible collaborative environment among different interest groups such as facility planners, architectural designers, researchers, and students can provide several possible lines of direction for theoretical and applied research.