

## DEVELOPING AN INTERACTIVE URBAN MODEL PROTOTYPE



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### Abstract

*The application of new digital media provides a methodology for reconstructing and analyzing certain architectural elements from the past. In this paper, a research project is described to develop a prototype system to represent and manipulate information in urban settings. In general, our research is aimed at developing a prototype urban database 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.*

### Introduction and Problem Statement

The study content of this paper was originally published in the SigraDi 2000 conference in Rio de Janeiro. This paper reports the progress of that study. More often than not, the same information may be evaluated differently by urban planners, designers, and researchers depending on their point of view. Each one of these groups 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. Most likely they are also difficult to access. As a consequence, this information is not fully utilized. One of the main reasons is that until recently computer hardware and

software limitations severely restricted the ability of digital media to aid the urban researchers in using these type of organized information. 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.

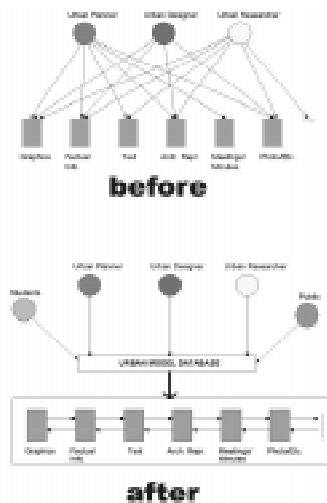
In this paper we focus on the visualization of the historical development of an urban area. In doing so, we attempt to address the problems as briefly outlined above. In general, our research is aimed at developing a prototype urban database model and an emphasis is placed on identification,

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), information representation (Giger-Hofmann 1991), interactive urban databases (McCullough 1993), and historical urban analysis (Dave and Schmitt 1994). Based on the existing studies and accumulated knowledge, we aim to build an urban database prototype model and to use a specific urban context to trace certain typological and morphological elements of an urban space.

### Proposed Approach

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 1).. 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 Analytical Model 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.

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.

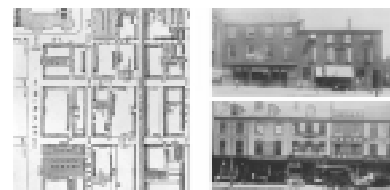
### Philadelphia as a Case Study

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.

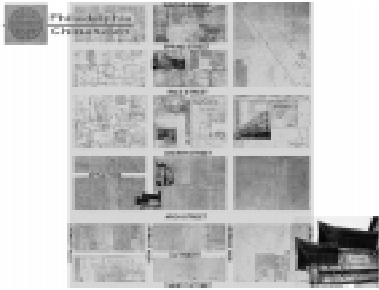
As a precursor to this project, some preliminary tests of a Philadelphia historical model have been carried out. These include a two mile study of Market Street drawn from the first post-war mapping period (1950), a two mile study of North Broad Street in two time periods – 1875 and 1998, and a study of a ten block area of the city, searching for the origins of its name 'Chinatown'.

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). Through these studies, we have developed the following knowledge-base:

1. In the Market Street mapping project, major works of architecture were addressed in relationship to the city plan. Because architectural icons are distinguishable in maps throughout the history of the city, they trace the city's planning and development. Because of their long lasting life, major architectural works often act as the anchors in the city and are therefore important to call out separately in a digital model or map.



2. In the Chinatown mapping project it was possible to pinpoint the origin of the name 'Chinatown' through a combination of historical maps and newspaper articles about the lore of the city. It was important to first record the location of current functions throughout the area to determine its character. The ability to 'test' hearsay information through map documentation could then be accomplished. The information recorded on the map would have been overlooked without the written information.



3. In the Broad Street mapping project, two historical periods were recorded - 1875 and the current day. Because of rapid growth in the city in the early twentieth century and changes in the late twentieth century, a third period would have been more accurate in depicting the city as a changing entity. We concluded that in any portion of the city it is important to represent at least three periods of growth.

With each project there was an attempt to address architecture and historical information alongside contextual information. The consistent use of an accurate plan and map as a grounding device and historical maps as documents to trace back through time proved in each of these test projects to be important parameters. With the contextual mapping, some conclusions became obvious and clear through visualization.

### 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 (depending on the portion of the city to be mapped) 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.

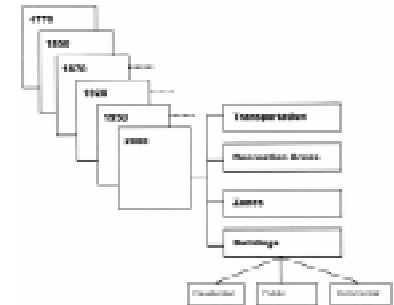
The time periods reflect some events and insights that are unique to the city and some that are indicative and typical of what has occurred throughout the country. This combination at one time shows the uniqueness of the city and at another, some universal trends. The combination, shown through the layers of history, gives us a comprehensive condition and supports the notion that a method can be achieved.

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.

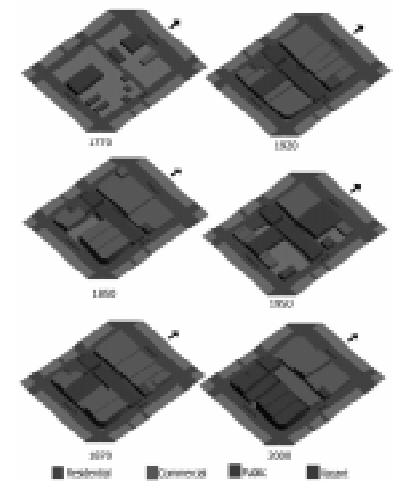
This computer model is the point of departure in this investigation. It is created by using a digital modeling program Building models are created using architectural plans, 2D digital files, elevations as well as site measurements and photographs. The digital models of the investigated elements, such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

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.



Currently, based on this organizational model, a nine-block area around Sansom and Chestnut streets is being reconstructed and analyzed accordingly.



### Conclusion

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 main and basic goals of this study have arisen from these considerations and questions. We believe that at the end of this study we will have developed a comprehensive digital model of Philadelphia, created and linked all forms of information in a single work area and built 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.

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