Urban spaces shaped by past cultures: historical representation through electronic 3D models and databases

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JOSÉ RIPPER KÓS

DEPARTMENT OF ARCHITECTURE AND BUILDING SCIENCE
UNIVERSITY OF STRATHCLYDE, GLASGOW
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Abstract

Digital tools have been increasingly used, in the last decades, for the study and representation of the city history. As the available instruments develop and the researchers become more familiar with them, their use turns out to be more effective and provides richer results. This study aims to explore the use of information technology, particularly 3D models, for the city history research. When this study was elaborated, few initiatives effectivelly applied those new tools to convey the history of the city. A smaller number of published scientific enterprises investigated that operation. Therefore, the study is structured mainly on the analysis of some precedents based on those tools, together with others selected for applying creatively traditional methods. These analyses also raise questionings on related issues such as historical narratives, traditional methods of historical graphic representation or other digital representation modes. The examination of those subjects constitutes the thesis' theoretical part.

The conclusion is presented in the form of a digital alternative for the representation of the city history. The tool developed as a prototype is grounded on 3D models representing different periods of the city linked to a database of a great diversity of historical documents. Thus, the city history is accessed through images of the significant sites from the 3D models. The prototype development is based on the assumptions that this process of retrieving historical information related to city spaces facilitates the understanding of the past culture. Furthermore, when the readers associate the space they know in the city to the historical information, they understand better the past culture that shaped it, strengthen their identity and intensify the relationship to the place they dwell in.

1 Introduction

Several authors agree that the term city is an artificial creation to facilitate theorizations on urban spaces and the lives performed within them (Shields 1996, Donald as quoted in King 1996, King 1996, and Deriu 2001). We say we live in cities but we do not know where are their edges or when an urban environment becomes a city or a town (Shields, 1996). Some centuries ago, the cities were enclosed in walls and that delimitation was much clearer. Kostoff remarks that 'wall' and 'city' are identical words in traditional Chinese and the relationship between the term city and the idea of enclosure is found in several other languages (Kostoff 1992). The cities however, became larger than the walls that protected them and when they no longer were useful they were demolished. Thus, States needed to create laws or statements to define the limit of cities but we can seldom differentiate the areas within the city next to the border to the other contiguous areas, which are no longer the city. According to Shields (1996), we "classify an environment as a city an then 'reify' ... that city as a 'thing'. The notion of 'the city', *the city itself, is a representation.*"

José Barki reminds us that people can only understand reality through representations. He continues explaining that representations are always "less" than the object they represent. They are constituted by selected elements put together for a partial and focused understanding of reality. Real objects are so complex that they need to be filtered in order to be apprehended by our minds (Barki 2003). Each person elaborates a different representation of the same object and even the same person represents differently the same object in distinct moments. To make things more intricate, thousands, often millions, of different individuals inhabit the cities. They generate a very complex set of social relations and are constantly elaborating different representations of the place they dwell.

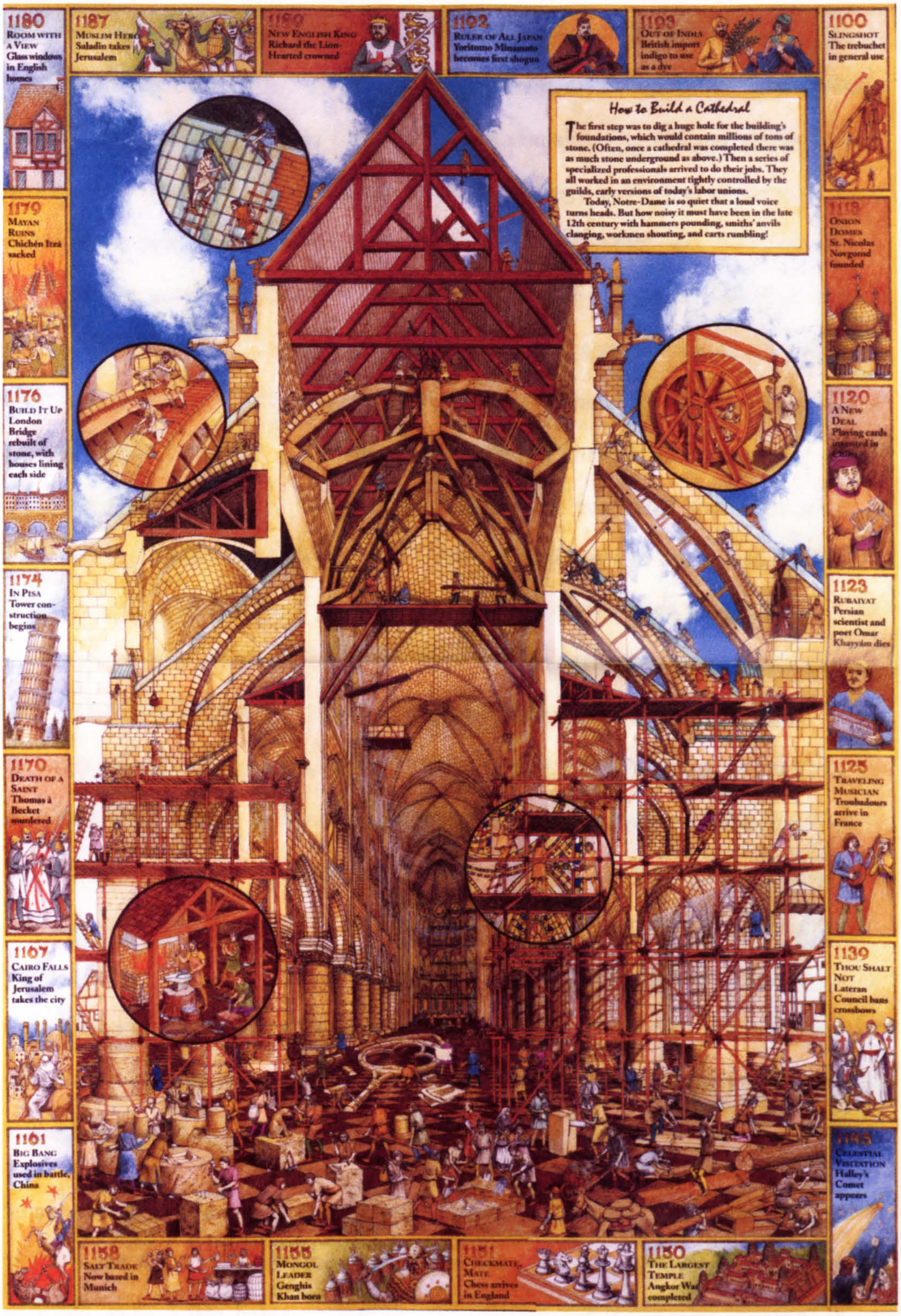


Figure 1.1: The construction of Paris' Notre-Dame (Lorenz 1996)

. It is also important to evaluate the term 'image' since it will be applied often throughout this dissertation, sometimes with different meanings. Santaella and Nöth stated that the world of images is divided in two domains. The first one is the domain of the images as visual representations such as drawings, paintings, engravings, photographs and those from the cinema, television, holographic and produced in computers. According to them, these images are material objects or signs that represent our visual environment. The second relates to the immaterial domain of our mind's images. In this domain images come from dreams, visions, fantasies, models or as general mental representations. They say, that despite their different characteristics, those domains do not exist separately because they are connected since their genesis. Visual representations have always been created from images in our minds and these mental images were influenced in their conception by the concrete world of visual objects (Barki 2003, Santaella and Nöth 1998). In this document, the term 'image' will often refer to both domains. Electronic representations of historical 3D models, although classified in the material world of the visual representations, are "immaterial" materializations of past environments. These virtual worlds have an intangible character and are connected to our senses through several devices that translate their features stored in the form of numerical codes. Screen monitors and printers are some of the most common outputs that allow us the recognition of the numerical codes materialization. This dissertation aims to concentrate on 3D models which provoke links with existing mental images of the represented spaces in order to produce new images in the user's minds.

Some authors criticize many historians for neglecting images in their work (Haskell 1993; Burke 2001). The historian Peter Burke suggested that XX century historians were educated under a text based training system. They learned the "source criticism" in order to select written documents but they are not prepared to deal with historical images. According to Burke, historians were not used to images and some confessed to

be "visually illiterate" (Burke 2001). One of the challenges is not only to use images to give new answers and raise new questions but also to communicate the research material in creative forms connecting visual material to texts. Additionally, historians' work should also address a new generation, which has grown up overtly exposed to all sorts of images from birth.

If we intend to investigate the representation of cities' history, it is important to keep in mind the character of those terms and the gap between the representations and the actual lives that take place on those stage settings. Furthermore, considering the impossibility to represent the actual life in the city, it is even more difficult to represent it in past historical documents which are partially and fragmentally exhibited to us.

Departing from these assumptions, we will use the term 'city' throughout this dissertation as that environment "reified," which is accepted by most people, to define the large urban space they live in. Furthermore, its history will be considered in a broader sense than the history of urbanism. The focus will be towards the history of the past cultures which interacted within the space of the city and, consequently, structured its places. The risk of this reification process is to prioritize the representation as the main object of study detached from the complexity of the actual environment. Shields (1996) reminds us that "the pedestrian and the idiosyncratic city of personal tastes vanishes or is at least thrown out of focus in representations such as plans." Therefore, one of the aims of this study is to emphasize the human interactions that take place in the studied areas and that architecture is not only important to provide a character for the spaces where these interactions occur but also as a product of the culture originated by these interplays. The search for photorealism in electronic 3D models tends to emphasize the perfection of the actual representation, but at the same time, exhibits it alienated from human interactions. The challenge for researchers who work with digital models is to facilitate links between the spatial representations and the experience which takes place in it.

1.1. Definition of thesis objective and framework

This thesis aims to investigate the use of electronic 3D models to facilitate the understanding of the history of cities. The focus has been devoted towards the analysis of spaces within the city that raise meaningful historical contents. These spaces provide not only the understanding of their own configuration but also of the past cultures that shaped them. Therefore, the buildings and urban areas should be selected in order to reveal a broader view of the cultural history of the city.

3D models have been widely used to represent historical sites which no longer exist or that suffered several changes over the years. Those tools have considerably evolved in the last three decades and through them it is possible to generate complex geometries (both in size and form) and produce high quality images. Additionally, several resources have been provided, which facilitate links between 3D models and their images with other type of files. Therefore, we have currently a great diversity of electronic technologies, which can be applied tothe interpretation of historical documents, particularly through the representation of a physical structure that has been transformed throughout the years.

The objective of this research is to explore alternatives that digital tools can provide for the representation of the city's history. The focus of these explorations has been directed towards the possibilities of content communication. Therefore, those devices will not be investigated by their ability to use the most complex and recently launched techniques. The advantages of applying these new tools creatively, over traditional forms of historical representation will be the emphasis of this study. These traditional forms of representation are not restricted to analog devices, since several digital enterprises do not present any innovation or benefit for using electronic technology. Consequently, not only digital precedents have been evaluated, but also creative projects that applied traditional instruments to analyze the city's history through

architectural artifacts.

The use of digital tools has spread through all scientific fields. Although the humanities and the social sciences took longer to apply electronic tools, even these groups have noticed the impact of information technology in their research methodology. However, the greatest advances in these areas have been related to communication, particularly through the Internet. In the field of history, most preeminent researchers are still not familiar with more complex electronic technologies. That issue may explain the relatively rare discussion of these technologies to provide new possibilities for the historians' representation.

In a previous project the research group based at the Laboratory of Urban Analysis and Digital Representation (LAURD) of the Post-Graduate Program of Urban Design in the Federal University of Rio de Janeiro investigated the urban evolution of Rio de Janeiro. That enterprise, based on historical 3D models, was the starting point for this PhD research. This dissertation's objective, however, is to broaden the investigation of the history of urbanism towards an overall cultural history associated to the built environment. That means, to investigate people's aims to make changes to the built environment towards the understanding of how they lived within the city and which were the forces that oriented the changes in their living. The physical changes should be viewed as both cause and consequence of those broader transformations.

Accordingly to these objectives, the dissertation is centered on two main axes: the study of representations historians are used to and contributions of 3D models and other digital tools to the history of cities. During this study, it was not possible to find a previous research with parallel aims. Therefore, we assume that the dissertation's main contribution is to merge those two separated research fields.

1.2. Thesis methodology

The website *Rio-H* is the main outcome of the research developed during the PhD studies at the University of Strathclyde and the Federal University of Rio de Janeiro. Therefore, it should be viewed as a response for most issues raised during this process. This experiment is a conclusion of the investigations carried out throughout those years. Although it resembles a finished system, it is a prototype developed to a stage in which its main characteristics would work and which could be presented as a closure to the theoretical section. The fact of being an architect made it easier to organize most of the issues, which became evident in this process, in a project than in a written conclusion. Thus, it would be better if the focus to review this system is directed towards its capacity to answer – or to provoke fresh reflections in – those issues, instead of regarding it as a final digital product, with its features, techniques, and also shortcomings.

In order to focus on the main structure of the PhD research, which theoretically shaped the *Rio-H* system, some of the subjects studied were not recorded into the main part of this document. They may be overviewed in some of the papers published in this period and included as thesis appendixes. Several parts of the thesis were actually published before as journal or conference papers. These publications were important to register the investigation throughout the process and additionally, to expose the work to other colleagues who gave valuable contributions. These were the main reasons to include the papers as appendixes.

From the beginning, a bibliographical database was elaborated to register the research material. Each publication reviewed represented one entry and selected text excerpts were scanned and stored into the system. Up to five keywords were assigned to each of these citations. The system proved to be a powerful tool to catalogue the studied bibliography and a noteworthy contribution for the papers elaborated since then, particularly, this thesis document. This database, created with Microsoft Access is not

an original idea. Many writers have registered in paper files citations from publications they read and considered important, for later examination, and others have already used similar digital systems to catalogue them. However, it is important to mention the bibliographical database created for this PhD research because it was not just a catalogue in this process. It was possible to later verify that one of the most important contributions to this research, Walter's Benjamin's Arcades Project, was also based in an analogous collection of citations. Furthermore, *Rio-H*'s database has several resources that were considered worthwhile in the bibliographical database, such as the keyword search. An analogous system that facilitates the creation of scientific narratives should support the creation of historical narratives in *Rio-H*. The merit of this bibliographical database, created as a resource for the PhD research, explicates the continuity of this system. It will be continually increased to include the publications that will follow this post-graduate program.

This study is also closely related to the research projects developed within the ABACUS group at the University of Strathclyde, particularly these related to the city of Glasgow, and also the projects carried out at the Laboratory of Urban Analysis and Digital Representation (LAURD) in the Federal University of Rio de Janeiro. *Rio-H* can be seen as an intersection of three recent projects developed by ABACUS about the city of Glasgow: the *Glasgow Directory* (ABACUS, 1999), *Glasgow 2000: the story of the city* (ABACUS, 2001) and *TheGlasgowStory* (ABACUS, 2003). Thus, the characteristics of the three projects, which respond to the issues raised through the thesis research were kept in *Rio-H*, such as the location within the city of historical events in *Glasgow 2000*, the *Glasgow Directory*'s 3D models or the archival database from *TheGlasgowStory*. Besides that, this work was influenced by the projects developed by our research group at LAURD, particularly the Colonial Havana and Rio de Janeiro. The base of the 3D model used in *Rio-H* was developed for the analysis of the Colonial Rio de Janeiro and is also used in several other projects in LAURD.

3D models are particularly useful to reconstruct demolished or modified buildings.

Hence, historical reconstruction has been one of the main themes for 3D modeling research. We can find many precedents in this area in scientific publications, particularly those from conference proceedings. For this study, we concentrated on 3D city models, which focused on historical analysis. The models were elaborated to display an urban area from the past. Several similar digital projects were examined besides these developed within ABACUS/Strathclyde and LAURD/Federal University of Rio de Janeiro. Most of these city models were elaborated in a greater detail than in *Rio-H*'s. They were analyzed in order to find out their objectives, the technologies used and how successful they were to respond to the objectives and also to provide material for further investigations.

It is important to mention that, as digital tools have been consolidated and refined, the investigations based in these technologies have to shift their focus also to their use areas. Information technologies are increasingly viewed mainly as vehicles for several uses. They usually introduce several changes in traditional processes and it is critical that, when researching these tools, a thorough analysis of their use is also done. Therefore, this study did not concentrate only in the technologies behind 3D city models and databases but also focused some areas that were not so familiar, such as historian's representations and city culture history. In order to study the representation of the history of cities, its buildings and dwellers, it is necessary to understand how historians have communicated their study. Narratives have been used for centuries as the main vehicles to these representations. From story telling to academic publications, narratives have been consolidated through most historians. Since the beginning of the XX century, narratives started to be challenged by historians and philosophers. The overview of this debate was significant to the present study because it exhibited more clearly the main vehicle of the historian's production and revealed many of its shortcomings. Therefore, coming from a different area of study, it was possible to view this debate from a different angle. Furthermore, it was possible to provide a digital angle to this debate which seems to be

not considered yet by the main champions of the conventional approaches.

Additionally, it was valuable to investigate some analogical projects in which the authors successfully revealed the culture of cities while analyzing architectural artifacts. This group includes very different projects, both in scale and in intention. Benjamin, Koolhaas, and the illustrators Macaulay and Lorenz produced diverse studies published in books. Their links lie in departing from buildings or architectural typologies to expose the history of a period within the city history and, moreover, to understand the culture of the city that shaped those constructions. The survey of these successful analogical precedents is imperative for this study. The main reason to choose them was due to their noteworthy and creative approach. However, it was interesting to find out that they also carry some characteristics of digital enterprises, which somehow supported their originality. The analyses of these projects were valuable to step back from the digital solutions and evaluate what is important to display and how an effective representation facilitates the understanding of a place's history.

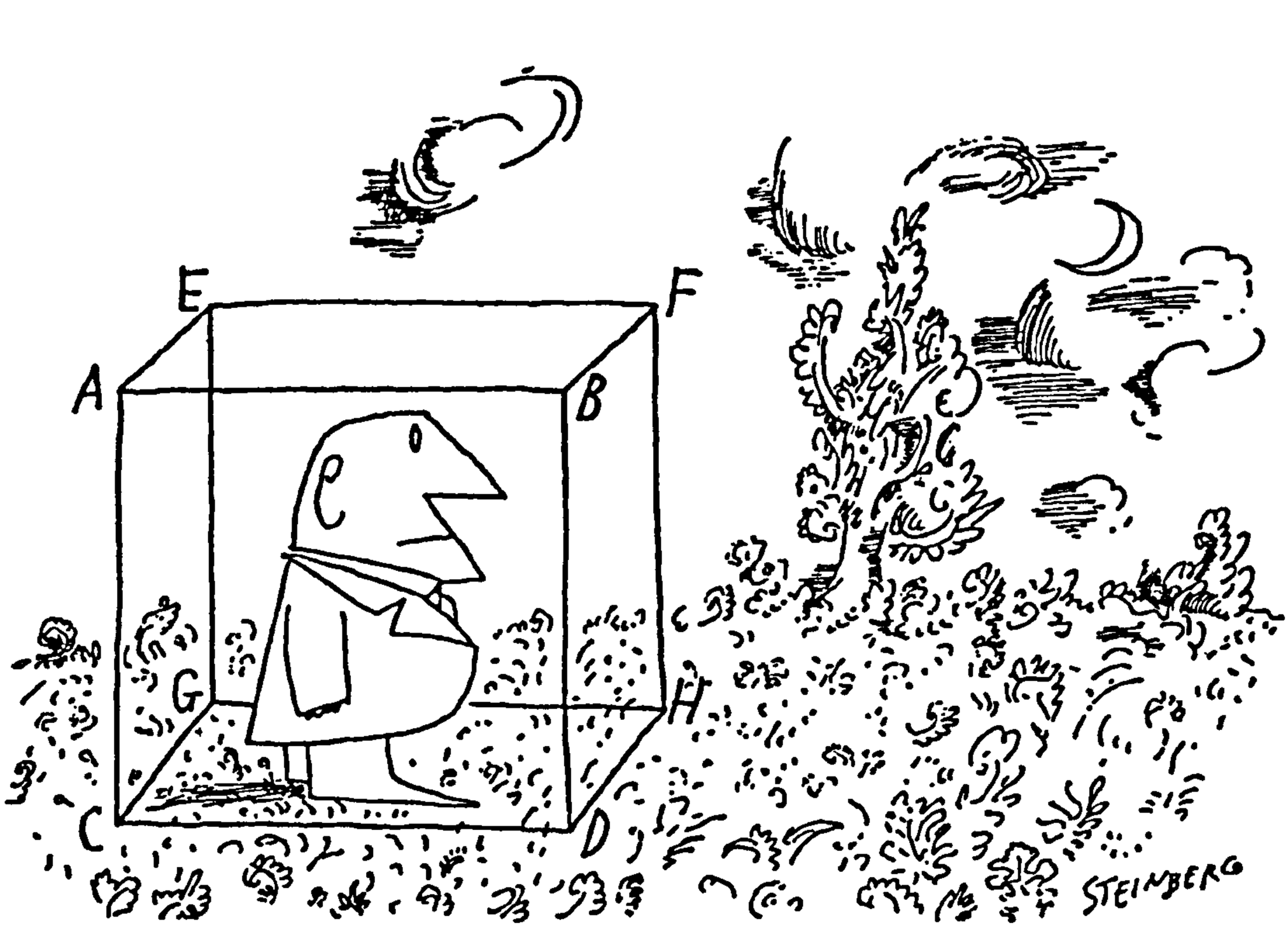


Figure 1.2: (Steinberg 1979)

2 The representation of the history of the city

2.1. *Historians and narrative: searching for a representation mode*

History as a science was developed from ancient storytelling. The individuals who first shared their stories among others aimed to perpetuate their family and social group experiences. Since then, until the first half of the XX century, narrative has been the major and almost unquestionable form of historical representation. Peter Burke mentions that in the age of the Enlightenment, authors like Voltaire and, the Scottish social theorist, John Millar were already challenging historical narrative. Millar wrote about the "surface of events which engages the attention of the vulgar historian" (Millar as quoted by Burke 1991). However, it was around the 1920s, that various authors raised several issues, which would question the scientific value of historical narrative. One of the main reasons was the influence of Marx's ideology and the social science methodology among historians, which determined a criticism of their scientific and social role. At the center of that criticism was the historical narrative focus on the individuals. The current belief determined a diversion towards the analysis of societies and their structure. Moreover, these historians defended the view that "*scientific history* could be achieved which would in time produce generalized laws to explain historical change". If until then the *what* and *how* questions were the main concerns of historical narratives, the shift should be towards the *why* historical questions (Stone 2001).

In the late 1970s, Lawrence Stone (2001) identified three very different groups that were the most prominent in their search for that scientific history within the previous thirty years: the Marxist economic model, the French ecological/demographic model, and the American *cliometric* methodology.

For Stone the historians who were aligned to the old Marxist model were claiming to pursue the "scientific history." They were profoundly affected by the idea of history moving through a dialectical process of thesis and antithesis with the control over the means of production through a clash of classes. According to Stone, those historians, usually young scholars, produced a simplistic and deterministic model based on the economic and social structures of society (Stone 2001).

The French ecological/demographic model originated around the journal *Annales d'histoire economique et sociale*, was created by Marc Bloch and Lucien Febvre in the late 1920s. According to Peter Burke, the first phase of the group, until the end of World War II, was characterized as "small, radical and subversive, fighting a guerrilla action against traditional history, political history, and the history of events." Burke considered the second *Annales*' phase more established as a 'school,' with a unified thought around the historian Fernand Braudel whereas fragmentation marked the third generation, after 1968, which shifted from socio-economic to socio-cultural history while some from the group were reinterpreting the importance of political history. That group was important for the interdisciplinary collaboration with other humanities disciplines such as geography, linguistics, psychology, economics, sociology and anthropology and the shift from traditional narrative of events to problem-oriented analytical history, opening up historical focus to other human activities from the current dominance of political history (Burke 1991).

Emmanuel Le Roy Ladurie emerged as a major *Annales*' spokesman, although Stone considered him a "rather extreme one". "According to him [Le Roy Ladurie], the key variable in history is the shift in the ecological balance between food supplies and population, a balance necessary to be determined by long-term quantitative studies of agricultural productivity, demographic changes and food prices. This kind of *scientific history* emerged from a combination of long-standing French interest in historical geography and historical demography, coupled with the methodology of quantification.

Le Roy Ladurie told us bluntly that 'history that is not quantifiable cannot claim to be scientific'" (Stone 2001).

"The French historians, who in the 1950s and 1960s were in the lead in this brave enterprise, developed a standard hierarchical arrangement: first, both in place and in order of importance, came the economic and demographic facts; then the social structure; and lastly, intellectual, religious, cultural and political developments. These three tiers were thought of as the storeys of a house: each rests on the foundation of the one below, but those above can have little or no reciprocal effect on those underneath. In some hands the new methodology and new questions - produced results which were little short of sensational. The first books of Fernand Braudel, Pierre Goubert and Emmanuel Le Roy Ladurie will rank among the greatest historical writings of any time and place. They alone fully justify the adoption for a generation of the analytical and structural approach" (Stone 2001).

The third group, the cliometricians, appeared in the late 1950s and was constituted mostly by North Americans. Cliometrics, as a Greek construction, means quantitative history and the cliometricians apply economic theory and statistical techniques to describe and explain economic historical events. It is a very hermetic group since their publications are based primarily on complex mathematical data, which produced results incomprehensible to their historian colleagues. Furthermore, the cliometricians claim to produce the only scientific historical research, excluding any other attempt. They, according to Stone, "are defined by a methodology rather than by any particular subject-matter or interpretation of the, nature of historical change. They are historians who build paradigmatic models, sometimes counter-factual ones about worlds which never existed in real life, and who test the validity of the models by the most sophisticated mathematical and algebraical formulae applied to very large quantities of electronically processed data" (Stone 2001).

Stone identified other groups, for their importance in that debate, such as the structuralists. Their contribution was quite significant and Stone did not include them within the other three because they concentrated on theorizing the theme and no major work of history was produced. Roland Barthes' structural analysis of narrative was one of their meaningful theories that influenced the debate.

Those new experiments towards a scientific history were not restricted to the content of historical representation. The shifts in historians' methodology raised an important debate on historical representation, namely traditional narrative. The unparalleled interdisciplinary collaboration fomented an analytic representation that was very different from the descriptive narratives used by historians until then. Furthermore, historians were becoming used to quantitative data in their research. Their representation no longer fitted in the storytelling method. Therefore, the representation alternatives came from those related disciplines and oriented the critique of the structural historians towards traditional narrative.

Narrative and structural historians differ in many issues while representing the same historical moment. The former tend to base their historical explanation on individual character and intention as opposed to the latter's focus on the existing society's structure such as economy, politics, demography and so on. In order to demonstrate their difference, Peter Burke quoted Braudel's famous example. A narrative historian would explain that "orders arrived late from Madrid because Philip II could not make up his mind what to do". Structural counterparts, on the other side, would assert that "orders arrived late from Madrid because sixteenth-century ships took several weeks to cross the Mediterranean" (Braudel as quoted by Burke 1991).

Narrative champions construct their version on the assumption that individual historical agents are more significant than structural aspects to explain an historical event. Therefore, a descriptive narrative is more suitable for their historical representation.

Their description is usually set up in a chronological order where events and personal decisions are linked together. These historians were criticized for personifying collective entities such as Government and Church and oversimplifying historical events, elaborating a representation which could not be scientifically verified. Besides that and because of that, their rivals argued that from the same set of primary documents, historians could elaborate opposing and still valid versions.

Although *structural historians* do not exclude narratives in their historical representation, they avoid their descriptive beginning-middle-end structure. They assert that there should be a distinction between popular and academic history. According to them, academic historians should avoid telling stories and concentrate on the analysis of problems and structures (Burke 1991). Some of the criticisms towards structural historians concern their rigid, reductionist and determinist attitudes. Diminishing the importance of historical characters, they reduce their individuality and suggest that any person in that situation would take the same decision. The analysis abstraction also scales down the sense of flow of time in their representation.

By the 1970s, after several important works authored by structural historians, new arguments were thrown to the narrative debate. The rejection of narrative by these authors started to be reconsidered. The flexibility and indeterminism of narratives started to be viewed as qualities by these former critics (Roberts 2001). Authors like Lawrence Stone, a former advocate of the structural history, by the late 1970s defended the revival of narrative. That revival didn't represent an acceptance of the narrative they criticized but a support towards a new form of narrative, often based on stories of regular people merged with an analysis of the overall society's structure. Some of the works of that new trend were discussed by Burke as it will be presented in the following pages of this thesis.

2.1.1. Real Life experiences and narrative structure

The philosopher Louis Mink arose as one of the most prominent figures in the historical narrative debate due to his significant essays published in the 1960s and 1970s. According to Geoffrey Roberts, Mink was "an early proponent that narrative was central to the historical enterprise" (Roberts 2001). Mink initiated a contention among narrativist historians and philosophers when he claimed that narrative structure differs from the structure of 'lived experience'. Therefore, narrative needs to be imposed upon historical experience in order to render it coherent. Through that move, narrative qualities were brought from art to life (Mink, 1978). David Carr, his most well known opponent, constructed his argument against Mink's theory, while White and Ankersmit stressed Mink's belief even in a more radical form.

One of Mink's slogans was that "stories are not lived but told" or that "the past is not an untold story". He asserts that we are culturally used to narrative in such a way that we impose it automatically to reality: "Historical actuality has, we may presume, its own complex structure (or lack of it); narrative has another". Mink continues, explaining that "It could be no more than a lucky accident if the structure of the narrative ever successfully represented the structure of historical actuality; but even worse, no one could possibly know whether it did, since to do so would require comparing the two and thus would require knowing the structure of historical actuality in itself independently of any representation of it. But this is impossible" (Mink as quoted by Roberts 2001).

Mink defended that traditional historical narrative, elaborated within a beginning-middle-end structure, is an artificial construction. If those constructions would be similar to the 'lived experiences', one could join narratives of events immediately adjacent in time without any problem. However, he verified that a narrative *beginning* always introduces the historians' argument and the *end* is developed as its conclusion. Therefore, the former narrative coherence no longer works when its *end* becomes the

middle of the new big narrative, connected to the beginning of the succeeding event narrative. The inherent narrative character that grants its unity prevents the association with other narratives in order to create a big story.

David Carr argued that life has an inherent narrative character; therefore narrative qualities are transferred from life to art. His famous book "Time, Narrative and History," was in dispute with Mink's assumption that "stories are not lived but told". Carr said that life experience is structured in a similar way to narrative. While constructing his argument, he used Husserl's concept that "even the most passive experience involves not only the retention of the just past but also the tacit anticipation, or what he calls protention, of the future. His point was not simply that we have the psychological capacity to project and to remember. His claim was the conceptual one that we cannot even experience anything as happening, as present, except against the background of what it succeeds and what we anticipate will succeed it" (Carr, 1986). Therefore, Carr asserted, if this is true for a single experience, it is also true for our lives in which we always consider past experiences, expect the future and view the present as a transition between the two. He concluded, "whatever else *life* may be, it is hardly a structureless sequence of isolated events". He went on to claim that life does have beginnings, middles and ends similar to narratives. Besides birth and death, actions have a moment of initiation and, in the same way as historical narratives have sub-plots, which are grouped to form major event stories. Those life actions are also part of a large-scale action such as conducting a love affair or solving a murder (Carr 1986).

Against Mink's notion that we don't dream or remember in narrative, Carr affirmed, "Louis Mink was thus operating with a totally false distinction when he said that stories are not lived but told. They are told in being lived and lived in being told. The actions and sufferings of life can be viewed as a process of telling ourselves stories, listening to those stories, acting them out, or living them through."

In a later essay, Carr was less radical in his affirmations. His main concern was narrative's capacity to represent real "events or actions they depict" (Carr 1994). He agreed that historians create their own stories added to those from the historical agents. "Carr accepts that a general demonstration of the narrative ontology of historical reality is no guarantee of the truth of particular narratives: establishing the truth is more a matter of epistemology than ontology" (Roberts, 2001). He maintained that structures of narrative and life have strong similarities, which would ultimately lead to the assertion that narrative would be the natural vehicle to represent real life or – more appropriate to his thesis – he tried to avoid the conclusion that narrative, as an imposed instrument on reality is not able to represent it truthfully. When he shifted the discussion from ontology to epistemology, he aimed to prevent questioning narrative inherent competence to represent reality. As an epistemological matter, distortions on reality are addressed case-by-case and the historian community is responsible for regulating the distortions of each case.

2.1.2. The debate on modern narrative

Peter Burke wrote that the debate should not be "concerned with the question, whether or not to write narrative, but with the problem of what kind of narrative to write" (Burke 1991). Burke presented several literary experiments, which challenged the notion of narrator or chronological sequence and responded to many historical narrative shortcomings.

According to him, the film historian Siegfried Kracauer "seems to have been the first to declare that modern fiction, more especially the 'decomposition of temporal continuity' in Joyce, Proust and Virginia Woolf, offers a challenge and an opportunity to historical narrators". Hayden White got more recognition than Kracauer when he suggested that historians should abandon nineteen- century's literary *realism* and pay attention to the "literary insights of its own age (including a sense of discontinuity between events in

the outside world and their representation in narrative form)" (White 1966, Burke 1991).

Burke identified three major problems of historical narratives in which literary experiments could offer alternative solutions. The first one is the representation of conflicts such as civil wars, which has very distinct versions. He demonstrated surprise that historian don't apply novelist techniques such as telling the story from different points of view to overcome those problems. History is written, most of the times, in the winners' version. Some literary experiments offer powerful devices to present to the readers both sides of the conflict and allow them opportunity for a more thorough interpretation. He exemplifies with the literary works by Aldous Huxley, William Faulkner and Lawrence Durrell. While he was finishing his essay, as he noted, Richard Price published the book "Alabi's World" on Surinam's eighteen-century history. His study presents four different voices: the black slaves, the Dutch administrators, the Moravian missionaries and the author himself. In this acclaimed work, Price exhibited the differences between opposing versions by the antagonistic agents and also in time through his own voice and the historical agents (Burke 1991).

The second problem refers to narrative competence in representing reality as introduced before with the debate between Mink and Carr. According to Burke more and more historians were realizing that they present just a "particular view of what actually happened" (Burke 1991). A major problem is that, typically, history books display that particular view as *the* representation of past reality. Authors do not communicate to the readers the awareness that their work is just one version of the facts. Traditional narrative is not very adequate for this task. Price's book, again, presented a successful effort to overcome this problem with his voice opposed to the three other selected agents. Another alternative, presented by Burke, is fiction's first-person narrator.

The third issue raised by Burke addresses the dispute between narrative and structural historians. According to him, none of the two groups was able to offer an historical

representation alternative without bringing about other shortcomings. Thus, he proposed a synthesis between their most valuable features. The result would be a *thick description* or *thick narrative*. That term was coined by the anthropologist Clifford Geertz, the author of the classic account on cock fighting in Bali (1989). A description, or narrative, is *thick* when it is embedded with a noteworthy analytical interpretation not only of the facts described but also of the overall structure in which they are circumscribed. Burke suggested that these structure analyses could act as brakes, or accelerators, between the events on narratives. He cited Tolstoy's "War and Peace" and Shimazaki Toson's "Before the Dawn" as important novels which exemplify that attitude. He added that historians can learn from novelists some of their techniques but it is not an easy move for them to solve their literary problems. "Since historians are not free to invent their characters or even the words and thoughts of their characters, they are unlikely to be able to condense the problems of an epoch into a story about a family, as novelists have often done" (Burke 1991).

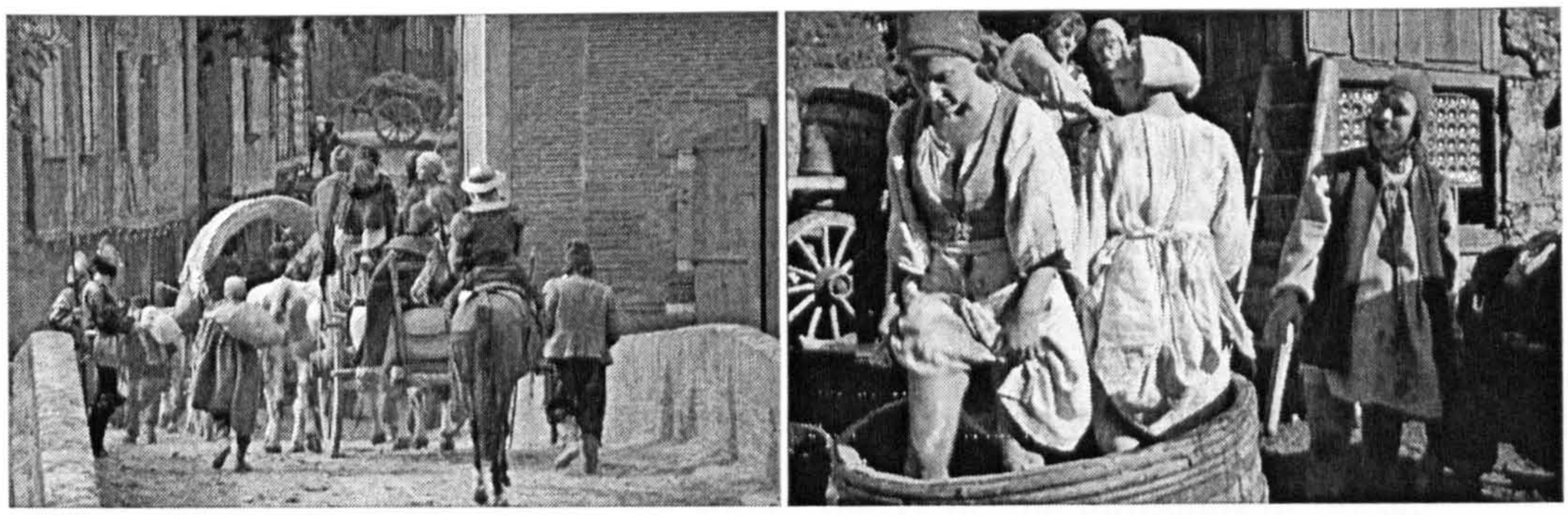


Figure 2.1: Images from the movie "The return of Martin Guerre" (Vigne 1982)

The solution most adopted by historians who were exploring this direction is the *micronarrative*. It was adopted by some of the former structural narrative champions and is becoming. *Micronarratives* are stories about ordinary people and their settings used as a "means of illuminating structures" (Burke 1991). Burke presented several examples. Among them, he cited Natalie Davis's version of a sixteenth-century's farmer, on his way back home in the south of France, after many years away, found his place occupied

by another man who claimed to be the farmer himself (Figure 2.1, Figire 2.2). The story was used to present the values of society in that place and time such as the status of French rural women and current relations between husband and wife or parents and children. He quoted the author, whose goal had been that of "embedding this story in the values and habits of sixteenth-century French village life and law, to use them to help understand central elements in the story and to use the story to comment back on them" (Davis as quoted by Burke 1991). Burke accepts that *micronarratives*, as powerful alternatives to historians, present some difficulties in linking microhistory to macrohistory or local details and general trends.

The second alternative introduces devices which reduce the difficulties of linking the micro-scale characters and the overall historical structure. Burke exemplified this move with Jonathan Spencer's "The Gate of Heavenly Peace" on the Chinese Revolution from 1895 to 1980. As opposed to Price's book on Surinam's history, Spencer constructed his narrative around characters that are not central to the revolution. They are actually totally impotent to that difficult period and their sufferings related to those events allow the readers to evaluate how those social conflicts impacted their lives. As the author suggested, the protagonists were selected because "they 'described their hopes and sorrows with particular sensitivity' and also because their personal experiences 'help to define the nature of the times through which they lived.' They are viewed as passive rather than active. Indeed, the author speaks of 'the intrusions of outside events' on his characters" (Spencer as quoted by Burke 1991). Burke mentions that Spencer was successful to "communicate in a vivid and moving way the experience of living (or indeed of failing to live) through these turbulent years". On the other side, the reader may be confused by the moves from one character to the other or the back and forth shifts on the historical time of the major events and the protagonists' time.

The backwards writing of history is the method applied by Norman Davies's "Heart of Europe" on Polish History. The author's "arrangement change" is restricted to the

sequence of the chapters, while the texts follows the chronological order. That conflict may cause some problems to the readers, however it allows "or even force[s] the reader to feel the pressure of the past on individuals and groups (the pressure of structures, or of events which have congealed, or as Ricoeur would say, 'sedimented' into structures)".

The fourth solution identified by Burke arose in the work of the anthropologist Marshal Sahlins on Hawaii and Fiji. Burke remarked that Sahlins was influenced by the Modern French thought, reinstating the *Annales* beliefs, but taking "the events more seriously than any of these thinkers do." Burke continued, commenting that "Sahlins also argues (contrary to Braudel) that there is a dialectical relationship between events and structures. Categories are put at risk every time they are used to interpret the changing world. In the process of incorporating events, 'the culture is reordered'" (Burke 1991). Burke identified in his work a synthesis between the narrative and structural historians. If Braudel returned to narrative as a way to explain overall structures, Sahlins went further dissolving the "binary opposition between these two categories". For the structure historians, Sahlins suggested that "they should recognize the power of 'events,' their place in the process of 'structuration.'" The narrative historians, on the other hand, were "encouraged to examine the relation between events and the culture in which they occur" (Burke 1991).

In Burke's essay, he diagnosed several limitations on historical representations. These limitations were evidenced in the debate between narrative and structural historians. They also demonstrated historians' conservative approach to their most important vehicle that provides access to their research. One of the symptoms of historian's conservative attitude is that a great part of the discussion concerning the debate on historical narrative is carried out by philosophers, with little participation of historians. Burke proposed directions that they could take in a search for new forms of narrative, which could overcome some of those problems. He distinguishes several experiments in twentieth-century literature and cinema. These experiments are seldom acknowledged

by historians and could benefit their interpretation of past reality.

Figure 2.2: Images from the movie "The return of Martin Guerre" (Vigne 1982)

Although most devices recognized by Burke in cinema come from literary experiments, they are clearly exhibited in some prominent films. Besides Kracauer's contribution mentioned above, Natalie Davis's "The Return of Martin Guerre" was launched almost at the same time as the homonymous film in which she was historical consultant (Vigne 1982, Davis 1983). Another remarkable film is Akira Kurosawa's "Rashomon" (Kurosawa 1950). In his film, Kurosawa constructed a simple story of a samurai found dead and his wife raped, within a very creative structure. The film has four different versions – like some historians' experiments described above – presented in flashbacks: the bandit, the main suspect, assumed that he had killed the samurai after a sword dispute but affirmed he had had consensual sex with his wife; the raped woman confirmed the rape and suggested she was the murderer; the dead man's version, told through a medium, ratified the rape and declared a suicide; and the only witness presented some elements from the three other versions without any conclusion (Figure 2.3). Burke reminds us that Ryunosuke Akutagawa's original story "Rashomon" did not adopt different versions, which was Kurosawa's creation. However, Kurosawa based his film in two short stories by Akutagawa. The other one, "Yabu no naka" (In a grove) presents the opposing confessions of the involved in the crime. While the Akutagawa's "Rashomon" inspired the filmsettings, "Yabu no naka" was the foundation for the film script (Akutagawa 2002a and 2002b).

Figure 2.3: Images from the movie "Rashomon" (Kurosawa 1950)

Kurosawa did not intend to offer a definite version but rather concluded for the impossibility of knowing what really happened. Not even those who were the participants in the event could elaborate similar versions. To the film producers who were not understanding the script, Kurosawa explained that "human beings are unable to be honest with themselves about themselves. They cannot talk about themselves without embellishing. This script portrays such human beings – the kind who cannot survive with lies to make them feel they are better people than they really are. It even shows this sinful need for flattering falsehood going beyond the grave – even the character who dies cannot give up when he speaks to the living through a medium. Egoism is a sin the human being carries with him from the birth; it is the most difficult to redeem. This film is like a strange picture scroll that is unrolled and displayed by the ego" (Kurosawa, 2002).

2.2. *Images in historians' research and representation*

Peter Burke noted that the influential journal *Past and Present*, which could be considered a representative of new trends among English speaking historians, did not include one single picture in its 1952 to 1975 papers. In the 1970s two articles were illustrated and in the 1980s fourteen of them used images together with the texts (Burke 2001). That tendency reflected the neglect of images by historians, as a vehicle

to communicate their studies. Additionally, it exhibited the disregard of images as historical evidence. According to Burke, historians have used images as mere illustrations, reproducing them with no commentaries. When historians discuss the images within the text, "this evidence is often used to illustrate conclusions that the author has already reached by other means, rather than to give new answers or to ask new questions" (Burke 2001).

Francis Haskell asserted that the survey of images as historical evidence has been delegated to antiquarians and other scholars who could claim expertise to study images. Historians have been more inclined to texts, which were considered to have more scientific significance. While discussing the historians' research with the passing of time, Haskell affirmed that historians "showed themselves to be increasingly reluctant to use the evidence offered by art or artefacts when trying to interpret the past." According to him, "historians were concerned not with evoking the past but with deriving moral and intellectual lessons from it, and (as has been frequently pointed out) the study of figured monuments was left to 'antiquarians', whose often imaginative and sometimes brilliant investigations at first made little impact on historical writing" (Haskell, 1993). The main shortage of that split concerned the training of the two groups: antiquarians were not trained with the historian expertise and historians neglected the study of images in their education. Thus, the two groups have developed separated investigations with few interactions between them.

Since images have little impact in historians' education, they have not been prepared to select, to consider their authenticity and to interpret them; they overlook images or use them inappropriately in their work. Historians need to carefully examine images, like texts, to be used as evidence of any account from the past. The problems of interpreting texts as historical evidences in order to reveal what really happened in the past, which were already overviewed in this dissertation, are parallel to image evidences. However, the process of applying images in historical research presents

several differences from text documents. Even though, historians have often disregarded images in their research, some of them need to rely on those evidences. Some specific areas of history don't present enough – or even none – written records. Historians dealing with minorities, or with several important social groups that were not represented in official documents, or even with antique history, have few remaining traces to study and most of them are images. The great majority of these images were not portrayed with the intention to be read as historical documents. Therefore, historians need to understand the context in which they were produced in order to elaborate a cautious approach towards their interpretation.

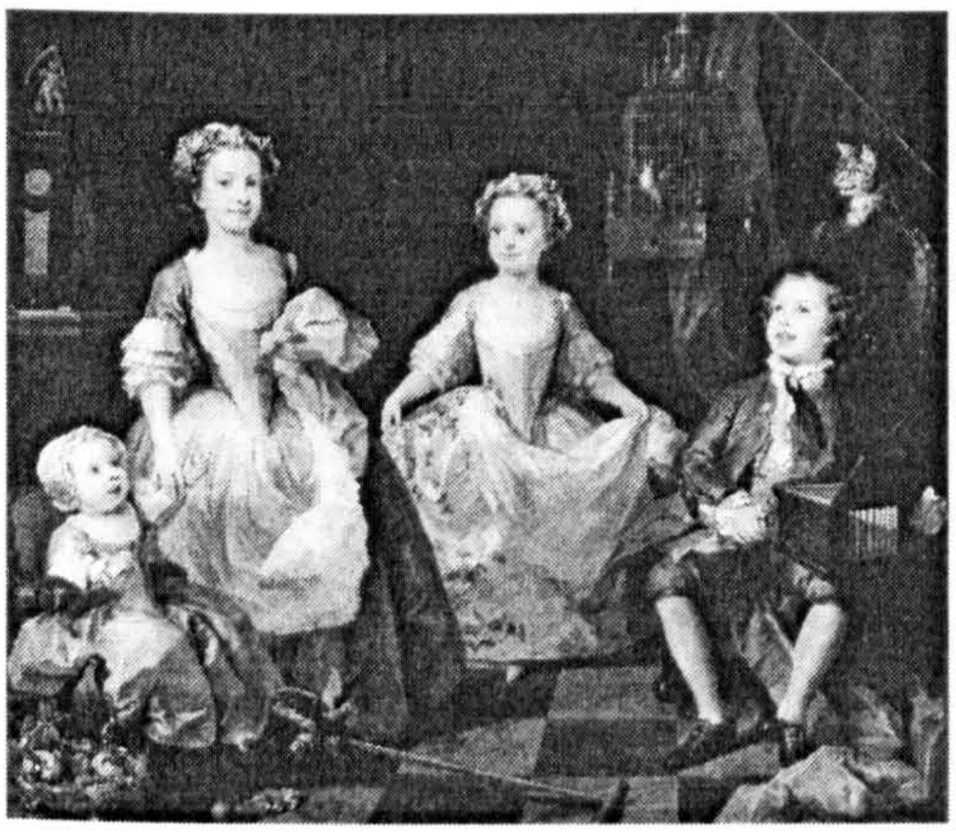


Figure 2.4: William Hogarth, "The Graham Children", 1742, oil on canvas (Burke 2001)

Philippe Ariès, for example, is recognized for his study of the childhood and family. Few written documents remained from the past, which could support his investigation. Thus, several conclusions were taken based on images. He often wrote about the process of image interpretation, although he included few images in his final publication. Burke, who identified problems that had already been criticized by other authors, discussed Ariès' interpretations based on images. Ariès, for example, stated that adults didn't show much concern for children and that children were treated as adults in the Middle Ages. He based his arguments on some paintings representing children as miniature adults, who were portrayed wearing adult clothes (Figure 2.4). Additionally, very few paintings were found exhibiting children. Burke reminds that a portrait was something special and children should be always depicted in their best clothes. Consequently, these paintings should not be regarded as a proof that children would always wear adult clothes in their everyday life. On the other side, paintings were

very rare in the Middle Ages and were more often associated with religious subjects. According to Burke, the only connection that children had at that time with the Church was through the image of Christ. Therefore, paintings were not used at that time to illustrate secular subjects (Burke 2001).

A cautious interpretation of images can reveal several aspects of the society that created them. A direct translation of the facts portrayed in a painting presents several risks enumerated by Burke (2001). Images are often biased. As texts they were a product of an individual or a group of people. Any image as a representation, tend to convey a 'political' message. The authors select what will be shown and what will be neglected. Thus, the authors' decision carry prejudices but also a richness of information related to that time. The role of historians who read those images is to identify what was deliberately changed, and what is left from the actual view. The changes produced by the artists – and by those who commissioned their work – in the actual scene, expose several aspects of the culture of that time. Those images were often created for propaganda or they attempted to portray an idealized world, with the authors removing what they considered imperfections. Even photographs, which were claimed to carry the exact image of what had happened, were vehicles of propaganda and presented the photographer's choices. Lewis Hine reminded that "while photographs may not lie, liars may photograph" (Hine as quoted by Burke 2001). There were also some technical problems which could affect the reliability of photographs. In early photographs, for example, the cities were portrayed deserted. That should not be interpreted as if people would stay mostly indoors. The explanation for those pictures was the attempt of the photographers to eliminate the blurring in the image caused by the rapid movement of people (Burke 2001).

Haskell remembered that the artists feared the end of painting with the widespread of photography. It is true that painting's roles associated to recording contemporary events were taken by photography. However, it may sound paradoxical, but at that time

historians became more aware of any kind of image, including those created long before the invention of photography. According to him, "the evocative appeal of historical illustrations can, in fact, be traced back to the seventeenth and eighteenth centuries. It was not, however, until the second half of the nineteenth that theories adumbrated by Hegel and others to the effect that 'the arts, taken as a whole, are the truest expression of society' first reached a wide public. The claim was made in 1871 by Paul Lacroix, a pioneer in the production of lavishly illustrated volumes devoted to social life in earlier ages. 'Of all that an epoch can leave to succeeding ages,' he asserted, 'it is art that represents it most vividly ... the arts of an epoch bring it to life and reveal it to us'" (Haskell 1993).

Burke gave some advice for the interpretation of images and the contemporary culture. He reminds that "images give access not to the social world directly but rather to contemporary views of that world ... Historians cannot afford to forget the opposite tendencies of image makers to idealize and satirize the world which they represent" (Burke 2001). The testimony of images, as Burke continued, should be placed in the overall society's contexts – Burke (2001). advised that 'contexts' should be addressed in plural, relating to different aspects such as "cultural, political, material and so on." The conventions of representation from that time should be included within those contexts. Therefore, historians should pay attention on how children, for example, are represented when they are studying a certain period or looking for a specific information. Additionally, historians should read between the lines, as in texts, "noting the small but significant details – including significant absences – and using them as clues to information which the image-makers did not know they knew, or to assumptions they were not aware of holding" (Burke 2001).

Peter Burke illustrated his advice with a photograph taken in 1865's Rio de Janeiro, by the German photographer Augusto Stahl. The image exhibits in its center a street directed against the central part of the city. On the left bottom part, the picture displays

partially a one-floor building which seems to be a bar. Some people were inside the building and others outside (Figure 2.5). Burke warned that, since the construction appears incomplete at one side of the photograph, it was not the focus of the photographer attention. Thus, he should not be paying attention to those people who were standing there and, therefore, they should be acting as they normally did, without any influence of the photograph's author. Burke noticed that those people were wearing hats but no shoes and that should be an evidence of a convention which seemed to be odd to the European standards. If a hat was not as necessary as a pair of shoes in Europe, the opposite should be the case for Brazil where a mix of climatic and social reasons justified it. According to him, "so far as the history of material culture is concerned, the testimony of images seems to be most reliable in the small details" (Burke 2001).

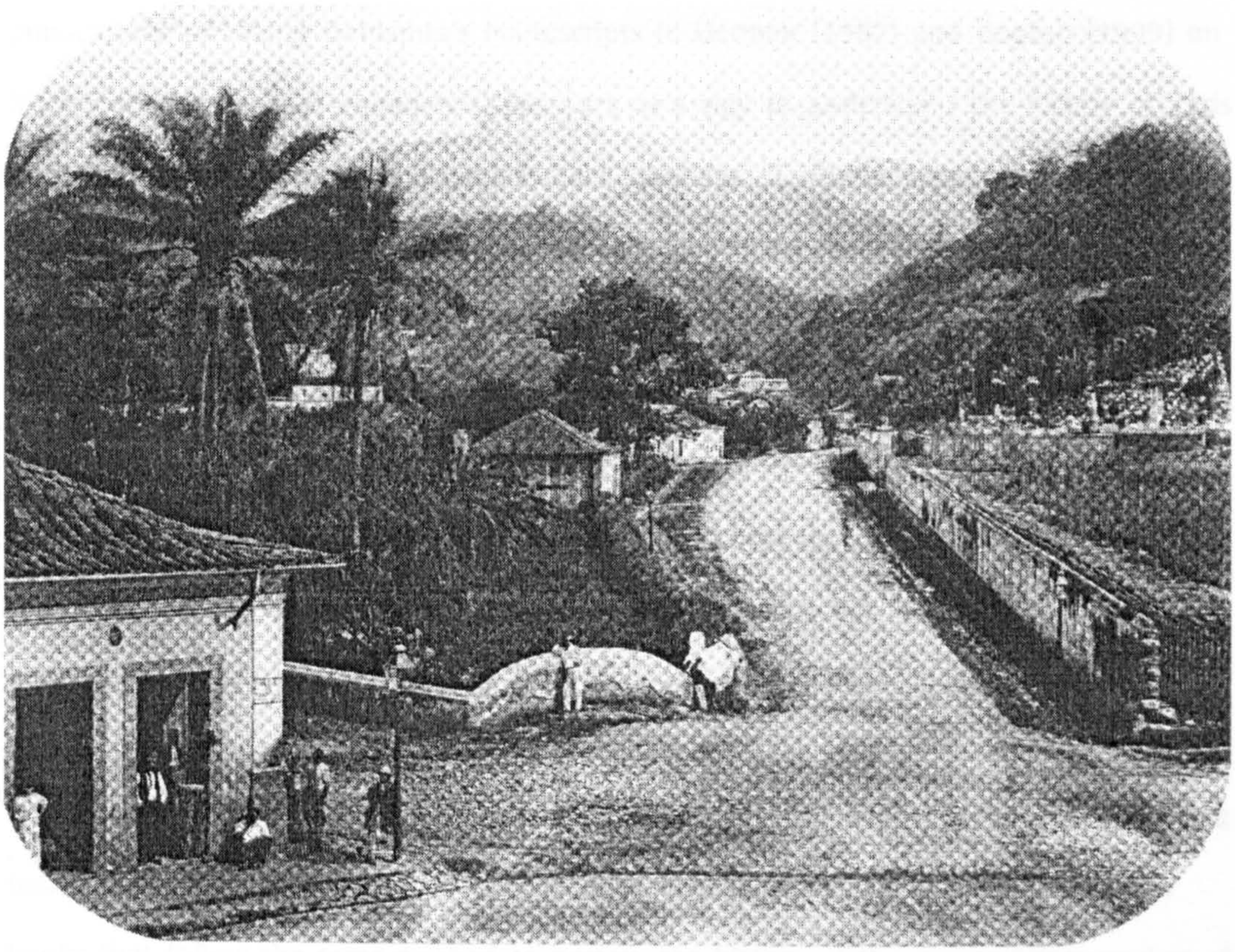


Figure 2.5: Augusto Stahl, Rua da Floresta, Rio de Janeiro, 1865, albument print (Burke 2001

2.3. *Understanding and representing the culture of cities through the investigation of their buildings' history*

The historians' research and particularly, their representation were examined in the preceding topics: both in the narrative form and through images. In order to focus into the cultural history of cities, and more specifically through the analysis of their architectural and urban artifacts, four acclaimed and diverse books were selected to be examined in this study due also to their ingenious representation methods. Although one of the focuses of this dissertation is the digital representation, those four projects were carried out with traditional instruments and published in book formats. The creativity of all those projects, however, is critic for this study and their analysis should bring significant insights and contributions to electronic technology research.

The first project, "Das Passagen-Werk" or "The Arcades Project," contains the publications of Walter Benjamin's manuscripts in German (1982) and English (1999) on his investigation of the commercial passages as a way to understand the history of Paris in the XIX century. The second work is Rem Koolhaas' "Delirious New York: A Retroactive Manifesto for Manhattan," which explores the history of Manhattan through the "the symbiotic relationship between its mutant metropolitan culture and the unique architecture to which it gave rise" in the regularity of the city grid (1994). The other two books are quite different works. The illustrated books from David Macaulay and Albert Lorenz are usually classified as children literature due to the focus on images rather than texts. Albert Lorenz published "Metropolis: ten cities, ten centuries" (1996) aiming to present the history of civilization from the 11th to the 20th centuries. David Macaulay's book is actually a set of books referring to the history of construction of important buildings and, in one case, a city. The review of his work will focus in his first book "Cathedral: the story of its construction" (1973), although he has several other books that follow the same method to portray the history of the construction process of

a significant building and the cultural history of the community involved in that process.

Since the works are so different, they were analyzed differently in this chapter. Although Koolhaas' and Benjamin's works follow very diverse methods, they have more similarities in structuring their arguments, mainly through texts, while the others are based primarily in images. Both Koolhaas' and Benjamin's books present particular literary structures. Benjamin's manuscripts were published as an assemblage of fragments of citations with few commentaries by his own. The German version is ordered chronologically, in the same sequence as he collected them, in the first half of XX century, while the English version published his notes grouped by subject, following codes he entered before each piece. Walter Benjamin died during the II World War and it is not clear if he intended to use the "Arcades document" just as raw material to elaborate other literary projects. Even if that would be his aim for the manuscripts, the rich material meticulously organized can be considered as a clear representation of one of the most significant research of our era's cultural history. It is evident that "underlying these fragmentary pieces of data and minute historical details, there is a coherent and persistent philosophical design" (Buck-Morss, 1991).

Koolhaas doesn't like the word fragment to define his analysis. He prefers to define his method of writing as episodes. According to him: "The great attraction of episodes [...] is that between them there is a space in which you don't have to make things and links. But which even so have an autonomous power if the episodes are well put together. It is not stated explicitly but the linking alone is enough to allow you to make things" (Koolhaas' interview in Craven 2001). As way to facilitate the linking and searching, he placed one-word section headings, such as "Lobotomy," "Automonument," "Void" or "Ballet," before each block of text. These headings powerfully synthesized his view of that theme and would later appear in his other publications (Koolhaas, 1994).

Furthermore, the one-word headings facilitate to search and read episodes and text segments separately.

The literary structure used to analyze Paris' and New York's history facilitates the presentation of some of their different aspects. It is also interesting to notice that in both cases, the act of reading is similar to the process of experiencing the city: a patchwork of juxtaposed layers of information, which are combined by the readers as they progress in their 'experience'.

The other group constituted by the history books from David Macaulay and Albert Lorenz do not seem to fit with the other two projects reviewed in this study. Their work is based mainly in illustrations and is usually presented as architectural and urban history books for children. However, similarly to Benjamin's and Koolhaas' books they display a creative form of representing the culture of past cities through analyses of architectural and urban artifacts. Even though some of them are used in architectural courses at universities, academic works usually disregard them as source of investigation. Their drawings restore the construction process in previous moments in history and, doing so, they exhibit the cultures that supported those methods and the lives that inhabited those spaces. That was the main connection between them and Benjamin's arcades or Koolhaas' skyscrapers and the reason they are included among them. Another significant issue is that both authors – Albert Lorenz books have the contribution of Joy Schleh – apply architectural techniques to display buildings from the past unveiling constructions methods and the intentions of those involved in the process.

Although very different in their conception, all these books resemble a hypertext

system structured by pieces of texts or images, which can be read independently. Koolhaas fully illustrated episodes and Benjamin's collection of quotations exhibits some characteristics envisage by digital project designers. Benjamin also developed a very complex system for cataloguing the historical citations. He used different codes to facilitate the retrieving of information and photocopied them to keep more than one version of that enormous work. It is hard to imagine that Benjamin would not use a digital database if his project were developed today and he probably would use a hypertextual structure to make it available for the readers. The use of image connected to text in Macaulay's books could easily and successfully be adapted to a web page. In fact, he already developed a CD-ROM version of one of his books. Lorenz's "Metropolis" seems to be a book version of an elaborated hypermedia system. The amount of information he can communicate in just one illustration seems almost impossible to be achieved by an analog project published in a book format.

2.3.1. The "total historic event:" Walter Benjamin's "ur-history"

In the 13 years that preceded his death in 1940, Walter Benjamin dedicated most of his time to a major research project concerned to XIX century Paris' history. It seems that he could never finish his work and his notes became one of the most remarkable documents of the history of Paris' culture in XIX century. Benjamin considered that project as the most important of his life. In a letter to his friend Gershom Scholem he commented about "the

Figure 2.6: Walter Benjamin at the card catalogue of the Bibliotèque Nationale in Paris, 1937. Photo by Gisèle Freund (Benjamin 1999)

theater of all my struggles and all my ideas" (Benjamin as quoted by Buck-Morss 1991). While escaping from the Germans who had already entered in France, towards Spain, he did not carry anything but the manuscripts of the Arcades Project. Although Benjamin never wrote about electronic technologies and his work does not present a through urban or architectural study, his investigation has many relevant aspects to this dissertation.

Benjamin started his research from an architectural typology, which had its origin, apogee and decay in the XIX century. Through that typology, the commercial arcades which crossed traditional city blocks as subversive devices, he traced a cultural history of the city. Correspondingly to their physical configuration, they hosted and represented an obscure system in Parisian society. Several characters that were not much exposed in the "official history" of Paris, such as prostitutes, collectors, gamblers and the "flâneurs" shared that space with the traditional families of the city. Benjamin's investigation had a significant political and pedagogical intention. He wanted to create

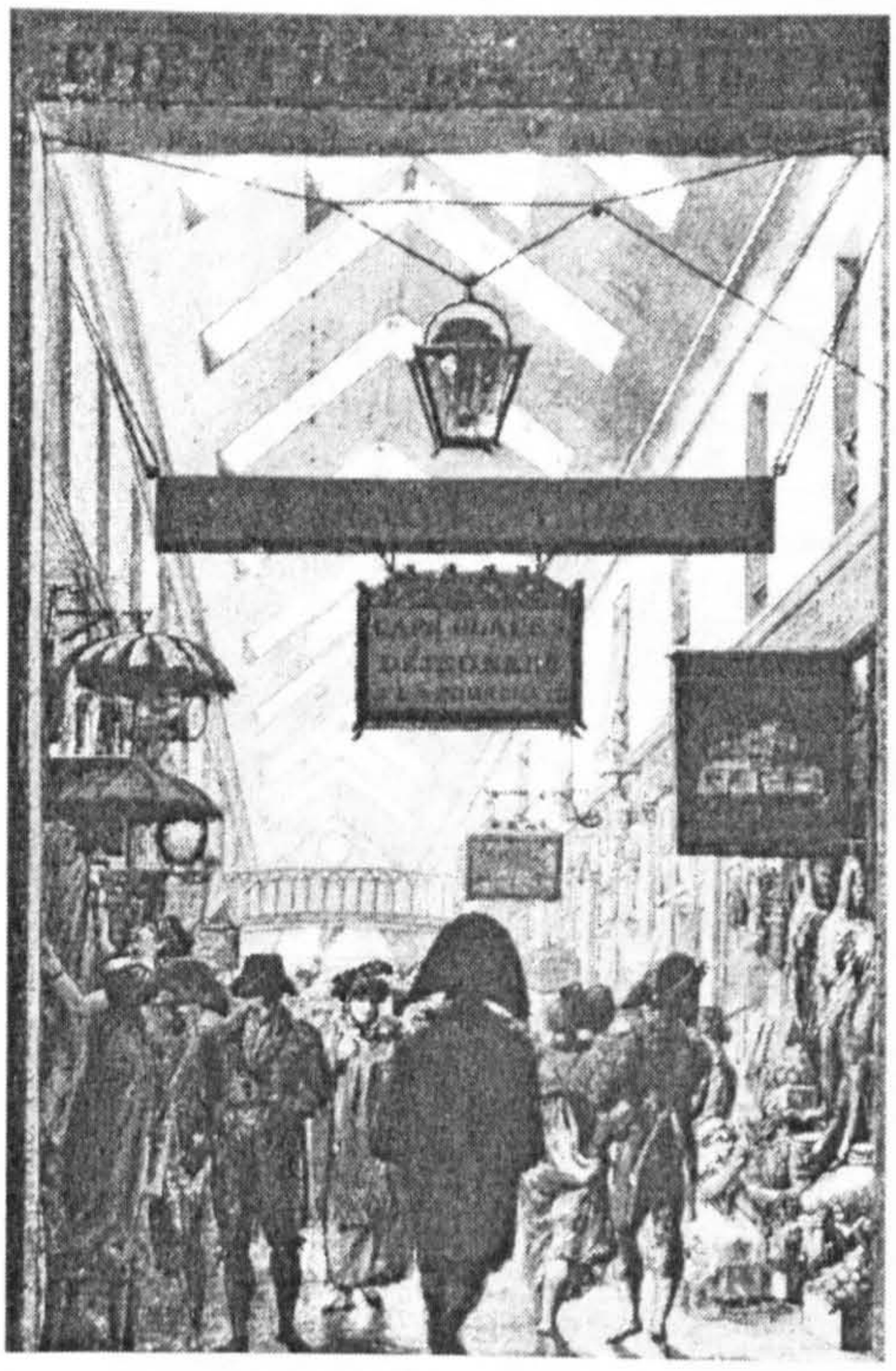


Figure 2.7: The Passage des Panorama. Watercolor by an unknown artist (Benjamin 1999)

Figure 2.8: The Passage des Panorama, 2003. Photo by José Kós

a device that would allow an innovative understanding of his time and originate movements towards the future transformation of society. Walter Benjamin claimed that "all history writing is a story of the triumph of bourgeois values and represents the posthumous reconstruction of fragmented events according to a completely fabricated architecture" (Boyer 1994). His objective was to dig from a myriad of sources in order to reveal a history which had not yet been written. Paris' arcades were his instruments to unveil this hidden history of the city. His notes were the legacy, documented in fragments and organized in an ingenious structure. Some authors speculate that they represent an intuition of today's computer technologies (Bolle 1998).

Benjamin was convinced that the arcades were the most significant architectural form in the XIX century and could be used as a connection to numerous meaningful issues of his previous century. (Eiland and McLaughlin 1999) The commercial arcades originated

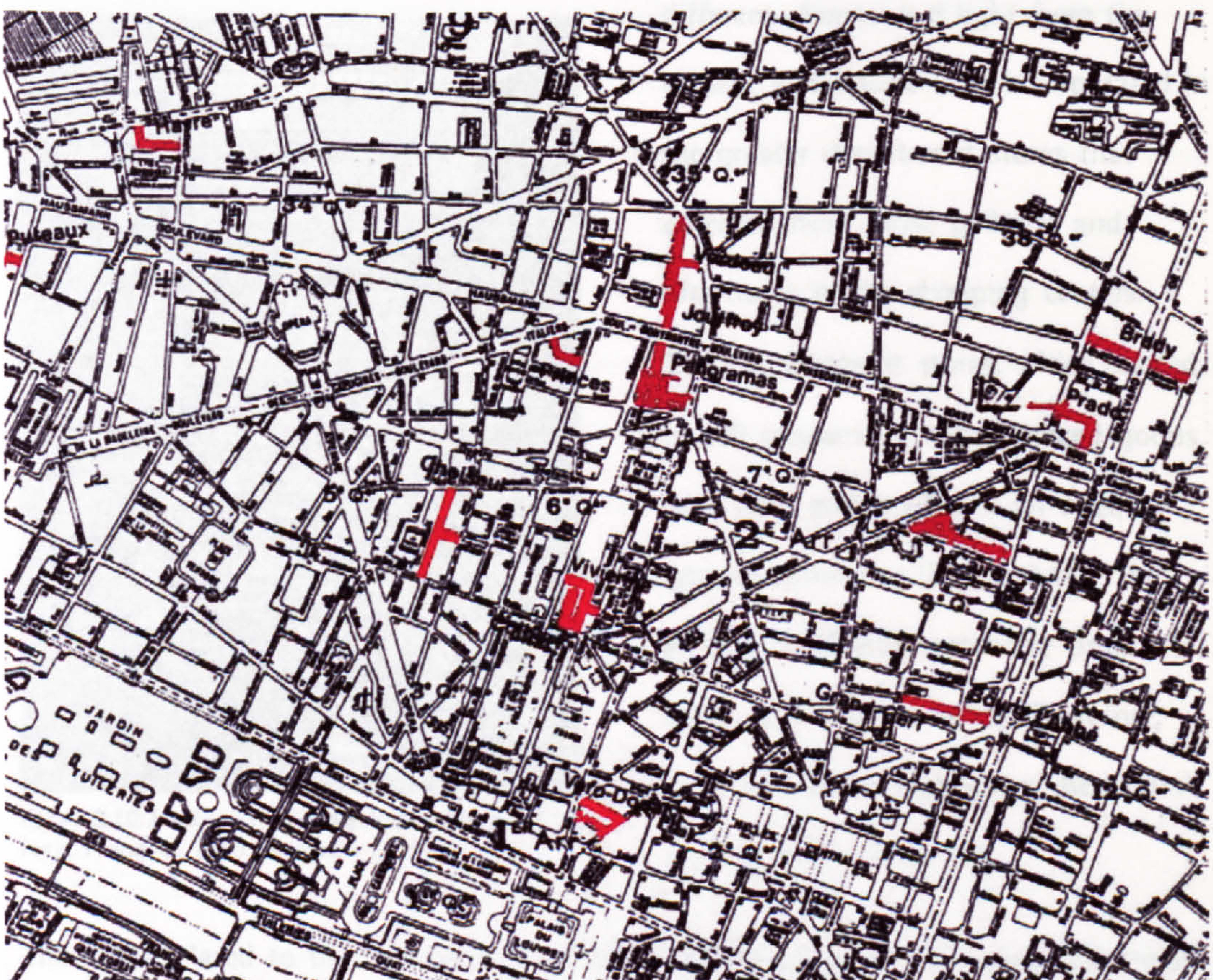


Figure 2.9: Location of some of the arcades in the Parisian grid

mostly as cast iron structures housing fancy stores and restaurants. They were luxury establishments and one of the first iron constructions. The most famous merchants, who wanted to assure their reputation, disputed avidly their spaces (Benjamin 1999).

The arcades constituted urban systems that disrupted the structure of traditional blocks in Paris (Figure 2.9). They cut the blocks through internal alleys creating alternative and distorted connections between the established streets in the grid with symmetrical and organized constructions. These galleries expressed the irrational labyrinths opposed to the urban reasoning of the French capital. Their passages, with relatively narrow openings to the street, were covered with glass which filtered the day-light to the interior. Almost hidden during the day, they were really revealed at night when the bright lights from their corridors shone through the glass roof towards the somnolent city. The interior was a world in miniature (Benjamin 1999). The characteristics of a different climate and light from the outside world were later incorporated in the greater department stores that emerged from those galleries and afterwards in the shopping centers. These department stores, which started to sell guaranteed industrialized goods with fixed prices, offered an unequal type of commerce (Figure 2.10). The arcades displaying expensive products could no longer compete. Therefore, their decadence highlighted Benjamin's underground characters.

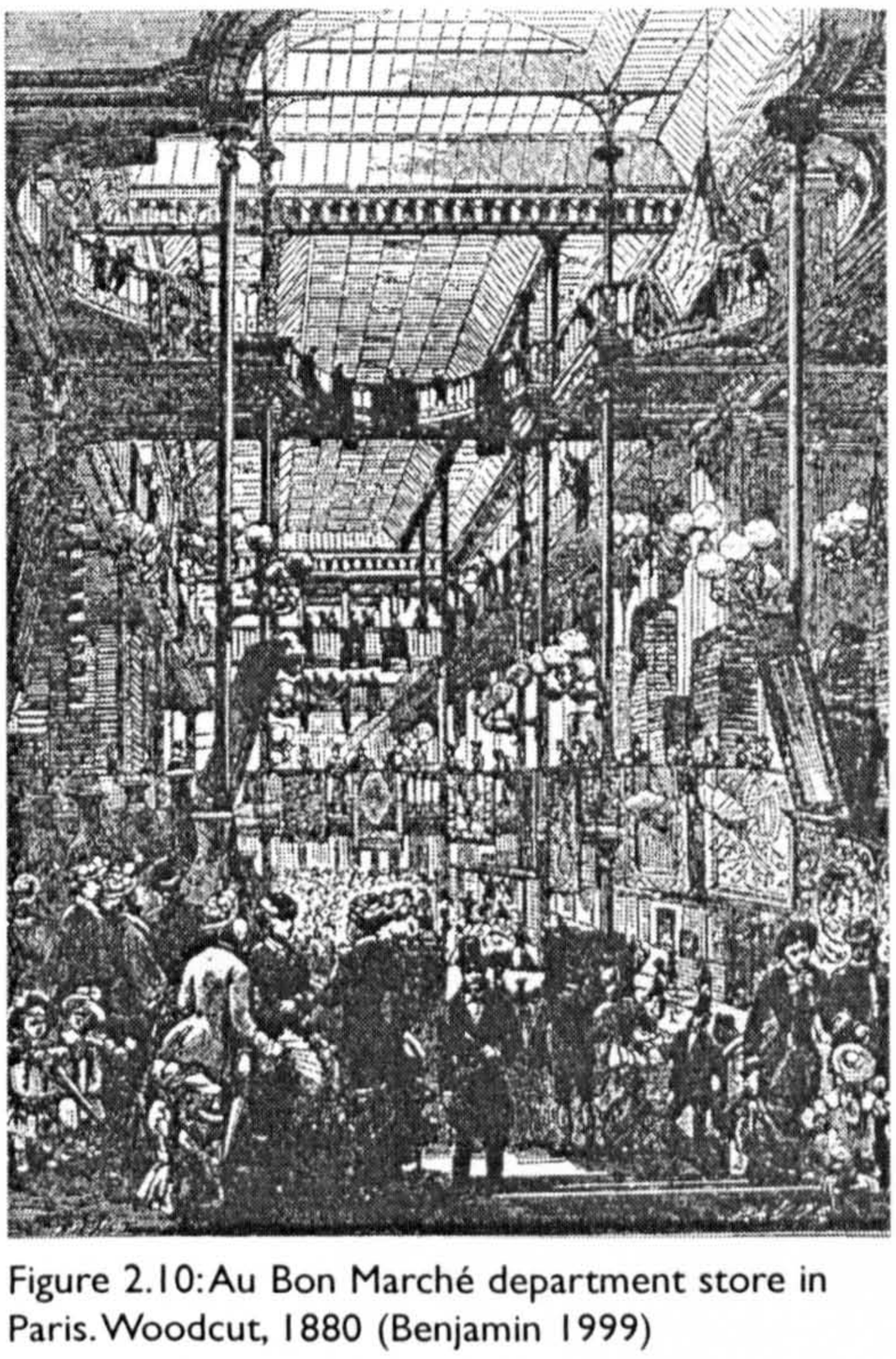


Figure 2.10: Au Bon Marché department store in Paris. Woodcut, 1880 (Benjamin 1999)

The notes related to the Parisian arcades and collected by Benjamin throughout those 13 years ranged from a great variety of subjects. He dug into the arcades and picked

out citations that referred to motifs such as Haussmann, photography, prostitution, Baudelaire, iron construction, social movement, panorama, or fashion. Through those citations, Benjamin attempted to reveal the city's 'ur-history.' He borrowed this term from Goethe, who had coined in his scientific research a parallel term: 'ur-phenomenon', "the essential pattern or process of a thing. Ur- bears the connotation of primordial, basic, elemental, archetypal; the ur-phenomenon may be thought of as the 'deep-down phenomenon,' the essential core of a thing that makes it what it is and what it becomes" (Seamon 1998).

In one of the citations form the Paris Arcade, Benjamin explains the parallels between Goethe's study of nature with his historical investigation through the Paris arcades: "In studying Simmel's presentation of Goethe's concept of truth, I came to see very clearly that my concept of origin in the *Trauerspiel* book is a rigorous and decisive transposition of this basic Goethean concept from the domain of nature to that of history. Origin – it is, in effect, the concept of Ur-phenomenon extracted from the pagan context of nature and brought into the Jewish contexts of history. Now, in my work on the arcades I am equally concerned with fathoming an origin. To be specific, I pursue the origin of the forms and mutations of the Paris arcades from their beginning to their decline, and I locate this origin in the economic facts. Seen from the standpoint of causality, however (and that means considered as causes), these facts would not be primal phenomena; they become such only insofar as in their own individual development – 'unfolding' might be a better term – they give rise to the whole series of the arcade's concrete historical forms, just as the leaf unfolds from itself all the riches of the empirical world of plants" [N2a,4] (Benjamin, 1999).

Benjamin's 'ur-history' was to be discovered from the historians' leftover. The 'rags' and 'refuse' were his primary material to erect an image of the past: a critique of the bourgeois' culture and a method to understand the origins of present's utopia. For Buck-Morss, "whichever form they took, such images were the concrete, 'small, particular

moments' in which the 'total historical event' was to be discovered, the 'perceptible ur-phenomenon' in which the origins of the present could be found" (Buck-Morss 1991).

The method to elaborate that material was 'purely montage.' Those fragments should be displayed as they were, without any elaboration. His task was to show the smallest components that would allow the comprehension of the 'total event' (Benjamin 1999). The citations were taken from a huge variety of sources from the previous century and many from his recognized contemporaneous intellectuals such as Marcel Proust, Paul Valéry, Louis Aragon, André Breton, Georg Simmel, Ernst Bloch, Siegfried Kracauer and Theodor Adorno.

In order to organize the already large number of collected quotations, Benjamin created a filling system based on the early motifs (Figure 2.11). The system of Konvolut assigned the quotations to those motifs or key words. To each keyword a letter was assigned and the quotations were numbered as he was collecting them. Thus, every quotation is associated to a code of letters and numbers being grouped in the Konvolutes. Every quotation is parallel to an object, which would expose an image of the epoch it came from. "These proliferating individual passages, extracted from their original context like collectibles, were eventually set up to communicate among themselves, often in a rather subterranean manner," as in a street congested with signs and store windows (Eiland and McLaughlin 1999).

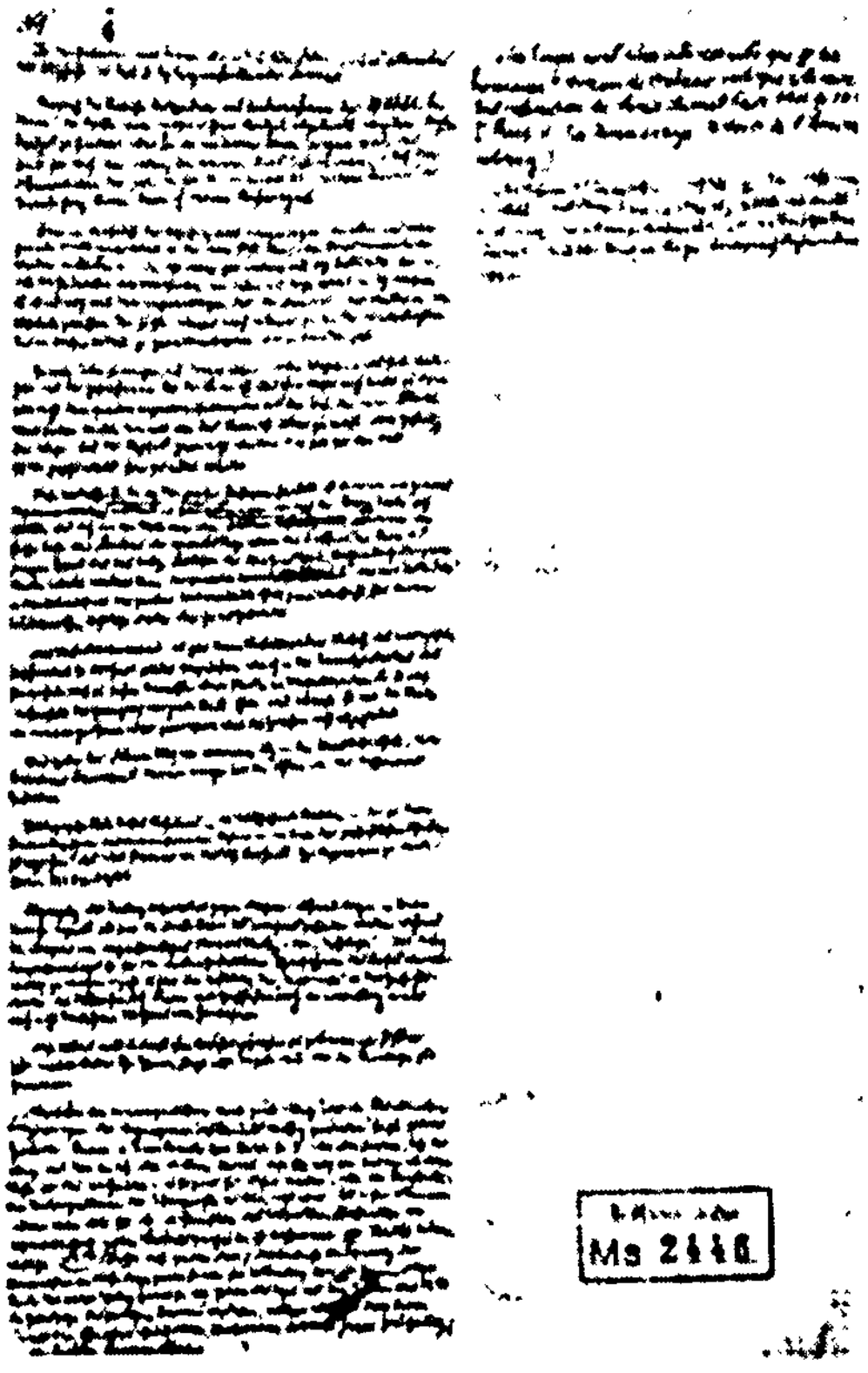


Figure 2.11: Konvolut **N** from Benjamin's manuscripts (Buck-Mors 1991)

Besides the idea of displacing fragments of texts in order to create the image of the past, Walter Benjamin started to collect in the mid-thirties, actual images. He had the access to a collection called "*Topographie de Paris*" of 150.000 images such as maps, drawings, press clippings, postcards, photographs, and posters, classified by *arrondissements* and streets. He made several copies of some selected items but his image album was never found. "If such research in iconographic documentation was 'still rare' among historians, it was unheard of among philosophers" (Buck-Morss 1991).

"In quite conventional neo-Marxist terms, he claims that the concept of progress, forfeited its critical power when 'the 'bourgeoisie conquered its power positions in the nineteenth century.' But quite unconventionally, he attempts to document this claim visually, in terms of the physical transformation of the city of Paris" (Buck-Morss 1991). History was his instrument to awaken his generation with a political education. He attempted to dig the origins of the present moment, which became visible through the "the world of industrial objects as fossils, as the trace of living history that can be read from the surfaces of the surviving objects" (Buck-Morss 1991). It was not the traditional history of the notorious people that could deliver the material he was searching. The hidden historical truth, the ur-history had to be searched in the material historians neglected. "Not conceptual analysis but something like dream interpretation was the model. The nineteenth century was the collective dream which we, its heirs, were obliged to reenter, as patiently and minutely as possible, in order to follow out its ramifications and, finally, awaken from it" (Eiland and McLaughlin 1999).

With the Paris arcades several unique urban characters appeared. They shared the luxury spaces of the arcades with the rising bourgeoisie. The luxury that was previously restricted to palaces became accessible to the public. Therefore, everyone who strolled urban renovated areas, the boulevards and parks, or visited the arcades, museums, and other public monuments "could experience the splendor of the modern city" (Buck-

Morss 1991). Those people such as the prostitutes, the gamblers or the *flâneurs* revealed to Benjamin the hidden historical image.

The *flâneur*, the stroller on Parisian streets, was a critical figure in Benjamin's musings. He was "the 'ur-form' of the modern intellectual. The *flâneur*'s object of inquiry is modernity itself. Unlike the academic who reflects in his room, he walks the street and 'studies' the crowd" (Buck-Morss 1991). Paris was the ideal 'landscape,' which brought forth the *flâneur*. That modern figure presented an alternative for the intellectuals who filtered the information, through preconceived theories, disregarding its essence. Benjamin aimed a sort of *flânerie* as a method of navigating through his notes. The arcades should guide the readers through the real city. That was the city which Benjamin meant as the dwelling of the collective, and the arcades synthesized that familiar interior character for the masses (Benjamin 1999). That city was often purposely neglected by most authors in order to perpetuate an ideal order of bourgeoisie. Benjamin's aim is to recall through his work that actuality of XIX's Paris.

There are no final conclusions for Benjamin's goal towards the "Arcades Project." Theodor Adorno, who kept the manuscripts' copies for several years, suggested that

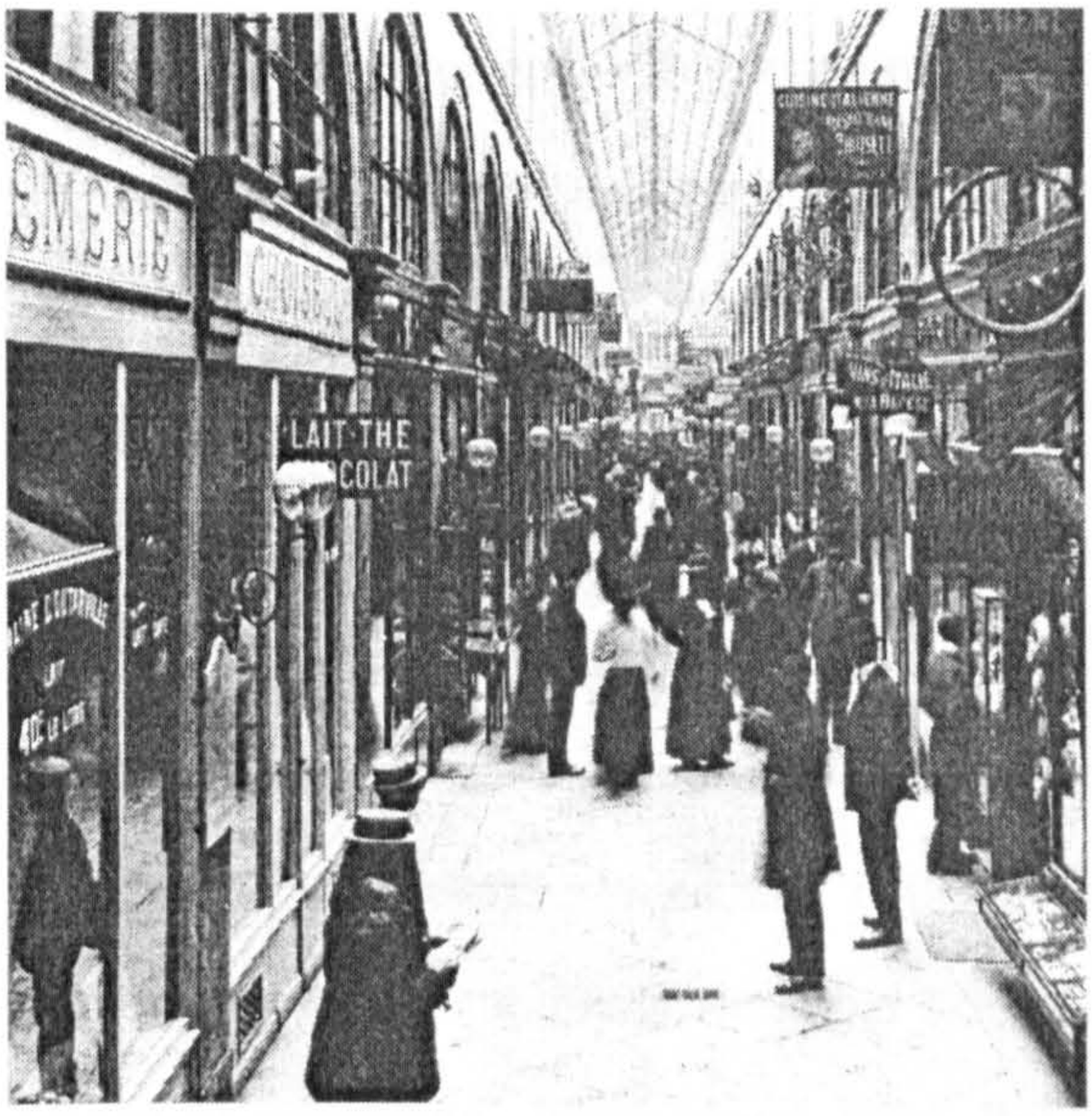


Figure 2.12: The Passage Choiseul, 1908 (Benjamin 1999)

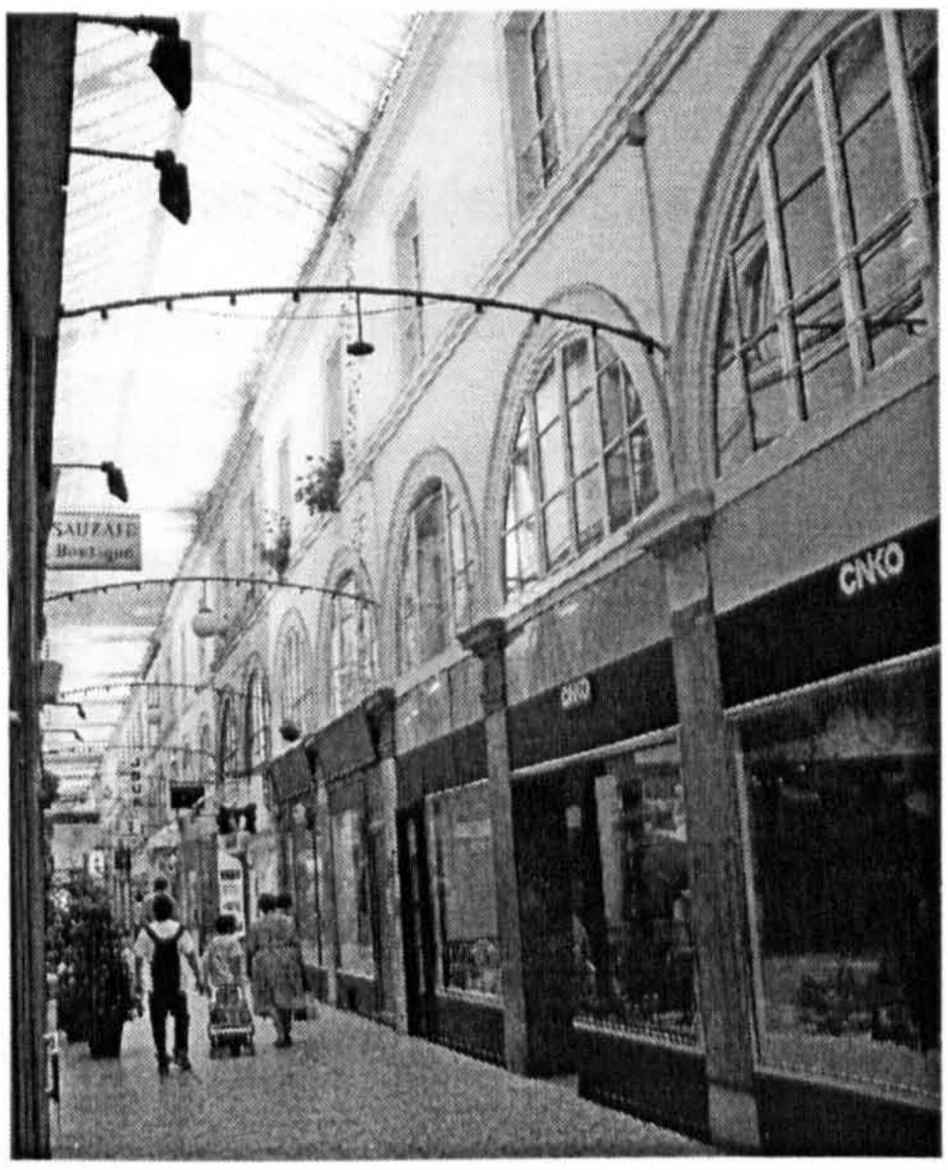


Figure 2.13: The Passage Choiseul, 2003. Photo by José Kós

Benjamin's intention is totally expressed in the manuscripts. Adorno based his arguments on Benjamin's statement that there was no need for any theoretical formulation and the theory would be evidenced through the juxtaposition of citations as a 'montage' (Buck-Morss 1991). On the other extreme, some authors state that the collection of quotations should be applied primarily as raw material for other literary projects. They attest that position with the fact that after Benjamin started to register the quotations, he wrote several articles based on the Arcades' manuscript. Furthermore, he developed a system of codes, selecting some entries that would conclude in a major text synthesizing the Arcades' material (Buck-Morss 1991).

Michel Espagne and Michael Werner formulated an alternative explanation for Benjamin's manuscripts based on some notes found by Giorgio Agamben at the *Bibliothèque Nationale*. According to them, Rolf Tiedemann, the editor of "Das Passagen-Werk," the German version of Benjamin's manuscripts, and a follower of Adorno, did not want to refute his master's hypothesis. Espagne and Werner stated that the quotations are not as important as it has been accepted by most authors. The book on Baudelaire supplanted the previous Arcades Project and the Konvolut system should be considered an initial stage of his research. The manuscripts from the Bibliothèque displayed some color codes that explained the overall plan for the new project. Most of the quotations assigned to color codes referred to the letter J (Baudelaire) and some Konvoluts were not represented at all. Espagne and Werner suggested that the only finished part, "The Paris of the Second Empire in Baudelaire," was taken from the publication of the Arcades Project as if it was not part of the big project. Therefore, according to their explanation, the part of the Baudelaire's book written in 1938 should not be considered a model, but a prelude for the Arcades Project. Against this hypothesis, Buck-Morss argued that if Benjamin had 'abandoned' the greater project, he would not continue filling the other Konvolutes after "The Paris of the Second Empire in Baudelaire" (Buck-Morss 1991, Bolle 2000).

2.3.2. *New York City and Rem Koolhaas*

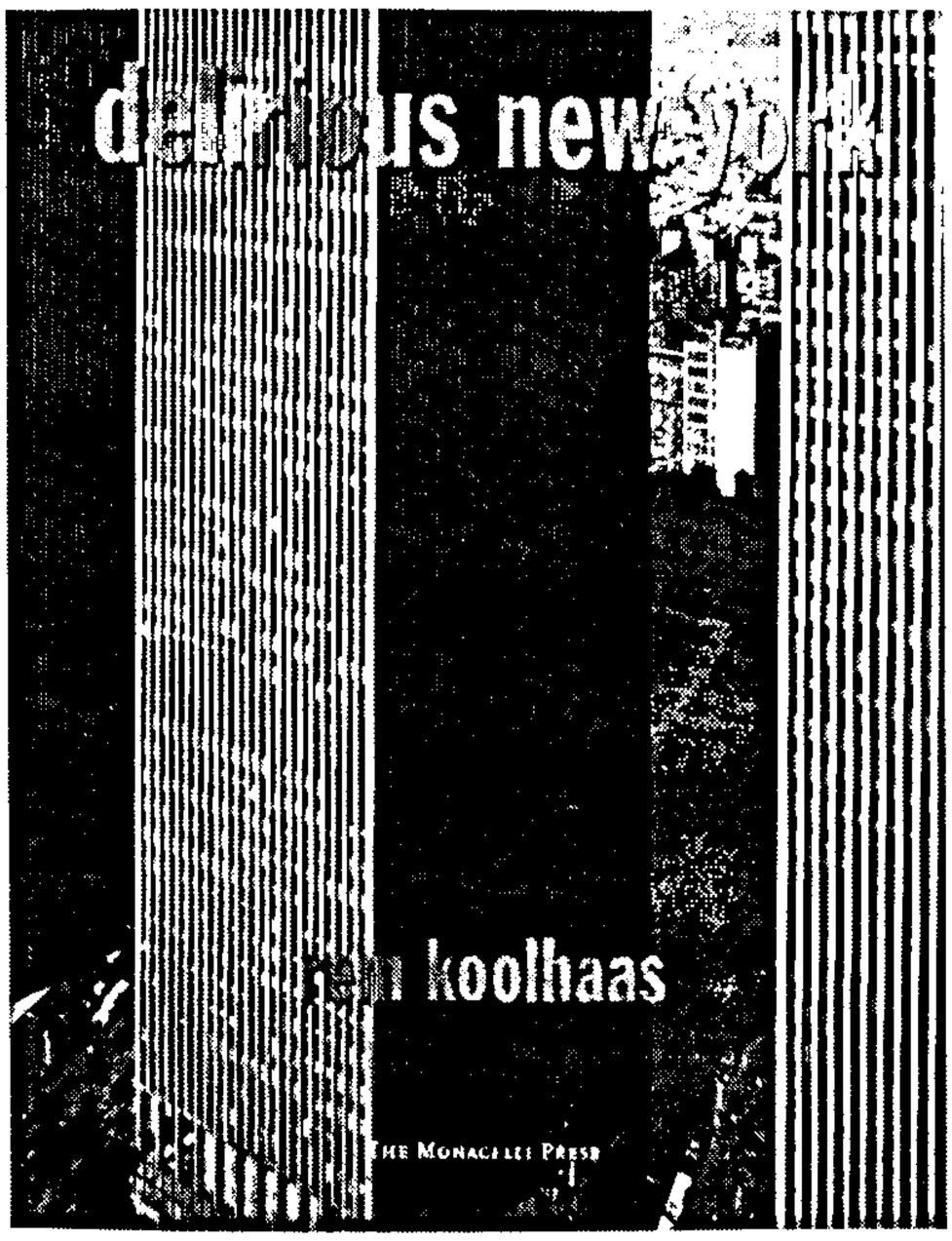


Figure 2.16: *Delirious New York* 2nd edition cover (Koolhaas 1994)

Rem Koolhaas is one of the most prominent current architects and theorists. He started his career as a journalist and a film screenplay writer before studying architecture at the Architecture Association in London. In 1978, he published the first edition of his "Delirious New York: A Retroactive Manifesto for Manhattan". It was the outcome of a scholarship he earned in the early 70s to stay in Manhattan and research its culture and architecture (Illinois Institute of Technology, 2001). The book is fully illustrated with outstanding historical images of the city's buildings and their projects, and an ingenious and sharp critique of the culture of Manhattan through its architecture.

Rem Koolhaas aimed to write a sort of manifesto for New York City. According to him the manifesto should be written "in an age disgusted with them." If the manifestos have their weakness in the lack of evidence, Manhattan has the opposite problem, he continues, "it is a mountain range of evidence without manifesto." Therefore, the book "was conceived at the intersection of these two observations: it is a retroactive manifesto for Manhattan." For Koolhaas, the manifesto for New York was never written because the city was generated in such a radical way that to realize the ambitious program, it could never be openly stated. Therefore, he proclaimed himself as Manhattan's "ghostwriter" (Koolhaas 1994).

The accomplishment of the city grid was the first and probably the most extreme move

towards Koolhaas' argument, for "Manhattanism." "In spite of its apparent neutrality, it implies an intellectual program for the island: in its indifference to topography, to what exists, it claims the superiority of mental construction over reality. The plotting of its streets and blocks announces that the subjugation, if not obliteration of nature - is its true ambition." Blocks and streets are identical. Instead of working with urban solutions to differentiate the various areas of city, the builders had to search for extreme architectural features. Therefore, Koolhaas concludes, the two-dimensional rigidity was set over against a three-dimensional anarchy. Besides that, the limitation of the 2,028 blocks of the grid, limited by the river Hudson, created one major direction for the city's growth: vertically.

Koolhaas declares that his book is "a simulacrum of Manhattan's Grid: a collection of blocks whose proximity and juxtaposition reinforces their separate meanings." For him, each chapter – "Coney Island," "The Skyscraper," "The Rockefeller Center" and "Europeans" – relates to a block, which shows "the progression (and subsequent decline) of Manhattan's determination to remove its territory as far from the natural as humanly possible" (Koolhaas 1994). The blocks with one-word section headings organize the structure of the material, which liberates the text to be often as flamboyant and spectacular as some of Manhattan's skyscrapers. The text blocks follow firm rules similar to Manhattan's grid while the text is free for radical flights.

The limitation of the space in the grid resulted that "one form of human occupancy can only be established at the expense of another. The city becomes a mosaic of episodes, each with its own particular life span, that contest each other through the medium of the Grid." The exploration of those episodes was a powerful tool to expose "Manhattanism." The episodes were not connected to families or personalities but to sites. The evolution of these locations is evidenced in the block between 33rd and 34th streets limited on the east by Fifth Avenue. That particular block, an original virgin site with a farm, two houses, and a barn housed in less than 150 years the Astor Mansions,

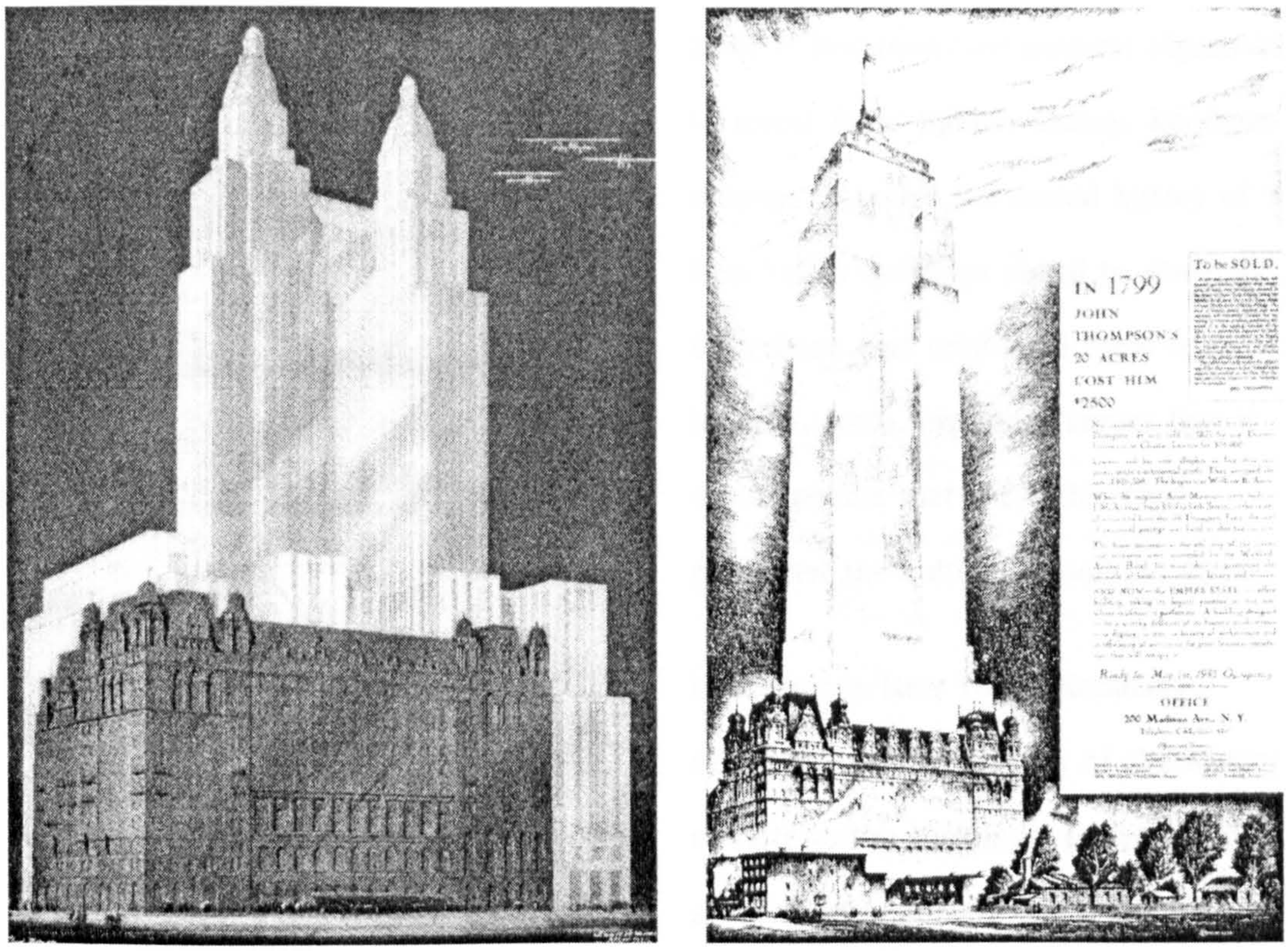


Figure 2.15: The Waldorf-Astoria and the Empire State Building (Koolhaas 1994)

the Waldorf-Astoria Hotel and finally the Empire State Building (Figure 2.15). The latter buildings became two of "Manhattan's most definitive Skyscrapers," and were erected only after the demolition of New York's former landmarks.

"Manhattan is the 20th century's Rosetta Stone. Not only are large parts of its surface occupied by architectural mutations (Central Park, the Skyscraper), utopian fragments (Rockefeller Center, the UN Building) and irrational phenomena (Radio City Music Hall), but in addition each block is covered with several layers of phantom architecture in the form of past occupancies, aborted projects and popular fantasies that provide alternative images to the New York that exists" (Koolhaas 1994). This statement is the motto for "Delirious New York." His process is very similar to Benjamin's investigation of Paris' commercial passages to bring to light the city's "ur-history." The skyscraper is a reduced and synthesized version of the whole Manhattan and Coney Island its subconscious origin. Their study is an effective method to understand the city and also to reveal its hidden history, which is not documented in most historians' work (Figure

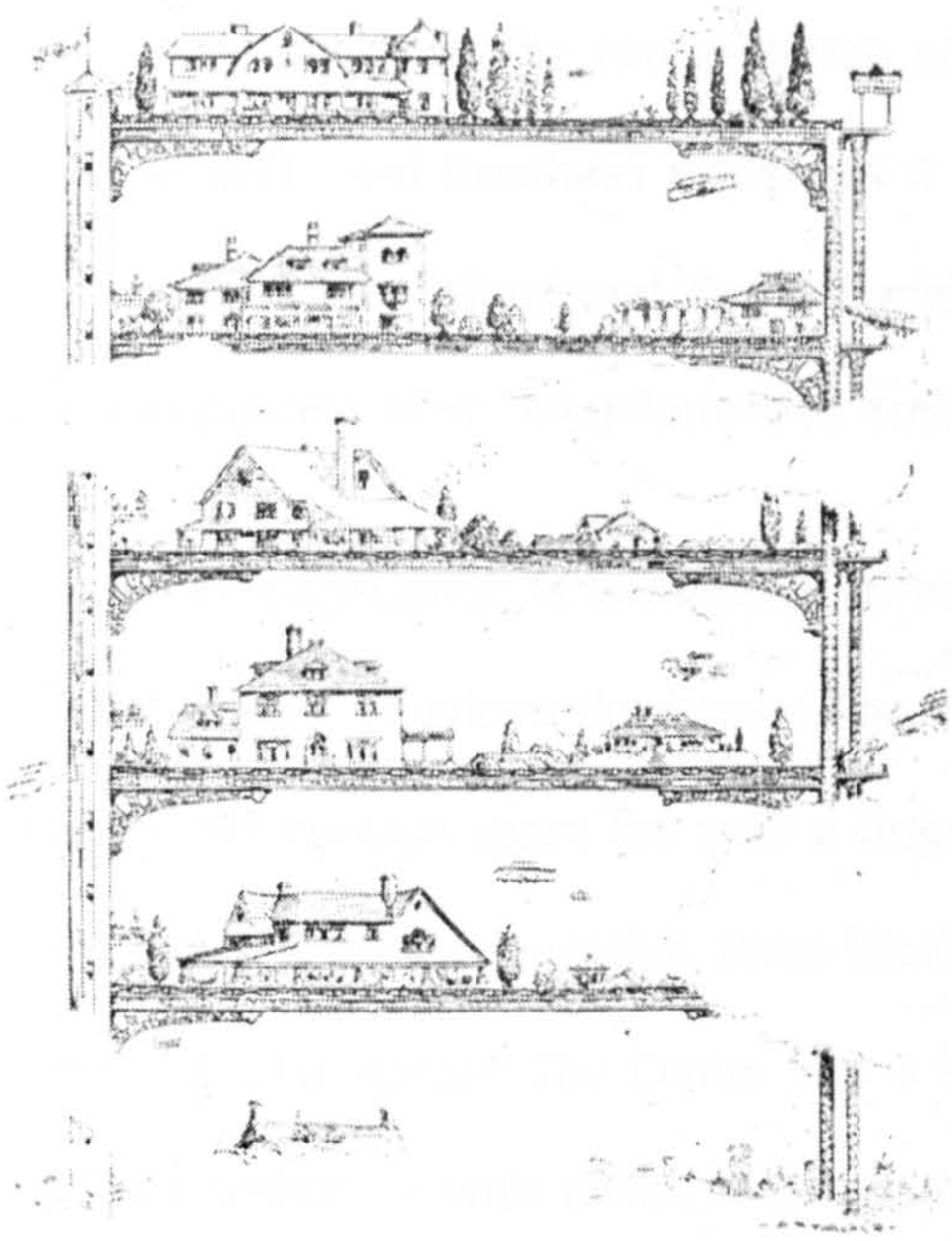


Figure 2.16: "1909 theorem: the Skyscraper as utopian device for the production of unlimited numbers of virgin sites on a single metropolitan location". (Koolhaas 1994)

2.16) If Benjamin had political objectives to reveal Paris' hidden history, Koolhaas attempt to unveil the buried history of New York's buildings aimed to show up the culture that originated them or, in his own words, his book "argues that it often appears that the architecture generated the culture" (Koolhaas 1994).

In "Delirious New York", Koolhaas demonstrated the richness of the history of noteworthy buildings' projects. They are not important just for the history of architecture but to apprehend the culture of a moment that produced great entrepreneurs within the city. These people took important decisions while investing a huge amount of effort and resources to erect those architectural masterpieces. The decisions they took expressed the way the bold elite groups viewed the city's future, but they also affected many city's inhabitants. The projects analyzed by Koolhaas were important landmarks within the urban environment but their significance lies mostly in the way they influenced the construction of the following buildings and ultimately how people lived. Therefore, the cultural environment produced those ideas which, when built, profoundly affected that former culture. Buildings can be exceptional vehicles for cultural changes and investigating them illuminates the society's transformation.

The ingenious analysis that Koolhaas developed from the several architectural artifacts revealed his method to extract the transformation of society from these buildings materialization. Their projects' evolution, the unfolding of the program, the decisions to hire some architects and their solutions often expose the rationale – or lack of it –

for cultural changes. The configuration of a society become clear in the development of those projects and Koolhaas evidenced it in the buildings he chose to investigate, particularly Coney Island and the Rockefeller Center. In those projects it is patent the shaping process of a "megalomaniac ambition of the definitive Manhattan".

The Rockefeller Center is considered to be the "parent of every large-scale urban complex every American downtown has built ever since" (Goldberger 1979a). The "Grid" didn't offer enough space for such a huge enterprise. One block was not enough and the project started connecting three blocks owned by Columbia University, between 48th and 51st streets. The Center was a small version of Manhattan – or Koolhaas' "Manhattanism" – with different programmatic functions such as square, concert hall, office spaces and commercial units. Several paradoxes guided its conception. Koolhaas quoted a 1936 *Fortune*'s article on the Center to display them: "The Center must combine the maximum of congestion with the maximum of light and space", and "all

Figure 2.17: Architects and developers playing with miniatures of the Rockefeller Center (Koolhaas1994)

planning ... should be based upon 'a commercial center as beautiful as possible consistent with a maximum income that should be developed'" (Koolhaas 1994). Koolhaas fully documented, with original drawings and models' photographs, the several versions of the project that had many designers involved. The designers' historical background, particularly Raymond Hood's, were critical to understand their decisions and the importance of some individuals to assemble this magnificent construction. Koolhaas also points out the lack of a great author behind the masterpiece due to the great number of people involved in the project (Figure 2.17). However, it is interesting to relate the background of the authors the different proposals to the evolution of each of all the schemes, until the definitive version which was finally built. Although the authorship is diluted through different designers and entrepreneurs, it is clear the importance of the individuals. If some of them were replaced, the result would be totally different. Probably, its impact on other buildings throughout the country and New York's inhabitants would not be too significant.

Koolhaas has a strong thesis that guides his arguments throughout the book. His notion of "Manhattanism" expresses the perception of a European who comes from a country that is known for horizontal densification. That outsider interpretation is most probably blurred for North Americans, particularly the New Yorkers. Like Jean Baudrillard's "America" (1989) and many other foreigner's readings of America's culture, he succeeded in exhibiting an innovative understanding. The organization of the sections within the book and his writing style facilitated and augmented the communication of his thesis. Koolhaas' original representation was very appropriate for his objective and exposed his architectural background. Architects are educated to adopt a representation method in their projects not only to communicate the technical aspects of the construction but the very representation method should convey the project's concept. Historians and other researchers from social sciences seldom use the potentiality of images and text configuration as tools to conduct an argument.

The incisive, and sometimes irreverent or pretentious, attitude got a great recognition and raised many polemics by "Delirious New York". Paul Goldberger, an important researcher of Manhattan's architecture, argues about Koolhaas' scientific procedure. He claims that Koolhaas analyzes an ideal situation – "a *theoretical* Manhattan, a *Manhattan as conjecture*" –, which is moved by irrationality and would explain the city while the latter is just "the compromised and imperfect realization" (Koolhaas). According to Goldberger, that statement would be a wise way to avoid any corroboration of his theory (Goldberber 1979b).

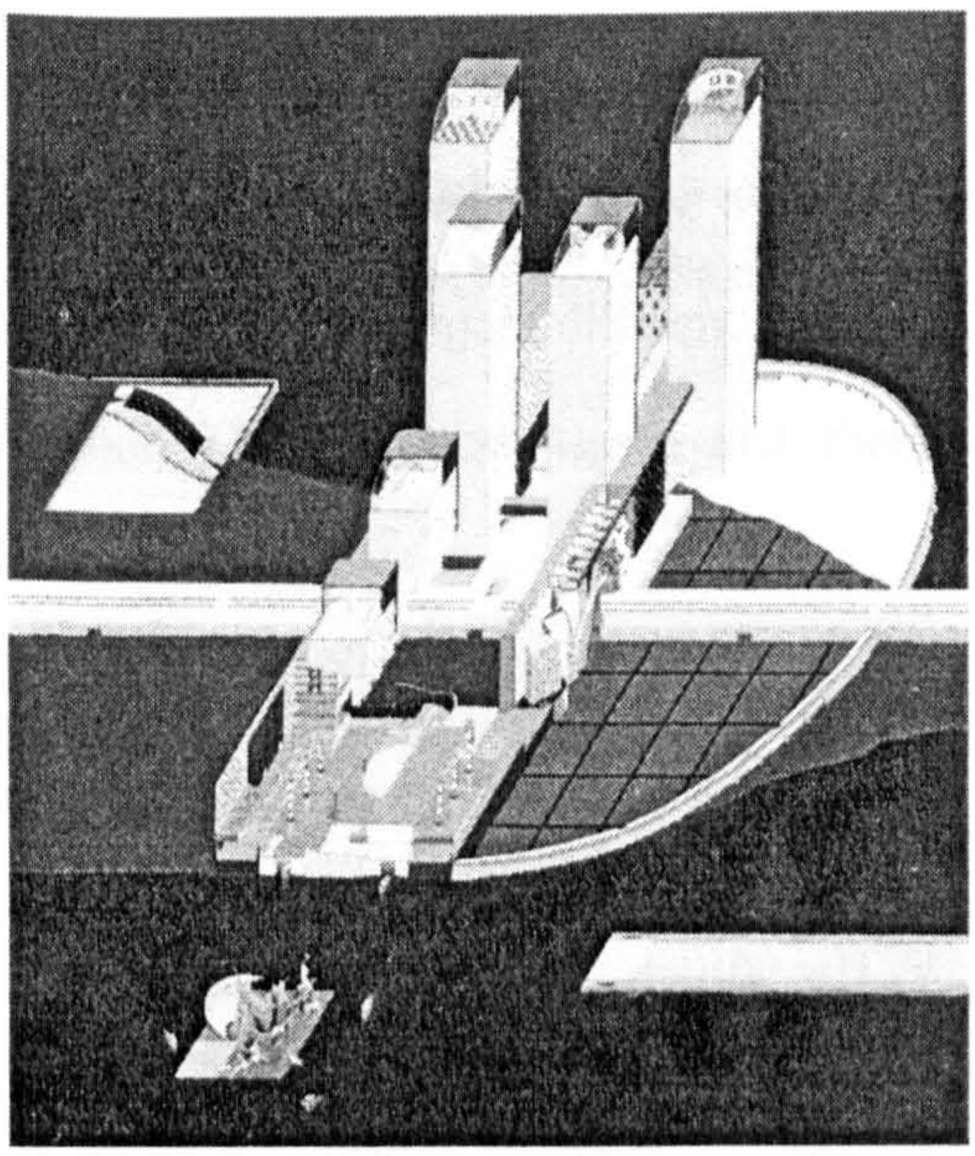


Figure 2.18: The Welfare Palace Hotel - "a City within a City," one of Koolhaas' projects included at the end of "Delirious New York" (Koolhaas 1994)

Koolhaas ends his book designing several architectural artifacts, which demonstrate his thesis, located in an "Appendix." Those projects expose the architectural character of the book. Koolhaas' book reveals his background of journalist and film writer, and concludes in the same way as many architects who are known for their thesis, manifested mostly through building designs. The projects illustrated through great color plates, aim to display the radical realization of his "Manhattanism." They also demonstrate how powerful architectural projects can be to convey a discourse, sometimes more effectively than texts (Figure 2.18).

2.3.3. *Urban history in the illustrated books of David Macaulay and Albert Lorenz*

The creative use of illustrations to present the history of urban cultures through their most significant architectural artifacts was the main reason to include David Macaulay and Albert Lorenz projects in this dissertation. These books are always advertised towards children. Therefore, they are seldom analyzed in scientific publications. Although both of them present the origins of cities using illustrated analysis of buildings, their work differs in several aspects. Lorenz aimed to present the history of civilization in one book using ten cities portraying each century (Lorenz 1996). He devoted a maximum of six pages to each city. Therefore, he needed to synthesize the history of the city – and the whole century – in just three plates. In his first book, Macaulay dissected a cathedral and in the second one, a planned Roman city, displaying with short texts and a great diversity of drawings their construction. He used the same approach in several books that followed "Cathedral" and "The city" to investigate different types of constructions or urban aspects of cities. Each of his books had a specific theme and, therefore, was much more detailed than Lorenz's.

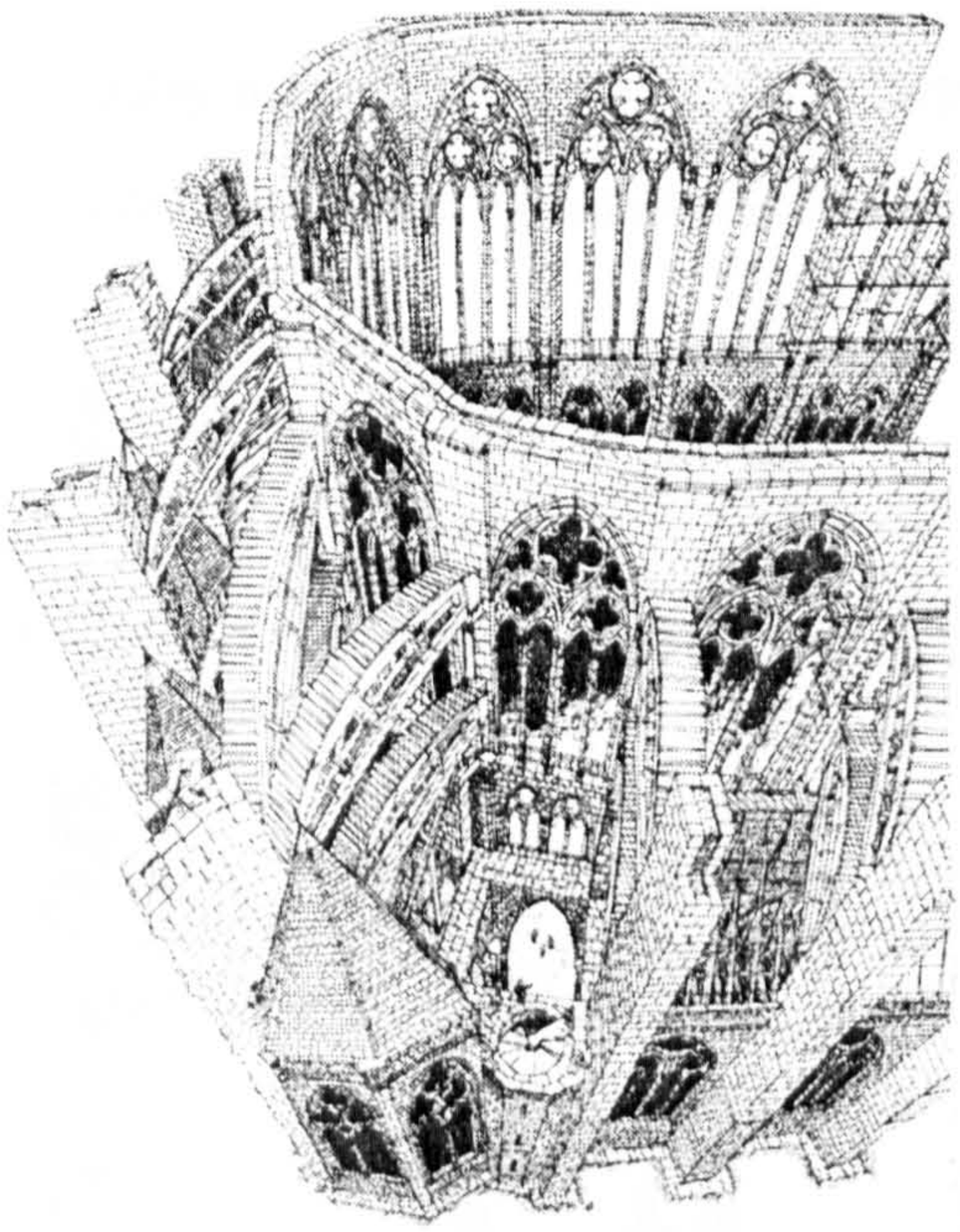


Figure 2.19: illustration representing the construction of the choir's walls, before the structure of the roof (Macaulay 1973)

David Macaulay was educated as an architect and, although he never pursued the professional career, his work is profoundly influenced by his university studies. The project of the first book was very different from the published version. His idea for the book was the story of a gargoyle from a cathedral under construction that suddenly came to life. He presented the argument with several illustrations to an editor, who rejected the idea. That editor, however, was impressed by the way Macaulay displayed

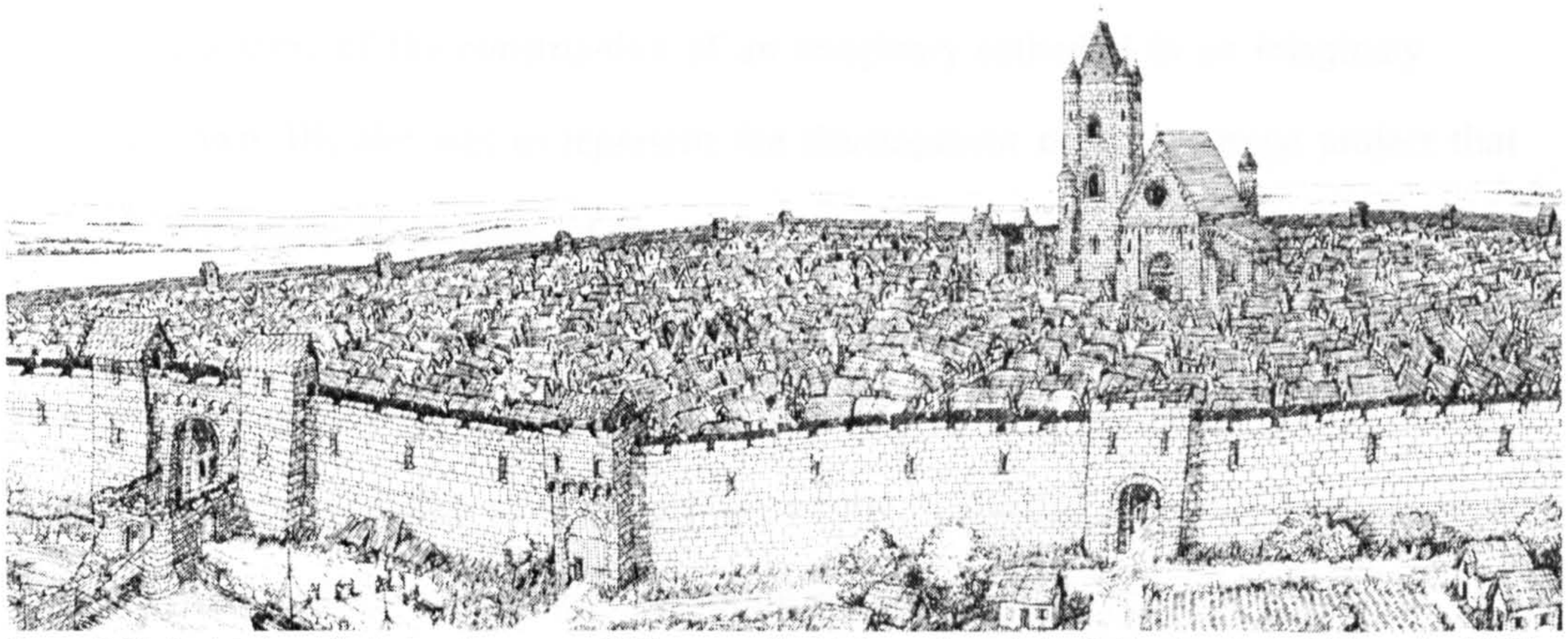


Figure 2.20: Aerial view displaying the town of "Chutreaux" with its walls and the finished cathedral (Macaulay 1973)

the construction of the cathedral and suggested he should write about the cathedral itself. Before starting the project, Macaulay had no specific expertise on the theme of cathedral construction (Hastings 2000; ViewZ 2003). He started to study from a history book and realized that it was not enough. He decided then that he would fly to France in order to acquire that knowledge: "Entering [Amiens cathedral] through one of the small doors cut into one of the huge doors, I found myself alone in an amazing space. I didn't draw or photograph anything. I just sat in one of the wooden chairs and stared upward, mentally dismantling the stonework above me" (Macaulay 1999 as quoted by Hastings 2000).

Macaulay overcame the difficulties to depict the construction of an important building with few records of the whole process by creating an imaginary building. Therefore, he

Figure 2.21: The craftmen involved in the cathedral construction with their tools (Macaulay 1973)

elaborated a story of the construction of an imaginary cathedral in an imaginary medieval town. His aim was to represent the development of such a huge project that involved the whole community of towns in that historical period. The constructions methods and the lives of those people who were usually associated with those enterprises were his target, and his success can be measured by the use of his books in several architectural colleges. In the preface of the "Cathedral," he explained his methods in a similar way he did in his following books:

"The cathedral of Chutreaux is imaginary, but the methods of its construction correspond closely to the actual construction of a Gothic Cathedral... Although the people of Chutreaux are imaginary, their single-mindedness, their spirit, and their incredible courage are typical of the twelfth-, thirteenth-, and fourteenth-century Europe whose magnificent dreams still stand today" (Macaulay 1973).

He constructed a story to demonstrate his arguments about cathedrals. In a chronological order, he described the growth of a cathedral from an empty plot – actually a space cleared from buildings within the town. The story was exhibited with short and straightforward texts which have a close connection to the drawings. The texts always refer to the images on the same page and work almost as captions for the black ink drawings. The story was a powerful device to introduce the people involved in

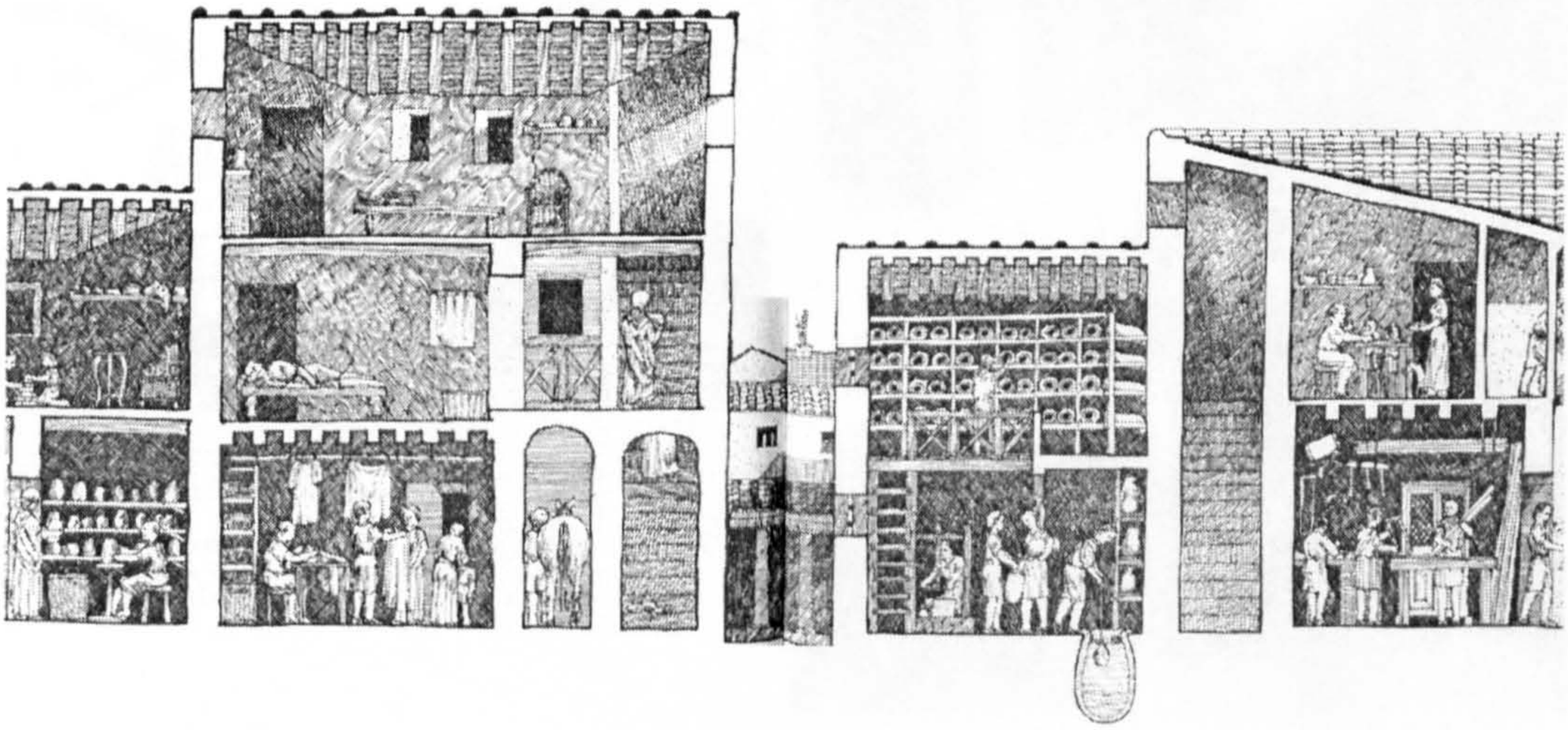


Figure 2.22: Section of the Roman city exhibiting shops and residential apartments (Macaulay 1974)

the construction, revealing how they lived and what were their roles in the process. In an interview, he explained his option for the story:

"I realized that in fact there was a story in the construction project itself and decided, as I designed the drawings, that what I would try to do is move the reader around as much as possible during the building process so they had a feeling of really being there and participating. I've tried to do that in all my books since" (ViewZ 2003).

David Macaulay has a very particular way to display the illustrations throughout his books. He doesn't present just perspective views of an observer from the story. As an architect, he often makes use of different and simultaneous types of graphical representation. Sections combined with perspective or orthogonal views are frequently superimposed in order to clearly convey his ideas (Figure 2.22, Figure 2.23). He demonstrated in a book directed to non-architects the importance to display different types of drawings to explain the reasons to construct those buildings. Due to the extensive use of images, and probably because of the clarity of his representation, his

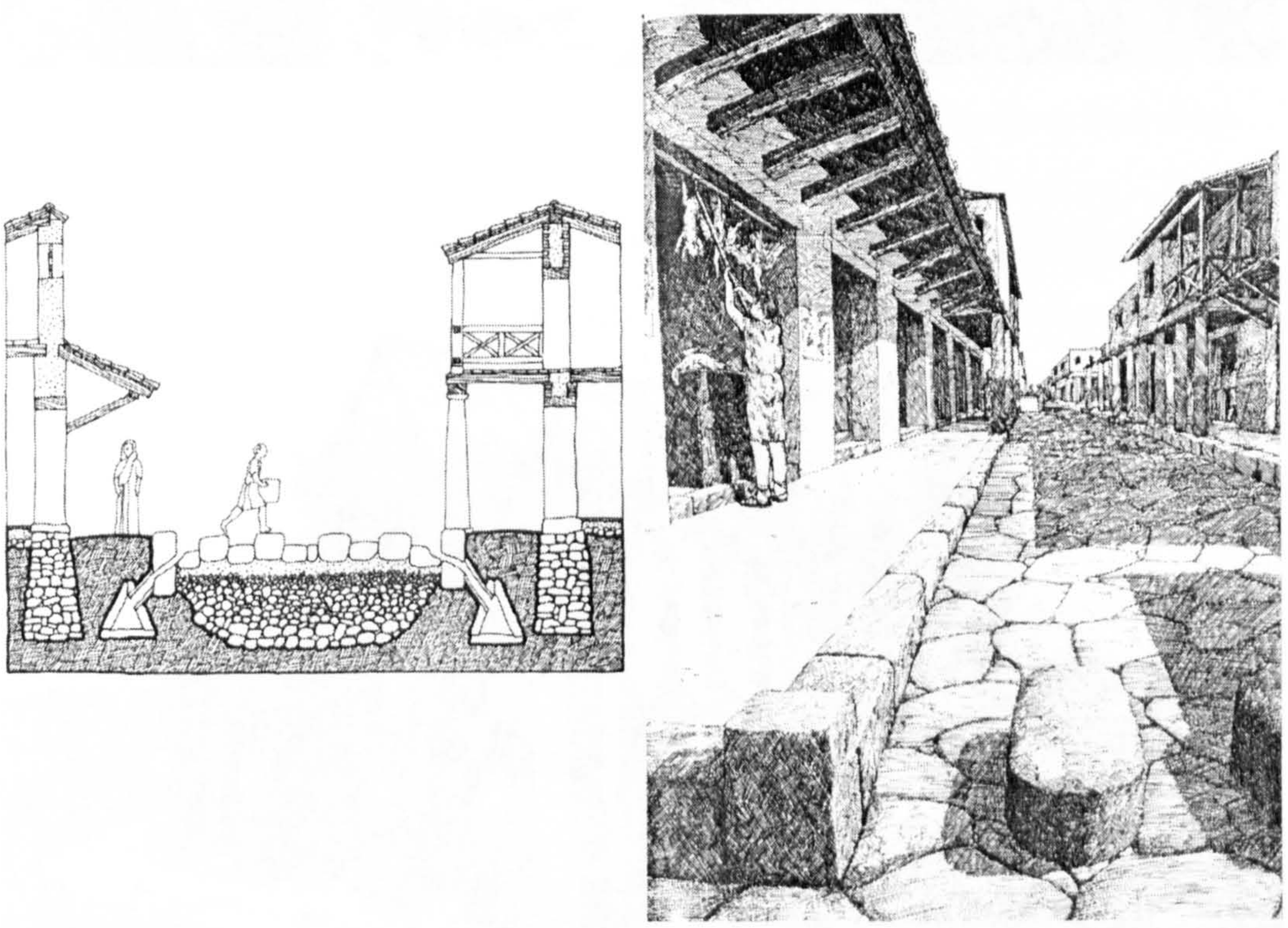


Figure 2.23: Section and perspective view illustratind the construction of a street and a sidewalk (Macaulay 1974)

books most often received the label of "children literature."

Among his illustrations of the cathedral construction, he elaborated a set of aerial views of the town with the construction site in the center of the drawing (Figure 2.24, Figure 2.25). Similarly to the several experiences of computer-generated models described in the following chapter, he drew a sequence of illustrations displaying the evolution of the construction. He made use of an analog method by photocopying the original drawing, cutting the parts that change, photocopying again and drawing only the differences (Hastings 2000). According to him, "only the first and last overview illustrations were drawn in their entirety. Numbers two, three, and four were made by

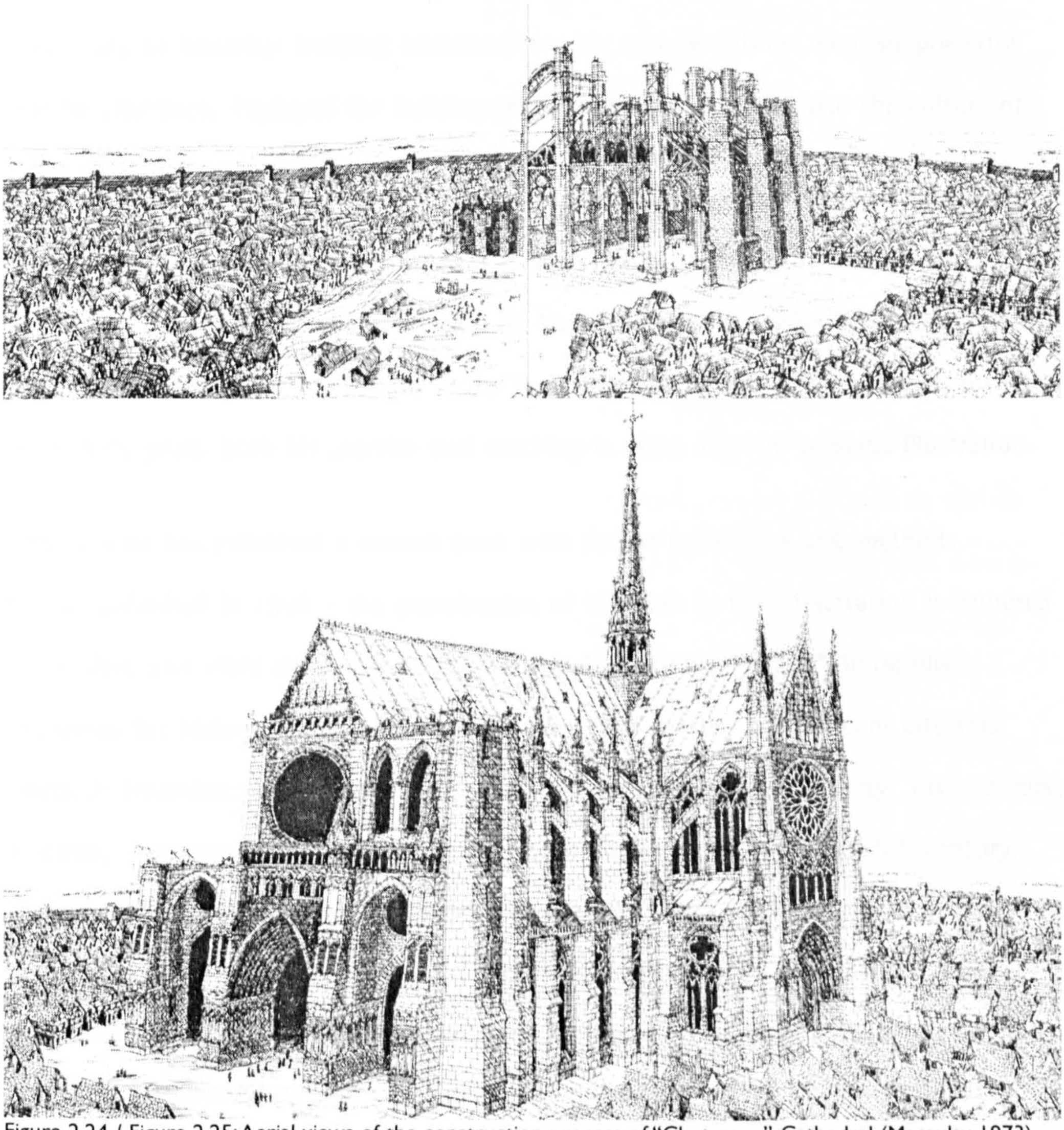


Figure 2.24 / Figure 2.25: Aerial views of the construction process of "Chutreaux" Cathedral (Macaulay 1973)

patching over photo prints of number one. Five, six, and seven were made over photo prints of number eight ... this technique guaranteed consistency and saved a lot of time" (Macaulay 1999 as quoted by Hastings 2000).

That review of Macaulay's architectural books often referred to his first book, the "Cathedral." However, several other books he published followed the same method, particularly those that refer to historical constructions such as "City" (1974), "Pyramid" (1975), "Castle" (1977) or "Mill." (1983) These five books were transformed into popular cultural television programs (Houghton Mifflin 2003). One of the significant aspects of these Macaulay's books to this study is that if his first objective was to explain the complexity of historical building constructions, his representations were so powerful that he effectively displayed the building methods of the past and also the culture of those past societies and how people lived.

Albert Lorenz's publications are not as diverse as those of Macaulay and his illustrated books have very different characteristics. As Macaulay, he also earned the architectural degree and although he has taught at the Pratt Institute School of Architecture for more than thirty years, both his practice and teaching is more oriented towards illustration.

Although he has published a second book with similar techniques and methods – House, published in 1998 – the examination of his work in this dissertation is centered in his first, and more acclaimed book, "Metropolis" (Lorenz 1996). "Metropolis" overviews the history of ten-century period. For each century a significant city was selected: Jerusalem, 11th century; Paris, 12th century; A Mongol tent city, 13th century; Koblenz, 14th century; Voyage of discovery, Lisbon and Mozambique, 15th century; Florence, 16th century; Osaka, 17th century; Vienna, 18th century; London, 19th century; New York, 20th century. As it was mentioned earlier in this chapter, Lorenz presents in "Metropolis" one city – and one century – in just few pages. No more than six pages are devoted to each city. That is the critical part of the book. It resulted in

Figure 2.26: Map of Italy displaying its main cities, represented by their most significant buildings (Lorenz 1996)

some of its advantages and also its shortcomings. The texts are very concise and limited. They were included to support the images with additional information but were not intended to provide more than a glimpse of each city/century analyzed.

What is significant in Lorenz's "Metropolis" is the amount of information he is able to embrace in his colorful plates. That is the main justification to include his book among the other works reviewed in this research. Each city's six-page set is grouped in pairs. The first two pages display the city in its context (Figure 2.26), locating other significant cities. A textual page followed by a color plate constitutes the first pair. The textual page presents a brief overview of the century and a graphic index of the illustration connected to it. The index locates the other cities and the main theme that Lorenz selected to convey the century's history. The two following pages were actually one large plate detailing the city (Figure 2.27). That illustration exhibits one building, a part of the city or even an aerial view displaying the whole area of this city. This is the most important part of the six-page set. It present the most elaborated illustrations with separate

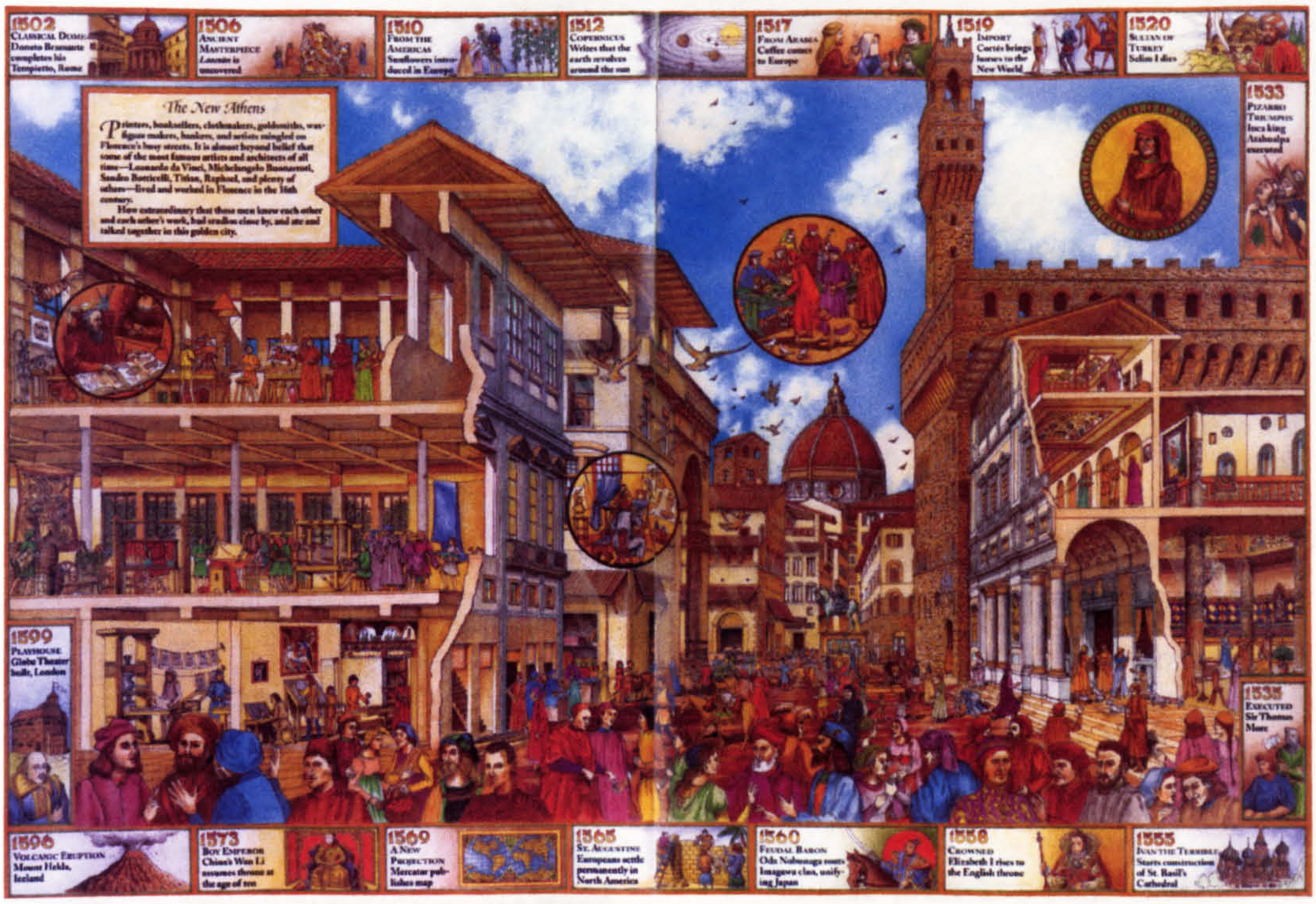


Figure 2.27: Perspective view of Florence in the XVI century (Lorenz 1996)

windows displaying blown-ups or details and surrounded by a timeline located along the four edges (Figure 1.1, Figure 2.28). In the last pair of the set, a textual page is preceded by an illustration of details. That last illustration of the set usually exhibits people with their costumes, utensils and art works. The text page presents two graphic indexes explaining the large two-page illustration and the last detailed illustration page (Figure 2.29). Therefore, the 3 pairs of pages assigned to each century, presents the city in three scale levels. The first one is an aerial map with perspective views of the cities, displaying out of scale most representative buildings. The second level presents the city in its urban scale with details of the buildings and, sometimes, as in the 13th century cathedral (Figure 1.1), just one particular building. In the closest scale, the drawings exhibit the people that inhabited each city. That organization is followed in all the centuries but the 15th. The Iberian expeditions were selected to illustrate the 15th century. Lorenz chose Lisbon and Mozambique, and four pages were assigned to present each of them. A human scale illustration was connected to a two-page representation of the cities in urban scale.

For the 16th century, Lorenz selected the city of Florence to represent the High

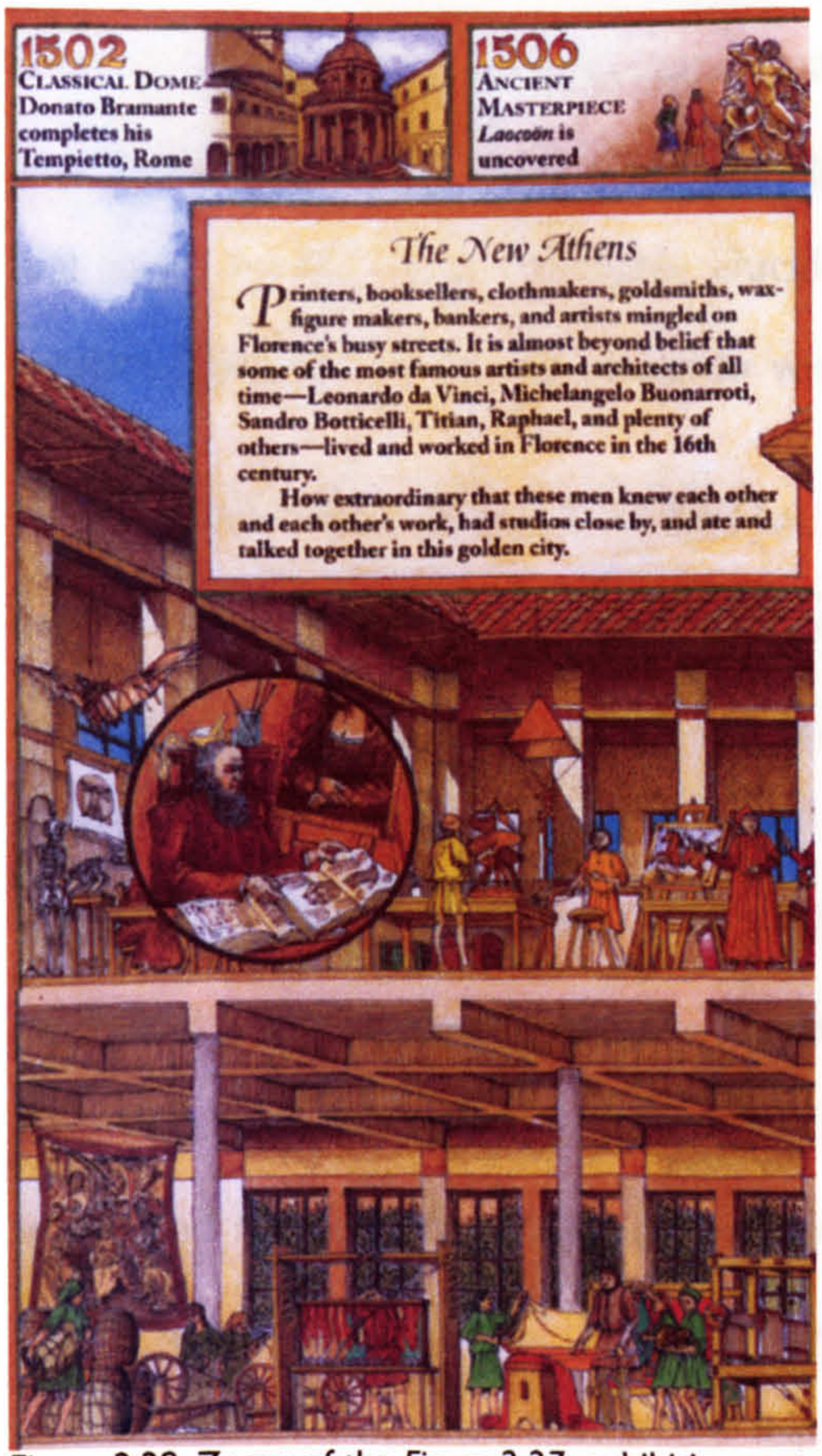


Figure 2.28: Zoom of the *Figure* 2.27, exhibiting part of the timeline, Leonardo da Vinci's studio and a wool shop (Lorenz 1996)

Renaissance. Within the first pair of pages, a perspective map of Italy, locates the cities of Genoa, Milan, Bologna, Venice, Pisa, Florence, Ravenna, and Rome (Figure 2.26). Each one is illustrated in the map by some of their most important buildings. Additionally two windows display Leonardo da Vinci's "The Canon of Proportions" and an aerial view of partial Florence around the *Palazzo Vecchio.* The preceding page explains the illustration with a graphic index. The index is associated with a black line graphic version of the illustration with numbers referring to each city's location in the drawing. On the top of the graphic index, a twelve-line text introduces the importance of Florence in the Italian Renaissance. The large plate displays a pedestrian view from the *Galleria degli Uffizi* approaching the *Piazza della Signoria* with the *Duomo* in the back (Figure 2.27). Part of the *Galleria degli Uffizi* , designed to be a suite of offices, in the image's foreground is freely presented, sectioned with the view of their façade and also their interior. The interiors show Leonardo da Vinci's studio, a wool shop with people making woolen cloth, a palace and a print shop (Figure 2.28). Additionally several notable figures of the time are shown in the streets, such as Raphael, Titian and many others. In three windows, Lorenz displayed bankers working, Boticelli's studio and Lorenzo de' Medici. Along the edges of the image, he exhibited a timeline with significant events from that century like Elizabeth I rising to the English throne, the sunflowers being introduced in Europe from the Americas, Japan's unification and

Copernicus theory of the earth revolving around the sun (Figure 2.28). The last text page explains the latter illustration through a graphic index similar to the one on the first page. Another parallel graphic elucidates the preceding page illustration, exhibiting Michelangelo and Leonardo with some of his works (Figure 2.29).

Lorenz can be criticized to present the history of ten centuries in such a thin book, with a limited number of text lines. However, the amount of information he exhibited in those few pages is enormous. Each illustration was carefully organized in order to convey a great diversity of facts belonging to that period. Numerous details and cut-away views facilitated his task. He moved from Europe to Asia, Africa and America, displaying different costumes, habits and buildings from each place and time. The buildings have actually, an important role in the book. Through the way people interacted within the urban spaces, the readers understand the differences between the cities, their particularities and their patterns of change over time and place. The images are Lorenz's most powerful vehicle. Through them, he synthesized information that would require a great number of textual pages.

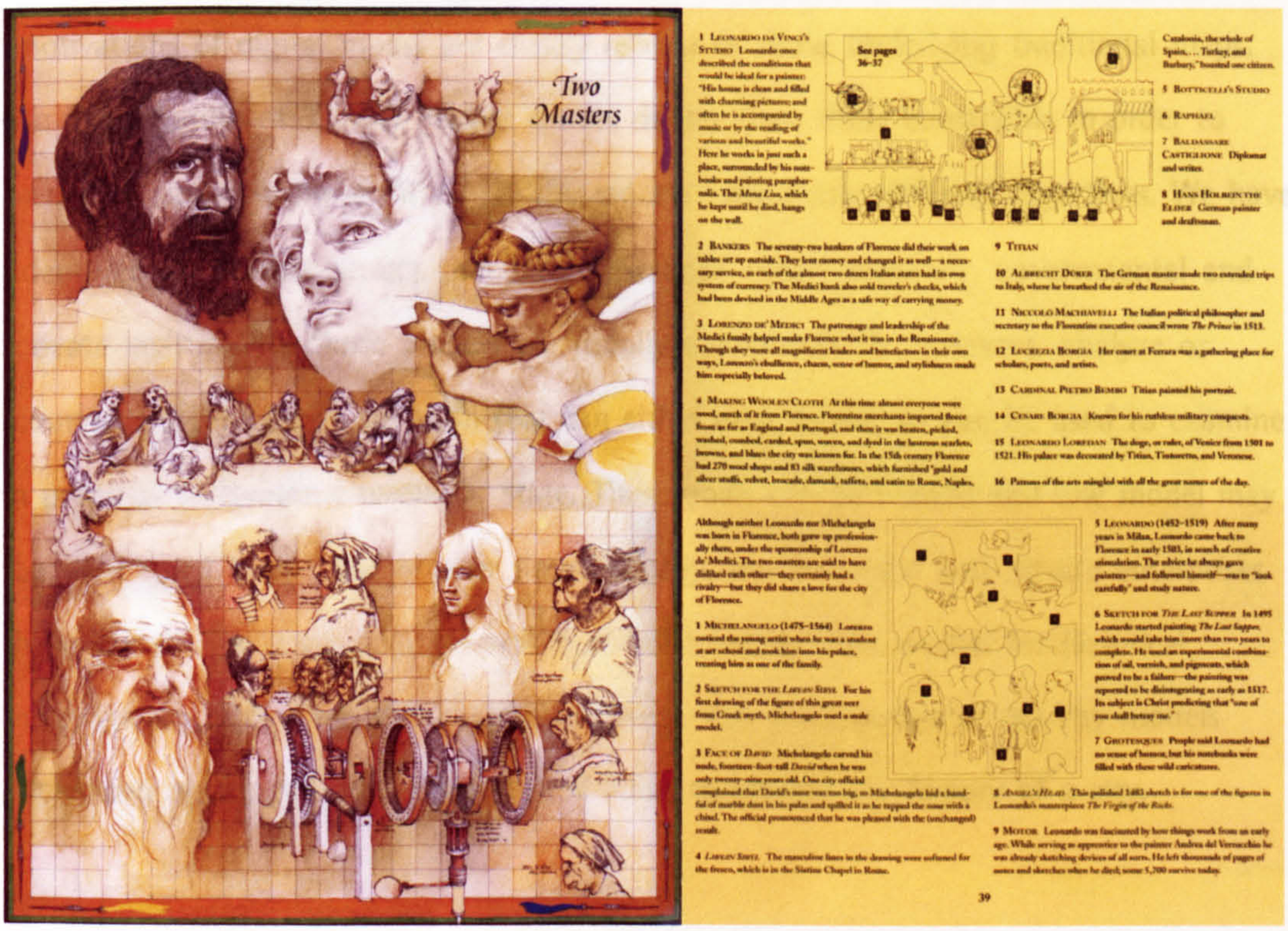


Figure 2.29: Michelangelo and Leonardo da Vinci with some examples of their works (Lorenz 1996)

3 Understanding the history of the city through 3D models and digital tools

The preceding chapter focused on the representation which historians have used to organize, document and communicate their research. Additionally, four authors were reviewed for their contribution to the specific study area of that dissertation: the study of the cultural history of the cities through their significant architectural artifacts. These four authors were selected for their creative work and they presented unique and diverse projects. All the precedent reviewed previously applied analog methods in their research and publication. This current chapter will be centered on digital initiatives to represent the history of the cities, particularly those which are based on 3D models, which is another focus of this thesis.

3D city models, as we currently apply them, have their origins in traditional city maps. Even though digital tools bring about many new possibilities, the roots and motivations of digital model are closely related to those underlying traditional maps. An investigation of 3D city models should depart from these constraints in order to verify its aims and possibilities. 3D city models have many different objectives. We have identified three main groups that have developed them: academic, governmental and private institutions. Those models are usually constructed to represent, analyze or communicate a specific situation that can either exist or not; or can be used to examine a proposal to change a particular state. These goals can be blurred and one model may be used for different purposes or users. Usually, governmental and private enterprises have specific goals and they are not intended to apply their models for historical investigation. Therefore, this chapter will focus the investigation of 3D city models developed by educational institutions in order to analyze the history of a city.

3.1. 3D models and other digital tools for the representation of the city history

> "A Reality Beyond Our Reach. And this, essentially is what maps give us, reality, a reality that exceeds our vision, our reach, the span of our days, a reality we achieve no other way. We are always mapping the invisible or the unattainable or the erasable, the future or the past, the whatever-is-not-here-present-to-our-senses-now and, through the gift that the map gives us, transmuting it into everything is not ..into the real" (Wood 1993).

Figure 3.1: Map of Imola by Leonardo da Vinci, 1502, Royal Library at Windsor

Leonardo da Vinci is acknowledged for having created the first accurate map based on an orthogonal view, which resembles our current modern maps. He was commissioned to devise the map of the small Italian town of Imola, located between Bologna and Faenza in 1502 (Figure 3.1). The Duke Cesare Borgia asked Leonardo to develop a plan for repairing the town's fortification, destroyed by an attack. The new ballistic methods required

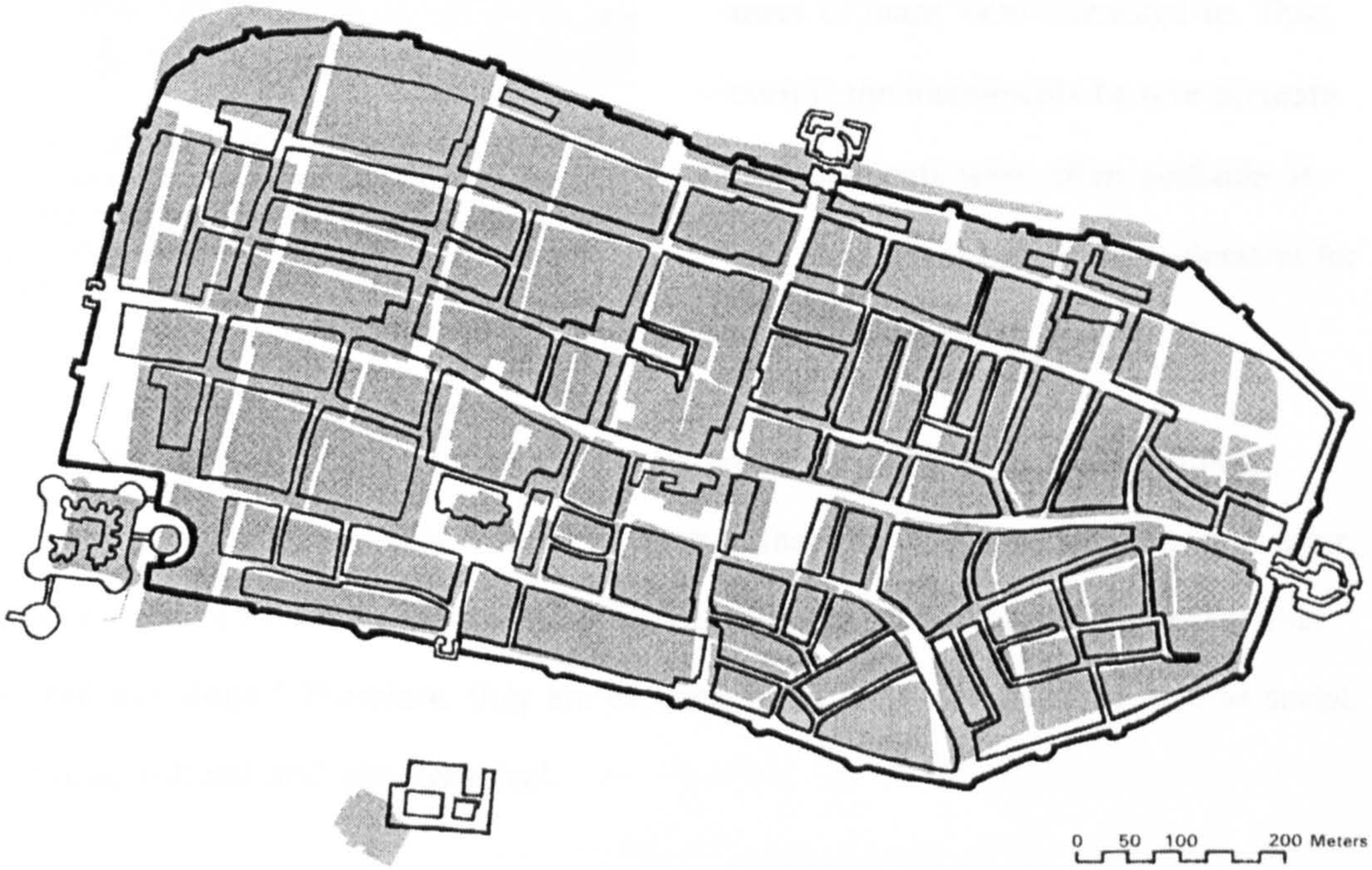


Figure 3.2: Comparison between Leonardo's map displayed in black lines and the 1984 map constructed by aerial photogrammetry techniques represented with shaded areas (Bosselmann 1988)

accuracy in the measurements in order to calculate the angles and distances. Therefore, Leonardo used a transit, a magnetic compass and a modified odometer to guarantee the precision and to register the dimensions of the town. The accuracy of his map is demonstrated by the superimposition of his plan, with the 1984 plan based on photogrammetry techniques (Bosselmann 1998) (Figure 3.2).

Figure 3.3: Map of Rio de Janeiro elaborated by the French Jacques de Van de Claye with the representation of the bay, several constructions and indian settlements, 1578/79 (Nonato and Santos 2000)

The exactitude of previous maps was not a major issue. These maps actually, had some of its details deliberately placed out of scale in order to represent a hierarchy of some elements. Usually churches and castles were drawn larger than they were, in other occasions they were represented in a perspective view while the other elements were drawn in orthogonal view (Figure 3.3). These were the elements the users of maps were interested in. Thus, even if the instruments to take accurate measurements were often available at that time, there had been no demand for a correct, measured map.

The maps, similarl to other forms of representation are reduced in an incomplete versions of actuality and they depend on their authors' wish of how accurate and what will be exhibited through them. As Dennis Wood noted, they represent a "reality that exceed our vision." Therefore, they are exposed to all sorts of influences such as social, political, cultural and also technical.

3D city models, like maps, are powerful when they can locate a set of information and

make it clearer. In the same way that the location of information facilitates its understanding, the place can be better understood with the embedded information. When Christian Norberg-Schulz (1984) analyzes Heidegger's concept of dwelling (Heidegger 1971), he associates it to an "existential foothold" and states that "man dwells when he can orientate himself within and identify himself with an environment, or, in short, when he experiences the environment as meaningful". In his "Genius Loci," Norberg-Schulz presented his phenomenological argument analyzing the space qualities of three cities: Prague, Khartoum and Rome. Among several aspects, he verified the evolution of those cities, their effects in the natural environment and the relationships shared by the buildings that structure their built environment and provided them with a special character, which is widely recognized. Therefore, an analysis of the process of shaping the built environment can be a powerful tool to demonstrate the meaning of a place and, we could also argue, to facilitate one's feeling of belonging to that place.

Revealing some of the hidden structures and sub-systems of a city to an inhabitant or visitor can support the development of a sense of being part of that place which transcends the act of being in a place. Norberg-Schulz also demonstrated the belief that "architecture represents a means to give man an 'existential foothold'." A 3D city model can be a powerful tool for analysis of buildings and urban spaces as artifacts, which synthesize our reality and aspirations. Usually, the knowledge about an architectural artifact's context strengthens the spectator experience. It could be possible to speculate that one can recognize the 'meaning' of places after the exploration of its creation and conception.

Electronic technologies bring forth a great variety of resources that can facilitate various phases of the research into the history of the city. Many of them remain untested or with few incursions done by historians. Some of them may even reduce the gap between the representations of such a complex theme and the great variety of lives that actually take place there. This chapter will explore some of the existing possibilities associated with 3D models, particularly through the analysis of previous experiences.

Hypertext represents a basic change that has affected most researchers, if not for producing it, at least to manipulate hypertext documents. With the World Wide Web the terms hypermedia and hypertext got a new dimension. Their distinctions are not clearly defined and in this thesis they will be used, as by many authors, with the same meaning. Hypertext is usually defined by contrasting with traditional texts, the latter being linear and sequential (Lévy1996, Nielsen 1990). Since books or print material are not always linear or sequential – dictionaries and encyclopedias for example do not follow that criteria – this definition is very imprecise. Hypertext can be defined as nodes – information elements, paragraphs, pages, images, sound, and video – with links between these nodes – references, notes, buttons or other elements, which execute the passage from one node to the other. Digital hypertext, therefore, would be a collection of multinodal information arranged in a network for fast and intuitive navigation (Lévy 1996).

In 1945, Vannevar Bush, Director of the Office of Scientific Research and Development in the U.S.A., wrote the article "As we may think." His wish was to afford all the produced knowledge to every scientist. At that time, the amount of information produced was already enormous. Thus, it should be organized in a different way to provide researchers with what they needed. He proposed a visionary mechanical device, which would act very similar to hypertexts. This machine, called *Memex – mem-ory ex-tender* – would help bridge the different disciplines in the specialization process. "A memex is a device in which an individual stores all his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory" (Bush 1945). He foresaw that all information stored in microfilms would be accessed through association and analogy linkage.

The hypertext concept was first imagined by Bush as a visionary mechanical device. Many decades later it was materialized in a digital format. The hypertext system was

accomplished through computer resources, which allowed the retrieval of information in different media (text, images, sound, and videos), through links, which could be easily updated.

Bush envisioned a cross-disciplinary movement of science and it's knowledge that were going in the opposite direction through increasing specialization. Floridi points out how "a philosophy divided into rigid areas of specialization, done by 'experts,' seems to be in flat contradiction to the universal and unifying ambitions of a rational reflection which, by its very nature, aims to be the ultimate threshold of theoretical understanding," and suggested that books invite vertical specialization while the computer could promote forms of horizontal inter-disciplinarity and multi-disciplinarity (Floridi 1999).

If hypermedia systems did not produce a radical change into conventional narrative, we cannot deny that they introduced powerful resources to communicate and organize information. Hypermedia systems are particularly effective when information is associated or described with images. In this context, hypermedia systems based on 3D city models can be extremely efficient to exhibit part of the information complexity inherent to a city. According to Wood, "It is the ability to link the territory with what comes with it that has made maps so valuable to so many for so long" (Wood 1993). Those map's characteristics are also shared with 3D models. Besides that, they have additional features that can strengthen the connection to the place and the manipulation of the territory representation and its embedded information. The impact of those additional features turns out to be evident when the area or information represented becomes more complex. The more thorough the analysis, the greater the difference with traditional maps.

Michael Batty, writing about information systems for urban planning, stated that "the digital world is about convergence. It is about representing information in digital form

in such a way that data and information that previously were considered to be quite unlike one another can be juxtaposed to make their correspondence and linkage considerably clearer" (Batty 2001). For a city, graphic representation, both 2D and 3D, is a powerful ground for this convergence. A city is automatically linked to the idea of place. Thus, associating information about the city to the place is very efficient to make it understood. 3D models are effective tools to make clearer this location and hence they are critical to link various layers of information to a precise and recognizable territory. Managing different types of files with 3D models in hypermedia systems is a complex task and should be planned cautiously. Each medium has peculiarities, advantages and limitations. Texts, for instance, have some limitations to display an image realistically. Many times, however, texts that are not direct or do not present the complete information allow the message to be more open, powerful and poetic Although it may sound paradoxical, the same occurs in modeling – a very realistic 3D model may reduce the potentiality to effectively convey the message.

There are two main possibilities to associate 3D models to a hypermedia system. The model can be used as a separate tool, which generates material for an autonomous hypermedia system – such as still images or animated clips – or it can be manipulated in the final interactive system. The latter usually requires more complex tools. The most common tools for this task are VRML (Virtual Reality Modeling Language) and GIS (Geographic Information Systems). Both systems however, have limitations. VRML originated as a virtual reality 3D system and has shortcomings with the tools to manipulate the model itself or with the manipulation of databases related to the 3D objects. GIS systems was created to manage large quantities of data related to two-dimensional maps. They still have some limitations to manipulate 3D objects. Additionally, most systems require a GIS software to access the information, limiting the diffusion to a wider public. For these reasons, many systems are elaborated with programming languages such as Java3D to facilitate the developers' goals.

The use of VRML is a standard for describing interactive 3D objects and worlds. An interaction with a database can be created with *Javascript*, added to both VRML model and HTML (Hypertext Markup Language) files, and viewed by standard browsers with specific plug-ins. Some tools have been developed to reduce some of VRML's limitations. In 1999 a paper describing a system that allowed the control over changes in time in VRML models was published in one of the Association for Computing Machinery (ACM) conferences. The *VRML History* was conceived at the University of Siegen, in Germany, as an extension of *VRML97* (Luttermann and Grauer 1999). With this tool, temporal or spatial-temporal data can be examined in the model, allowing the understanding of the evolving processes. The project was part of Hartmut Luttermann's PhD research and it seems that he has not carried through the project (Luttermann 2003).

3.2. Concept and precedent analysis: Previous experiences on research into 3D architectural and urban historical models

3D modeling reconstruction of historical environments or important buildings from the past has been widely applied and the subject of many publications. The great majority of those experiences are limited to addressing digital modeling as representation of past constructions. Few publications recognize 3D models as research tools or credit its importance to link past and present without seeing historical events as isolated episodes. In this section of the dissertation, four diverse projects, which address these issues and interpret the history of cities, rather than isolated buildings, were selected.

3.2.1. Modeling a hypothetical town as a tool to teach the history of urban form

In January 1990, Thomas Seebohm and Robert-Jan van Pelt started a course at the University of Waterloo's School of Architecture on the history of urban form and three-

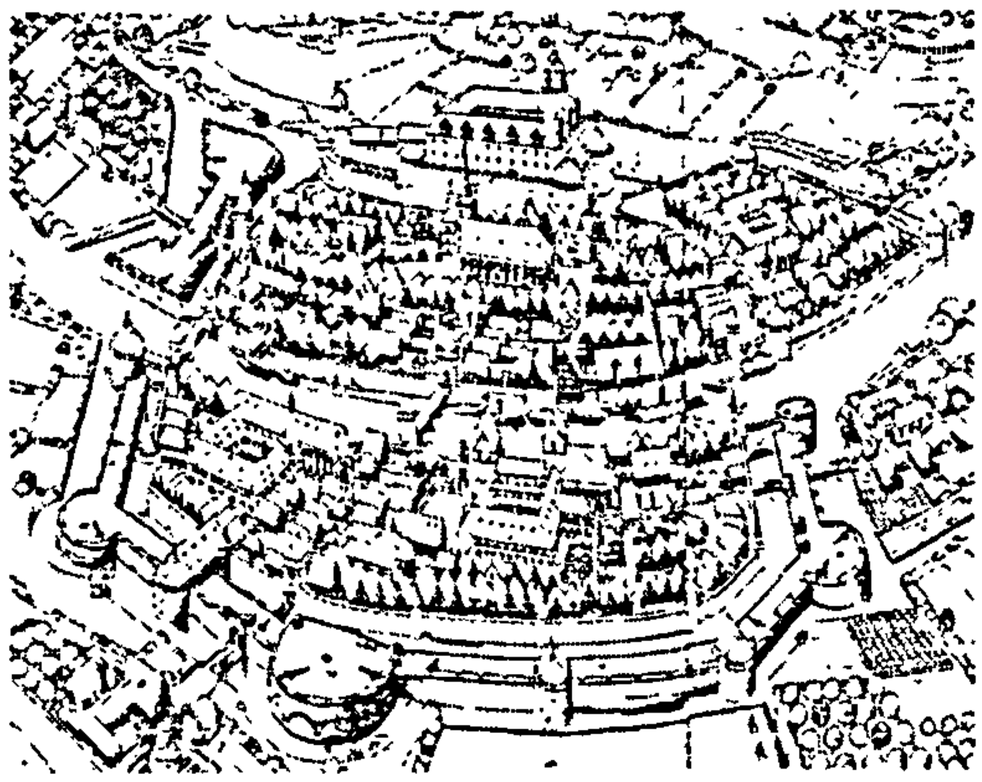


Figure 3.4: Gruber's ideal prototypical German city (van Pelt and Seebohm 1990)

dimensional modeling. The course was based on historical lecture courses and practical classes of modeling a hypothetical Greek city, located in a hypothetical site, in different periods of its history up to the XX century. One of the paradigms for the course idea was Karl Gruber's book "*Die Gestalt der deutschen Stadt*" (The form of the German City) published in 1952. Gruber presented illustrated analyses exhibiting "a 'typical' cathedral city, abbey city, merchant city, and so on," and specially "four pairs of drawings the history and of a prototypical south German city 'situated perhaps along the Neckar or Main' over more than five centuries" (van Pelt and Seebohm 1990) (Figure 3.4). A similar idea for their course, already discussed in the previous chapter, was carried out by David Macaulay, when he registered the construction process of a hypothetical Roman city. Both projects aimed to document an imaginary city. The main distinction of David Macaulay's project is his option to display only the process of construction rather than illustrate the changes the city suffered over the centuries.

The students were asked to study the history of Greek cities' form, and design their own versions of Xara, a hypothetical city designed during the course (Figure 3.5, Figure 3.6, Figure 3.7, Figure 3.8). That city should be modeled digitally using the McDonnell Douglas software *General Drafting System*, *GDS*, acquired by the University of Waterloo in 1985. Several models should be elaborated, representing the city in different historical periods. The students would start with the assumption that they would "settle a site as Greek colonists, transform it according to Hellenistic insights, adapt it after the city's incorporation in the Roman empire as a *Municipium*, rebuilt it after the year 1000 AD, expand as trade expands in 1350, modify it to fit a succession of republican, ducal

and royal governments in the 15th, 16th and 18th centuries and so on. Each epoch would inherit the fabric, or remainder thereof, of the earlier, and the assumption was that each addition or transformation would challenge the students to rethink the earlier one and, also, the canonic examples of urban history" (van Pelt and Seebohm 1990). Although the plans proved to be too ambitious, the experience exhibited significant ideas, particularly because some of the difficulties the students found in *GDS* were already minimized in current versions of modeling *software.*

The *GDS* software was constituted of 5 different parts, which were used in different phases of the project. The site modeler – *XSITES* – was used to digitize the site contours with a digitizing tablet. The *XGDS* was applied for starting new drawings in two dimensions, saving the changes for the *Site Modeler* and the *Assembly Modeler.* With the *Solid Modeler – XSOLID* – the students created the 3D solid elements for the site, the buildings and the urban structures for Xara. Those pieces were put together onto the two-dimensional contours of the site with the *Assembly Modeler – XPAM.* Finally, the model was visualized with shaded colors with the *Scene Viewing System – XSVS.* The students required more time than the teachers had planned, to learn the software, and the modeling process was too complex to accomplish several historical periods in just

Figure 3.5: The hypothetical city of Xara: view from the harbour (All the images from Xara were provided by Thomas Seebohm in 2002)

one semester (van Pelt and Seebohm 1990).

Seebohm and van Pelt's experience was first published in 1990 (van Pelt and Seebohm, 1990) and in another version in 1992 (Seebohm 1992). Through these papers, they were one of the first, and still one of the few, to introduce a comprehensible discussion about the role of 3D modeling to the study of urban history (van Pelt and Seebohm, 1990; Seebohm, 1992). The authors' observations were recorded more than 12 years ago and are based on a very specific piece of software, which was limited compared to the options available today. Their methodology, however, is still useful to any current project to structure a city model. Although their investigation focused particularly on the teaching of urban form history, the papers were also relevant as contributions to the modeling process of the city history and its research. They based their argument – against the tendency of seeing historical facts as isolated fragments with no links to the present – on authors such as Benedetto Croce and Rudolf Bultmann. In order to understand urban history and its presentness, the authors argued that "to study the alternatives of the past means to become involved as if one were a participant, experiencing the dread and anxiety generated by an undecided future already past." Although the experience had some practical shortcomings, it seems that modeling proved to be a powerful method to enhance the desired "sense of existential commitment to the situation studied" (van Pelt and Seebohm 1990).

Figure 3.6 / 3.7: Views of Xara (images from the course, provided by Seebohm in 2002)

Figure 3.8:View of Xara

Modeling a hypothetical city was an effective technique to allow the students a deep understanding of the relationship between urban form and ideology in different historic periods. According to Seebohm (1992), "to gain a true understanding of urban history one has to place oneself back in historical time to consider all of the possible courses of action which were open in the light of the then current situation of the city, to act upon a possible course of action and to view the consequences in the physical form of the city."

The disagreement of this thesis lies with Seebohm's (1992) statement that, opposed to hypothetical city models, studies on models of existing cities based on specific points in time are not able to "actually provide a true understanding of history." According to him "such studies only show a record of one of many possible courses of action at various moments in time. To gain a true understanding of urban history one has to place oneself back in historical time to consider all of the possible courses of action which were open in the light of the then current situation of the city, to act upon a possible course of action and to view the consequences in the physical form of the city."

If imaginary city models are powerful tools to achieve an understanding of urban form history, their great abstraction presents limited relations to comprehend the city history. The city's physical form is a result of infinite and varied decisions. Formal approaches to shape cities based on specific urban theories or stylist currents have a limited influence on the overall city's physical configuration. Haussmann's work in Paris, for example, was followed by several other cities around the world. The differences found in all those cities were a response to the specific physical characteristics of the previous existing configuration. A great diversity of issues contribute to the implementation of changes in each of them. The city celebrates

important events, which are unique and differentiate it from other cities. Those events leave marks on the space and respond to the city's individuality through links between those past events and the present. Analyzing cities evolution through 3D city models can be a powerful mode to comprehend its richness while, at the same time, "overcome[s] the limitations of historical relativism, which contends that historical fact is of value only in historical context" (Seebohm 1992).

3.2.2. 3D historical models and the changing image of the city

Patricia Alkhoven developed her work as part of her PhD studies from the late 1980s to the early 1990's (Alkhoven 1991 and 1993). Therefore, nearly at the same time as Seebohm and van Pelt published their work, she was developing the model of Heusden, in the Netherlands. The limitations of the contemporary software and hardware are more evident in her work than in Seebohm and van Pelt's. She based it mostly on available commercial software and regular PCs. However, because of the characteristics of her investigation for a PhD thesis, her study was obviously more profound than the one developed within the course in Waterloo, Canada.

Alkhoven set out to investigate the transformation of the spatial structure of the townscape. From this overall objective, she addressed the issue of representation and particularly the process of research of those changes over time using 3D models and texture maps. She compared digital models with other traditional techniques used to represent the town in different moments in history. In addition to that, she examined the amount of information or level of detail in the computer models necessary to provide a basis for interpreting the changes over time (Alkhoven 1993).

A great number of iconographic sources was used to provide information for the model construction. The buildings were represented by their volumetric features, the façade characteristics such as type of roof and shape of gables, and details like doors, windows

and some ornaments. A "time-coordinate" was assigned to each building, which was constituted by a code associated to the time-phases of the model. These time-coordinates would allow the automatic exhibition of changes in buildings in each modeled phase representing a specific historic period. Additionally, the model had different levels of details for each aspect to be studied, which was associated to specific views of the model, such as plan, perspective or axonometric, and also view point distances.

In addition to the accurate measurements of the built elements, Alkhoven introduced representations associated to thematic cartography, applying color codes or symbols. With that method, she could represent her interpretations juxtaposed to the physical configuration. Therefore, the model could be applied to a great variety of uses, registering her conclusions, which could be verified together with the analysis of the different periods of the model. She compared the process of "exaggeration of features" in the digital model, to the 17th century maps when "the most important buildings were deliberately enlarged and the house types were standardized" (Alkhoven 1993).

Alkhoven noted that some of the possibilities offered by the digital models could also be found in other types of traditional representations. The method she utilized was actually quite similar to the "before and after" drawings that architects are so used to (Figure 3.9, Figure 3.11). She acknowledged Karl Gruber's "*Die Gestalt der deutschen Stadt*" (Figure 3.4) mentioned before by Seebohm and van Pelt (van Pelt and Seebohm 1990) and also other initiatives carried out in Heusden in the second half of XX century

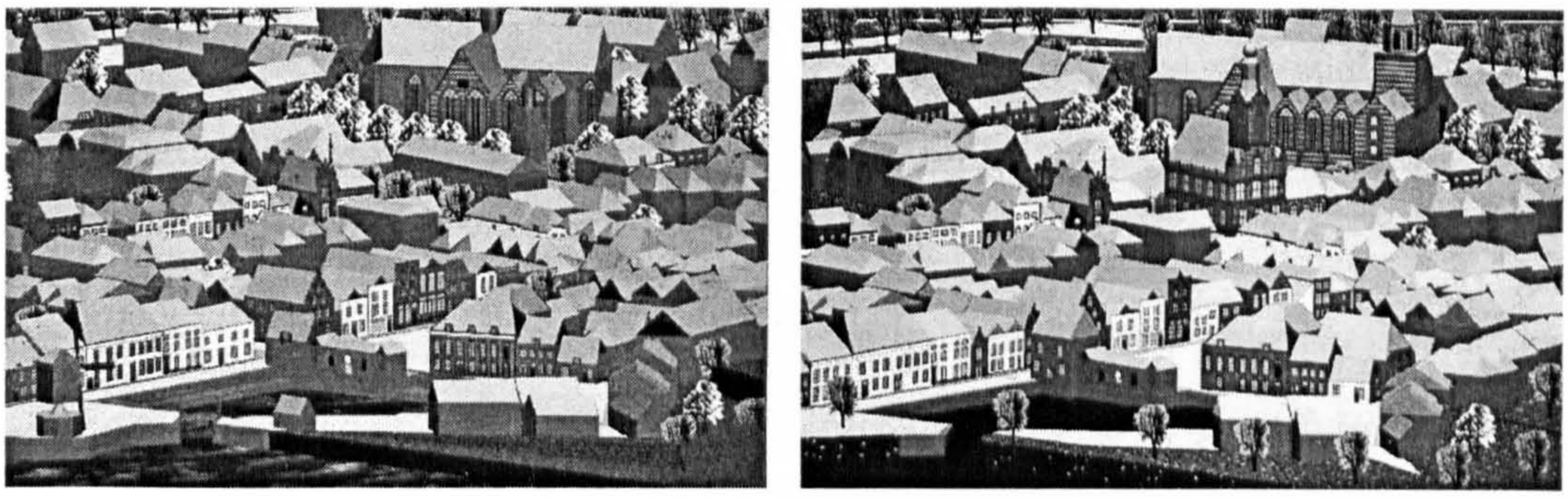


Figure 3.9: Perspective views of Heusden's model representing the city in 1900 and 1990. (Alkhoven 1993)

to represent the whole town, such as a wooden model and an oblique projection map. However, she also remarked that all those projects had demanded a significant amount of work and time. Additionally they were not as flexible as the digital models to allow different uses for the research and representation process (Alkhoven 1993).

She also recognized the risks of using historical documents for the construction of the digital model. According to her, those models often displayed the authors' adjustments and idealizations, which needed to be verified before extracting information from them (Alkhoven 1993). The possibility to confront all those sources in one single scale is an important feature of digital models. Therefore, the researcher can compare several documents which represent one building, for example, and conclude after a careful analysis, the most accurate version.

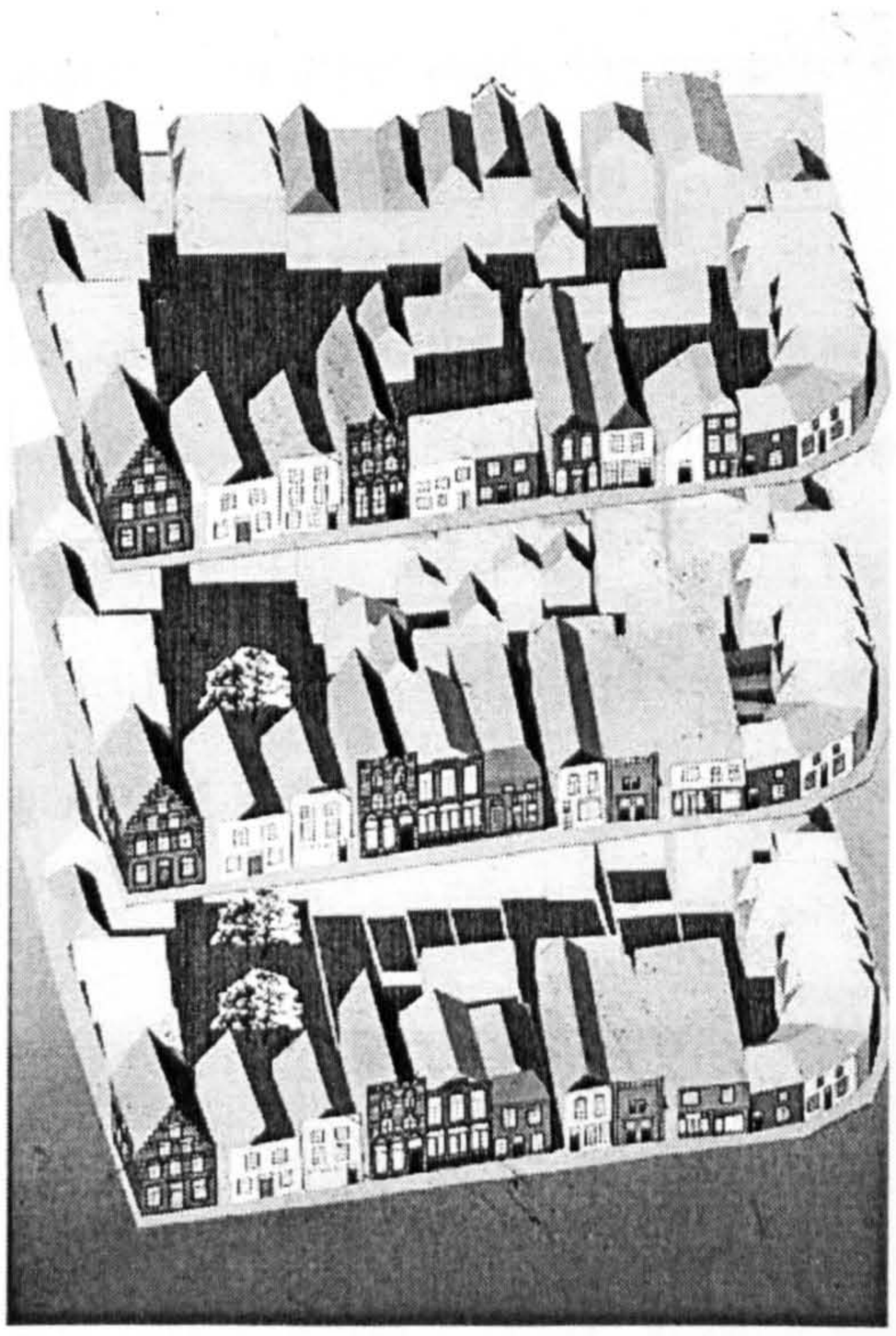


Figure 3.10: Study of the blocks through the 3D model (Alkhoven 1993)

The model proved to be very useful basically for two different types of analyses. One of them, concerns the analyses done in one single model and the other when compared to a different period. In both cases, several types o analysis could be examined in the models, such as "the plan, the spatial structure of the townscape, the houses, and the appearance of the façades at different periods and the city's transformation, land use, and the distribution of elements" (Alkhoven 1993). The model, therefore, carried critical information, which was demonstrated to be powerful for her

historical and morphological studies. Besides being a vehicle for the town representation, the model exhibited significant possibilities for the research process.

Actually, an important contribution of her investigation is the acknowledgement of the modeling process to the historical research. According to Alkhoven, "while constructing the models (i.e., making a graphical simulation), one learns about the structure, distribution of elements, sizes, scale, dimensions, characteristics, and regularities, etc. The creation of the computer models is in itself a way of studying the city, since it is an active mode of research and one is more actively involved in the process of research" (Alkhoven 1993). Her modeling process was a method to verify, for example, drawings' or maps' accuracy and also to analyze the "dynamics of change and continuity in the building process." Alkhoven also stated that "the most important quality of these spatial models is that they provide direct visual feed-back to the researcher during the project. ... In other words, the computer images become a source of information themselves" (Alkhoven 1993).

She concluded that the 3D model was a powerful tool for "understanding the town as a spatial construction." According to her "the three-dimensional models do give a good impression of the masses and even of the character of the town. Their value as a means of verification and communication of visual aspects of the built environment surpasses any other visual medium" (Alkhoven 1993).

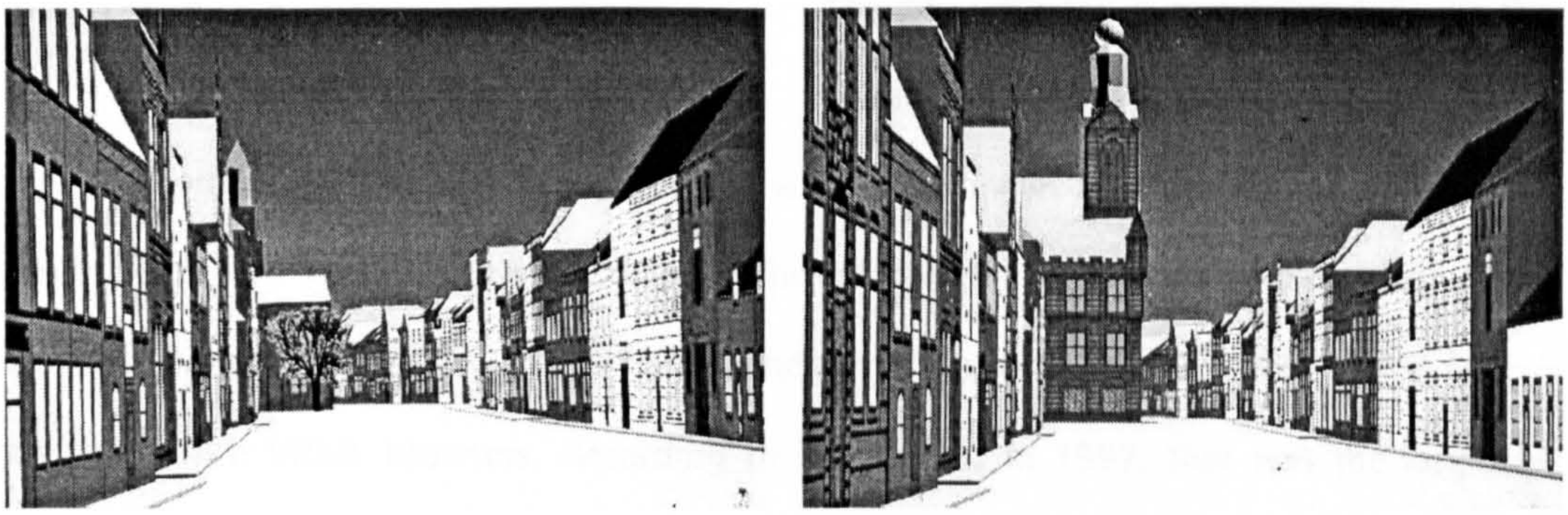


Figure 3.11: Perspective views from Heusden's model (Alkhoven 1993)

3.2.3. 3D city model as the focus for urban research

Bath is a small predominantly Georgian historic city in the United Kingdom that was added to *UNESCO's World Heritage List* in 1987. In 1991, the Centre for Advanced Studies in Architecture (CASA), University of Bath, received a grant to develop the model of the city (Smith et al. 1998). It was constructed applying aerial photogrammetry from the plans of the Ordnance Survey in 1991. For that task, the researchers used a photogrammetric plotter connected to a personal computer, registering the plan projections and the building heights from the aerial photographs. They decided to use regular commercial packages to develop the model and originally the buildings were registered in three different levels of detail: "the outline polyline, a simple block model and the fully detailed geometric model" (Day 1994). The model was very difficult to handle with every modeled building displayed in the fully detailed version. According to Day, a personal computer would require 20 minutes to regenerate the screen and 50 hours to render one single image. Even a powerful *Silicon Graphics* would take several hours to render one image (Day 1994).

Figure 3.12: Overall view of the Bath model (CASA 2002)

The model registered the built geometries for an area of 2.5km x 3.0km together with the topography covering an area of 10km x 10km (Figure 3.12). The landscape geometry was important to provide the feeling one understands the city with the surrounding hills on the back. The precision agreed to start the digitizing process of the aerial photographs was half a meter and the façade details were taken from street level photographs. The geometries were translated through Data Exchange Format files (DXF) to *VRML2.0*, generating interactive models that could be navigated with VRML browsers. According to Bourdarkis, in 1997, that was the largest

and most detailed VRML known city model. In 1997 the model could still not run on regular PCs. It required a *MAX IMPACT Silicon Graphics* to navigate through the model at 5 frames per second. At that time, the model was structured in four levels of detail:

> "Level 1: a simple volumetric description of each terrace with a flat roof at the average height for that terrace ... Roads, pavements and landscape areas are also added in. All level 1 data is placed together in the loader file.
>
> Level 2: each building is modelled with accurate wall and roof geometry and tagged as a separate object in the model. This means that each property in the city can be identified and used for data linking. Description hints are set so that the name and address of the property is directly accessible. Trees that are within the urban block are also switched on (as billboards). Typically Level 2 switches on at approximately 150 metres from the camera.
>
> Level 3: windows, doors, parapets, party walls and free-standing garden walls are added. Windows and doors are defined as single faces "floating" in front of the walls (usually at 5cm) and instanced from *EXTERNPROTOS* definitions facilitating remote management. It should be noted that not all windows, doors etc. of an urban block are under one *LOD* node. *LOD* nodes are created on the basis of keeping concise, more or less square (in plan) areas together. This usually means organizing them per street facade although a very long street will require more than one. Level 3 typically switches on at 90 metres.
>
> Level 4: architectural detail such as chimney pots, string courses and pilasters are added. At this level some photographic texture maps are also included for windows and shop fronts. The Level 3 structure is kept; Level 4 switches on at approximately 60 metres" (Bourdakis 1997).

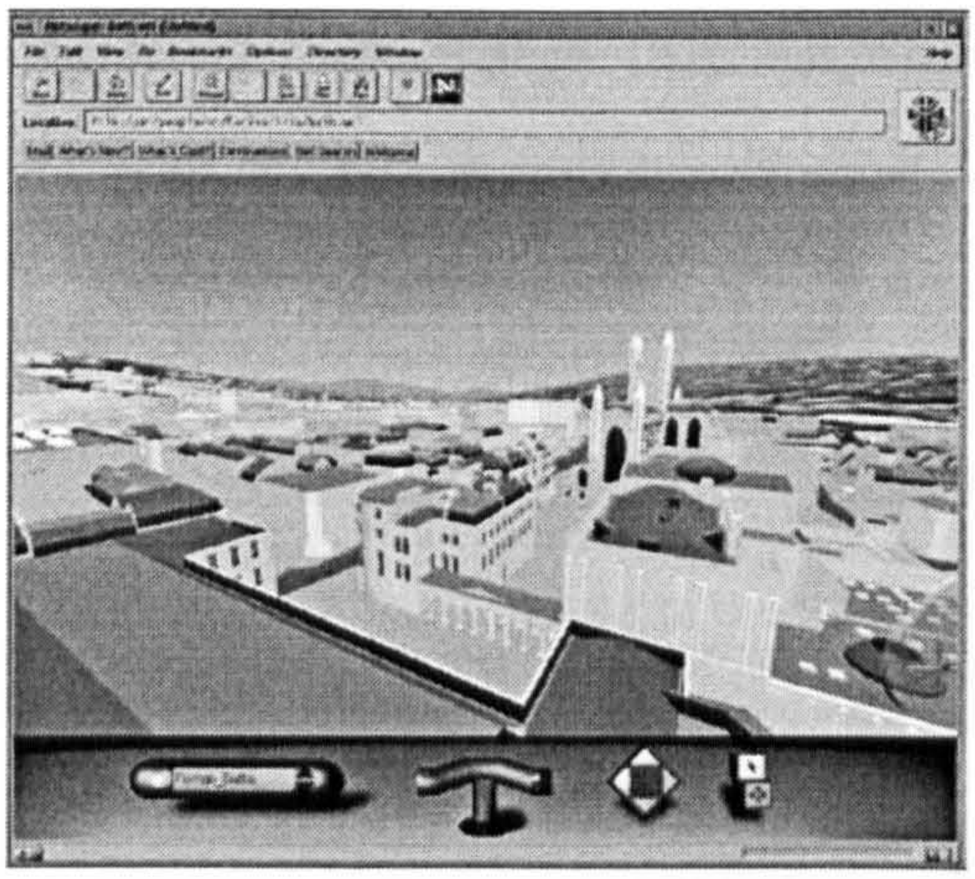


Figure 3.13: *Silicon Graphics* browser visualizing the Bath model (Smith et al. 1998)

Therefore, the level of details switches to a more detailed version as the observer gets closer to the object and the more distant ones are exhibited less detailed. Even with this feature, the navigation required powerful machines to run the browser, limiting the access to the model to those who could visualize it in CASA's computers (Figure 3.13). One of the main model's applications was the evaluation of new constructions' impact into the existing historical environment by the planning authorities. The architects took their proposals to The University of Bath, setting up meetings with the local authorities to visualize the project models within the city context.

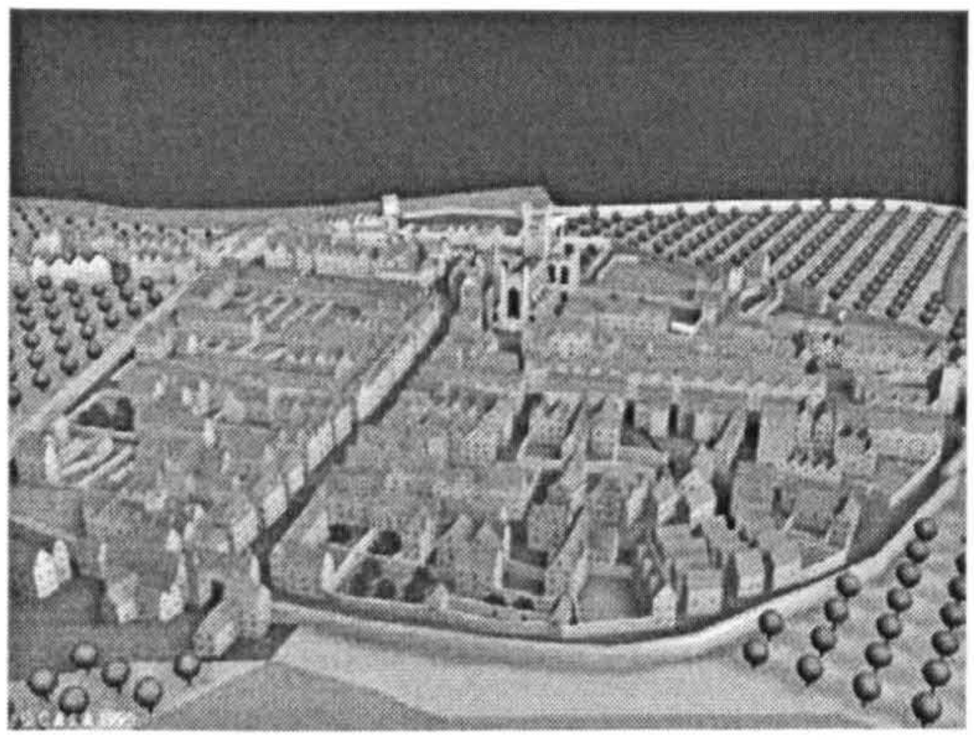


Figure 3.14: Reconstruction of the Medieval period with the Bath model (CASA 2002)

Additional versions of the Bath model have been constructed to represent different historical moments of the city such as the Roman and Medieval periods (Figure 3.14). For this thesis, that the most significant aspect of the model. Alan Day and Anthony Radford focused on that issue in the paper "Imaging change" (Day and Radford 1995). They observed that once the model was built, several uses for it were verified. One of them was to use the model of the existing city and remove the new structures, producing a time-line model using historical records. They quoted Alkhoven to state that this method is much more efficient than constructing an historical model from the beginning based only in historical records. They aimed to elaborate a version of the city every 20 years from 1620 to 2000. According to them, the period from 1620 to 1820 was already registered two dimensionally, although only the years of 1620 and 2000 were totally constructed in 3D (Day and Radford 1995).

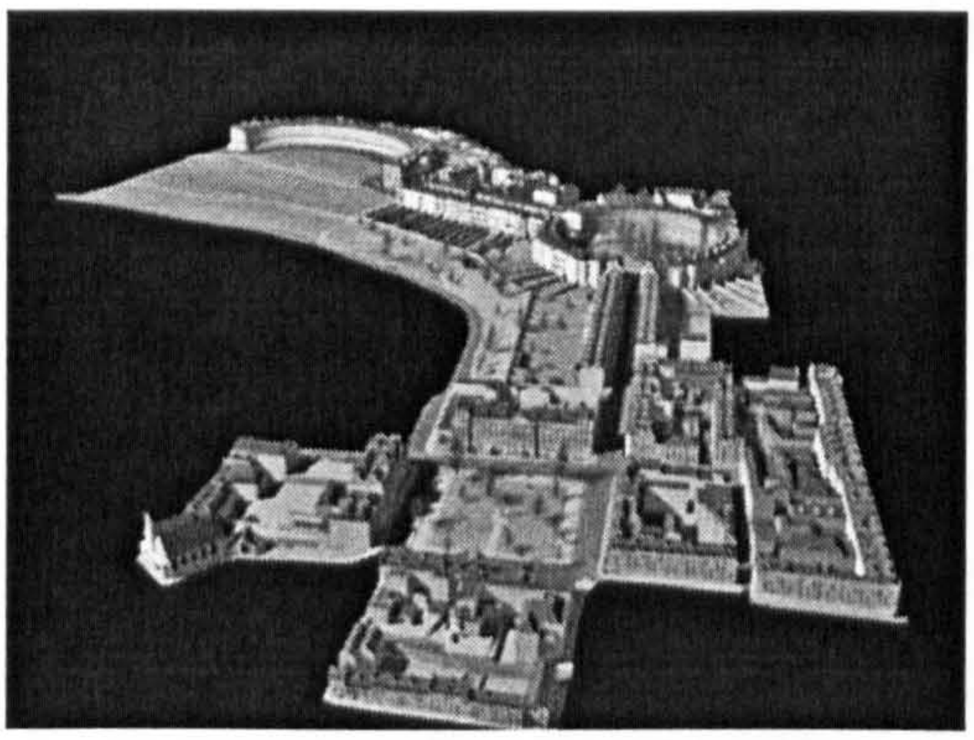


Figure 3.15: Partial view of the Bath model: Queens (CASA 2002)

Day and Radford (1995) stated that "the computer model of Bath has always been primarily directed at being a 'means': a means to explore issues in urban design, in the public perception of a city, in the implications; on physical form of various strategies for making more sustainable cities, and a means for understanding more about the city's form and history." They described that the model "can act as an indexing system for historical information, much in the way that maps are used in geographical information

system." Therefore, the model is used as a database where information spread in different formats is assigned to "individual properties in the city", facilitating its access. Many unbuilt plans were also stored in the model as "alternative cities." As in Seebohm and van Pelt's papers (van Pelt and Seebohm 1990, Seebohm 1992), they "acknowledge that the city we see today is only one of a numbers of possibilities and reaffirm that the city of the future will be determined by investigating and choosing between today's alternative" (Day and Radford 1995).

Day and Radford's paper covers several topics related to the model's structure, process and theory. Their conceptual ideas are very interesting and seem to be quite effective. However, there is no record of what they finally achieved in the topic of Bath's historical survey. The statements mentioned in the previous paragraph were not very detailed and it is not clear how any user interested in the history of Bath could finally retrieve some of the mentioned historical information. On the other hand, the description of such different applications for the 3D city model reveals that a comprehensible model, designed to be a "means", can be a powerful research tool and a vehicle to several forms of analysis and representation.

3.2.4. *Interacting with an historical model: Sheffield*

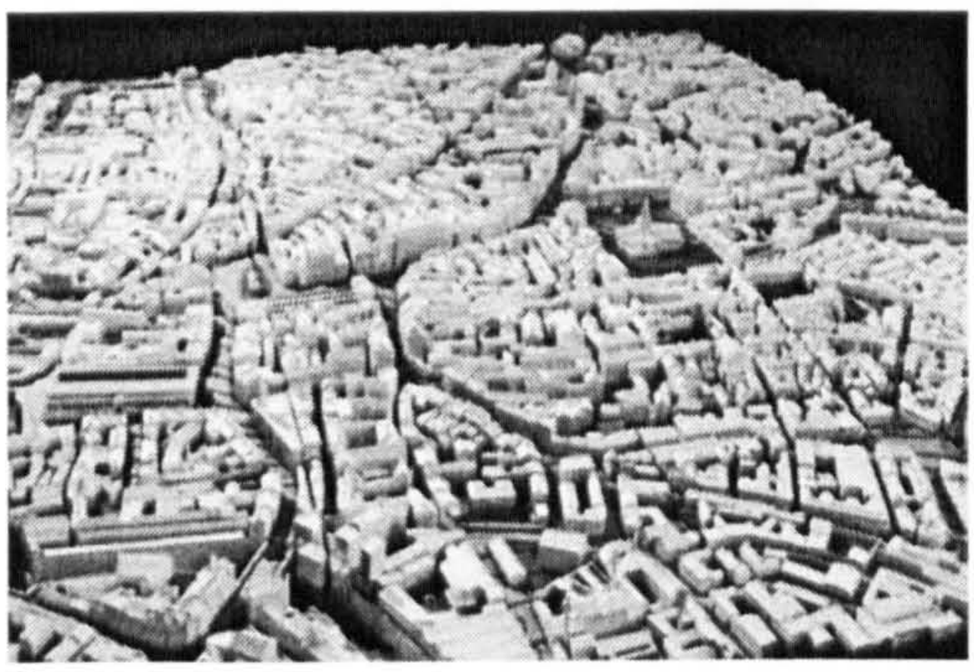


Figure 3.16: Sheffield physical model (image from Peng's presentation at eCAADe'2003, Graz)

Researchers from the University of Sheffield conceived the last project reviewed in this section. The development of the historical 3D city model of Sheffield had quite a unique origin. In the academic year of 1998/1999 the students of the School of Architecture, started the urban study project "Sheffield 1990" (Figure 3.16). The main outcome of this project was a large physical urban model of the city constructed at a

scale of 1:500. In addition to the physical model, the students kept several records of the buildings, stored in paper boxes. 95 students participated in this first version of the project and they developed 20 model pieces, each representing a square with side-length of 200 meters. The juxtaposition of the 20 pieces, created a model of 2.0 x 1.6 meters. Each group of students was responsible tfor modeling one of the 20 squares, providing additional information, including a detailed examination of one selected building in the square. The decision to model the city in the year 1900 was due to several reasons. It displayed the city in its peak of wealth before the war destructions and the decay of heavy industry and the availability of records of the buildings in accurate maps and photographs. According to their authors, the study had four pedagogical objectives: "to demonstrate the importance of understanding how a place has evolved before contributing a new design; to show the changes that have taken place in cities during the last century; to teach students how to undertake historical research; and to build up a database about the history of Sheffield for future reference" (Peng and Blundell Jones 1999).

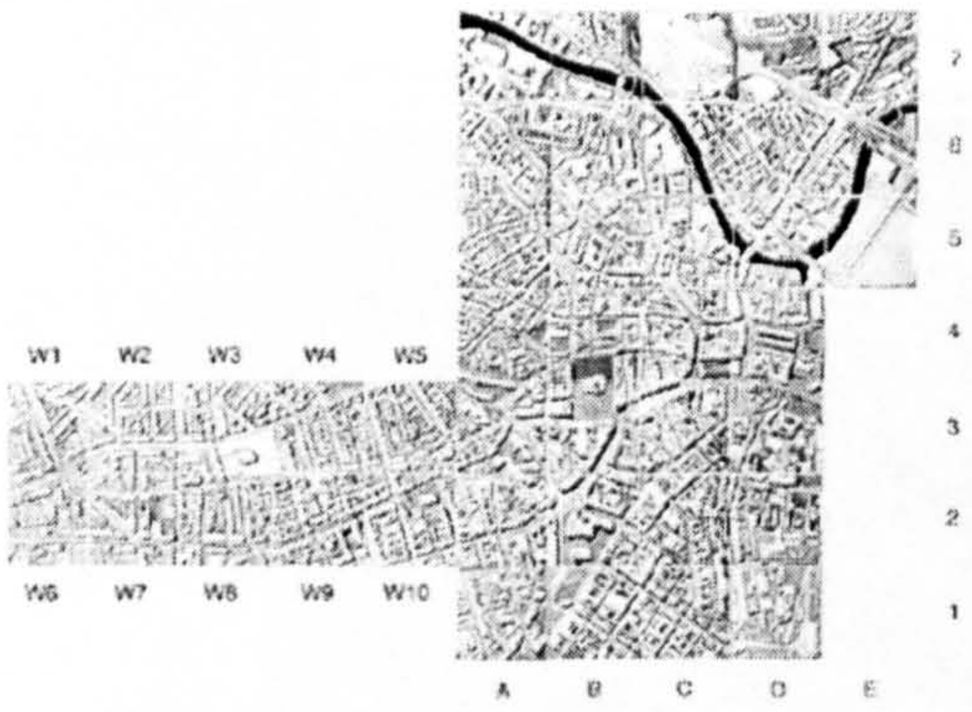


Figure 3.17: 41 pieces of the Sheffield physical model

The success of the first experience allowed the continuity of the project in the following years. The *Sheffield Urban Study Archive – SUSA –* is currently constituted by 41 squares, comprising an area of 1.64 square kilometers (Figure 3.17). Additionally, it displayed several possibilities for information assembled by the students. The paper based model and additional information could be digitized, allowing benefits in several areas such as storage, retrieval and application to other purposes. Therefore, "in June 1999, a major research grant from the Arts and Humanities Research Board was awarded to the authors to embark on a separate project

with an aim to investigate how the physical database amassed by the *Sheffield Urban Study* project can be put into electronic form accessible through multiple routes" (Peng et al. 2001). Thus, the S*heffield Urban Contextual Databank* (*SUCoD*) Application had its inception with the project to build a physical model and the first objectives of the digital project were to make available the contextual data on-line; to extend and update the contextual models and to share these models in a collaborative design environment. Hypermedia authoring based on HTML and VRML were selected to accomplish the task (Peng and Blundell Jones 1999) (Figure 3.18).

The *Sheffield Urban Contextual Databank* application aims to provide a platform to deliver 3D interactive VRML models with the potential to be associated to other related data through HTML pages. Although up to now the 1900 model is the only one available in the system, the *SUCoD* project aims to provide a tool to visualize the city in change. Conceptually, in *SUCoD*, a time axis can be assigned to any model. Therefore, models of different times can be visualized together matching the spaces in different

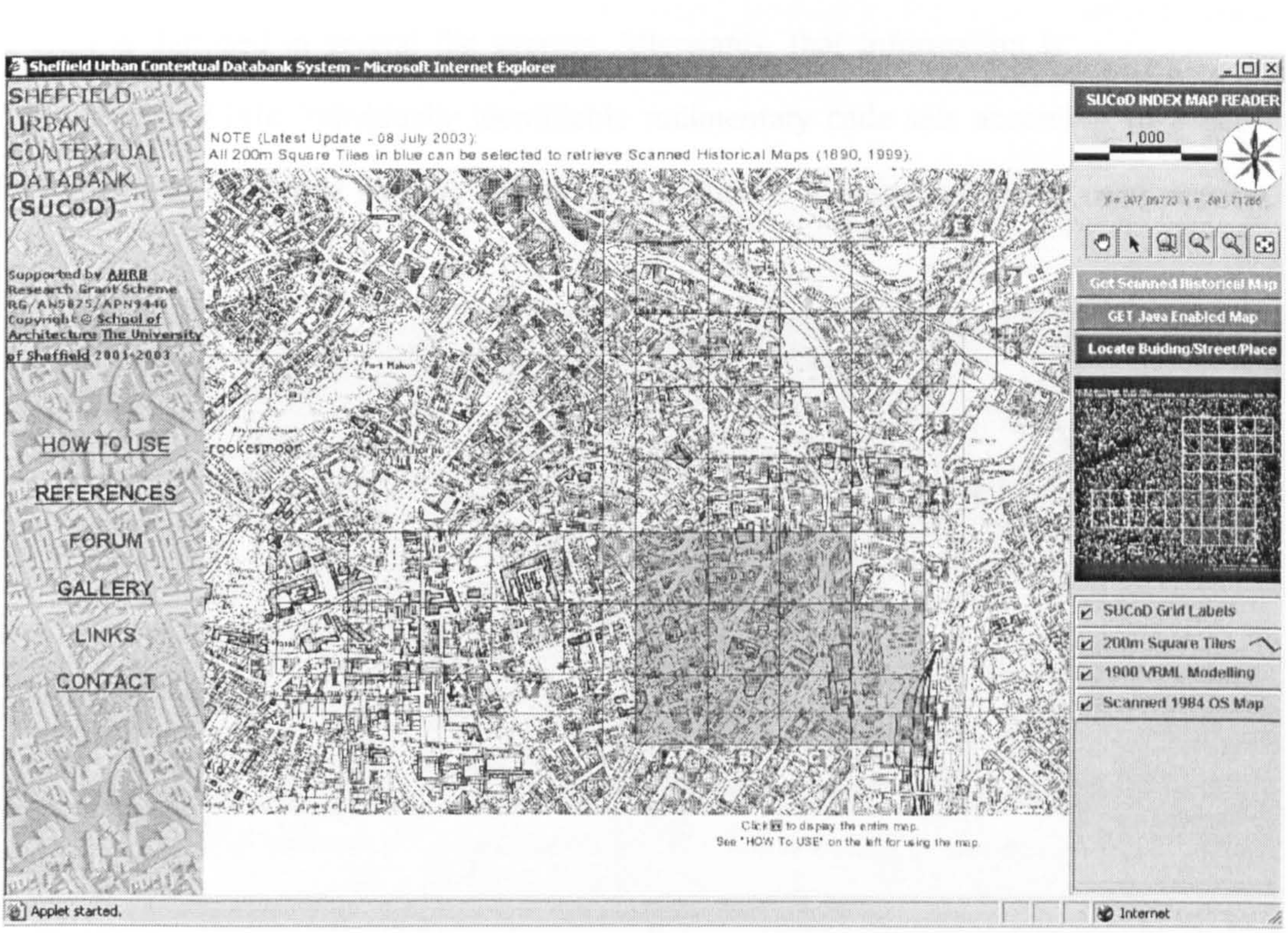


Figure 3.18: The graphic interface of the *Sheffield Urban Contextual Databank* application (The University of Sheffield 2003)

historical periods. Those tools were tested with a partial model of the year 2000 when the time axis demonstrated the possibility to apply them to models from any other period (The University of Sheffield 2003) (Figure 3.19).

The *SUCoD* system is structured with *Java* and *Common Gateway Interface* (CGI) technologies. They developed a Multi-tier Extensible platform for *Dynamic and Interactive Urban Modelling (MEDIUM)* in connection with the 3D model of the city of Sheffield. The *MEDIUM* basically allows the users to interact with the database of spatial information stored in the server. Through the CGI clusters the users can specify their needs associated with the area of the models and/or the historical period. The CGI provides the connection with the database stored in the server retrieving the files of 3D models, maps and the other information associated to them. According to Peng, the *MEDIUM* would deliver to the *SUCoD* a methodology of "Virtual Reconstructivism." The "Virtual Reconstructivism" would be constituted by three phases of "Construction," "Deconstruction," and "Reconstruction." Thus the urban information recorded for the project is digitized in several file sources. Afterwards, that information is "deconstructed into individually identifiable rudimentary code sets according to a geo-referencing and naming method" (Peng 2003). Finally, in response to the users request,

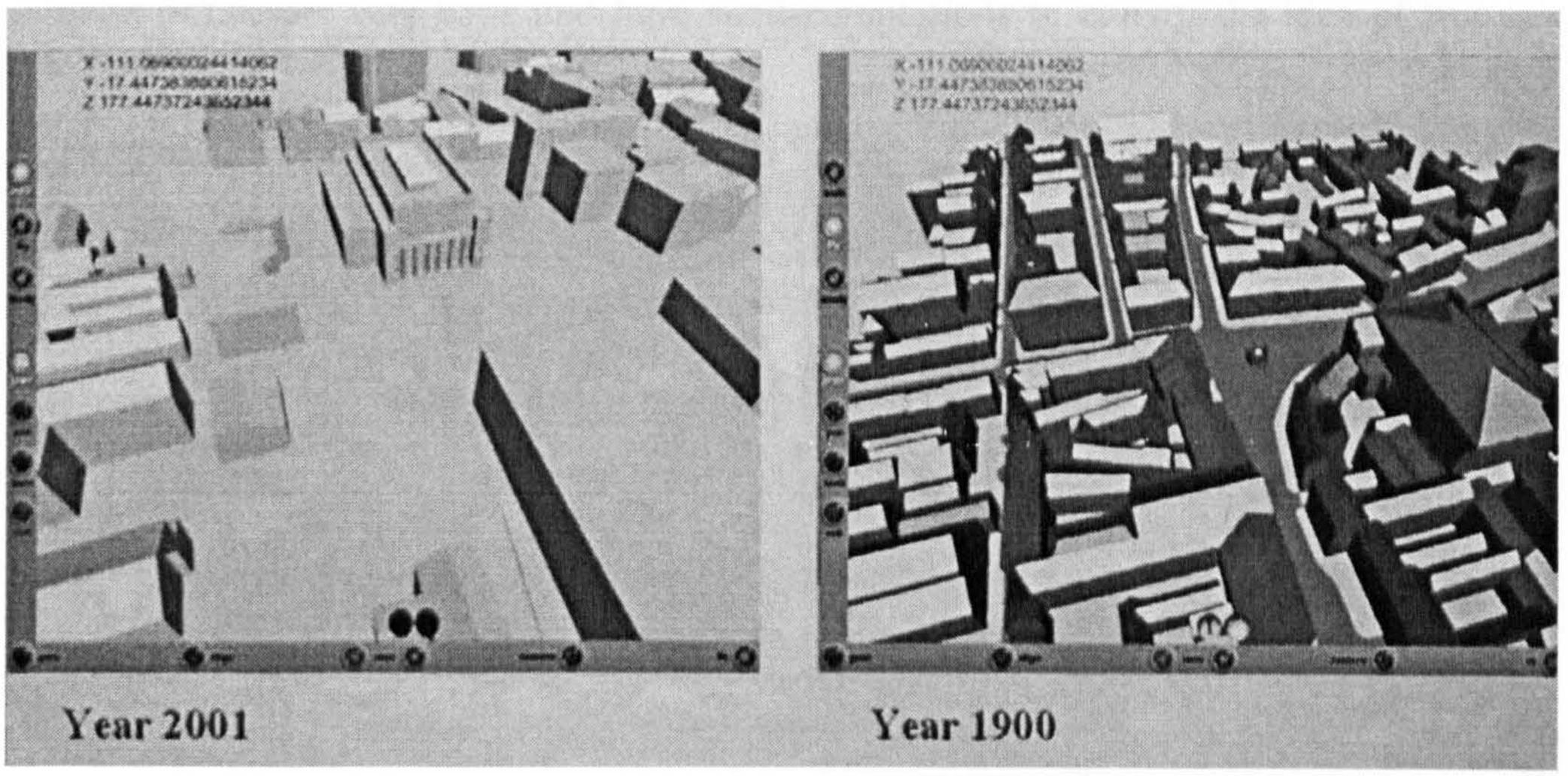


Figure 3.19: Visulializing the city in chance through *SUCoD* (image from Peng's presentation at eCAADe'2003, Graz)

the information is re-assembled in a singular format and delivered to the users through the *SUCoD* interface (Peng et al 2001 and Peng 2003).

The investigation carried out in Sheffield differs from other precedents for developing flexible systems oriented towards user's needs. To provide this flexibility, the system should be filled with a great diversity of information. Since just a limited amount of information is available to be retrieved, the system has been developed more as a conceptual tool, which still cannot be verified by users. The development of the project has been carried out by few people, restricting the possibilities to upload the information already recorded in analog format by the *SUSA*. Therefore, the emphasis of the researchers' work seems to have been directed towards the development of the system and furnishing it with the functionality that would conceptually allow the accomplishment of their objectives.

One of *SUCoD*'s limitations is associated to the VRML navigation with existing browsers Peng (2003). reported that the lack of roof details diminishes the capacity of conveying the true city form in the *Glasgow Model* (this project will be discussed in 3.2.4). He is correct, however; the existing restrictions of the Internet, define a bottleneck to which on-line VRML are subject. Thus, even with roof details, the models currently available through *SUCoD* are very basic and have similar limitations to convey the idea of true

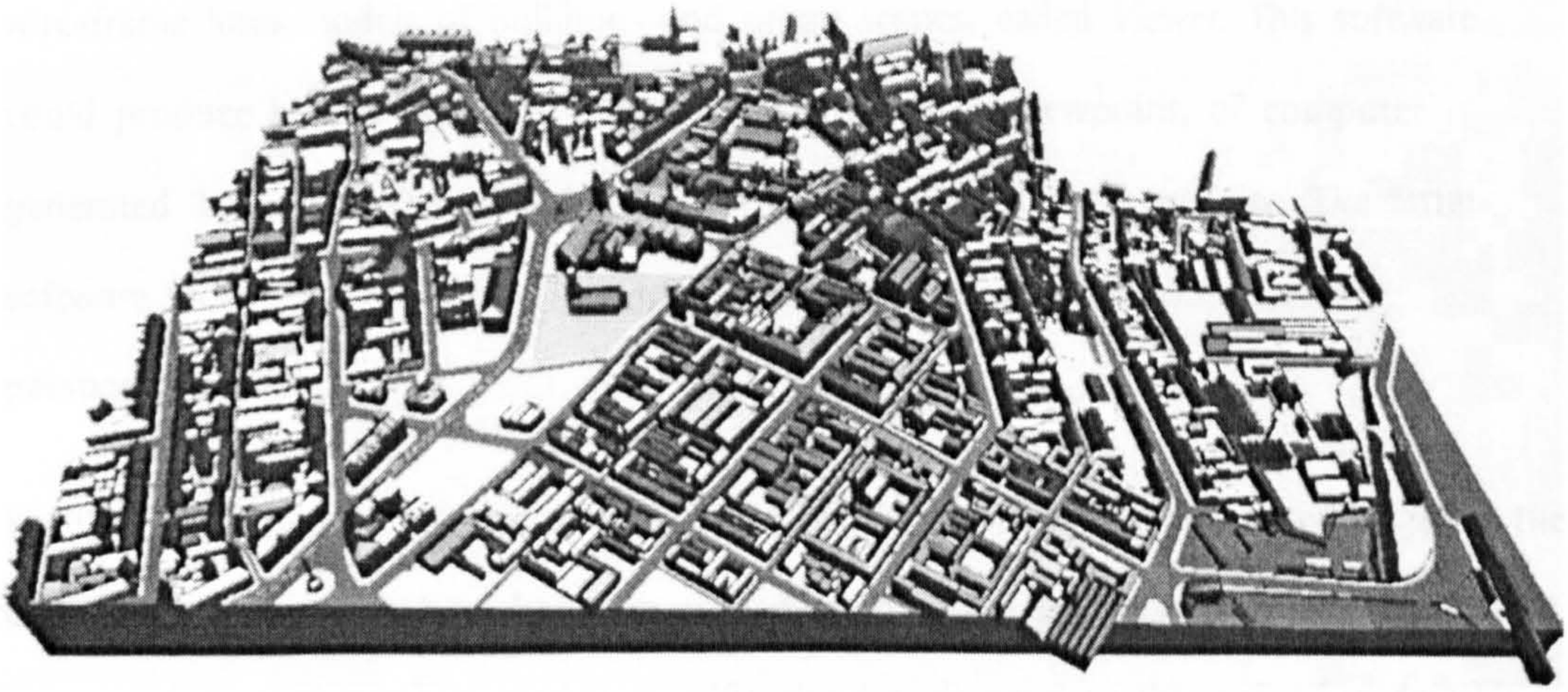


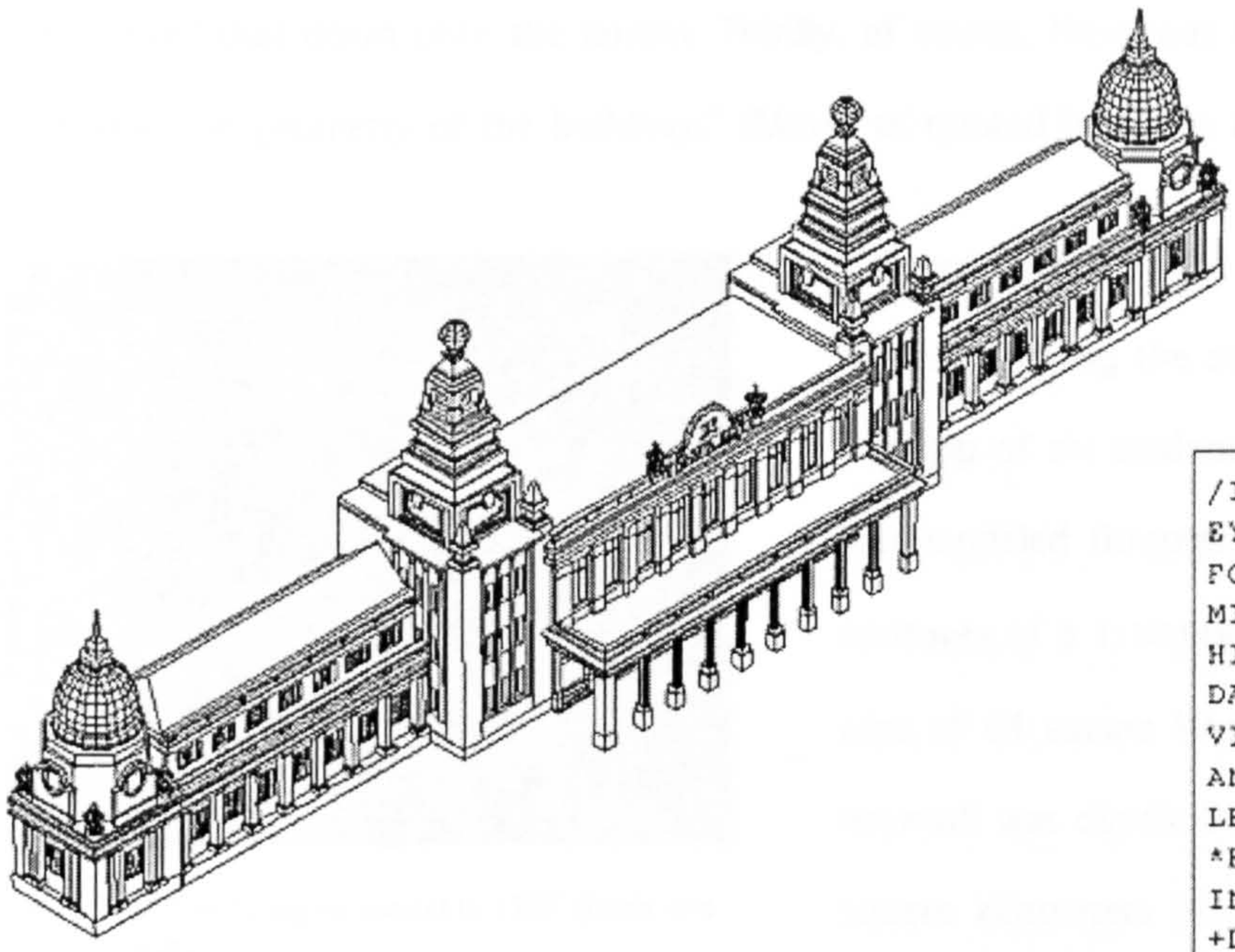
Figure 3.20: Sheffield VRML model (image from Peng's presentation at eCAADe'2003, Graz)

city form. Additionally, restrictions on VRML browsers result in obstacles for a friendly or 'natural' navigation through the 3D models. The great advantage of the physical model developed in Sheffield is actually to visualize all the squares together. Since the buildings do not present many details, the feeling of comprehending the space is due to the area covered by the 3D buildings. The most significant aspects of the Sheffield digital version, according to this thesis, relates to the possibility to assign a great diversity of related data together with the VRML model. This is a very difficult task to be accomplished by the physical model and the related paper boxes of recorded documents. Thus, the possibility to choose the data stored in HTML files, in a spatial environment, and have it downloaded, is the noteworthy aspect brought forth by *SUCoD*.

3.3. *ABACUS projects: outputs from the Glasgow Model*

In the 1980's the ABACUS (Architecture and Building Aids Computer Unit Strathclyde) research group, based at the Department of Architecture and Building Science, University of Strathclyde engaged in a major enterprise for that time. The group led by Prof. Thomas Maver built a 3D model of Glasgow City Center. ABACUS was already researching with digital modeling and visualization and had extensive experience in this area. At the end of the 1970s they had developed visualization software oriented to wire-frame lines models of buildings and urban scenes, called *Viewer*. This software could produce hidden line perspectives from any chosen viewpoint, of computer generated 3D models (Figure 3.21). Viewer was closely followed by *Vista*. The latter software moved a step further, providing the ability to produce texture colors perspectives.

In 1986 ABACUS took the opportunity given by *Silicon Graphics* that wanted to prove the capacity of their newly launched computer. The computer Iris "was revolutionary in that it had a dedicated graphics engine, specific circuitry devoted to the task of undertaking



VIEWER

/INPUT	NEWFIL
EYEP	TYPALL
FOC&MP	4PAVER
MIDP	3PAHOR
HIDDEN	2PERSP
DASHED	1ORTHO
VISIBL	SCREEN
ANGLEV	OUTFIL
LENSFL	BYEBYE
*ENLRG	$STERE
INPALL	.LAYER
+DEFV	#ZONE
?HELP	_LEVEL

Figure 3.21: A hidden line perspective produced by ABACUS's software *Viewer* (Ennis and Lindsay 1999)

large geometric transformations at speed, giving the illusion of real-time animation" (Ennis and Lindsay, 1999). Although very powerful at that time, their computer had not been tested as a geometry engine processor in Europe. Therefore the main purpose for the model construction in the 1980s was related to an academic exercise. It was created to test the creation, storage, access and manipulation of a large quantity of data. The model later proved to carry other significant uses such as the visualization of design proposals inserted in the context of the city. This latter use helped to finance the extension of the model to cover 25 square kilometers with the building geometries (Ennis and Lindsay 1999, Ennis and Maver 2001, ABACUS 2003).

According to Ennis and Lindsay, Maver explained in the video "The Glasgow experience: building a computer based model of a city" that:

"The strategy we decided to adopt was to build a model in three levels, as it were ...

First, we had to capture the terrain of the city. Secondly we digitized the road network

and floated that down onto the terrain. Thirdly, of course, there was the challenge of capturing the geometry of the buildings" (Maver as quoted by Ennis and Lindsay 1999).

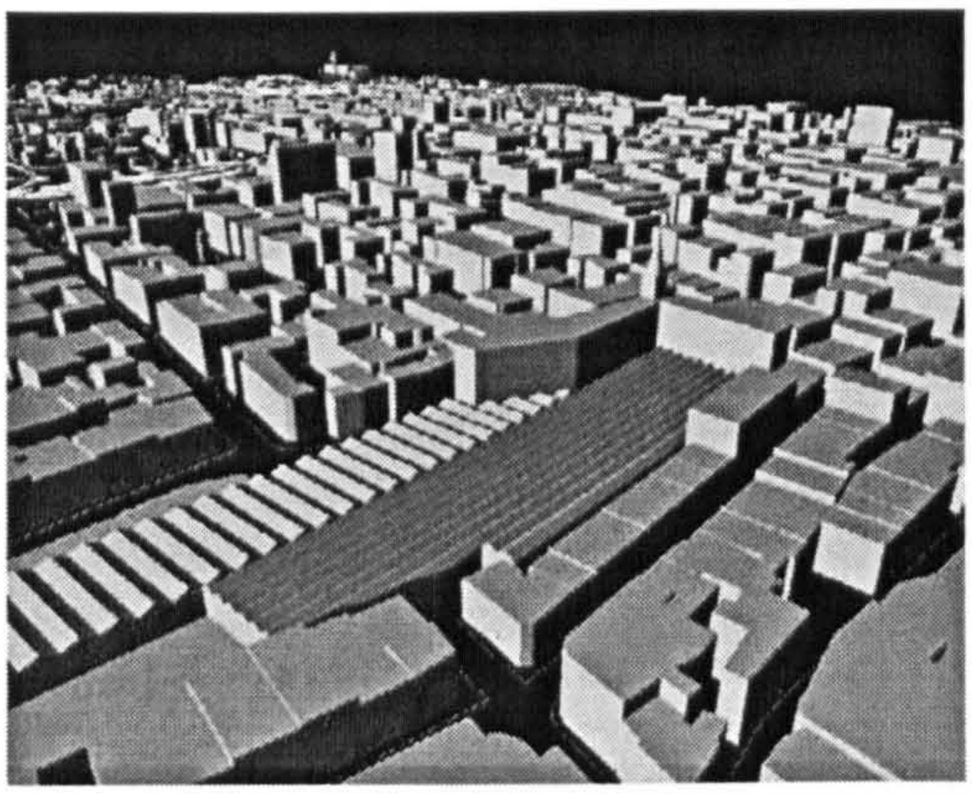


Figure 3.22: The Glasgow model in 1987 (Ennis and Lindsay 1999)

The geometries of the city center were captured during the summer of 1986 by a group of six students. The topography was modeled through digitizing the contours of a 1:10.000 scale map for an area of 64 square kilometers. The street network was digitized for an area of six square kilometers from orthogonal plans. Later, the roads were superimposed onto the terrain model, assuming its shape. The buildings, according to Maver, constituted the most laborious part of the modeling process. They were constructed from 20 ordinance maps of the city in the 1:1250 scale, which were digitized. The heights were obtained from a variety of sources: stereoscopic analysis of aerial photos, or previous projects which registered that information (Maver 1987) (Figure 3.22).

The resources presented in the *Glasgow Model* seem to be quite basic nowadays. However, they were revolutionary in the second half of the 80s, particularly for the amount of information modeled, and are still useful nowadays. That model, generated near twenty years ago, is still being used by several projects developed by ABACUS, related to the city of Glasgow. Three of those projects, which were significant for this dissertation, are described in the following topics.

3.3.1. Searching the city in 3D:The Glasgow Directory

The *Glasgow Model* represented an enormous effort and was recognized at that time by most researchers from the area. However, it presented some serious drawbacks. The model required ABACUS' software to be visualized and it lacked interactivity. More than ten years after its creation, The *Glasgow Directory* (ABACUS 1999) was developed taking advantage of two main circumstances: the emergence of the language VRML for the World-Wide-Web and the award of Glasgow as the *1999 UK City of Architecture*. (Ennis and Maver 2001) The latter was the main motive for the grant received to develop the interactive system based on the 3D Glasgow city model. The model, which was enormously complex and needed a very powerful computer that could manipulate its graphics in the 1980s, proved to be currently simple enough to be transformed into VRML files allowing the navigation over the Web. An in-house software was created to translate the database model files into VRML models. Therefore, the model, with the geometry of the topography, roads network and 10.000 buildings, was divided into "28 neighboring city 'chunks' which could then be interactively explored on the internet" (Ennis and Maver 2001).

According to Ennis and Lindsay, Steven King, a University of Strathclyde research student analyzed the *Glasgow Model* in 1987 and presented a list of recommendations for future developments of that project:

> "1. The data set is too large to enable realistic animation, use only what is needed in each scene.
>
> 2. Different levels of detail need to be introduced i.e. the nearest block should have the highest detail and those blocks in the background should have very little detail.
>
> 3. Labelling - the data set requires labelling with street names, building names, owners, uses etc. being retrievable interactively.
>
> 4. More powerful hardware is needed.
>
> 5. The user-interface needs to be developed to provide more intuitive navigation.
>
> 6. Software is needed to allow the user's eye-point to remain at a constant height above ground level to aid the sense of 'walking' in the model, yet allowing a 'manual over-ride' for investigative manoeuvring.
>
> 7. Integrated databases containing building information should be linked directly to the model, i.e. it should be possible to stop outside a building and then call up information on that building

including a detailed picture. This could be displayed in a separate segment of the VDU" (Ennis and Lindsay 1999).

King raised significant issues but the ABACUS group did not consider them. At that time, the amount of work necessary to implement those changes seemed to be much greater than their benefits. Several years later, the programming language VRML was developed to allow the manipulation of 3D models over the Internet. King seemed to have envisaged several years before the characteristics of VRML, which responded to his list of requirements (Ennis and Lindsay 1999).

Figure 3.23: Hidden line perspective of Glasgow City Center visualized with the software *Viewer* (Ennis andLindsay 1999)

With the advent of VRML, the *Glasgow Model* was granted a new and significant use. The conversion of the pioneer model into the VRML allowed the development of *The Glasgow Directory*. This new project aimed to connect data related to buildings and streets to the 3D model. Users would search for the information navigating through the 3D models in a similar way they would do in the 'real' city. Information would be organized by different categories in a database, which would be linked to individual buildings of the 3D model.

The users navigating through *The Glasgow Directory* choose the area they want to visit among forty-seven available options. Then, the system displays an interface with a VRML browser located in its largest window. Another window exhibits a map with a red bullet representing each area available for visiting, where the users can choose to jump to a different area. The other screens were designed to facilitate the navigation through the browser and display the information related to the searchers placed on the 3D model. The buildings linked to information on the database are classified by their use and date of construction and are considered landmarks. When the users choose the categories they want to search, the buildings assigned to those categories, exhibit a specific sign. Therefore, the users identify the building classification facilitating their choice and allowing the downloading of more information related to them. A photograph of their façade, their address, the architect of the project and a brief text explaining them constitute the available information related to the landmark buildings. Some of them exhibit also a panorama image of their interior in *Quick-Time VR* format.

The Glasgow Directory has been continuously developed since its implementation in 1999. Most of the effort was directed towards a 3D multi-user environment with users

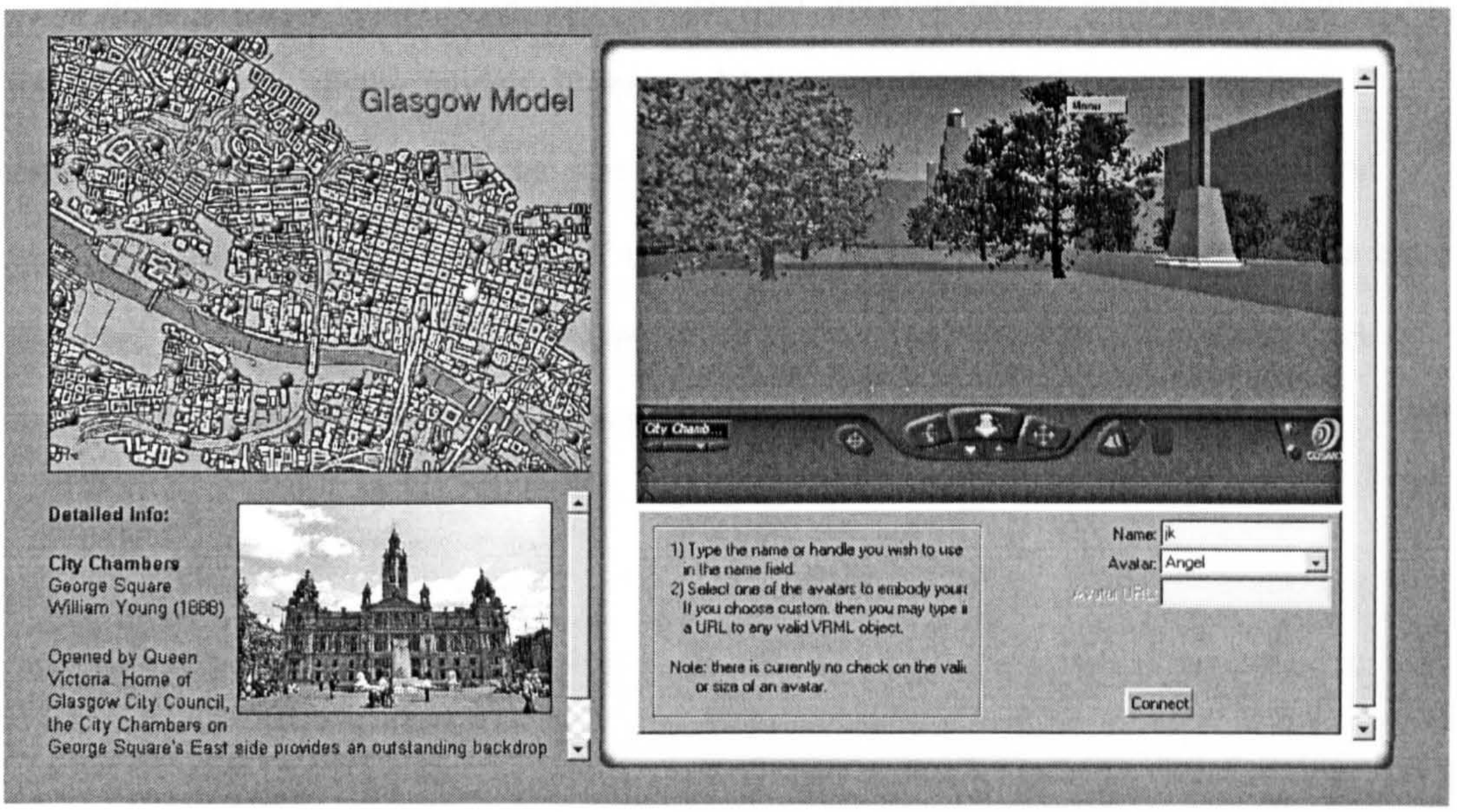


Figure 3.24: Graphic interface of *The Glasgow Directory* displaying in the large window the VRML browser and in the small window the City Chambers (ABACUS 1999)

interacting among themselves through avatars. Thus, each user can connect to the system choosing one avatar assigning a user name to it. The avatars "walk" through the 3D model and can be seen by any one who is simultaneously connected. The area of George Square was chosen to host the interactions through the avatars because it has always been the most visited and with more available resources.

The Glasgow Directory presents a creative method to apply the VRML language and the *Glasgow Model*. However, it also brings inherent difficulties of VRML models. In the homepage, before downloading the VRML models, the user is instructed to use the arrow keys from the keyboard instead of using the mouse to navigate through the model. The arrow keys present an easier way to control the directions through the VRML browser. Controlling the browser with the mouse gives more freedom to the user but is far from being easy for a beginner. However, even the arrow keys do not enable the user to navigate in a similar way as one moves through the city. Another noticeable issue is the lack of details in the buildings, which makes navigation through every regular street appear to be almost the same. Models which don't have many details are very efficient when viewed from far away but look poor when examined from a closer distance. Developing a VRML model to be downloaded over the Web carries always the dilemma of relation size/detail of the models. If the model is more detailed, the user may have difficulties to download it. On the other side, if the model has a reasonable size to be quickly downloaded by the average of users, it may be too poor to be navigated in a close distance. If the idea of *The Glasgow Directory* is noteworthy, sometimes the model lack of details does not facilitate the implementation of the authors' objectives.

3.3.2. Sense of 'place' through linking past events and geographical location

Figure 3.25: *Glasgow2000*'s open page (ABACUS, 2001b)

The CD-ROM *Glasgow2000: the history of the city* (ABACUS 2001b) was chosen to be included in this document for several reasons and it is probably the project that is closest to *Rio-H*, which will be introduced in the following chapter. It doesn't present many images from 3D models and 3D models were not applied as a research tool for the CD development. Although the Glasgow's digital model cannot be noticed in the CD-ROM, it was actually used as a base for artists to traditionally render perspectives of the city in different periods. They prepared their historical renderings from large printouts of the model's perspective view. For that project, the possibility to manually elaborate the renderings was much more feasible due to the limited time and budget allocated to it. Thus, each period of the city was illustrated by watercolors and in "the most recent period of the city's development, actual aerial photographs were 'draped' over the computer generated topography" (Maver, Ennis and Jarvis, 2001). The fact that 3D models were not used to render historical images for the final product, demonstrates that, even if the research group had a quite complete 3D model of the existing city configuration, the transformation of that model into historical ones from previous periods would be a laborious task.

The *Glasgow2000* introduces the city in six different historical periods. Each one is presented with an aerial view of the city, displayed in the larger window on the screen interface. A cursor that moves through this window selects the areas of the city that will be zoomed on a separate smaller window. Therefore, the users can always evaluate a closer view of a specific area in the city while they locate this area in the overall image

of the city. When an historical period is chosen, the navigation is done through two columns of items that the users can select. The column on the left is named 'Landscape' and displays elements that are connected to locations in the city while the right column with the title 'Concepts' is constituted by elements which are not related to places such as 'Government,' 'People,' 'Taxes,' and so on (Figure 3.26, 3.27).

It is important for this dissertation to acknowledge the authors' aim through the CD, to "give a sense of 'place' and to link all of the information to geographical locations" (Maver, Ennis and Jarvis 2001). The authors make use of a great number of historical documents from several file types, such as sound or video clips, photographs and written documents, connected to city locations. Traditionally, those files, when displayed in historical works, are only accessible in limited number and connected to some texts on specific topics. Seeing, hearing or reading many of them, in a chosen order and linked to known areas of the cities is a powerful move. One has a comprehensible feeling of the city's environment through those pieces of information and the comparison of the present city's urban spaces.

Although the 3D model was just a support to generate city's historical representations, this project suggests significant use for it. From the digital base the artists could render freely what the city looked like in previous times following the correct location of rivers, streets, and other elements that relate to current roads and other physical features of the

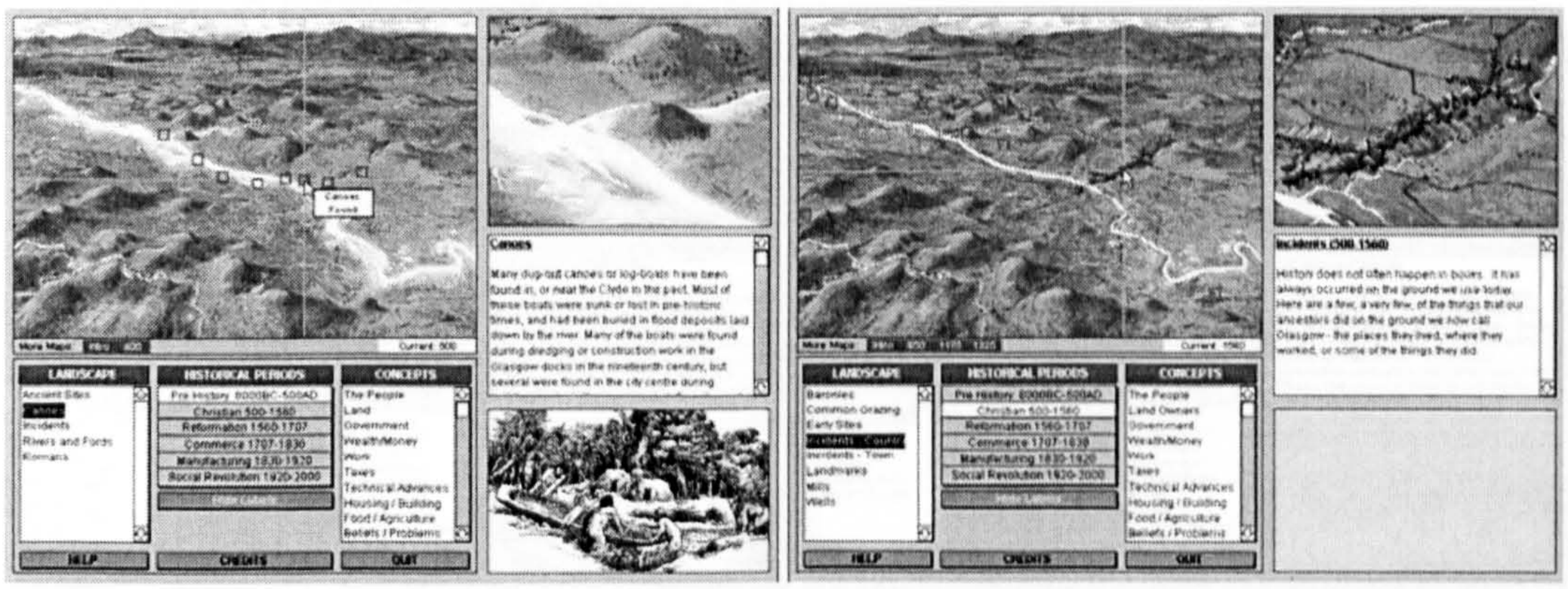


Figure 3.26: Graphic interface exhibiting the Pre History and Christian periods (ABACUS, 2001b)

city. The advantage of the watercolors over the digital models is that the formers are less precise. The images are often blurred suggesting some configurations for the city without exactly asserting how it was physically constituted. From a distance, the lack of precision was not a problem and, actually, was probably more efficient than a complete model of the city in the past. Those images successfully achieved their goal. Anyone who is familiar with the city will recognize its spaces and will relate the events displayed, to the known places in the city. The watercolors exhibit distant views of the city. Thus, they are often similar to maps but, since they are perspective views, it is possible to identify the hills and rivers and how they directed the city growth. The watercolors facilitate the recognition of the places from the past and also locate the events described by the files included in the *Glasgow2000*. The files exhibit the main events and, particularly, how people lived in the different places in the city. Therefore, the most valuable issue of this project is to link those files that present the human interactions within the urban spaces to the aerial views. They exhibit a city we cannot grasp with our senses when we are walking through its streets. Both of them are meaningful representations of the city. One presents what is missing in the other. However, they are seldom put together in usual city's representations. Although this CD-ROM presents a limited amount of information and the texts presented are relatively short, it is an invaluable contribution to those who research creative forms of presenting the history of the city. The greatest shortcomings of *Glasgow2000: the history of the city* are the relatively small quantity of available historical information. It provides a magnificent structure and users want to see more.

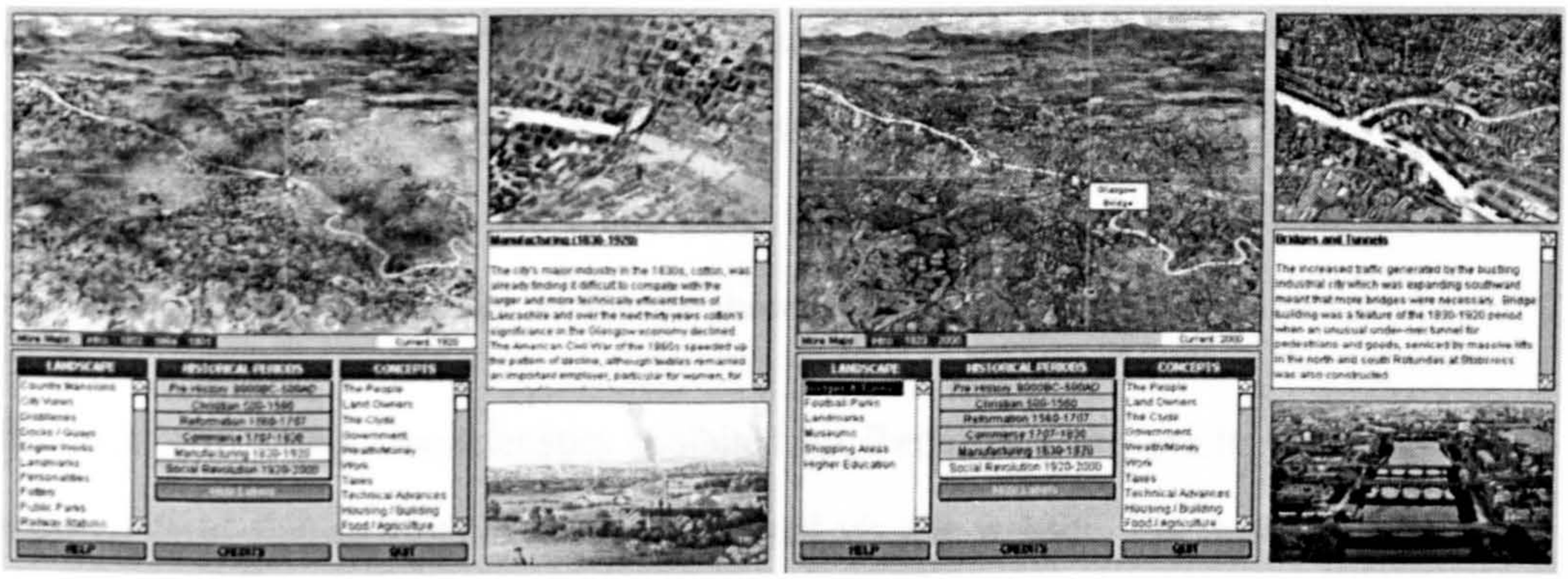


Figure 3.27: Graphic interface exhibiting the Manufacturing and Social Revolution periods (ABACUS, 2001b)

3.3.3. *Connecting stories of the city to archive images: TheGlasgowStory*

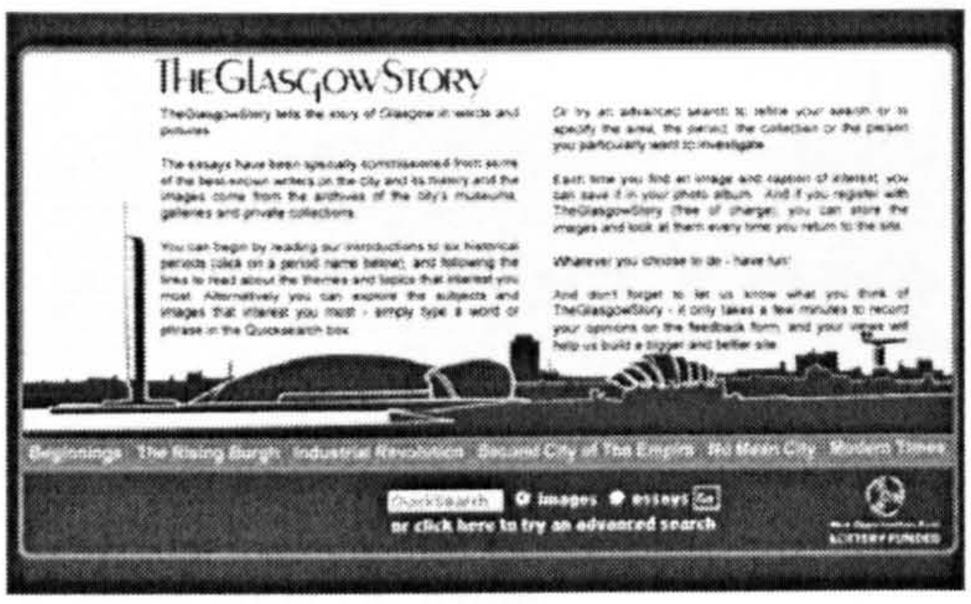


Figure 3.28: *TheGlasgowStory*'s initial page (ABACUS, 2003b)

The last project involving ABACUS that is analyzed in this dissertation is *TheGlasgowStory* (ABACUS 2003b). It is one of the results of the United Kingdon support with governmental funds of great initiatives that provide learning and research material online. The project *TheGlasgowStory* is being carried out by a large consortium including two Universities and all of the public libraries in the city; it aims to digitize archives of different institutions about the city of Glasgow, bringing together the material and providing online access to the public, particularly educators, students and researchers. *TheGlasgowStory* is a website to be launched at the end of October 2003, which earned a grant of £600,000 from *The New Opportunities Fund* financed by the Lottery. The project led by the University of Glasgow and ABACUS (University of Strathclyde) was sub-contracted to develop the website *TheGlasgowStory* (Figure 3.28). The authors of the project aimed to digitize about 15,000 images located in several recognized institutions such as university, museums, libraries, art galleries and other archives (ABACUS 2003). The digitalization process was carefully planned and for each digitized image, a caption was created. These captions explain the images and also the online survey from the database. Additionally, several writers were hired to elaborate around 500 essays of 250 to 1,500 words, on topics of the city history in which they specialize. The digitized images can be inserted in the essays to illustrate the writers' stories. Therefore, those images can be downloaded from the stories or directly from queries placed to the database.

The most remarkable characteristics exhibited by *TheGlasgowStory* are its size and the importance of the digitized material distributed via the website. The material owned by

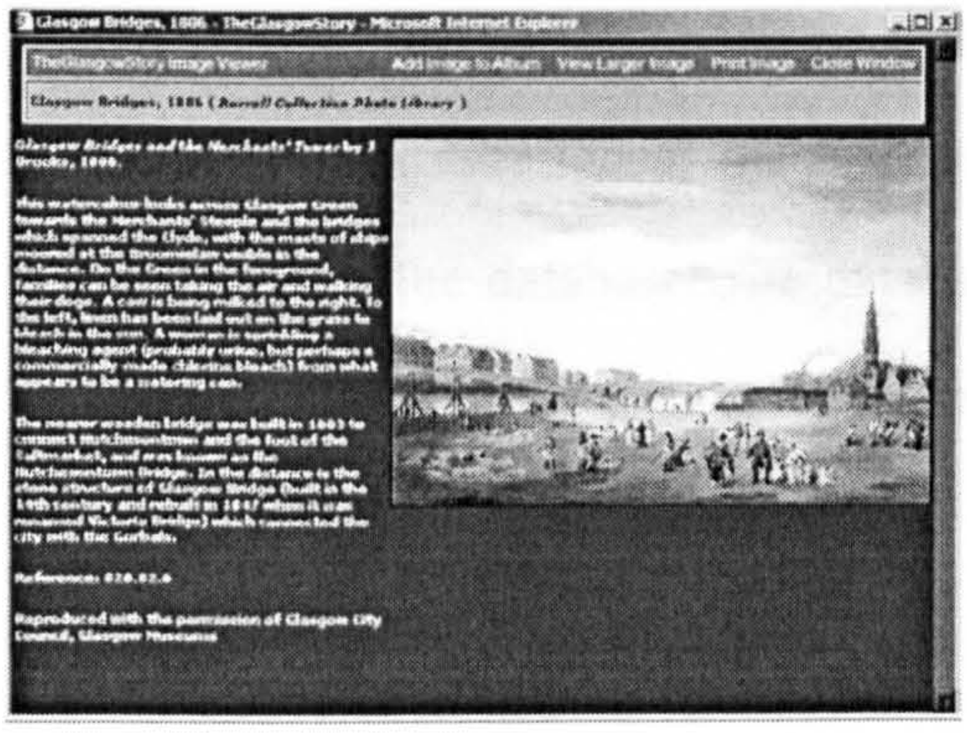


Figure 3.29: Low resolution image displayed next to its caption (ABACUS, 2003b)

Similar initiatives will start to change the way history is communicated and apprehended. Therefore, those pioneer projects that organize and distribute that material should be carefully analyzed. As 'revolutionary' vehicles they will influence the way users choose the distributed material and consequently, how they learn from those instruments.

libraries, museums and archives is always seen for the economic value associated to its historical value and uniqueness. In this case the institutions which participated in the consortium were the most prominent in the city. They all agreed to give away medium size resolution copies of their collections to any one who would freely access the database through *TheGlasgowStory*. That is a remarkable issue, particularly to researchers and students, whose access will be extremely facilitated. It is most probably that the number of people who have access to those historical archives will increase exponentially. Historical books always present a small selection of images due to the typical limitations of printed material. Thus, students, and sometimes researchers, are exposed to a restricted number of all available images concerning the history of the city.

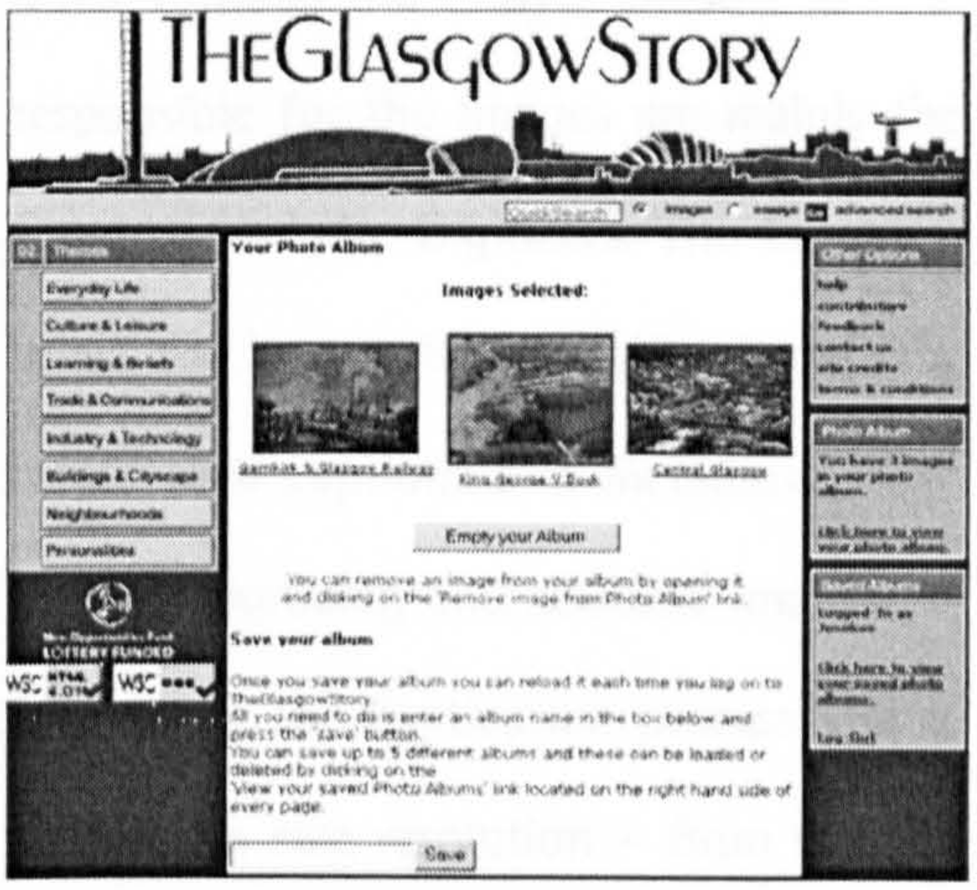


Figure 3.30: Users can create their own album of images, registered in the system for later access (ABACUS, 2003b)

The authors and developers of *TheGlasgowStory* organized a structure based on a database, which is the central axis of the whole project. The website itself is basically an interface which provides the means to query the database and display the relayed information (Figure 3.31). The database integrates the various components of the

project. Besides the writers, everyone involved in the project, from the director who manages its administration to the final user, performs his or her role in the structure interacting with the database. The database is organized in order to provide a system that would allow the material upload, the curators and editors revision and finally the end users access through the web pages (Aitken, 2002). Five groups were classified accordingly to their interaction with the system: the Administrators, Digitizers, Curators, Editors, and End Users. In accordance to the initial project, the administrators are responsible to manage the whole system, providing the structure for other groups to interact easily and safely with the database.

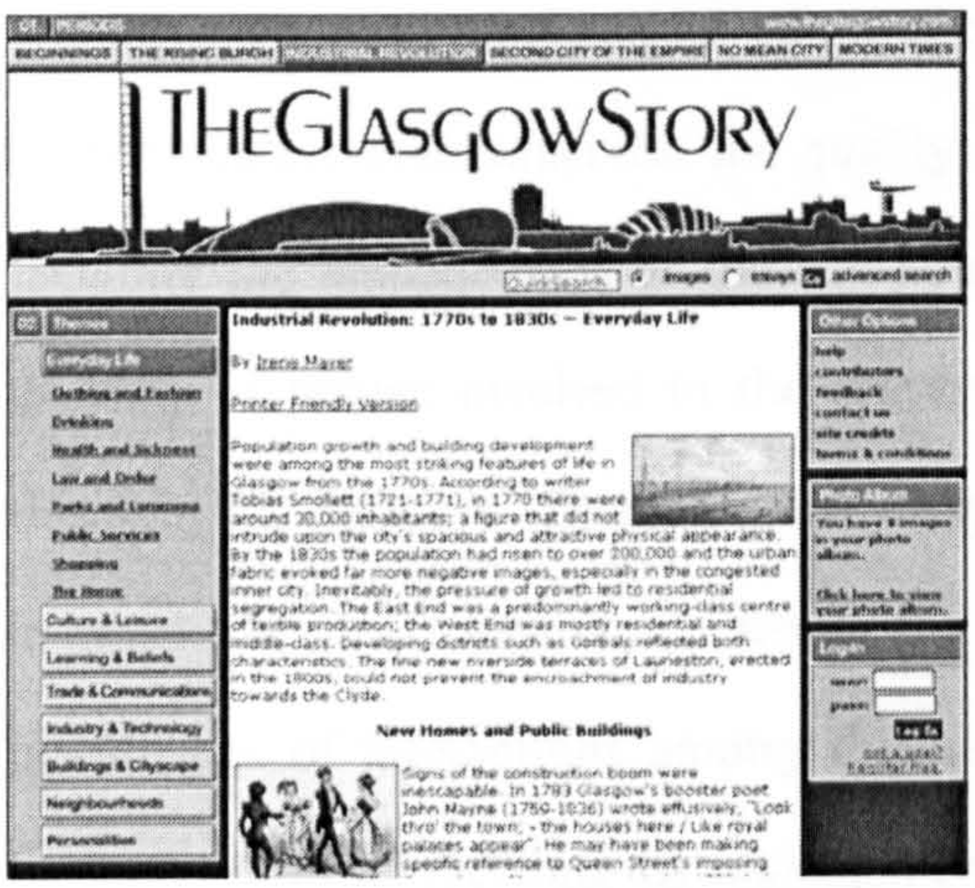


Figure 3.31: A page exhibiting the graphic interface and topic structure of TheGlasgowStory (ABACUS, 2003b)

The development of the material that will be included in the database can be divided in two distinct phases: one oriented towards the images and the other towards the essays. Those responsible for the images are mainly the Curators and the Digitizers. The Curators select the images to be digitized and create their captions and metadata. Besides digitizing the selected images, the Digitizers will create the technical metadata concerning the digitization process and to generate the JPG derivatives – for downloading in medium size resolution – from the archival image files (TIF format). The system is elaborated in order to automatically create the reduced file versions for the thumbnails and for visualization in low resolution. The Administrators, work together with the Editors and Writers in the production of the essays. The writers are the only ones who are not registered into the database. The Administrators manage the assignment of the essays and upload to the database the writer's contribution. They are responsible to assign the essays to the Editors. The Editors

are responsible for approving the essays and the image's captions. Additionally, they should assign the images which illustrate the essays (Aitken 2002).

The project *TheGlasgowStory* is the outcome of a consortium of librarians and archivists. Therefore it is possible to recognize the careful management of the whole system that is oriented towards the organization and exhibition of the great collection from the archives. Even librarians cannot develop such a project following an unbiased manner. Besides producing a list of documents in alphabetic or chronological order, the developers of those systems need to take decisions of what and how documents should be placed for the users' searching. The authors of *TheGlasgowStory* decided to follow "a 'publisher's model' with careful editorial control over the content and structure of the archive" in order to supervise the quality of the produced material (Aitken 2002). To facilitate the management of the contributions coming from a great number and diversity of people involved in the process, strict rules were defined and structured through the database. Therefore, the essays had to be stored in the same format as that in which the final users would search for them. Usually, web pages allow several possibilities of interactions among themselves. However, to be sure of the quality presented and to facilitate its management, no external link was allowed and even links inside the website, to other essays, do not happen. The website follows the structure of the database with an index of themes organized by main historical periods. Thus, each essay is self-contained and linked only to external images selected by the Editors.

One of the main drawbacks caused by the decision to follow a rigid structure of indexes is the lack of spatial references. If the CD-ROM *Glasgow2000* is always connecting the historical information to places in the city, that doesn't happen in *TheGlasgowStory*, at least not with images. Names of neighborhoods were always mentioned, the same thing happened to streets and rivers. However, the users don't have a device to facilitate their spatial location within the city. Even maps are seldom displayed when a neighborhood analysis is done. When users who are not very familiar with the city visit

TheGlasgowStory, they have difficulties to locate the places mentioned with those they know. In a project that aims to present the city history, it is important to verify spatial relationships among events even for the Glasgow dwellers.

3.4. Analysis of Rio de Janeiro experiments

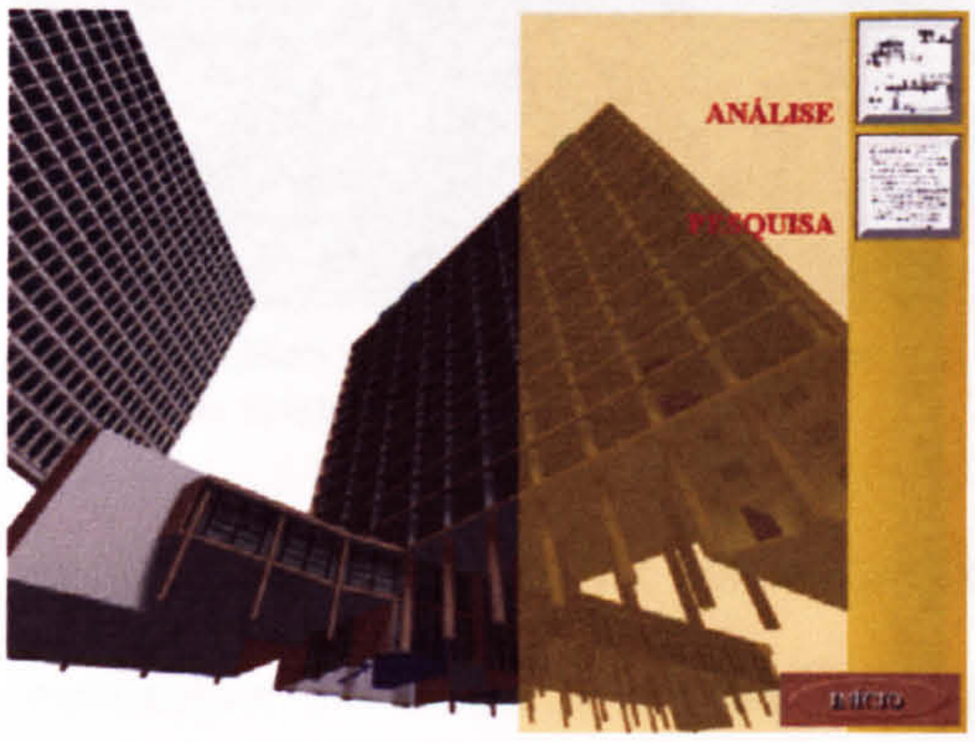


Figure 3.32: A screen shot of the hypermedia system *Palácio Gustavo Capanema* (1994)

The final group of projects analyzed in this dissertation relates to those developed at the Federal University of Rio de Janeiro in Brazil. The first project that was based in 3D modeling and hypermedia was developed between 1993 and 1994 and investigated the building developed in the 1930s for the Ministry of Education in Rio's city center. This project was described in two papers (Kós and Ferreira 1993, Ferreira and Kós1994) and resulted in a multimedia application named "*Pal´cio Gustavo Capanema*" (Figure 3.32). In 1994 the Post-Graduate Program of Urban Design (*PROURB*) was launched and a research group was created under the coordination of Professor Roberto Segre. The research project aimed to investigate the symbolic structures of Latin American cities and one of the objectives was to explore the possibilities of electronic technologies for the representation of urban analysis. Most researchers who were developing the project of the Ministry of Education continued in the new group that later originated the Laboratory of Urban Analysis and Digital Representation (*LAURD*). *LAURD*'s researcher has developed the model of Rio de Janeiro but it has never been completed, even for the central part of the city. The addition of buildings and other elements always followed a specific project that required the model of that specific area. Four of *LAURD*'s projects were selected to be analyzed in this section due to their close relationship to this investigation.

3.4.1. Colonial Havana: the analysis of its urban evolution until the end of the XIX century

Figure 3.33: Main menu for the *Colonial Havana* hypermedia system

This research project was funded by the *Brazilian Ministry of Science and Technology* and aimed to develop a dynamic reading of the Latin American city. This interpretation should allow the interplay between the different perception scales of the urban processes: from the territory structure, mainly in the plan view, to the public space configuration, of the squares and streets, until the architecture dimension of the buildings and monuments. Another important objective of the research project was to investigate new forms of representing urban analysis through interactive digital systems and 3D electronic models. The idea was to produce a model that could be applied to the study of other cities in Latin America. The following step would be to establish temporal sections that could facilitate comparisons between the other cities studied in the project (Kós and Segre 1997).

The group agreed to start with the study of the Latin American cities with Havana, Cuba. Roberto Segre had just arrived from that country after living there for 30 years. He was responsible for the Department of History and Theory of Architecture and Urbanism at the University of Havana and had his material already catalogued. If the

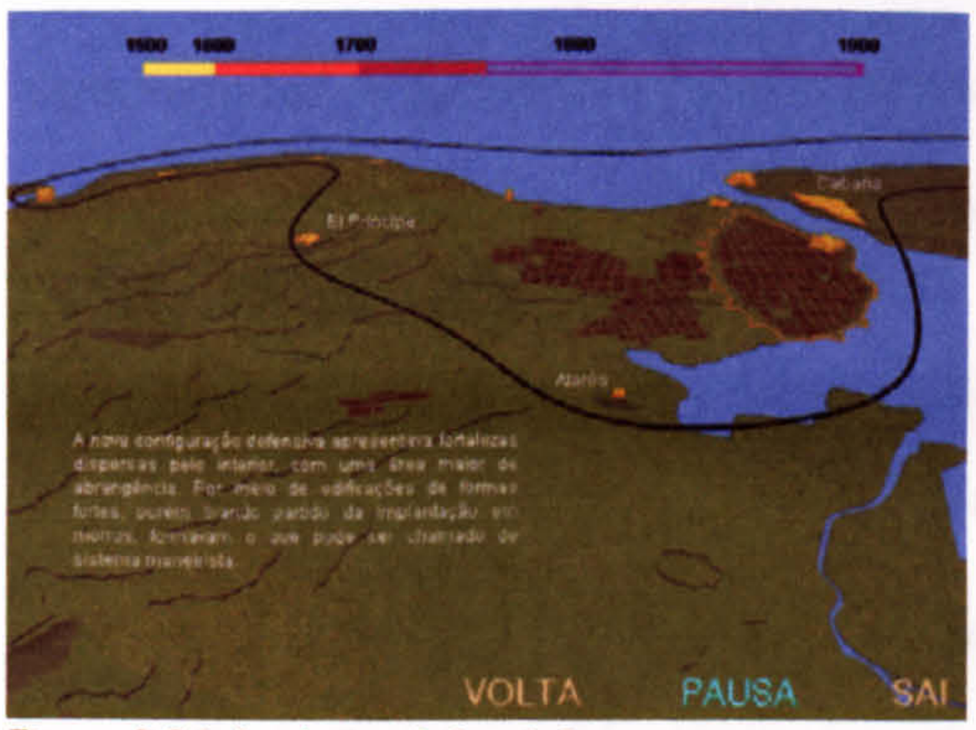


Figure 3.34: Analysis of the defense system

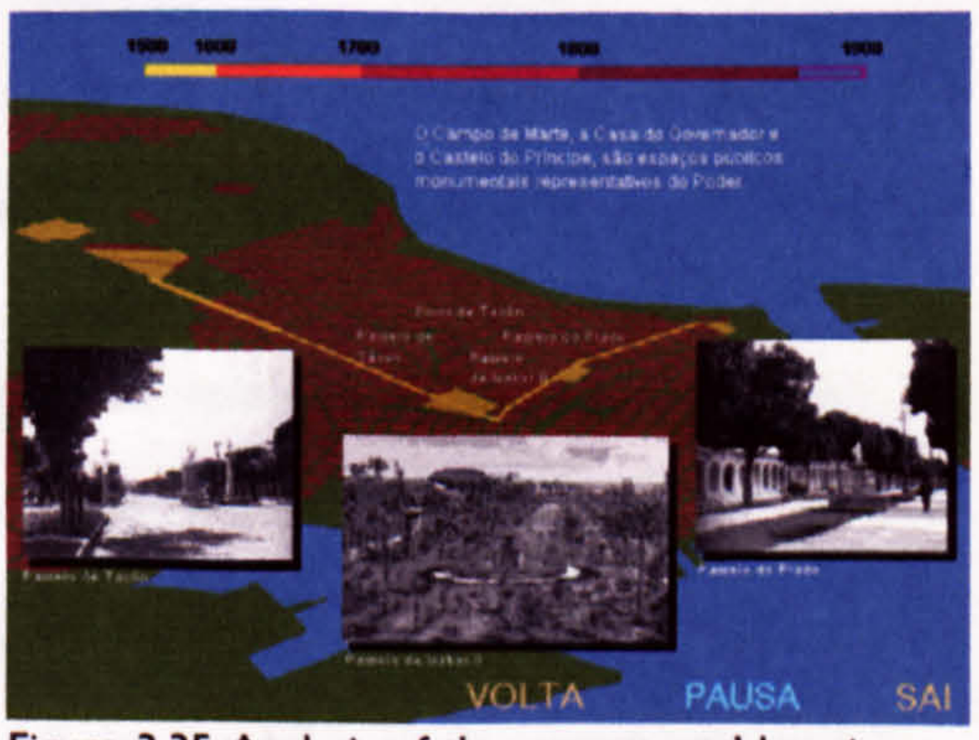


Figure 3.35: Analysis of the monuments' location

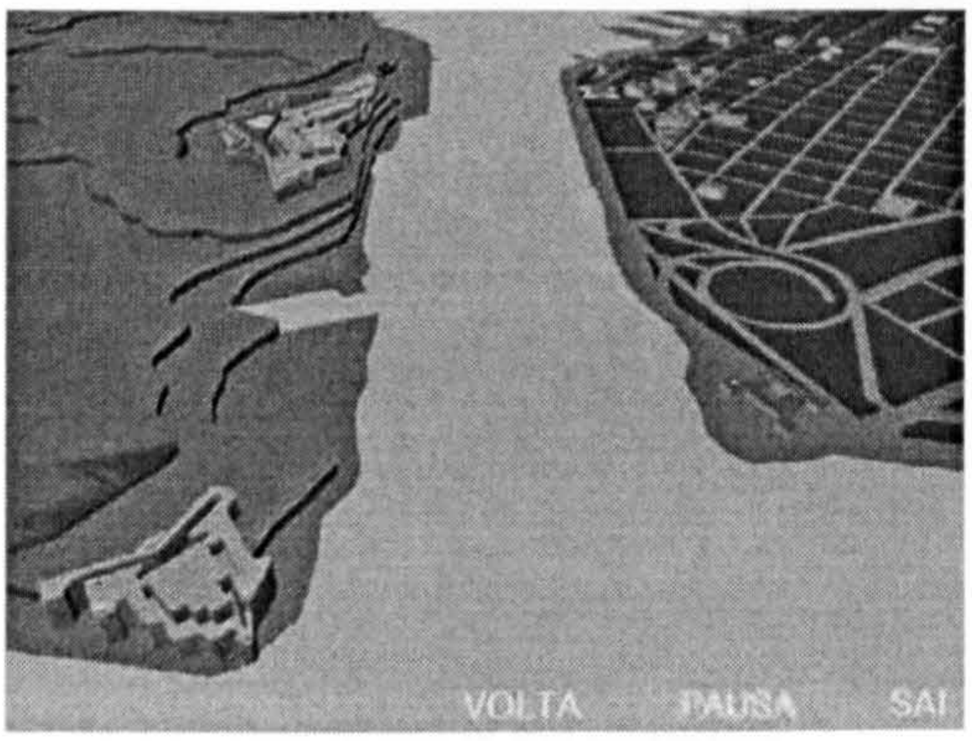


Figure 3.36: The model displaying the Bay entrance

research group could count on the material brought by Segre, all that material, such as books, photographs and maps, had to be digitized. The most difficult task was to develop a 3D city model without any digital base and thousands of kilometers away from the actual city. After one trip of the coordinators to Havana and based on some maps and aerial perspectives the model started to be constructed. Due to the difficulties to make a model in those circumstances, it was decided that only the most important buildings would be modeled onto the 3D landscape and street network. That decision proved to be correct since the model could be done with the available information and it was still very efficient as a vehicle to support the analysis of the city (Figure 3.36).

A hypermedia system was developed to communicate the analysis and the 3D model was the main element for structuring the storyboard. The navigation system was quite simple, based on a six main topic index accessed through buttons (Figure 3.33). The user could also choose to navigate through the 3D model zooming to 6 different areas of the historic center. These main topics are: the evolution of the urban street network; the defensive system; the symbols of colonial power; the public-private space; the city outside the walls; and the relationships of the symbolic structures. The latter demonstrated a synthesis of the previous topics, superimposing them onto the orthogonal views of the model, representing different historic periods.

The hypermedia system was relatively simple and the model was used to generate bitmap images that would display the urban analysis. Many times the model was displayed in orthogonal view as a traditional plan, while in others a perspective view was applied. The most significant contribution of the model was the production of a

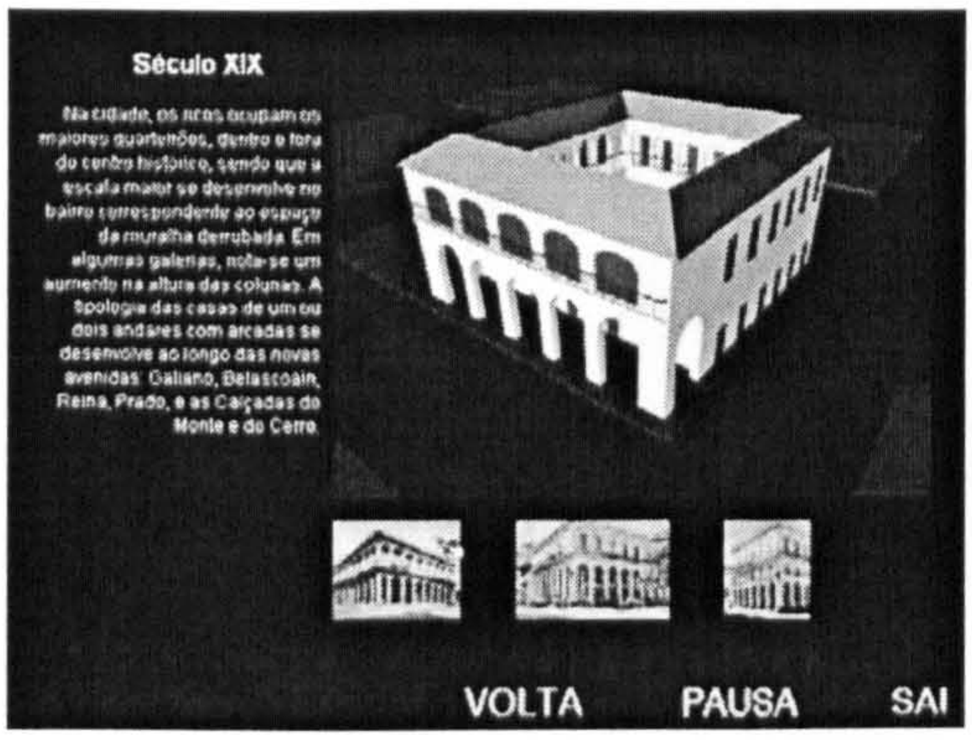


Figure 3.37: View of one of the animations exhibiting the house evolution

great number of images, displaying the city in singular forms of representation. Several surfaces were created to highlight in the city space, the theoretical urban analysis usually communicated only through texts. When rendered with the streets and main buildings, they were powerful tools to facilitate the understanding of our interpretation of the city's evolution (Figure 3.34, Figure 3.35). The public-private space, for example, was illustrated by 3D animations exhibiting the evolution of the house types and their impact on the streets. In another example, while analyzing the main square, the use of traditional drawings, superimposed to renderings from the 3D model were more effective than just digital images (Figure 3.37).

This first hypermedia system developed by *LAURD* was quite successful and is still one of the most comprehensive projects carried out by the research group. In 1997, the project won the *Latin American Prix Möbius* prize and was presented in Paris at the *Prix Möbius International Multimedia Festival*. This work influenced most of the following projects and had also a significant impact in the development of *Rio-H* in the current investigation. A noteworthy contribution was that in several times simple techniques creatively applied had greater effect than some complex technologies that require expensive equipment to be accomplished (Figure 3.38).

The development of the *Colonial Havana* took much more time than the group planned and the idea to apply the same methodology to several other cities was given up. The delay in the project had two main reasons. The first one resulted from an underestimation of the time required to undertake such project. The other reason was

Figure 3.38: Animation of traditional drawings demonstrating the analysis of Havana's main square

that much of the time spent in the project was oriented towards the search for a creative and innovative representation that would apply the resources delivered by electronic technology. Thus, often some proposals already implemented for representing a specific analysis, were abandoned. The justification was that the group decided for a different proposal that would be better to convey the message. Even if *Colonial Havana* demanded more effort and time to be completed, the group was quite satisfied with the project's outcome.

3.4.2. Colonial Rio de Janeiro

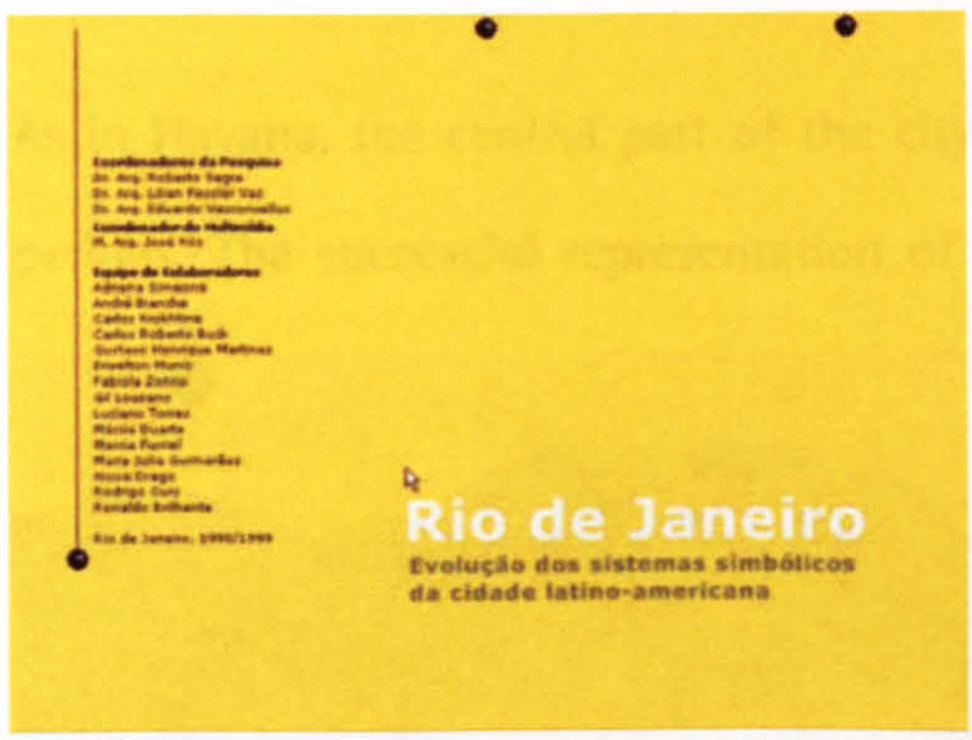


Figure 3.39: Initial screen for Rio de Janeiro's hypermedia

The project to develop a hypermedia interpretation of Rio de Janeiro's urban evolution started almost at the same time as the one for Havana. (Figure 3.39) They were both the selected cities to inaugurate the investigation of the symbolic structures of the Latin American cities. The Rio de Janeiro project however, was put on hold due to the complexity of the city topography. At that time, *LAURD*'s computers were not powerful enough to handle its geometry. Additionally, the digital base of the city contours, provided by the city planning authorities, had so many problems that it had to be done from scratch. Besides that the size of the group and the available equipment were not enough to carry two parallel projects at *LAURD*. During the development of *Colonial Havana*, only one researcher would dedicate some time to fix the topography contours. It was agreed that the

Figure 3.40: A preliminary version of the topography model

topography was essential for a 3D analysis of the city and therefore, the only possibility to carry the project would be with the landscape model (Figure 3.40).

When the researchers who were working on the *Colonial Havana* project moved to *Colonial Rio de Janeiro*, it could be considered that the project was really launched. At that time, *LAURD* was better equipped and the group could work with less effort the landscape model. In addition to the difficulties to model the geometries of Rio's landscape, the group had other obstacles. The placement of the buildings and particularly the street network onto the mountains has always required complex solutions.

As in Havana, the central part of the city was modeled illustrating different historical periods. The successful representation of the most important buildings in Havana was

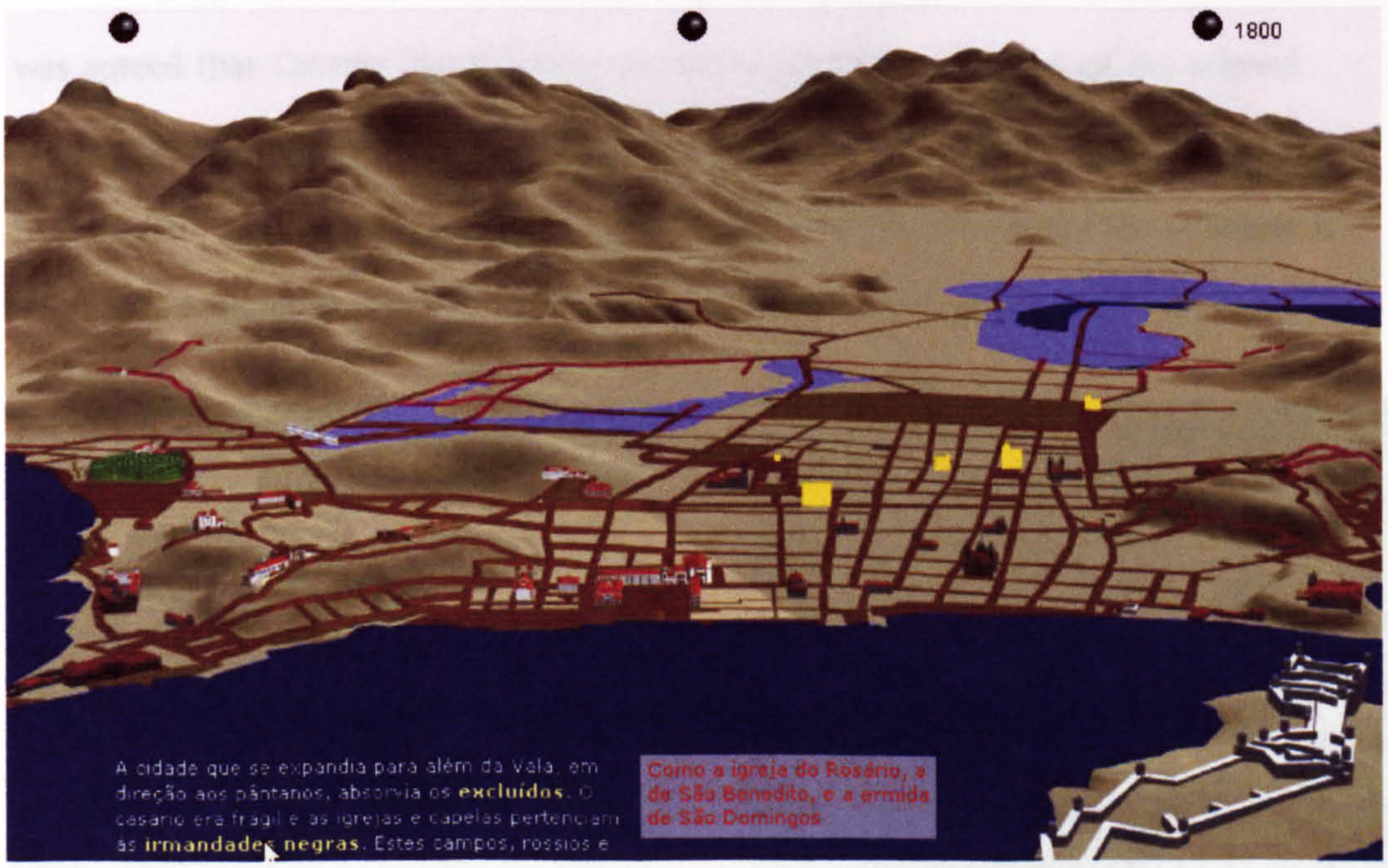


Figure 3.41: View of the Colonial Rio de Janeiro with the slave's churches highlighted, demonstrating their location far from the waterfront

followed i the Rio model (Figure 3.41). Although the work was being developed in Rio itself, it was not much easier to represent previous moments of the city. The city suffered in its history several radical urban changes. Havana, as in several European cities, keeps its historical center in a very similar situation she had some centuries ago. To represent most of the Central Rio's buildings in different periods would require an enormous amount of work and also some imagination. It was agreed that it would be more effective to represent more historical periods with less details than depict a couple of historical moments with no gap in the buildings located in the central city grid.

Although the hypermedia system of C*olonial Rio de Janeiro* remains still incomplete, one can navigate through most of the planned resources. Both systems were intended to cover the history of the cities until the end of the XIX century. For Havana, that was the time its colonial period ended and Cuba became independent. The structure of Rio's project was divided in three main periods: the Colonial and the period when the Portuguese Royal family moved from Portugal to the city; the independency with the two Emperors; and the beginning of the Republican period. This structure would cover the history up to the end of XIX century. However, the project became enormous and it was agreed that *Colonial Rio de Janeiro* would be the reduced version of the original project. Therefore, the original timeline that would be divided in three main periods is restricted to the initial period. In addition to the timeline, the navigation structure is divided in 8 grand topics: the history of the city, with an overview of the urban

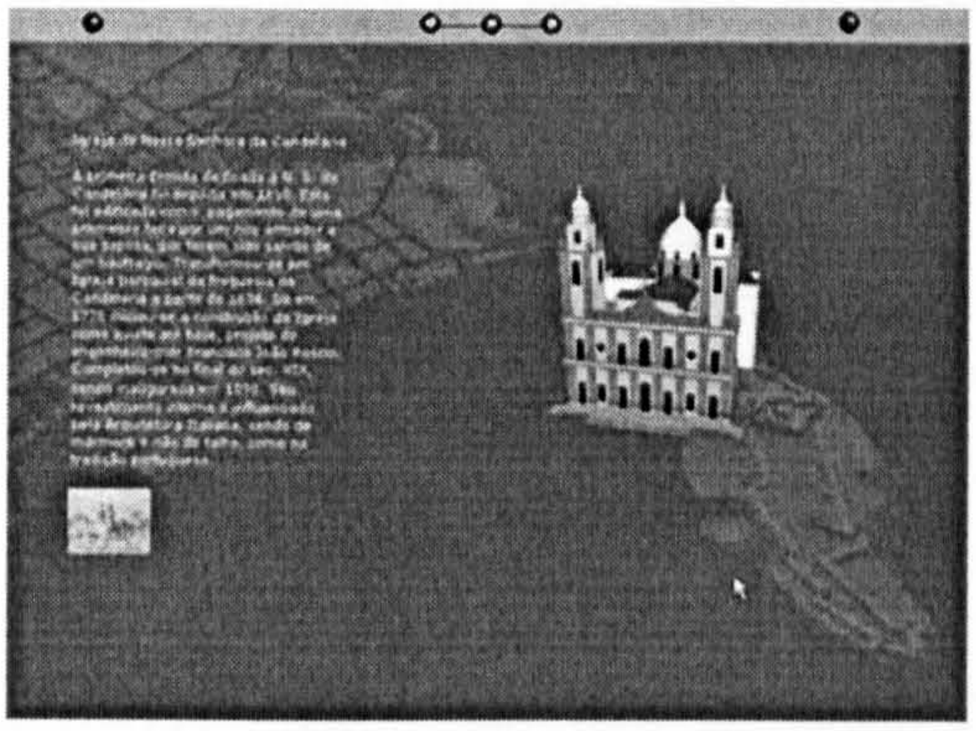


Figure 3.42: Section that exhibits the most significant building's analysis

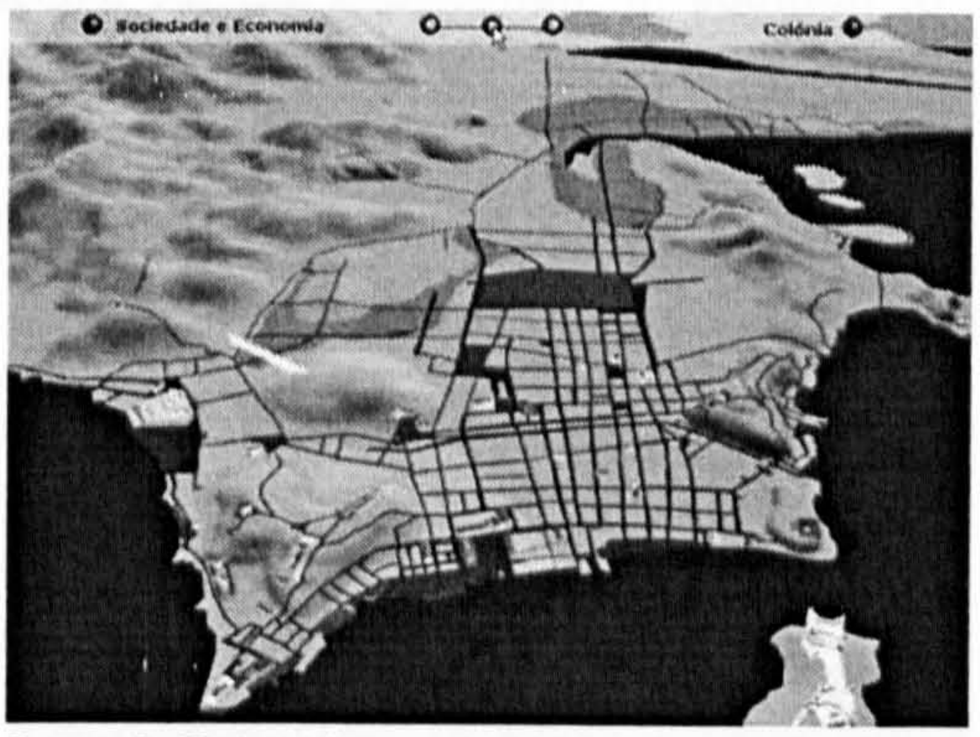


Figure 3.43: Aerial view displaying the center of the city

evolution since its foundation demonstrated by a sequence of 3D rendered images and animations associated to explaining captions; the defense system; the civilian power; society and economy; the housing system; the natural and the built environment, displaying the relationship between the growth of the city and the natural landscape; Religion; and a navigation through the most important buildings of the city divided in 6 main areas, as in Havana.

The navigation system in *Colonial Rio de Janeiro* was much more complex and provided more resources for the analyses than the Colonial Havana. Besides that, after the experience acquired with the previous project, the development in the graphic interface exhibited a special care with it. The screen area devoted to the analyses was greater and just few and very small elements to allow the navigation, remained in the screen. However, the number of project coordinators was greater and the interpretations varied among the members of the group. The result was a beautiful hypermedia system, displaying creative resources but not much theoretical contribution from the group. The system exhibited several facts from the history of the city and the model facilitates their understanding. However, the simpler structure of Havana conveyed better opportunities to apprehend the reasons that oriented its growth, even if that system presents a 'bias' interpretation of its urban evolution. Even though some of the difficulties deriving from the project's organization reflected in the final product, the system for Rio's project provided significant contributions. Besides being very elegant, the navigation system facilitated the focus into the aspects selected for the exploration. In addition to

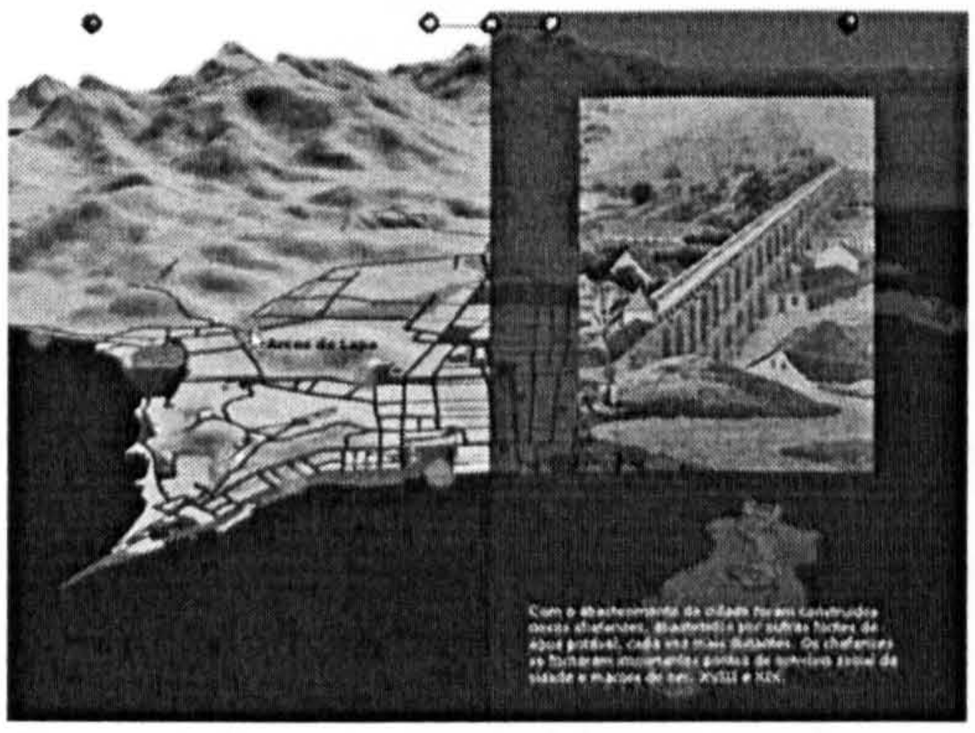


Figure 3.44: Section explaining the water systems

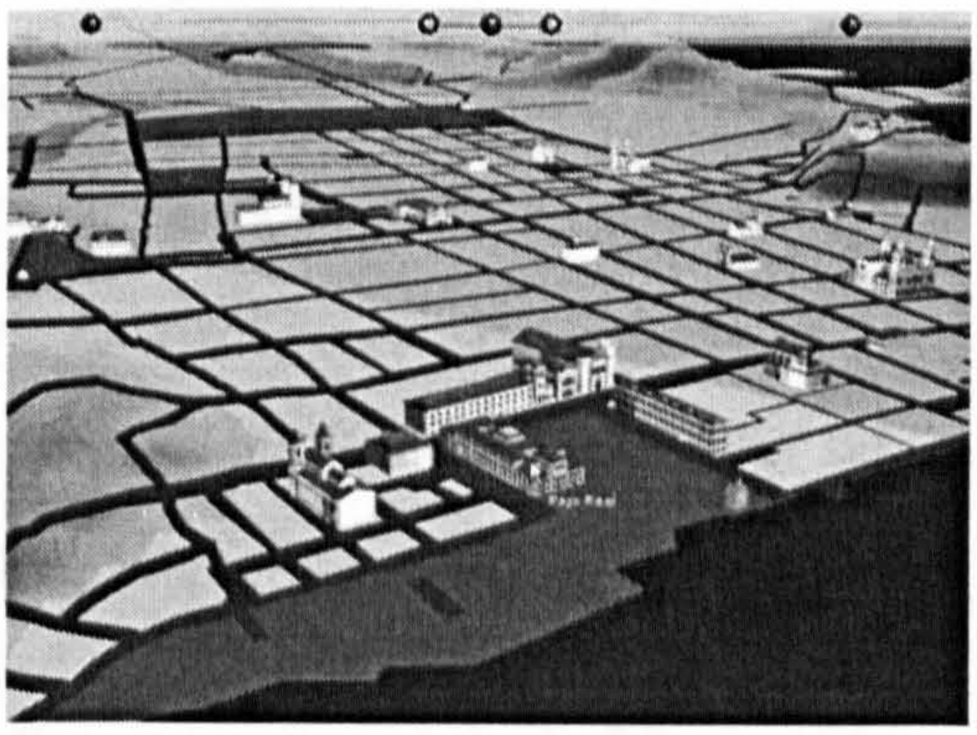


Figure 3.45: closer view of the main square

that, it allowed an easy interaction with the other themes included in the system.

Finally, it is important to mention that the 3D model of the city, developed for this project has been used for several other purposes, demonstrating the richness of its uses. Similarly to other experiences already reviewed in this dissertation, various projects developed in LAURD use the model as a vehicle for their goals. Besides being useful for those projects, the model has been improved, each time a new project profits from its resources.

3.4.3. *Catete Palace* website

Figure 3.46: Page with the index interior section of the *Catete Palace* website

Among the four projects included in this section, the *Catete Palace* project is the only one developed for the World Wide Web. (Figure 3.46) The origins of LAURD research group were associated to projects to be stored in CD-ROMs. These research projects are still being oriented towards that media. However, several smaller projects have applied web pages as their main vehicle. The *Catete Palace* project (Kós et al. 1997) was intended to inaugurate that direction. It was developed during a couple of moths for a website competition, which LAURD won the prize. The competition was promoted by the *Museu da República* (Museum of the Republic) located in the *Catete Palace*. The building constructed to be a private residence, was later acquired by the Federal Government and housed the country's presidents until Brazil's capital moved to the new city of Brasilia. The theme of the competition was the creation of a digital class related to the museum. An architectural class was our approach for the competition. This class would demonstrate the main features of the building, the reasons for their construction and its relationship to the city.

The website was divided in two main parts. The first one presented the building and its

relationship to the site and the city: the building related to the outside. The other one presented the building's relationship to its interior (Figure 3.47). Several techniques were tested in this project. The group was not used to solutions that would require little disk space. Therefore, the researchers had to search for creative methods to present the analyses. Several animations with small elements were introduced to demonstrate the façade composition, the relationship to the city's natural landscape and the organization of the internal rooms. A VRML model, for example, was included as an instrument to apprehend the relationship between the building and its large site (Figure 3.48).

Although the scale of the project was relatively small, the construction of this website was effective to test possibilities for communicating ideas through hypermedia systems. It is important to be involved in large-scale projects that present meaningful scientific contribution. One of the problems is that after the design of the main idea, a great amount of effort is oriented towards the implementation of the project, filling the system with data. Smaller projects, on the other side, present the possibility to quickly test these tools' resources. They are important for involving the whole group in rapid creative work. For this specific project, the group had to investigate solutions that would be implemented in a short period of time. Some of the resources from these investigations are still being used in other projects.

The study of one of Rio's architectural icons proved to be significant to understand the history of the city in a period in the past. After some years, we agreed to propose a

Figure 3.47: Plan analysis of the first floor

Figure 3.48: Site analysis with a VRML model

research project that would resume the original idea of the Catete Palace. This project is the theme of the following project investigated in this section.

3.4.4. *Urban Icons of XX century: the Ministry of Education Building*

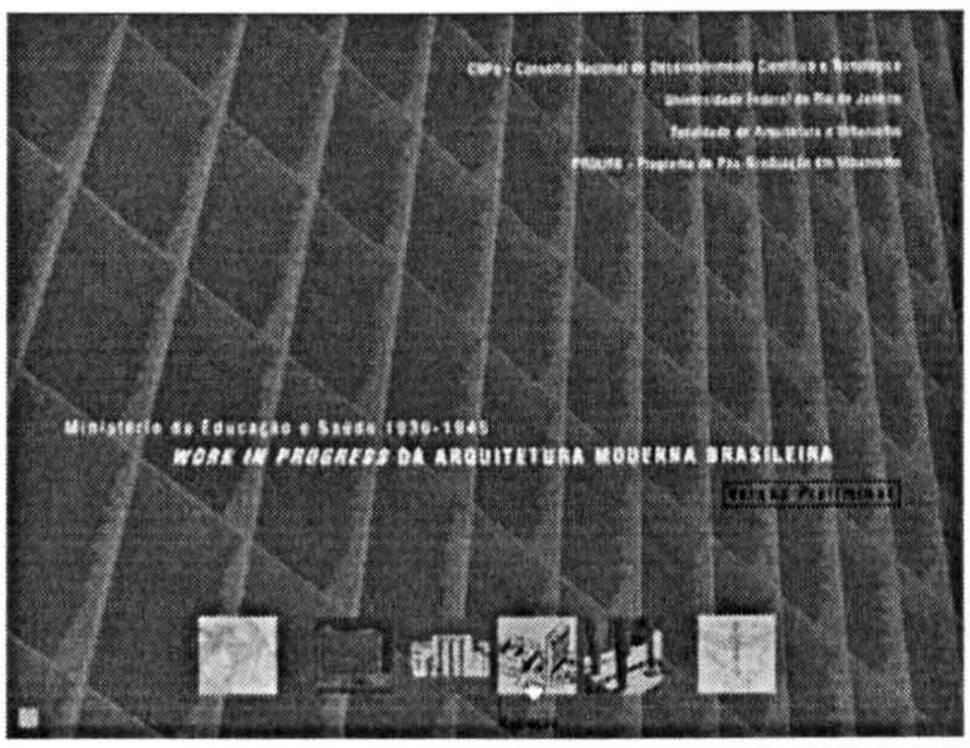


Figure 3.49: Initial page of the Ministry of Education CD-ROM with the navigation system in the lower part

In the last three years, a research project has been carried out at the Federal University of Rio de Janeiro (UFRJ), in *LAURD*. The research project is called "Urban and architectural icons of Rio de Janeiro: contribution to the symbolic systems of the city in the XX century." The research project has a close relationship to this current investigation, which provided several opportunities for exchanging information between the two projects. Within this project, our group investigated meaningful buildings and significant urban spaces spread through different periods and areas of the city in the XX century. Through that investigation, we attempted to reveal the history of the city of Rio de Janeiro. The group selected more than 20 'icons' and is currently investigating 6 of them. A preliminary version of the Ministry of Education Building's analysis was already registered in an interactive CD-ROM (Figure 3.49) (Every image in this section is from that CD-ROM).

The term 'icon' conveys a very broad meaning. Therefore, we decided to narrow it down in order to use it throughout the research project. We assumed that, to consider an architectural artifact or urban space as an 'icon,' it should be able to synthesize several forces, such as social, cultural or political, which act in a specific time and place. Thus, the 'icons' would be representations or images of those forces that act in the city. However, it is important to mention that even though those forces take place in a specific historical context, it does not mean that their references are not valid in a different context. It is actually because they represented that value in a specific occasion, those artifacts

transcend that context and are considered 'icons' in a different one.

That definition, incorporated by our research group gathers a great variety of examples with distinct characteristics. Those icons range from buildings acclaimed by the professionals for their architectonic value but with little recognition by most city dwellers with other structures celebrated by *Cariocas* (Rio de Janeiro's inhabitants), which architects criticize for their constructive and aesthetic quality. Several of them, however, are unanimous among architects and laymen.

In the same way as Benjamin and Koolhaas searched for the actual and concrete – through the commercial galleries in Paris and the architectural competition in the Manhattan's regular grid – in the investigation of both cities; we focused the analysis of Rio de Janeiro through the urban and architectural icons. The use of hypermedia systems as vehicles for the research analysis and 3D models as indexes to display the collected information, demonstrated to be powerful solutions throughout the research process. Furthermore, if the icons are representations or images of the forces that act in a specific moment and location, the investigation of the icon proved to be an effective method to study and understand those forces. Significant aspects of the city history can be revealed through that analysis.

As already stressed by other projects reviewed in this dissertation, visualizing 3D models of urban areas as well as individual buildings allows one to isolate some of their

Figure 3.51: Political context in the 1930s

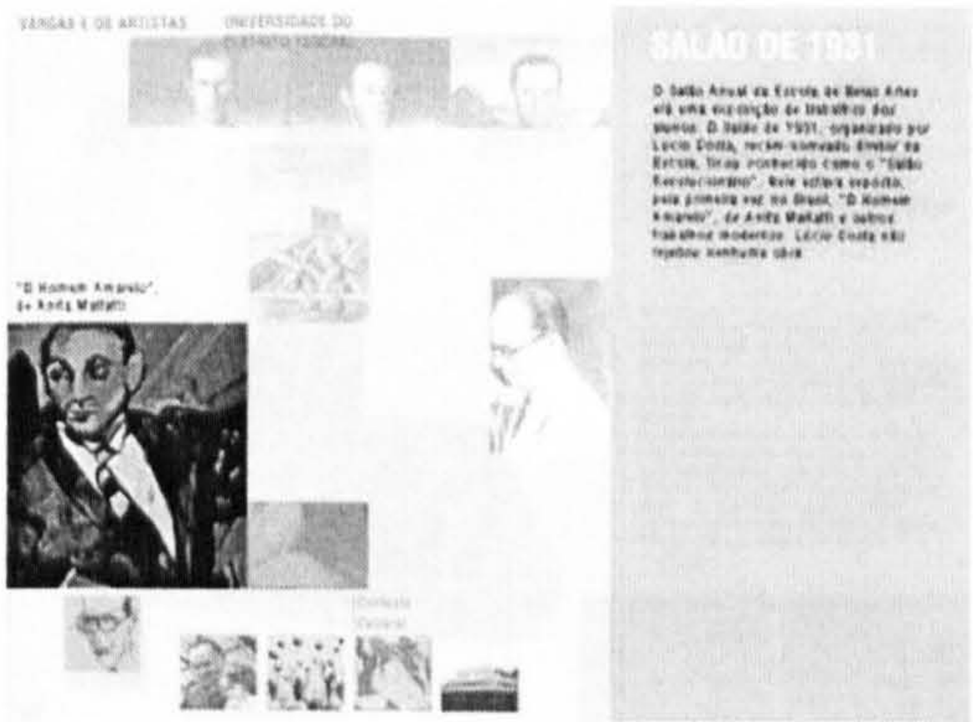


Figure 3.52: Brazilian art movements in the 1930s

aspects while removing others, which are not significant for the analysis, from the screen. These aspects can be viewed separately or in the complete model within the overall context. Facts such as the spatial changes of social groups or a particular construction technique can be compared with other aspects in the overall context and, at the same time, separated from the other components. Although this technique is not possible with photography, it would be possible to use other analog instruments such as physical models or drawings. A significant advantage of 3D models is the potential to simulate, with precision, several alternatives in a shorter period of time. Once 3D models are constructed, it is possible to render several images from a variety of points of view or different selections of the model components exhibited. Therefore, it is possible to simulate those "small particular moments" described by Walter Benjamin. Furthermore, the digital representation of those images, may allow one to understand the overall historical events (Benjamin 1999).

Our investigation of Rio de Janeiro's history was inaugurated with the acclaimed building of the Ministry of Education in the City Center. That choice reflected the rich history associated with the building's design process and to the productive cultural moment of the city. Some of the most distinguished Brazilian architects participated in the project, which resulted in the most representative example of Modern Architecture in the country. (Figure 3.53, Figure 3.54) Although most of the city inhabitants ignore those facts, its genesis analysis exposed episodes which influenced the city and its

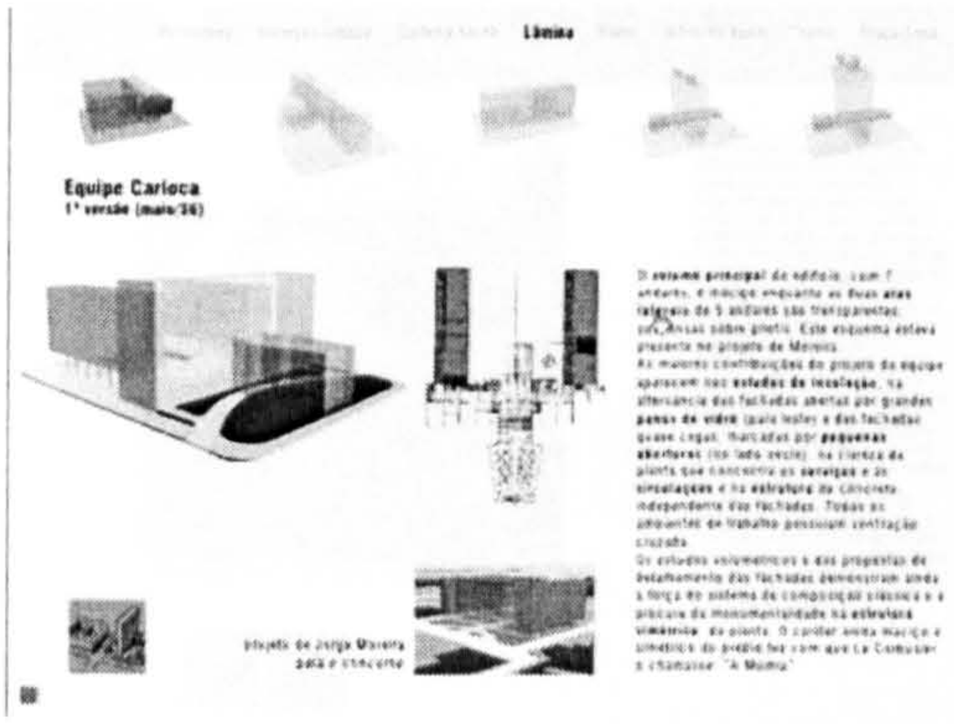


Figure 3.53: Study of the first design proposal

Figure 3.54: Analysis of the definitive proposal

dwellers until today.

*T*he projects presented in the design competition organized by the Ministry exhibited the opposition between the leading architectural trends, the *Beaux-Arts* group and the emerging Modernists. Modeling the most significant proposals was decisive to understand the transition towards one of the most important moments of Brazilian Architecture. Through the models it was possible to identify the volumetric composition, configuration of entrances and circulations and the location of the building on the site. The proposals demonstrated the evolution towards a refinement of Modern Architecture and their analysis dissected that transformation and how it influenced the way the architects designed their solutions. Each proposal used different representation methods at the competition and the 3D model was an effective instrument to set every proposal to a standard representation. Therefore, they facilitate the comparisons between those proposals and in relation to their context, inserted in the 3D city model.

An analogous solution was adopted for the final scheme evolution until the actual construction. After the selection of the team of architects that would develop the project, several proposals were elaborated. Although the architects involved in the project were quite young, they became some of the most recognized Brazilian Modern Architects. Lucio Costa, Afonso Reidy, Jorge Moreira, Carlos Leão, Ernani Vasconcellos, Oscar Niemeyer and Roberto Burle Marx composed the team. Besides that, Le Corbusier

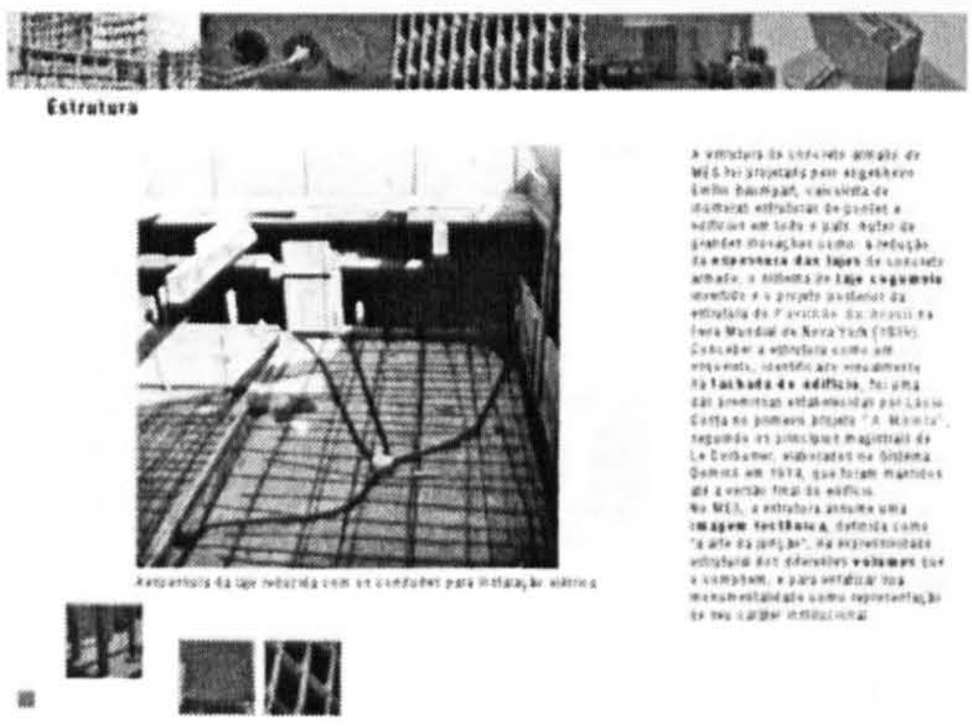


Figure 3.55 / Figure 3.56: Survey of the building's electrical system

came to Brazil and elaborated two intermediary proposals. When Corbusier returned to France, the Brazilian team presented a new proposal, which was based on their first scheme, and the two which Corbusier developed. With this last project the construction was launched with some changes, such as the addition of some office floors and the redesign of the ground floor. Thus, five different schemes were modeled and explored in the project evolution analysis. Each scheme was evaluated through the 3D models based on different categories related to the main parts of the building: such as site location, ground floor, galleries, theater, office floors, gardens or square. Since the five solutions had these parts clearly defined it was easier to structure the analysis in that way. Thus, issues such as relationship with nature or the city, monumentality or relationships between public and private could be verified by the location of those building parts in each project. Moreover, the 3D model was very effective to display those relationships.

If the building project exhibited several proposals, its urban environment had been the stage setting for drastic changes throughout the history. The city was founded in that site on the top of a hill that was dismantled. If the hill still existed, it would reach the ninth floor of the building at that location and the shore was probably less than one tenth from the current distance. Two blocks, and a large modern park block the bay view from the neighbor church. That church was located at the foot of the hill, just a few meters from a former beach that used to bear the same name. The unresolved south part of the Ministry

Figure 3.57: Structural system review

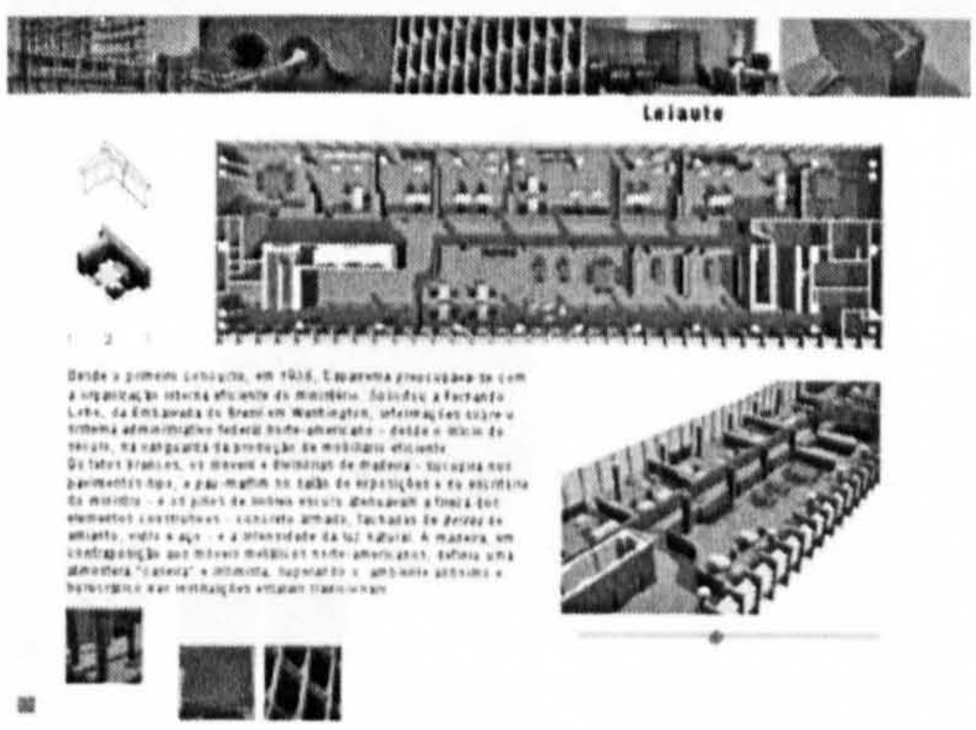


Figure 3.58: Lay-out system resulting from the construction approach

Building site witness the clash between the new grid created by the urban projects and the hill dismantling, and the old streets following the curves of the bay.

Various digital techniques were applied for the building examinations. These devices were searched as new possibilities to represent buildings and their feature through digital tools. Thus, animations and interactive systems were searched in order to make clear the architect's decisions throughout the design and the construction details.

The Ministry Building's hyperdocument is composed by several other parts, which exhibit the context in which the building was erected. The historical context section is structured by images, which defined the indexes for retrieving the information. The reader should dig up the images, partially hidden on the screen, and acquire its full size version with the corresponding text. Those images supported the comprehension of the historical moment which brought fourth the construction of the Ministry of Education Building. Moreover, the analysis of the building provided rich material to apprehend that historical moment. In addition to that, the 3D models were critical for the understanding of the building evolution and its relation with that moment of Rio's society. The complexity of the design process does not exhibit just the various decisions taken by the architect to adjust the program of a major public building. It also exposes the sedimentation process of the Brazilian Modernity. The forms of the building and its neighborhood are the result of imported ideals of modernity – from Haussmann to Corbusier – merged with political,

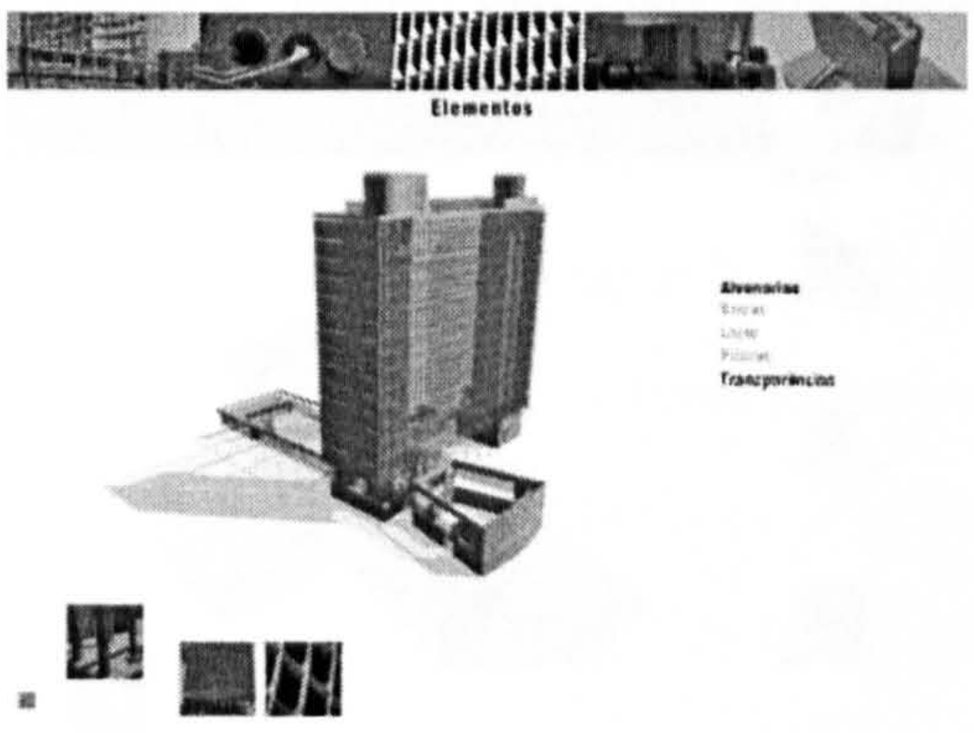


Figure 3.59: Exploration of the building's elements: Brick walls

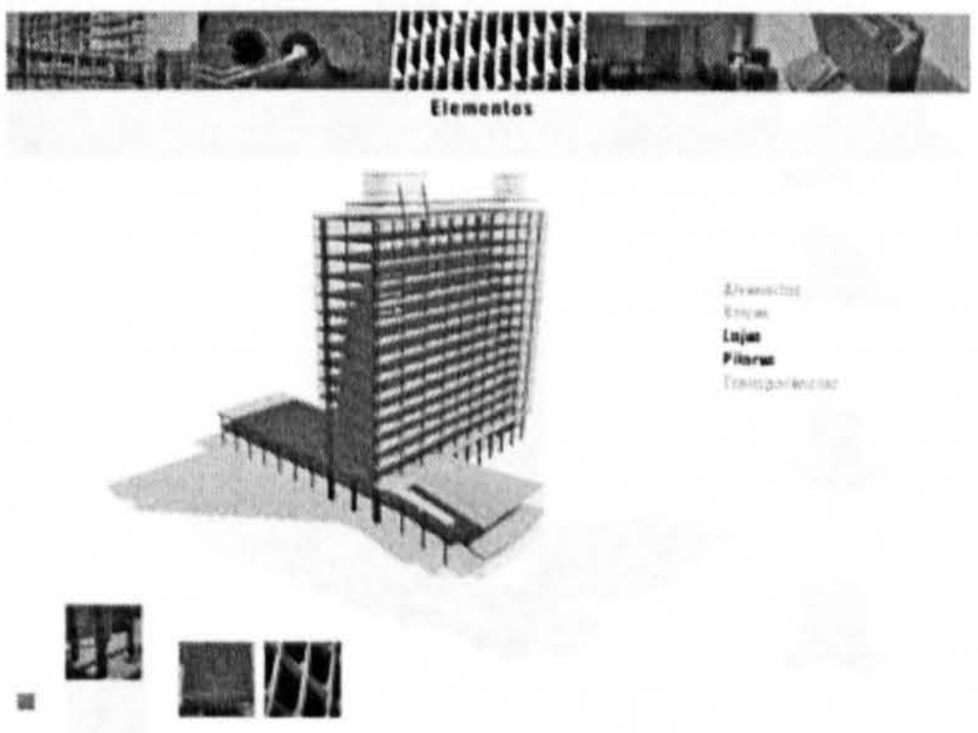


Figure 3.60: Exploration of the building's elements: Structure

economic and cultural motivations specific of Rio's context.

The *LAURD* group aims to search, through the use of electronic technologies, an understanding of the city's overall context. The Ministry of Education digital models always restate that it is located in the center of the city as opposed to an isolated site. It is possible to verify architectural analyses together with the neighbor buildings. Even proposals that were not built can be tested within the city configuration from that time and also from other decades after they would have been constructed. The influence of those buildings and design proposals in the city landscape and to the inhabitants has been constantly examined. That process of linking building analysis to their context can be obtained in traditional books but with much more difficulty. Additionally, when those relationships are displayed on the screen, the readers who are familiar to the city easily relate the analysis to the place they know. Therefore, those architectural examinations are not restricted to the building itself but viewed in a broader cultural context. The readers are more active not only because they control the hyperlinks but also because of the inherent openness of graphical representations. Images allow several interpretations and the users construct their own narrative based on the links they choose and the interpretation they elaborate. Thus, their culture is put together in relation to the previous culture that shaped historical constructions.

Another noteworthy issue is that while modeling unbuilt designs, it is possible to simulate a "reality" that could have existed if those buildings had been constructed.

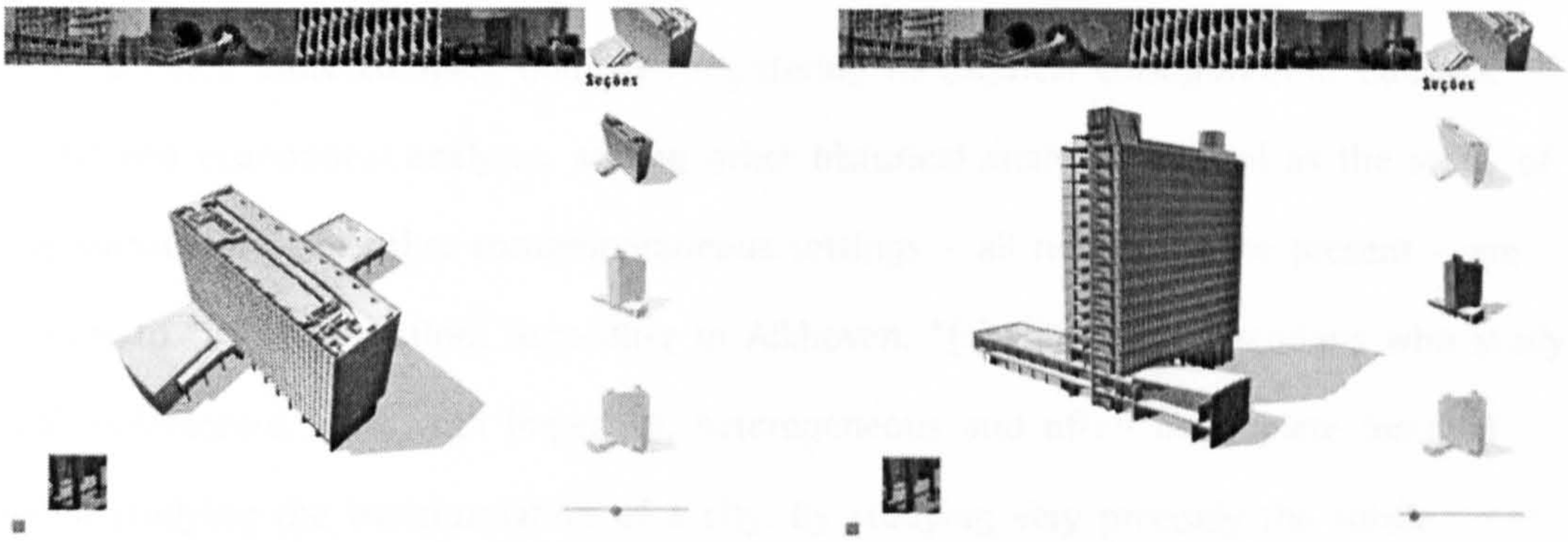


Figure 3.61 / Figure 3.62: Dynamic sections examining the building in plan and two orthogonal sections

When those proposals are evaluated within the site context, one can understand the physical relations the designers attempted to create through those electronic models. Additionally, it is possible to simulate ideas that represented different views of the world that occurred in the same moment of a society. One could visualize the physical outcome that those projects would have produced and from them interpret the wishes behind the minds that generated the drawings. Walter Benjamin attempted to evaluate the changes to Parisians produced by the Industrial Revolution in his review of the arcade's decay in the last half of the XX century. Correspondingly, it is possible to examine the origin of Modern Movement in Brazil through the projects of different architects for the Ministry of Education Building. Each portrayed different beliefs that coexisted in that rich moment of Brazilian society.

3.5. 3D models applied to the history of cities and the research process

The historical research process consists of collecting a multitude of fragments from different sources. The researcher task is the recognition of the data relevance and its interpretation related to other studied pieces. The analysis of urban or architectural history is often related to images based on visual sources, as well as textual, aural and other sources. From these sources, architectural and urban historians often attempt to imagine a setting, which no longer exists. Although sometimes those buildings or urban spaces were not eliminated or didn't change much over the time, the historians duty is much more complex than just registering its physical configuration. Cultural, social and economical analyses, among other historical analyses, as well as the study of the surroundings or other contemporaneous settings – all related to the present – are critical to the investigation. According to Alkhoven, "[a]rchitectural historians who study real architecture, work with imperfect, heterogeneous and often incomplete material when studying the transformation of a city. By studying very precisely the subtle

transformation over time it is possible to trace the agents and forces that have produced the image of the city" (Alkhoven 1991).

Usually, researchers responsible for collecting or analyzing an urban historical setting are not the same as those responsible for the 3D model construction. The recognition of the modeling process importance to the historical analysis and research depends often on the interaction between those two groups. Patricia Alkhoven developed a research project, which successively connects the 3D urban model of Heusden, to the analytical and research process (Alkhoven 1991, 1993). One of the reasons for its success lies in the fact that she seemed to be responsible for every phase of the project.

3D models are constructed from the collected fragments in the research process. This investigation supports the argument that 3D models should be regarded as a research physical database rather than a representation of an already concluded study (Day and Radford 1995). Each modeled object should be a piece of historical data linked to different information sources, such as drawings, photographs and texts. Thus, the model should be the research core which synthesizes the collected information as form.

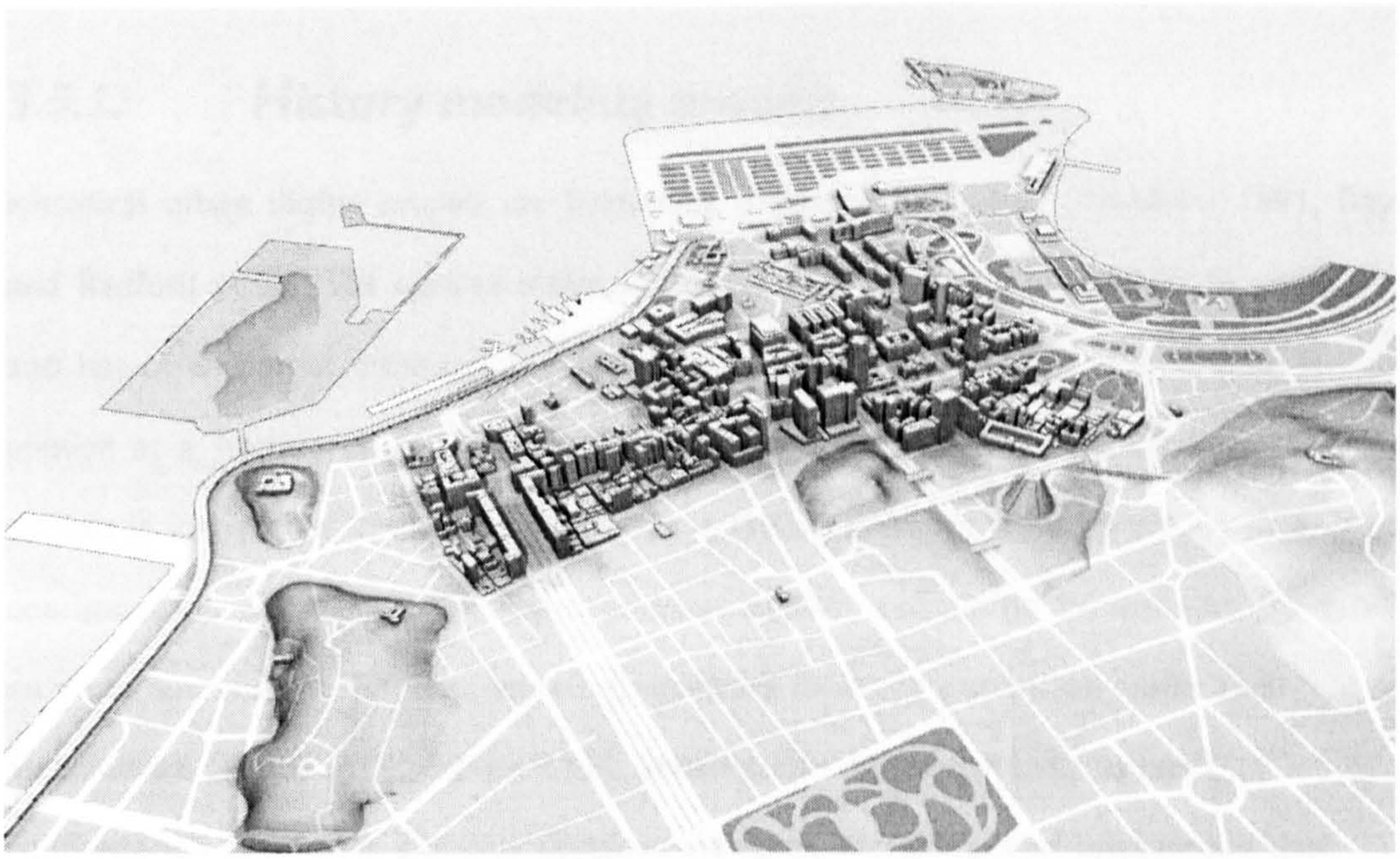


Figure 3.63: Model of the central area of Rio de Janeiro in the year 2000, based on aerial photogrammetry techniques

The model's detail level is less important than the possibility to represent in 3D each investigated object as a component of the overall study and to give form to the research material. It evidences the links between each piece and the physical context and also among every piece in the investigation.

Architectural models can display links among the several parts of an historical research (Saggio, 1993, Galli and Mühlhoff, 2000). This process, however, is much more obvious in urban models. A city is produced throughout a long period of time by a myriad of fragments. Most physical fragments are autonomous objects linked to many others. These fragments are usually related to constructed objects, which are erected in different times with particular characteristics. Cities are delineated by the creation and transformation of those objects. Therefore, their research is critical to the city history. As many of those objects, created in various periods, remain in the present, they are both testimonies of a past and a piece of the current urban configuration. The study of historical components of a city is often a study of the existing fragments in the urban fabric. Present and past dwell within the urban fabric and city's inhabitants share their lives with historical settings.

3.5.1. History modeling process

Historical urban digital models are frequently produced backwards (Alkhoven 1991, Day and Radford 1995). The current information is always more accurate, easier to verify and has often partial information available in digital form. Thus the current state is applied as a starting point to elaborate previous periods. The information from those periods is interpreted in order to fit on the established standard based on the present configuration. The researcher shapes previous periods assembling information from different sources and formats, replacing elements from the current city with their predecessors (Figure 2.64, Figure 2.65). Starting the model from the present configuration is often a practical decision. However, the process of interpreting past

events according to the present embodies a critical issue (Buck-Morss 1991, Benjamin 1999). The past is not studied as a separate episode as opposed to its relation to the present and to humanity as a whole (Croce 1941 as quoted in van Pelt and Seebohm 1990). This relationship is enhanced by the modeling process, which evidences spatial links between past and present. Therefore, the model as a research instrument, rescues the past from the foundations of the present and, at the same time, the present from the fragments of the past. The digital model grounds the investigation to a constant move, departing from the present, towards the past, always considering future implications.

The acknowledgement of this link between past, present and future is also important for the model as a research representation. Places, which are the settings of our lives, are able to accomplish this powerful link between different periods and the present. As past events are spatially organized throughout the city model, connections between those events and the present are strengthened by the recognition of city spaces represented on the model. Inhabitants of a city comprehend better the complexity of urban historical experience associated with familiar places. The observation of 3D historical city models becomes a pedagogical action. One, who consciously experiences historical sites, also experiences the presentness of historical events.

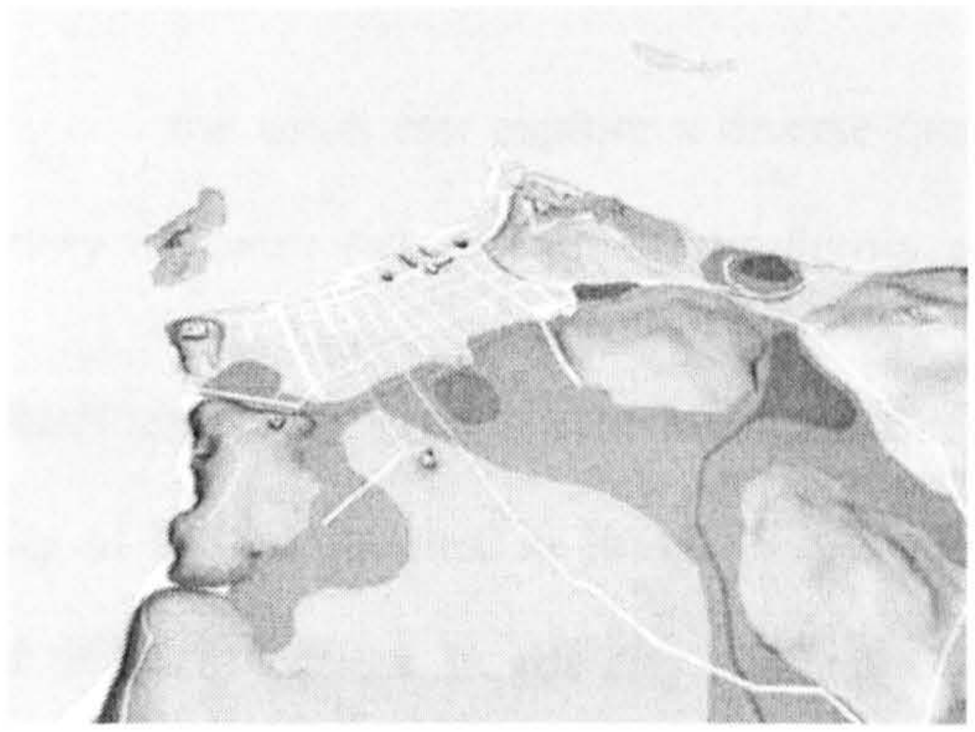


Figure 3.64: 3D model of Rio based on 1713 historical maps and in the 2000 model

Figure 3.65: 3D model of Rio based on 1808 historical maps and in the 2000 model

4 Rio-H

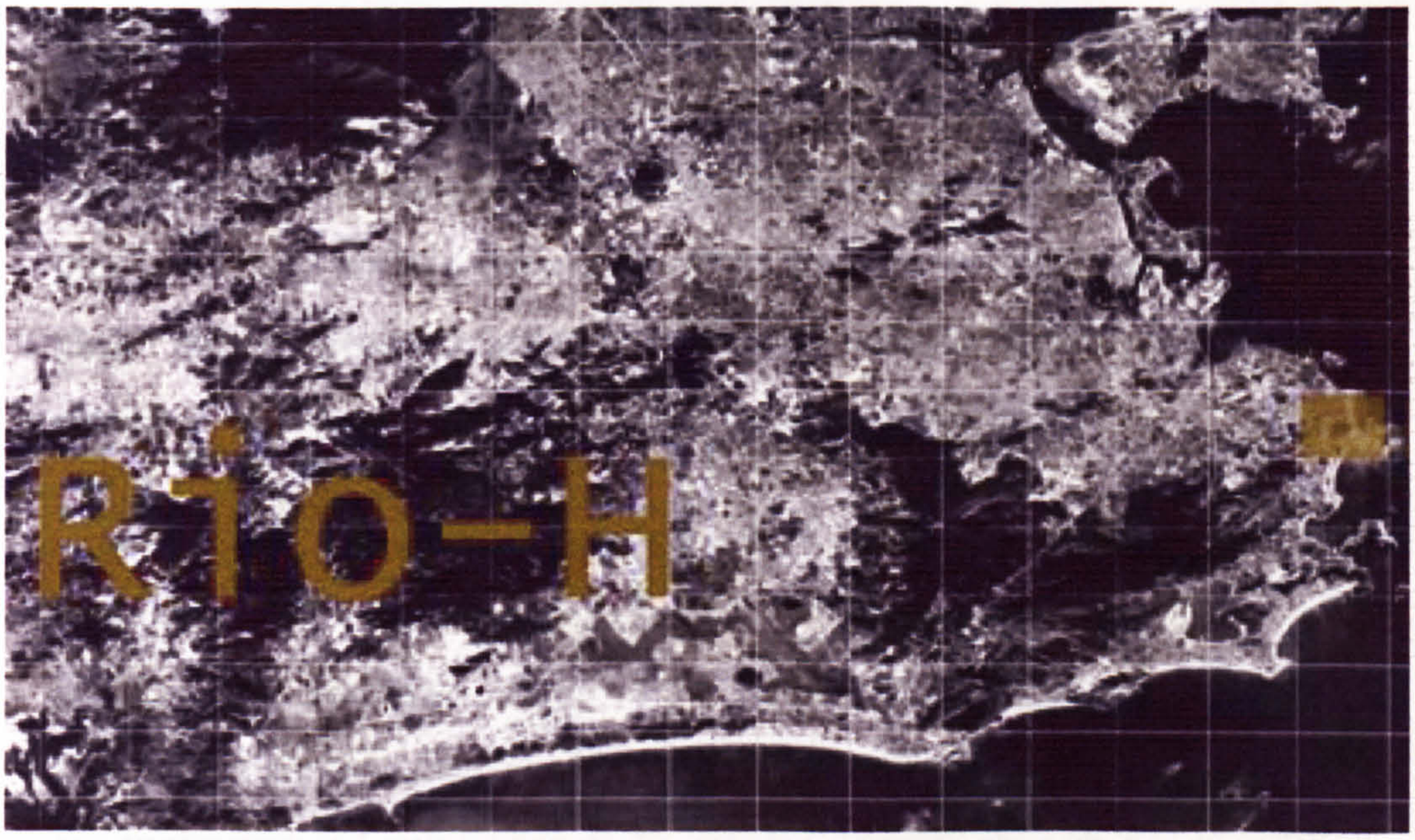


Figure 4.1: Initial page of the system Rio-H. Available at **http://www.kos.med.br/thesis**

Rio-H is presented in this document as a prototype version of a system which should respond to the main issues raised during this investigation. It was conceived as a web-based alternative for the presentation of a place's history. *Rio-H* embodies two main characteristics which differentiate it from usual historical documents:

1- the user doesn't follow it sequentially or if there is any sequence it is rather a spatial sequence since the documents are organized according to places in the city;

2- the users can explore a diverse group of documents concerning one subject – many of them can present contradictory versions.

Rio-H rests on a database of historical documents related to specific places within the city of Rio de Janeiro, in Brazil. These documents are searched from 3D model's images of different periods in the city's history. The database entries are text, image or even sound and movie files. They are digital versions of historical documents taken from a

great variety of sources. Each database entry can be linked to up to five different places in the city model, five different historical periods and five keywords for searching the information. Every search starts from places represented in the city models. Thus, the information is organized according to the space in the city and the users are always aware of the city spatial organization and relationships. The database entries are classified in different categories such as photographs, newspaper articles, paintings, fiction books and official documents. Therefore, the users can search documents which present different versions or aspects of a place's history. They should be able to elaborate their own historical narrative from the spaces within a city.

Rio-H 's complete system should be a large-scale project, which would be carried out by a multidisciplinary team. It is composed of four main parts, which, even for the prototype, were developed separately. In the definitive project different people or teams should develop them. Therefore, the construction of the 3D historical models; the development and maintenance of the historical database; the collection of historical documents; and the elaboration of the web-based tool constitute the whole system. All four phases are already defined but the system is not yet functional. Only after feeding it with meaningful data it can be useful to most users.

Figure 4.2: List of the search results displaying the color codes for the document's languages

Although this document provides enough information about the system, *Rio-H* can, be accessed while reviewing this investigation. Eventually, the best way to evaluate the system is navigating through it. Its prototype version can be accessed at the URL: **http://www.kos.med.br/thesis.** Most text documents are not translated to English, being presented in their original Portuguese version. However,

images can be accessed and few text documents are in English, to allow the analysis in both languages. For every search, the system returns every entry in the system, in the two languages. In order to facilitate the search, the entries which are in English, have their titles displayed in a black font. Those in Portuguese, are displayed in a greenish font and the gray text fonts are assigned to images without captions (Figure 4.2). The navigation details are explained in the section **4.5 - Navigating through the Rio-H.**

4.1. The 3D historical models

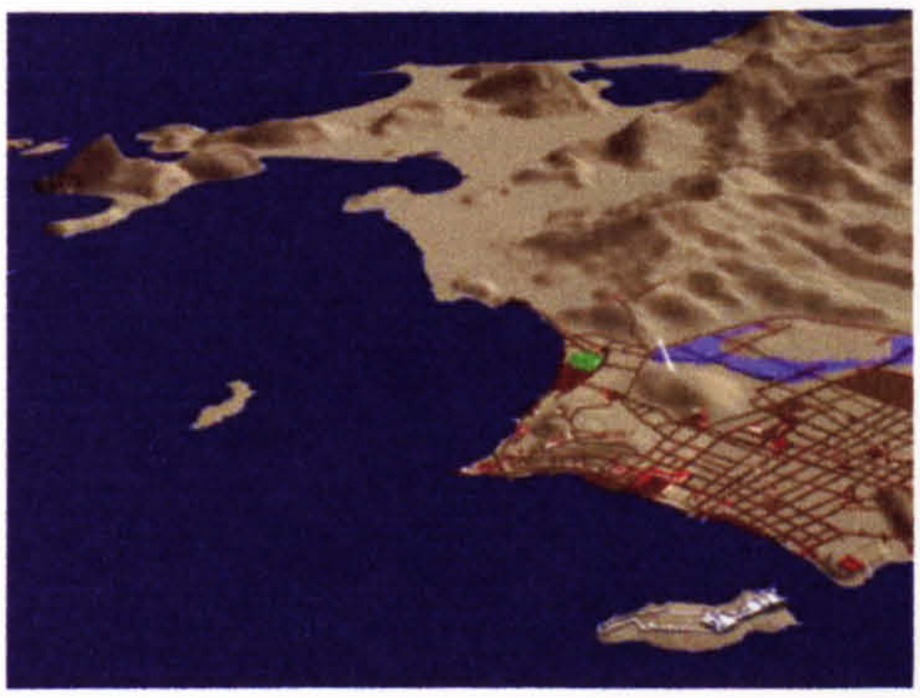


Figure 4.3: View of Rio de Janeiro's historical model in the first half of the XIX century

The 3D models of the city of Rio de Janeiro were elaborated in the Laboratory of Urban Analysis and Digital Representation (LAURD-PROURB) at the Federal University of Rio de Janeiro. They have been used in several projects related to the city. Those models render historical periods in the city, represented in cuts selected from available antique maps or aerial photographs. The models were constructed from the existing city 3D model with the support of the historical graphic information. The current city model is represented by the existing situation of the city in the year 2000. Thus, each historical model was elaborated backwards based on previous maps and in the remaining constructions and streets, deconstructing the changes which occurred over the years until 2000. In order to facilitate their construction, every model was structured in three main parts: the natural landscape, with the topography and the shoreline; the street network; and the main buildings (Figure 4.3).

The representation of the landscape is critical for this project due to the history and characteristics of the city. The city growth was always driven by the relationship with

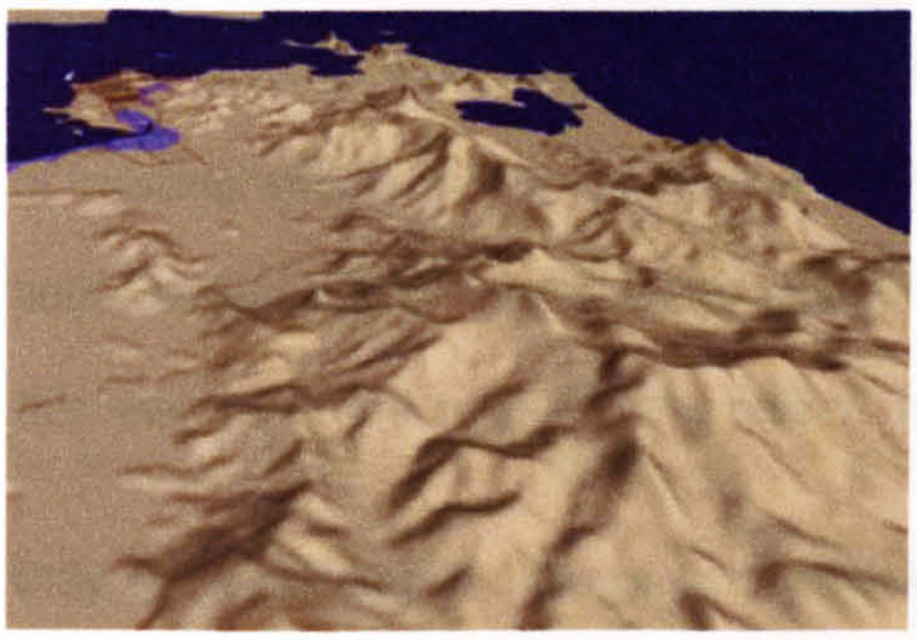


Figure 4.4: View from the back of the mountains of first half of the XIX century Rio's model

the natural landscape. Sometimes this relationship required a defensive or laborious attitude and in others the natural assets supported urban enterprises. Thus mountains and waterfront were several times changed over the history to conform to major urban changes. Infills and hill dismantling are not uncommon in Rio's urban evolution. Besides that, the city dwellers always used the waterfront and the mountains as guiding resources or references for places. Until today, the city is more known for its natural configuration than for its built environment. The city landmarks built by its inhabitants are often exhibited near the natural landscape. Therefore, even requiring complex modeling solutions, the topography was constructed with fairly rich details (Figure 4.4). The topography was always the most problematic part of the model. It required a lot of workstation's disk and memory to manage the models and elaborated procedures to place streets or buildings in it.

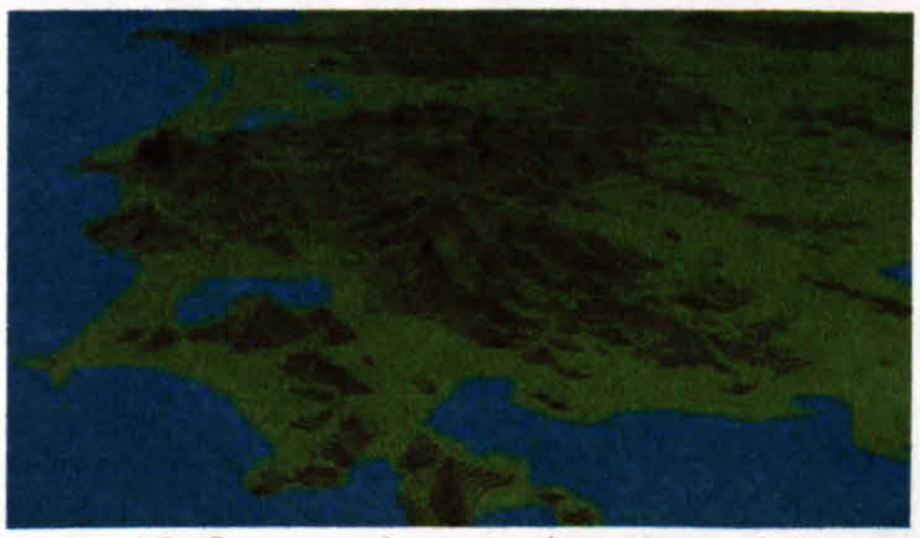


Figure 4.5: Contours from the first phase of the modeling process

The Municipality of Rio de Janeiro granted their digital topography files to the project. However, since they were used mainly for 2D printing, they had several problems for transferring to three dimensions. Thus, the contours had to be redone over the official ones in order to provide good quality curve lines to extrude the hills and mountains (Figure 4.5). The level of detail used to model the mountains increased accordingly to the proximity to the city center.

The street network was produced from the official current model, superimposed to old

maps. The maps were adapted to conform to the official representation and the width of existing streets or the changes in others that disappeared were modified from the 2000 version of the model. Every change was registered in the historical models and this was important to guide the readers in the past models.

Only some selected buildings were modeled for the historical models. Most of them have changed or disappeared since they were built. The lack of precise information was a problem to model them. Since few had plans or sections available, they were mostly built from paintings or old pictures. They were selected due to their importance in the urban environment and the amount of historical documents. They were modeled with few details to facilitate the manipulation of the city model, already complex because of the elaborated topography.

The models were elaborated with *AutoDesk AutoCAD* and *Discreet 3ds max*. Mostly undergraduate students, who were more proficient with those pieces of software, developed the historical models. Therefore, even though, they were not the most suitable for that job, they were chosen for practical reasons. Some tasks, which were too laborious to be done with the two tools, were accomplished with other ones such as *auto·des·sys form·Z* to extrude some of the mountains.

Figure 4.6: Historical model with the street grid in the City Center

Although most of the topography of the "Greater Rio de Janeiro" was modeled, only part of the city center had the street network and important buildings constructed (Figure 4.6). Therefore, the tool *Rio-H* is currently restricted to the center of the city, where it originated. It is important to notice that before the XVIII century, the city was mostly

confined to that area. Even though urban areas did not occupy the mountains, it is important to have them modeled in order to understand the surrounding configuration and the feeling of the city center's natural environment.

The central area of the city has eight historical models and one current model of the city in the year 2000 in this first stage of the research. The dates for the historical models were chosen due to the interval between the models and the quality of the available information, mainly maps or aerial photographs for the most recent years. Thus, the years 1600, 1650, 1713, 1750, 1808, 1850, 1910, 1928 were selected to be represented in the first historical models, which were included in the prototype.

Those historical models of the city were not constructed to be realistic representations of the city. Actually it is important to emphasize their abstractionism. Each model should be accessed as a reduction to a physical fragment of the city in the past. Therefore, its role as a spatial representation is mainly to locate the "historical image" – or "dialectic images", as Benjamin states (Benjamin 1999) – elaborated by the readers in the space of the city they already know. The simplicity of the model, based on a digital Cartesian system, is critical to bring about the great complexity of city history.

The organization of historical urban 3D models poses additional important issues. It's much easier to represent an existing situation than past moments of the city, which are never completely documented. Latin American cities, for example, suffered radical changes, particularly from the end of the eighteenth century. Most buildings in the city center were demolished and few records remained from them. Even with a relatively short age, those cities are very difficult to represent with historical 3D models because few buildings remained from the previous centuries. Therefore, modeling an "incomplete" and more abstract version of the city can overcome lack of information problems and also facilitates the users to construct their own images of that period. That could be done with the support of other historical documents associated with the

users' knowledge of that existing space in the city. 3D models have an important role to locate within the city, past events and associate present and past spaces. It is more important to place those events in the city space than trying to realistically reproduce an environment from the past.

4.2. The historical database of Rio de Janeiro

The database for Rio de Janeiro's historical documents was elaborated in order to organize the historical data related to Rio and its connection with the spaces within the city. The database of historical information linked to the city space is composed of a great diversity of file types. It is constituted by primary documents such as letters, photographs, official maps, official documents and also other sources like journal articles, historians' texts and even fictional texts. It was designed as a regular database to keep records of historical archives. In addition to the regular information such as authorship, type of media or file quality, the database hosts the information, which connects the entry to the 3D models. The entry should be linked to one or more historical 3D models and to areas within those models. Thus, for each entry the database offers 5 possibilities to relate to one of the eight preliminary 3D historical models (1600, 1650, 1713, 1750, 1808, 1850, 1910 and 1928); 5 possibilities of areas within the model, which could be buildings, squares, streets or small urban spaces; and 5 subject keywords, for conducting the historical search engine.

The software chosen for the task was *Microsoft Access* and several forms were elaborated to fill in the different sources of entries. The two most used forms were designed for images and texts (Figure 4.7 and Figure 4.8). They are separated to allow the visualization of the file when the person responsible to register it, fills the form. The different forms have also specific fields such as bibliographic information or quality of the media that do not apply to the other format. Another difference is that the *Rio-H* website gets the text information directly from the database fields while the image files are separate files

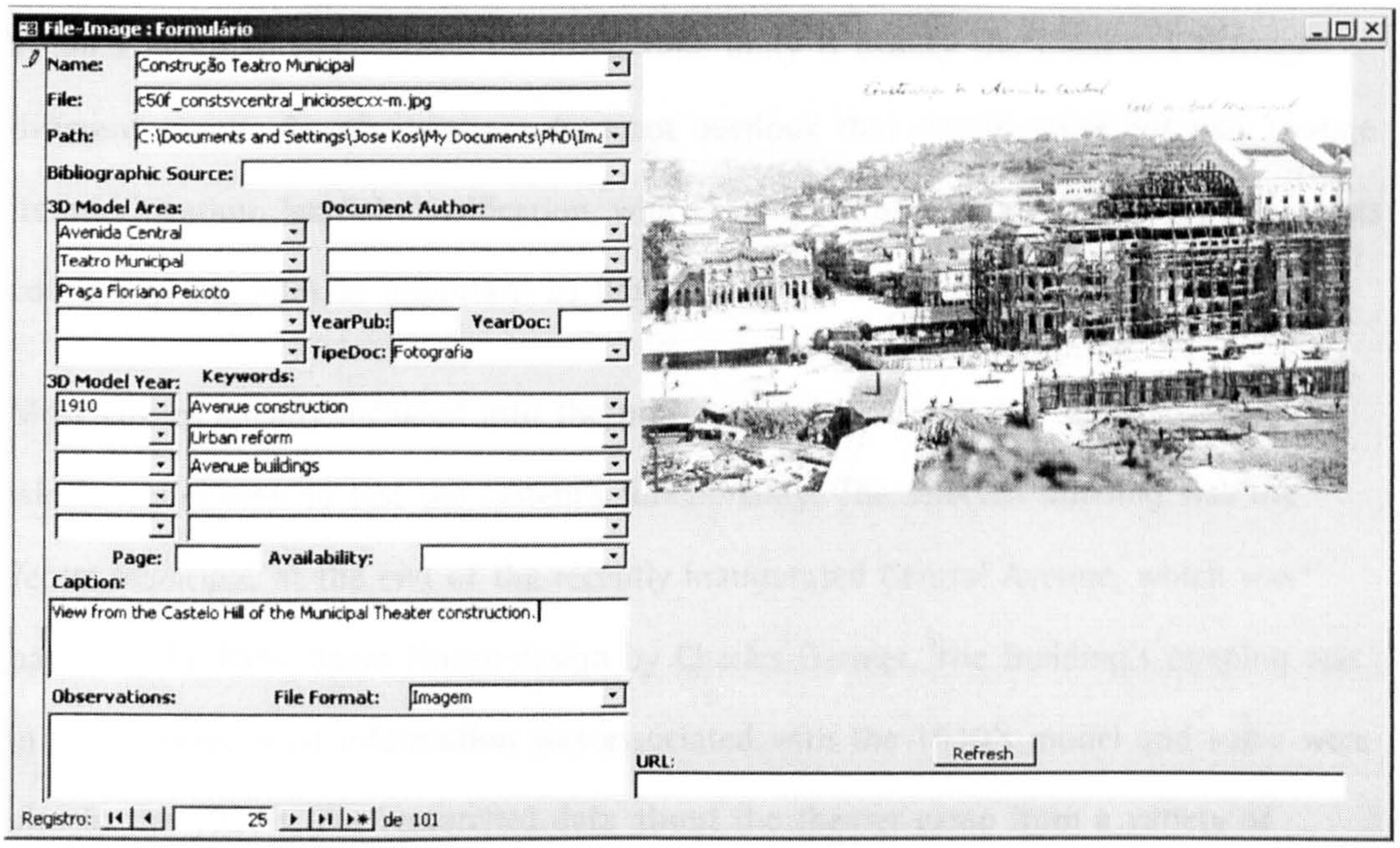


Figure 4.7: Data entry form for cataloguing Rio-H's image files

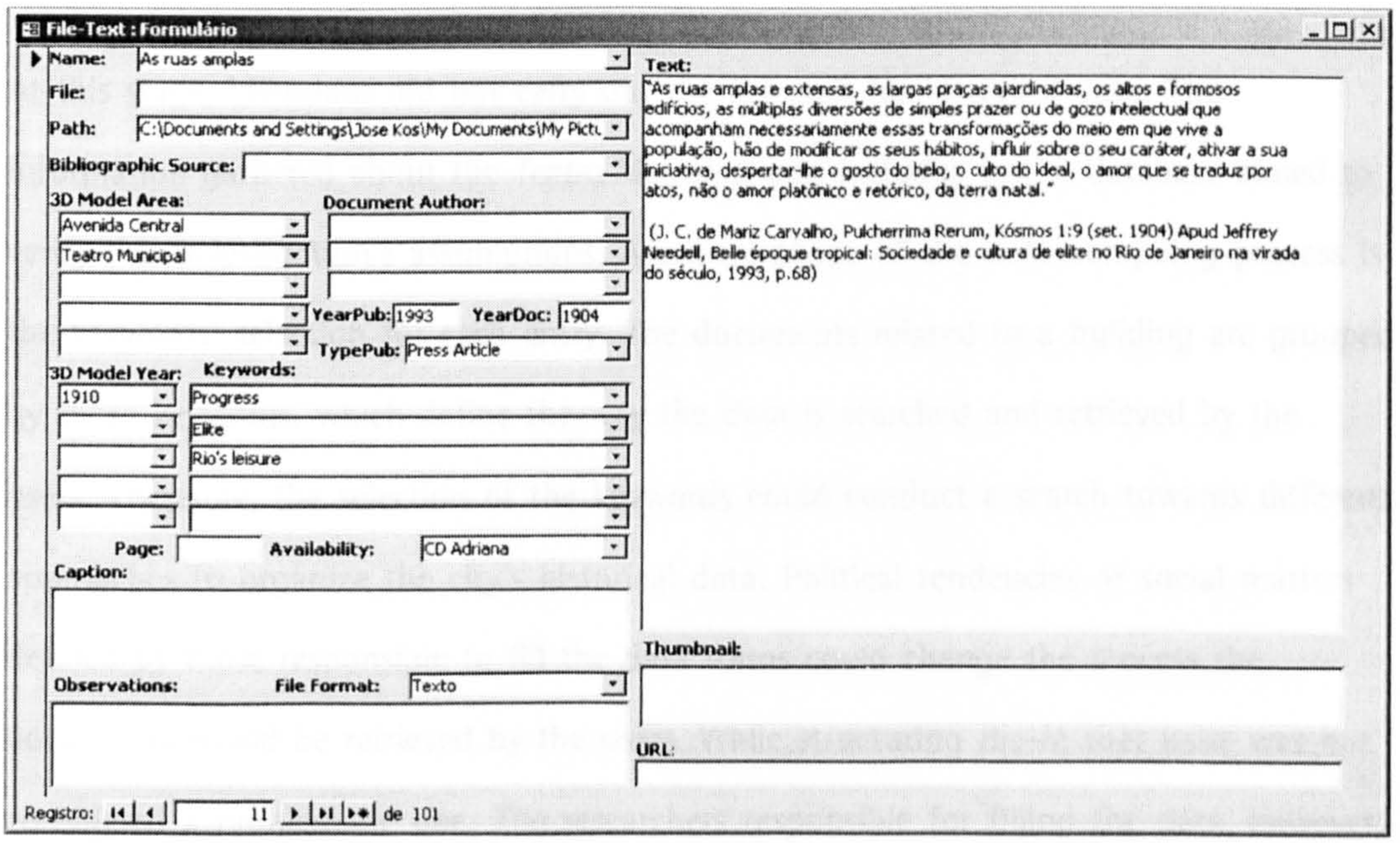


Figure 4.8: Data entry form for cataloguing Rio-H's text files

stored within the server. The database registers the image file information in order to associate the file to the entry when the system relays its information.

The fields to select the historical models associated to the entries define a chronological classification. However, each entry can be linked to 5 different models. The chronological classification is always considered critical for an historical documentation.

When a historian elaborates a narrative, time unity is usually the main link through different events. *Rio-H*'s database does not overlook that classification but may change its prioritization. Spatial classification, which is important but not crucial for the events continuity, becomes as important as time.

Most entries already included into the prototype refer to only one specific building, which was chosen to test the system's functionality. The selected building was the *Teatro Municipal*, at the end of the recently inaugurated Central Avenue, which was based in the Paris Opera House design by Charles Garnier. The Building's opening was in 1909. Thus, most information was associated with the 1910's model and some were also to the 1928's. The researched data about the theater came from a variety of sources and was used to confirm the validity of the prototype database.

At this stage, historians did not carry out the research for historical data. The information gathered about the *Teatro Municipal* and included in the database aimed to verify this investigation's assumptions. A critical phase of the data compiling process is the keywords' selection for each entry. The documents related to a building are grouped by those keywords, which define the way the data is searched and retrieved by the users. Therefore, the selection of the keywords could conduct a search towards different approaches to organize the city's historical data. Political tendencies or social matters defined by those responsible to fill the data forms could change the process the documents would be retrieved by the users. While structuring *Rio-H*, that issue was not considered a problematic one. The researchers responsible for filling the data, however, should be aware of it when they plan the strategies for accomplishing it. The database should not be seen as a neutral tool that automatically displays historical data to any one that would access it. The individuals directing the planning and developing process should take the responsibility to clearly define their main objectives and how the information would be available through the places and keywords. That issue should not be regarded as a 'constraint' but one of the 'advantages' of the system.

4.3. The historical documents

One of *Rio-H*'s main objectives is to accumulate a great amount of historical information related to different places in the city. The information that is usually dispersed in different historical publications would be concentrated in one tool and related to several places of the city. The users should be able to confront different versions of one event and elaborate an image of the place they are searching through the Web in different moments in the past. Although the system can be accessed by anyone interested in the history of the city, it focuses on those who have some knowledge of the areas they are searching. It is very important that the experience they previously had in those places should be associated with the retrieved documents. Therefore, each user should elaborate a different image of that place in the past, which would depend on the selected documents in the system and the way they "read" that place in the present.

The documents available through *Rio-H* should reflect a great diversity of file types and sources and should present different versions for the same event. Walter Benjamin (1999) and several historians (Burke 1991), for example, attempted to raise the history of ordinary people who suffered through their difficult lives and were not registered in the official documents. Therefore, some fictional stories from recognized authors, contemporary to the studied period, who wrote about living in the city, are also included in the database, among the historical documents. They are frequently some of the most important registers of the city's population culture, particularly the poor and powerless ones. However, it's important to acknowledge the source of those entries so that the users would identify that some of them may not be telling a story about a real person but they are probably a clear account of the way of life in that particular moment.

Another important source of documentation are the image files from paintings, engravings, photographs or even maps. Usually books have a limited quantity of

images due to the cost of printing and the size of the publication. Since the database will carry all the effort to manipulate the information and the users would retrieve just the selected documents, the images can be an important part of *Rio-H*'s files. Besides that, they offer rich material to understand the life-style of the city dwellers.

Video and sound files will also be available through the system, although they refer to more recent periods and are usually more difficult to obtain. It's very important to include them, particularly because they are important historical account, which are often not represented due to the characteristics of most historical publications. Those files, however, were not included in this first version of the prototype.

Additionally, personal accounts will be included in *Rio-H* and the users can add their report to the database to become later accessible through the system. This resource provides a channel of interaction between the users and the system and some accounts, which could never appear through other means, would register and present noteworthy versions of events that happened in some places in the city. Many elderly citizens of the city have valuable contributions to the understanding of those places. These contributions may cause some problems. A personal account, which does not convey a true story, may be exhibited. However, since they are assigned as personal accounts, the users would know the type of origin of those reports. However, even these external contributions do not enter automatically in the system. They are reviewed and associated with different historical models, areas in the city and keywords by the team responsible for updating the system.

As presented in the previous paragraphs, every entry is classified in nine different categories of source types. The file classification is effective for supporting the files identification, which are presented only by their titles in the document list; and also to make the users aware of the type of document they are reading and how it should fit when they mentally structure the viewed files towards their own historical narratives.

Additionally, that classification should help the users to provide a filter in the *Rio-H* system, to list just one source type category The classification includes: newspaper articles; letters and official documents; photographs; maps, plans and architectural drawings; drawings, paintings and engravings; videos and audio; historians' publications; fiction books and novels; personal accounts; and other types of files which do not fit in the previous categories.

Historians usually publish a small portion of the documents they search. They select the most important ones that corroborate the argument and narrative they construct. They usually have a limitation on the documents they can describe or present. Therefore, the users have to rely on the choices those historians have taken and would never know the neglected documents. *Rio-H* aims to present the history of a city and its places with the maximum variety of records and evidences. This diversity is the system's advantage over other historical documents, even video documentaries, and consequently, it has to be pursued.

4.4. The web-based tool: Rio-H

Rio-H is a web-based system structured from a Macromedia Flash movie file connected to a Microsoft Access database using ASP (Active Server Pages) pages to query the database and relay information back and forth. The flash movie file is the front end, which presents the dynamic content to the users. It was chosen because it is becoming a standard to most web users and offers powerful tools to manipulate graphics, animation and sound, and the ability to interface with ASP pages. The Flash movie cannot directly query a database. Thus, it should link to an ASP page through a Flash's ActionScript that queries the database. ASP was chosen as the "middleware" to transfer the information from the Flash movies and the Access database due to its capacities to be installed in low-end systems, particularly to perform locally in notebooks running Microsoft Windows.

The *Rio-H*'s Microsoft Access database is hidden to the users who navigate through the 3D renderings of the historical models. The first choices to access the information on the system are done through the images (Figure 4.9). First choosing the date of the historical model and, once the model is loaded, one building or street should be chosen, which would relate to an ASP page to connect to the database. Therefore, the areas of the city, selected in the 3D models, relate to the first query to the database.

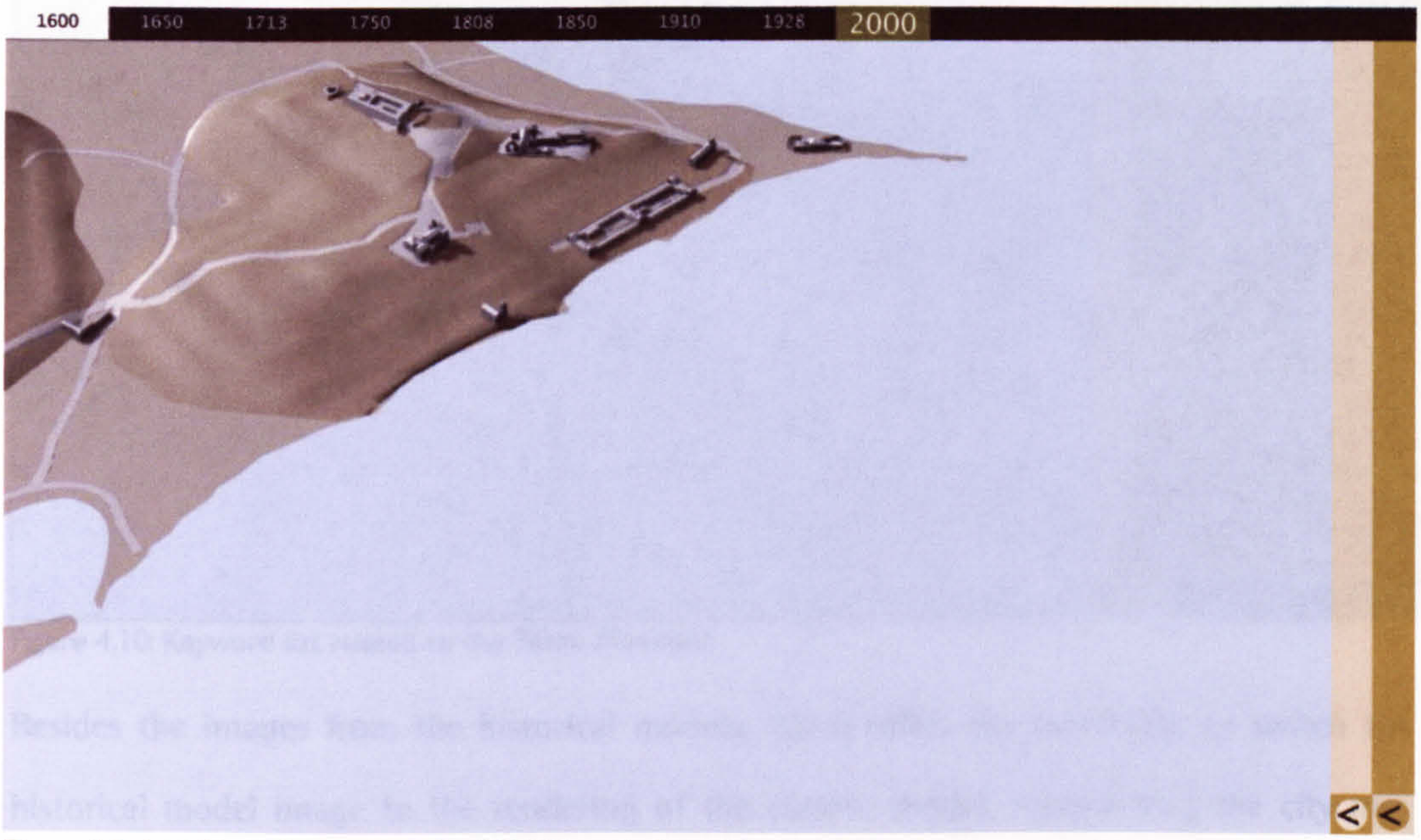


Figure 4.9: Initial interface page – the 1600 historical model

Once the area is selected, the database returns every keyword associated with that area in that particular historical model. (Place + Time) The users can choose one keyword or, if they want a more focused result, two keywords. The result is a list of every entry in the database that have in their fields that historical 3D model (Time), that area (Place), and one or two keywords (Subject) depending on the user's choice (Figure 4.10). The following result is another list of files from different sources. The files are grouped in nine different categories of source types associated with their respective buttons. If the user chooses to press one of the buttons, the system would list only the source type's selected files. Thus, the users follow this order in the process of searching the files: Time, Place, Subject and Source Type. The last one is not mandatory and is a way to

refine their searches. One possibility to identify the file's source is to move the mouse over the file title in the list. The button associated to its source type category will change to its negative.

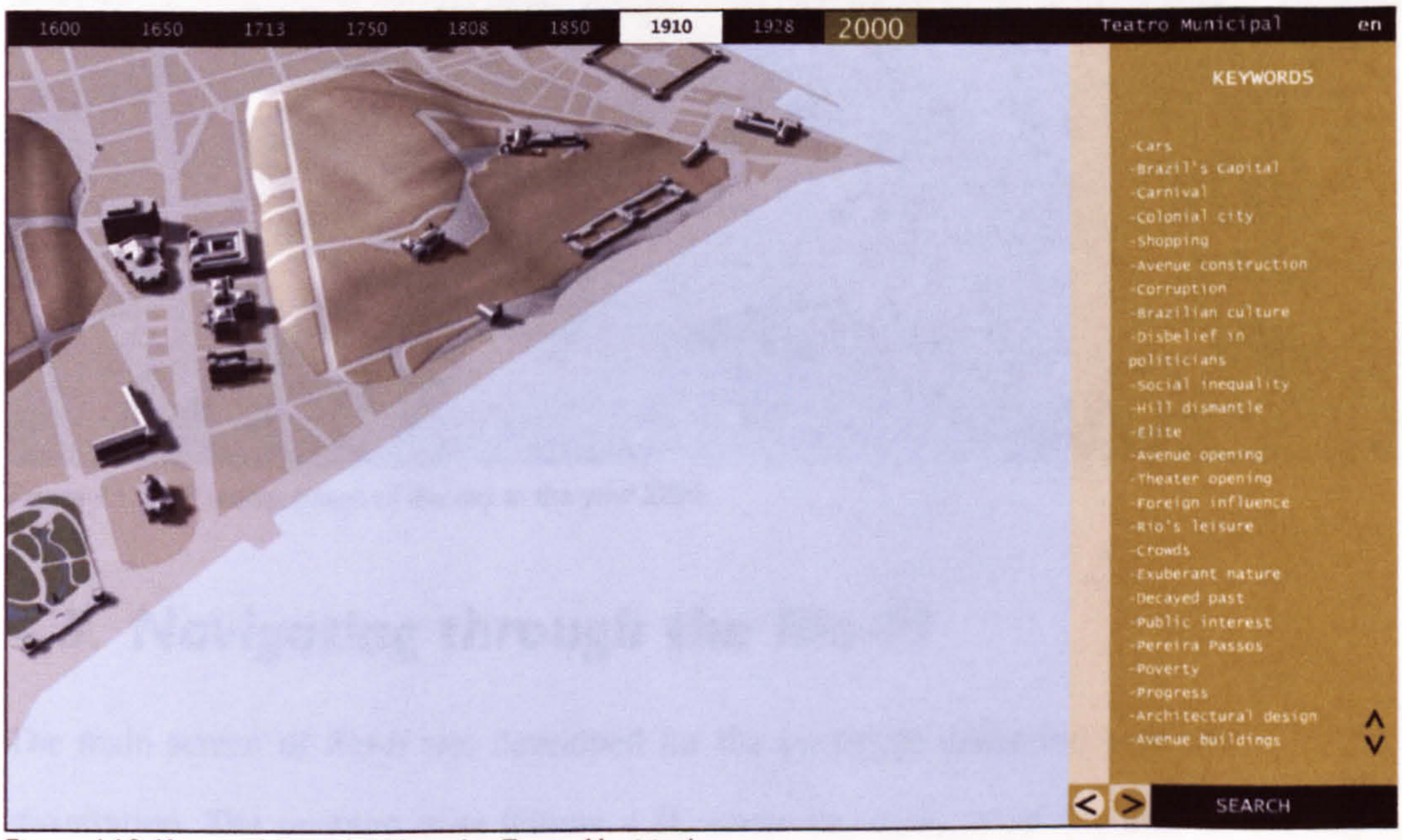


Figure 4.10: Keyword list related to the *Teatro Municipal*

Besides the images from the historical models, *Rio-H* offers the possibility to switch the historical model image to the rendering of the current model, representing the city in the year 2000 (Figure 4.11). That switch can be done anytime during the navigation if the mouse passes over the "2000" sign. That is an important feature of the system to allow the users to recognize the places in the past while they relate them to the present. Therefore, the users are always aware of the city they know and they have experienced and use that remembrance to relate to the files they read and produce an image of the past city.

One of the aims of the experiment is to use spatial information to bond historical fragments in a coherent narrative and also to strength historical continuity to the presentness of each user. Space becomes more important and less abstract than time. Therefore, historical narrative can be constructed in different formats facilitating a clear understanding of the city's past and, furthermore, of the users' present and future.

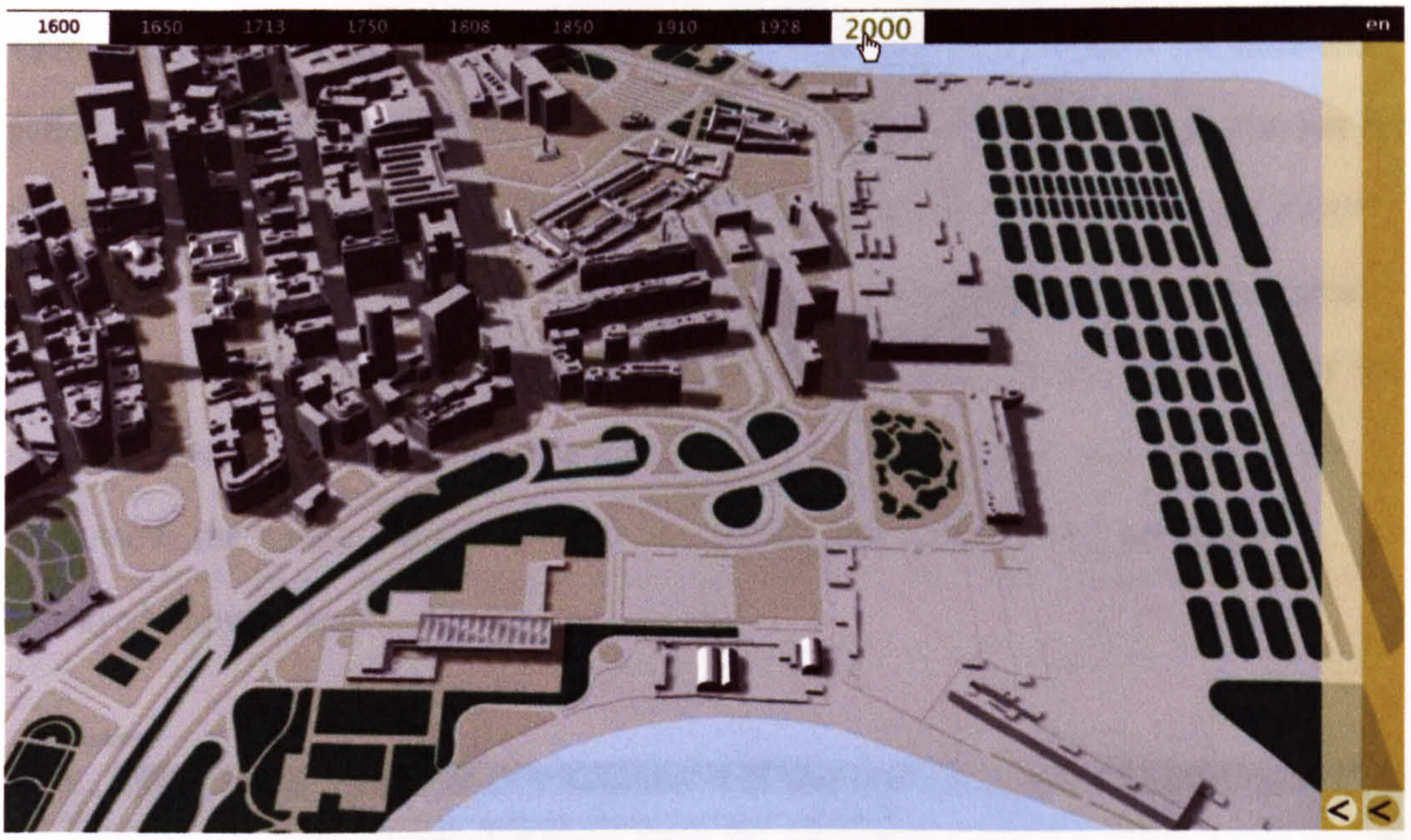


Figure 4.11: 3D model image of the city in the year 2000.

4.5. Navigating through the Rio-H

The main screen of *Rio-H* was developed for the prototype presented with this dissertation. The opening page (Figure 4.1), where the users select the area of the city they want to search, offers only one possibility for the users' navigation. The area in the center of Rio de Janeiro, where it was founded, is the only one available in this first prototype. This area displays the Castelo Hill where the first buildings of the city were erected (Figure 4.9). That hill was dismantled in the first half of the XX century during one of the largest urban transformations in the city center.

The main interface is constituted by two prevailing elements: a 3D image of the chosen area – in this case, the Castelo Hill region as the only available area in the prototype – representing the first period of historical search and a timeline menu on the screen upper part (Figure 4.12). The model that illustrates the first urban settlement of Rio de Janeiro, reproduces its configuration in the year 1600. That model displays for selection eight buildings and the main streets and paths of the city. The other options available for the historical search represent the years 1650, 1713, 1750, 1808, 1850, 1910 and

1928. They exhibit exactly the same area, to allow comparisons between the different period models. The model of the year 2000 is also available for comparisons but not for the documents' search. If one passes the mouse over the year 2000 option, the current model of the city is exhibited on the screen but it is not possible to select urban areas in it (Figure 4.11). There are no hyperlinks available in it and, actually, the image of the model is only visible on screen while the mouse is over the "2000" menu area. If the users move the mouse away to another part of the screen, the model previously displayed appears again.

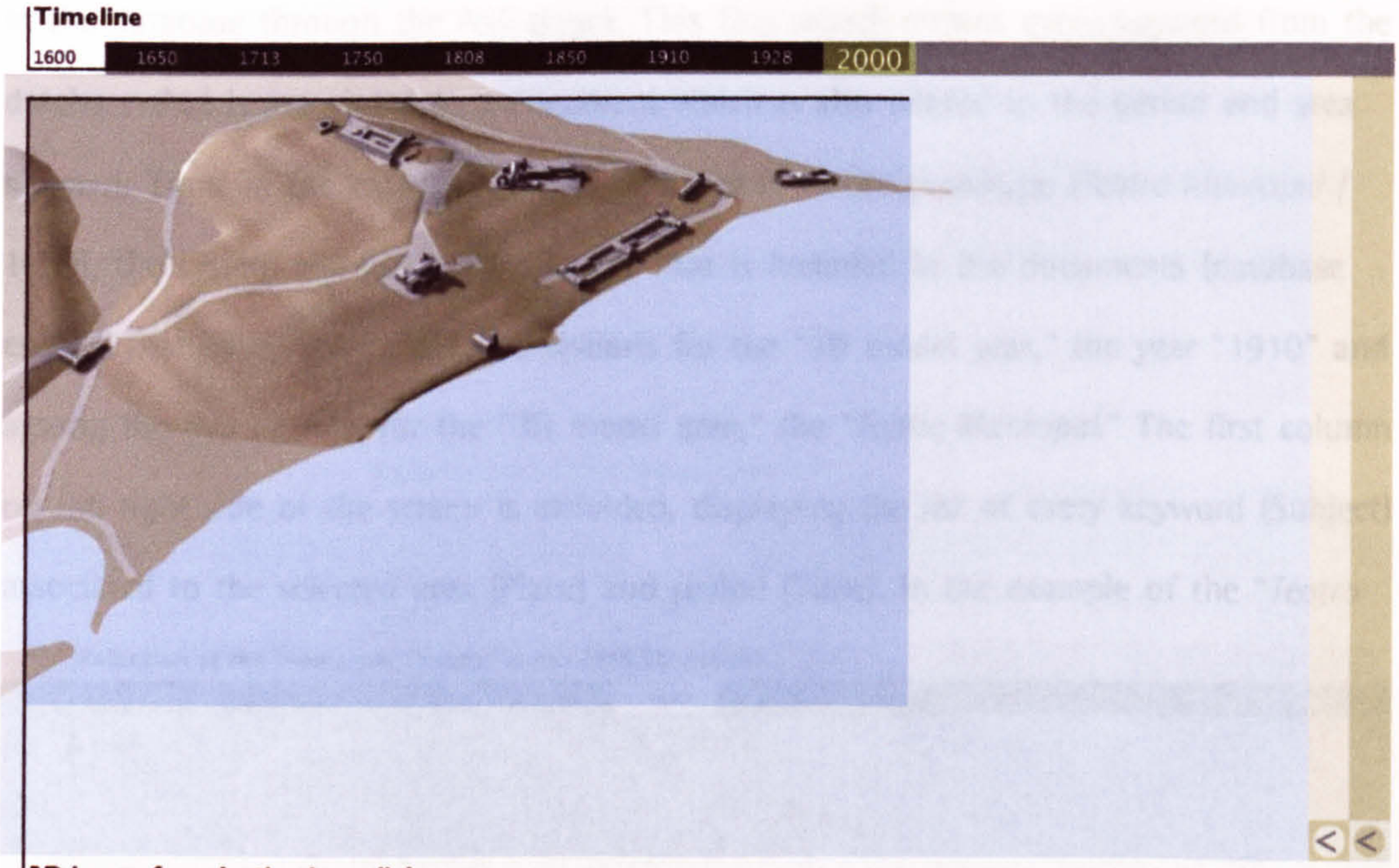


Figure 4.12: Prevailing elements in the main interface opening screen

In the historical model images, the user has the option to select any building, street or urban area, which is linked to documents from the database or to select one of the other seven historic models. To discover the buildings which can be selected, users have to pass the mouse over the 3D image. When the mouse passes over the hyperlink areas, the arrow cursor will change to a hand shape indicating the searchable building or urban area. Additionally, the name of the hyperlink urban area appears on the upper right side of the screen when the mouse passes over it, facilitating the selection

decision. If the user decides to choose a different period, the 3D image changes to the chosen year and the selection process of the urban hyperlink areas is the same as described for the year 1600.

In this first version of the prototype, only the ***Teatro Municipal*** in the **1910** model is available for search. Therefore, to evaluate the system, the user needs to select the year "1910" in the Timeline and after the model view changes to the model of the year "1910," select the "*Teatro Municipal*" hyperlink (Figure 4.13). When a hyperlink urban area, such as the *Teatro Municipal*, is selected, the system links the selection to a search in the database through the ASP pages. This first search returns every keyword from the database that is associated to a document which is also related to the period and area selected. Thus, in the example available for search in the prototype (*Teatro Municipal* / 1910), the system will list every keyword that is included in the documents (database entries) that have, among the five options for the "3D model year," the year "1910" and among the five options for the "3D model area," the "*Teatro Municipal.*" The first column on the right side of the screen is unfolded, displaying the list of every keyword (Subject) associated to the selected area (Place) and period (Time). In the example of the "*Teatro*

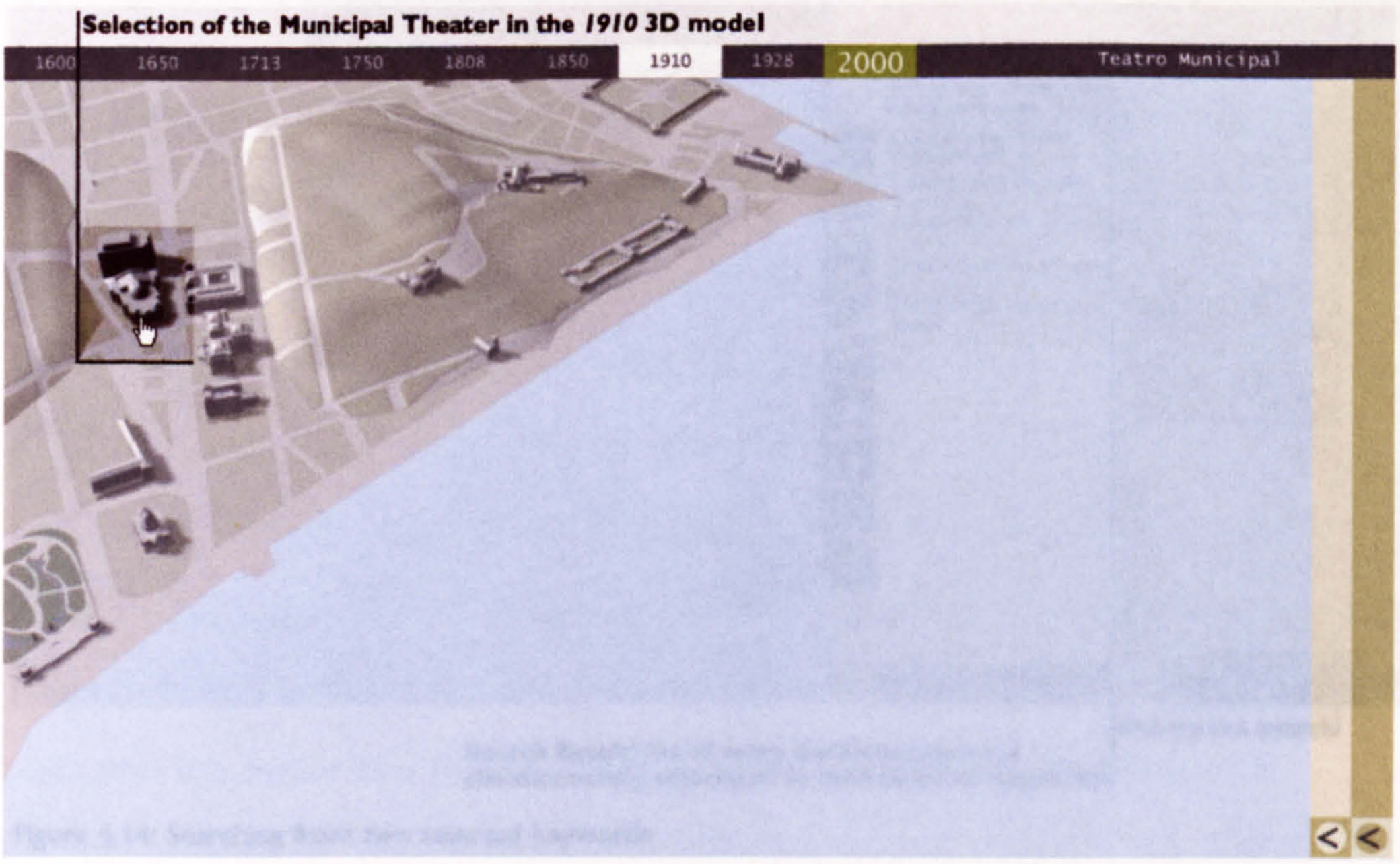


Figure 4.13: Selecting a hyperlink urban area in the 3D historical model image

Municipal" and the year "1910," the links vary from the "Theater opening" to "Disbelief in politicians." The keywords should facilitate the document search, grouping them by predefined subjects (Figure 4.10).

To initiate a search for documents, the users need to select one or two keywords. Two keywords should be selected if the users want to narrow down the number of entries focusing on two different and simultaneous subject keywords. To select a keyword they need to pick one on the list and if they want to deselect it they should pick that keyword again. The keywords are listed in white characters and the selected ones shift to black characters. Two is the maximum number of selected keywords. If there are already two keywords selected, and the users decide to choose another one, the first selected keyword is de-selected, leaving the two last keywords selected. When one or two keywords are selected, users need to click on the word "SEARCH," to place the search (Figure 4.14).

Figure 4.14: Searching from two selected keywords

When the "SEARCH" word is selected, the system connects again to the database, looking for every entry which has the chosen "3D model area" (Municipal Theater), the chosen "3D model year" (1910) and the selected keyword. When two keywords are selected, the system will search for the documents that are associated simultaneously to both keywords. The second column on the right is unfolded displaying the search result. The result is constituted by a list of every historical document that fulfills the search criteria (Figure 4.14). To facilitate the selection of documents, they are divided in categories, which define the type of documents (Figure 4.14). Some of those documents can be excerpts from novels or fictional books that were not created to describe a real event but can be very powerful for the understanding of a past environment or culture. Therefore, it is important to make clear to the users the origin of these documents. They should be instructed that the authors who created them had no intentions to register facts that occurred in the past. They should also be aware that they can download a document from a primary source other than from works elaborated by historians, for example. Another effective use of those categories is to afford the possibility for the users to know, before downloading the document, if it is an image or a text. Hence, the files are divided in nine different categories: photographs; newspaper and magazine articles, from the searched historical period; paintings, engravings and other visual art documents; maps, plans and other architectural drawings; letters and official documents, contemporary to the searched period; fictional books and novels, also from the searched period; non-fictional books or historical books and articles, which were written after the researched events; personal testimony and users contribution; and other types of documents which don't fit in the previous categories (Figure 4.15). Each of the ten categories is represented by one icon, with the symbols in white on a black background, located on the right side of the second column. When the users pass the mouse over one document, the icon associated to the document's category turns to its negative (black with white background) (Figure 4.16). Additionally, it is possible to list only one category of documents by clicking in one of the category

icons. When one category is selected, its icon is fixed in negative (black lines with white background). If the users click in that icon again, it de-selects.

Photographs

Contemporary newspaper and magazine articles

Paintings, engravings and other visual art documents

Contemporary letters and official documents

Maps, plans and other architectural drawings

Contemporary fiction books and novels

Personal testimony and users contribution

Historical books and articles (written after the events)

Other types of documents

Figure 4.15: Categories of document types

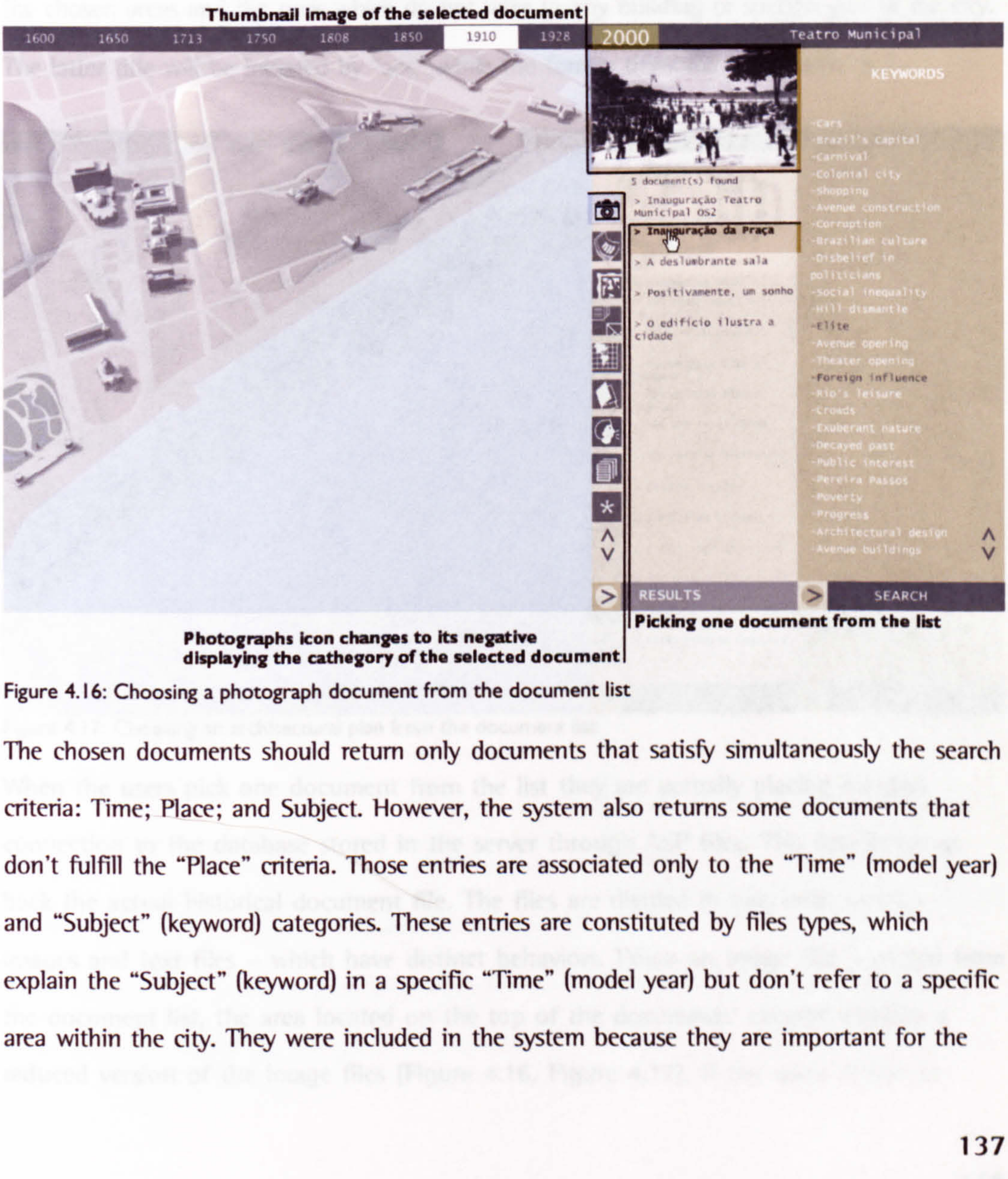


Figure 4.16: Choosing a photograph document from the document list

The chosen documents should return only documents that satisfy simultaneously the search criteria: Time; Place; and Subject. However, the system also returns some documents that don't fulfill the "Place" criteria. Those entries are associated only to the "Time" (model year) and "Subject" (keyword) categories. These entries are constituted by files types, which explain the "Subject" (keyword) in a specific "Time" (model year) but don't refer to a specific area within the city. They were included in the system because they are important for the

understanding of the subject and, therefore, the areas associated to that particular subject. Without this procedure, documents that explain one "Subject" (keyword) – disbelief in politicians, for example – but are not specifically attached to a building or square, wouldn't have space in the system. They will be listed in every building's list relayed by a search for the specific urban area and keyword associated to those historical documents. Placing them in the system associated with a "Time" and "Subject" facilitates the understanding of the other documents that satisfy also the "Place" criteria. Therefore, they could also support the unfolding of more thoroughly "individual narratives" by the users. It is possible to verify in the document list relayed through the database search which documents are associated to the chosen areas and the ones which do not refer to any building or specific area in the city. The latter title will be initiated by ">>," while the former titles will begin with ">."

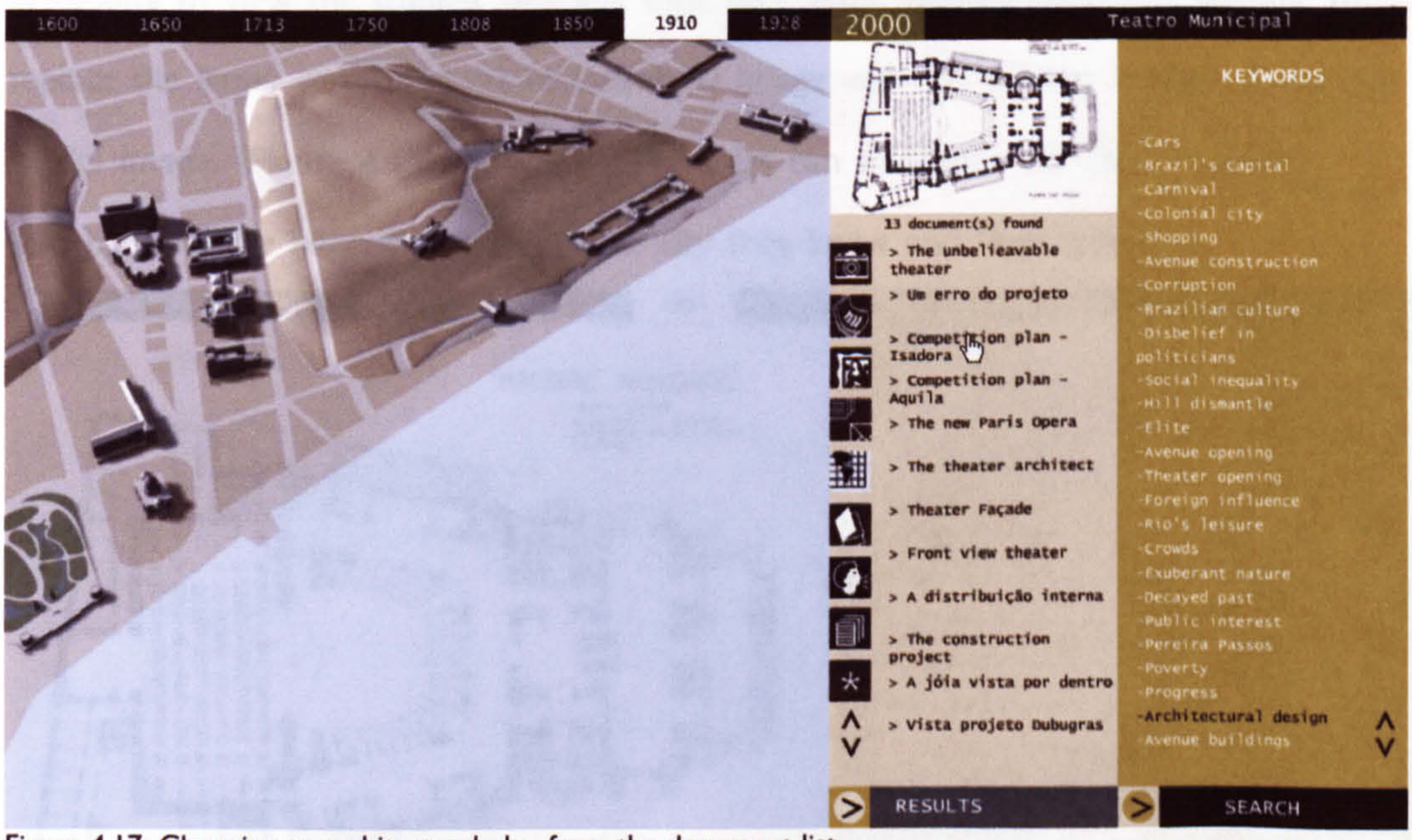


Figure 4.17: Choosing an architectural plan from the document list

When the users pick one document from the list they are actually placing another connection to the database stored in the server through ASP files. This search brings back the actual historical document file. The files are divided in two main types – images and text files – which have distinct behaviors. When an image file is picked from the document list, the area located on the top of the documents' column displays a reduced version of the image files (Figure 4.16, Figure 4.17). If the users decide to

download the larger version of the image, they have to click into the image of the small version. Then, the image occupies the larger area of the interface replacing the 3D image (Figure 4.18). The latter's small version goes to the upper part of the documents' column, previously occupied by the image file thumbnail. If one wants to view the larger version of the 3D image, they change position again and the 3D image is exhibited back to its original size and position. The main difference between the image files and the text files is that the latter are exhibited in the larger area of the interface screen when they are first selected. Since they are small files and are quickly downloaded, there is no need to exhibit first its smaller version. Similarly to the image files, the 3D images turns to their smaller version and can shift position with the text in the interface screen. This is an important feature of the system to afford the users the possibility to view the studied area any time they want. Besides that, it is possible to replace the larger version of the historical 3D image with the current version of the city model image. (Figure 4.19). Therefore, the users can also associate the document searched and the historical image to the city they know and they experience

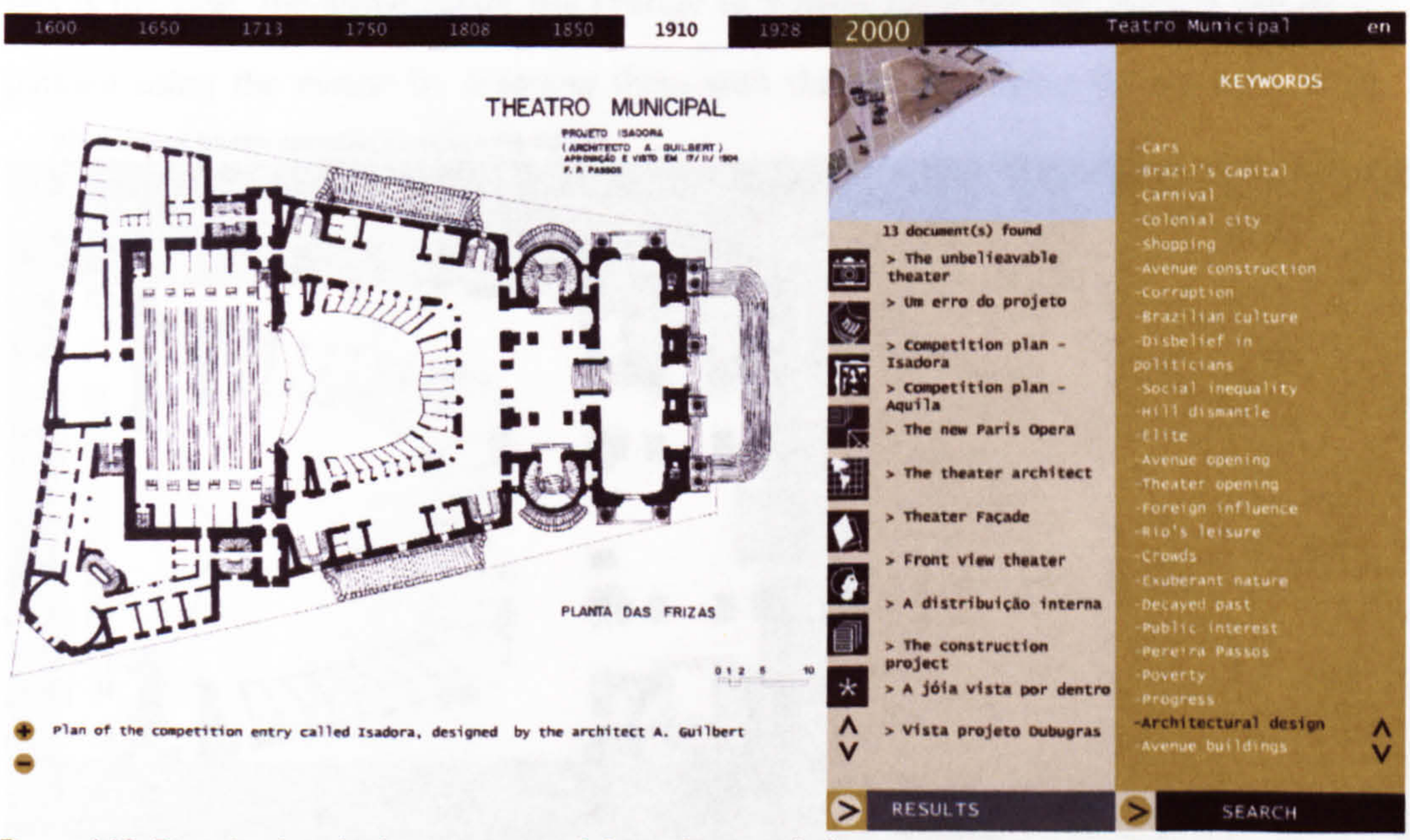


Figure 4.18: Downloading the larger version of the architectural plan

Most images were scanned at a much greater size than the area allocated in *Rio-H* for viewing them. Therefore, the users can zoom those images up to their original scanned

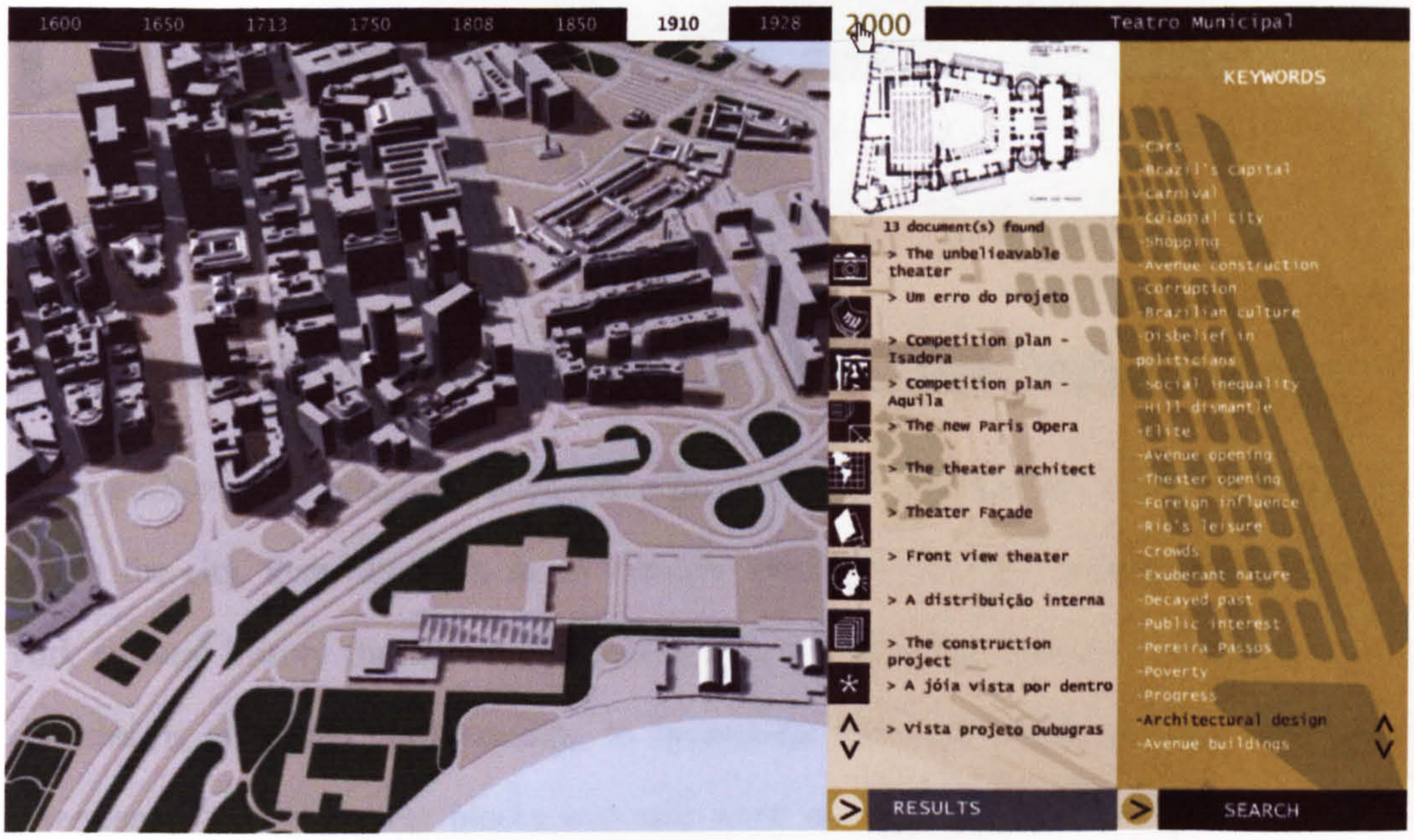


Figure 4.19: Replacing the historical 3D image with the current 3D model view

size in order to check details, using the "+" and "-" buttons placed on the left side of the area designated for the figure captions – at the bottom of the image area (Figure 4.20). Besides zooming the images, users can scroll them to see different areas. When this is the case, the arrow cursor will change to a hand shape and the images can be panned using the mouse by dragging them with the primary mouse button held down.

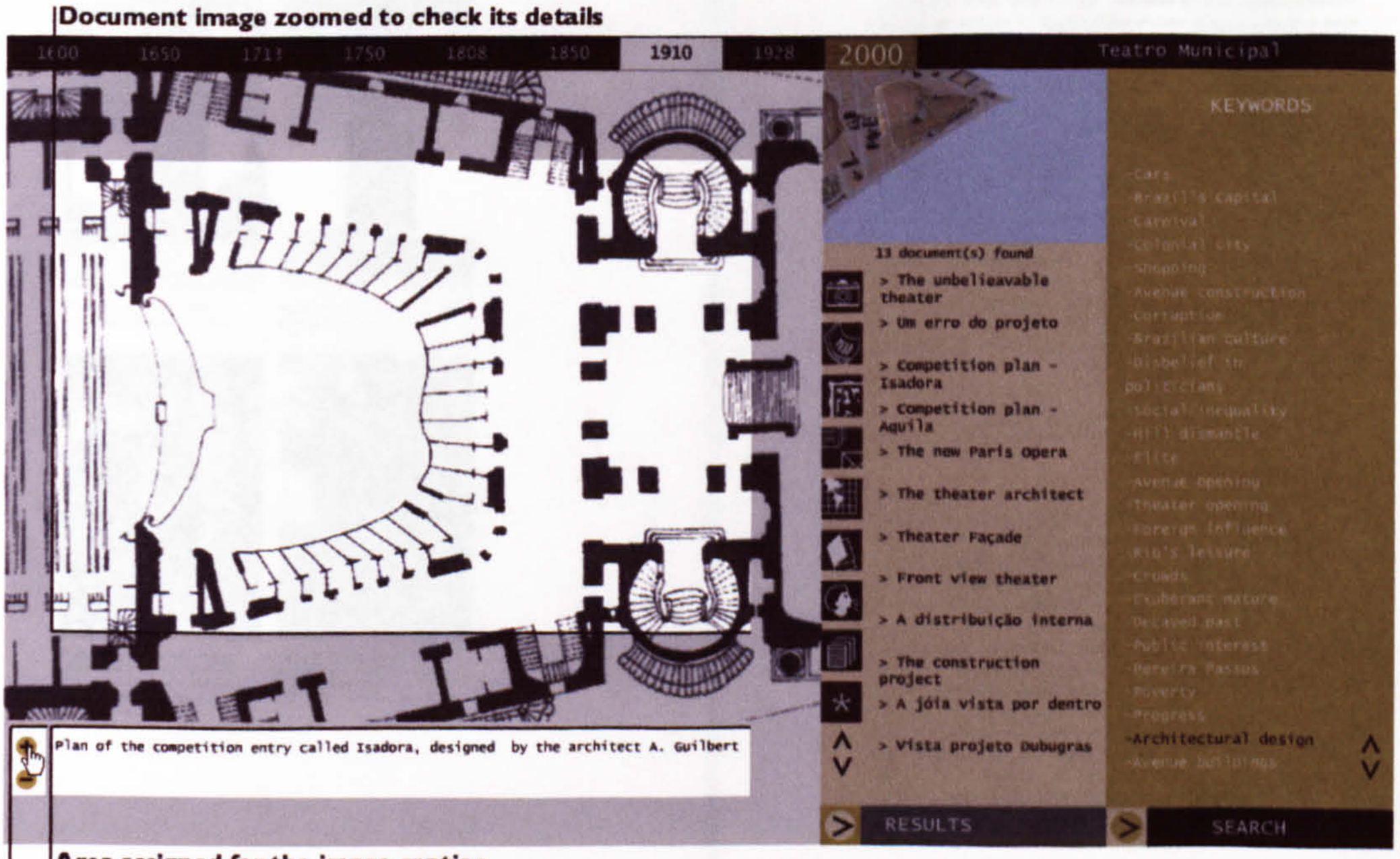


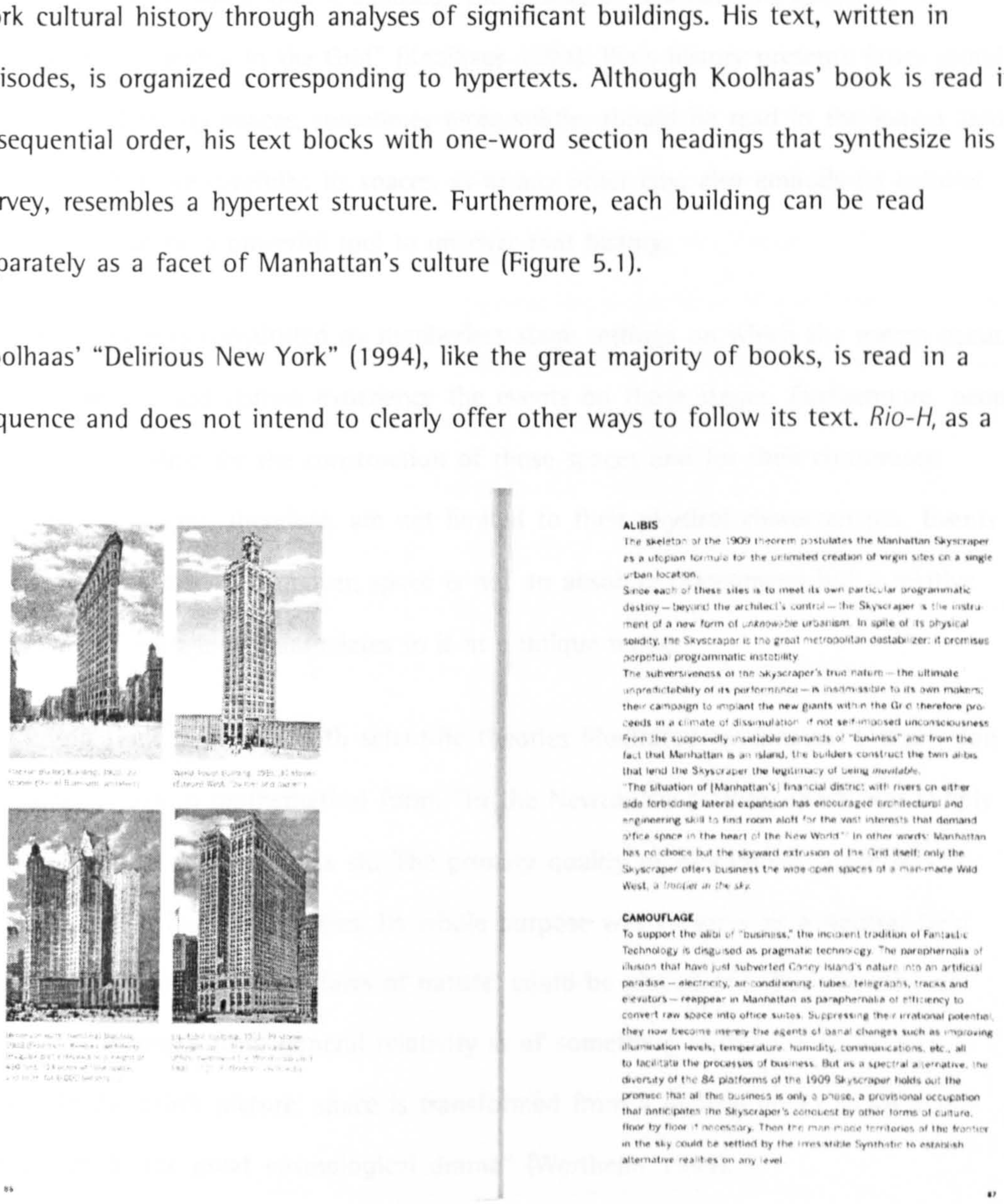
Figure 4.20: Zooming the larger version of the image

5 An alternative for depicting the history of the city

5.1. Spatial organization of historical information

Many authors have already applied the organization of information according to places within the city. Rem Koolhaas, as an example already mentioned, structured his New York cultural history through analyses of significant buildings. His text, written in episodes, is organized corresponding to hypertexts. Although Koolhaas' book is read in a sequential order, his text blocks with one-word section headings that synthesize his survey, resembles a hypertext structure. Furthermore, each building can be read separately as a facet of Manhattan's culture (Figure 5.1).

Koolhaas' "Delirious New York" (1994), like the great majority of books, is read in a sequence and does not intend to clearly offer other ways to follow its text. *Rio-H,* as a



ALIBIS

The skeleton of the 1909 theorem postulates the Manhattan Skyscraper as a utopian formula for the unlimited creation of virgin sites on a single urban location.

Since each of these sites is to meet its own particular programmatic destiny — beyond the architect's control — the Skyscraper is the instrument of a new form of *unknowable* urbanism. In spite of its physical solidity, the Skyscraper is the great metropolitan destabilizer: it promises perpetual programmatic instability.

The subversiveness of the skyscraper's true nature — the ultimate unpredictability of its performance — is inadmissible to its own makers; their campaign to implant the new giants within the Grid therefore proceeds in a climate of dissimulation, if not self-imposed unconsciousness. From the supposedly insatiable demands of "business" and from the fact that Manhattan is an island, the builders construct the twin alibis that lend the Skyscraper the legitimacy of being *inevitable*.

"The situation of [Manhattan's] financial district with rivers on either side forbidding lateral expansion has encouraged architectural and engineering skill to find room aloft for the vast interests that demand office space in the heart of the New World." In other words: Manhattan has no choice but the skyward extrusion of the Grid itself; only the Skyscraper offers business the wide-open spaces of a man-made Wild West, a *frontier in the sky.*

CAMOUFLAGE

To support the alibi of "business," the incident tradition of Fantastic Technology is disguised as pragmatic technology. The paraphernalia of illusion that have just subverted Coney Island's nature into an artificial paradise — electricity, air-conditioning, tubes, telegraphs, tracks and elevators — reappear in Manhattan as paraphernalia of efficiency to convert raw space into office suites. Suppressing their irrational potential, they now become merely the agents of banal changes such as improving illumination levels, temperature, humidity, communications, etc., all to facilitate the processes of business. But as a spectral alternative, the diversity of the 84 platforms of the 1909 Skyscraper holds out the promise that all this business is only a phase, a provisional occupation that anticipates the Skyscraper's conquest by other forms of culture, floor by floor if necessary. Then the man-made territories of the frontier in the sky could be settled by the irresistible Synthetic to establish alternative realities on any level.

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Figure 5.1: Pair of pages from Koolhaas Delirious New York (Koolhaas 1994)

digital hypertext – based on 3D renderings linked to an historical database – provides a very different structure for the users. *Rio-H* is also diverse from chronicles organized by spatial or even temporal aspects. Instead of simple facts, entries available at *Rio-H* are separate narratives on their own – even when they are not textual pieces – and should allow users to elaborate an image of that place and time. Like in Koolhaas' book one can understand the constitution of one area in the city and comprehend the cultural environment which materialized it. Koolhaas remarked that the construction of New York City was so radical that it exposed "the desires of Manhattan's collective unconscious as reality in the Grid" (Koolhaas 1994). Rio's history presents fewer grand enterprises. The city spaces, sometimes more subtle, should be read in the longer term, and probably more carefully. Its spaces, as in any other city, also embody its cultural history and can be a powerful tool to uncover that history.

Any city's space is constituted by numberless stage settings on which the events occur. The inhabitants and visitors experience the events on those stages. Furthermore, people are also responsible for the construction of those spaces and for their continuous changes. The stages, therefore, are not limited to their physical characteristics. Events also leave their marks. Moreover, space is not an absolute phenomena but a relative one in which each individual relates to it in a unique mode.

One could trace a parallel with scientific theories illustrated by Einstein's expression of a similar idea in mathematical form. "In the Newtonian picture, space was simply a passive arena in which objects sit. The primary quality of Newtonian space was precisely that it had no qualities. Its whole purpose was to serve as a neutral field within which the God-given 'laws of nature' could be played out. But the view of space that emerges from general relativity is of something imbued with its own power. In Einstein's picture, space is transformed from a neutral arena to an active participant in the great cosmological drama" (Wertheim 1999).

Figure 5.2: Madelon Vriesendorp, *Flagrant délit* (Koolhaas 1994)

Einstein synthesized through his theory a different way of seeing our universe. That view was not restricted to the physics and had also been framed by other areas. Artists, philosophers, science-fiction writers and many others had previously attempted incursions in that field.

Koolhaas and other urban historians didn't base their studies on Einstein theory. However, they also shared a parallel view in the relationship between history and space. *Rio-H* was also elaborated with an analogous intention to avoid seeing space as a "neutral arena." Koolhaas' plan to investigate Manhattan's culture by the buildings to which it gave rise was also aimed in *Rio-H. Rio-H* intentions were probably less ambitious comparing the importance of the building projects with the city culture. Due to New York's radical architecture, Koolhaas argued that "it often appears that the architecture generated the culture." (Koolhaas 1994) Rio may not possess as extreme an architecture as New York. However, the relationship between the creation of the city spaces and the natural landscape is quite unique and fundamental to the understanding of how inhabitants experience the urban environment. The urban spaces and the buildings are often a result of that relationship which varies from sympathetic to defensive. Koolhaas' book on New York is appropriately recognized as one of the most successful studies on Manhattan's urban culture and in the relationship between architecture and cultural history. However, one misses the spatial relationship within the city among the buildings examined by him. Even in an extremely organized city grid, as in Manhattan, the description of the streets is not enough to locate the buildings, particularly to those who are not residents. Additional graphical information would facilitate the spatial association with every city icon and their spatial relationship among the others.

Rio de Janeiro has a different configuration than Manhattan's. The relationship between

the city and natural landscape increases the need for more precise location of the urban spaces and buildings. Furthermore, the changes in the city are not limited to the built environment. There were extensive transformations in the natural landscape. The waterfront contour changed dramatically and some hills were totally dismantled. Those changes altered the relationship between the urban fabric and the natural landscape. Buildings that were first constructed facing the bay, for example, had a tight connection with the water. Suddenly they found themselves some blocks away and with no visual contact with the shore. Those changes are critical for the understanding of the city and require specific graphic tools to make them explicit. 3Dmodels of the city can be efficiently applied for that task, particularly to understand the relationship of the heights of buildings and the hills next to them.

The 3D views of the city, included in *Rio-H*, are not intended to provide an exact illustration of one place in a specific moment in history. Those views should be regarded as very simple representations of complex environments, which cannot be fully pictured. Therefore, the main purpose of the 3D views is to locate the events in a

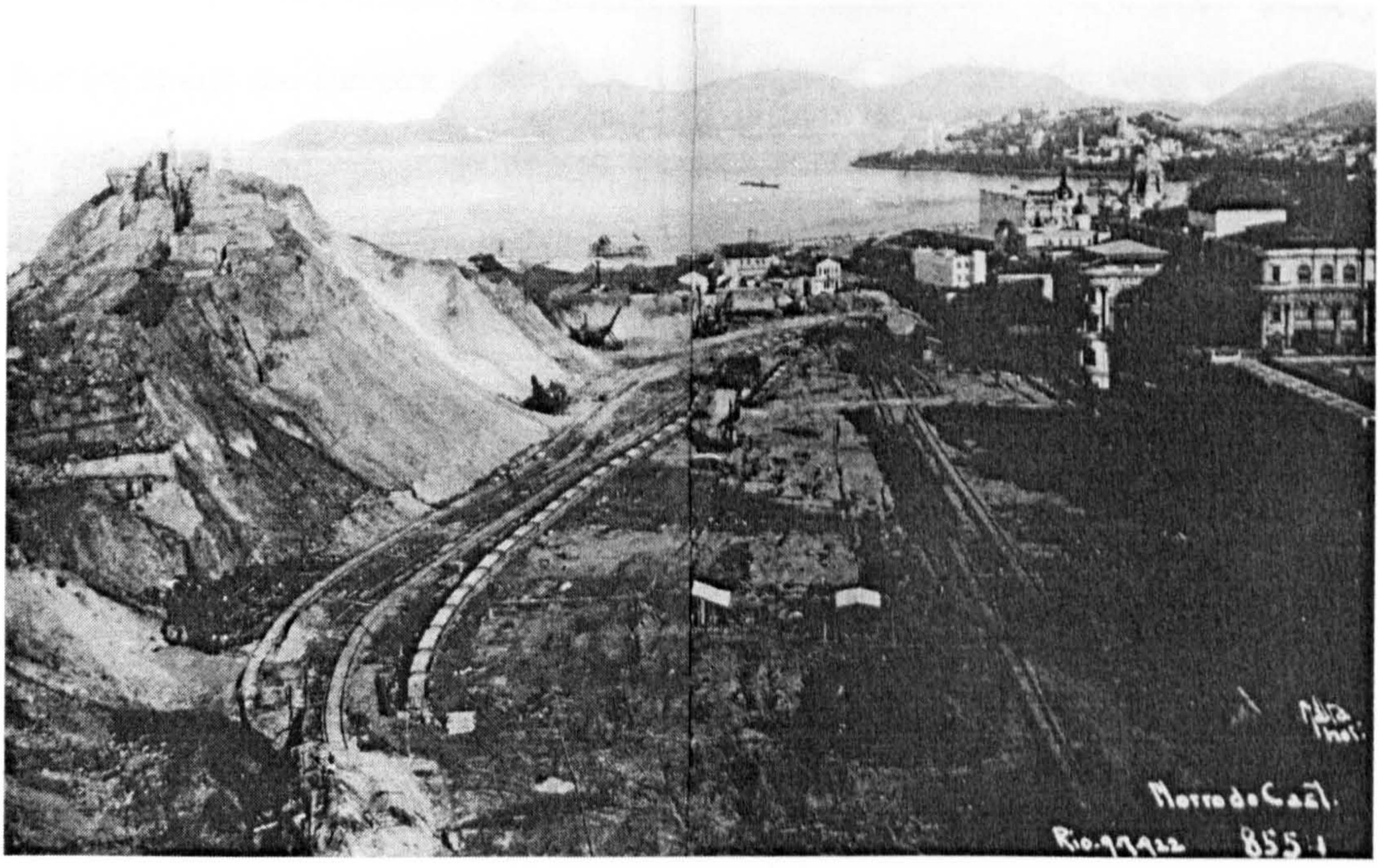

Figure 5.3: The dismantle of the Castelo Hill in the center of Rio de Janeiro. Photograph by Augusto Malta, 1922. "*Album de fotografias do Castelo*," 1922 (Nonato and Santos 2000)

place the users can recognize. The users should generate their own image of that space from the information provided by *Rio-H* and from the space they already know through their experience. The exchanging of images – of the 3D past scene and a current one with the same point of view on screen is offered to facilitate the recognition of the space within the city, in the past (Figure 4.19). It should just provide a setting for the users' construction of their image of that past space and never to provide a ready image of that space. One could argue that a 2D view of that space, like a map, could be enough for that task. However, it is much easier to convey the magnitude of a building or hill in their settings through 3D views than by traditional maps. It is easier for most people to identify a space within the city through perspective views of important buildings than from bi-dimensional maps. Moreover, 3D views of those buildings are more efficient to connect most users to the space they know than the 2D plans of city blocks.

Although Einstein's space is not restricted to three dimensions, it is often pictured three-dimensionally as an abstraction, which makes it intelligible to most people. 3D views of the city are also used in *Rio-H* as abstractions, which could provide links to urban spaces that are always too complex to be totally communicated. Therefore, the views are elaborated as simple renderings without any search for photorealism. This graphic abstraction should provide the users with an effective system to search for landmarks associated with significant historical events without presenting a definitive image of that particular space. In addition to that, it should facilitate the users to locate themselves and the searched events within the city. Thus, the 3D views should be powerful enough to provide a context that facilitates the creation of images of the city's past.

5.2. An historical narrative alternative

Peter Burke didn't consider electronic documents when he argued about modern narratives and literary experiments in his essay "History of events and the revival of

narrative" (Burke 1991). Web-based documents and hypermedia offer a great opportunity to present and distribute historical research but historians have seldom explored those techniques. As already addressed, most researchers from the humanities and social sciences use computers as word processors and communication tools. Until now, very few engaged in more ambitious experimentations. Books are always regarded as the primary vehicle for historical researches and images have played a secondary role even for investigations on urban or architectural history. *Rio-H* aims to present an alternative for this tendency. It illustrates that historians could evaluate electronic narratives as tools to overcome some of the traditional narratives difficulties.

As mentioned before, Burke noted that historians accept that their representation of history only presents a point of view and does not reproduce "what really happened" (Burke 1991). He suggested that historians should find solutions to make readers aware of this issue, which is not clear in most publications. Presenting different versions of one event was adopted by Kurosawa's "Rashomon" as a critique of reality representation and also by historians such as Price and Spencer. Burke suggested that presenting different versions of historical events could confuse readers when they move back and forth, from one character to the other as in Spencer's work on the Chinese Revolution. However, he attested those works as some of the most successful devices to deal with the different perspectives in viewing an historical event.

The structure of the city history is very different from the traditional narrative. It is composed by infinite "narratives"/events which often interact with each other. Each narrative can be read by itself but it cannot explain the city without the others. Any attempt to explain a city is predisposed to be incomplete since it is impossible to grasp every event that occurs simultaneously within its urban environment. Besides the discussion concerning the truth of an historical representation, there is always the issue of incompleteness.

The issue of different points of view in the representation of the same event is addressed by *Rio-H.* When different documents of similar subjects are confronted in *Rio-H*, the reader is aware that they come from different sources and have different authors. Many times they have conflicting versions. Those different versions may be unbalanced since the 'elite' version is better documented than others. However, this device creates an opportunity to place together information that is spread across different locations and from different authors who have different perspectives of an event. It also confers to the readers the opportunity to combine those historical pieces in their own manner. *Rio-H*'s database can be much larger than the one which the readers would actually survey but they have the option to evaluate the different areas and within them the different documents they will finally retrieve.

Besides the issue of different perspectives for an historical event, several others related to the historian's narrative are raised by *Rio-H.* It is important to mention some of them in this investigation: the existence of much historical evidence that is not considered by the historian; the impossibility of neutrality in a historian's representation; the historian's publication of an "open document;" the relation between past history and present; the use of images in their publications; or the role of an urban historian's research for the lives of the inhabitants of a city.

It is easier to incorporate "many different voices and events to reflect the diversity of past human experiences" (Cronon 1992) on a hyperdocument than on a traditional historical narrative. The authors of the latter often hide conflicting versions of the same event in their search for a coherent text. In addition to that, the development of an historical hyperdocument with several different sources gives more control to the readers to elaborate their own narrative.

Considering a database of simultaneous events and narratives does not solve the problem of incompleteness or the truth of the historical representation. However, the

very fact of introducing several options for an historical document reading already implies the existence of many others. Thus, the readers act of choosing some of the available options makes clear that historical representation, and its reading, is a constant election of alternatives. Besides that, the confrontation of opposed versions of the same event facilitates the reader to be closer to the truth, or better, to be sure that there is no truth or there are several different truths.

Researchers evaluate historical events through limited evidence to which they have access. Historians usually include in their publications inferences that fill in gaps that are not registered in their sources. Analogous to the different versions mentioned above, historians often fail to make readers aware of those inferences or the limitations of their sources. An important point is that affording different document versions for the readers, as in *Rio-H*, implies that many documents may not have been included in that vehicle and several others could have been lost forever.

The historians' narrative is embedded by their own culture, since it is an interpretation of the events consequences. The distance between the historians and their object of study makes it more difficult for the reader to understand the culture of that particular moment, which is always filtered by the historians' culture.

Historians always struggle between choosing or omitting documents in order to base their work. This choice and several others that emerge during their research and particularly their representation, confirm the active participation of historians. *Rio-H* can be seen as a collection of historical documents available through an electronic database. Thus, the authors of this system would have a somewhat neutral position. However, they also have taken several choices when they decided which documents to include and, particularly, when they had to classify them. Choosing keywords, for example, defines the readers' route to access the sources and direct their navigation through the system. Therefore, the construction of the "readers' narrative" will depend on the

decision taken by *Rio-H*'s authors.

Another significant issue is the concept of organizing historical documents in a database available on the Internet. It addresses the issue of an historical open document. Usually, historians continue their research after they publish their books. The publication freezes and documents only one stage of the historical research. However, history books are not considered just a vehicle to convey historical research but an end in themselves. As already discussed, historians' development of their publication is considered a primary activity and distinguishes a closure of a phase in their career. On the other side, their research continues, they revise their writings, and eventually they publish revised editions. Web-based documents may establish a change of direction in historians' activities. They allow a continuous update of publications, as more information is available through the research. When historians develop a research project of an online electronic document, they are concurrently defining a research methodology, which can be continuously updated. Thus, instead of indicating the conclusion of a phase, the publication, or actually the project of the publication, is seen in the first phases of the research. The publication itself can start at an intermediate phase and continue indefinitely as the research work progresses.

5.3. The view of the present through the past

A great number of historians nowadays agree that historical events should be viewed not only in relation to the present but also related to our expectations for the future. Such a shift opposes traditional historiography trend to view historical events detached in the past. Croce argued that "people have been the same in their relationship to the future as the field of action, the past as the domain of judgment and the present as the realm of decision. Croce did not deny the validity of the historicist assertion that historical situations are determined by the specific conditions of time and place. But he also recognized that every historical situation is open to the as always unresolved future, that

its horizon is the actuality of decision" (van Pelt and Seebohm 1990). Benjamin, for example argued that history should be seen as "the source of critical knowledge that alone can place the present into question" (Buck-Morss 1991). He thought that history should have an embedded political mission. Through his works, he attempted to communicate a history that was not written by the winners. That history should be a vehicle, which would ultimately awaken the "accommodated masses."

Croce and Benjamin represent a growing number of historians who address their work in relation to both present and future. Besides that, historians always seek to relate, through their narrative, past events to current culture, as a method to "familiarize the unfamiliar". Hayden White identifies historiography's data as "immediately strange, not to say exotic, simply by virtue of their distance from us in time and their origin in a way of life different from our own" (White 1978). Thus, narratives are usually used to relate cultural aspects of the past to our culture in order to reduce the strangeness of those past events.

Rio-H does not present history through a traditional narrative form. It actually presents countless narratives, which are created by each reader's navigation. However, it does create links between past events and the present in order to familiarize those events. This link is primarily spatial. Readers are always aware, through their navigation, of relationships between past spaces and current ones. They know, in various degrees those spaces in the current configuration. Their experience is very powerful in the generation of links with the past and facilitates their creation of an image of that past. The remaining physical characteristics of a different period are important to locate the stage settings of past events and also to recognize the people who shaped those spaces by their decisions and actions. Therefore, space is very powerful in locating historical events and to establish a familiar link with them.

Furthermore, it is very important for the inhabitants of a city to recognize their spaces and the past that shaped them. Spaces are experienced differently when the agents are

aware of their history. Recognizing their ancestors' role in shaping the space they use in their everyday life is critical for the creation of a close relationship with that place. Current civilizations consciously keep their built heritage in order to support that awareness. Although, mystery and "what is left unsaid" in those spaces are important for a sense of place (Stefanovic 1998), historical information related to them is valuable in expanding people's knowledge. Therefore, if people have more information about an area within the city, they will have a broader view of that area. Hence, the possibilities of identifying the mysteries and "what is left unsaid" in those locations will increase when historical knowledge is strengthened. Clarity and complexity, which seems to be opposed, are complementary and essential to convey that sense of place.

Rio-H aims to facilitate the creation of a sense of place by sharing knowledge of different spaces within the city in the past. Therefore, it also aims to increase both the clarity and complexity of city spaces. Most studies of urban history have similar objectives. However, many historical publications try to hide the complexity of a past moment in order to make it clearer for the readers. Oversimplification of historical events creates a false idea of how society behaved and how spaces were constructed. *Rio-H* attempts to display the complexity of past events in a comprehensible manner and their importance to erect the city.

A critical issue to be addressed by historians who study cities is the connection between the historical information and the actual space. If that connection is not achieved, the information becomes abstract and depends on the readers' effort to relate it to the city they know. Several techniques are applied for this task: most often images like photographs, drawings, maps and paintings. Usually they are complementary to texts, which play the primary role. Since the great majority of historical studies are published in printed format, there are always limitations in the reproduction of images such as their size or quantity.

Historical publications rarely utilize 3D city models in their works. Their use is critical in

Rio-H and the choice to include renderings from those models as a point of departure to search information has several reasons and implications. As already mentioned, the renderings generated by the models are simple and do not intend to be photorealistic. They may resemble perspective maps developed for tourists with only city landmarks or even antique maps. The renderings from the 3D models of the past should not attempt to convey the complexity of reality in that moment because they could never reproduce it. When the 3D renderings support the location of the historical information in the city, they contextualize it and help to clarify a puzzling set of relationships from past society. Therefore, the space organizes the historical information, taking for granted its complexity but trying to display it in an organized form.

5.4. *Benjamin, Koolhaas, Macaulay, Lorenz, and electronic documents*

The works by Koolhaas, Benjamin, Macaulay and Lorenz demonstrate that the search for new forms to represent the history of the cities through a non-linear document are not restricted to electronic technology initiatives. Furthermore, Benjamin's project, for example, introduced theories and techniques that could later be enhanced with the use of tools that were not available when they developed their projects. The approach of displaying the history of Rio de Janeiro through its different buildings using digital tools, such as 3D models, database, and hypermedia, is the main goal of this investigation. 3D models connected to an historical database through hyperdocuments are the instrument to unify and connect those buildings spread through space and time. Similarly, those authors' arguments provided to the readers the connections to the discontinued pieces. On the other side, electronic technology allows the construction of different arguments, by the author and also by the readers, in order to put together the available material. Hyperlinks and spatial digital models facilitate the connections among the separated parts.

Another important aspect of the digital analysis is the augmenting importance of images for the representation of historical facts. Macaulay and Lorenz, and even Benjamin and Koolhaas demonstrated that images are very powerful to reveal the culture of past societies. They are also valuable for giving more autonomy to the readers to elaborate their own interpretation of the facts. Furthermore, 3D models can display graphical representations that are not possible through photographs. Several aspects related to buildings and urban spaces are better understood through 3D models. Therefore, electronic technology delivers new forms to represent and comprehend cultural history, particularly when related to urban history.

The inventive structures created by those authors introduced a cultural analysis, which brought about an innovative form of representation through a traditional support: books. Additionally, they also displayed characteristics usually embedded in digital projects, such as large-scale database, small blocks of texts and close relationship with images. Even though Benjamin's book doesn't include many images, he collected several of them that were not printed in the publications of his work. Besides that, he stated that he aimed to portray, through his quotations, images of that time. We may conclude that digital techniques deliver significant resources, which can facilitate the understanding of a past society.

Those authors also demonstrated that buildings and urban spaces most often display the characteristics of a society that originated them. Besides that, once they are erected and inhabited, they influence the community and its cultural production. On the other side, several digital projects demonstrate that Information Technology provides powerful tools to analyze architectural artifacts. Therefore, digital tools bring forth new possibilities to the manipulation and communication of that material raised by building analysis.

One of the main objectives of this research has been to explore these new possibilities. It is important to keep the focus on the content and the most creative and appropriate

way to convey it. In this context, the study of those authors that worked with traditional tools is critical to provide a distance from which to evaluate Information Technology and its potential. The exploration of new technology usually leads towards testing and stretching new resources. This process often distracts from the goal of finding the best way to carry the message. A simpler method, applied creatively, is frequently more effective than the most recent, expensive and complex technology. Therefore, previous experiences, even analogical ones, should also be used to support digital investigations.

The development of 3D modeling and authoring software has significantly evolved in the last fifteen years. Current low-cost desktop computers are able to manipulate fairly complex models and edit sophisticated hyperdocuments. However it is very rare to find projects that merge advanced techniques with high quality content. It is also difficult to see historical projects that can really benefit from those new possibilities to transmit content in a way that was not possible with traditional tools. Therefore, the investigation of literary experiments can be a powerful source for the exploration of new areas by academic digital investigations. Following this direction, their books were particularly significant. They present parallel subjects in a revolutionary structure to convey a creative and meaningful content. In addition to that, their revolutionary structures raise several issues that are also found in the digital analysis of this thesis. Therefore, a thorough study of their work should be considered a primary support for the careful evaluation of this investigation.

Benjamin is considered today, as one of the most important thinkers of the XX Century. It is hard to compare a project in which he concentrated most of the last thirteen years' efforts of his life to any similar individual intellectual enterprise that would be developed nowadays. The value of his work is not restricted to the structure he created but is due mainly to the excellence of the material he collected, which connects the commercial galleries and Parisian culture.

The scale of Koolhaas' work is not parallel to Benjamin's, since his research did not intend to last the same period of time and cover such a broad range of themes. However, it is no less creative and significant to our investigation. Koolhaas' argument to investigate the construction of the Manhattan's celebrated buildings is very close to our architectural approach of raising history from the city's built elements.

Macaulay and Lorenz, on the other hand, exhibited the capacity of image to synthesize and convey some messages much more comprehensively than several pages of text. The development of the major constructions that structured the city in the past was a major event for the whole society, and had an enormous impact on people's life. The representation of those moments also revealed significant and intimate aspects of the culture of an historical period, which were not usually recorded in history books.

This dissertation does not intend to present a conclusion, or to be more exact, a written conclusion. *Rio-H* should be the concluding vehicle that would merge the separate pieces raised throughout this document. *Rio-H*'s concept of collecting historical documents, which disclose the history of Rio de Janeiro is a response to several of those issues. It should not resolve all of them but its contribution – and the contribution of this thesis – is to provide an alternative to narration of the history of the city and its dwellers, exhibited in each of its built fragments. Susan Buck-Morss' expressed Benjamin's methodology in this last statement. Our wish is that a final version of *Rio-H* would follow similar aims.

"... each of these 'small, particular moments' was to be identified as an ur-form of the present. Benjamin's commentary, in which those facts were embedded, provided the rivets that allowed the fragments to cohere as the philosophical representation of history as a 'total event'" (Buck-Morss 1991).

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Appendix

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Kós, José R., Barbosa, A., Krykhtine, C., Silva, E. and Paraizo, R., 2000. "The city that doesn't exist: multimedia reconstruction of Latin American cities" in *IEEE Multimedia*, 7(2), pp. 12-16. (a similar interactive version of this paper is available at http://www.fau.ufrj.br/prourb/cidades/vsmm99/: May 2002) II

Kós, José R., 2001. "Architectural hypermedia based on 3D models" in D. Donath (Ed.) *Promise and Reality: Proceedings of the 18th Conference of Education in Computer Aided Architectural Design in Europe*, Weimar, eCAADe, 2000 VII

Kós, José R., 2001. "Modeling the City History" in H. Pentillä (Ed.) *Architectural Information Management [19th eCAADe Conference Proceedings]*, Helsinki, pp. 436-441 XI

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the field of architecture, design of graphics user interfaces for CAD applications, and design and development of virtual heritage applications. In 1996 he earned a Bachelor of Architecture degree with honors at Sir J.J. College of Architecture, Bombay, India.

Readers may contact Haval at 4/11, Kartar Mansion, Tribhuvan Rd., Bombay 400 004, India, e-mail nikreations@usa.net.

The City that Doesn't Exist: Multimedia Reconstruction of Latin American Cities

José Ripper Kós, Adriana Simeone Barbosa, Carlos Krykhtine, Erivelton Muniz da Silva, and Rodrigo Cury Paraizo
Federal University of Rio de Janeiro

The city is one of our most complex cultural manifestations, particularly because it has existed as the center of most social life throughout human history. Furthermore, the city is a powerful agent of human development.

Since 1995, our research group at the Federal University of Rio de Janeiro has used multimedia systems to investigate the city as a physical footprint of the social dynamics of cultural, economic, political, and social activities. The original contribution of this research is the study of symbolic structures that define the evolution of cities. Because this group is located in the Graduate Program of Urbanism of the School of Architecture and Urbanism, this investigation focuses mainly on attributes related to buildings and public spaces.

We based the multimedia systems on historical 3D digital models of two Latin-American cities: Havana, Cuba, and Rio de Janeiro, Brazil. Through these models, we collected and restored their urban structures in different historical periods to facilitate the understanding and analysis of the evolution of each city's identity. This research is part of a project called "Evolution of the Symbolic Systems of the Latin-American City," coordinated by Roberto Segre, professor at the Graduate Program of Urbanism.

The central purpose of this study is the development of a hypermedia application—an analytical system rather than a descriptive one. This application will enable a creative reading of symbolic structures' meanings, in terms of their cultural value in the city's form and of the collective understanding of the urban image. The investigation tries to break down separate treatments of the different levels of exploring the city: the large general territorial plan; the urban structure of the squares, streets, and public spaces; and the architectural structures. We undertook the hypermedia presentation as a new way to represent urban and architectural analysis.

The research group chose Havana and Rio de Janeiro mainly because of the great amount of information available about these locations. We then used the first Havana CD-ROM (see Figure 1) as a prototype for other Latin-American cities. The Rio de Janeiro analysis (see Figure 2) is an evolution of this. We also experimented with analysis of architectural landmarks and urban projects as Web-based systems (see http://www.fau.ufrj.br/prourb/catete and http://www.fau.ufrj.br/prourb/cidades/favela).

For our first analysis, we chose Havana's colonial period. The city's structures have a logical form of spatial and temporal distribution—critical to this study. Most of the time, the city grew toward empty spaces without destroying the existing buildings. We analyzed Havana through its urban development axis; defensive structure; plazas and their relationships to politics, religion, and economy; distribution of different dwelling types; and relationship to the original core and the hinterlands. We explored these topics both in isolation and in relation to each other. Also, many of the buildings that defined the city's evolution were analyzed separately to enable directly accessing specific information from the map of the urban plan.

The construction of the Rio de Janeiro material was much more complex than for that of Havana, however. In contrast to the process in Havana, in Rio de Janeiro politicians and others responsible for the construction of the city demolished buildings, and even hills, to open space for new development. The complexity of the natural environment and its

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Figure 1. Havana CD-ROM, main menu.

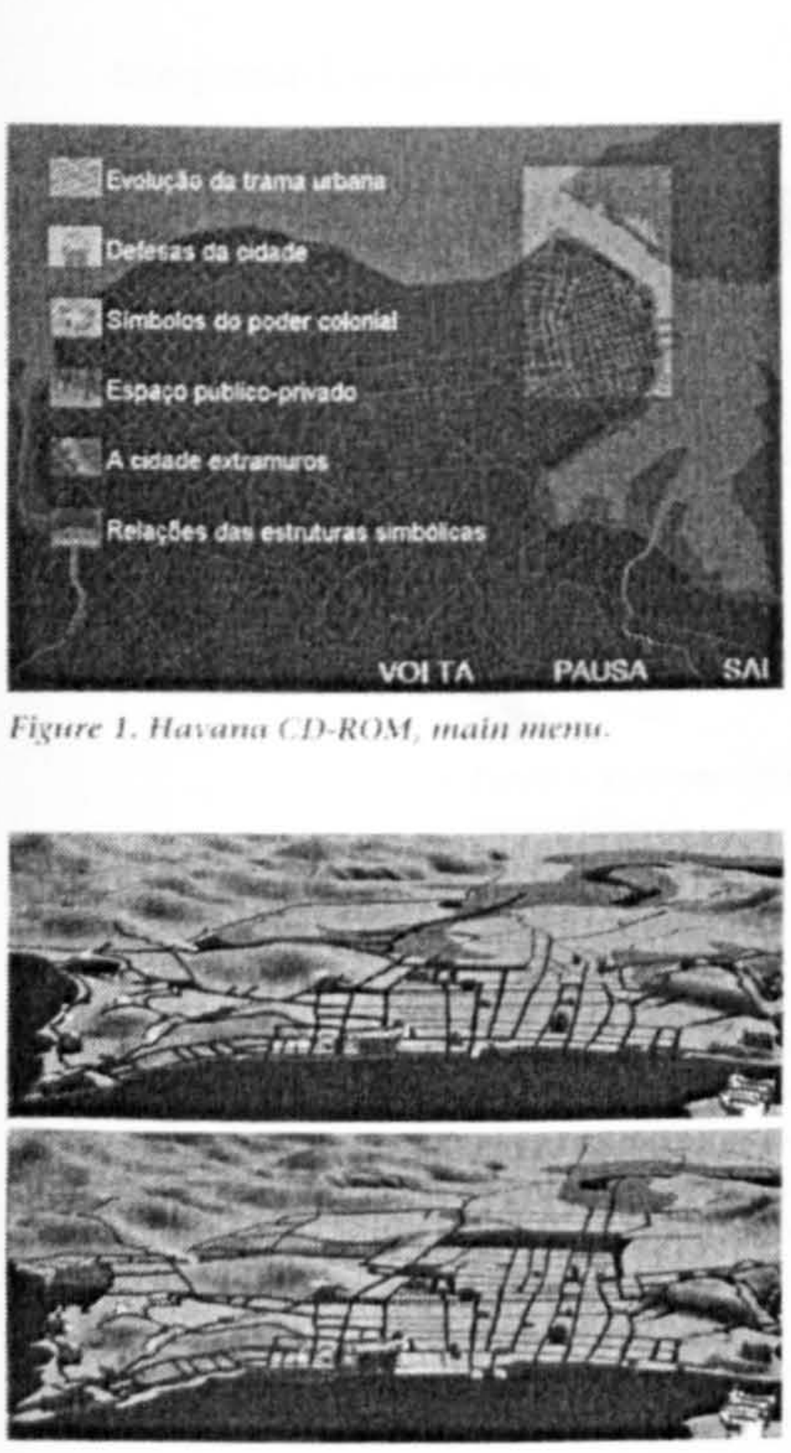

Figure 3. Rio CD-ROM, evolution of downtown area.

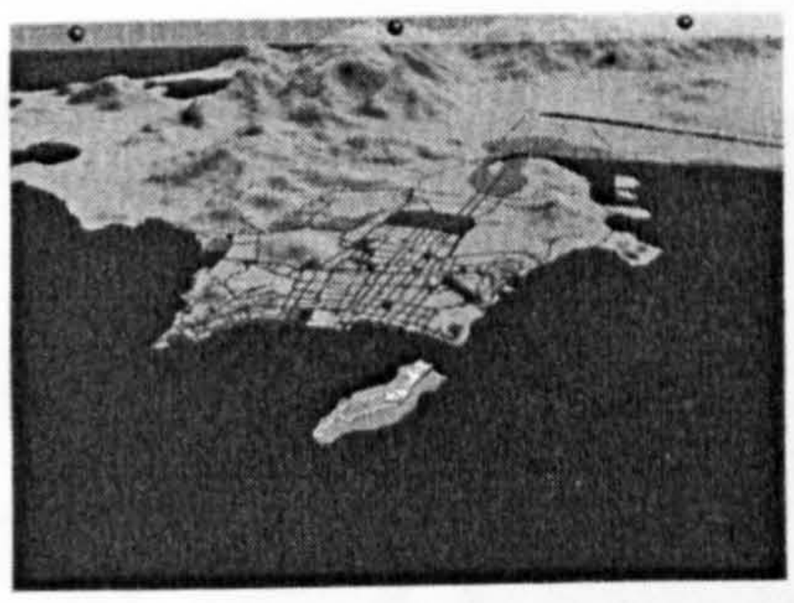

Figure 2. Rio CD-ROM, aerial view of the city (1808).

Figure 4. Rio CD-ROM, slaves carrying water on the streets.

importance for the city, particularly its topography, required a laborious 3D model. Furthermore, we needed to present the city's evolution in a layered form to account for many parts demolished during different renovations.

A critical examination of Havana's multimedia application also pointed to the need for a new navigation structure and a different interface for the analysis of Rio de Janeiro. The new interface displays only three small circles on the screen, versus the multiple choices for Havana's menu. These provide the necessary routes to navigate throughout the whole hyperdocument. Through the circles, users can shift to a different topic of concern or a different time period, or they can move backward, forward, or pause. The city model with the grid, mountains, and important buildings provides a base for the digital analytical renderings that explain the theories about the city's evolution.

Methodology

The foundation for the hypermedia development consists of an archive and bibliographic survey of the history of the city and its elements. Thus, we created a database including all text and image sources. Throughout all phases of the work, we continually added new data to the electronic database to provide information on buildings and structures.

Following the historical research, we converted buildings, topography, and the road system, as well as their changes through time, from original documents and their interpretations into a single 3D electronic model. By means of a hide and unhide system, it was then possible to generate images from different time periods, with the elements represented on them dictated by the needs of each scene (see Figure 3). This enables study of buildings and public spaces by taking into account their urban context, from a wide range of possibilities.

Landscape paintings and photos are by nature exuberant, richer in visual information than most computer-generated renderings. Thus, when we needed to restore the subject's complexity, we added pictures, sometimes restored or hyperlink-punctuated ones, taking advantage of the dynamic possibilities of hypermedia (see Figure 4).

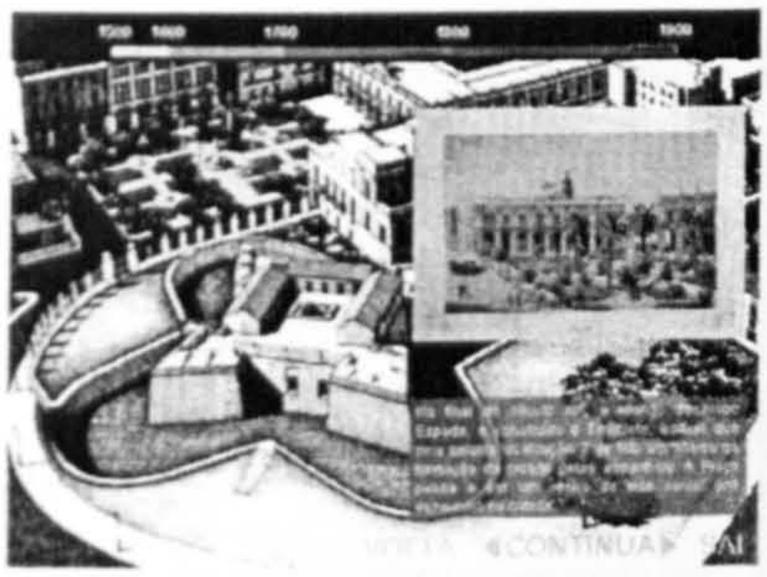

Figure 5. Havana CD-ROM, square associated with political power.

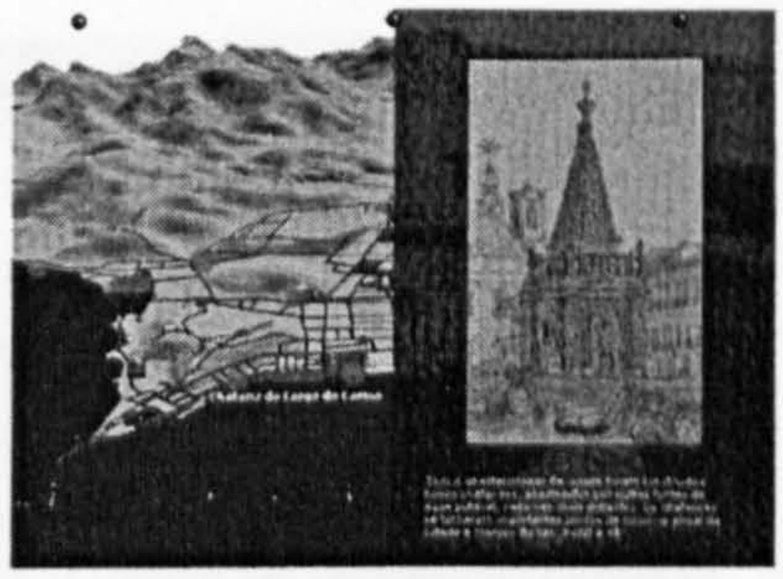

Figure 6. Rio CD-ROM, water system (main fountain).

The complexity of the subject material demands an equally complex navigation structure that nonetheless must appear clear and simple to the user. All data collected from books, maps, and paintings were converted into different narratives explaining the city from selected viewpoints. We added hyperlinks when different narratives converged or to provide access to extra information, such as other images or short explanations.

The equipment we used in the project is based on ordinary Pentium PCs. These defined the balance between the level of detail in the buildings and the complexity of the whole model in such a way that the machines could render the images and also support viewers having just average technology.

City and hypermedia

The research group's investigation of the city always relates to its form. This doesn't mean that we considered the formal configuration as the only important issue. We decided to study many critical issues that defined the city through its buildings, public spaces, blocks, and neighborhoods. We analyzed economic, political, religious, social, and cultural aspects, among others, through these urban and architectonic artifacts representing the forces that interacted with the city.

The city's form isn't defined only by its political leaders. After many periods of history, the formal aspect of the city becomes a superimposition of many layers of events and forces. Buildings and public spaces provide a strong physical manifestation of the result of all these forces. The use, size, and form of buildings and public spaces change following events, decisions, crises, wealth, poverty, myths, powers, and other forces. An accurate analysis of urban form requires an investigation of these events and their causes. The study of the squares and monuments, the main axis that directs the city growth; the residential typologies; and many other aspects together reveal the city's unfolding history.

Cities are created by a complex system of forces, often hidden in their formal structure. The city's configuration is the result of these forces on the existing structure and among themselves. An analysis of the impact of each force on the city, particularly in its formal structures, is rich and complex. Hypermedia and 3D modeling represent powerful tools for investigating the evolution of city form (see Figures 5 and 6).

It's possible to justify the choice of a digital document by drawing analogies between hypermedia and books or digital models and photography. The linear printed document has many restrictions on the relationship between text and images. Its limited size doesn't allow the use of many images and makes it difficult to manage the relationship between images and text. The use of different media, in a hypermedia application, and the interaction among and between them and the user (reader) is an efficient means of representing the complexity of the city.

Many forces act in the city to create a nonlinear system of evolution. Each aspect influences and is influenced by the others. The buildings and city blocks are small pieces in this complex system. Similarly, hypermedia navigation lets users shift between various aspects of the city in space and in time, which is critical in explaining the various influences on the whole city and, simultaneously, on a given area.

The use of a digital model helps shift the city image to different scales. Users can move from the scale of a building to the scale of a street or a neighborhood. We can compare the perception of

the building character through its details, windows, doors, and form of the roof to its insertion in a city block relating to other buildings and to the whole neighborhood. The change of the user's point of view of part of a city helps explain the significance of a building and how its insertion in a specific site creates a symbol for the population. In addition, users can trace the city's history through a single building or public space.

Architecture witnesses and registers the many processes that take place on urban land. Moreover, its capacity for adapting to a new urban logic lets buildings reintegrate into those new dynamics. Understanding the evolution of urban architectural systems provide a keystone for understanding the city's actual form, as it deals with the city's soul, the relation between image and reality as it was built.

Time and changes

We set up the electronic model as a common denominator for different kinds of representation—from sixteenth century maps to later reconstruction plans or paintings. We never intended to develop a hyper-realistic model in our research. We made this decision because of equipment limitations, but also for conceptual reasons. Our intent is to explain the city so that users can learn about its growth and how it reached its present configuration.

The city's evolution is generally displayed as a linear, chronologically oriented narrative. Indeed, the many forces acting to form the city are simultaneous. Also, each force acts at an independent pace. On the other hand, different users have different interests, leading to different rhythms of reading. With that in mind, we adopted interfaces with timelines and play/pause buttons, allowing control over the narratives and manipulation of time, hence enabling users to construct their own view of history.

Latin American cities offer an opportunity to study an urban settlement from its very beginning. Furthermore, these cities—mainly in former Spanish colonies—were planned through a utopian European image of the ideal city. Understanding their accelerated development over their first three or four centuries is a good way to comprehend urban mechanisms of evolution.

We studied urban evolution to reconstruct buildings that no longer exist, but were previously important. In Rio de Janeiro, some hills were demolished for later urban development. Their reconstruction was part of our original 3D modeling of the topography. If Havana exhibited a more ordered, concentric growth, Rio de Janeiro presented us with demolitions, changes in the course of roads, streets laid upon streets, and buildings and monuments changing their appearance, use, and even their locations. We added a timeline to the interface to provide the user with an overview of changes and with the possibility of interaction through it.

Figure 7. Rio CD-ROM, zoom of individual buildings.

Cities are formed by a diversity of factors, each one with a different influence. For example, housing consolidates the character of city segments, economy determines areas of production and trade, nature contributes by facilitating or impeding expansion, and so on. However, the different forces don't act alone in the city, but interact among themselves and superimpose constantly. Moreover, besides acting together, each one has its own logic and rhythm of change.

Conceptual virtualization

Paintings and traditional drawings interact with CAD models in three instances. We used the most varied types of urban plans from different time periods to digitize the cities, both in time and space, in work far beyond simple transcription. The project involved cross-checking information, and even some interpolation. Next, we used paintings and drawings as a source of information for modeling, since few photographs are available for buildings dating from Rio de Janeiro's colonial period. Finally, the paintings or drawings complement the CAD-based analysis, enriching it with their visual exuberance of details and further information.

We used a clear model devoid of extensive details to stress the concept that the model is an abstraction, not a substitute for the actual city. In addition, the clean-looking model makes it easier to analyze highlights without distraction, like locating areas described in the text, such as shaded areas. The user recognizes the city, associating theories to spaces seen on the screen.

The models of the buildings are also simplifications of actual buildings, having only windows, doors, and a few details (see Figure 7). Three motives prompted this solution: when users perceive the model as a simplification, they

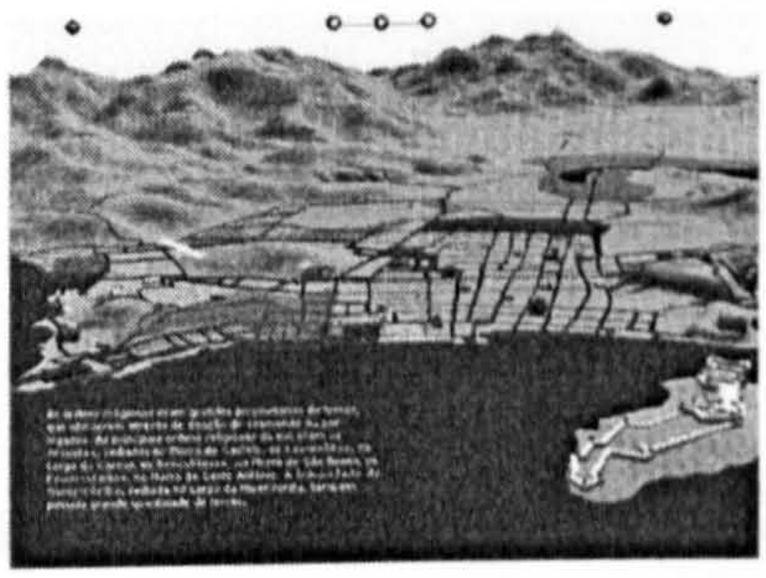

Figure 8. Rio CD-ROM, analysis of church properties.

take it as a version, not a fact itself; next, the simplicity, especially while considering the whole model set, helps create the visual order necessary for analysis; and finally, keeping them simple (and the whole set less complicated) allows their analysis in the urban context, rather than individually.

Sometimes it was difficult to obtain CAD-precise data on certain subjects, such as spatial distribution of different social groups. On other occasions, however, we needed to show concepts in a generic way, for example, areas of influence of buildings or land ownership by different groups (see Figure 8). Throughout the project the research group faced decisions about obtaining contextual information and displaying this information on the screen. When faced with excessive detail or a lack of information, we chose to emphasize the conceptual understanding. However, we investigated the accuracy of the images in terms of reinterpreting them, defining them as imprecise, so the exactitude of CAD models could be combined with the human capacity for imagining different physical realities in the face of uncertainty or incomplete information.

Future work

Our group is currently working on a project about the twentieth century history of Rio de Janeiro through analysis of 25 buildings. We explore the urban, economic, social, and political evolution of the city in each multimedia building analysis. We choose the buildings by their significance in time or space as icons that represent an important city stage or evolutionary shift. **MM**

Readers may contact Kós at the Federal University of Rio de Janeiro, PROURB, Prédio da FAU/Reitoria, sala 529, Cidade Universitária, Rio de Janeiro, RJ, 21949-900, Brazil; e-mail josekos@pobox.com.

José Ripper Kós is an assistant professor at the School of Architecture and Urbanism of the Federal University of Rio de Janeiro, where he directs the Laboratory of Urban Analysis and Digital Representation at the Graduate Program of Urbanism, or PROURB. He earned a Master of Architecture degree from Tulane University and an undergraduate degree in architecture from the Federal University of Rio de Janeiro. He is a PhD candidate with Abacus at the Department of Architecture and Building Science at the University of Strathclyde, Glasgow, with a scholarship from the Brazilian Ministry of Education.

Adriana Simeone Barbosa is a designer and has an undergraduate degree from the design school of the State University of Rio de Janeiro. She works as a researcher at PROURB.

Carlos Krykhtine is an architect with an undergraduate degree from the School of Architecture and Urbanism of the Federal University of Rio de Janeiro. He works as a researcher at PROURB.

Erivelton Muniz da Silva works as a researcher at PROURB. He is an undergraduate student at PROURB and will graduate in December 2000. His research interests include multimedia editing and programming.

Rodrigo Cury Paraizo has worked as a researcher at PROURB since 1994. He earned an undergraduate degree from the School of Architecture and Urbanism of the Federal University of Rio de Janeiro.

Architectural hypermedia based on 3D models

José Ripper Kós

Keywords
Hypermedia, 3D Model, Hypertext, Latin-American Cities, Architecture

Introduction

The World Wide Web gave a new dimension to the terms hypermedia and hypertext. Their distinctions are not very clear and in this paper we will use both with the same meaning. They are usually defined in a very generic way as a revolutionary form of writing. The generalization and glorification of hypertext, however, obscures a clearer view of its real possibilities. Architects will benefit by investigating carefully its resources - and how it can be a powerful tool for the profession, particularly when associated with 3D models.

Hypertext is usually defined in opposition to texts, the latter being linear and sequential.[1] [2] As books or print material are not always linear or sequential (like dictionaries and encyclopedias), this definition is very imprecise. Hypertext can be defined as nodes (information elements, paragraphs, pages, images, sound, and video) with links between these nodes (references, notes, buttons or other elements, which execute the passage from one node to the other). Digital hypertext would be a collection of multinodal information arranged in a network for fast and intuitive navigation.[3]

In 1945, Vannevar Bush, Director of the Office of Scientific Research and Development in U.S.A., wrote the article **As we may think**. His wish was to afford knowledge produced available to every scientist. The amount of information produced was already enormous. Information should be organized in a different way to provide researchers with what they needed. He proposed a visionary mechanical device, which would act very similarly to hypertexts. This machine, called Memex (mem-ory ex-tender) would help bridge the different disciplines in the specialization process. *"A memex is a device in which an individual stores all his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory."*[4] All information stored in microfilms would be accessed through association and analogy linkage.

Hypertext concept was first imagined by Bush as a visionary mechanical device. Many decades later it was materialized in a digital format. Hypertext's envisaged system was accomplished through computer's resources, which allowed the retrieval of information in different media (text, images, sound, and videos), through links, which could be easily updated.

Bush envisioned a cross-disciplinary movement of science and it's knowledge which were going in the opposite direction through increasing specialization. Floridi points out how *"a philosophy divided into rigid areas of specialization, done by "experts", seems to be in flat contradiction to the universal and unifying ambitions of a rational reflection which, by its very nature, aims to be the ultimate threshold of theoretical understanding,"* [5] suggesting that books invite vertical specialization while the computer could promote forms of horizontal inter-disciplinarity and multi-disciplinarity as a *"return of the Renaissance mind."*

Text and image in architectural representation

Architects always struggle to transmit all their ideas to people involved in the construction of their projects. During the Ancient World, in Egypt, we have evidence that *"plans and elevations drawings, often used in conjunction, were governed by a central axis line and the rule of bilateral symmetry."* [6] However, these drawings seem to be incomplete to transmit all the building information. In Greece an example of a very detailed technical text describing a construction seems to have references to drawings which would complement it. Many times, this issue was minimized with the participation of the architect in the construction.[7]

Verbal forms of communication, often oral, were always required in addition to visual aids like drawings and models to convey the complexity of buildings. The intricate aspects of architecture profession were many times confined in architect's minds. *"Drawing and talking are parallel ways of designing, and together make up what I will call the language of designing. The preliminary result reveals that designing is related mostly with visual thinking as the action of decision making and synthesis, while understanding design is related with linguistic faculties. The interaction between verbal and visual conceptualization is indeed complex, and both expressions are generally agreed to be close related. This idea can imply the textual information can assist the analysis for understanding the design rationale."* [8]

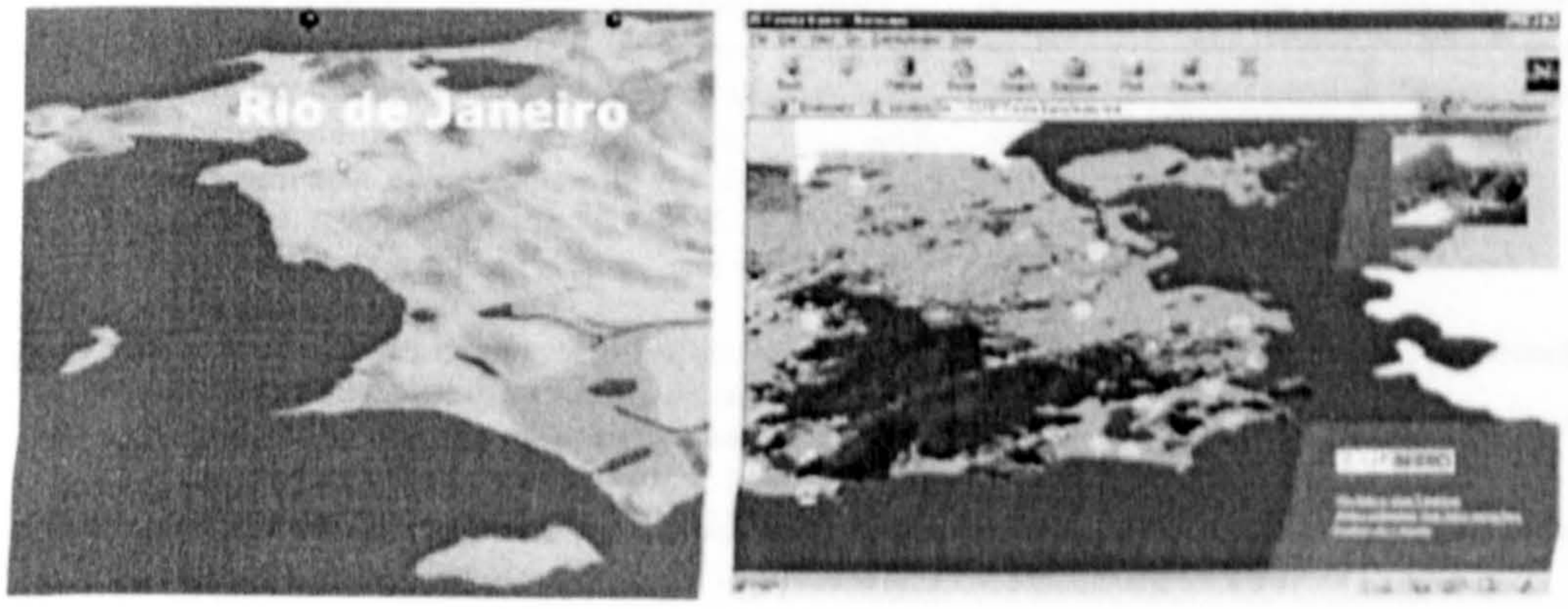

Figure 1:
Rio de Janeiro Cl
and Favela-Bairro

Research at the Federal University of Rio de Janeiro

The investigations of these issues related to hypermedia concepts and architectural representation were raised during the investigations developed in PROURB (Graduate Program of Urban Design) at the School of Architecture and Urbanism of the Federal University of Rio de Janeiro, Brazil.

The research group based on LAURD (Laboratory of Urban Analysis and Digital Representation) in PROURB focuses the investigations towards urban and architectural hypermedia analysis. These projects started in 1993 and most of the participants in the groups have been undergraduate architectural students. The main projects are the CD-ROMs of Rio de Janeiro and Havana evolutions and the Ministry of Education Building in Rio and the sites for the Catete Palace in Rio (http://www.fau.ufrj.br/prourb/catete) and the Favela-Bairro Program (http://www.fau.ufrj.br/prourb/cidades/favela), a Municipality Projects for the slums in Rio.[9] The main objective of most of these projects is not a final product but, rather, an investigation of new forms of digital representation through hypermedia. The investigation is done exploring its characteristics of information retrieval, links through different files format and the importance of images and their relationship to words.

These works are structured in four important phases: the bibliography and iconography research, 3D modeling, storyboard construction and hypermedia editing. Instead of ruling all other phases, storyboard writing is a result of group debate, the 3D modeling process, and the discoveries of the research group.

The rendering excellence of the 3D models is not the main issue in these works. Instead, they are explored by their capacity to organize, search, display and communicate information. They are used as separate layers of information which express intentions, constraints, concepts and techniques in built environments. These issues are achieved with many different techniques like the use of animations linked to hotwords in a text, superimposing layers of information in 3D models or VRML navigation to understand the relationship of buildings and their site.

Conclusions

The experiments developed at LAURD testify that the use of hypermedia based on 3D models helps to identify the creation of buildings and cities as a complex system of constraints, ideas and decisions. Hypermedia structure allows, through images and text links, comprehension of the whole architectural process. In one piece of representation, it's possible to identify cultural impact, social influence, site constraints, client desires, architect's concept and technical decisions. More than that, one can understand how an architectural project is a result of all these forces acting together.

One can trace an analogy between philosophy and architecture. Architects are still educated as Renaissance master-masons who synthesize in a project their age technique, art and philosophy. Specialization in the building industry have shifted professionals in the other direction. Nevertheless, hypermedia could be a powerful tool of resistance. Its structure allows, through images and text links, a better comprehension of the whole architectural process.

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José Ripper Kós
PROURB - Graduate Program of Urban Design, Faculdade de Arquitetura e Urbanismo, Universidade Federal do Rio de Janeiro
ABACUS - University of Strathclyde
josekos@pobox.com

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Modeling the City History

KÓS, José Ripper
PROURB (Graduate Program of Urban Design) - Faculdade de Arquitetura e Urbanismo, Universidade Federal do Rio de Janeiro, Brazil
ABACUS - Department of Architecture and Building Science – University of Strathclyde, United Kingdon
http://www.fau.ufrj.br/prourb josekos@ufrj.br

This paper explores the idea that 3D city models integrated with hypermedia systems can facilitate the sense of belonging to a place. 3D models are powerful tools for buildings and urban space analysis as artifacts, which synthesize men's reality and aspirations. As such, combined with hypermedia resources, they can strengthen the spectator's actual experience in the analyzed space.
The focus of the investigation is 3D models constructed to represent and analyze city evolution. The experience of developing the models of Latin American cities – Rio de Janeiro, Brazil and Havana, Cuba – developed at PROURB (Faculty of Architecture and Urbanism, Federal University of Rio de Janeiro) is explained with an overview of its methodology.
Keywords: 3D city model; hypermedia; sense of place; city evolution; Latin America.

Introduction

> "A Reality Beyond Our Reach. And this, essentially is what maps give us, reality, a reality that exceeds our vision, our reach, the span of our days, a reality we achieve no other way. We are always mapping the invisible or the unattainable or the erasable, the future or the past, the whatever-is-not-here-present-to-our-senses-now and, through the gift that the map gives us, transmuting it into everything is not ... into the real." (Woods, 1993)

3D city models, as we know them today, have their origins in traditional city maps. Even though digital tools bring about many new possibilities, digital models roots and motivations are closely related to maps. An investigation of 3D city models should depart from these considerations in order to verify its aims and possibilities. 3D city models have many different objectives. We have identified three main groups that have developed them: academic, governmental and private institutions. Those models are usually constructed to represent, analyze or communicate a specific situation which exists or not or they can be used to examine a proposal to change a particular state. These goals can be blurred and one model may be used for different purposes or users. The focus of this paper is the investigation of 3D city models developed mainly by educational institutions in order to analyze a city based on historical explorations about its evolution.

3D city models, like maps, are powerful when they can locate a set of information and make it clearer. In the same way that the location of information facilitates its understanding, the place can be better understood with the embedded information. When Christian Norberg-Schulz (1984) analyzes Heidegger's concept of dwelling, he associates it to an "existential foothold" and states that "man dwells when he can orientate himself within and identify himself with an environment, or, in short, when he experiences the environment as meaningful". An analysis of the shaping of built environment is a powerful way to grasp

the meaning of the place and hence, to facilitate one's feeling of belonging to that place. The aim of this paper is to demonstrate that 3D city models can be very effective in this process, particularly when associated with different file sources in an interactive multimedia system.

Transcending the city modeling

The notion of meaningful stressed by Norberg-Schulz (1984) has a poetic connotation and goes beyond a "scientific understanding". However, through the scientific understanding, it's possible to create a foundation which facilitates the perception of poetic connotation. Revealing some of the hidden structures and sub-systems of a city to an inhabitant or visitor can support the development of a sense of being part of that place which transcends the act of being in a place. Norberg-Schulz also demonstrate the belief that "architecture represents a means to give man an 'existential foothold'." A 3D city model can be a powerful tool for analysis of buildings and urban spaces as artifacts, which synthesize men's reality and aspirations. Usually, the knowledge about an architectural artifact's context strengthens the spectator experience. It could be possible to speculate that one can recognize the 'meaning' of places after the exploration of its creation and conception.

There are important examples of successful written texts which analyzes a city structure and raises this poetic connotation. Two different approaches of noteworthy texts are Walter Benjamin's (1999) XIX century Paris through the analysis of commercial passages and Rem Koolhaas's (1994) XX century Manhattan by means of the city grid and its architecture investigation. Both books demonstrate that hypermedia doesn't represent a revolution into traditional texts' linear discourse. They resemble a hypertext system structured by fragments of texts, which can be read independently. In both cases, the act of reading is similar to the process of experiencing the city: a patchwork of juxtaposed layers of information, which are combined by the readers as they progress in their 'experience'.

Other remarkable experiences, using digital tools, can be enumerated: the Glasgow digital exploration developed by ABACUS - University of Strathclyde (ABACUS, 2001 and Ennis, Lindsay and Grant, 2001) and Kiko Goifman's prison investigation (Goifman, 1998). One of the former example's main qualities is the multiplicity of information collected and presented about the city. Besides being one of the precursors of 3D city models, many other Glasgow related initiatives were developed. The Glasgow Virtual Open Door project, for example, exhibits a significant contribution to the city understanding (ABACUS, 2001). Building interiors are presented in a CD-ROM. Those interiors, hidden by most visitors and even inhabitants of the city are digitally exposed, revealing aspects of how people dwell in their buildings. Goifman brings a very different approach displaying his research about prisons in an instigating hypermedia system. Navigation turns out to be the main tool to communicate the space character. In his work, it's more important the way the space is apprehended than its architectural characteristics.

If hypermedia systems didn't produce a radical change into conventional narrative, we can't deny that those systems introduce powerful resources to communicate and organize information. Hypermedia systems are particularly effective when information is associated or described with images. In this context, hypermedia systems based on 3D city models can be extremely efficient to exhibit part of the information complexity inherent in a city. According to Woods, "It is the ability to link the territory with what comes with it that has made maps so valuable to so many for so long." The similar characteristics 3D models have with maps, make this assertion also valid to them. Besides that, they have additional features that can strengthen the linkage to the place and the manipulation of the territory representation and its embedded information. The impact of those additional features turns out to be evident when the area or information represented becomes more complex. The more thorough the analysis, the greater is the difference with traditional maps.

Michael Batty (2001), writing about information systems for urban planning, stated that "the digital world is about convergence. It is about representing information in digital form in such a way that data and information that previously were considered to be quite unlike one another can be juxtaposed to make their correspondence and linkage considerably clearer." For a city, graphic representation, both 2D and 3D, is a powerful ground for this convergence. A city is automatically linked to the idea of place. Thus, placing an information about the city is very efficient to make it understood. 3D models are effective tools to make clearer this location and hence they are critical to link various layers of information to a precise and recognizable territory.

Managing different type of files with 3D models in hypermedia systems is a complex task and should be planned cautiously. Each media has peculiarities, advantages and limitations. Texts, for instance, have some limitations to display an image realistically. Many times, however, the text inherent characteristic of hiding part of the context makes the message more open, powerful and "poetic". That may sound paradoxical. The same occurs to modeling – a very realistic 3D model can frequently reduce the potentiality to convey effectively the message.

The evolution modeling process

An existing 3D city model can be used as a base to develop an evolution model of the city. The technique employed should be selected according to the way the model will be used and the available historical information. The model can be used as a separate tool, which generate material for an autonomous hypermedia system or it can be manipulated in the final system. The latter is more elaborated and usually requires more complex tools. The most common tools for this task are VRML (Virtual Reality Modeling Language) and GIS (Geographic Information Systems). Both systems however, have limitations. VRML originated as a virtual reality 3D systems and have shortages in the manipulation of databases related to the 3D objects. GIS systems, created to manage large quantities of data related to maps have limited resources with the manipulation of 3D objects and to provide access to the information in autonomous systems, without the need of costly and complex GIS systems. For these reasons, many systems are elaborated with programming languages such as Java3D to attend the developers goals.

The use of VRML is a standard for describing interactive 3D objects and worlds. An interaction with a database can be created with Javascript, added to both VRML model and HTML (Hypertext Markup Language) files, and viewed by standard browsers with specific plug-ins. Some tools have been developed to reduce some of VRML limitations. The control over changes in time is specially useful to demonstrate the evolution of a 3D city model. The VRML History was created with this goal at the University of Siegen, in Germany, as an extension of VRML97 (Luttermann and Grauer, 1999). With this tool, temporal or spatial-temporal data can be examined in the model, allowing the understanding of evolving processes.

The procedure of modeling the evolution of the city is similar to modeling the present situation of an existing one. It's accuracy is a major issue in both cases. In the former, however, the method to obtain the data is more difficult, uncertain and should be more flexible. Often alternative solutions should be applied in order to deal with lack of information of a particular time or situation.

In most cases, constructing the model backwards is the most utilized alternative. The data of the present city is frequently the most accurate and, in many cases, the model can be started from an existing digital base. A critical decision in the process of developing those models is the definition of a base, which will orientate the insertion of all collected information. Since data is acquired from different documents with various scales, formats and also many discrepancies, it needs to be adapted according to the most precise and complete document. That document is usually the last version available from the department of planning of the city. Elaborating a 3D model of

previous moments is frequently a laborious job. Older maps often present incomplete 2D information. The modeling has to be based on iconographic information that displays information partially and inexactly.

The orientation of the final hypermedia system will dictate the method for modeling. Since iconographic data is often inexact, modeling a historical setting should apply an 'undefined' form of representing the imprecise data. Thus, defining the final product depends on the modeling and vice versa. Both processes run in parallel until the project conclusion. Besides that, modeling becomes an analytical stage where many hypothesis origin.

The research at Universidade Federal do Rio de Janeiro

The research based on 3D city modeling in the Graduate Program of Urban Design (PROURB) started more than six years ago. The objective of the project was to analyze Latin American cities through the investigation of their evolution based on 3D models. The approach taken since the beginning was related to the use of the model to prepare images and animations that would identify and manifest hypothesis about those cities.

The first two cities modeled were Havana and Rio de Janeiro (Kós et al., 2000). They were chosen due to the information availability and the contrasts between both of them. Since the research was based in Rio, it was easier to collect information of that city. On the other hand, the complexity of its natural setting caused many delays in the modeling process, which explained the advance of the Havana model over Rio's. While Rio de Janeiro had much digital information, although 2D and imprecise, Havana was totally modeled from analog iconography – maps, photographs and paintings (fig 1).

In both cities, the model started from the current city situation with the modeling of topography, the ocean front and the street grid. The situation of the streets over time and in the case of Rio, also the ocean front and the topography which changed a lot. The information was taken from every existing map and adapted to conform to the model of current state. At that time we started to define some of the hypothesis, which would be investigated, and model significant buildings and areas on the model representing important places for the analysis.

The focus of the research was the recognition of important "forces" which would shape the city. The selection of the "forces" varies among the cities researched. They can be: religion influence, dwelling typology, different social groups location, political decisions, fortifications, natural elements, architectural icons, cultural tradition and economic physical concentration. They are many times hidden in the

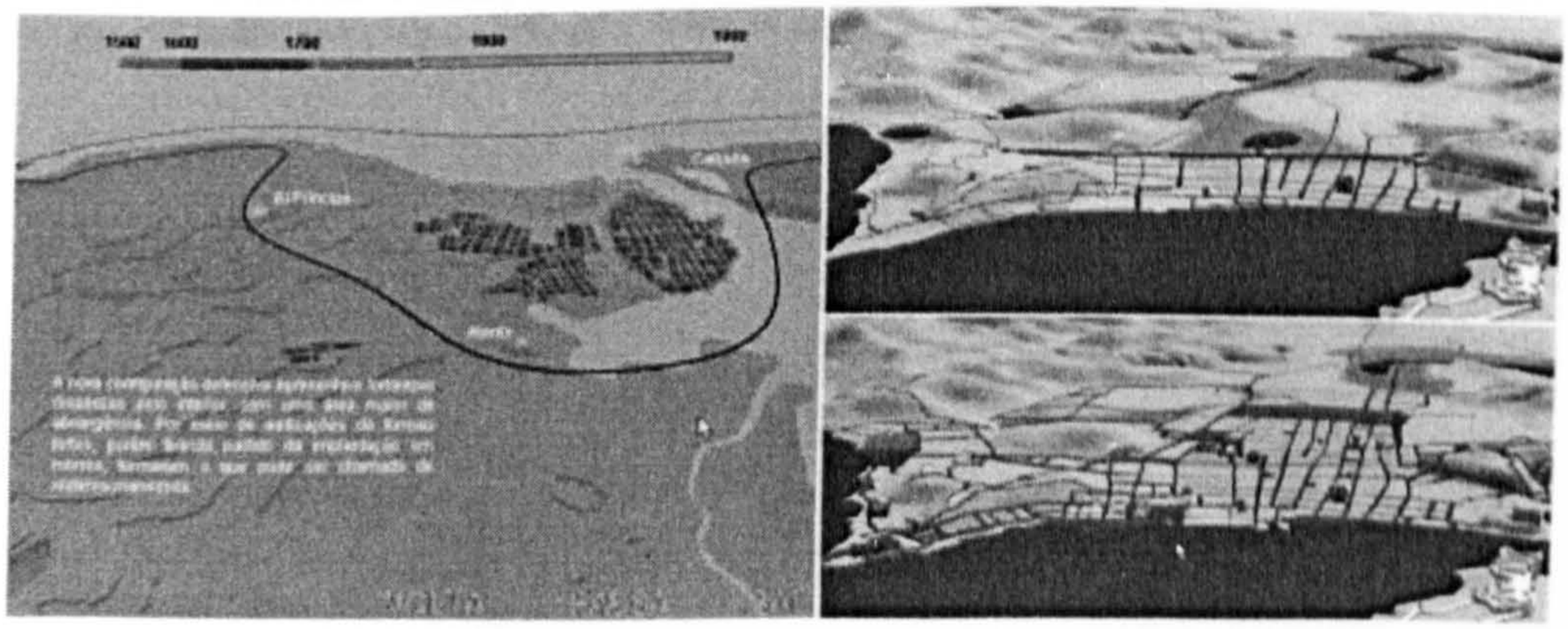

Figure 1. 3D city models of Havana and Rio de Janeiro's central area evolution.

current city but once they are identified in the physical environment, their relationship become clearer and it's possible to understand many feature of the actual city through that analysis. Abstract concepts, when linked to a place modeled according to a specific time support the elucidation of territory roots, which are materialized in the actual place. Placing these roots facilitates the consciousness of the relationship between human beings and where their life take place (fig 2).

Most hypermedia systems developed by our research group are edited with the software Macromedia Director and they do not allow the manipulation of the 3D model by the user. From the 3D model, images and animations are generated and imported into the hypermedia document according to the topics explored in each part of the document. There are seldom examples developed that the user can manipulate the model in the final document. An example of this initiative can be found in the VRML exploration of the relationship between the Catete Palace, in Rio de Janeiro, and its gardens (Kós and Segre, 1998).

One of the next steps of the research group is to link 3D objects to a database that could juxtapose different information in a single location. That's very important because the shaping of the city depends on many different issues and they should not be analyzed separately. This approach is already used *in the current stage of the research* but the linkage between 3D objects and a database would allow the 'readers' to structure their own research.

The information for the hypermedia systems have been addressed mainly to architects but prepared in such a way that lay users can easily understand the overall concept. Information synthesized in 3D model images can be very powerful method to communicate a complex message to a person lacking extensive knowledge of urban or architectural matters. The potential to transmit specialized information to the inhabitants or visitors intensifies their relationship with the subject presented and, therefore with the actual city. The hypermedia attributes allow also the possibility to convey different levels of information in a single document, where users can search for deeper idea, as they feel knowledgeable about it.

Final remarks

A challenge for our research group is to use models constructed with very straightforward systems based on mathematical logic, to contribute to bring forth the sense of belonging to a place. It's impossible to convey the actual space experience with a hypermedia system. However, there are many details of the space missed by the actual experience. A more thorough observation can be achieved after the acquaintance of some of that missing information.

According to Ramesh Jain's article, in a recent issue of *Communications of the ACM* devoted to the future of technology, "Experience is fundamental to

Figure 2. Analysis of the Ministry of Education Building's site evolution.

human existence. The desire to share it will continue to be the motivating factor in the development of exciting multimedia technology in the foreseeable future." (Jain, 2001) Besides technology advancements, we need much more experimentation in the integration of 3D city models and hypermedia systems, in order to make use of their full potential.

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The Digital Historical Researcher

KÓS José Ripper

PROURB (Postgraduate Program of Urban Design) - Faculdade de Arquitetura e Urbanismo, Universidade Federal do Rio de Janeiro, Brazil
ABACUS - Department of Architecture and Building Science - University of Strathclyde, United Kingdon
http://www.fau.ufrj.br/prourb josekos@ufrj.br

Abstract. 3D modeling is many times applied as a tool to represent historical buildings or urban settings. Most of the time, however, its importance in the research process is minimized. Few researchers credit it as an instrument to discover and understand a historical process. The objective of this paper is to present 3D modeling as an important part of an architectural or urban historical research process. This argument is presented through 3D modeling previous experiences related to historical research, the concept of 'ur-history', conceived by Walter Benjamin during his major research project about the history of XIX Century Paris and also our research group examination of the growth of a South American city and the design development of a Modern Architecture icon in that city. In both cases historical research was based primarily in the modeling process, which synthesizes all data collected from plans, archive images and documents, books and analyses of existing artifacts.

Keywords. History; 3D modeling; research; city evolution; project analysis.

Introduction

Digital technology has been often applied to fulfill a universal wish to reconstruct demolished historical monuments throughout the world. The relative low cost, compared to the results achieved, has generated multiple enterprises spread through governmental, private and academic areas. The latter will be the focus of this study. Educational institutions have produced many historical models of buildings, urban areas and even complete cities. Many of those models were published in various academic journals. Few of those articles, however, acknowledge the role of 3D modeling to the research process as an instrument to discover and understand historical processes.

Considering, from the amount of publications on the subject, that the importance of 3D models in the historical research process is frequently minimized, the objective of the paper is to emphasize that, 3D models can be very important in the research process. Its use may change the research methodology regarding data organization, formulation and corroboration of hypotheses and representation and communication of conclusions. Furthermore, 3D models may have a significant role in historic researches, facilitating the link between past events, the present and the future.

This paper aims to present our arguments based on analogous research experiences' examinations and on observations of the modeling

process developed at the Laboratory of Urban Analysis and Digital Representation (LAURD) within the Postgraduate Program of Urban Design (PROURB) – Faculty of Architecture and Urbanism, Federal University of Rio de Janeiro, in Brazil. The researchers based at LAURD have produced various models as part of research projects on the evolution of Latin American cities, particularly Havana and Rio de Janeiro, and urban icons of Rio de Janeiro. In those projects, historical research was based primarily in the modeling process, which synthesizes all data collected from different sources.

Previous experiences on architectural or urban history, 3D models and research

3D modeling reconstruction of historical environments or important buildings from the past has been widely applied and subject of many publications. The great majority of those experiences are limited to address digital modeling as representation of past constructions. Few publications recognize 3D models as research tool or credit its importance to link past and present without seeing historical events as isolated episodes. A significant part of this paper is devoted to the examination of some of the latter publications, which share some awareness with this study, in order to support our arguments, assumptions and speculations. Although those investigations seem to be rare among publications on historic 3D models, once they concentrate on issues of architectural or urban history and research, they seem to agree in most points also sustained in this study.

Modeling an hypothetical town as a tool to teach urban form history

Thomas Seebohm and Robert-Jan van Pelt were one of the first to place a comprehensible discussion about the study of urban history related to 3D modeling (Pelt and Seebohm, 1990; Seebohm, 1992). The authors' observations were done more than 12 years ago and are based on a previous version of a very specific piece of software, which was limited compared to the options available today. Their methodology, however, is still useful to any current project to structure a city model. Although their investigation focused particularly on the teaching of urban form history, the papers were also relevant to the contribution of the modeling process to the city history and its research. They based their argument – against the tendency of seeing historical facts as isolated fragments with no links to the present – on authors such as Benedetto Croce and Rudolf Bultmann. Thus, their students were asked to model an imaginary Greek town "from a small pre-historic settlement to the 20th century", in parallel to historical lectures. In order to understand urban history and its presentness, the authors argued that "[t]o study the alternatives of the past means to become involved as if one were a participant, experiencing the dread and anxiety generated by an undecided future already past." Although the experience had few practical shortcomings, it seems that modeling proved to be a powerful method to enhance the desired "sense of existential commitment to the situation studied." (Pelt and Seebohm, 1990)

Modeling a hypothetical city was an effective technique to allow the students a deep understanding of the relationship between urban form and ideology in different historic periods. According to Seebohm (1992), "[t]o gain a true understanding of urban history one has to place oneself back in historical time to consider all of the possible courses of action which were open in the light of the then current situation of the city, to act upon a possible course of action and to view the consequences in the physical form of the city."

Our disagreement lies on Seebohm's (1992) statement that, opposed to hypothetical city models, studies on models of existing cities based on specific points in time are not able to

"actually provide a true understanding of history." According to him "such studies only show a record of one of many possible courses of action at various moments in time. To gain a true understanding of urban history one has to place oneself back in historical time to consider all of the possible courses of action which were open in the light of the then current situation of the city, to act upon a possible course of action and to view the consequences in the physical form of the city."

If imaginary city models are powerful tools to achieve an understanding of urban form history, their great abstraction presents limited relations to apprehend the city history. City's physical form is a result of infinite and varied decisions. A current formal approach to shape cities has limited impact on city's physical configuration. The city celebrates important events, which are unique and differentiate it from any other city. Those events leave marks on space and respond to its individuality through links between those past events and the present. Analyzing cities evolution through 3D city models can be a powerful mode to acquire its richness while, at the same time, "overcome [s] the limitations of historical relativism, which contends that historical fact is of value only in historical context." (Seebohm, 1992)

3D historical models and the changing image of the city

Patricia Alkhoven developed her research also in the early 90's (1991; 1993). The limitations of the current software and hardware are more evident in her work than in Seebohm and Pelt. She based it mostly on available commercial software and regular PCs. However, because of the characteristics of her investigation for a PhD thesis, her study was obviously more profound than the one developed within the two professors' course in Waterloo, Canada.

An important contribution of her investigation is the acknowledgement of the modeling process to research. According to Alkhoven, "[w]hile constructing the models (i.e., making a graphical simulation), one learns about the structure, distribution of elements, sizes, scale, dimensions, characteristics, and regularities, etc. The creation of the computer models is in itself a way of studying the city, since it is an active mode of research and one is more actively involved in the process of research." (1993) Her modeling process was a method to verify, for example, drawings or maps accuracy and also to analyze the "dynamics of change and continuity in the building process." Alkhoven also stated that "[t]he most important quality of these spatial models is that they provide direct visual feed-back to the researcher during the project. ... In other words, the computer images become a source of information themselves." (1993)

3D city model as an urban research core

Bath (UK) 3D model has been the subject of several papers in the last years. The paper presented by Alan Day and Anthony Radford (1995) was chosen for this study because of its focus on urban history and research process. The authors stated that "[t]he computer model of Bath has always been primarily directed at being a 'means': a means to explore issues in urban design, in the public perception of a city, in the implications; on physical form of various strategies for making more sustainable cities, and a means for understanding more about the city's form and history." They describe that the model "can act as an indexing system for historical information, much in the way that maps are used in geographical information system." Therefore, the model is used as a database where information spread in different formats is assigned to "individual properties in the city", facilitating its access. Many unbuilt plans are also stored in the model as "alternative cities". Like in Seebohm and Pelt's papers (1990 and 1992), they "acknowledge that the city we see today is only one of a numbers of possibilities and

reaffirm that the city of the future will be determined by investigating and choosing between today's alternative." (Day and Radford, 1995)

Day and Radford's paper covers several topics related to the model's structure, process and theory. Thus, the previous statements are not very detailed and it is not clear how some of the mentioned historical information can be retrieved. On the other side, the description of such different applications for the 3D city model reveals that a comprehensible model, designed to be a "means", can be a powerful research tool and a vehicle to several forms of analysis and representation.

Modeling methodology as formal critic of Terragni's projects

The investigation carried out by Antonino Saggio (1993) followed by Mirko Galli and Claudia Mühlhoff (2000) about Giuseppe Terragni's projects is the only one in this group which relates to architectural artifacts rather than urban environments. The authors elaborate hierarchically structured 3D models in order to allow many possibilities to analyze buildings and communicate the authors' hypotheses. This methodology has much in common with the city models and demonstrates that architectural projects' 3D models can also be organized in such a way that facilitates discovers, analysis, tests, representations and communications. Saggio (1993) states that "[t]he critical ideas about how the project is interpreted are contained in the way the model is built. Therefore, critical understanding of the project and hierarchical construction coincide." Thus, the researcher has an active role while defining modeling methodology as part of the modeled project critic. According to Galli and Mühlhoff (2000) "structural patterns do exist that can establish complex relationships between data, identical to those established by the researcher between the different parts of a project during analysis, by identifying and grouping together certain elements (even if they are very different from one another) by function, material and compositive meaning. A model constructed in this way will not only provide a 3D representation of the work, but the structure of relationships between the data will contain a critical knowledge of the role, meaning and functions of its elements."

Sense of 'place' through linking past events and geographical location

The CD-ROM *Glasgow2000: the history of the city* (ABACUS, 2001) doesn't present many images from 3D models and 3D models were not applied as a research tool for the CD development. Although digital models are seldom presented in the CD-ROM, they were actually used as a base for artists to traditionally render different periods of the city based on digital terrain renderings while in "the most recent period of the city's development, actual aerial photographs were 'draped' over the computer generated topography." (Maver, Ennis and Jarvis, 2001) The reason 3D models were not used to render images for the final product was the project's limited time and budget. This fact demonstrates that, even if the research group had a quite complete 3D model of the existing city configuration, the transformation of that model into historical ones of previous periods would be a laborious task.

The ABACUS research group has many projects related to their 3D city model, one of the first to be elaborated at such a scale. Although the 3D model was just a support to generate city's historical representations, this project suggests significant use for it. If we consider previous projects from ABACUS such as *The Glasgow Directory* (http://iris.abacus.strath.ac.uk/glasgow/: May 2002), which links different sort of data to a *vrml* city model, then, the same could be done with *Glasgow2000*'s historical data. Therefore, a more flexible digital model – compared to the still watercolor images – could be applied to also achieve the authors' desired "sense of place".

Besides the speculations about 3D models, it's important to acknowledge the most important issue of this CD-ROM to our paper: their aim, through the CD, to "give a sense of 'place' and to link all of the information to geographical locations." (Maver, Ennis and Jarvis, 2001). The authors make use of a great number of historical documents from several file types connected to city locations. Traditionally, those files, like sound or video clips, photographs and text are accessible in limited number and connected to some texts on specific topics. Seeing, hearing or reading many of them, in a chosen order and linked to known areas of the cities is a powerful move. One has a comprehensible feeling of the city's environment through those pieces of information and the comparison of the present city's urban spaces.

The "total historic event": Walter Benjamin's "ur-history"

In the 13 years that preceded his death in 1940, Walter Benjamin dedicated most of his time to a major research project concerned to XIX century Paris' history. It seems that he never finished his work and his notes constituted an important historical document. Although Benjamin never wrote about 3D models and his work is not actually an urban or architectural history, his investigation has many relevant aspects to this study. Benjamin started his research from an architectural typology, which had its origin, apogee and decay in the XIX century. Through this typology, the commercial arcades which crossed traditional city blocks as subversive devices, he traced a cultural history of the city. His investigation had a political and pedagogical intention. His objective was to dig, from a myriad of sources, a history which was not written by the 'winners'. Paris' arcade was his instrument to unveil this hidden history of the city. His notes were composed of fragments, organized in an ingenious structure which some authors speculate as an "intuition of today's computer technologies." (Bolle, 1998)

Benjamin attempted to reveal the city's 'ur-history'. He borrowed this term from Goethe, who used, in his scientific research, the term: 'ur-phenomenon', "the essential pattern or process of a thing. Ur- bears the connotation of primordial, basic, elemental, archetypal; the ur-phenomenon may be thought of as the 'deep-down phenomenon,' the essential core of a thing that makes it what it is and what it becomes." (Seamon, 1998) Benjamin's 'ur-history' was comprehended through several 'images'. For Buck-Morss (1991), "[w]hichever form they took, such images were the concrete, 'small, particular moments' in which the 'total historical event' was to be discovered, the 'perceptible ur-phenomenon' in which the origins of the present could be found." Through collected object's images, organized by means of montage, he wished to "telescope the past through the present." (Benjamin, 1999; Buck-Morss, 1991)

The flâneur, the stroller on Parisian streets, was a critical figure in Benjamin's musings. He was "the 'ur-form' of the modern intellectual. The flâneur's object of inquiry is modernity itself. Unlike the academic who reflects in his room, he walks the street and 'studies' the crowd." (Buck-Morss, 1991)

Urban and architectural history and the research process

The historical research process consists of collecting a multitude of fragments from different sources. The researcher task is the recognition of the data relevance and its interpretation related to other studied pieces. The analysis of urban or architectural history is often related to images based on visual sources as well as textual, aural and other sources. From those sources, architectural and urban historians often attempt to imagine a setting, which no longer exists. Although

sometimes those buildings or urban spaces where not eliminated or didn't change much over the time, the historians duty is much more complex than just registering its physical configuration. The cultural, social and economical among other historical analyses as well as the study of the surroundings or other contemporaneous settings – all related to the present – are critical to the investigation. According to Alkhoven (1991), "[a]rchitectural historians who study *real* architecture, work with imperfect, heterogeneous and often incomplete material when studying the transformation of a city. By studying very precisely the subtle transformation over time it is possible to trace the agents and forces that have produced the image of the city." (1991)

Usually, researchers responsible for collecting or analyzing an urban historical setting are not the same as those responsible for the 3D model construction. The recognition of the modeling process importance to the historical analysis and research depends often on the interaction between those two groups. Patricia Alkhoven developed a research project, which successively connects the 3D urban model of Heusden, to the analytical and research process (1991; 1993). One of the reasons for her success lies in the fact that she seemed to be responsible for every phase of the project.

3D models are constructed from the collected fragments in the research process. This investigation supports the argument that 3D models should be regarded as a research physical database rather than a representation of an already concluded study (Day and Radford, 1995). Each modeled object should be a piece of historical data linked to different information sources, such as drawings, photographs and texts. Thus, the model should be the research core which synthesizes the collected information as form. The model's detail level is less important than the possibility to represent in 3D each investigated object as a component of the overall study and to give form to the research material. It evidences the links between each piece and the physical context and also among every piece in the investigation.

Architectural models can display links among the several parts of a historical research (Saggio, 1993; Galli and Mühlhoff, 2000). This process, however, is much more obvious in urban models. A city is produced throughout a long period of time by a myriad of fragments. Most physical fragments are autonomous objects linked to many others. Those fragments are usually related to constructed objects, which are erected in different times with particular characteristics. Cities are delineated by the creation and transformation of those objects. Therefore, their research is critical to the city history. As many of those objects, created in various periods, remain in the present, they are both testimonies of a past and a piece of the current urban configuration. The study of historical components of a city is often a study of existing fragments in the urban fabric. Present and past dwell within the urban fabric and city's inhabitants share their lives with historical settings.

Historical urban digital models are frequently produced backwards (Alkhoven, 1991; Day and Radford, 1995). The current information is always more accurate, easier to verify and has often partial information available in digital form. Thus the current state is applied as a starting point to elaborate previous periods. The information from those periods is interpreted in order to fit on the established standard based on the present configuration. The researcher shape previous periods assembling information from different sources and formats, replacing current elements with their predecessors. Starting the model from the present configuration is often a practical decision. However, the process of interpreting past events according to the present embody a critical issue

(Benjamin, 1999; Buck-Morss, 1991). The past is not studied as a separate episode as opposed to its relation to the present and to humanity as a whole (Croce, 1941 as quoted in Pelt and Seebohm, 1990). This relationship is enhanced by the modeling process, which evidences spatial links between past and present. Therefore, the model as a research instrument, rescues the past from the foundations of the present and, at the same time, the present from the fragments of the past. The digital model grounds the investigation to a constant move, departing from the present, towards the past, always considering future implications.

The acknowledgement of this link between past, present and future is also important for the model as a research representation. Places, which are the settings for our lives, are able to accomplish this powerful link between different periods and the present. As past events are spatially organized throughout the city model, connections between those events and the present are strengthened by the recognition of city spaces represented on the model. Inhabitants of the city comprehend better the complexity of urban historical experience associated with familiar places. The observation of 3D historical city models becomes a pedagogical action. One, who consciously experiences historical sites, also experiences the presentness of historical events.

The research developed at the Federal University of Rio de Janeiro

The research group based on the Laboratory of Urban Analysis and Digital Representation of the Graduate Program of Urban Design (PROURB-FAU-UFRJ) has been working with models of the Latin American cities of Havana and Rio de Janeiro and some of the latters important buildings. The modeling process is the core of our investigations and most hypotheses are elaborated while the models are constructed. As most research subjects become very complex, models turn out to be powerful tools to represent and organize data, elaborate and verify hypotheses and communicate research analysis.

Our first models of Havana and Rio de Janeiro (Kós et al., 2000) were developed to allow a thorough analysis of the forces that influenced their urban configuration in the colonial period. Other projects were related to the investigation of individual buildings or projects. In our current research, we chose to shift the study procedure. We decided to analyze specific buildings in order to comprehend the city. Those buildings are examined as a synthesis of countless forces which affected a specific period and place. Through the location of those forces, 3D modeling assumes a critical position in the research process. The process of deconstructing and reconstructing models is analogous to the "theoretical" research and becomes the field where the latter is shaped, tested and represented (Saggio, 1993).

The building for the Ministry of Education is the first studied project as an autonomous CD-ROM (Figure 1) and also as part of the larger city project with other icons of the XX century. Around 20 models were elaborated for different proposals or phases of the project. An overview of the peri-

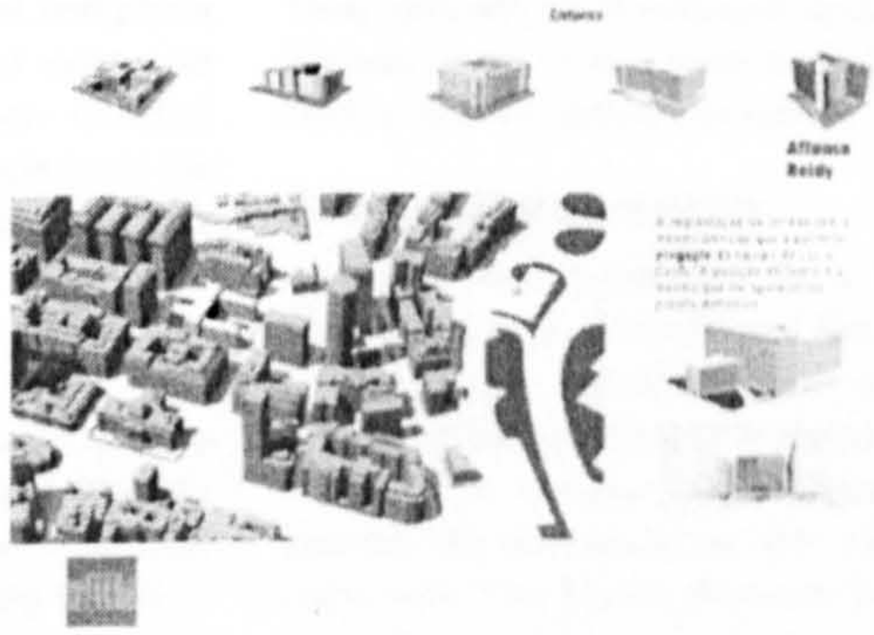

Figure 1. Ministry of Education Building CD-ROM.

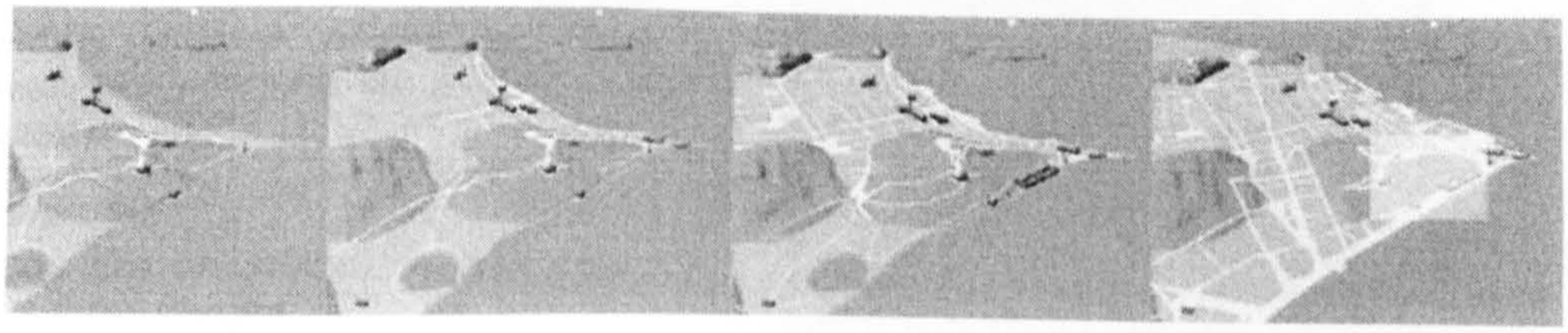

Figure 2. Interface for Rio de Janeiro historic database.

od through cultural, political and social examination is also provided. The objective of this project is to supply information to understand the environment of the time in order to understand the motives and impacts of the decisions taken by those responsible for the project. The project's analysis is the motto to comprehend an important period of the city and to reveal some of the hidden facts of the city history, which are not explicitly stated in most studies historic studies.

We are also starting a project which aims to collect and retrieve all sort of information related to the city, connected to spatial locations through the 3D model (Figure 2). In this project, one can choose a specific period view from the 3D model and access the information that will be associated with that period and place. Therefore, one will retrieve pieces such as images, newspaper articles, drawings, statements or commentaries of that period and area of the city. The 3D model will facilitate the link between the known current area of the city to that same area in the past and place will be the main connection element past and present. Instead of retrieving just an isolated piece of historic information, the 'reader' will be placed in a position to actually make the link between past, present and future.

Final remarks

As urban and architectural historians become more proficient with 3D modeling, we will verify a shift in the use of 3D models in historical research. This shift will not only modify research organization but may have significant impact on its results. Our assumptions are that modeling will facilitate a deeper understanding of urban and architectural history. 'Ur-history' is acquired through the immerse process of modeling a historic environment structure. On the other side, the 'reader', who retrieves information wandering through 3D models, is Benjamin's flâneur digital version.

Although modeling is an abstract representation, a simplification of the real studied object, it allows a spatial assemblage of innumerable pieces of information resembling the physical configuration of the object. The possibility to include such quantity of information in one individual source actually permits acknowledgement of the richness of cities or buildings within complexity of data organization. Built environments are more than just boundaries where life takes place. They actually mirror human existence. To really grasp their richness one needs to thoroughly comprehend their creation process' complexity. Then, one will have a deeper understanding of her (is) own place in the world and will be better qualified to ponder future decisions.

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3D models as a base for historical narrative experiments

José Ripper Kós

PROURB (Postgraduate Program of Urban Design) - Faculdade de Arquitetura e Urbanismo, Universidade Federal do Rio de Janeiro, Brazil

ABACUS - Department of Architecture and Building Science - University of Strathclyde, UK

http://www.fau.ufrj.br/prourb/jkos.htm

Abstract. Historians have relied mostly in descriptive narratives to represent their research. In the first half of the XX century, with the influence of other disciplines, that instrument started to be questioned. This paper aims to overview that debate and the search for new forms of historical representation that would overcome most of the historians' alleged shortcomings. A web-based system that relates 3D city models to a database of historical documents of a great variety of sources is presented as a digital alternative for the representation of Rio de Janeiro's history.

Keywords. 3D city models; historical narratives; database; cultural history; urban evolution.

Historians and narrative: searching for a representation mode

Narrative has been the major and almost unquestionable form of historical representation until the first half of the XX Century. Peter Burke (1991) mentions that in the age of the Enlightenment, authors like Voltaire and the Scottish social theorist John Millar were already challenging historical narrative. Millar wrote of the "surface of events which engages the attention of the vulgar historian" (Millar as quoted by Burke, 1991). However, it was around the 1920s, when various authors raised several issues, which would question the scientific value of historical narrative. One of the main reasons was the influence of Marx's ideology and the social science methodology among historians, which determined a criticism of their scientific and social role. At the center of that criticism was the historical narrative focus on the individuals. The current belief determined a diversion towards the analysis of societies and their structure. Moreover, those historians defended that *"scientific history could be achieved which would in time produce generalized laws to explain historical change". If until* then the what and how questions were the main concerns of historical narratives, the shift should be towards the why historical questions. (Stone, 1979)

Those new experiments towards a scientific history were not restricted to the content of historical representation. The shifts in historians' methodology raised an important debate on historical representation, namely traditional narrative. The unparalleled interdisciplinary collaboration fomented an analytic representation very different from the descriptive narratives used by historians until then. Furthermore, historians were becoming used to quantitative data in their research. Their representation no longer fitted in the storytelling method. Therefore, the representation alternatives came from those related disciplines and oriented the critique of that group, the

structural historians, towards traditional narrative.

Narrative and structural historians differ in many issues while representing the same historical moment. The formers tend to base their historical explanation on individual character and intention as opposed to the latter's focus on the existing society's structure such as economy, politics, demography and so on.

Narrative champions construct their version on the assumption that individual historical agents are more significant than structural aspects to explain an historical event. Therefore, a descriptive narrative is more suitable for their historical representation. Their description is usually set up in a chronological order where events and personal decisions are linked together. Those historians were criticized for personifying collective entities such as Government and Church and oversimplifying historical events, elaborating a representation which could not be scientifically verified. Besides that and because of that, their rivals argued that from the same set of primary documents, historians could elaborate opposing and still valid versions.

Although structural historians do not exclude narratives in their historical representation, they avoid their descriptive beginning-middle-end structure. They assert that there should be a distinction between popular and academic history. According to them, academic historians should avoid telling stories and concentrate on the analysis of problems and structures (Burke, 1991). Some of the criticisms towards structural historians concern their rigid, reductionist and determinist attitudes. Diminishing the importance of historical characters, reduces their individuality and suggests that any person in that situation would take the same decision. The analysis abstraction also scales down the sense of flow of time in their representation.

The debate on modern narrative

Peter Burke wrote that the debate should not be "concerned with the question, whether or not to write narrative, but with the problem of what kind of narrative to write" (Burke, 1991). Burke presented several literary experiments, which challenged the notion of narrator or chronological sequence and responded to many historical narrative shortcomings.

According to him, the film historian Siegfried Kracauer "seems to have been the first to declare that modern fiction, more especially the 'decomposition of temporal continuity' in Joyce, Proust and Virginia Woolf, offers a challenge and an opportunity to historical narrators". Hayden White got more recognition than Kracauer when he suggested that historians should abandon nineteen-century's literary realism and pay attention to the "literary insights of its own age (including a sense of discontinuity between events in the outside world and their representation in narrative form)" (White, 1966; Burke, 1991)

Burke identified three major problems of historical narratives in which literary experiments could offer alternative solutions. The first one is the representation of conflicts such as civil wars, which has very distinct versions. He demonstrated surprise that historian don't apply novelist techniques such as telling the story from different points of view to overcome those problems. History is written, most of the times, in the winners' version. Some literary experiments offer powerful devices to present to the readers both sides of the conflict and allow them opportunity for a more thorough interpretation. He exemplifies with the literary works by Aldous Huxley, William Faulkner and Lawrence Durrell. While he was finishing his essay, as he noted, Richard Price published the book "Alabi's World" on Surinam's eighteen-century history. His study presents four different voices: the black slaves, the Dutch administrators, the Moravian missionaries and the

author himself. In this acclaimed work, Price exhibited the differences between opposing versions by the antagonistic agents and also in time through his own voice and the historical agents (Price, 1990; Burke, 1991)

The second problem refers to narrative competence in representing the truth. According to Burke more and more historians are realizing that they present just a "particular view of what actually happened" (Burke, 1991). A major problem is that, typically, history books present that particular view as the representation of past reality. Authors don't communicate to the readers the awareness that their work is just one version of the facts. Traditional narrative is not very adequate for this task. Price's book, again, presents a successful effort to overcome this problem with his voice opposed to the three other selected agents. Another alternative, presented by Burke, is fiction's first-person narrator.

The third issue raised by Burke addresses the dispute between narrative and structural historians. According to him, none of the two groups was able to offer an historical representation alternative without bringing about other shortcomings. Thus, he proposes a synthesis between their most valuable features. The result would be a thick description or thick narrative. That term was coined by the anthropologist Clifford Geertz (1973), the author of the classic account on cock fighting in Bali. A description, or narrative, is thick when it is embedded with a noteworthy analytical interpretation not only of the facts described but also of the overall structure in which they are circumscribed. Burke suggests that those structure analyses could act as brakes, or accelerators, between the events on narratives. He cites Tolstoy's "War and Peace" and Shimazaki Toson's "Before the Dawn" as important novels which exemplify that attitude. He adds that historians can learn from novelists some of their techniques but it is not an easy move for them to solve their literary problems. "Since historians are not free to invent their characters or even the words and thoughts of their characters, they are unlikely to be able to condense the problems of an epoch into a story about a family, as novelists have often done" (Burke, 1991)

The most adopted solutions by historians who are exploring in this direction is the micronarrative. It was adopted by some of the former structural narrative champions and is becoming fashionable. Micronarratives are stories about ordinary people and their settings used as a "means of illuminating structures" (Burke, 1991). Burke presents several examples. Among them, he cites Natalie Davis's version of a sixteenth-century's farmer, on his way back home in the south of France, after many years away, found his place occupied by another man who claimed to be the farmer himself. The story is used to present the values of society in that place and time such as the status of French rural women and current relations between husband and wife or parents and children. He quotes the author, whose goal was that of "embedding this story in the values and habits of sixteenth-century French village life and law, to use them to help understand central elements in the story and to use the story to comment back on them" (Davis, 1983; Burke, 1991). Burke accepts that micronarratives, as powerful alternatives to historians, present some difficulties in linking microhistory to macrohistory or local details and general trends.

In Burke's essay, he diagnoses several limitations on historical representations. Those limitations were evidenced in the debate between narrative and structural historians. They also demonstrate historians' conservative approach to their most important vehicle that provides access to their research. One of the symptoms of historian's conservative attitude is that a great part of the discussion concerning the debate on historical narrative is carried out by philosophers, with little

participation of historians. Burke proposes directions that they could take in a search for new forms of narrative, which could overcome some of those problems. He distinguishes several experiments in twentieth-century literature and cinema. Those experiments are seldom acknowledged by historians and could benefit their interpretation of past reality.

Although most devices recognized by Burke in cinema come from literary experiments, they are clearly exhibited in some prominent films. Besides Kracauer's contribution mentioned above, Natalie Davis's "The Return of Martin Guerre" was launched almost at the same time as the homonymous film in which she was historical consultant (Vigne, 1982; Davis, 1983). Another remarkable film is Akira Kurosawa's "Rashomon" [FIGURE 01] (Kurosawa, 1950). In his film, Kurosawa constructed a simple story of a samurai found dead and his wife raped, within a very creative structure. The film has four different versions – like some historians' experiments described above – presented in flashbacks: the bandit, the main suspect, assumed that he killed the samurai after a sword dispute but affirmed he had consensual sex with his wife; the raped woman confirmed the rape and suggested she was the murderer; the dead man's version, told through a medium, ratified the rape and declared a suicide; and the only witness presented elements of the other three versions without any conclusion.

Kurosawa didn't intend to offer a definite version but rather conclude the impossibility of knowing what really happened. Not even those who were participants in the event could elaborate similar versions. Once, when the film producers were not understanding the script, Kurosawa explained that "[h]uman beings are unable to be honest with themselves about themselves. They cannot talk about themselves without embellishing. This script portrays such human beings – the kind who cannot survive with lies to make them feel they are better people than they really are. It even shows this sinful need for flattering falsehood going beyond the grave – even the character who dies cannot give up when he speaks to the living through a medium. Egoism is a sin the human being carries with him from the birth; it is the most difficult to redeem. This film is like a strange picture scroll that is unrolled and displayed by the ego". (Kurosawa, 2002)

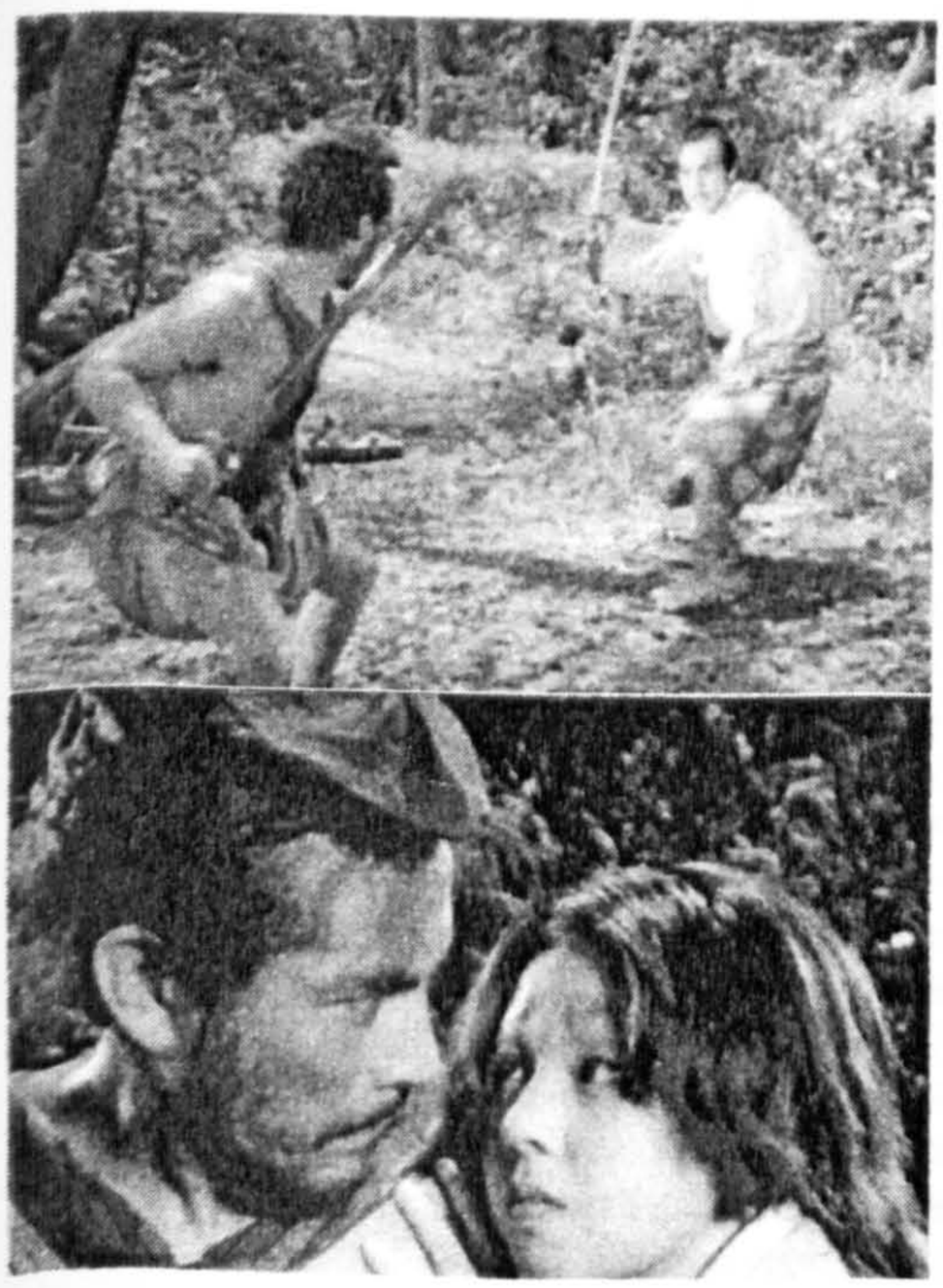

Figure 01. Akira Kurosawa movie "Rashomon".

RIO-H

RIO-H was conceived as a web-based alternative for the presentation of a place's history. It rests on a database of historical documents related to specific places within the city of Rio de

Janeiro, in Brazil. Those documents are searched from 3D model's images of different periods in the city's history [FIGURE 02]. Each database entry can be linked up to five different places in the city model, five different historical periods and five keywords for searching the information. The database entries are classified in different categories such as photographs, newspaper's articles, paintings, fiction books, official documents and videos. Therefore, the readers should start the documents' searching from historical places in the 3D models' images representing the city. The readers are able to search documents which present different versions or aspects of a place's history. Thus, they should be able to elaborate their own historical narrative from the spaces within a city.

Figure 02. RIO-II:

3D historical models

The 3D models were elaborated in the Laboratory of Urban Analysis and Digital Representation (LAURD-PROURB) at the Federal University of Rio de Janeiro. They render historical periods in the city, represented in cuts selected from available antique maps or aerial photographs. The models were constructed from the 3D model of the existing city with the support of historical graphic information. The current city model is represented by the existing situation of the city in the year 2000. Thus, each historical model was elaborated backwards based on previous maps and in the remaining constructions and streets, deconstructing the changes done over the years until 2000. In order to facilitate their construction, every model was structured in three main parts: the natural landscape, with the topography and the shoreline; the street network; and the main buildings.

The representation of the landscape is critical for this project due to the history and the characteristics of the city. The city growth was always driven by the relationship with the natural landscape. Sometimes this relationship required a defensive or effortful attitude and others the natural assets supported urban enterprises. Thus mountains and waterfront were several times changed over the history to conform to major urban changes. Infills and hill dismantles are not uncommon in Rio's urban evolution. Besides that, the city dwellers always used the waterfront and the mountain as a guiding resources or references for places. Until today, the city is more known for its natural configuration than for the built environment. The city landmarks built by its inhabitants are often exhibited near the natural landscape. Therefore, even requiring complex modeling solutions, the topography was constructed with fairly rich details. The topography was always the most problematic part of the model. It required a lot of workstation's disk and memory to manage the models and complex procedures to place streets or buildings on it.

Those historical models of the city were not constructed to be realistic representations of the city of Rio. Actually it is important to emphasize their abstractionism. Each model should be accessed as a reduction of an historical city fragment. Therefore, its role as a spatial representation is mainly to locate the "historical image" – or "dialectic images", as Walter Benjamin stated (1999) – elaborated by the readers in the space of the city they already know. The simplicity of the model, based on a digital Cartesian system, is necessary to bring about the great complexity of

city history.

The organization of historical urban 3D models poses additional important issues. It's much easier to represent an existing situation than past moments of the city, which are never completed documented. Modeling an "incomplete" and more abstract city can overcome lack of information problems and also facilitates readers to construct their own images of that period. That could be done with the support of other historical documents and their knowledge of that existing space in the city. Therefore, 3D models have an important role to locate within the city past events and associate past and present spaces.

Historical database of Rio de Janeiro

The database for Rio de Janeiro's historical documents was elaborated in order to organize the historical data related to Rio and its connection with the spaces within the city. The database of historical information linked to the city space is composed by a great diversity of file types. It is constituted by primary documents such as letters, photographs, maps, official documents and also other sources like journal articles, historians' texts and even novels. It was designed as regular databases that keep records of historical archives. In addition to the regular information such as authorship, type of media or file quality, the database hosts the information which connects each entry to the 3D models. The entry should be linked to one or more historical 3D models and to areas within those models. Thus, for each entry the database offers 5 possibilities to relate to one of the eight preliminary 3D historical models (1600, 1650, 1713, 1750, 1808, 1850, 1910 and 1928); 5 possibilities of areas within the model, which could be buildings, squares, streets or small urban spaces; and 5 subject keywords, for conducting the historical search engine.

At this preliminary stage of the investigation, historians have not carried out the research for historical data yet. The information gathered about few buildings and included in the database aimed mainly to verify this investigation's assumptions. It was confirmed that a critical phase of the data filling process is the keywords' selection for each entry. The keywords systemize the list of files related to a building, assembling them by different subjects and themes. Thus they facilitate and direct the readers to the files they want to retrieve. The selection of the keywords could conduct a search towards different ways to view the city history. The database should not be seen as a neutral tool that automatically displays historical data to any one that would access it. Those responsible for planning and developing it should take the responsibility to clearly define their main objectives and how the information would be available through the places and keywords.

The web-based tool: RIO-H

RIO-H is a web-based system structured by a Macromedia Flash movie file connected to a Microsoft Access database using ASP (Active Server Pages) to query the database and relay information back and forth. The Flash movie file is the front end, which presents the dynamic content to the readers. It was chosen because it is almost a standard to most web users and offers powerful tools to manipulate graphics, animation and sound, and the ability to interface with ASP pages.

The RIO-H's Microsoft Access database is hidden to the readers who navigate through the 3D renderings of the historical models. The first decisions when accessing the information on the system are done through the images. First choosing the date of the historical model and, once the model is loaded, one building or street should be selected in the 3D model, which would relate to an ASP page to connect to the database. Therefore, the areas of the city, selected in the 3D models,

relate to a first query to the database.

Once the area is selected, the database returns every keyword associated with that area in that particular historical model (Place + Time). The readers can choose one keyword or, if they want a more focused result, two keywords. The result is a list of every entry in the database that have in their fields that historical 3D model (Time), that area (Place), and one or two keywords (Subject) depending on the reader's choice. The following result is another list of files from different sources [FIGURE 03]. The files are grouped in nine different categories of source types associated with their correspondent buttons. If the reader chooses to press one of the buttons, the system would list only the source type's files selected. Thus, the readers follow this order in the process of searching the files: Time, Place, Subject and Source Type. The last one is not mandatory and is a way to refine their searches. One possibility to identify the file's source is to move the mouse over the file title in the list. The button associated to its source type category will change to its negative. From the list of files, the readers choose those they want to retrieve, elaborating their own image of that space in the past, from the downloaded documents [FIGURE 04].

Figure 03. RIO-H: The list of keywords and files associated to the selected building.

Figure 04. RIO-H: Retrieving a photo from the list of files.

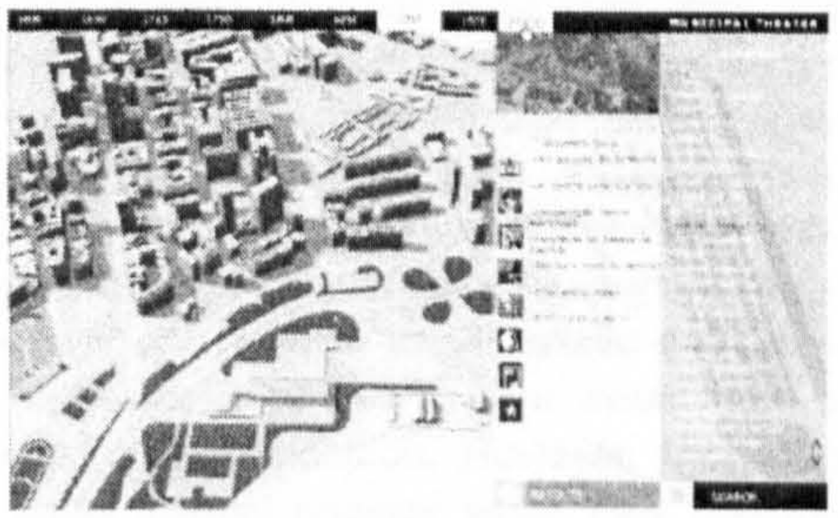

Figure 05. RIO-H: switching to 3D model year 2000.

Besides the images from the historical models, RIO-H offers the possibility to switch the historical model image to the rendering of the current model, representing the city in the year 2000. That switch can be done anytime during the navigation if the mouse passes over the "2000" sign. That is an important feature of the system to allow the readers to recognize the places in the past while they relate them to the present. Therefore, the readers are always aware of the city they know and they have experienced. They should relate that remembrance to the files they read in order to produce their image of the past city.

One of the aims of the experiment is to use spatial information to bond historical fragments in a coherent narrative and also to strength historical continuity to the presentness of each reader. Space becomes more important and less abstract than time. Therefore, historical narrative can be created in different formats facilitating a clear understanding of the city past and, furthermore, of the readers' present and future.

An alternative for a city's history

Peter Burke didn't consider electronic documents when he argued about modern narratives and literary experiments in his essay "History of events and the revival of narrative" (1991). Web-based documents and hypermedia offer a great opportunity to present and distribute historical research but historians have seldom explored those techniques. Books are always regarded as the primary vehicle for historical researches and images have played a secondary role even for most of the investigations on urban or architectural history. RIO-H aims to present an alternative for this tendency. It illustrates that historians could evaluate electronic narratives as tools to overcome some of traditional narratives difficulties.

The issue of different points of view in the representation of the same event is addressed by RIO-H. When different documents of similar subjects are confronted in the system, the reader is aware that they have different origins and authors. Many times they have conflicting versions. Those different versions may be unbalanced since the 'elite' version is better documented than others. However, this device creates an opportunity to place together information that is spread across different locations and from different authors who have different perspectives of the same event.

Besides the issue of different perspectives for an historical event, several others related to the historian's narrative are raised by RIO-H. It is important to mention some of them in this work, such as the existence of much historical evidence that is not considered by the historian, the impossibility of neutrality in a historian's representation, the relation between past history and present, or the use of images in their publications.

Researchers evaluate historical events through limited evidence to which they have access. Historians usually include in their publications inferences that fill in gaps that are not registered in their sources. Analogous to the different versions mentioned above, historians often fail to make readers aware of those inferences or the limitations of their sources. An important point is that affording different document versions for the readers, as in RIO-H, implies that there may have innumerous others which are not included in that vehicle and many more which are lost forever.

Historians always struggle to choose on which documents they will base their work and the others, which they will disregard. This choice and several others that emerge during their research and particularly their representation, confirm the active participation of historians. RIO-H can be seen as a collection of historical documents available through an electronic database. Thus, the authors of this system would have a somewhat neutral position. However, they also have taken several choices when they decided which documents to be included and, particularly, when they classified those documents. Choosing keywords, for example, defines the readers' route to access the sources and direct their navigation through the system. Therefore, the construction of the "readers' narrative" will depend much on the decision of RIO-H's authors.

Historical publications rarely utilize 3D city models in their works. Their use is critical in RIO-H and the choice to include renderings from those models as a point of departure to search information has several reasons and implications. As already mentioned, the renderings generated by the models are simple and do not intend to be photorealistic. They may resemble perspective maps developed for tourists with only the city landmarks. The only complete model, with every building, is the one which represents the city in the year 2000. The previous ones are simpler because their main purpose is to locate the readers within the past urban fabric and to facilitate the relationship between the searched area in the

past and the current city. The renderings from the 3D models of the past should not attempt to convey the complexity of reality in that moment because they could never reproduce it. The reader should elaborate their own images of that period with various degree of complexity depending on their previous experience with that space and how they relate the searched documents to the city space they know. When the 3D renderings support the location of the historical information in the city, they contextualize it and help to clarify a puzzling set of relationships from past society. Therefore, the space organizes the historical information, taking for granted its complexity but trying to display it in an organized form. This procedure should be a way to facilitate the creation of a sense of place in readers who already have some relation to that space.

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3D models of urban icons: tracing Benjamin and Koolhaas

José R. Kós

Abstract

Walter Benjamin and Rem Koolhaas developed two significant investigations, which explored the culture of Paris and New York through the analysis of their architectural artifacts. Their research projects successfully dig up, from a few meaningful components of the built environment, an understanding of the overall city and its society. The objective of this paper is to address some similarities between the research carried out at the Federal University of Rio de Janeiro (Brazil) and those two acclaimed works. Our group aims to select urban icons to be studied, representing different moments and areas in Rio de Janeiro, in order to understand the city evolution throughout the XX Century. The Ministry of Education building, the investigation's prototype, is analyzed thorough several 3D models and other digital techniques. We conclude that a thoroughly study of Benjamin's and Koolhaas' work should be considered as a primary support for the digital investigation's evaluation.

1. Introduction

In the last three years, a research project has been carried out at the Federal University of Rio de Janeiro (UFRJ), in the Graduate Program of Urban Design of The Faculty of Architecture and Urbanism. Under the coordination of Professor Roberto Segre, a group of faculty members and graduate and undergraduate students are involved in this investigation, which is located at the Laboratory of Urban Analysis and Digital Representation. The research project is called "Urban and architectural icons of Rio de Janeiro: contribution to the symbolic systems of the city in the XX Century." Within this project, our group applies digital techniques to investigate meaningful buildings and significant urban spaces spread through different periods and areas of the city in the XX Century. Through that investigation, we attempt to reveal the history of the city of Rio de Janeiro in that period. This article aims to address some issues raised by the research project. The group has selected more than twenty 'icons' and is currently investigating six of them. A preliminary version of the Ministry of Education was already registered in an interactive CD-ROM. (Figure 1)

The term 'icon' conveys a very broad meaning. Therefore, we decided to narrow it down in order to use it throughout the research project. We assumed that, to consider an architectural artifact or urban space as an 'icon,' it should be able to synthesize several forces, such as social, cultural or political, which act in a specific time and place. Thus, the 'icons' would be representations or images of those forces. However, it is important to mention that even though those forces take place in a specific historical context, it does not mean that their references are not valid in a different context. It is actually because they represent such value in a specific occasion, that those artifacts transcend their context and are considered 'icons' in a different one.

That definition, incorporated by our research group gathers a great variety of examples with different characteristics. Those icons range from buildings acclaimed by the professionals for their architectonic value but with little recognition by most city dwellers to other structures celebrated by Cariocas (Rio de Janeiro's inhabitants), and which architects criticize for their constructive and aesthetic quality. Several of them, however, are welcome by both architects and laymen.

2. Culture of cities and their buildings' history: Koolhaas and Benjamin

The idea of investigating the history of cities through their architectural and urban artifacts was incorporated in two acclaimed books, which will be overviewed in this work. They were selected for this examination, among other reasons, for their ingenious approach, innovative narrative structure and for similarities with our investigation of the urban icons of Rio de Janeiro. The first one, "Das Passagen-Werk" [1] or "The Arcades Project," [2] contains the posthumous publications of Walter Benjamin's manuscripts in German and English of his investigation on the commercial passages in Paris as a way to understand the history of the city in the XIX Century. The second work is Rem Koolhaas' "Delirious New York: A Retroactive Manifesto for Manhattan," [3] which explores the history of Manhattan through "the symbiotic relationship between its mutant metropolitan culture and the unique architecture to which it gave rise" [4] in the regularity of the city grid.

2.1. The "total historic event:" Walter Benjamin's Parisian arcades

Although Benjamin never wrote about 3D models and his work is not actually an urban or architectural history, his investigation has many relevant aspects to our study. Benjamin started his research from an architectural typology which had its origin, apogee and decay in the XIX Century. Through that typology, the commercial arcades, which crossed traditional city blocks as subversive devices, he traced a cultural history of the city.

Correspondingly to their physical configuration, they hosted and represented an obscure system in Parisian society. Several characters that were not much exposed in the "official history" of Paris, such as prostitutes, collectors, gamblers and the "flâneurs" shared that space with the traditional families of the city. His objective was to dig from a myriad of sources in order to reveal a history which had not been written. Paris' arcades were his instruments to unveil this hidden history of the city. His notes were the legacy, documented in fragments organized in an ingenious structure which some authors speculate as an intuition of today's computer technologies. [4]

Benjamin was convinced that the arcades were the most significant architectural form in the XIX Century and could be used as connection to numerous meaningful issues of his previous century [5]. The arcades constituted urban systems that disrupted the structure of traditional blocks in Paris. Those galleries expressed the irrational labyrinths opposed to the urban reasoning of the French capital. Their passages, with relatively narrow openings to the street, were covered with glass which filtered the day-light to the interior. Almost hidden during the day, they were really revealed at night when the bright lights from their corridors shone through the glass roof towards the somnolent city. The interior was a world in miniature. [2]

2.2. Rem Koolhaas: Manhattan's ghostwriter

Rem Koolhaas aimed to write a sort of manifesto for New York City. For Koolhaas, the manifesto for New York was never written because the city was generated in such a radical way that, to realize the ambitious program, it could never be openly stated. Thus, he took the responsibility to write down that "retroactive manifesto" and proclaimed himself as Manhattan's "ghostwriter." [3]

Rem Koolhaas declared that his book is

"a simulacrum of Manhattan's Grid: a collection of blocks whose proximity and juxtaposition reinforce their separate meanings." [6]

For him, each chapter – "Coney Island," "The Skyscraper," "The Rockefeller Center" and "Europeans" – relates to a block, which shows "the progression (and subsequent decline) of Manhattan's determination to remove its territory as far from the natural as humanly possible." [6] The text blocks with one-word section headings organize the structure of the material, which liberates the text to be often as flamboyant and spectacular as some of Manhattan's skyscrapers. Those blocks follow firm rules just like Manhattan's grid while the text is free for radical flights.

The limitation of the space in the grid had the result that

"one form of human occupancy can only be established at the expense of another. The city becomes a mosaic of episodes, each with its own particular life span, that contest each other through the medium of the Grid." [7]

The exploration of those episodes was a powerful tool to expose "Manhattanism." The episodes were not connected to families or personalities but to sites. The evolution of those locations is evidenced in the block between 33rd and 34th streets limited on the east by Fifth Avenue. That particular block housed in less than 150 years a virgin natural site, a farm with a barn and other houses, the Astor Mansions, the Waldorf-Astoria Hotel and finally the Empire State Building. The latter buildings became two of Manhattan's most definitive Skyscrapers, [3] and were erected only after the demolition of New York's former landmarks.

"Manhattan is the 20th Century's Rosetta Stone.

Not only are large parts of its surface occupied by architectural mutations (Central Park, the Skyscraper), utopian fragments (Rockefeller Center, the UN Building) and irrational phenomena (Radio City Music Hall), but in addition each block is covered with several layers of phantom architecture in the form of past occupancies, aborted projects and popular fantasies that provide alternative images to the New York that exists." [8]

This statement is the motto for "Delirious New York." His process is very similar to Benjamin's investigation of Paris' commercial passages to bring to light the city's "archetypal history." For Koolhaas, the skyscraper is a reduced and synthesized version of the whole Manhattan and Coney Island parallels its subconscious origin. Their study is an effective method to understand the city and also to reveal its hidden history, which is not documented in most historians' work. If Benjamin had political objectives to reveal Paris' hidden history, Koolhaas attempt to unveil the buried history of New York's buildings aimed to show up the culture that originated them or, in his own words, his book "argues that it often appears that the architecture generated the culture." [9]

The ingenious analysis that Koolhaas developed of the several architectural artifacts was his method to extract the transformation of society from those buildings materialization. Their projects' evolution, the unfolding of

the program, the decisions to hire some architects and their solutions often expose the rationale – or lack of it – for cultural changes. The configuration of a society become clear in the development of those projects and Koolhaas evidence it in the buildings he chose to investigate, particularly Coney Island and the Rockefeller Center. In those projects it is clear the development of a "megalomaniac ambition of the definitive Manhattan." [3]

2.3. Experiments on the representation of cultural history

Both books present particular literary structures. Benjamin's manuscripts were published as an assemblage of citations with few commentaries of his own. The method to elaborate that material was 'purely montage.' Those fragments should be displayed as they were, without any elaboration. His task was to show the smallest components that would allow the comprehension of the 'total event.' [2] The citations were taken from a huge variety of sources from the previous century and many from his contemporary intellectuals such as Marcel Proust, Paul Valéry, Louis Aragon, André Breton, Georg Simmel, Ernst Bloch, Siegfried Kracauer and Theodor Adorno. Extracted from their original context, those fragments were placed in a different setting where one would relate to each of the other as in a street congested with signs and store windows. [5] Walter Benjamin died during the World War II and it is not clear how his manuscripts published as the "Arcades Project" should be formatted. Whatever his intentions were, the rich material meticulously organized can be considered as a clear representation of one of the most significant research of our era's cultural history. It is evident that "underlying these fragmentary pieces of data and minute historical details, there is a coherent and persistent philosophical design." [10]

Koolhaas doesn't like the word fragment to define his analysis. He prefers to specify his method of writing as episodes. According to him:

"The great attraction of episodes [.].is that between them there is a space in which you don't have to make things and links. But which even so have an autonomous power if the episodes are well put together. It is not stated explicitly but the linking alone is enough to allow you to make things." [11]

As a way to facilitate the linking and searching, he placed one-word section headings, such as "Lobotomy," "Automonument," "Void" or "Ballet," before each block of text. Those headings powerfully synthesized his view of that theme and similar devices would appear in some of his later publications. Furthermore, the one-word headings facilitate searching and reading episodes and text segments separately.

Although very different in their conception, both books resemble hypertext systems structured by pieces of texts, which can be read independently. Benjamin also developed a very complex method for cataloguing the historical citations. He used different codes to facilitate the retrieving of information. He also photocopied them a few times to keep more than one version of that colossal work. It is hard to imagine that Benjamin wouldn't use a digital database were he to be developing his project today. Besides that, he would probably use a hypertextual structure to make it available to the readers.

The literary structure used to analyze the two cities' history facilitates the presentation of some of their different aspects. It is also interesting to notice that in both cases, the act of reading is similar to the process of experiencing the city: a patchwork of juxtaposed layers of information, which are combined by the readers as they progress in their 'experience.'

In our research project we have attempted to reach some of the main objectives of both works, by Koolhaas and Benjamin. If Koolhaas analyzed several specific and celebrated buildings from Manhattan, Benjamin concentrated his work in one commercial typology in the city of Paris. Both Paris and New York's cultures were dissected by means of the history of those buildings and the cultural changes they conveyed. Similarly, the research group of UFRJ identified buildings that represented significant places and periods in the city of Rio. The outcome of our research project, however, is clearly defined by the use of electronic technologies, particularly the 3D models and hypertext. Like the arcades' and the skyscrapers' analyses, those of Rio's urban icons conception were confirmed as powerful material to understand different moments in the city history.

Koolhaas' and Benjamin's works demonstrated that the search for new forms to represent the history of the cities through a non-linear document were not initiated with the advent of electronic technology. Furthermore, they introduced theories and techniques that can be enhanced with the use of tools that were not available when they developed their projects. The approach of displaying the history of Rio de Janeiro in the XX century through the analysis of different buildings using digital tools such as 3D models and hyperdocuments is the main goal of our investigation. 3D models and hyperdocuments are the instrument to unify and connect those buildings spread through space and time. Koolhaas' and Benjamin's arguments provided to the readers the connections to the discontinued pieces. Electronic technology allows the construction of different arguments,

by the author and also the readers, to put together the material available. Hyperlinks and spatial digital models facilitate the connections among the separated parts.

Another important aspect of the digital analysis is the augmenting importance of images for the representation of historical facts. Images are very powerful to reveal the culture of past societies. They are also valuable for giving more autonomy to the readers to elaborate their own interpretation of the facts. Furthermore, 3D models can display graphical representations that are not possible through photographs. Several aspects related to buildings and urban spaces are better apprehended through 3D models. Therefore, electronic technology delivers new forms to represent and apprehend cultural history, particularly when related to urban history.

3. The investigations carried out at LAURD

In the same way as Benjamin and Koolhaas searched for the actual and concrete – through the commercial galleries in Paris and the "architectural contests" in Manhattan's regular grid – to the investigation of both cities, we focused the analysis of the city of Rio de Janeiro through the urban and architectural icons. The use of a hyperdocument as the vehicle for the research analysis and 3D models as indexes to display the collected information, confirmed to be powerful solutions throughout the research process. Furthermore, if the icons are representations or images of the forces that acted in a specific moment and location, the investigation of the icon proved to be an effective method to study and understand those forces. Significant aspects of the city history can be revealed through that analysis.

The inventive structures created by Benjamin and Koolhaas to raise deep cultural analysis brought about an innovative form of representation through a traditional support: books. Additionally, they also displayed characteristics usually embedded in digital projects, such as large-scale database, small blocks of texts and close relationship with images. Even though Benjamin's book doesn't include many images, he collected several of them that were not printed in the publications of his work. Besides that, he stated that he aimed to portray, through his quotations, images of that time. We may conclude that digital techniques can also be applied to facilitate the understanding of a past society.

Buildings and urban spaces most often display the characteristics of a society that originated them. Besides that, once they are erected and inhabited, they influence the community and its cultural production. On the other side, several digital projects demonstrate that Information Technology provides powerful tools to analyze architectural artifacts. Therefore, digital tools give forth new possibilities to the manipulation and communication of that material raised by building analysis.

One of the main objectives of the research group at the Laboratory of Urban Analysis and Digital Representation (LAURD) is to explore those new possibilities. It is important to keep the focus into the content and the most creative and appropriate way to convey it. In this context, the study of Koolhaas' and Benjamin's works is critical to provide a distance to evaluate Information Technology and its potential. The exploration of new technology usually leads towards testing and stretching new resources. This process often distracts from the goal of finding the best way to carry the message. A simpler method applied creatively is frequently more effective than the most recent, expensive and complex technology. Therefore, previous experiences, even analogical ones, should also be used to support digital investigations.

LAURD researchers explore 3D models as tools to understand the evolution of significant projects and to display those analyses. Reconstructing changes throughout the design process highlight significant decisions taken by those involved in the process. 3D models are useful for this task as they facilitate matching design versions among themselves and allow the visualization of those versions that were not built. Several questions related to the building construction evidence also other broader issues that help the comprehension of a society. An analysis, for example, of the design evolution of a ground floor displays the relationships between the building and cars, pedestrians or its neighbors. Furthermore, it can evidence public and private conflicts, political disputes and even predominance of different social groups.

Another meaningful issue is how buildings related to the existing city. LAURD researchers have developed a complex 3D model of the city evolution and its main constructions. That model proved to be a significant device to understand the process of the city growth. It can locate the most important buildings in the city grid, evaluate its proximity to other elements and several significant aspects of the city configuration. The representation of the landscape, for example, is critical for this research project due to the history and the characteristics of the city. Rio de Janeiro's growth was always driven by the relationship with the natural landscape and its comprehension is much clearer when visualized through 3D models. Sometimes this relationship required a defensive or effortful attitude by the city dwellers and other times the natural assets supported many urban enterprises. Thus, mountains and waterfront were several times changed over history to conform to major

urban changes. Infills and hill removal are not uncommon in Rio's urban evolution. Besides that, the city dwellers always used the waterfront and the mountain as guiding resources or references for places. (Figure 3) The city model has the ability to display just a few selected elements that compose it. One can understand how changes in the natural resources affected the street configuration by visualizing just the topography and street network in different moments.

Visualizing 3D models of urban areas as well as individual buildings allows one to isolate some of their aspects while removing others, which are not significant for that analysis, from the screen. Those aspects can be viewed separately or in the complete model within the overall context. Facts such as the spatial changes of social groups or a particular construction technique can be compared with other aspects in the overall context and, at the same time, separated from the other components. A significant advantage of 3D digital models over traditional methods is the potential to simulate, with great precision, several alternatives in a shorter period of time. Once 3D models are constructed, it is possible to render several images from a variety of points of view or different selections of the model components exhibited. (Figure 4) Therefore, it is possible to simulate the "small particular moments" searched by Walter Benjamin.[2] Furthermore, the digital representation of those images, may allow one to understand the overall historical events.

3.1. Rio de Janeiro and The Ministry of Education Building

Our investigation of Rio de Janeiro's history started by looking at the acclaimed building of the Ministry of Education in the City Center. We assumed that significant buildings usually reflect meaningful aspects of the city. Benjamin, for example, searched for subjects related to Paris' arcades because those buildings were originated in the first half of the XIX century, become very important and, by the end of the second half, were replaced by new typologies that were associated with industrial goods. The rise and decay of those public buildings displayed also the changes that affected the Parisians in that century.

Similarly to the Parisian arcades, the rich history associated with the design process of the Ministry of Education Building and the productive cultural moment of the city were decisive to the choice to investigate that building. (Figure 5) Some of the most distinguished Brazilian architects took part in the project, which resulted in the most representative example of Modern Architecture in the country. Although the majority of the city inhabitants ignore those facts, the analysis of its genesis exposed episodes which have continued to influence the city and its dwellers until today.

The projects presented in the design competition organized by the Ministry exhibited the opposition between the leading architectural trends, the Beaux-Arts group and the emerging Modernists. Modeling the most significant proposals was decisive to understand the transition towards one of the most important moments of Brazilian Architecture. Through the models it was possible to identify the volumetric composition, configuration of entrances and circulations and the location of the building on the site. The proposals demonstrated the evolution towards a refinement of Modern Architecture and their analysis dissected that transformation and how it influenced the way the architects designed their solutions. The design competition for the building presented significant proposals with very different representations. The 3D model was an effective instrument to set every proposal to a standard representation facilitating comparisons between them and in relation to the context, inserted in the 3D city model. (Figure 6)

An analogous solution was adopted for the final scheme evolution until the actual construction. After the selection of the team of architects that would develop the project, several proposals were elaborated. Although the architects involved in the project were quite young, they became some of the most recognized Brazilian Modern Architects. Lucio Costa, Afonso Reidy, Jorge Moreira, Carlos Leão, Ernani Vasconcellos, Oscar Niemeyer and Roberto Burle Marx composed the team. Besides that, Le Corbusier came to Brazil and elaborated two intermediary proposals. (Figure 7) When Corbusier returned to France, the Brazilian team presented a new proposal, which was based on their first scheme, and the two which Corbusier developed. With this last project the construction was launched with some changes, such as the addition of some office floors and the redesign of the ground floor. [12] Thus, five different schemes were modeled and explored in the project evolution analysis. Each scheme was evaluated through the 3D models based on different categories related to the main parts of the building: such as site location, ground floor, galleries, theater, office floors, gardens or the square. Since all five solutions had those parts clearly defined, it was easier to structure the analysis in that way. Thus, issues such as relationship with nature or the city, monumentality or relationships between public and private could be verified by the location of those building parts in each project. Moreover, the 3D model was very effective in displaying those relationships. (Figure 8 and Figure 9)

If the building project exhibited several proposals, the building's urban environment had been the stage setting

The development of 3D modeling and authoring software has significantly evolved in the last fifteen years. Current low-cost desktop computers are able to manipulate fairly complex models and edit sophisticated hyperdocuments. However it is very rare to find projects that merge advanced techniques with high quality content. It is even more difficult to see products that can really benefit from those new possibilities to transmit content in a way that was not possible with traditional tools. The investigation of literary experiments can be a powerful source for the development of academic digital investigations. Following this direction, Benjamin's and Koolhaas' books were particularly significant. They present parallel subjects in a revolutionary structure to convey a creative and meaningful content. In addition to that, their revolutionary structures raise several issues that are also found in our digital analysis. Therefore, a thorough study of their work should be considered a primary support for the careful evaluation of our own investigation.

Benjamin is considered today, as one of the most important thinkers of the XX Century. It is hard to compare a project in which he concentrated most of the last thirteen years' efforts of his life to any similar individual intellectual enterprise that would be developed nowadays. The value of his work is not restricted to the structure he created but is due mainly to the excellence of the material he collected, which connects the commercial galleries and Parisian culture.

The scale of Koolhaas' work is not parallel to Benjamin's, since his research did not intend to last the same period of time and cover such a broad range of themes. However, it is no less creative and significant to our investigation. Koolhaas' argument to investigate the construction of the celebrated Manhattan's buildings is closer to our architectural approach and analogous to the analysis of the design process of Rio's icons.

Rio de Janeiro's hypertextual exploration is based on images of each phase of the process which shapes those icons. That exploration aims to bring to mind the research carried out by Benjamin and Koolhaas. This objective can be expressed in Susan Buck-Morss' statement that:

"..each of these 'small, particular moments' was to be identified as an ur-form of the present. Benjamin's commentary, in which those facts were embedded, provided the rivets that allowed the fragments to cohere as the philosophical representation of history as a 'total event.'" [13]

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