2000 Years of Town Planning in Vienna

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Abstract: Around 2000 years ago, Roman legionnaires planned and built their military fortress upon today's city terrain according to a customary and trustworthy scheme. Due to the arrival of natives and Roman citizens, further settlements, which were constructed more or less systematically, came to exist in the whereabouts of this legionnaire fortress. On these Roman walls and on some sparse remnants from the early middle ages, the cosmopolitan city of Vienna was erected.

In cooperation with the Board for City Planning, strategies were developed to conserve the historical assets of this city for the coming generations. For this reason, a Land Registration Project for Cultural Assets, which is part of a Protective Zone Project, was elaborated for the City of Vienna. This land register has been available in the Internet since Autumn 2000 (http://service.wien.gv.at/kulturkat/). In addition to buildings worth conserving and pin-pointed protective zones, all known archeological sites of the city have been included in this GIS-application of the municipal authority.

Key words: Stadtarchäologie Wien, Cultural Heritage Land Register, GIS, Roman fortress, Gemeindeberg, Seniorarchäologie

Introduction

In a time when our cultural heritage is being destroyed by carelessness, greed, religious fanaticism and other evils at an increasingly alarming rate, it is absolutely necessary that not only the people from historic monument protection agencies and archeologists, but also city planners develop strategies to counteract these developments. To this end, it is important that these people be informed of the historical development of sites, settlements and subsequent cities. Archeology can not only be practiced in relation to a site or a time period, the entire cultural surroundings need to be observed and brought together in one unit. In this regard especially, the Stadtarchäologie Wien, in cooperation with various municipal departments of the city of Vienna, such as the EDP-department, City Surveying, City Planning and the City Archive, is attempting to pave new paths in archeology with the help of computer applications and the Internet. Only those cultural treasures that are known, can be protected.

Morphological and historical background of Vienna

Geographically Vienna can roughly be divided into 3 parts: the area north of the Danube River, the terraced landscape south of the Danube and the wooded hills of the Wienerwald in the west. The Vienna Basin provides an excellent environment for settlements and has therefore attracted settlers since prehistoric times.

The Danube served as an east-west-highway for water transport. Fords, with which the branched-out Danube could easily be crossed, provided an ideal north-south-communication.

The area south of the Danube with its terraces formed by the ice ages and rivers, in particular, was very inviting to settlers. The northern part of Vienna, the present day 20th, 21st and 22nd districts, is less favorable for settlements because of its morphological features (fig. 1). The area has no terraces and the height-differences are negligible. The constantly changing riverbed of the Danube before its regulation and the formation of new branches has largely destroyed all evidence of settlements.

It can not be said with certainty when the first settlers reached the Vienna basin, however, the first traces of settlement can be dated back to the Neolithic (Franz/Neumann 1965). Traces of early settlements can be found especially along the streams that led to the Danube River, such as the River Wien and the Ottakringer Stream, as well as in the valleys of the Wienerwald. These places were also sought out for settlement in the following time periods as well. The hills of the Wienerwald (Urban 1999), the southern region of the present day city and the region north of the Danube River were also settled (Holzer 1989).

Around 2000 years ago, Roman legionnaires planned and built their military fortress upon today's city terrain according to a customary and trustworthy scheme (Mosser 1998). There they found a relatively flat platform which was protected by brooks and rivers, and was therefore ideal for building a fort. Due to the arrival of natives and Roman citizens, further settlements, which were constructed more or less systematically, came to exist in the whereabouts of this legionnaire fortress. The civilian town (Zivilstadt) was built in today's third district (Mader 1998). Roman Villas and smaller towns could be found near further watercourses.

On these Roman walls and on some sparse remnants from the early middle ages, the cosmopolitan city of Vienna was erected.

Public Access to Heritage

The continuing development of the Internet, and associated technologies, is matched by an equally rapid growth in new business approaches to its use. In the Heritage industry this growth is dominated by a desire to make material more widely available and a corresponding necessity to find practical, efficient and usable ways to do so (Pringle 2001:329).

In the year 1993, the vice president of the United States of America, Mr. Al Gore, declared the "Super Information Highway" to an object of national concern. Only one year later, the European Commission labeled this era as the "Age of the Information Society". In summer 1999, the Austrian Government therefore introduced an initiative with the name of "Go on! Österreich ans Internet" in order to shape up the Austrian population and all Austrian enterprises in terms of these new Information-Technologies (Willenpart 2000:187).

The City of Vienna, on its part, has been attempting to reach its citizens and offer them services such as the "virtual information centers" since the year 2000 with its project "E-Vienna". An integration with cultural services and information is also planned for the near future.

It seems that we are now in a changing process comparable to the Industrial Revolution of the 19th century which had a deep impact on the economic and social structure of that period. Today, continued education and advanced training for the citizens have become a major topic for not only the different national governments but also on a European level. These new information and communication technologies are the primary cause for the momentary developments in the economy and society, as well as the means for surviving the rapid changes occurring in all branches of business. The Internet offers every organization, large and small, an opportunity to increase the dissemination of their information.

The Cultural Heritage Land Register

For the development of usable, computer-based, information systems, it is imperative that pre-implementation research is conducted into the available information, as well as the available delivery system. Understanding of any specific information set necessarily requires understanding of information at a slightly higher level, where it can best be described in terms of its part within a larger, user-centered process (Pringle 2001:329).

O'Brien and Polovina (O'Brien/Polovina 1997) give two definitions of information: the first suggests that information results from emphasizing salient features of data; the second, that information is the organization of data trends into a form that can be understood in a broader context and communicated as potential knowledge to others. In both cases it is essentially the interpretation placed on data that transforms or develops said data into information. Information by its nature, is primarily concerned with interpretation (Davies/Ledington 1991)

To provide prepared information to interested citizens, economical and political decision-makers, educators and subsequently to everyone who is interested in history and the cultural development of the City of Vienna through the ages, is the goal of the Cultural Heritage Land Register. This register of cultural treasures, which was created in cooperation with the municipal departments mentioned above, has been available in the Internet since fall 2000 (http://service.wien.gv.at/kulturkat/). The register contains information from the City Planning Department (objects worthy of protection and protected areas), the "Altstadterhaltungsfonds" (Downtown Preservation Fund) (Jugendstil buildings), as well as objects from the Stadtarchäologie Wien (archeological sites, map of the Roman legionary fortress and the Zivilstadt, and the Franziszeischer Land Register).

Technical Details of the Database for Cultural Heritage

Hardware:

- Web-Server, MapObjects-Server: NT-Workstation, Dual-Pentium, 350MHz
- Development computer MapObjects- / WEB-Application: NT-Workstation, Pentium 266MHz
- GIS-Data-Server: Unix-Workstation Bull Estrella 300 (PowerPC 604, 166MHz)
- GIS Arc/Info (GIS-Applications for processing data): Unix-Workstation Bull EscallaT (4 220MHz CPUs, 1Gb)
- ORACLE-Databank (Addresses, data concerning units such as information in order to pin-point findings and further more): Unix-Workstation Bull EscallaT (4 425MHz CPUs, 1Gb)

Software:

- Geographical Information System Arc/Info (from ESRI) for the processing of data
- MapObjects (ActiveX-Control) for the presentation of GIS data (from ESRI)
- ArcIMS as an Internet connection (from ESRI)
- VB in order to program the WEB-Application "The Cultural Heritage Land Register", using MapObjects
- ORACLE-Databank for address-search + storage of fact data of GIS data (Geometry)
- Web-Server: MS-IIS

Function of MapObjects-Server / WEB-Application:
VB-Program with embedded ActiveX-Control MapObjects and a WebControl (ArcIMS) as an Internet connection, functioning as a service (momentarily as NT but soon as Windows2000 in the "The Cultural Heritage Land Register"). WEB-Application is Frame-controlled and uses Client-side JavaScript (such as co-ordinate indication) and Server-side ASP-pages (such as the first page of the application). The fact data of the geometrical objects are to be found in the ORACLE-Databank – access to the Databank-Server possible via ODBC (SQLNet). Statistics of access are included in ORACLE .

Archeological Contents of the Cultural Heritage Land Register

The Cultural Heritage Land Register is still in development, and it should thus be noted that there are still some changes to be made regarding the application's user-interface and user-friendliness.

Archeological Content:

- Archeological sites: The archeological sites of Vienna that are linked with the so-called "site database" are marked with green triangles. A short description can be called up for each or the currently 1,375 sites which includes the address, year of the excavation/find recovery, the time period, description of the find situation and the finds. Further links are not yet available, but are being prepared.
- Maps of the Roman legionary fortress and the Zivilsiedlung: The maps of the Roman settlements, created with AutoCAD R14 and AutoCAD-Map 2000, were integrated into the application as Shape-Files. Expansion is also planned here for the near future as well. The ultimate goal is to put all of the excavation maps, fully prepared and with links to click for further information, into the Net.
- Franziszeischer Land Register: This land register, carried out by order of Emporer Franz I of Austria in 1820 (Fischer 1995), will be available for all of Vienna in digital form by the end of 2002. Its current form as a line graph will also be altered so that users will be able to click on objects in the Franziszeischen Land Register to receive information (Börner 2001:151f.).

Models

As mentioned in the section above, an expansion of the Cultural Heritage Land Register is planned and has already begun to some extent. This expansion will roughly follow two branches that will nevertheless cross paths again and again. One branch will be the intranet for the archeological colleagues of the Stadtarchäologie Wien, in which all the available information and analyses for each site will be prepared, and ultimately sent on to the second branch, the Internet. This data will then be complimented with data from other municipal departments such as the City and Provincial Archives, City Planning and data which has been gained from interested laypeople and students. The following describes three projects that, to some extent, are still in the planning phase. These projects use quite a few GIS-processes such as Distributional Analyses, Predictive Modeling und Viewshed Analyses (Constandinidis 2001).

Model 1: Citizens Write History Themselves!

For some years now, the "Senior Archeology Campaign" has belonged to the scope of responsibility of the "Stadarchäologie". This campaign was conceived in December 1994 within the framework of the research group Wiener Stadtarchäologie (Strohschneider-Laue 1998a), and was created to ensure that archaeology be available for everyone, and not just the professionals.

In contrast to the "Junior Archeology Campaign" (Strohschneider 1998b), "Senior Archaeology Campaign" is designed for those over 18 years of age. Thus the term "senior" is rather to be understood as an honorary title and not a reference to age.

These volunteer helpers support the work of archeologists through working at excavations, cleaning, labelling, and in some cases, restoring finds, (special training courses are offered at the "Volkshochschule" (community college) Meidling in the Vienna's 12th district (Kleinecke 1998)), as well as through help in the preparation of exhibits. The people who are interested and participate in the "Senior Archeology Campaign" are between the ages of 19 and 89, with the average age being between 50 and 70. The professional background and interests in archeology and history of the participants are as varied as their ages. Together with a group that is interested in the historical development of the City of Vienna, a project has been started entitled "Citizens write history themselves!" and has meet with great interest on a city political level. The above mentioned Franziszeische Land Register serves as a basis for this project. The following provides some background information as to the history of this land register.

It was under the rule of Emperor Franz I of Austria that the legislative and technical hindrances were cleared away in order to commence with big changes. One can truly say that it was due to his land tax patent from the 23rd of December 1817 that he founded the main land register of Austria. The basic ideas of this patent are still valid today. This land register, named after its originator, was also said to be a "stabile" land register because the net profit rate, which was crucial for the rating of taxation, was to be stabilized without giving consideration to higher productivity or diligence except to cases in which the fertility of the earth was destroyed by natural phenomenon. The land register was developed for the city of Vienna in the years 1819 to 1824.

Today, many churches, palaces, garden compounds, cemeteries and industrial areas can be found on the map which no longer exist.

The objects that have vanished often only remain as a street name. The question "What was here before my house was built" is only one of the many questions that this project should help to answer.

The historical development of the different districts of Vienna can be traced back by superimposing this land register onto the newly developed electronic city map of today's city. With the help of the "Senior Archaeology Campaign" and the support of the district museums, a database is being developed in which these structures are contained. According to this project, citizens interested in history will be able to gather historical data, such as literature, plans, pictures and photographs, about their home district and feed it directly into a database. The material will then be examined by historians and finally connected through the address code with the proper building site.

A simple click on a modern city map or the Franziszeische Land Register will then answer many questions concerning the historical development of the City of Vienna. It is easy to imagine the various directions in which this project can expand. It would be entirely feasible to include commercial interests as well, for example the history of traditional inns or cafés, of which quite a few still exist today, and to provide from this culturally historical link a link to the actual business homepage where the user could find addresses and even menus of the businesses. In a further developmental step, it is also planned to enlist the help of schools.

Model 2: Hidden Cultural Strata in the Area of the Roman Legionary Fortress Vindobona

A further project which is currently in the planning phase is the digital elevation model with predictive modeling characteristics of the Roman legionary fortress, which was located in Vienna's present day first district.

In this model, which was also started in the legionary fortress of Regensburg a fairly long time ago (Huber 2000), it is our aim to find out how far it is possible to make predictions concerning the structure of the Roman terrain in the region of the legionary fortress Vindobona.

The theory behind predictive modeling is that human behavior is patterned; therefore, locational behavior – that is, where sites or settlements are located throughout the landscape – should exhibit non-random tendencies. The basic theory behind the development of an archaeological location model is that if tendencies or pattern exist between site locations and one or more regionally distributed variables, then a model can be constructed through the exploitation of those tendencies (Brandt/Groenewoudt/Kvamme 1992:269).

The main aim of this archaeological topography is a reconstruction of the Roman terrain in the form of a map which is based on the determination and mapping of remaining cultural strata unto areas which have been disrupted by the construction of cellars and other forms of diggings.

Material origin:

- Site databse of the "Stadtarchäologie Wien", which among other information contains the elevation of sites.
- Cultural Heritage Database. This database also provides information as to whether a house has a cellar or not. Most of the houses in downtown Vienna have cellars, and sometimes as many as four, one over the other. Due to the lack of space before the city walls were torn down in 1860, it was necessary to store many things such as food, heating material, wine and much more in cellars. The servants also usually lived in the first level of the cellar. Many cellars were also extended, in true mining fashion, beneath the city streets. Thus it came to be that the cellars joined one another. This cellar system was used as a bomb shelter during World War II. The myth that it is possible to go from St. Stephan's Cathedral to Palace Schönbrunn is also most certainly based on the extensive cellar system.
- Building-age plans from the City Planning Department
- Drill-holes done by the Geological Department of the City of Vienna – through these drill-holes, of which there are around 1,000 from the area of the legionary fortress already, the thickness of modern and historical strata can be obtained.

The Roman surface in the area of the legionary fortress:
When settlements occupy the same area for several centuries, traces of buildings and activities may accumulate to such extent that original distinct patterns and structures become totally obscured (Holst 2001:159). Since the arrival of the Romans in Vienna's present day first district, the city has gone through many fundamental changes and many old building structures have been destroyed and rebuilt. Many of these renovation phases are undocumented. It wasn't until the 19th century that scientists became interested in the historical settlement structure of Vienna, which reaches back to the Romans. A true building boom was set off at the end of the 19th century by the fall of the city walls, which had restricted the expansion of Vienna until 1860. During this period of extensive building, many archeological remains were unearthed, and thanks to the first urban archeologist Josef Nowalski de Lila, they were in part documented (Stipanits 1998; Börner/Mosser 1996).

Initialized by the construction of new buildings, works for the channel system, underground garages and other strata disturbing measures, historically precious objects have been recovered and some arranged archeological excavations have been accomplished. The results, which have been collected in the form of lay-out plans, strata drawings, profile drawings and descriptions, excavation diaries and often enough simple sketches and draft-mappings, are being evaluated while keeping the following questions in mind:

Was the bottom of the Roman strata reached during the excavation? If the bottom stratum was reached, how far above sea level was it?

If the bottom of the last stratum was not reached, other criteria will be necessary in order to establish the bottom height none the less. According to experience, the first Roman buildings are to be found just above the upper natural strata. The upper edge of the natural strata could therefore be useful as an indicator for the bottom edge of Roman settlement. If for example the results of an excavation were a Hypocaustum, one could expect from experience that the object was built around 0.05 m deep into the natural strata.

The next step will be to synchronize the mapped objects of the legionary fortress with the patterns determined from the samples taken out of drill-holes as well as the land register for cellars. Luckily the conduit-maps are already installed in our computers, making it easy to scrutinize the information in this regard as well. With all these mappings, a digital terrain model can be established showing Vienna's Roman topography.

With the help of this model, it might indeed be possible to predict in certain circumstances whether or not planned construction work might encounter Roman strata (Börner/Öllerer 1998).

Model 3: Viewshed-Analysis of Prehistoric Settlements

In the last decades the prehistoric age has not been treated with the necessary interest. Lately the attitude has changed, even though it is still very hard to develop a settlement scheme for each period in a city as densely settled as Vienna, the federal capital of Austria. As a substitute we can, however, present the early Neolithic period settlement on the so-called "Gemeindeberg", meaning community hill, in the "Wiental", the name referring to the valley in which the river "Wien" flows into the 13th district of the city of Vienna.

Along the "Wiental", excavation findings from early history, prehistoric, Roman and middle age settlements are densely lined up one after the other. The "Gemeindeberg" (320 m above sea level but only 164 m in relative height) is part of the Jura-cliffs which suddenly appear between the regions of "Lainz" and "Ober-St.Veit" on the edge of the sandstone-zone in the 13th district. Since the sloping terrain drops towards the northwest, northeast and southwest quite steeply and the northwest hillside is flanked by the river mentioned above, this place is of special strategic value for its inhabitants. A further advantage found here is the abundance of Jasper and Flint (Chert).

The first excavation was done in the years between 1880 and 1924. It seemed then, that the complete northern hillside had been settled. The huts, which had been partially lowered into the earth itself, showed remains of one or two stake holes reinforced by several stones. The quantity of the findings too, where opulent.

This project was carried out in cooperation with the Surveyor's Department of the City of Vienna. The first step was the creation of a digital elevation model for the excavation area, were, as will be discussed later, the first difficulties arose.

Since quite a few Neolithic places have been discovered in the "Wiental", it is hoped to use the very controversial "Viewshed-Analysis" to clarify eventual correlations between the sites. This tool is closely associated with the human capacity of sight, and together with relative ease of application, results can be achieved which have clearly appealed to many different archaeological research agendas over the last decade (Tschan/ Raczkowski/ Latalowa 2000). The problem with this kind of analysis for Vienna and the surrounding Vienna Woods (including the Hallstatt and La Tène aged settlement on the hill "Leopoldsberg" including the surrounding hills), is that only very few topographical maps actually exist, and the few existing maps can only be evaluated very poorly by a GIS system such as IDRISI.

By the end of the year 2002, however, the city limits of Vienna will have been surveyed with a 3D-Laserscanner from the air (Dumfarth 2001), a process which has already proven successful during its first trials in the town of "Klosterneuburg".

3D-Laserscanning:
3D-Laserscanning functions by means of cooperation between a laser and a sensor. To describe it in general, the investigated object, such as a house, a cliff or a street, is scanned by a net of impulses from a laser. The impulses are reflected by the investigated object and immediately recorded. The position of each point of the object to the scanner is calculated by the time the signal needs and the angle of the transmitted impulses. Each second, up to 6,000 points can be surveyed allowing the recording of a large area in only a few minutes. The degree of accuracy varies by only several millimeters or centimeters. By including 4 geodetically measured coordinates, the entirety of 3D points collected can be transformed into any geodesy coordination system needed.

- maximal reach:
  2 to 350 m for natural objects with a reflectivity of approx. 50 %
  until 150 m for natural objects with a reflectivity of approx. 10 %
- minimal reach: according to type; 2 m
- Precision of the survey: 3 according to type +/- 2.5cm
- Scan density: 42.5 cm
- Velocity: up to 6,000 points per second

With this system it is also possible to fade out interfering buildings or vegetation.

Result:
With the raster data currently available, an initial analysis was made, whereby it became clear that in addition to the very incomplete topographical maps of Vienna, it would be necessary to include data from older map materials that to some extent also included topographical information and to include them as well as aerial pictures in the analysis. A truly exact analysis will not be possible until the 3D-Laserscanning has been carried out.

Prospects and Further Application Possibilities of the Cultural Heritage Database

The possibilities that the Cultural Heritage Land Register has to offer are manifold and open to virtually every area of archeology and cultural history. Subsequently, a web portal is being planned for the culture and history of Vienna. The Cultural Heritage Land Register will also serve as a basis for this portal. The number of hits in the Internet alone shows that the public is greatly interested in this application. One week after the application was brought on line, it was receiving 12,000 to 15,000 hits a week, currently the number of hits per week fluctuates between 4,000 and 8,000. The Stadtarchäologie Wien sees in this application a possibility to reach the general public, students, decision-makers, city planners and tourists and offer them and introduction to the history and culture of Vienna, thus raising the acceptance level of the population for our profession.

By incorporating modern technology such as Virtual Reality or GPS-systems, a wide range of uses are created for the application. Who would have thought even a few years ago that it would be possible to tour Vienna with a computer in their hand and be able to plan an individual sightseeing route? I am sure that not even Chenhall imagined such things when he wrote down his vision 31 years ago:

"When the anthropologist begins a research project his first step will be to query the databank, through a remote terminal

(probably located in his office) in order to obtain a printed list of all references on the topic or a listing of ethnology or archaeology of a specified area, together with whatever other data he may think he will need in carrying out his project" (Chenhall 1971, 159).

This project has a long way to go and a number of as yet unknown hurdles to overcome before it is complete, but nevertheless one of our duties, in addition to our daily work, must be to keep the general population informed of the developments in our field. Information is for everyone and should be shared, but information is only interesting if it is prepared and presented correctly.

References

Börner, W. 2001. Vienna Archaeological GIS (VAGIS): A short Outline of a New System for the Stadtarchäologie Wien. In: Z. Stancic/T. Veljanovski, *Computing Archaeology for Understanding the Past (CAA 2000), Proceedings of the 28th Conference, Ljubljana, April 2000,* BAR International Series 931:149-152.

Börner, W./Mosser, M. 1996. Von der 100-jährigen Karteikarte zum Plan des Legionslagers. In: *Forschungsgesellschaft Wiener Stadtarchäologie (ed.) Workshop 1 – Archäologie und Computer:9-20.*

Börner, W./Öllerer, Ch. 1998. Der „Archäologische Kataster" im Rahmen des Schutzzonenprojektes der Stadt Wien. *FWien 1*:64-66.

Brandt, R./ Groenewoudt, B. J./Kvamme, K.L., 1992. An experiment in archaeological site location: modeling in the Netherlands using GIS techniques. In: *World Archaeology Volume 24 No. 2, Analytical Field Survey*, Routledge:268-282.

Chenhall, R.G. 1971. Computers in anthropology and archaeology. New York: *IBM Coporation Publication No. GE 20-0384*, 156-161.

Constandinidis, D. 2001. Introspective Sitescaping with GIS. In: Z. Stancic/T. Veljanovski, *Computing Archaeology for Understanding the Past (CAA 2000), Proceedings of the 28th Conference, Ljubljana, April 2000*, BAR International Series 931:165-172.

Davies, L.J./Ledington, P.W.J. 1991. *Information in Action*, Macmillian, England.

Dumfarth, E. 2001. Terrestrische 3D Laserscanning: Real World... Scan data...3D-Modell.. In: Schrenk M. (Hrsg.), *Beiträge zum 6. Symposium zur Rolle der Informationstechnologie in und für die Raumplanung*, Wien:165-169

Fischer, K. 1995. Streiflichter auf die Wien-Kartographie der letzten beiden Jahrhunderte. In: Fischer K. (ed.), *Das ist die stat Wien*, Wien, Wiener Geschichtsblätter, Beiheft 4:38-45.

Franz, L./Neumann, A.R. 1965. Lexikon ur- und frühgeschichtlicher Fundstätten, Wien.

Holst, M.K. 2001. Formalizing Fact and Fiction in Four Dimensions: A Realtional Description of Temporal Structures in Settlements. In: Z. Stancic/T. Veljanovski, *Computing Archaeology for Understanding the Past (CAA 2000), Proceedings of the 28th Conference, Ljubljana, April 2000*, BAR International Series 931:159-163.

Holzer, V. 1989. *Die latènezeitlichen Siedlungs- und Gräberfeldfunde aus Wien XXI und XXII (Leopoldau und Aspern)* [unpubl. Diss Univ. Wien]

Huber, I. 2000. *Verborgene Kulturschichten im Bereich des römischen Legionslagers Castra Regina*, Regensburg.

Kleinecke, G.. 1998. *Wenn Tonscherben wieder zu Gefäßen werden: Keramikrestaurierung mit der Unterstützung von SeniorarchäologInnen.* FWien 1:48-51.

Mader, I. 1998. *Die EDV-gestützte Erfasssung der archäologischen Fundstellen im 3. Wiener Gemeindebezirk.* FWien 1:89-97.

Mosser, M. 1998. *Das Legionslager Vindobona – EDV – gestützte Erfassung alter und neuer Grabungen.* FWien 1:74-78.

O'Brien, S./Polovina, S. 1997. Web Design and Information Architectur, *Proceedings of the Sixth International World Wide Web Conference, Santa Clara, California, USA, April 7-11, 1997.*

Pringle, M.J. 2001. Using Virtual Reality to Imporove Public Access to Heritage Databases over the Internet. In: Z. Stancic/T. Veljanovski, *Computing Archaeology for Understanding the Past (CAA 2000), Proceedings of the 28th Conference, Ljubljana, April 2000*, BAR International Series 931:329-337.

Stipanits, U. 1998. *Über 100 Jahre handschriftliche Fundmeldungen und ihre EDV-gestützte Erfassung.* FWien 1:67-73.

Strohschneider-Laue, S. 1998a. *Über die Unbezahlbarkeit freiwilliger Helfer.* FWien 1: 38-43.

Strohschneider-Laue, S. 1998b. *Initiative Juniorarchäologie oder: Wieviel Archäologie braucht die Schule.* FWien 1:44-47.

Tschan, A./Raczkowski, W./Latalowa, M. 2000. Perception and Viewshed: Are the mutually inclusive? In: ####

Urban, O.H. 1999. Der Leopoldsberg. Archäologische Forschungen auf dem Wiener Hausberg. In: *Wiener Archäologische Studien, Band 2 (Hrsg. O. Harl)*, Wien.

Willenpart, B. 2000. Stadtplanung im Internet – Möglichkeiten internetgestützter Bürgerinformation und Bürgerbeteiligung in österreichischen Stadtplanungsämtern. In: Schrenk M (Ed.), *Beiträge zum 5. Symposium zur Rolle der Informationstechnologie in und für die Raumplanung.* Wien:187-192.

Figures

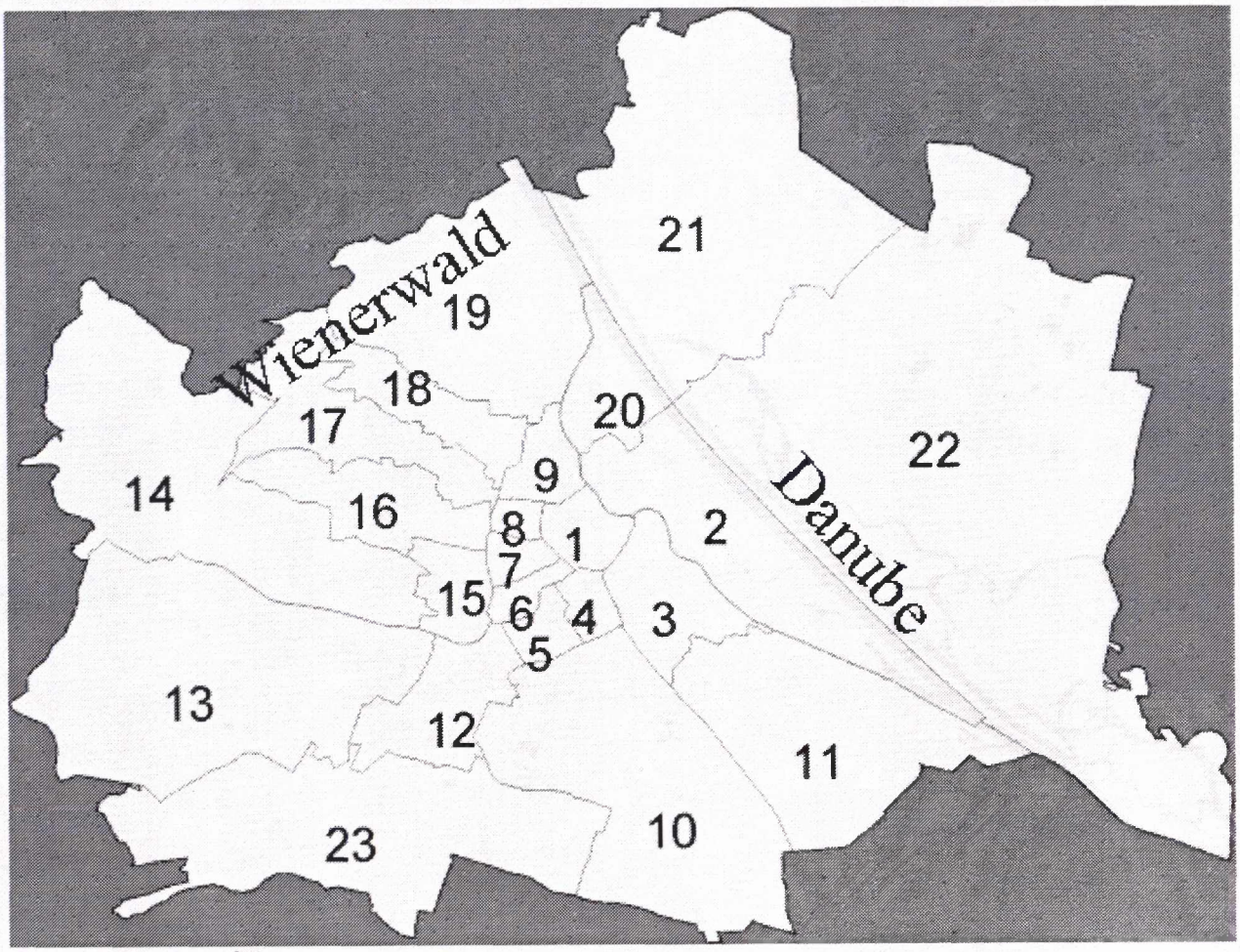

Figure 1. Districts of Vienna