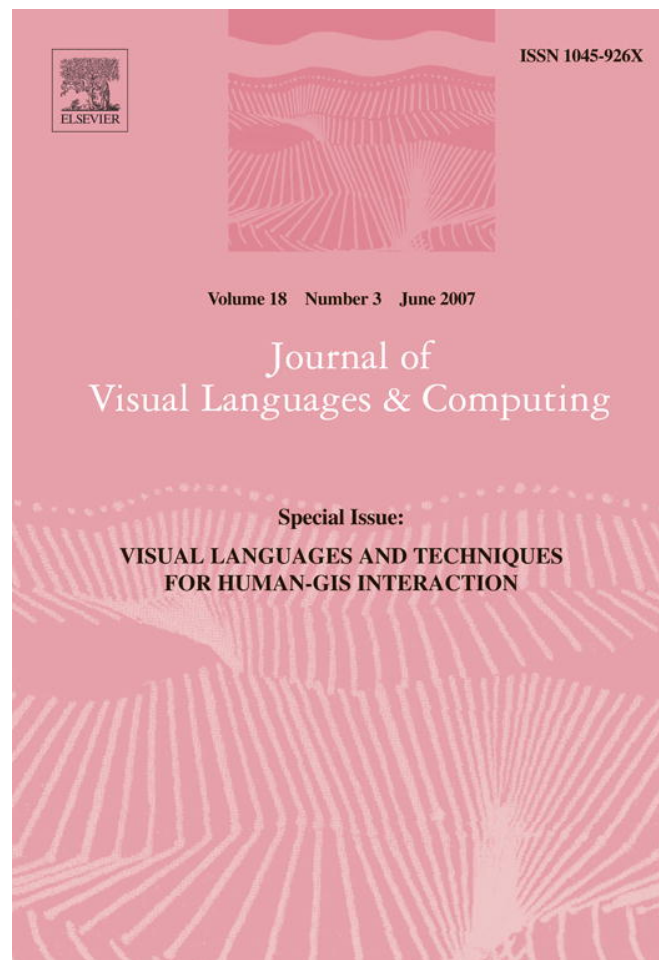


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Visual access to city websites: A challenge for PDA's GUI

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Abstract

At the inception of the Internet, the websites were only textual. Now, with the graphic possibilities, more and more websites integrate visual aspects, essentially to access and to visualize information. The goal of this paper is to examine the use of some visual techniques in city websites. More particularly, we will examine the metaphor of virtual cities, hypermaps and geography-based accesses, news magazines, etc.

In the last part of this paper, we will examine the implications of using those metaphors for small screens, and overall for Graphic User Interfaces (GUI) of Personal Digital Assistant (PDA). We will essentially argue that as the syntactic transformations, i.e., the syntactic adaptations are one face of the problem, the semantic adaptation, i.e., the transformation or the adaptation of the metaphors, is a very challenging issue.

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Keywords: Visual access; Websites; Cities; Metaphors; PDA; GUI

1. Introduction

Nowadays, all cities have a website. The objective of this paper is not to make a detailed study about their contents, but to examine their organization from a visual point of view. By visual, we mean examining the quality of graphics, the metaphors used and their efficiency.

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First, let us give the following definitions:

- a home page is the first page of a website, usually the Uniform Resource Locator, (URL) which represents the pointer by which documents or data are addressed in the World Wide Web;
- a sitemap is the entry structure to access all pages lying into a website; in other words, it can be seen as a table of contents;
- and a portal allows the accessing to only few pages, which highlights the more important items for the administrators and the site owners.

Usually, the portal is located in the home page. However, in multiple language websites, or in user-profile-oriented sites, the home page often acts as a profile selector so as to give access to different sub-websites.

With respect to the use of metaphors for website design [1], let us first of all mention that the two words, portal and sitemap, evoke metaphors: portal meaning the entrance gate and sitemap the cartography of the website. We can summarize the situation as follows:

	Portals	Sitemaps
Existence	Always	Not always
Contents	Salient items	Exhaustive or quasi exhaustive table of contents
Use of metaphors	Possible	Possible

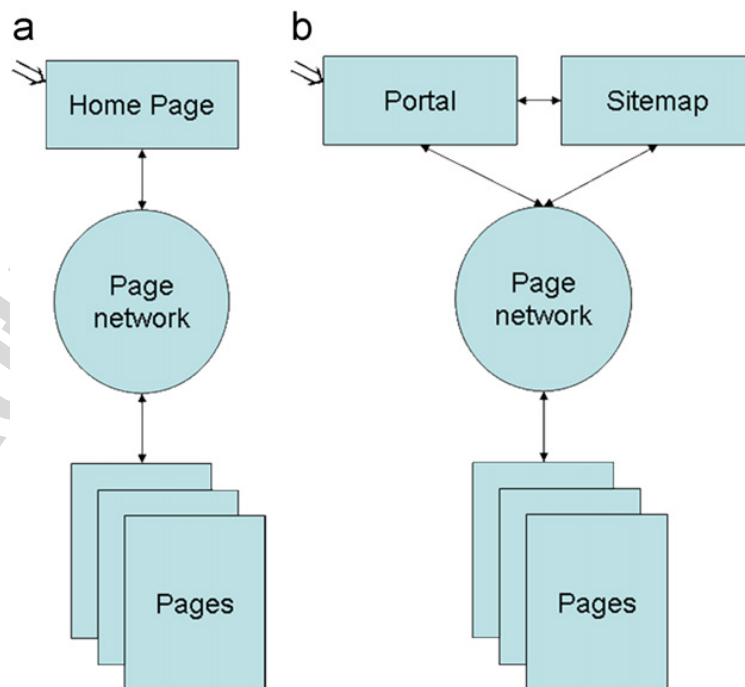


Fig. 1. Different models of websites' entry modes: (a) simple website and (b) website with portal and sitemap.

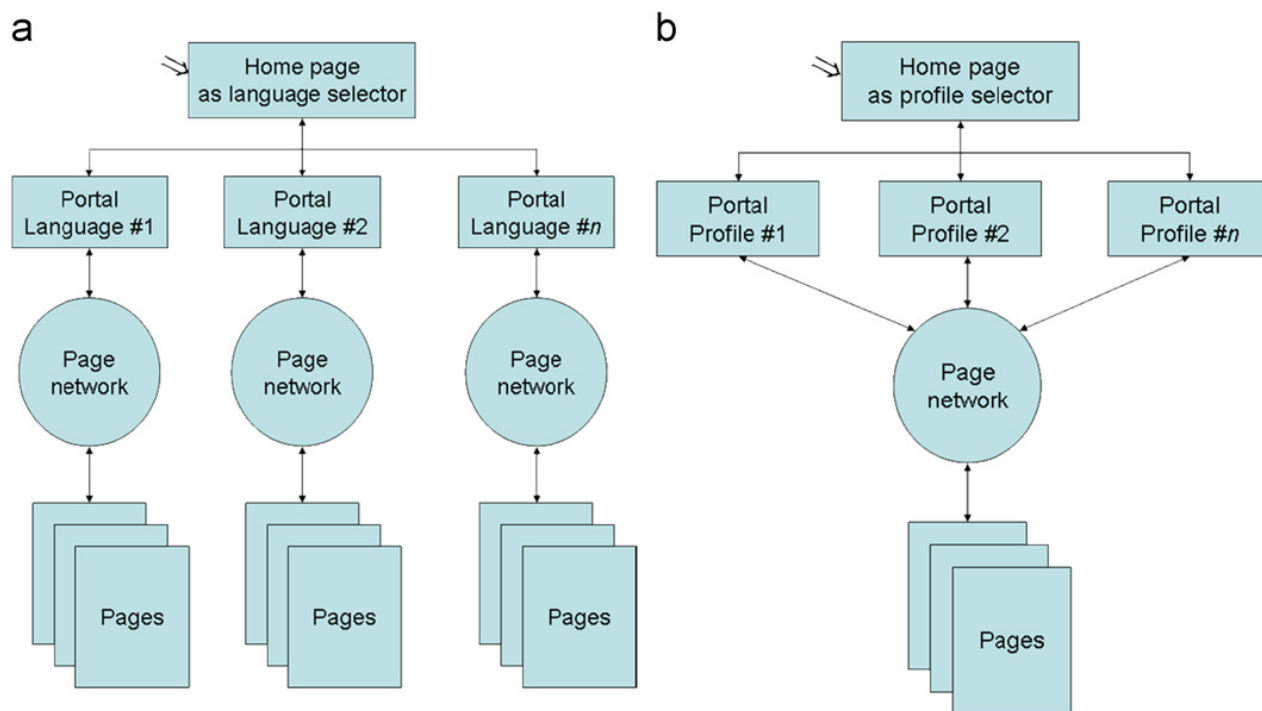


Fig. 2. Other more complex different models of websites' entry modes: (a) multiple language websites and (b) multiple profile websites.

Taking into account the previous analysis, we can distinguish four models of websites from a portal point of view. In this model, we will distinguish portals, sitemaps, language selectors and profile selectors as entry possibilities (the symbol \Rightarrow representing the URL); we will then model the remaining website, as a network (see Figs. 1 and 2). The first one models (Fig. 1a) the simpler structure in which usually the home page also acts as both a portal and a sitemap allowing the access to all items; the second model pictures the case in which a portal and a sitemap co-exist.

For cases in which selectors must be used, either for languages and user's profiles, their models are given respectively in Figs. 2a and b. In multilingual websites, usually parallel sub-websites exist, perhaps having only pictures in common. The more complex structures correspond to different user's profiles, generally allowing different trajectories into the same set of pages; in this case, the metro-line metaphor (see Section 4.2) allowing to access pages in different orders, offers an interesting theoretical concept.

In this paper, all Internet examples were taken in March 2007. For the less recent examples, the reader can refer to the URL <http://www.archive.org/> in which a very large quantity of Internet pages are stored together with their dates.

On the other hand, more and more location-based services (LBS) are proposed to Personal Digital Assistants (PDAs). However, due to the limited size of their screens, adaptation of web pages must be done. Therefore, a new technological barrier is emerging, i.e., how are semantically adapt Graphic User Interface (GUI) to PDAs?

In this paper, we will examine the various types of visual accesses in city websites, and also the way the city metaphor is used in other domains. And in the last part, we will examine the consequences when using PDA screens.

But beforehand, we will very rapidly study text-only websites.

2. Main metaphors for cities

The first aspect to mention is that some sites use neither metaphor nor visual tools: the presentation is only made with words. In this category, we can distinguish text-only portals and textual portals with some light pictorial decorations.

2.1. Text-only portals or with light pictorial decorations

Text-only portals presently are very rare, although there were a majority in the 90s. Take for instance the site of the city of South Milwaukee <http://www.ci.south-milwaukee.wi.us/>. Several years ago, the portal was practical text-only, with a unique icon for the letterbox. Few years after, the style is quite similar and only a picture of the city entry sign was added, emphasizing the idea of a portal as illustrated in Fig. 3.

Anyhow, even if those portals were common in the past, they were very functional and were a sort of preliminary step to reach present portals.

Even though the French Minitel experience (for instance, <http://en.wikipedia.org/wiki/Minitel>) was little known in the US, let us remind that this system was built on the telephone system and was very useful to inform people. Minitel is still in use in France and in some other countries; for instance, in France, contacts with the French administration (information, forms to fill, etc.) are still made through Minitel, as for example in university

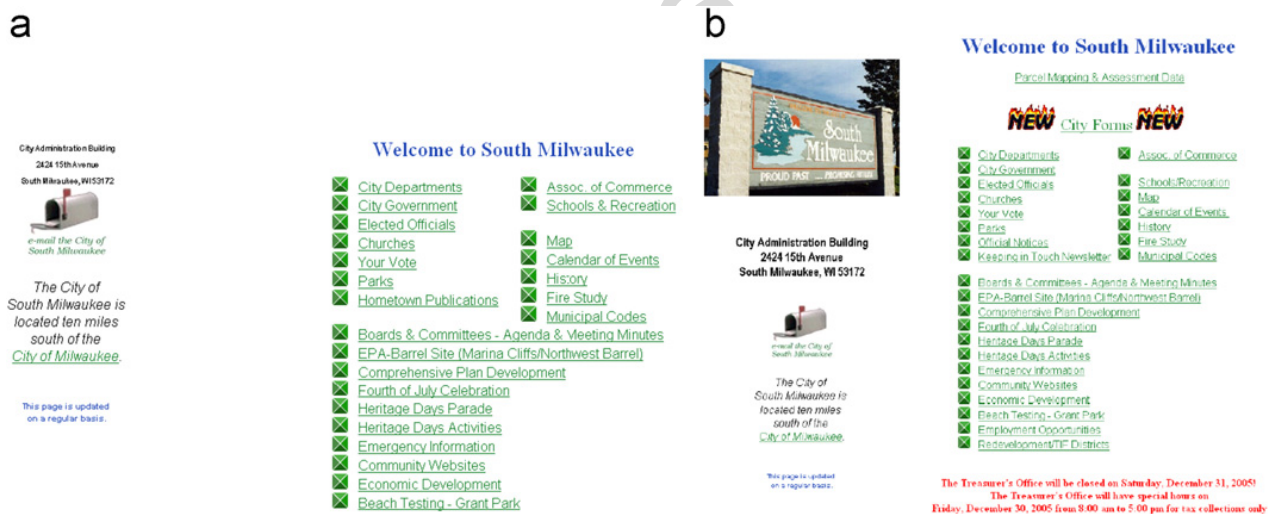


Fig. 3. Example of a text-only website and its evolution, <http://www.ci.south-milwaukee.wi.us/>.



Fig. 4. A profile-oriented portal from the city of Richmond, Virginia, <http://www.ci.richmond.va.us>.

registration, or results in the exams. Text-only websites can be seen as outcomes of the Minitel experience.

Another aspect is the diversity of users. In order to target more precise information to deliver, some cities have organized their websites by user profiles. An example is taken from the city of Richmond, Virginia (Fig. 4), offering different information according to the following six text-only profiles, businessmen, newcomer, resident, senior, visitor and young people in a text-only list. The Italian city of Salerno offers a dozen of profiles (<http://www.comune.salerno.it>); for instance profiles such as handicapped, immigrant, sportive and student are added.

2.2. Visual menu

Verbal menus are more and more replaced by visual menus. Fig. 5 gives the example of a home page including several icons for Edinburgh, Scotland as it was in 2002. Now the portal is replaced by a new one.

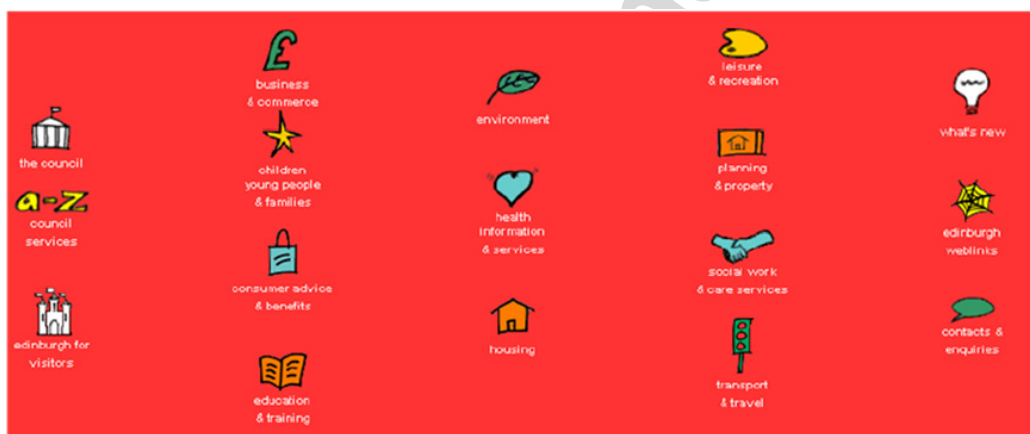


Fig. 5. A visual portal, extract of the Edinburgh visual portal in 2002, <http://www.edinburgh.gov.uk>.

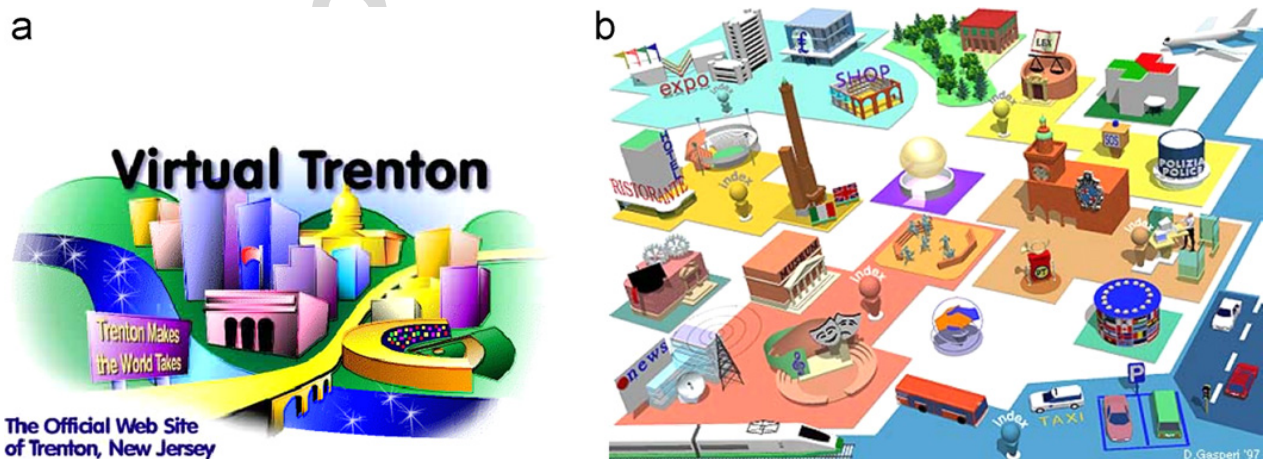


Fig. 6. Examples of virtual cities: (a) Trenton, New Jersey, <http://www.ci.trenton.nj.us/> and (b) Bologna home page <http://www.comune.bologna.it> as it was in 2002.

2.3. Virtual city

In another direction, there exist portals based on a sort of virtual city. An example is Trenton, New Jersey as illustrated in Fig. 6a. The more famous example is the home page of Bologna, Italy (See Fig. 6b as it was several years ago). As pictograms such as trains or theaters are meaningful, the interpretation of some buildings can be misleading. To correct this drawback, some words are added such as “ristorante”, “shop” or “lex”; it is interesting to note that in order to be understandable for anyone, some international words were selected: one of them is in Italian (ristorante), a second in English (shop) and the last in Latin (lex). However, we were intrigued by the spherical building right in the middle: it is the entry point for religious information; Indeed, a church pictogram should lead to Christian information not valid for other religions. Thus, the search for a very generic icon promotes the creation of pictograms the meaning of which is not clear. To conclude this paragraph, let us say that this approach is very interesting from a visual point of view, but presents some difficulties for interpretation, especially for people who are not accustomed with images. Another difficulty is updating such an image.

But this metaphor is not only used for cities, but it can be used for any kind of organization. In the fourth paragraph, we will examine some other examples of the metaphor.

2.4. Hypermaps and geography-based access

A very interesting way of organizing geographic information is to use hypermaps [2], also called clickable maps. Fig. 7a is a good example from the city of Antwerpen, Belgium. Another example is given in Fig. 7b for a gridded map for Oxford (UK).

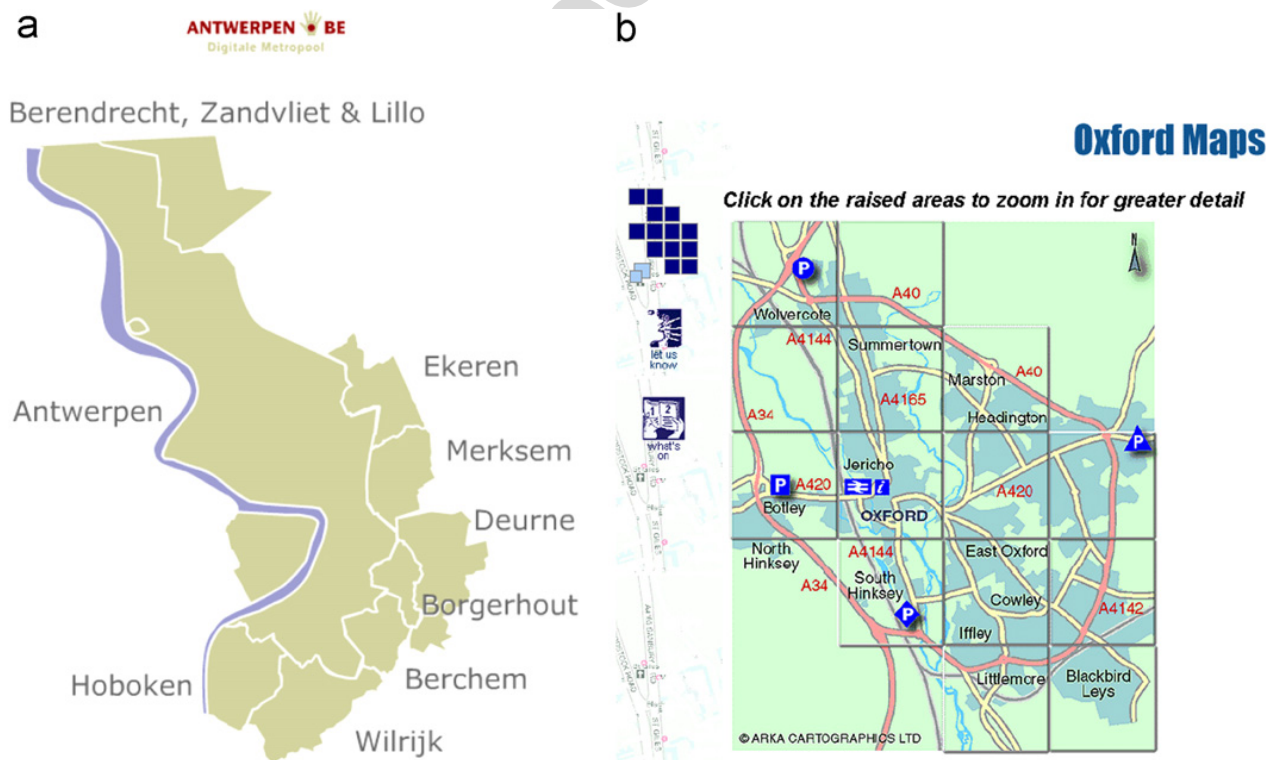


Fig. 7. Example of hypermap-based city portals: (a) Antwerp, Belgium, <http://www.antwerpen.be/MIDA/> and (b) Oxford, UK, <http://www.oxfordcity.co.uk/maps/ox.html>.

In Venice, Italy, an original entry system is provided through aerial photos (Fig. 8), named “Fotopiano”, i.e., photomap. This system is interesting for people knowing Venice a little bit. Two ameliorations can be suggested:

1. at some scales (when zooming), it could be interesting to change the system by presenting façades, for instance, along the Canale Grande, but in this case, the modification of the access system can trouble some users.

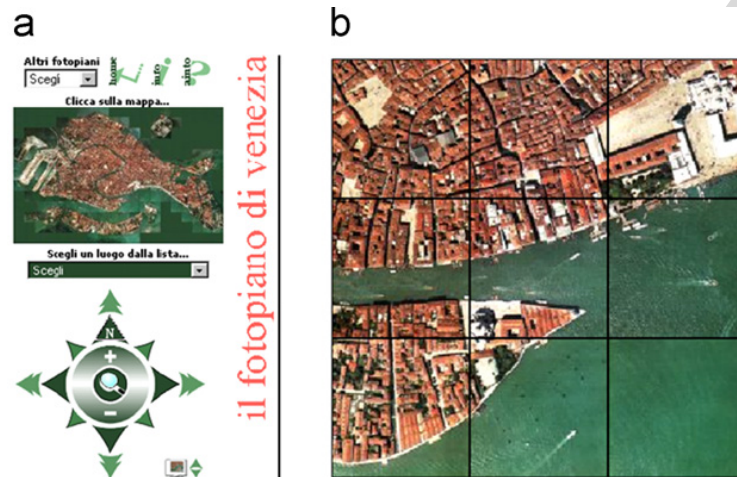


Fig. 8. Portal based on geographic locations, portal of Venice, Italy based on aerial photos, <http://www.comune.venezia.it>.

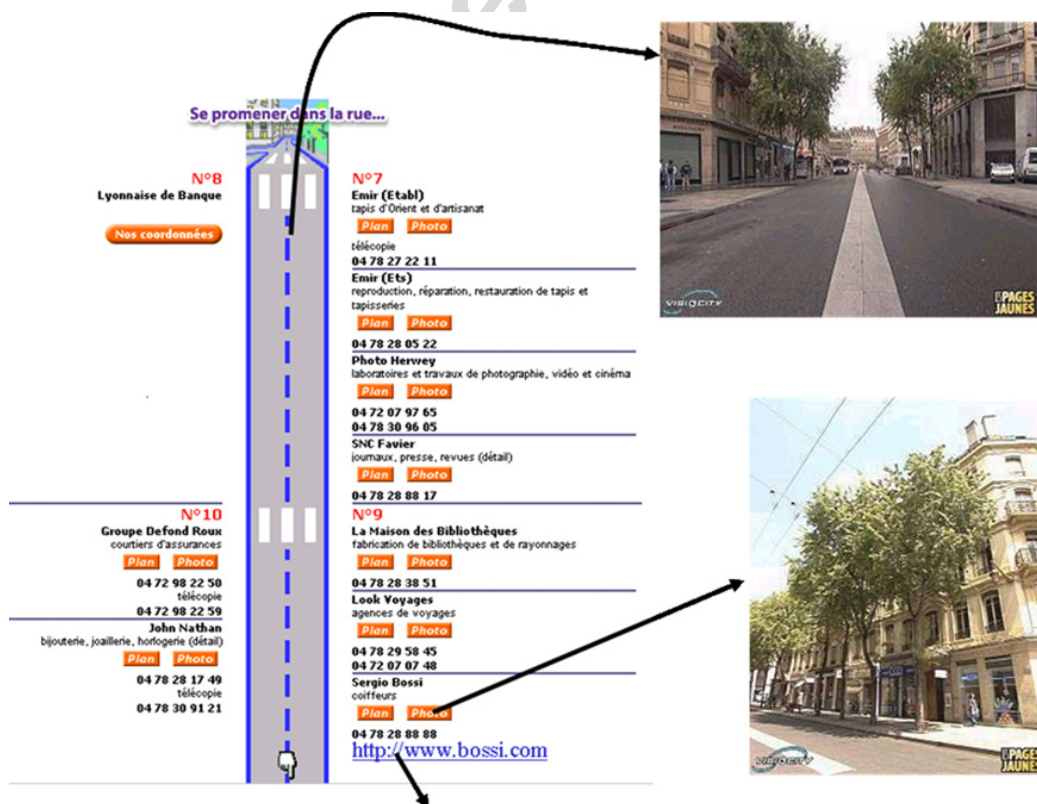


Fig. 9. Some portals based on geographic locations, excerpt of “shopping streets” from the Visiocity systems, <http://www.mappyvisiocity.com/> for the French Yellow Pages.

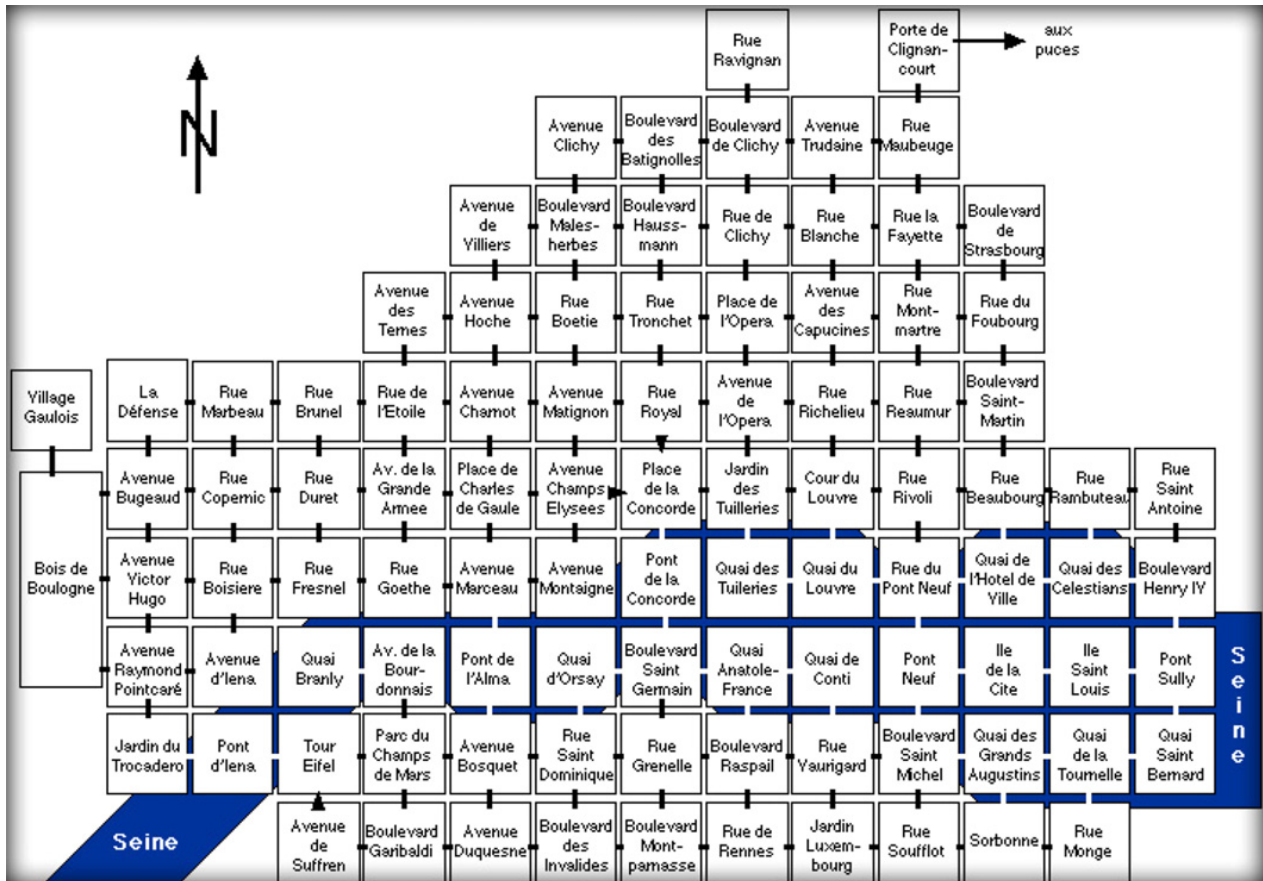


Fig. 10. Another interesting example to access to Paris information from streets (<http://www.umsl.edu/~moosproj/carte.html>) that are approximately positioned along the Seine River (blue background).

- it could be also interesting to pinpoint the names of certain important buildings, which can help the user to position himself in the city.

Some accesses through streetmaps and photos are also a possibility. See Fig. 9 for another example available from the French Yellow Pages. This system is comparable to the shopping street systems as existing in other cities. In this case, the metaphor evokes a pedestrian walking along a street, seeing façades and looking for some shops. For any shop, opening hours, telephone numbers and URLs website if any are given.

Fig. 10 depicts another interesting visual access system for cities, namely from a list of main streets in Paris. It is interesting to note that only important streets are mentioned, and that they are positioned approximately in a sort of squared grid along the Seine River.

2.5. News magazines

Some cities organize their website as a news magazine: the home page is looking as a cover giving a nice picture of the city (Fig. 11). It is overall interesting to know that there is now a sort of convergence between the presentation of those two media, namely news magazine cover and website portal, applying same corporate design, same graphic semiology and similar content.

2.6. Visual portals for visual portals

In some places, there are portals of portals. By this expression, we mean that, instead of giving a textual list, or a set of icons, an interesting idea is directly to include a thumbnail



Fig. 11. Examples of home pages looking like news magazine covers in March 2007: (a) Lynchburg, VA, <http://www.ci.lynchburg.va.us> and (b) Miami, FL <http://www.ci.miami.fl.us>.

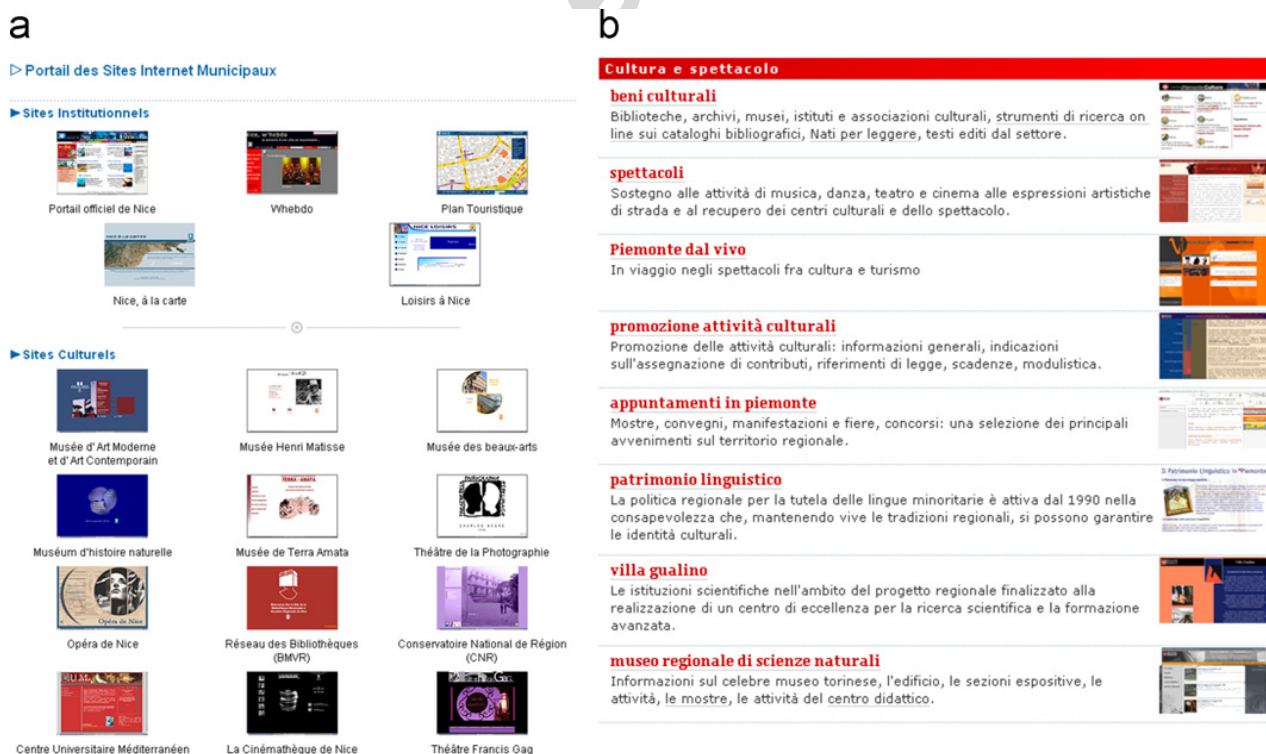


Fig. 12. Examples of portals for portals made of thumbnails: (a) Nice, France, http://www.nice.fr/mairie_nice_1489.html and (b) Piemonte Region, Italy, http://www.regione.piemonte.it/sez_tem/cult_spett/cult_spett.htm.

of the portal the user desires to go. See two examples in Fig. 12: the first from the French city of Nice, the second of Region Piemonte in Italy. Usually, those thumbnails are not generated in real time; i.e., they are not updated each time a modification occurs, but moreover a screenshot is taken regularly or once in a while. Another well-known example is the Exalead search engine <http://www.exalead.com/>.

3. Cartography for citizens

Internet mapping for the residents is now something common. Numerous cities allow the city dwellers some mapping capabilities; indeed, some small geographic information system (GIS) is provided. In this section, we will examine only two aspects: risk mapping and planning consultation.

3.1. Risk mapping

For instance relative to risks, let us examine two examples. In the Italian city of Genua (Fig. 13a), the inhabitants must first give the zone, and then, they will get detailed information: in other words, location → type of risks. Whereas in Charlotte (Fig. 13b), NC, this is the contrary; the inhabitants must give first the type of risk, and then they will get a map, i.e., Type of risk → location. Differently said, this kind of visual interface is only informative.

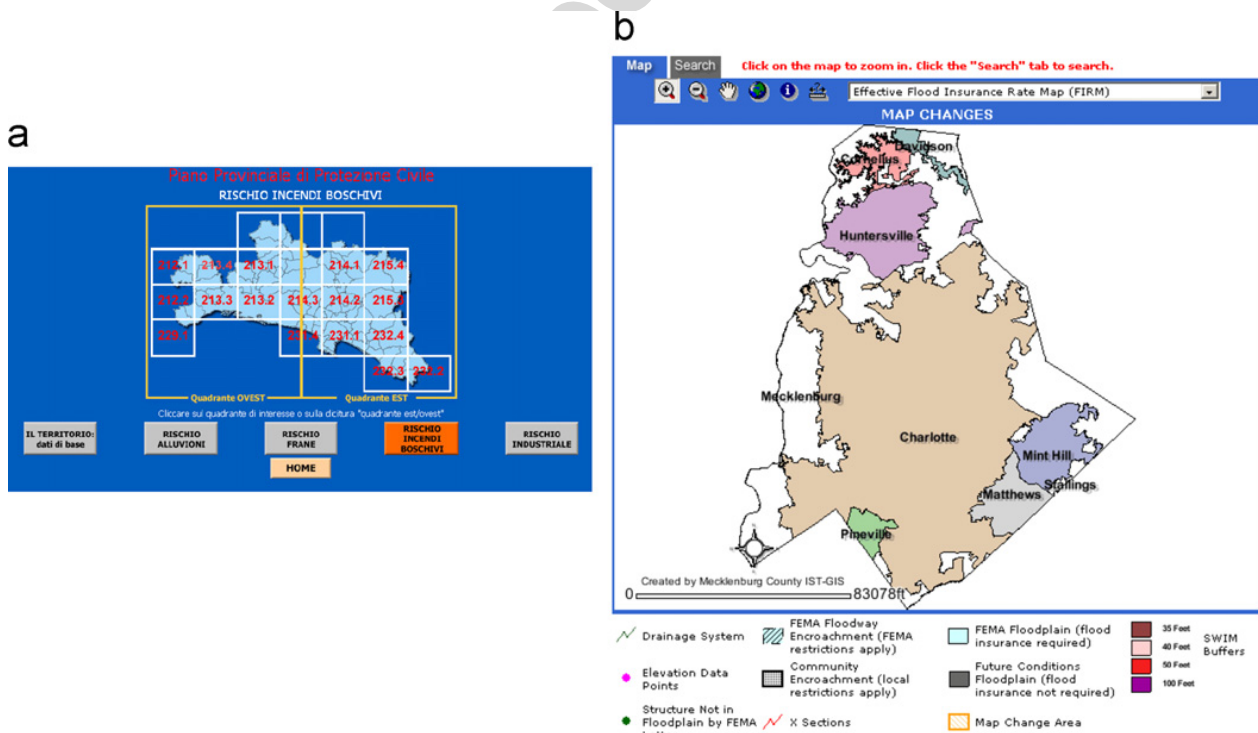


Fig. 13. Examples of risk mapping through Internet: (a) Genua, Italy, <http://cartogis.provincia.genova.it/cartogis/ppc/rischincbos.htm> and (b) Charlotte, NC, USA, <http://maps.co.mecklenburg.nc.us/website/floodzone/map>.

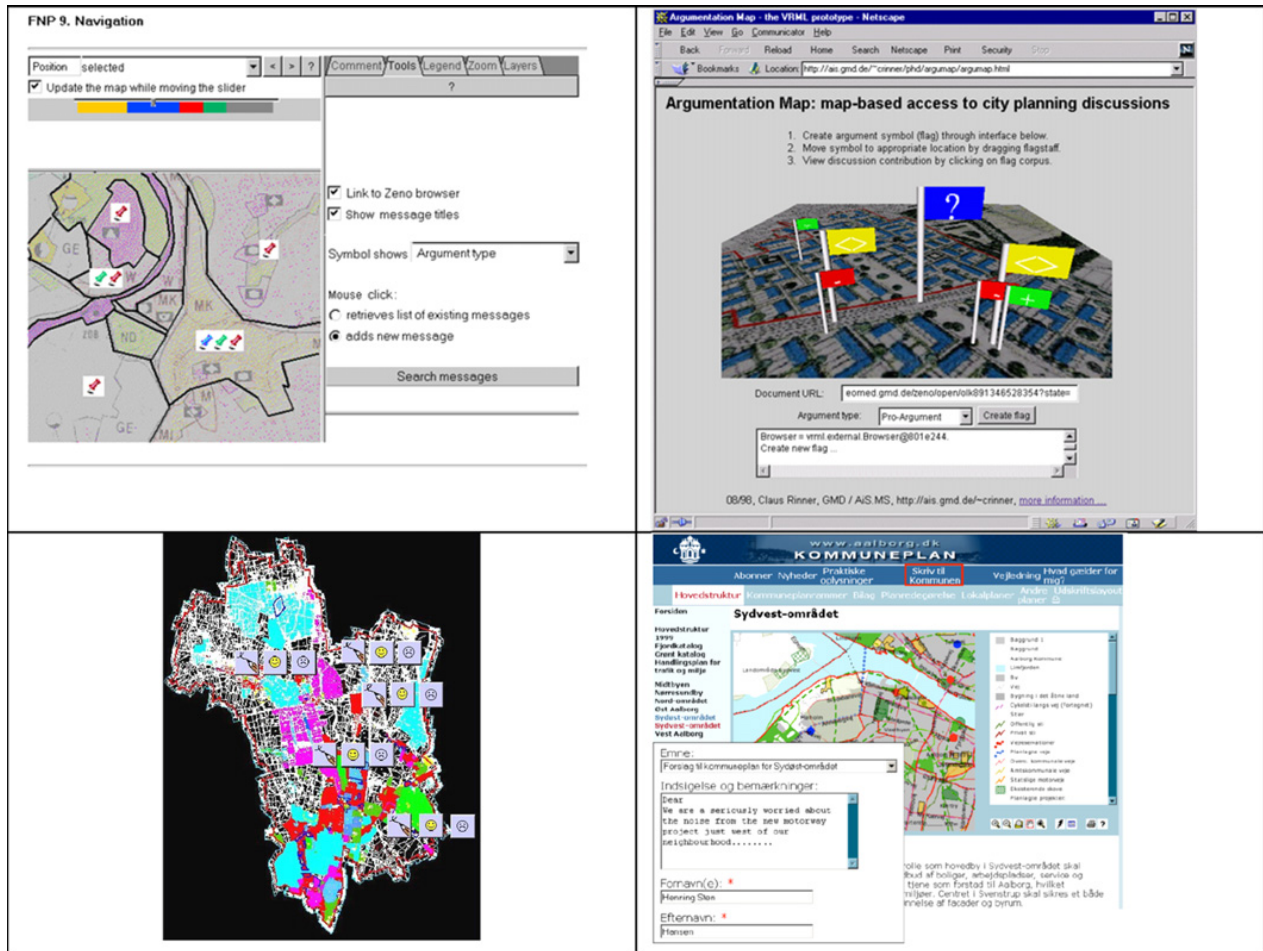


Fig. 14. Cartography of arguments, examples of graphic semiology (pins, flags, smileys) and an application in a Danish city, <http://www.detaktiveaalborgkort.dk> in 2006. The argumaps based on pins and flags are issued from Rinner [4], the third one (based on smileys) is issued from Laurini [5].

3.2. Planning consultation

Another interesting aspect is the participation of citizens for urban planning. Regarding master plans, land use plans or development plans, in all countries, there is some phase of public participation. In other words, the planning officers, together with elected politicians, ask the city dwellers their opinions regarding the future of their city. For that, usually some planning maps are proposed through Internet. But the main problem is how to organize the participation? Several trials [3] were made under the name of PPGIS (Public Participation GIS). One of the important aspects is to allow people giving their opinion about the projects. For that a solution could be using argumaps. Proposed by Rinner [4], those argument maps are made to help the users to position arguments on a map. Fig. 14 gives examples, for instance, by using markers such as pins, flags or smileys. Typically, three types of markers are interested to position pro-opinions, against-opinions and official arguments. Imagine that a city council wants to construct a new bridge over a river, then official arguments will explain the necessity of building such a bridge and the citizens agreeing this project can give or explain a positive opinion (pro-opinion), whereas the opponents can detail a negative opinion (against-opinion). At the end of the consultation,

hotspots can be easily detected, and a synthesis can be made in all places of the debate. Fig. 14c gives such an example in Denmark in 2006.

4. Virtual city as a metaphor for website design

In another direction, the metaphor of a virtual city can also be used to structure websites not only for cities, but also for other organizations [6]. As illustrations, let us show two examples. In the first one (Fig. 15a), a journal of robotics uses this metaphor to present its sitemap, whereas in the second (Fig. 15b), a Swiss dance band named Rigatoni uses again this metaphor for its portal (as it was in 2002).

Fig. 16 illustrates another interesting case of a virtual city. This illustration comes from an Italian course on virtual cities: <http://www.tipus.uniroma3.it/Master/lezioni/AID/VirT.jpg>. Here, the virtual city acts as a basemap to access services.

4.1. Map metaphor (tendermaps)

The map metaphor was created in 1654 by Mme de Scudéry with her tendermap (*carte du tendre*) in which she published an allegorical map of love and desire. Fig. 17 depicts two examples of website using this metaphor. The first one (Fig. 17a) presents a small map with some “cities” corresponding to entry points into a website for a dancing company.

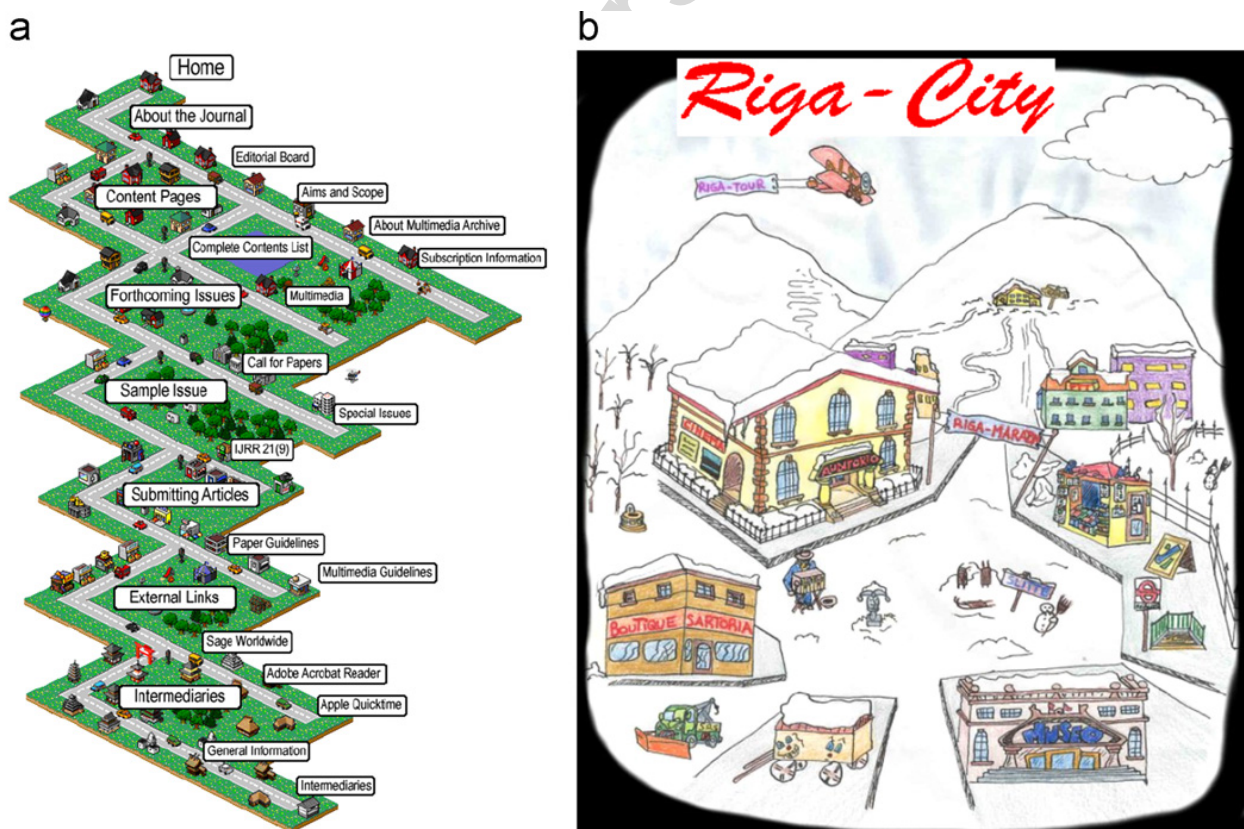


Fig. 15. Virtual cities. (a) A virtual land development map as a transition between a map, a graph layout and a virtual city, <http://www.ijrr.org/images/sitemap.gif> and (b) the Rigatoni band using the city metaphor to present its activities (as in 2002), <http://www.rigatoni.ch/>.

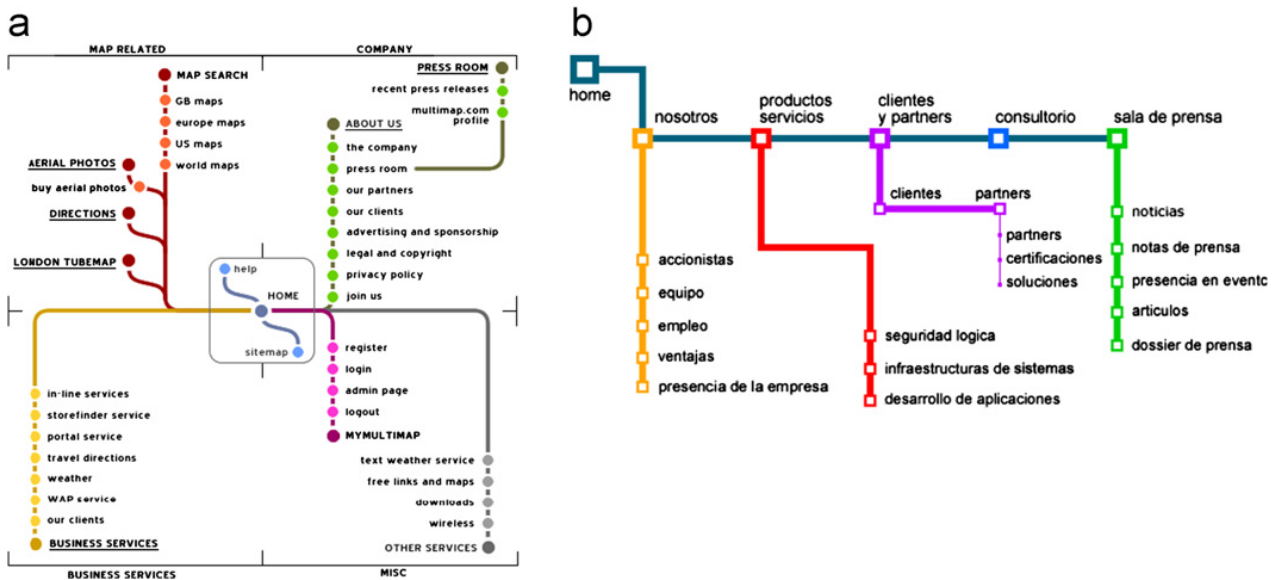


Fig. 18. Sitemaps designed with the metro-line metaphor: (a) <http://www.multimap.com/images/ps/misc/sitemap.gif> and (b) <http://www.germinus.com/mapa.htm>.

the site administrators propose several walk-through tours in lieu of sitemap. Fig. 18 gives two examples of sitemaps designed with the metro-line map metaphor.

Starting from a list of pages, the main difficulty is to select stops and lines. For instance, one line can correspond to a special class of users. The main interest is the definition stops corresponding to connections between lines.

5. Adaptation to PDA's GUI

More and more portable devices such as PDAs or camera phones are used by people for LBS. Among those services, geo-services need portals, especially in cities, for instance, for tourist applications (see [10,11]).

Adaptation of services to small PDAs small screens (typically 2–3 in by 3–4 in size) presents two levels:

- at lower level, one means the transformation of the layout of the interface without modifying the contents, for instance, splitting one long page into several smaller pages [12]; let us call it syntactic adaptation;
- at upper level, one means the transformation of the used metaphor; let us call it metaphor adaptation, or semantic adaptation.

Differently said, screen images are reduced until a factor of 10, and when they encompass textual information, these texts must not be reduced accordingly, and the size of the characters must not be below 8 or 10. So, taking size into account, we can set up the major specifications as follows:

- only few items can be displayed,
- small images and icons can be used,
- visual menus can be deployed, provided they are readable.

Let us take an example: A person equipped with a PDA wants to select a vacant parking lot not far from a Greek restaurant and a movie theater. For this kind of LBS, a special interface must be defined. If the hypermap structure has been used, understandability must be the key issue for structuring the visual entry system. The scale of the map, the size of used characters and of icons must be taken into consideration.

Let us now examine the studied visual systems and their consequences at semantic level.

- (a) *Text-only entry systems (nothing visual)*: Two cases depend on the length of the menu. If it is short, no problem, otherwise, it must be split into some hierarchical textual menus, or even into a rolling list.
- (b) *Textual menus with thumbnail portals*: It can be seen as a variant of the previous one, but with thumbnail images toward the pointed portals. If those thumbnail images when reduced are still understandable, they can still be used; otherwise, those thumbnail images must be discarded.
- (c) *Hypermaps, tendermaps, aerial photos, streetmaps, façades*: Hypermaps can be still used, provided the map is still readable, essentially depending on the scale. In some cases, the map can be split into several sub-maps. It can be done similar to tendermaps, aerial photos, streetmaps and façades.
- (d) *Virtual cities*: This case is the more difficult, essentially depending on the size of the image representing the virtual city. Back to the Bologna example (Fig. 6b), my opinion is that another background drawing must be designed to fulfil the requirements of the PDAs.
- (e) *Metro-lines*: This metaphor can still be used, provided the attached texts are readable. However, when there is a very dense metro-line system, simplification must be done. Otherwise, the metaphor must be totally transformed, and another visual entry system must be designed.
- (f) *News magazines*: Here again, this is a question of readability. When the menu is too dense, it must be split into several sub-menus. But in this case, the interest of the metaphor diminishes.

As a conclusion to this very rapid analysis, it is easy to see that the adaptations of the metaphors are not so easy. When the visual system is not very dense in a “normal” computer screen (typically 13–19 inch diagonal), the transformation is easy, provided the text characters are changed to be readable enough. However, when there is very dense visual information, the used metaphor must be either transformed into several newer steps, or totally changed to fulfil PDA’s GUI requirements.

6. Conclusions

Designing visual access to website has become a research domain per se in which some metaphors seem to structure the websites. In this paper, the structuring and the visual accessing to local authorities’ websites have unveiled several tendencies.

The Bologna-type virtual city, experience of a total visual access has shown the difficulty of understanding some icons in an alphabet-based culture. Now, it appears that a mixture of icons and letters seems to be a nice compromise. The use of photos instead of icons also appears as an interesting research direction. Apparently, the dominant metaphor in cities seems to be the news magazine metaphor. It is also interesting

to see that now in some news magazines the website metaphor is also in use; in other words, those metaphors influence each other, and some cross-fertilizations will certainly appear.

Geography-based metaphors are also a source of inspiration for designing portals and sitemaps. The tendermaps are one of them, but the big difficulty is to update them regularly, i.e., adding or removing automatically some elements into the map, still keeping high esthetic quality levels.

The metro-line map metaphor is interesting essentially when different paths can be defining into the website. The selection of “lines” and “stops” is still difficult, and a methodology must be defined based on decision rules, for instance, in user-oriented portals with the metro-line metaphor, each line can correspond to a user type. Back in cities, a line can be defined for residents, a line for businessmen, a line for home-seekers, a line for handicapped people and so on.

In local authorities, some other visual accesses can be defined. Examples in informative cartography, for instance, for risks are good illustrations. For interactive cartography, visual techniques such as Rinner’s argumaps are an interesting way for structuring public participation in urban planning.

However, applying those metaphors to PDA’s GUI is still a challenge. As there are solutions for light visual entry systems, the problem is more complex for heavy visual entry systems. In practice, the majority of visual entry systems must be totally designed to fulfil legibility requirements.

To conclude this paper, let us say that in the near future some innovation will still continue to appear in designing visual access to websites, essentially because of the necessity to attract more people. Local authorities seem an interesting domain to study, not only because they are numerous, but also because each of them tries to emphasize its own characteristics and culture; differently said, each of them shows or tries to show its own personality.

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