Mapping *Visualization On-Demand* onto a Virtual Globe: an Appealing Complement to Browser-Based Navigation

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ABSTRACT

Current *browser-based* navigation is a universal and powerful tool, but lacks of three useful features: overview of the global website structure, efficient history browsing and an alternative to link-link navigation. By combining Visualization on-demand (Vizod) with an interactive virtual globe, we tackled these issues by means of multi-resolutions maps displayed according to user's interactions and preferences. We provided in this way a contextual hypertext navigation, each page being assigned locations and links on top a a virtual map. We built up and performed experiments of a prototype providing a smooth, appealing and promising complement to browser-based navigation.

Categories and Subject Descriptors

H.5.2 [**Information Interfaces And Presentation**]: User Interfaces—*Graphical user interfaces*

General Terms

Design, Human Factors

Keywords

Visualization On-Demand, Vizod, Personalization, Browser.

1. INTRODUCTION

First introduced in the early '90s, the web browser interface has not fundamentally evolved, remaining a classical WIMP (Window, Icon, Menu, Pointer) interface. It is nonetheless a widely spread, stable and homogeneous interface that makes it a compulsory gateway for both web users and developers. Its wide adoption has many positive aspects, such as making the browser a universal client platform on top of which can extra features be added. Theses features are based on plugins such as internal extensions, Flash or Silverlight programs. Recently, AJAX enhanced the user experience by enabling asynchronous navigation, keeping user interactions on the same page. The counterpart is high change inertia, slowing down adoption of new features, and making innovation incremental rather than disruptive.

Our goal is to provide an innovative usable tool to explore data masses, while keeping all the technical and cognitive aspects of browser-based navigations. We concentrated on three major limits in current navigation experiences. *First*, the lack of a quick website global overview, allowing users to get quantitative information such as website size, proportions and frequency of updates. *Secondly* a weak history navigation loosing users complex navigation path, whereas actual browsers allow multi-task navigation by featuring tabbed browsing and multi-windows. *Thirdly*, browsers limit users to link-link navigation, meaning that this is difficult -if not impossible- for users to jump from badly-linked, disconnected or deep pages (the ones needing many clicks). In other words having a generic hyper-access to every page.

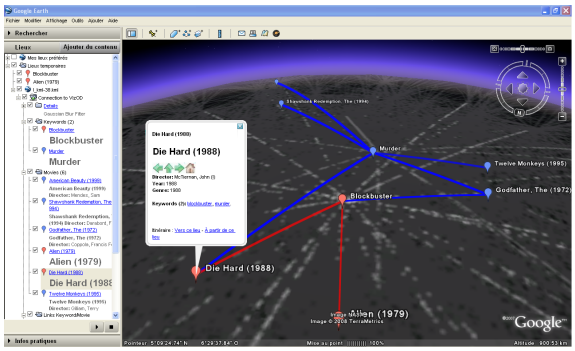

Figure 1: Website structure is mapped on a virtual globe, every page are assigned a virtual location with blue link/icon if not visited, red if visited.

Our approach is to keep existing webpage layout and hyperlinks, and to focus on the layout of website structures, which are currently invisible with browsers (or sometimes in the sitemap section if any). We want to make it visible and interactive, to tackle above mentioned issues, while not requiring users extra learning effort.

2. MAPPING VISUALIZATION ON-DEMAND OUTPUTS ONTO A VIRTUAL GLOBE

Vizod is a Visualization on-demand service [7] reachable as a RESTful web-service through an API [3]. Given a URL, it will produce annotated pictures representing its structure in a human understanding layout such as graph or tree-like. The service allows personalization of visual output according to user preferences, that are stored on a visual user profile. Vizod holds many layout libraries and allows post-processing of rendered image (using image analysis techniques such as Gaussian blur or Laplacian filter) to provide a *pre*-processed

HT'08, June 19-21, 2008, Pittsburgh, Pennsylvania, USA.
ACM 978-1-59593-985-2/08/06.

visual result. To make pictures understandable and interactive, we used the earth metaphor that is perfectly well-suited to explore maps and is well known by everybody. We used Google Earth [2] (GE) a 3D post-WIMP interface [6], as for interactive virtual globe, which instead of being connected to a geographical database is connected to Vizod. GE uses DirectX or OpenGL capabilities of the client machine. From now on, GE explores the virtual world that is Vizod's output, according to user's altitude and angle of view (see `<viewFormat>` tag). Here is the (simplified) request GE will send to Vizod using its `KML`[1] file format:

```
<kml xmlns="http://earth.google.com/kml/2.0">...
  <Url><href>http://vizod.insa-lyon.fr/I_kml.php</href>
    <viewFormat>BBOX=[lookatRange],[bboxWest],[bboxSouth]..
```

Vizod's response is also `KML` formatted, including a link to the generated map and embedded HTML description of every location on the map:

```
<kml xmlns="http://earth.google.com/kml/2.0">
<GroundOverlay>
   <href>http://vizod.insa-lyon.fr/infovis/img/kw_gau.png</href>
     <LatLonBox><north>-25</north><south>25</south>
     <east>25</east><west>-25</west>...
  <Folder><name>Keywords</name><Placemark><name>murder</name>
    <description><![CDATA[Description in HTML]]></description>
    <coordinates>-1.4773434, -1.6006787, 0</coordinates>...
```

That way, HTML pages become `<Placemark>` on the map, hyperlinks become links between two placemarks and original HTML pages are embedded in placemarks' `<description>` (rather than using GE internal browser which reduces user's field of view). A click on a hyperlink becomes a virtual fly from one location to another. While keeping existing hyperlinks structure, new features are enabled such as:

Overview: the perception of the whole dataset will be the first step of the visual investigation. Since websites have an underlying graph structure, it is visualized as a nodes/links extracted by Vizod using crawling robots or sitemaps. Quantitative insights are visible by easy zoom in and zoom out, allowing smooth details inversely proportional to user's `<altitude>`. The user can continuously keep track of the context, compared to brutal discrete browser page transition. All interactions can be performed with the mouse only, not requiring extra device.

History: in our context user activity is collected by clicks on placemarks. We reused the same color code as browsers for links and visited pages. We also colored links and visited links the same way. The visualization of long path history will be improved with a fading color code (highlighting the most recently visited pages). Back to the overview level, users can see all their history path, sessions or tabs having different colors. And most visited pages can have a bigger icon and users activity is visible.

Navigation: having two extra degrees of freedom enables new user actions such as *pan*, *zoom* and *rotate*. Users can freely explore other pages (not connected ones), making their own scenario unchained from the underlying website structure. Pages from a same website are spatially closer and can be previsualized by small icons or screenshots. Making placemarks disappear once visited, or only viewing the one resulting from a search can also improve contextual exploration of a large dataset by preventing visual overload.

3. RESULTS

We built up a prototype [4] as a proof of concept. It is fully usable and using a subset of the Internet Movie Database (IMBD), where users can explore movies and their connections to keywords. The background maps holds all the movies (around 10 000) but remaining just informational (no details available). An early result is that users appreciated to forget repetitive aspects of a work and concentrate on creativity, intuitive and high level of abstraction. Giving them an appealing means, but remaining in a still useful and structured environment kept them focus. The environment allowed to visualize new attributes such as visited links (as opposed to visited pages). A new functionality that showed great interest was the Homepage becoming an Home*view* with a certain angle of view rather than a unique location. This is an already existing need, that is done today with customized homepage hosting many RSS feeds. Finally, flexibility was appreciated, users kept switching with old browser interface (both coordinated), or allocating a screen each, when dual screen was available. Users thought the word *complement* described the best that novel interface, providing added value on top of ordinary web browsing experience.

4. CONCLUSION AND FURTHER WORK

We introduced an innovative metaphor to browse webpages, focusing on enhancing overview, history and navigation, while following recommended design guidelines to make a well designed 3D environment [5]. By hijacking existing tools, we made possible to reuse user's capabilities but for another task, making our *collage* quickly adopted. Our contribution needs further usability tests, larger datasets and an increased reliability to be fully evaluated. A Google Map version is on track, keeping all interactions within the browser frame, and fitting technical limits of light clients and PDA. Personalization of the interface is our major future research perspective, since many attributes can now be visualized according to users preferences, stored in the visual user profile and reusable regardless the website being browsed.

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