Geoportals and Geocollaborative Portals: Functionality and Impacts on Travellers' Trip Panning and Decision Making Processes

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ABSTRACT
As more and more travelers wish to create their personalised trip itineraries, the provision of geographical information and services is an unavoidable necessity for travel websites. The current evolution of geoportals and geocollaborative portals present numerous opportunities for making the trip planning process less complex and time consuming, more efficient, social, collaborative and enjoyable for travelers and their travel companions. This paper aimed to analyse the functionality and services of geoportals and geocollaborative portals and to thoroughly demonstrate their impacts on the trip planning and decision making processes on travelers. The discussion provides practical guidelines for designing geoportals and/or geocollaborative portals and directing future research.

Key Words: geoportals, geocollaborative portals, functionality, impacts, trip planning and decision making processes

INTRODUCTION
Nowadays, the majority of tourists prefer and demand to design and book their own personalized tourism packages and itineraries. This trend is heavily demonstrated by the huge take up and use of dynamic packaging services by several cyberintermediaries and online tourists respectively (Sigala, 2009). However, tour planning is a very complex process for consumers requiring the identification, filtering, evaluation and selection of a massive amount of information (Fesenmaier and Jeng, 2000), which very frequently relates to geography content and capabilities, such as geographical information about the proximity of cultural attractions and events from accommodation providers and the calculation of distances and itineraries from one place to another. Hence, the effective and efficient planning of personalised tourism experience necessitates that users have availability and accessibility to mapping services. Mapping services can also play a major role at all stages of the tourists’ trip planning decision making process: need identification (i.e. desire to travel somewhere), information search and evaluation, choice and booking processes and post-trip travel experience sharing (Moutinho, 1987).

The recent development of distributed Geographic Information Systems (GIS), that combine the power of GIS with the ubiquity of the internet (Duran et al., 2004), has further enhanced the online provision, accessibility and dissemination of geographical capabilities and knowledge through the development of geoportals (Tait, 2005). The use of geoportals and the provision of web map services has also become a widespread standard for numerous tourism websites and e-tourism applications. By using web map services, tourists can more quickly, precisely and accurately find all travel information for organizing their itineraries (Ilies & Ilies, 2006). As a result, the trip planning process has been transformed from a frustrating (Pan & Fesenmaier, 2006) to a more enjoyable and efficient experience (Pan et al., 2007) and more recently to a social collaborative process (Sigala & Marinidis, 2009). Nowadays, advances in free web map services (such as Google (Maps), Yahoo! (Maps), Microsoft (Virtual Earth), MapQuest and ArcWeb) have introduced new (collaborative) ways for the development, searching, reading and dissemination of geographical information and services. Moreover, web 2.0 (i.e. the user-generated content and social networking capabilities) are totally transforming these web mapping information and capabilities by democratizing the creation and dissemination of geographical content (and media) to Internet users and networks. These cheap, web-based, collaborative, multi-layer and multi-advantage web map services further empower tourists with new trip planning geographical related tools and information.

Although previous studies have heavily investigated the use of geoportals for developing geophysical applications, e-government practices as well as applications for spatial policy making, planning and development (e.g. Sayar, Pierce & Fox, 2005; Beaumont, Longley, and Maguire, 2005), limited search exists so far regarding the use of geoportals for trip planning purposes (Pan et al., 2007). Specifically, there is limited knowledge regarding: the use of geographical information and capabilities of geoportals by travelers for supporting their trip planning processes; and the impacts of such geoportals’ use on travellers’ decision making processes and behavior. Current literature on geoportal assessment is also inappropriate for investigating its impacts on travelers’ decision making.
processes, since the majority of previous studies (e.g., Crompvoets et al., 2004) have focused on the macro-economic measurement of geoportals' impacts on the society (i.e., the economic, social and environmental impacts of geoportal applications).

In this vein, this study has a dual goal. First, it aims to analyze the role and the utilization of geoportals’ information and web map services for enabling travelers to facilitate and enhance their trip planning processes. Secondly, the paper focuses on providing a framework for investigating the impacts of geoportals’ use on travelers’ decision-making processes and behavior related to trip planning. To achieve these aims, the paper first discusses the functionality of geoportals and their current evolution due to web 2.0 advances allowing users’ active involvement on the development of geoportals. In this vein, emphasis is given on analyzing the web 2.0 enabled functionality of geoportals and the concept of geocollaborative portals (i.e., group work based on the top of a map). Finally, the impacts of these two applications on the trip planning and decision-making processes of travelers are discussed in details. The paper provides several practical implications and guidelines on how to design the functionality of a geoportal for enabling travellers to plan personalised trip plans and itineraries either individually and/or collaborative with their co-travellers and/or within travel social groups. Thus, the paper contributes to the literature related to the design of user toolkits for creating personalised services. Its theoretical implications are also discussed.

**GEOPORTALS**

**Geoportals: definition, functionality and evolution to engage users more actively into geoportals’ development**

Geographical Information Systems (GIS) represent the major application referring to the digitization of geographical data. However, traditional GIS require experts to use specific desktops and workstation environments for accessing and further manipulating geographical data. Advances in web services have supported the online diffusion-distribution of and the wider participation in the development of GIS services, which is demonstrated by the boom of distributed GIS services (Tait, 2005; Longley & Batty, 2003). Distributed GIS services are simply GIS technology that is built and deployed using the standards and software of the internet (Tait, 2005). By using web service standards, distributed GIS allow many GI systems to be linked and accessed as a single virtual system enabling the three following major benefits to accrue (Sigala & Marinidis, 2009): a) wide distribution, as it is easier to distribute geospatial data and applications across platforms, operating systems, computer languages, etc; b) integration of applications and businesses operations, as it is easier for application developers to integrate geospatial functionality and data into custom applications; and c) the development of a huge infrastructure being built to enable the web services architecture, including development tools, application servers, messaging protocols, security infrastructure, workflow definitions.

Geoportals represent a key application of distributed GIS services. Geoportals are built using underlying World Wide Web infrastructure technology and commercial off the shelf GIS (Geographical Information System) software. Network communication between clients and web servers uses HTTP (Hypertext Transmission Protocol). Technically speaking, a geoportal is essentially a master web site, connected to a web server, which contains a database of metadata information about geographic data and services. The services are built and exposed as web services (Sigala & Marinidis, 2009), that is, self-contained, self-describing web applications that can be invoked over the web using messages encoded in XML (eXtensible Markup Language) and transmitted over a HTTP connection. Built on geographic web services, geoportals give user-friendly accessibility to high-end GIS applications over the Internet. A geoportal is implemented using three distributed GIS (Service Oriented Architecture) components (Tait, 2005); a web site presenting the geographic application or portal; web services that publish geographic functionality as a web service; and data management software providing a managed relational environment for both raster and vector geographic content.

In this vein, Tait (2005) defined geoportals are websites that act as entry points to web-based geographic content, where such content can be discovered. Maguire and Longley (2005) have also defined geoportals as the ‘…gateways that organise geographic content and services-capabilities such as directories, search tools, community information, support resources, data and applications’. Being WWW gateways-portals, geoportals provide web environments for an organisation or a community of information providers and users to: aggregate and share content and information flows; and build consensus (Maguire and Longley, 2005). In other words, geoportals facilitate the storage, sharing, discovery of and access to geospatial resources (that are either offline or online geospatial content) that are described and searched by metadata. The most typical geographical web service functionality of geoportals include: map rendering; feature streaming; data projection; geographic- and attribute-based queries; address...
geocoding; gazetteer/place name searches; metadata query and management; network analyses; 3D terrain visualization; and data extraction.

Maguire and Longley (2005) subdivide geportals into two groups: catalogue geportals and application geportals. Catalogue geportals are concerned primarily with organizing and managing access to geo-information and so, they are consisted of data catalogues, which are publishing, discovery and access systems that use metadata as the target to query spatial data (Maguire and Longley, 2005). For publishing data, the data providers need to create metadata for describing their data and then publish this through the catalogue client (either by manual inputs or metadata harvesting). For data discovery, the catalogue services are equipped with tools to query and present metadata records as users initiate searches for data or services they require. In this conception, most geportals have a cataloguing function, concerned with organizing geospatial data and providing access to it. However, in addition to a cataloguing capability, application geportals provide on-line, dynamic geographic web services that represent capabilities that cannot only query metadata records of data services, but they also link directly to the data services themselves. Geographic web services may refer to routing, geocoding and mapping services. For example, Mapquest provides routing services (www.mapquest.com) and National Geographic provides mapping services (http://www.nationalgeographic.com/maps/).

Traditionally, the development of GIS information and services has been relying with experts. This represents a top-down authoritarian, centrist paradigm that has existed for centuries, in which professional experts produce, dissemination is radial, and amateurs consume (Goodchild, 2007). However, the diffusion of distributed GIS and geportals has given opportunities to develop community-based participatory mapping development activities that represent bottom-up approaches. For example, Aditya (2008) described an application of a geo-community portal whereby a local community could upload and share geo-data in order to participate and assist in collaborative decision making and activities for disaster management. Beaumont et al. (2005) has also described several other bottom-up approaches to the development and application of geportals for several e-government and e-democracy UK based projects. Nowadays, recent web 2.0 advances have further expanded and democratized the development of geportals by offering Internet users the tools to participate in the development and distribution of web mapping services. Moreover, the growth of internet use and advances in web mapping applications including the availability of Application Programming Interfaces (API) from popular web applications (e.g., GoogleMaps, YahooMaps, and Microsoft LiveMaps) has opened up more possibilities to involve public users and group communities in participatory mapping. According to Turner (2006), the implications of web 2.0 on geportals leads to a new era called neogeography, and several recent publications (e.g. Erle, Gibson, and Walsh, 2005; Scharl and Tochtermann, 2007; Sigala & Marinidis, 2009) analyse numerous case studies illustrating how the two features of web 2.0 (collective intelligence and social networking) have revolutionised the creation and diffusion of geportals. The increasing size and impact of this neogeography (Turner, 2006) is also reflected in the rise of specialized conferences, e.g. the Where 2.0 conference series (conferences.oreillynet.com/where), specialized websites such as Google Earth Hacks (www.gearthhacks.com).

Goodchild (2007) used the term volunteered geographic information (VGI) for describing the web 2.0 empowerment of users to participate in geportals’ development and diffusion. Goodchild (2007) described the production economics of VGI (whereby producers and consumers geo-information and services are no longer distinguishable) and analysed three levels of users’ engagement in developing VGI. The first and lowest level refers to users’ involvement in data publication. For example, similar to Wikipedia’s functionality and tools, Wikimapia (http://www.wikimapia.org) allows users to provide descriptions of places and artifacts of interest to them, along with geographic coordinates. Users’ entries of geo-tags appear in a rectangle aligned with latitude and longitude of the place, together with a description text, photographs, videos and other links that the user may wish to include for interpreting – describing the specific place geo-tagged on the Wikimapia’s map. In other words, Wikimapia represents a collaboratively developed encyclopedia of geographically located places and artifacts. At a higher level of sophistication are projects in which volunteers contribute substantial technical content. For example, OpenStreetMap (www.openstreetmap.org) require volunteers-users to have some level of expertise in GIS use and the website’s software (e.g. in geographic measurement and the website’s system for classifying street) for collaboratively building a public-domain street map of the entire world. Each contributor develops a map of his/her local streets using GPS tracking, and then, individual contributions are assembled and reconciled into a single patchwork. In addition, extensive metadata is incorporated, since each piece of the patchwork may have different levels of accuracy and may have been acquired at different dates. At a third level of sophistication are those services that allow the average person to make their own complex information available to others within easy-to-use
Web 2.0 environments. Google Earth is one of the best-known examples of such services, and one can found several such examples and applications by visiting the Google Earth’s community portal (http://bbs.keyhole.com/ubb/). Google Earth’s Application Program Interface (API) allows any user to create and publish new content, in the form of layers that can be viewed over the Google Earth imagery base, or mashed with it.

Overall, it becomes evident that geoportals are not only to be used for a single user, but also in a group, thereby enabling geocollaboration, i.e. collaboration efforts using geospatial information and tools (MacEachren, 2001). This has tremendous implications for users when they use geoportals for trip planning and decision making purposes, as trip planning is very frequently a process and decision that requires the consideration of the needs, preferences and requirements of several people, e.g. a couple, a whole family and/or a group of friends designing together their travel itinerary and experience. By accessing and using the collaborative portal, geocollaboration enables the collaborating actors to together by interacting, accessing and exchanging geospatial information, sharing specific and local knowledge, and assessing choices to support actions (MacEachren et al., 2005; Aditya and Kraak, 2009). The following section focuses on analyzing how geoportals as well as their web 2.0 enabled functionality and geocollaboration capabilities facilitate travelers to (collaboratively) design their personalised trip plans and experiences. The implications of the former on travellers’ decision making processes and behavior are discussed.

Web 2.0 functionality and geocollaborative capabilities of geoportals: implications on trip planning and decision making processes

Tait (2005) identified four major functionalities of geoportals namely search, mapping, publishing and administration capabilities. The social networks and social intelligence developed through Web 2.0 tools provide users with further and new capabilities to create, disseminate, share, read and combine (mash-up) geographical content and metadata within online social communities. In this vein, the four original functionalities of geoportals should be expanded further in order to include the social and collaborative capabilities of web 2.0 tools. Table 1 describes these new functionalities of web 2.0 empowered geoportals by identifying the major web 2.0 tools enabling these functionalities and providing examples on how they can facilitate and support the trip planning process of travellers.

<table>
<thead>
<tr>
<th>Functions</th>
<th>Description</th>
<th>Web 2.0 enhanced functions</th>
<th>Description</th>
<th>Web 2.0 tools supporting the functionality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search</td>
<td>Place location and provision with particular set of features or objects.</td>
<td>Social search</td>
<td>Users can search geographical related information based on others’ personalized trip maps (social collaborative searching services) or (geo)tags: tourists can identify others with similar profile, interests, travel experiences and travel needs (e.g. hotels providing services for people with disabilities) and search/identify location-items-firms based on others’ personalized maps.</td>
<td>Tag-searching, vertical meta-searching, link-searching, social bookmarking etc.</td>
</tr>
<tr>
<td>Mapping</td>
<td>Map visualization capabilities in order to add value to the search process</td>
<td>Social mapping</td>
<td>Any user can create, publish and share a personalised map and itinerary of his / her trip by entering geotags of any location or resource (e.g. hotel, attraction, monument, restaurant etc) on a map and relate it with multimedia content (text, picture, artifact, video etc) that may also include tourists’ feedback and experience of the place.</td>
<td>(geo)-Tags, hotspots, points of interest (POIs)</td>
</tr>
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Table 1
Geoportal web 2.0 functionality and its implications on trip planning and decision making processes
In fact, the power and the implications of the functionality related to the social (collaborative) creation and publishing of maps is best illustrated by the current emergence of geocollaboration portals aiming to support group-work applications that are related to geographical resources. Geocollaboration portals represent the web 2.0 empowered evolution of collaborative GIS and geoportals. Collaborative GIS are defined as a process of making collaborative use of GIS technology and data amongst group members that can be (Applegate, 1991): at the same place and same time (synchronous & co-located); same place different time (asynchronous & co-located); different place same time (synchronous & distributed); and different place different time (asynchronous & distributed).

Geocollaboration portals have emerged as a good solution for improving group work, because maps can play a crucial role in enhancing group formation, cohesion and collaboration. MacEachren (2005) identified three roles that maps can have for supporting group work: a) an object of the collaboration; b) a visual depiction to support dialogue; or c) a device to support coordinated activity. Existing literature also provides evidence of the applicability for these three roles of maps in collaboration environments. Armstrong and Densham (1995) discussed the design of a map to facilitate location selection (i.e. maps as an object of the collaboration), Rinner (2001 and 2006) described the use of geo-referenced discussions on top of a map for facilitating group dialogue in a planning context (i.e. maps as a device to support dialogue). Specifically, Rinner (2006) developed an annotated map that was aimed at providing a medium for several stakeholders involved in spatial planning to share and exchange their arguments. Finally, Aditya (2008) described the development of a geocollaboration portal for coordinating a group work using a map-based portal. Analytically, Aditya (2008) demonstrated how the geocollaboration portal facilitates distributed collaboration by enabling different stakeholders (including analysts, decision makers and local residents) to: a) share their perspectives on the problems, cause, and possible solutions concerning their neighborhood’s infrastructure problems on top of a map; b) facilitate discussions; and c) actively contribute to the decision-making processes related to disaster mitigation and responses. Regarding the impact of web 2.0, Sigala (2008 and 2010) reviewed the literature and provided evidence of the role of (geo)tags sharing on the creation and facilitation of collaborative group processes, such as collaborative learning, group social networking and knowledge exchanges.

The success of group work depends on many factors, including cognitive, organizational work setting as well as social-and cultural factors of group members. Geocollaboration portals afford several capabilities for positively influencing these factors. For example, geocollaboration portals can be used for increasing the visualization of information (by using for examples maps, graphics, and images) related to the group work. Information visualization supports the intelligence design, and choice phases of a group decision making (Simon...
1981), because it increases cognitive resources, reduces the search complexities, eases the pattern determination, and fastens the perceptual inferences (Thomas and Cook, 2005). In a collaboration context, collaborative tasks involving maps (and graphics) span from collaborative exploration – collaborative confirmation or analysis – collaborative analysis – to collaborative presentation (MacEachren and Brewer 2004). This typology of collaborative tasks can be related to the four processes required in group work: generate (idea and options), negotiate, choose, and execute (MacEachren and Brewer, 2004). These are also parallel to the notion of Rinner’s (2006) decision-making phases, in which he has also incorporated a post-decision group task namely, review: intelligence, design, choice, and review.

Trip planning is done very frequently collaboratively and it is also a complex process consisting of six similar collaborative tasks namely as (Moutinho, 1987): problem identification (i.e. generation of ideas and options for traveling), information search, information evaluation (negotiation and assessment), choice (choose), book (execute) and post choice (review). Maps can play any of the three roles identified by MacEachren (2005) for supporting and facilitating group decision making in trip planning. In this vein, geocollaboration portals can be regarded as important group collaboration tool for facilitating collaborative trip planning and decision-making processes. Table 2 analyses the functionality of geocollaboration portals by describing how these can assist groups of travelers in effectively and efficiently accomplishing the collaborative tasks related to trip planning and decision making processes.

<table>
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<tr>
<th>Functionality</th>
<th>Collaborative tasks</th>
<th>Examples describing the collaborative trip planning and decision processes</th>
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</thead>
</table>
| Collaborative presentation  | See, observe, perceive, distinguish, understand | Problem Identification
  - reading others’ users travel itineraries, experiences and reviews on a map and generating ideas on what they can do
  - exploring and understanding the attractions, tourism operators, and the road infrastructure in different locations
  - distinguishing destination – itinerary options by the availability and attractiveness of their attractions |
| Collaborative discovery/ exploration | Search, browse, identify, compare, associate | Information Search
  - searching geographical information and resources for specific locations
  - identifying the location and surrounding infrastructure of specific attractions, airports and tourism operators
  - compare itineraries based on their distances, road infrastructure, availability of attractions
  - associate travel itineraries with the visitation of attractions and / or stays with hotels etc |
| Collaborative analysis      | Discuss, assess, examine, scrutiny, breakdown, investigate | Information Evaluation & choice
  - sharing travel itineraries and suggestions with others for further discussion and elaboration |
| Collaborative synthesis     | Combine, share, join, link, separate | Book – Execute
  - collaboratively synthesizing discussions on trip planning and itineraries on group maps
  - identifying tourism operators and completing with them the booking-purchase processes (e.g. mash-up applications such as www.earthbooker.com maybe required) |
| Collaborative review        | Assess, re-design, feedback, simulation | Post choice
  - viewing their generated itineraries on a map, having a virtual tour and deciding on whether to change plans or not
  - Upload feedback, photos and videos on maps after returning from a trip for future decision making and/or for the use of other groups |

Overall, web 2.0 empowered geoportals and geocollaborative portals have significantly changed the way tourists (individually and/or in groups) plan their trips by enabling them to search, read, write and share travel information and experiences on top of a map. Trip planning requires travelers to gather and assess a huge volume of information in order to assist them with three types of decisions (Fesenmaier and Jeng, 2000): 1) core decisions including information related to travel budging and costs, lodging, length-duration of trip, route-itineraries, primary, travel group; 2) secondary decisions prior to the trip (information related to secondary destinations, activities and attractions) and 3) en route decisions (information regarding stops for different purposes, gifts etc). As it was shown in Table 1, Web 2.0 empowered geoportals provide travelers with numerous tools to identify, search, share and
evaluate all this required trip related information. Several geoportals also enable users to download geoinformation and applications to mobile devices, while several other web 2.0 tools (such as twitter, facebook) also enable users to stay in touch and collaborate with their groups even if they are on the move. In this vein, recent technologies also enable travelers to take and/or change trip decisions ad hoc and while they are on their route or at the destination (i.e. facilitate travelers on their third type of trip decisions). Geoportals also allow travelers to store information for future retrieval as well as to upload information after their trip. In this vein, geoportals can also facilitate post trip planning decision making as well. In summary, travelers can be both passive and active users of web 2.0 empowered geoportals and geocollaborative portals, and the latter affect travelers’ trip planning processes by enabling them to:

- search and use geographical information and services based on: (geo)tags of locations and resources; (themed) maps; other travellers’ profile; geographical distances and other features that are provided by the geoportals and/or created by other users (i.e. enabling social collaborative searching services);
- create and publish their personalized maps by uploading (geo)tagged information related to any location-item (hotel, attraction, monument, restaurant etc) on a map and enhancing (geo(tags) with multimedia content (text, feedback, photos, videos, links etc) for describing the geographical resource;
- use maps for creating social networks or group-works and supporting – facilitating their collaborative activities, such as discussions, debates, knowledge exchanges, evaluation and synthesis;
- create maps collaboratively within a work – group or social network and share it amongst all members of the group for supporting collaborative and social tasks;
- publish personalized (collaborative) maps on (personal/group) websites and/or social networks e.g. in facebook
- combine geographical information and resources with other content for creating mash-up applications: e.g. Google Earth applications.

CONCLUSIONS, PRACTICAL AND THEORETICAL IMPLICATIONS

As more and more travelers wish to create their personalised trip itineraries and experiences, the provision of geographical information and services on travel websites will be an unavoidable necessity. The current evolution of geoportals and geocollaborative portals (that facilitate work group based on the top of a map) coupled with the enhancement of their functionality with web 2.0 tools and capabilities, present numerous opportunities and services for making the trip planning process less complex and time consuming, more efficient and more social and enjoyable for travelers and their travel companions. In this vein, the paper analysed the functionality and services of geoportals and geocollaborative portals and thoroughly demonstrated how the former affect the trip planning and decision making processes on travelers. This discussion provides useful practical guidelines for designing the functionality of geoportals and/or geocollaborative portals. Analytically, geoportals and geocollaborative portals need to provide: rich geographical information and services (e.g. calculation of distances and route identification); multiple search engine capabilities for geographical information retrieval and analysis; capabilities enabling users to provide and share geographical information and services; capabilities enabling users to create and share personalised maps; tools enabling the formation and support of group work tasks (such as discussions, sharing and synthesis of information) related to trip planning processes; and social search capabilities. Suggestions for future research include the study of: the types of value and benefits that travelers get from passively and/or actively using geoportals and geocollaborative portals; the impact of geoportals and geocollaborative portals on the efficiency and effectiveness of the trip planning processes; and the impacts of geoportals and geocollaborative portals usage on travellers’ loyalty, perceptions and future intentions regarding the travel website.

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