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Abstract

Nowadays, museums employ web-based services, such as websites and social networking, to connect with their audience and to create new. In this paper we try to identify how Interactive educational design tools can add value to museums websites and populating the online visits. This paper discusses the case of the Natural Europe Pathway Authoring Tool and the educational pathway usage. Additionally, this paper presents findings on how museum educators and science teachers use the Natural Europe Pathway Authoring Tool. Moreover, this paper aims to set a preliminary discussion on whether learning design environments can potentially raise the traffic on the museums websites and vice versa.

Keywords: educational pathways, informal learning, natural history museums, learning analytics, data sets

Introduction

Nowadays, museums employ web services, such as websites and social networking, to connect with their audience and to create new. According to Tom Moritz the use of such services by the museums has two main goals: "*to increase awareness and to promote*" (Moritz, 1996). It goes without saying that the role of museum and its website are complementary. Websites of museums should attract visitors in the museums and vice versa (Marty, 2007). Museums' website should be created based on a learning model rather than an information model (Anderson, 1999) and they should include storytelling, context and dynamic content (Donovan, 1997). As far as it concerns the learning resources that are available through museums' websites, they "*aim to provide rich contextual information, with different layers of interpretation and entry points*" and they also promote the "*active involvement in learning*" (Loran, 2005).

In this short paper we try to identify how Interactive educational design tools can add value to museums websites and populating the online visits. In first place we present the background of this study that is taking place within the context of a European project, the natural Europe initiative. Following we analyse the methodology and the tools that we have used in order to compare the visit indicators of two websites before and after the deployment of the Natural Europe Pathway Player. In the next section we study the visit sources of the Natural Europe Pathway Authoring Tool (PAT) and we study how these visits correlate to visits in the Pathway Player or to other Natural History Museum (NHM) websites. In the end of this paper we discuss some preliminary conclusions and future work.

Background

NHMs are unique spaces that have only recently come to comprehend the effectiveness of the learning opportunities they offer to their visitors (Falk & Storksdieck, 2005). Lately, their collections that form a rich source of knowledge about Earth's biodiversity and natural history are gradually being digitized, aiming to become available to everyone through the museums' websites.

The current study took place within the context of a European founded project named the Natural Europe project (http://www.natural-europe.eu/). More specifically, building on the experience of COSMOS project, the first to organize science-related learning objects in educational design made available through digital repositories (Sampson et.al 2011), the Natural Europe project aims to bring together digital collections from NHMs around Europe and make them accessible through Europeana portal (www.europeana.eu) for educational reasons. To this end, software tools have been designed and cutting-edge educational approaches have been studied, developed, adapted and applied to address the needs of different categories of museum visitors through innovative online educational activities named as educational pathway modes. NHMs and Science Centers (SCs) from six different European countries (Hungary, Greece, Portugal, Estonia, Germany and Finland) participate in the Natural Europe project. Additionally, the PAT will be accessed through the participating museums website. For this purpose a Pathway Player is deployed and installed to the museums website. For the time only the University of Lisbon's National Museum of Natural History - MNHNL (http://education.natural-europe.eu/mnhn/) and the Estonian Museum of Natural History - TNHM (http://education.natural-europe.eu/tnhm/) have deployed the Pathway Player to their website.

Cennamo et al. have investigated ways to add value to museum websites in order to support informal learning addressed to various user groups (Cennamo et al, 2001). They stated that the most suitable way is to employ inquiry-based learning in the museum's website. In each step of the inquiry-based process, different methods have been used. Likewise, Natural Europe PAT is based on an inquiry-based model to create the pathways that are available in Pathway Player. The Natural Europe project adopted the educational approach recognized by the European Union as the most effective for school students: inquiry-based learning model (Rocard 2007). Inquiry-based learning engages students in the investigative nature of science (Sandoval & Bell 2004), through active search for knowledge or understanding to satisfy a curiosity. The partner museums have set the audiences, thematic areas and educational needs to be addressed by the Natural Europe project, in order to ensure innovation in terms of education. In this context, the Natural Europe project has taken into consideration the three main components of NHMs (collections – educational activities put forward by museum educators – visitors) for the design of educational activities and the respective tools.

Impact of the Pathway Player to the NHMs websites

Research problem & questions

Our aim is to analyze the visitations' statistics of the websites of NHMs before and after embedding the pathway player in their websites. For the time being the Natural Europe Pathway Player has been embedded to the websites of the MNHNL and the TNHM. In the future plans of the project is to deploy the Pathway Player to all NHM's websites that participate to the Natural Europe project. The research problem that we have investigated in

this section is the impact of the Pathway Player on the two before mentioned NHM's websites.

Variables studied

In order to evaluate the impact that the implementation of the Pathway Player has to the webpage statistics for both the TNHM and the MNHNL, a number of indicators were used in website level. The variables that have been used in this section are presented in Table 1. These variables have been derived from the Google analytics of the TNHM's website and MNHNL's website.

Table 1. Variables used in this section of the study

Variables	Description
Visits (per day)	Visits per day to the website of the specified NHM
Pageviews (per day)	Daily pageviews per visit to the website of NHM
Unique visitors (per day)	The amount of unique visitors of the NHM's website per day
Bounces per day (per day)	The bounce rate per day for each NHM website

Methods & tools

The methods that have been used so as to investigate the research problem were the analysis of Google analytics data (http://www.google.com/analytics/) for each NHM's website. The Google analytics feature is reporting the visits of a particular website and provides tools for the analysis of the website's statistics.

In order to investigate the research problem, the following analysis type has been used:

- *Statistics of the NHM's website:* these are the website level indicators.

The main tools that have been used were the Google analytics service and the Microsoft Excel. Moreover, data post-processing and analysis was carried out using Microsoft Excel where exported CSV files from Google Analytics where processed.

Context and period of study

Due to the fact that the Pathway Player has been implemented in different time period to each museum, the testing period differs for each of them. Moreover, the study compares the page indicators that take place between two different periods, the period before and after the Pathway Player deployment to the website. Therefore, the reference periods used in this paper for the MNHNL are set (a) from November 1st, 2012 to January 31st, 2012 and (b) from February 1st, 2012 to April 20th, 2011. In the meantime, the reference period for the TNHM is set (a) from January 24th 2012 to February 24th and (b) March 1st 2012 to April 1st, 2012.

Results

The results are presented in the form of tables and figures that focus on the variables that are examined.

Table 2. Overview of webpage statistics for MNHL and TNHM

	NHM website	Visits/day	pageviews/day	Unique visitors/day	Bounces
Before PP deployement	TNHM	44.74	206.38	39.58	32.59%
After PP deployement	TNHM	57.74	271.93	52.06	29.44%
Before PP deployement	MNHNL	238.37	1,170.72	186.12	35.9%
After PP deployment	MNHNL	278.68	1,274.36	213.76	37,17%

As derived from the table 2, the visits per day to the TNHM's museum have been increased by 29.05% after the Pathway Player deployment, while the daily pageviews per visit have been augmented by 31.76%. There are 31.54% more unique visitors per day to this website, while the bounce rate has been diminished by 9.66%.

The visits per day to the MNHNL's website have been increased by 16.91% and the unique visitors per day have been augmented by 14.85%. However, the pageviews per visit of this website have been increased by 8.85% and the bounce rate has been increased 3.53%.

After embedding the Pathway Player to their websites, the overall statistics of both the NHM's websites have been increased. As a direct consequence, the deployment of Natural Europe Pathway Player draws more visits to the websites of Natural History Museums.

The visit sources of Pathway Authoring Tool

Research problems & questions

The aim of this section is to investigate the visit sources of PAT and examine the way that they correlate to visits NHMs' websites. The visit sources might be either referral, direct or via a search engine.

Variables studied

In order to examine the visit sources of PAT and how they connect to visits NHMs websites several variables were used. These variables associate with the statistics of the webpages. The before mentioned statistics concern the visit sources of the webpages, the behavior of visitors and the amount of visits to the webpages.

Table 3. Variables used in this section of the study

Variables	Description
Visits (per day)	Visits per day to the website of the specified Natural History Museum
Visits	The amount of visits to this website
Pageviews (per day)	Daily pageviews per visit to the website of NHM
Pageviews per visit	The pageviews for each visit.

Unique visitors (per day)	The amount of unique visitors of the NHM's website per day
Visit from returning visitors per day (per day)	The daily visits from visitors that have already visit the website
Total visits	The total amount of visits to the website
Search traffic	The traffic of the website that derives from search engines
Referral traffic	The traffic of the website that derives from other websites, which refer to the URL of this website
Direct traffic	The traffic of the website that directly visit the URL of the website

Methods and tools

The methods used to examine the questions posed in this section involve the statistics provided by the Google analytics.

Especially, the methods employed to investigate the first question, that is which are the visit sources of the PAT, were the following:

- Statistics of PAT website: the website level indicators of the Pathway authoring tool

To explore the way that the visits to PAT associate with the visits to PP and NHMs websites the following methods were used:

- Statistics of NHM's websites: The website level indicators of the NHM's websites

The main tools that have been used were Google analytics and the Microsoft Excel.

Context and period of study

In the context of the Natural Europe project we have developed the Natural Europe PAT, that is an online web installation serving as a database of educational pathways, where educators can create their own pathway and share them with the community, while making use of a large collection of digital resources from Natural History Museums and collections such as Europeana, a European-wide cultural heritage digital library. In this section we present an overview of the page statistics for the PAT.

The reference period that we study is set from February 1st, 2012 to April 20th, 2012.

Moreover, the statistics of the pathway player deployed in the TNHM website, as well as the pathway player deployed in the MNHNL website are also presented. The period of the study for both the NHM's pathway player statistics is set from February 1st, 2012 to April 20th, 2012.

Results

As the figure 2 shows, the website of Natural Europe PAT has the most page views per day, followed by the website that contains the educational pathways of University of MNHNL. The educational pathways of TNHM have the least page views from the other two (2) web sites.
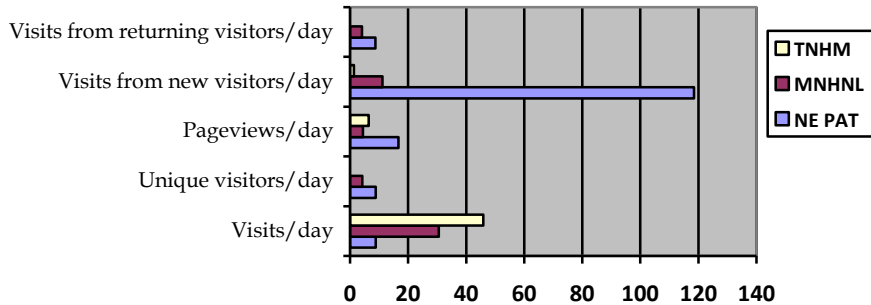
Figure 1. Comparison of the statistics of the websites that containing pathways

Sources of Natural Europe pathway tool visitors:

One thousand fifty (1050) visitors have been at the Natural Europe pathway tool website. From whom the 20.29%, two hundred thirteen (213) visits, have been redirected to the Natural Europe pathway tool website by a search engine. The percentage of referral traffic for the same period was 56.29% that corresponds to five hundred ninety one (591) visits, whereas the direct traffic was 23.43%, which corresponds to two hundred forty six (246) visits.
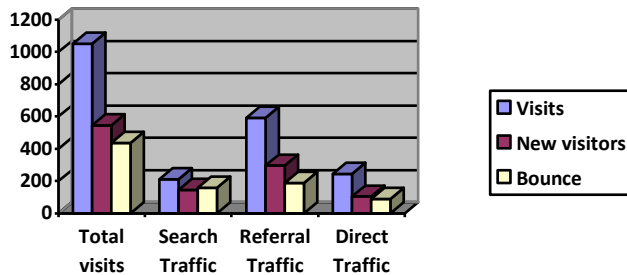

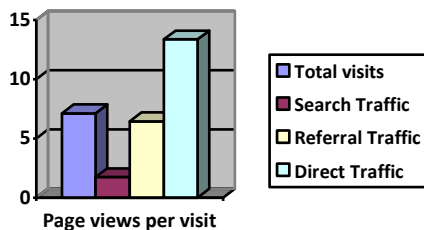**Figure 2.** Comparison of statistics according to the traffic source

Figure 3. Comparison of page viewed per visit depending on Traffic source

Search sources:

As far as it concerns the search traffic the visitors viewed an average of one point seventy two (1.72) pages per visit, while the average visit duration was one minute and eleven seconds (00:01:11). The percentage of new visitors that were brought by search engines was 68.54%. However, the amount of visitors that left the website from the entrance page was one hundred fifty eight (158)

Table 4. The ten (10) most used keywords in the search traffic sources

Keyword	Visits
natural europe PAT	55
olive tree	32
natural europe pathways	8
olive	4
allosaurus um dinossáurio dois continentes	3
antti kurola	3
deinotherium	2
deinotherium size	2

Table 5. Search traffic source

Search Source	Visits
google	206
babylon	4
avg	1
images.google	1
search-results	1

Direct traffic:
An average of thirteen point thirty seven (13.37) pages per visit have been viewed from visitors that have browsed directly Natural Europe pathway tool website, while their average visit duration was eleven minutes and thirty six seconds (00:11:36). The amount of new visits was one hundred five (105) visitors, whereas the percentage of visitors that have left the website from their entrance page was 36.59% of the total amount of visitors.

Table 6.The ten (10) most visited direct traffic landing pages

Direct Traffic Landing Page	Visits
/natural_europe/	82
/natural_europe/index	37
/natural_europe/?nhm=MNHN	22
/natural_europe/exhibits/show/olivetree/to-begin-with	10
/natural_europe/exhibits/show/Flying_dinosaurs/to-begin-with	9
/natural_europe/?nhm=TNHM	8
/natural_europe/exhibits/show/Be-the-Ultimate-DinoDoctor/to-begin-with	7
/natural_europe/exhibits/show/Olive-tree-mythology/to-begin-with	7
/natural_europe/exhibits/show/nature/to-begin-with	4

Referral sources:
Visitors redirected to Natural Europe pathway tool from referral traffic have viewed an average of six point forty five pages per visit (6.45). The total amount of the new visitors derived from referral sources are two hundred ninety six (296), while the bounce rate from referral sources was 31.98%. The average time that visitors spend in this website is seven minutes and forty seven seconds (00:07:45).

Table 7. The ten (10) referral sources that brought the higher amounts of visits to Natural Europe pathway tool

Referral Source	Visits
mnhnc.ul.pt	284
ariadne.cs.kuleuven.be	90
ul.pt	73
36ohk6dgmcd1n-c.c.yom.mail.yahoo.net	27
wiki.agroknow.gr	26
google.com	25
/mnhn/	17
Natural History Museum of Crete	16
mnhn.ul.pt	9
google.ca	4

Visits from NHMs with a pathway player embedded:

MNHNL has a pathway player embedded in its website. The total amount of visits that derived from the Educational Pathways website of the MNHNL was two hundred ninety three (293). That corresponds to the percentage of 49.57% of the referral visits and the 27.9%

of the total visits to the Natural Europe PAT, so the higher amount of referral visitors to PAT derived from the MNHNL. Moreover, the 93.09%, that is 419 people, of the visitors to the PP of MNHN also derived either from the University of Lisbon or from the MNHNL. That results to keeping the visitors to MNHNL longer to the NHM website and increase the visitors' interest about the MNHNL.

As far as it concerns the visits to the website of the MNHNL they have also increased significantly after the deployment of the PP (Table 2). As a direct consequence the interest on the website of MNHNL has been grown and more new visitors have been drawn to it.

The TNHM website has not attracted any substantial amount of visitors to the PAT. Likewise, there were not any visitors drawn to the PP of the TNHM museum drawn from the Tallinn NHM's website. However, the deployment of the PP had a positive impact on the TNHM website (Table 2), since 29.05% more visits per day have been done to the TNHM website after the deployment of the PP.

Conclusions

The main goal of this short paper is to serve as a preliminary study on the correlations between learning design tools and museums websites. The Natural Europe PAT is an online web installation aimed to be used by teachers and museum educators to create their own pathways and share them with the community. Additionally, the Natural Europe PAT will be accessed through the participating museums website. For this purpose a Pathway Player is deployed and installed to the museums website, apart from the MNHNL and the TNHM the Pathway Player will be deployed to all participating museums website. In the context of the present research the interests are to study in depth the influence of the Natural Europe educational environments in the augmentation of the online visits to the museums website.

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