Introduction

The Biodiversity Heritage Library (BHL) is a consortium of twelve natural history and botanical libraries that cooperate to digitize and make accessible the legacy literature of biodiversity held in their collections and to make that literature available for open access and responsible use as a part of a global "biodiversity commons."

The Biodiversity Heritage Library has over 33 million pages and counting. It is now a collection of over 46,000 titles and 89,000 volumes, accessed by tens of thousands of users worldwide, but only a handful of library and technical staff manage the daily operations of the BHL. In order to juggle the tasks required to manage this digital library along with the assigned duties of their own home brick-and-mortar institutions, the Biodiversity Heritage Library has adopted a commercial, off-the-shelf issue tracking system to resolve problems and manage feedback from users.

Just as the digitization of books occurs one page at a time, so must the process of fine-tuning the digital collection happen one task at a time. Using Countersoft's *Gemini* issue tracking software, BHL staff document and monitor user feedback to process scanning requests, correct metadata errors, replace missing or poorly scanned page images, reconcile duplicate entries, address bugs associated with the BHL website, and answer reference inquiries. Going beyond virtual reference, *Gemini* serves as the reference desk, the technical services office, the acquisitions department, the meeting space, and the round table for the Biodiversity Heritage Library. Implementation of *Gemini* enhances staff's ability to meet users' needs for more content and better services.

Scanning is easy, everything else is not

BHL is a niche collection of legacy biodiversity literature where separate, autonomous collections are brought together into one globally accessible virtual place. Each BHL member institution participates in the project by scanning material from its own library collections, managing its own digitization workflows and volunteering its own staff resources.

Collection development for the BHL began with a push among member libraries to scan their respective collections according to subject strengths. The collective goal was to digitize the contents of each library collection with a minimum amount of duplication. Selecting materials

¹ Please note that the authors do not advocate any one platform, tool, or solution over any other.

for scanning without duplicating already digitized content is a complex process with twelve libraries that have very similar collections. The BHL consortium considered the adoption of a union catalog to help manage the digitization workflow from a collective approach, but given the need for volume-level bibliographic detail, building a distributed library union catalog using the standard Z39.50 protocol was not sufficient. In the absence of a union catalog, low-barrier deduplication tools were developed to aid in this process; however, the tools, though collectively used, were insufficient because they lacked a platform for communication and collaboration. In addition, there was no mechanism for managing content post-digitization. For example, with limited staff resources, it is impossible to do quality review for 100% of the BHL collection. Furthermore, it is difficult for staff to ensure that all available metadata is correct and complete or gather information about gaps in the collection.

As a provider of digitized content to the Encyclopedia of Life, which came online in early 2008, BHL needed to stock its shelves as fast as possible.² The initial subject-based scanning efforts formed the building blocks of BHL, which launched in May 2007 with 3,240 volumes of scanned material. Scanning selection and workflow developed and evolved throughout the next eighteen months, and the corpus of taxonomic literature available via the BHL portal continued to grow. Subject-based scanning assignments neared completion just as new members joined the BHL consortium. Having missed initial scanning opportunities, it was unclear how these institutions should contribute material from their collections. As BHL collection development evolved from a mass digitization workflow to something more targeted, it became evident that staff required new methods to drive digitization and address user-discovered issues. With the initial scanning completed, staff determined that users could become a valuable resource for both selection of new materials and improvements to services. As an experiment in user-driven collection development, BHL had a unique opportunity to expand the collection in accordance with the documented needs of users and answer the question of what should be scanned now that subject-based selection was no longer viable.³ In other words, user feedback was potentially a rich resource, and staff needed a way to harness user perspective.

A new approach

Conventional communication tools are not able to deliver the flexibility and collaborative functionality necessary to effectively collect and resolve user feedback. Tools like email, wikis, and virtual reference software lack measures that guarantee resolution of problems. These tools

² "The Encyclopedia of Life is an unprecedented effort to gather and share scientific knowledge about all living things in a single online resource." "Encyclopedia of Life 2010 Brochure," last modified August 23, 2010, http://content2.eol.org/content/2010/08/26/08/00750.pdf.

³ Leslie J. Reynolds et al., "User-Driven Acquisitions," *Collection Management* 35 (2010): 244-54.

leave necessary tasks too often neglected and unresolved by well-intentioned yet over-extended librarians. Email threads are too often buried; wiki pages are better suited for documentation than detailed discussion; virtual reference requires significant staff resources. Working with these tools, the daily business of correcting errors and implementing enhancements—identified by staff and users—became haphazard and cumbersome. It was clear that the collaborative nature of BHL demanded an equally collaborative, iterative, and *flexible* tool.

Faced with an immediate need to better address user feedback and select new material for scanning, staff considered issue tracking software. BHL programmers had been managing tasks associated with technical development, planning, and bug tracking using Countersoft's *Gemini* issue tracking system. Staff considered that this tool could be adapted to meet the complicated needs of the BHL project from a user and collections perspective.

To determine whether *Gemini* was the right answer for BHL, staff identified their requirements and explored a variety of issue tracking software as potential candidates for the project [see Appendix, Figure 1]. There are as many issue tracking systems as there are special libraries: *Gemini* suited BHL's needs. *Gemini* is hosted externally, cost-effective, user-friendly, and technically supported. That said, staff made some minor modifications to adapt *Gemini* from a programmer's tool to a viable system for librarians working in the digital arena.

Turning a help desk into a reference desk

Issue tracking systems are typically used to manage tasks associated with computer programming, institutional information technology needs, networking, telecommunications, and other services where a small, centralized staff serve a decentralized user group. In order to make issue tracking software work for BHL, staff adjusted the existing language to translate developers' ways of describing issues into a digital library's task management needs. *Gemini* functions on the premise of individual issue tickets that can be opened, interacted with, collaborated on, and ultimately closed as issue resolution occurs. For the purposes of BHL, these issue tickets equate to the feedback submitted by users on the BHL website. With each piece of feedback staff receives, various attributes track the progress of an issue from receipt to resolution.

Two of the more important attributes of *Gemini* for BHL staff are the comment feature and the email notification system. *Gemini*'s commenting feature functions in many ways like a wiki, allowing staff to communicate in one "place". Comments are identified according to the user who creates them, efficiently keeping track of all conversations regarding a specific issue. Furthermore, automatic email notifications alert staff to issues as they are assigned and updated, prompting staff to participate.

With *Gemini* in place, staff could now more efficiently manage user feedback. But how effectively could users reach staff? To facilitate feedback collection, staff implemented two different webforms to collect general questions and comments, and scanning requests. Available via a single "contact us" link, users have the choice to select what kind of feedback (questions, comments, or scanning requests) they would like to submit. Users receive an automatic email response immediately following issue submission, reassuring them that their feedback was received

Reaction and response

Upon implementation of *Gemini* to collect user feedback and advertisement of the feedback form, staff received 72 questions/comments in the first month, a startling increase from the rate of 11 comments per month for the previous two years. After adding the option to request a specific title for digitization, users contributed 108 requests in the first week alone. *Gemini* empowered staff to address the increase in feedback more efficiently than if they had to communicate solely by email. The new system enabled staff to address and resolve tasks that would normally have taken several weeks, if not months, in a matter of days.

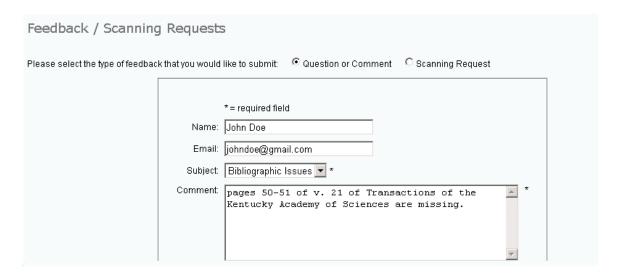
The sudden increase in user response prompted the need to have selected staff serve as moderators to perform an initial triage of issues. Receiving email notifications whenever issues are created or updated, moderators are responsible for reading all feedback that enters *Gemini*, and classifying, prioritizing, and assigning issues to specific staff members. They monitor the progress of all issues, moderating comments and reassigning tasks as necessary. Moderators are also responsible for initial personal communication with users. While there is an automatic email sent to a user when feedback is submitted, staff are aware that users prefer more personalized communication. Moderators directly communicate with users to let them know that their feedback is received and what specific steps are being taken to resolve it.

Gemini functions as a communication, documentation, and collection management system all-inone. By delivering user feedback to BHL staff via an issue tracking system, a handful of librarians are able to effectively manage the ever-growing collection. Gemini documents user feedback about scanning requests, missing volumes of a journal title, missing pages, poor image quality, de-duplication of titles, metadata correction, and traditional reference questions. Feedback from users not only helps BHL staff discover new issues, but informs known issues and inspires new development regarding technical functionality. More importantly, the user feedback received and monitored through Gemini allows staff to engage with individual users about specific issues while also facilitating collaboration among staff to resolve these issues.

Issue by issue and user by user, *Gemini* maximizes the BHL's ability to implement rapid-development and user-centered-design principles as part of its project philosophy.

Theoretical to practical

The discussion of *Gemini* and its adaptation for the BHL project is useful, but a demonstration of exactly how *Gemini* functions within the BHL environment will help further clarify. Following an issue through the system from creation to resolution, the demonstration begins with the submission of feedback by a user on the BHL website.



The above feedback example, alerting staff that one of the volumes held within the BHL collection is missing pages, is automatically added to *Gemini* as a new issue as soon as the feedback form is submitted, and BHL *Gemini* moderators receive an email notification.

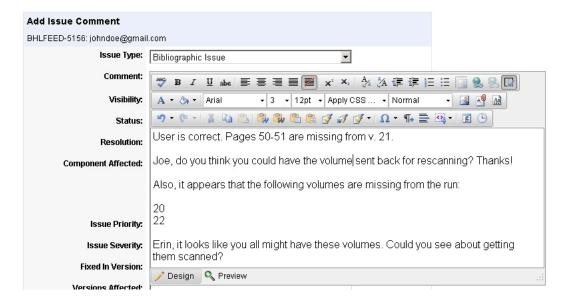


The first step for the moderators is to verify the submitted issue. Thus, in this example, staff access v. 21 of *Transactions of the Kentucky Academy of Science* in the BHL collection to confirm that pages 50-51 are missing.

However, as this example demonstrates, issues submitted to *Gemini* are rarely of a simple, one-step nature. A seemingly straightforward problem often morphs into something much more complicated. Consider the issue outlined above. As staff investigate the missing pages, they realize that this serial title is missing some volumes in the run. Therefore, this issue is no longer a simple rescan situation, but it is now also a collections gap-fill issue.

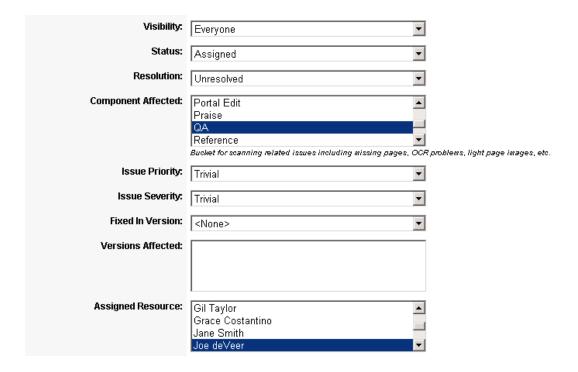
After the user feedback is verified, and all further issues are determined, *Gemini* moderators ascertain who should be assigned to the issue. In the case of problems with scanned content, the issues are always assigned to the original scanning institution. To address gap-fill situations, moderators determine which partner institutions own the missing volumes and can scan them to complete the run.

Once this information is gathered, moderators update the issue by entering a comment indicating that the user feedback has been verified, outlining any additional problems that were identified, and directing a message towards the colleague(s) assigned to the issue. Such messages often recommend a course of action for assigned colleagues to take in order to rectify an issue, and later comments serve as a message board for all colleagues assigned to the issue.

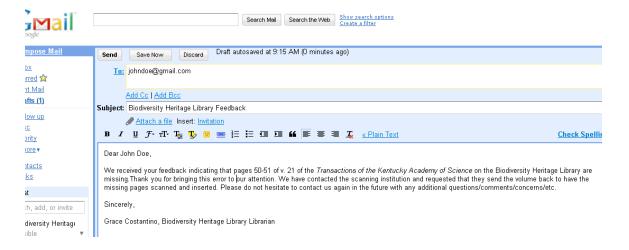


The persistent nature of these comments (as opposed to strings of email messages with many recipients) encourages collaboration and thoughtful communication. There are BHL staff in four different time zones and the commenting structure allows all parties to participate, while gleaning insight from the comments left by colleagues during the problem-solving process. While email is easy to delete, comments and assignments persist in *Gemini* until resolution. Staff are incentivized to participate and assist in resolving issues to which they are assigned.

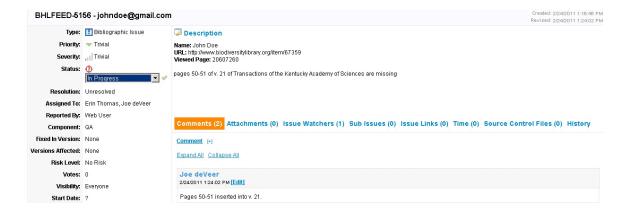
After commenting, moderators indicate the type of feedback, who is assigned to the issue, the status of the issue, and the priority of the issue.



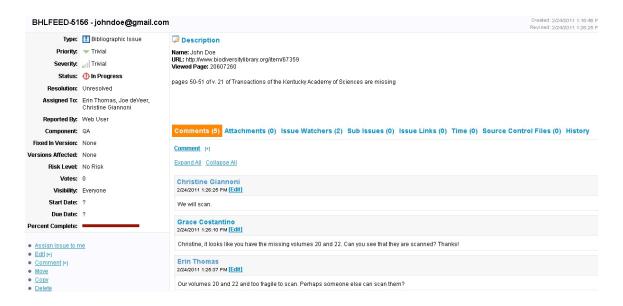
Finally, *Gemini* moderators send an email to the user confirming receipt of their feedback and describing what steps will be taken to resolve it. Staff assigned to issues are responsible for any additional communication with the user that might be required at a later time.



As soon as a staff member is assigned to an issue, they receive an email alerting them to the fact. They can then sign in to *Gemini*, read the indicated comments, and take the necessary actions to resolve any problems. As they perform tasks, they add new comments and update the issue's status, resolution, and any other necessary fields as required.



It often happens that a staff member assigned to an issue is not able to perform the actions necessary to rectify it. In such instances, the staff member leaves a comment indicating exactly what tasks they cannot perform. *Gemini* moderators and everyone assigned to the issue receive email alerts when these comments are created. *Gemini* moderators then find alternative colleagues to assign to the issue to perform whatever actions previous assignees could not.



When the issue is finally completed, the staff member who performs the last task needed for issue resolution creates a comment affirming positive issue completion and updates the issue as closed and complete.



Why an issue tracking system works

Having walked through a discussion of the practical application of *Gemini* for the BHL project, it is useful to step back and discuss exactly why *Gemini* succeeds in the hands of BHL staff where other tools do not. To do so, one must consider the specialized needs of the Biodiversity Heritage Library and its patrons. What aspects of *Gemini* lend themselves to the unique demands of administering this digital library? How does *Gemini* enable the BHL staff to foster user relationships?

With the earliest digital library projects, researchers already voiced concerns over the tendency for digital library plans to "remove social exchange and interaction, focusing narrowly on the technical mechanisms of information access." While increased user interaction is a key reason for adopting *Gemini*, the challenges of operating BHL transcend issues related to patron contact. These obstacles are not unique to digital library projects; indeed, all institutions are challenged by the ability of librarians and associated staff to work together and execute core library functions such as reference and collection development. Through the use of this customized version of *Gemini*, the Biodiversity Heritage Library not only encourages interaction between staff and users, but between geographically dispersed staff members as well. If, as O'Reilly and Battelle state, "Web 2.0 is all about harnessing collective intelligence," then one must recognize that terms such as "social" and "interactive" must apply to staff relationships with one another as well as to users. In adapting *Gemini*, the BHL staff created a hub for staff and patron activity, a tool that fosters a sense of place. If a digital library is indeed a space that conceptually resembles

⁴ Mark S. Ackerman, "Providing Social Interaction in the Digital Library," (paper presented at the First Annual Conference on the Theory and Practice of Digital Libraries, College Station, Texas, June 19-21, 1994): [1], accessed February 15, 2011, http://www.eecs.umich.edu/~ackerm/pub/94b11/dl94.final.pdf.

⁵ Tim O'Reilly and John Battelle. *Web Squared: Web 2.0 Five Years On* (O'Reilly: Sebastopol, 2009): 1, accessed February 15, 2011, http://assets.en.oreilly.com/1/event/28/web2009_websquared-whitepaper.pdf.

the brick-and-mortar library, then it is also much more than a collection of texts, accessible via the Web. 6 *Gemini* offers the opportunity to bring the service model of a traditional library into a digital library space.

As the engine that drives staff functions and user interactions, *Gemini* is an integral part of BHL success. In a society with increasingly technology-savvy citizens, use of and satisfaction with online library services is in decline.⁷ In the OCLC report *Perceptions of Libraries, 2010*, survey responders of all ages resoundingly declared that increased customer service, such as more staff and extended hours, should be among libraries' top priorities.⁸ The Biodiversity Heritage Library is not a brick-and mortar structure, but stakeholders understand that free, 24-7 online access does not negate the need or desire for more traditional, in-person library services. The implementation and effective use of issue tracking software is a response to user-inspired demand for personal interaction.

Conclusion: Building a library on user feedback

The Biodiversity Heritage Library has proven itself a popular and effective tool for research in systematics, taxonomy, and natural sciences. Recent user statistics show annual increases in traffic and an ever-expanding global reach [see Appendix, figures 2 and 3]. However, longevity and continued relevance rely on the project's ability to adapt to changing environments and respond to users' needs. Without user feedback, the BHL risks becoming a static and self-serving tool. In fostering greater, more efficient staff collaboration, *Gemini* allows BHL to capitalize on the diverse collections and skills of member libraries and librarians. User feedback has also allowed BHL to focus collection development in new and productive ways. In adopting issue tracking software, a small, decentralized staff is able to leverage user feedback, transforming it into an essential component of daily workflow and empowering users to determine ongoing Biodiversity Heritage Library activities.

⁶ Francis L. Miksa and Philip Doty, "Intellectual Realities and the Digital Library," (paper presented at the First Annual Conference on the Theory and Practice of Digital Libraries, College Station, Texas, June 19-21, 1994), accessed February 15, 2011, http://www.csdl.tamu.edu/DL94/paper/miksa.html.

⁷ OCLC, *Perceptions of Libraries, 2010: Context and Community* (Dublin, OH: OCLC, 2011): 30, accessed February 15, 2011, http://www.oclc.org/reports/2010perceptions/2010perceptions all.pdf.

⁸ OCLC. Perceptions of Libraries, 62, 68, 70, 76, 82, 88.

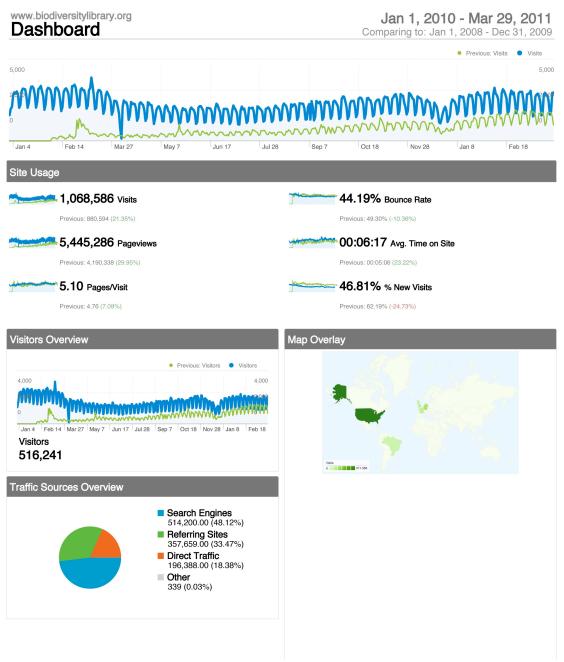
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- Reynolds, Leslie J., Carmelita Pickett, Wyoma vanDuinkerken, Jane Smith, Jeanne Harrell, and Sandra Tucker. "User-Driven Acquisitions: Allowing Patron Requests to Drive Collection Development in an Academic Library." *Collection Management* 35 (2010): 244-54.

Appendix

Figure 1

Requirements		Gemini	Trac	Bugzilla	Redmine
Email Integration					
	Send Email when Issue				
	Assigned	×	×	×	×
	Send Email when Issue Updated	×	×	×	×
	Receive Emails to Update Issue	×		×	×
Hosted		×			
Sub-Issue Ability		×			
Easily Customizable Workflow/Navigation		×			×
One-Stop Navigation		×	×	×	×
Affordable		×	×	×	×
Spam Filter					
Support/Help Documentation		×	×		×
Auto and User Generated Reports		×		×	
API Enabled		×			
Unicode Enabled		×	×	×	×
Integratable with Windows		×	×	×	×
Issue Time Tracking		×		×	×

Figure 2



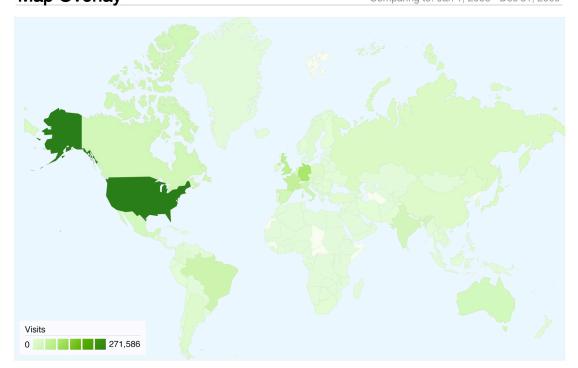
Comparison of traffic and visitors to the Biodiversity Heritage Library website from January 1, 2008-December 31, 2009 (represented in green) to January 1, 2010-March 29, 2011 (represented in blue).

Figure 3

www.biodiversitylibrary.org

Map Overlay

Jan 1, 2010 - Mar 29, 2011Comparing to: Jan 1, 2008 - Dec 31, 2009



1,068,586 visits came from 233 countries/territories

Site Usage						
Visits 1,068,586 Previous: 880,594 (21.35%)	Pages/Visit 5.10 Previous: 4.76 (7.09%)	Avg. Time on Site 00:06:17 Previous: 00:05:06 (23.22%) % New Visits 46.86% Previous: 62.24% (-24.71%)		44.19 Previous	Bounce Rate 44.19% Previous: 49.30% (-10.36%)	
Country/Territory		Visits	Pages/Visit	Avg. Time on Site	% New Visits	Bounce Rate
United States						
January 1, 2010 - March 2	29, 2011	271,586	4.48	00:05:27	52.80%	48.85%
January 1, 2008 - Decemb	per 31, 2009	262,813	3.95	00:03:42	69.30%	55.31%
% Change		3.34%	13.53%	47.25%	-23.81%	-11.67%
Germany						
January 1, 2010 - March 2	29, 2011	97,911	5.58	00:06:37	45.00%	40.19%
January 1, 2008 - Decemb	per 31, 2009	71,687	6.11	00:06:37	52.60%	39.40%
% Change		36.58%	-8.66%	-0.08%	-14.44%	2.01%
United Kingdom						
January 1, 2010 - March 2	29, 2011	70,104	4.61	00:05:21	44.61%	43.84%

Google Analytics

January 1, 2008 - December 31, 2009	55,621	3.97	00:03:47	64.52%	53.87%
% Change	26.04%	16.08%	41.76%	-30.86%	-18.61%
France					
January 1, 2010 - March 29, 2011	57,664	5.95	00:08:12	39.05%	35.77%
January 1, 2008 - December 31, 2009	41,850	6.14	00:07:12	47.75%	38.21%
% Change	37.79%	-3.14%	13.77%	-18.21%	-6.39%
Brazil					
January 1, 2010 - March 29, 2011	40,393	5.96	00:07:55	40.58%	37.12%
January 1, 2008 - December 31, 2009	26,904	5.97	00:07:19	54.92%	36.74%
% Change	50.14%	-0.23%	8.19%	-26.10%	1.04%
Italy					
January 1, 2010 - March 29, 2011	37,560	6.23	00:07:06	40.13%	37.04%
January 1, 2008 - December 31, 2009	28,042	6.67	00:06:33	49.34%	38.71%
% Change	33.94%	-6.51%	8.32%	-18.67%	-4.32%
Canada					
January 1, 2010 - March 29, 2011	32,452	4.36	00:04:36	60.87%	50.29%
January 1, 2008 - December 31, 2009	30,808	3.84	00:03:21	75.14%	56.56%
% Change	5.34%	13.54%	37.80%	-19.00%	-11.08%
Spain					
January 1, 2010 - March 29, 2011	32,362	6.31	00:07:48	38.08%	32.76%
January 1, 2008 - December 31, 2009	23,520	6.94	00:07:33	48.30%	36.82%
% Change	37.59%	-9.07%	3.27%	-21.15%	-11.02%
India					
January 1, 2010 - March 29, 2011	29,529	4.18	00:05:00	69.79%	53.36%
January 1, 2008 - December 31, 2009	28,860	3.08	00:03:22	81.82%	60.23%
% Change	2.32%	35.75%	48.35%	-14.70%	-11.40%
Australia					
January 1, 2010 - March 29, 2011	28,280	4.92	00:06:14	36.41%	41.24%
January 1, 2008 - December 31, 2009	20,083	4.11	00:04:40	61.69%	50.80%
% Change	40.82%	19.61%	33.64%	-40.98%	-18.82%
					1 - 10 of 233

Google Analytics

Global visits overview, comparison of January 1, 2008-December 31, 2009 to January 1, 2010-March 29, 2011.