

Analytical Usability Evaluation: Model-based Evaluations and Analytics

Automatic Accessibility Testing
Keystroke-Level Model (KLM)
Web Analytics

The dream of a usability expert

A software program that can

- Automatically judge the usability of a system
- Telling you why something is a problem
- Telling you how to improve it



Bobby: An old Accessibility Tester

A Web-based tool
that analyzes Web pages
for their accessibility
to people with disabilities

Based on W3C's Guidelines

- Provide text equivalents for images, audio
- Do not convey information with color only
- Identify headers for data tables and make line-by-line reading sensible for layout tables
- Provide summaries of graphs and charts
- Identify document language and any changes of the language
- Organize content logically and clearly, such as with headings, list elements, meaningful links, and navigation bars
- Provide alternative content for features (e.g., applets or plug-ins) that may not be supported

Bobby example



email: reservations@1stworldtravel.com tel: 0871 271 0050



12953/V3686

12 August 2003

- Home
- Flights
- Majorca Holidays
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- Financial Security
- Booking Conditions
- Feedback
- Travel Information
 - Passport Info
 - World Weather
 - Tourist Boards
 - Exchange Rates
 - ABTA
 - ATOL
 - Foreign Office
 - Health Board

FLIGHT FINDER

ABCDEFGHIJKLMNOPQRSTUVWXYZ 

Click on the capital letter of the place you want to fly to above.

HOLIDAY FINDER

From:

To:

When:

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One problem Bobby found



Provide alternative text for all image map hotspots,
26 instances



Provide alternative text for all image map hotspots,
1 instance

Another problem Bobby found

Provide alternative text for all images

 **FLIGHT FINDER** A B C D E F G H I J K L M N O P Q R S T U V W X Y Z 

 **HOLIDAY FINDER**

From

To

When

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Some of the things that need checking according to Bobby

- If you use color to represent information, make sure it is also conveyed in another way
- If this is a data table (not used for layout only) identify headers for the rows and columns

Also comments on speed of page loading,
compatibility different browsers

Usefulness of Bobby

- How useful is Bobby and what are its limitations?
 - What kind of problems can it find?
 - What kind of problems will it not find?

Where is Bobby now?

- Bobby was launched in 1995 by CAST, a non-profit US research and development organisation i
- It was a free public service to make the WWW more accessible to people with disabilities
- Bobby was sold to Watchfire, which was acquired by IBM in 2007. Ideas from Bobby are now included in the IBM Rational Policy Tester Accessibility Edition software
- NB “Section 508” is the US (1998) law requiring Federal agencies to give disabled employees access to information comparable to that given to others.

AppScan® Enterprise - Section 508 Compliance (Altoro Mutual Accessibility) - Windows Internet Explorer

http://localhost/webxm/Reports/XReports.aspx?fid=120&rid=905&fid=8&viewid=290

AppScan® Enterprise - Section 508 Compliance (Altoro Mutual Accessibility)

Andrzej Szaryk | Help | Support | About | Log Out

Training | Jobs & Reports | Administration

Jobs & Reports > Default Folder > Altoro Corporate > Corporate Pages > Altoro Mutual Accessibility > Section 508 Compliance

Folders

Create... Edit Delete

- Default Folder
 - Altoro Corporate
 - Corporate Pages
 - Company Info
 - Personal Products
 - Small Business
 - Online Banking
 - Content Developers
 - Samples
 - Templates

Recently Viewed

- Section 508 Compliance (Altoro Mutual Accessibility)
- Report Pack Summary (Altoro Mutual Accessibility)
- Broken Links (Quality & Inventory Report)
- Report Pack Summary (Quality & Inventory Report)
- Altoro Public Pages
- Altoro Corporate
- Search Engine Optimization (Quality & Inventory Report)
- SSoA

Section 508 Compliance

Last Updated: 5/2/2008 4:36:07 PM View Details | View History | Reset Report View

Summary Group Show Search Layout

There are 1214 distinct violations of Section 508 Guidelines appearing in 1214 places across 60 pages of the site

All items | Group: Paragraph

Items 1-13 of 13 Go to page: 1 of 1 Apply

Action: Export to Excel Apply

	Parag...	Description	Quantity
<input type="checkbox"/>	a	A text equivalent for every non-text element shall be provided (e.g., via "alt", "longdesc", or in el...	127
<input type="checkbox"/>	o	A method shall be provided that permits users to skip repetitive navigation links.	60
<input type="checkbox"/>	n	When electronic forms are designed to be completed on-line, the form shall allow people using assi...	9
<input type="checkbox"/>	m	When a web page requires that an applet, plug-in or other application be present on the client sys...	4
<input type="checkbox"/>	i	Frames shall be titled with text that facilitates frame identification and navigation.	1
<input type="checkbox"/>	c	Web pages shall be designed so that all information conveyed with color is also available without c...	805
<input type="checkbox"/>	d	Documents shall be organized so they are readable without requiring an associated style sheet.	60
<input type="checkbox"/>	k	A text-only page, with equivalent information or functionality, shall be provided to make a web sit...	60
<input type="checkbox"/>	p	When a timed response is required, the user shall be alerted and given sufficient time to indicate ...	60
<input type="checkbox"/>	j	Pages shall be designed to avoid causing the screen to flicker with a frequency greater than 2 Hz ...	12

Other accessibility tools

- Long list on www.w3.org/WAI/ER/tools/
- Try out wave.webaim.org

What is KLM? (1)

- Part of the GOMS family of user interface modeling techniques
- Input: detailed description of UI and tasks
- Output: measure of efficiency

Psychological basis

- Based on Model Human Processor:
 - Human cognition consists of separate components for cognitive, motor, and perceptual processors

Key-Level Model (KLM)

- List specific actions user does to perform task:
 - K: Keystroking (including shift, ctrl, alt)
 - B: Button pressing on mouse
 - P: Pointing a mouse
 - H: Hand moving between devices
 - D: Drawing line segment
 - M: Mental preparation for physical action
 - R: System response (if time significant)

Keystroke-Level Model (KLM)

- Make sure to include mental actions!
- Assign execution times to steps
(based on existing tables, for instance
pressing a mouse button=0.1 sec)
- Sum execution times

KLM Example

Getting help in Powerpoint

Operators:

Time:

- | | |
|--|----------|
| – H: Move hand to mouse | 0.4 sec |
| – M: Find Help | 1.35 sec |
| – P: Move pointer to Help | 1.1 sec |
| – B: Press the mouse button | 0.1 sec |
| – M: Read menu and find
“Microsoft Powerpoint Help” | 1.35 sec |
| – P: Move to “Microsoft Powerpoint Help” | 1.1 sec |
| – B: Release the mouse button | 0.1 sec |

KLM Exercise

In pairs, determine the time needed to

- Delete a file on the desktop by dragging it to the trashcan.
- Delete a file on the desktop by using the “Cut” menu option (Under Edit menu).

Delete by dragging to trashcan

1. Move hand to mouse (H)
2. Mentally prepare (search for file icon) (M)
3. Point to file icon (P)
4. Press and hold mouse button (B)
5. Find trash can (M)
6. Drag file icon to trash can icon (P)
7. Release mouse button (B)

$$\text{Time} = H + 2M + 2P + 2B = .4 + 2.7 + (2 * 1.1) + (2 * .1) = 5.5$$

Delete by using menu option Cut

1. Move hand to mouse (H)
2. Mentally prepare (search for file icon) (M)
3. Point to file icon (P)
4. Click mouse button (to highlight icon) (BB)
5. Find edit menu (M)
6. Point to Edit menu (P)
7. Press and hold mouse button (B)
8. Point to Cut item (P) (and M if search needed)
9. Release mouse button (B)

$$\text{Time} = H + 2M + 3P + 4B = .4 + 2.7 + (3 * 1.1) + (4 * .1) = 6.8$$

KLM Limitations

- Applied to expert users only
- Does not account for errors
- Does not address fatigue
- Does not account for individual differences between users

GOMS family

- Keystroke-Level Model (KLM)
Single stream of sequential operators
- Card, Moran, and Newell GOMS (CMN-GOMS)
Adds hierarchical structure to KLM
- Natural GOMS Language (NGOMSL)
Provides learning time predictions
- Cognitive Perceptual Motor GOMS (CPM-GOMS)
Emphasis on parallel activities

Web Analytics: What is it

- Automatically gather data and then analyse who visited, for how long, and doing what
- Software gathers the data, human analyst makes sense of it and decides how to improve the site



Web Analytics: What it tells you

- Who

Language, Country, Technology use,
New users vs Returning users

- When

How many visited when, For how long

- What

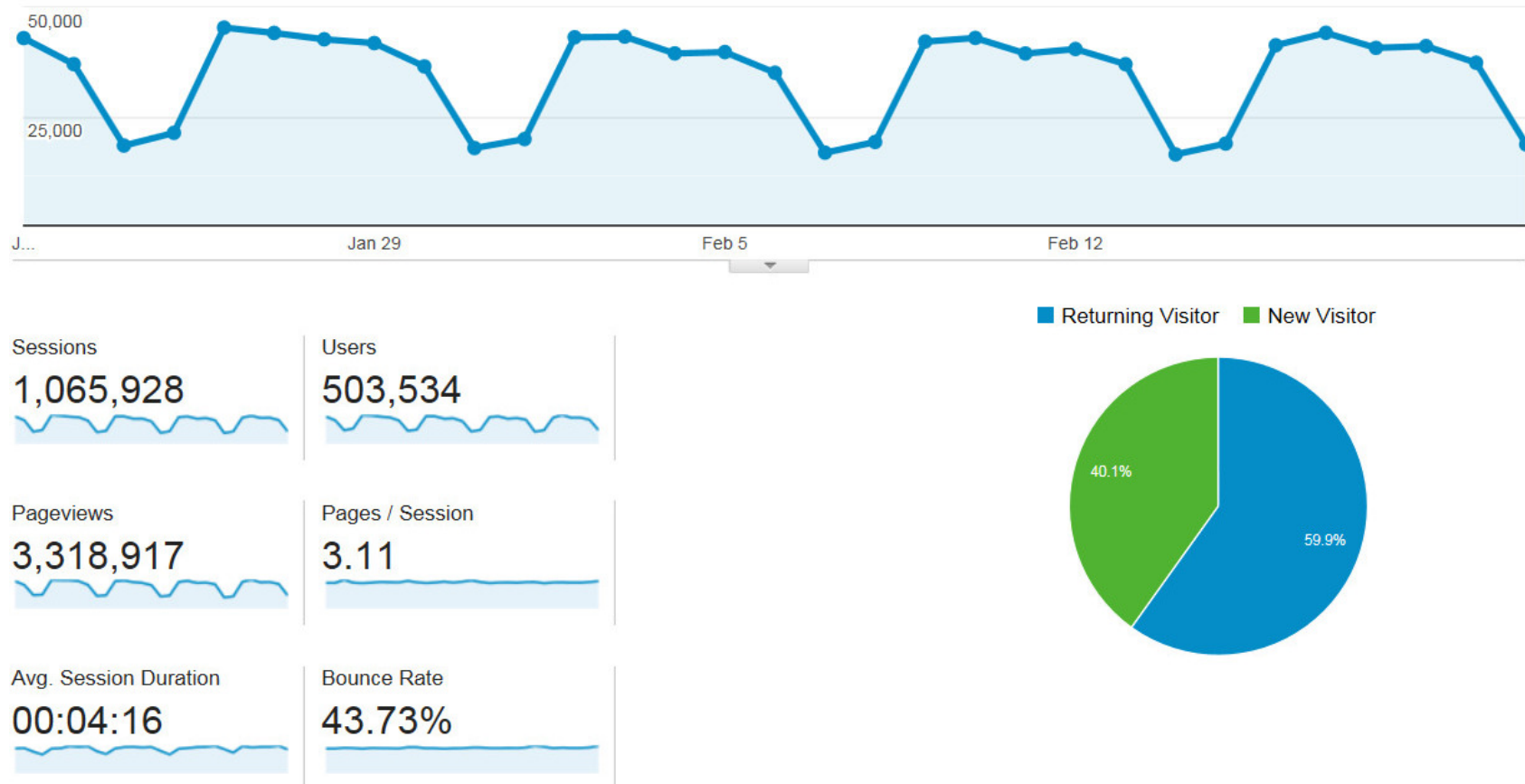
What they clicked on, What search terms they used

- Where

Where they came from (referring sites)

Web Analytics: Example











- Google Analytics on University home page



Web Analytics: Example





















- Google Analytics on University home page

	Language	Sessions	% Sessions
1.	en-us	684,518	<div><div></div></div> 64.22%
2.	en-gb	265,206	<div><div></div></div> 24.88%
3.	en	12,007	<div><div></div></div> 1.13%
4.	zh-cn	10,379	<div><div></div></div> 0.97%
5.	de	10,027	<div><div></div></div> 0.94%
6.	fr	7,281	<div><div></div></div> 0.68%
7.	es	5,912	<div><div></div></div> 0.55%
8.	de-de	4,845	<div><div></div></div> 0.45%
9.	ru	3,925	<div><div></div></div> 0.37%
10.	pl	3,904	<div><div></div></div> 0.37%

	Country	Sessions	% Sessions
1.	 United Kingdom	840,016	<div><div></div></div> 78.81%
2.	 United States	31,221	<div><div></div></div> 2.93%
3.	 Nigeria	14,591	<div><div></div></div> 1.37%
4.	 India	12,666	<div><div></div></div> 1.19%
5.	 Germany	12,655	<div><div></div></div> 1.19%
6.	 France	6,834	<div><div></div></div> 0.64%
7.	 Ghana	6,820	<div><div></div></div> 0.64%
8.	 Canada	6,584	<div><div></div></div> 0.62%
9.	 Indonesia	6,179	<div><div></div></div> 0.58%
10.	 Italy	6,140	<div><div></div></div> 0.58%

Web Analytics: Example

- Google Analytics on University home page

Page		Pageviews	% Pageviews
1. /		328,446	 9.90%
2. /staffnet/		300,236	 9.05%
3. /infohub/		189,260	 5.70%
4. /motd/		92,448	 2.79%
5. /study/		31,436	 0.95%
6. /study/undergraduate/index.php		31,178	 0.94%
7. /library/		30,612	 0.92%
8. /infohub/support/computing.php		28,702	 0.86%
9. /pgap/login.php		27,709	 0.83%
10. /library/collections/		20,411	 0.61%

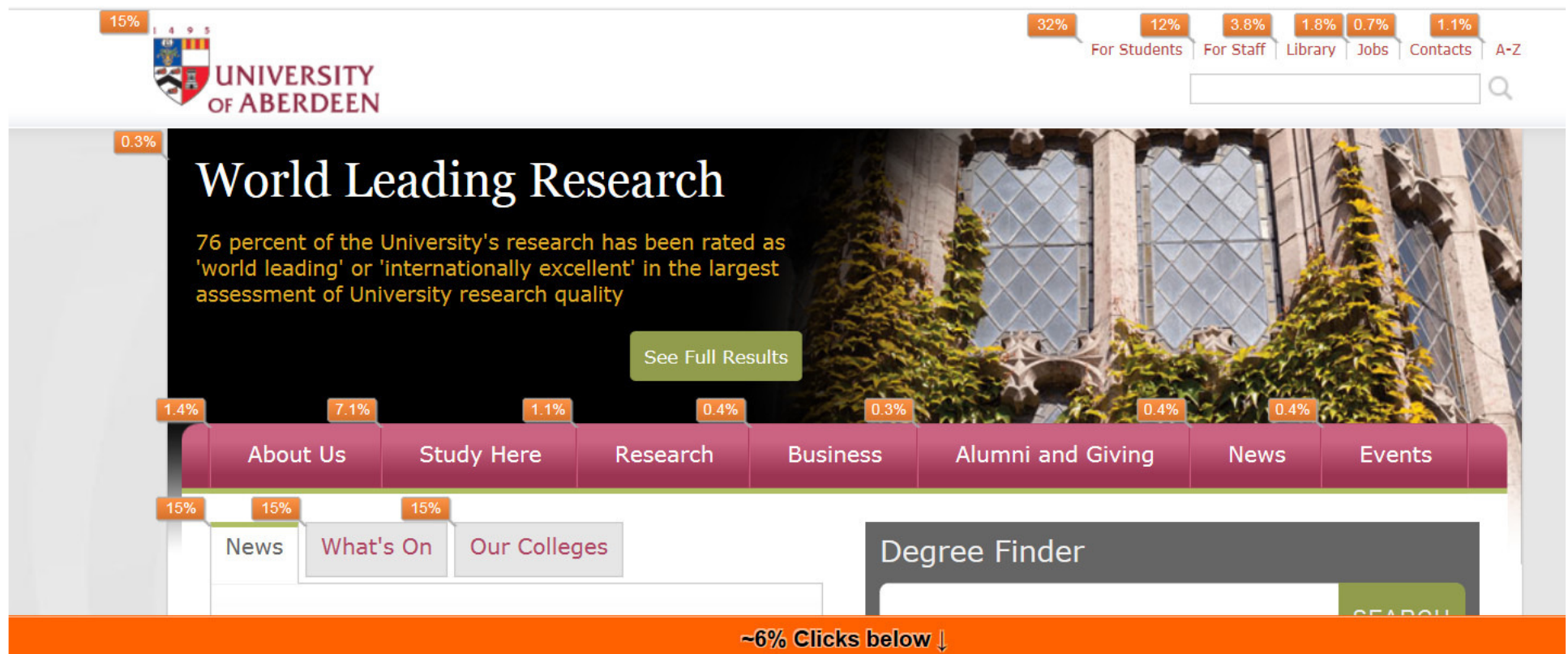
Web Analytics: Example

- Google Analytics on University home page

Search Term	Total Unique Searches	% Total Unique Searches
1. Postgraduate Taught	2,098	2.44%
2. Postgraduate Research	1,218	1.42%
3. primo	602	0.70%
4. term dates	543	0.63%
5. course catalogue	479	0.56%
6. week numbers	308	0.36%
7. email	295	0.34%
8. online store	295	0.34%
9. erasmus	291	0.34%
10. graduation	269	0.31%

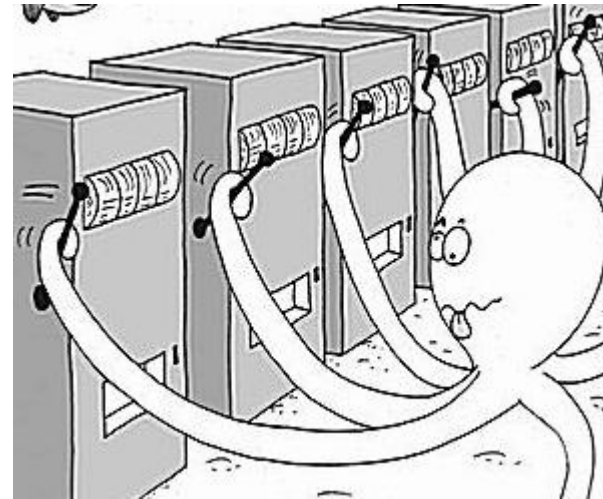
Web Analytics: Example

- Google Analytics on University home page



Web Analytics: More advanced

- Can test out multiple versions of web page/site and see which one performs better
- This can be done through so-called A-B testing or multi-armed-bandits



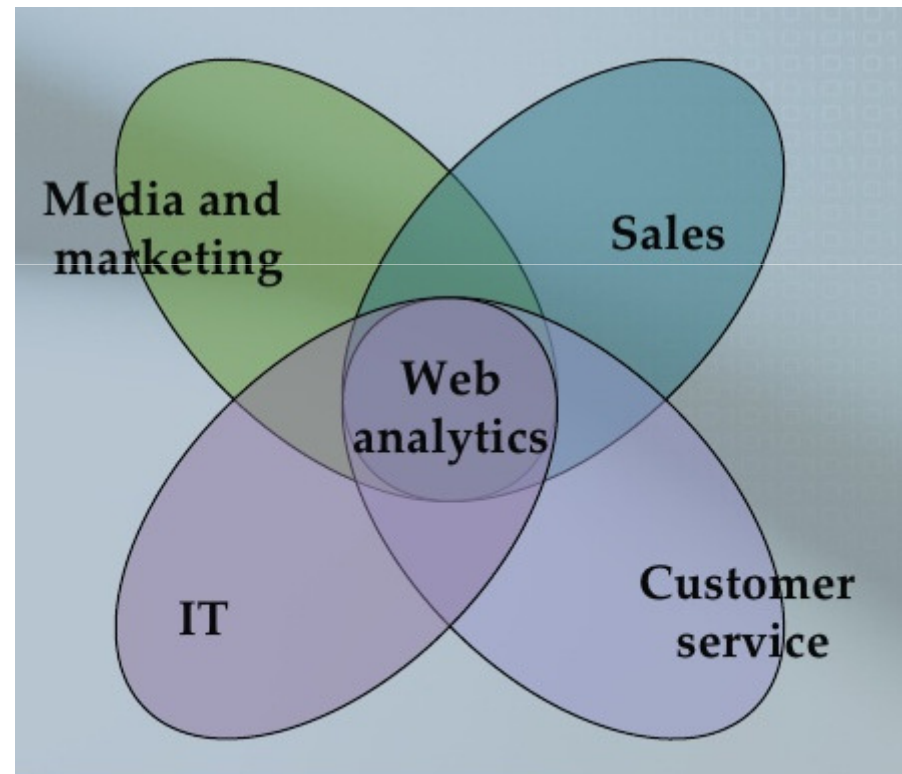
- Some Analytics tools support these kinds of experiments

Web Analytics: How to do it?

- google.com/analytics. Requires only a bit of code adding to each web page; they provide this code
- Alternatives:
 - mixpanel.com (video shows how it works)
 - [flurry](#), for mobile apps (taken over by yahoo: see developer.yahoo.com)
 - localytics.com, for mobile apps

Web Analytics: Where it fits

- Has become very important for different business parts
- Good for jobs



Web Analytics: Limitations

- You learn what users do and not do, but not necessarily why
- Do not know what users where trying to achieve
- Do not know whether they succeeded