

# Eye Tracking in Web Usability: What Users Really See

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# Outline

- Eye tracking : Eye Tracking in Human Computer Interaction
- Eye tracking technologies
- Eye tracking in website usability
- Developed websites.
- Analysis of developed websites
  - Browser compatibility of developed websites.
  - Attention Wizard: Heat maps and gaze plots
  - Survey results
- Conclusions

# Eye Tracking

- Eye tracking is the process of recording the location of a gaze and the motion of the eye.
- Eye tracking in Human Computer Interaction(HCI).
- Initial eye tracking methods were invasive.
- Eye movement research and eye tracking flourished in the 1970s.

# The Eye

- Human vision has two parts.
  - Foveal Vision
  - Peripheral Vision
- The human eye may seem a lot like a camera.
- Human vision is only sharp in the center, and blurred at the edges.
- When the eye is resting or focused on a spot, it's called a **fixation**.
- The eye's rapid movement from one fixation to the next is called a **saccade**.

# Eye Tracking Technologies

- Eye trackers
- Intrusive and non intrusive eye tracking systems
- Commercially available eye trackers
  - Head mounted
    - Worldwide used in, psychology, neuroscience, marketing research, sports, training and usability
    - <http://www.arringtonresearch.com/>



# Eye Tracking Technologies

- Commercially available eye trackers
  - Head restrained
    - Accurate
    - Reliable measurement
    - <http://asleyetracking.com/site/>



# Eye Tracking Technologies

- Commercially available eye trackers
  - Free head motion
    - High tracking accuracy
    - Ability to track nearly all people
    - Completely non-intrusive
    - <http://www.tobii.com/corporate/start.aspx>



# The Mind Eye Hypothesis

- What people are looking at and what they are thinking tends to be the same.
- Looking and thinking are certainly not always intertwined.
- Mind eye hypothesis holds true for eye tracking.
- Fixations equal attention.



# Benefits of Eye Tracking In Web Design

- Self-reporting tools such as questionnaires may produce biased or even wrong data.
- One can analyze how a user's eyes move across a web page in real time using visualization techniques
  - Gaze plots and hot spots

# Commercial Applications

- Web usability, advertising, medical research, computer usability etc.
  - The analyses focus on the visibility of a target product.
- Numerous companies offer eye tracking services and analysis.
- Eye tracking cameras in automobiles can monitor the drowsiness or inattention of the driver.
  - Lexus claims to have equipped its LS 460 car with the first driver monitor system in 2006.

# Eye Tracking In Website Usability: Page Layout

- Full is not better when it comes to web pages.
- When designing a web page, a designer should determine the following:
  - What do visitors of their website want.
  - What priority real estate sections (areas most eye catching to the users) are in the design.
- Consistent web conventions.
- Graphics add interest but are slow to load and can impede navigation.

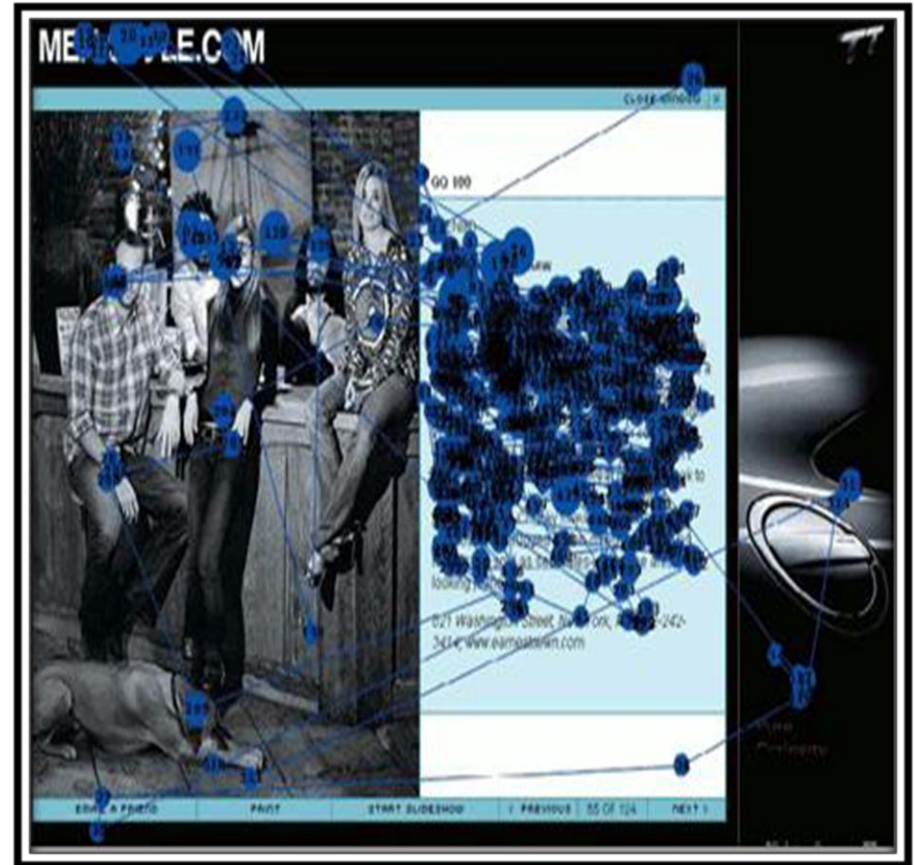
# Eye Tracking In Website Usability: Page Layout

- Heat-maps are the best-known visualization technique for eye tracking studies.
- Red areas indicate most attention
- Yellow areas indicate fewer fixations.
- Blue areas indicate the least viewed areas.
- Gray area means no fixations.



# Eye Tracking In Website Usability: Page Layout

- A gaze plot represents fixations during a single user's visit to a page.
- The size of each dot represents the duration of that fixation
- The bigger dots indicate longer durations.

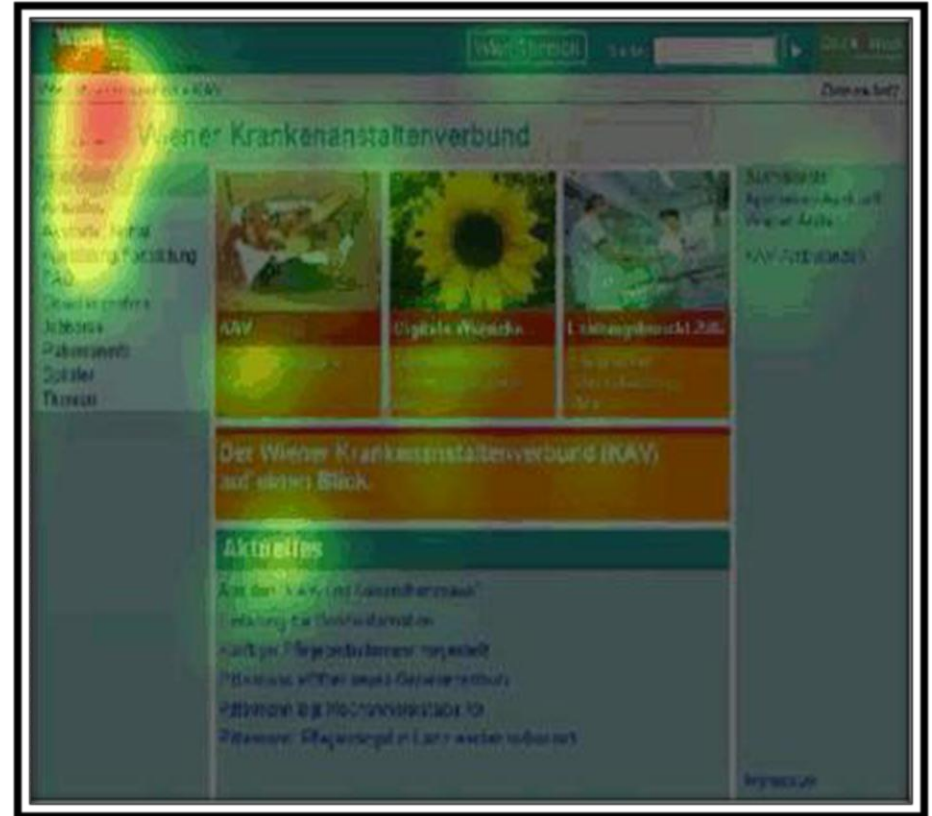


# Eye Tracking In Website Usability: Navigation

- Web is a combination of contents and presentations.
  - Allow people to plan monitor and control their activities.
- People use navigation on a website to move from one page to another page.
  - Gather all the information that is required.
- Global, top-level, persistent, or primary navigation should be displayed on every web page.
- Local navigation guides a user to a specific section on a long page.

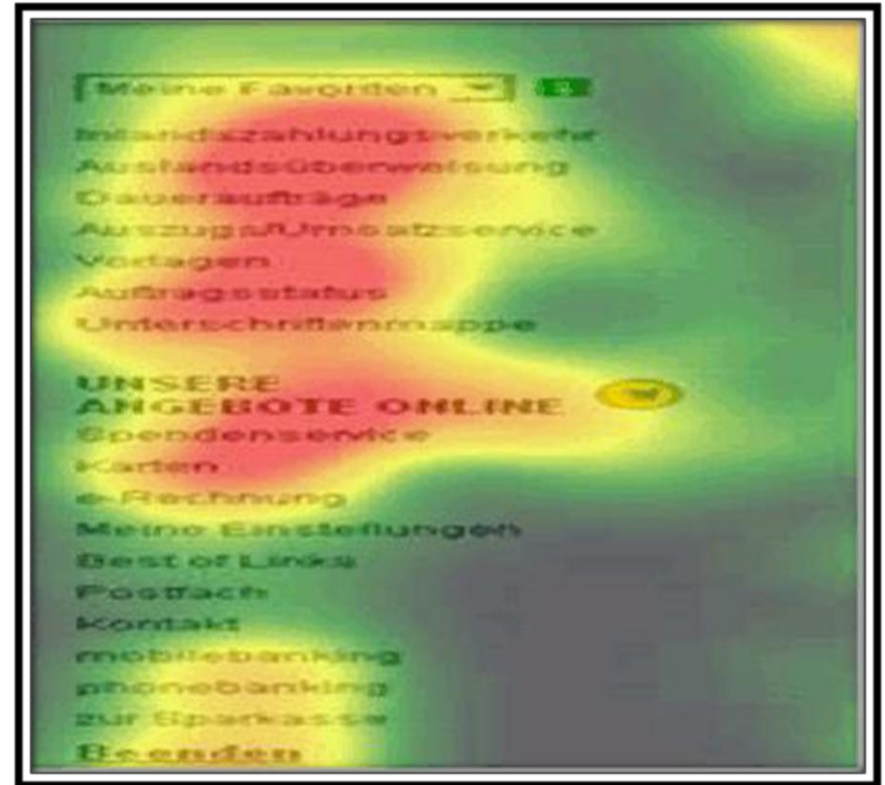
# Eye Tracking In Website Usability: Navigation

- Comparing different types of navigation menus, most users concentrated on the top-left.



# Eye Tracking In Website Usability: Navigation

- In a study of an online banking system users were shown the entry page of the system.
- Links underneath the text “UNSERE ANGEBOTE ONLINE” get much less attention than the links above it





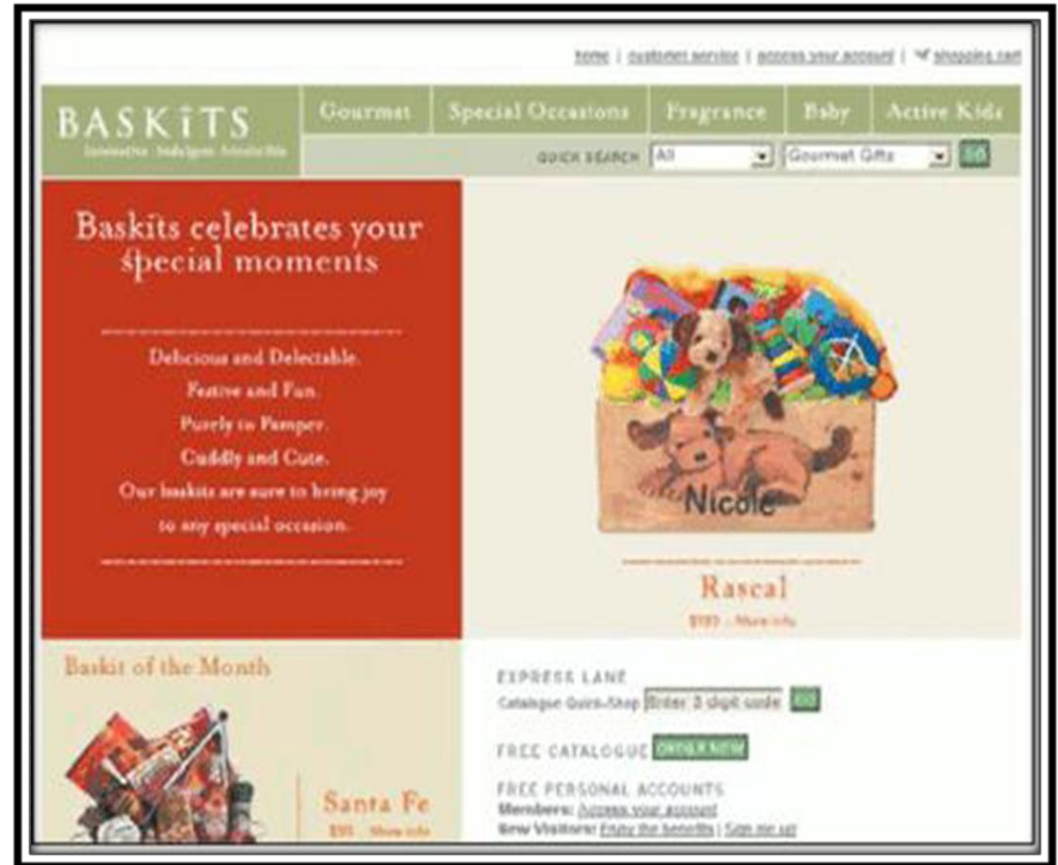
# Fundamental Web Design Elements: Homepage

- The home page is different from all other web site pages.
- A homepage should clearly communicate the site's purpose.
  - Show all major options available on the web site.



# Fundamental Web Design Elements: Shopping Carts

- In this site shopping cart at the right in the uppermost row.
- People found shopping cart in fewer fixations.

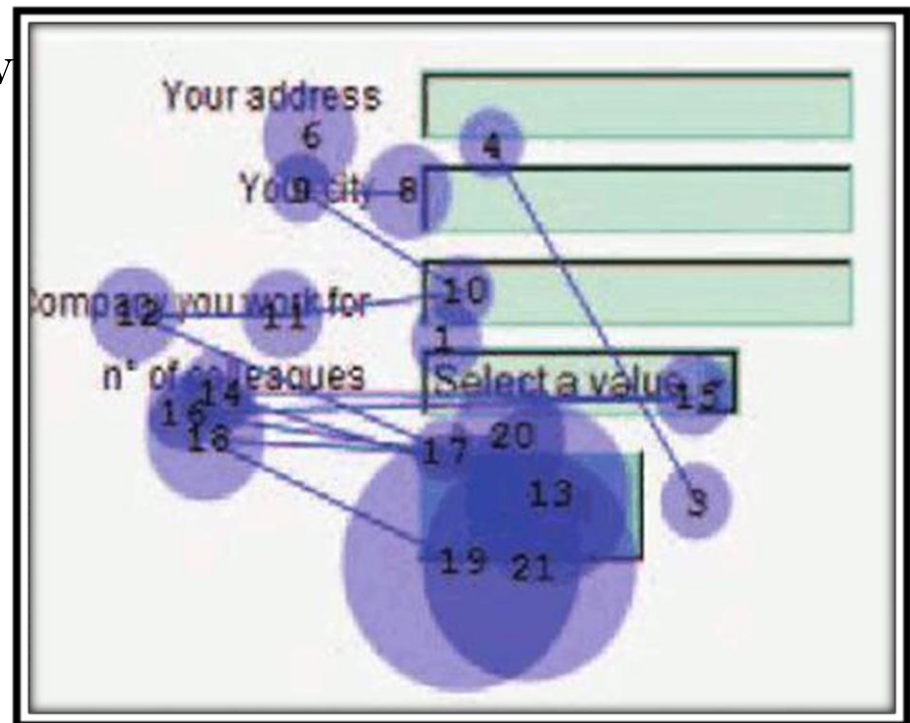


# Fundamental Web Design Elements: Web Forms

- Web forms should be easy for users to quickly look at, register, and deal with all parts of a form.
- According to Matteo Penzo's study
- **Left-aligned Labels:** These are easily associated labels with the proper input fields.
  - Users took more time because of excessive distances between labels inputs.
- **Right-aligned Labels:** These reduced overall number of fixations by nearly half.
  - Forms completion times were cut nearly half.

# Fundamental Web Design Elements: Web Forms

- **Top-aligned Labels:** Users capture both labels and inputs with a single eye movement.
- Gaze plot data shows how people's eye move through a simple form



# Fundamental Web Design Elements: Web Forms

- Research shows that not all participants know what an asterisk '\*' means.
- Word 'optional' should be placed inside the text boxes in gray fonts.



The image shows a web form with five input fields. The labels are on the left, and the input boxes are on the right. The labels are: 'First line of address', 'Second line of address', 'Town / City', 'County', and 'Post Code'. The input boxes for 'Second line of address' and 'County' contain the word 'Optional' in a gray font, indicating that these fields are optional. The other input boxes are empty.

First line of address	<input type="text"/>
Second line of address	<input type="text" value="Optional"/>
Town / City	<input type="text"/>
County	<input type="text" value="Optional"/>
Post Code	<input type="text"/>

# Images

- Images are a powerful part of web design.
- Good images explain a concept, convey information, and enhance people's overall experience on a site.
- Bad images waste space, are ignored by users, and create more confusion .
- Pictures express ideas and thoughts effectively.

# Images

- People did not look on the small and low-contrast images



# Images

- Minor tweaks in an image can increase the user's attention





# Advertisements

- Eye tracking helps us determine when and how much people look at advertisements on the web.
- What attributes of advertisements attract their attention.
- The look of an ad is important, but so is its placement on the page.
- Close proximity to popular editorial content helps ads get noticed.
- Of all types of ads tested, text ads are viewed most intently.

# Advertisements

- Ads that blend into the look and feel of the page get more attention



# Developed Websites: Technologies Used

- HTML : Hyper Text Markup Language
- CSS: Cascading Style Sheets
  - Styles define how to display HTML elements.
- Javascript: to add interactivity to HTML pages.
- AJAX : Asynchronous JavaScript and XML
  - It is possible to update parts of a web page without reloading the entire page.
- PHP : PHP: Hypertext Preprocessor.
  - It is a server-side scripting language, like ASP.
  - PHP scripts are executed on the server and support many databases

# Developed Websites: Technologies Used

- MySQL: MySQL is a database server and ideal for both small and large applications.
- PHP + MySQL: PHP combined with MySQL are cross-platform
- WampServer: WampServer is a Windows web development environment.
  - It enables creating web applications with Apache, PHP and MySql.
- Browsershots: convenient way to test website's browser compatibility in one place.
- Attention Wizard: Eye Tracking without the Eyes

# Health Website

<http://farrukhjabeen.info/health/>

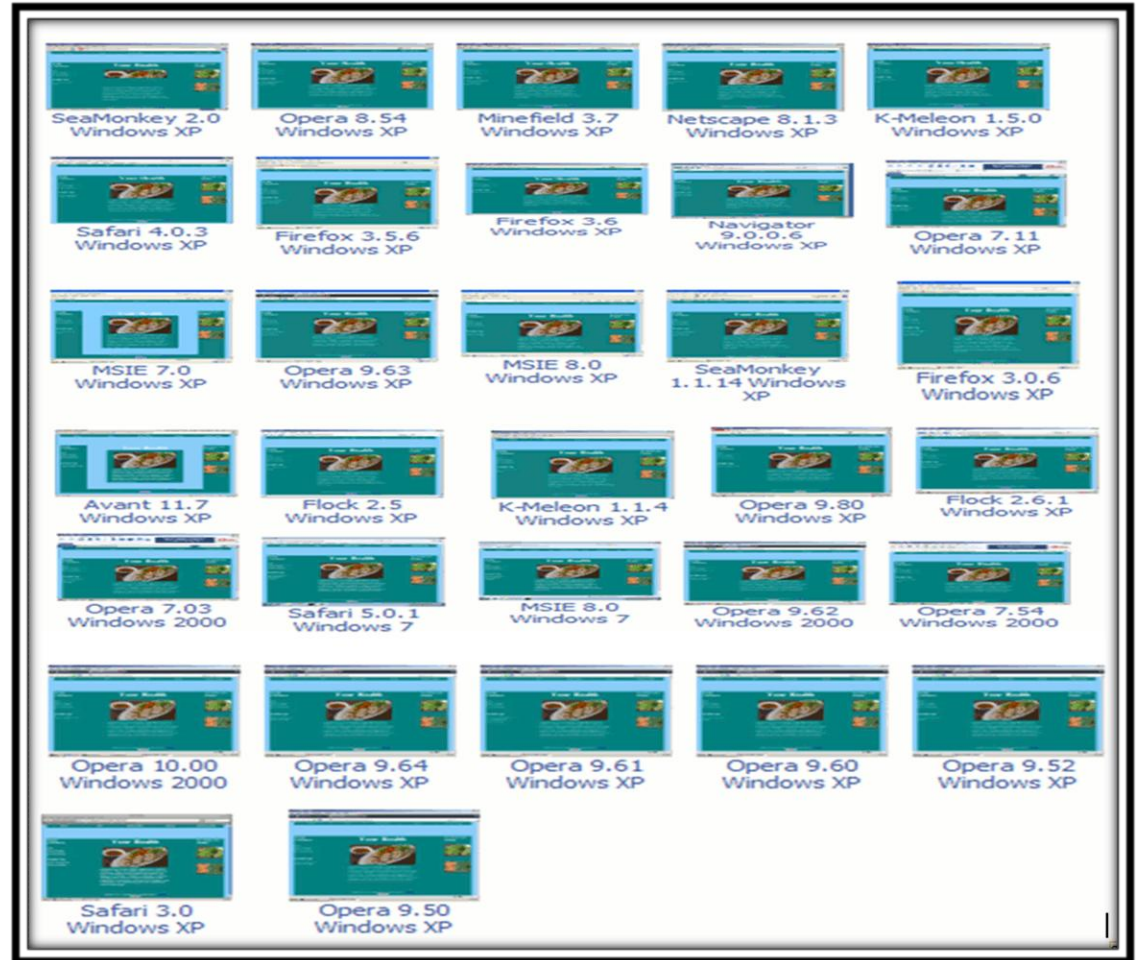
- Layout of Health website



# Health Website

<http://farrukhjabeen.info/health/>

- Browser Compatibility Test on Windows



# Health Website

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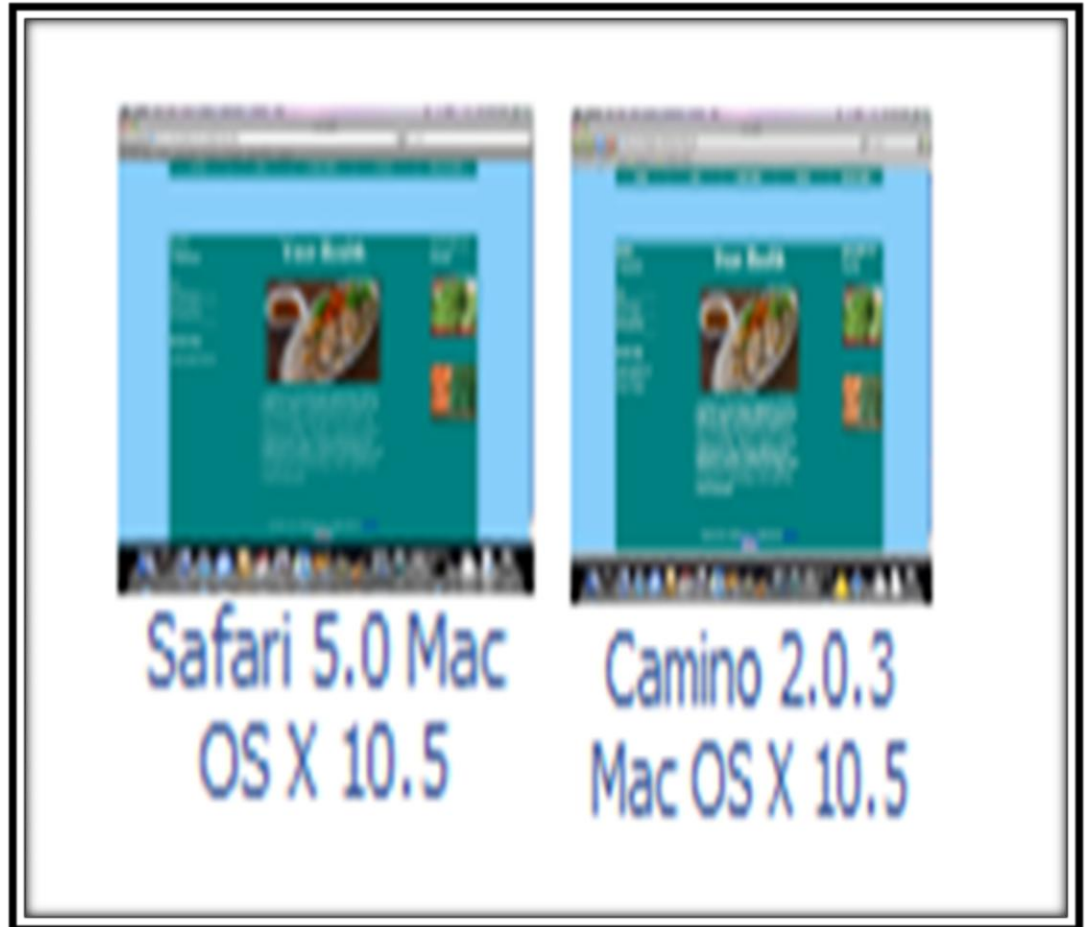
- Browser Compatibility Test on Linux



# Health Website

<http://farrukhjabeen.info/health/>

- Browser Compatibility Test for Mac OSX

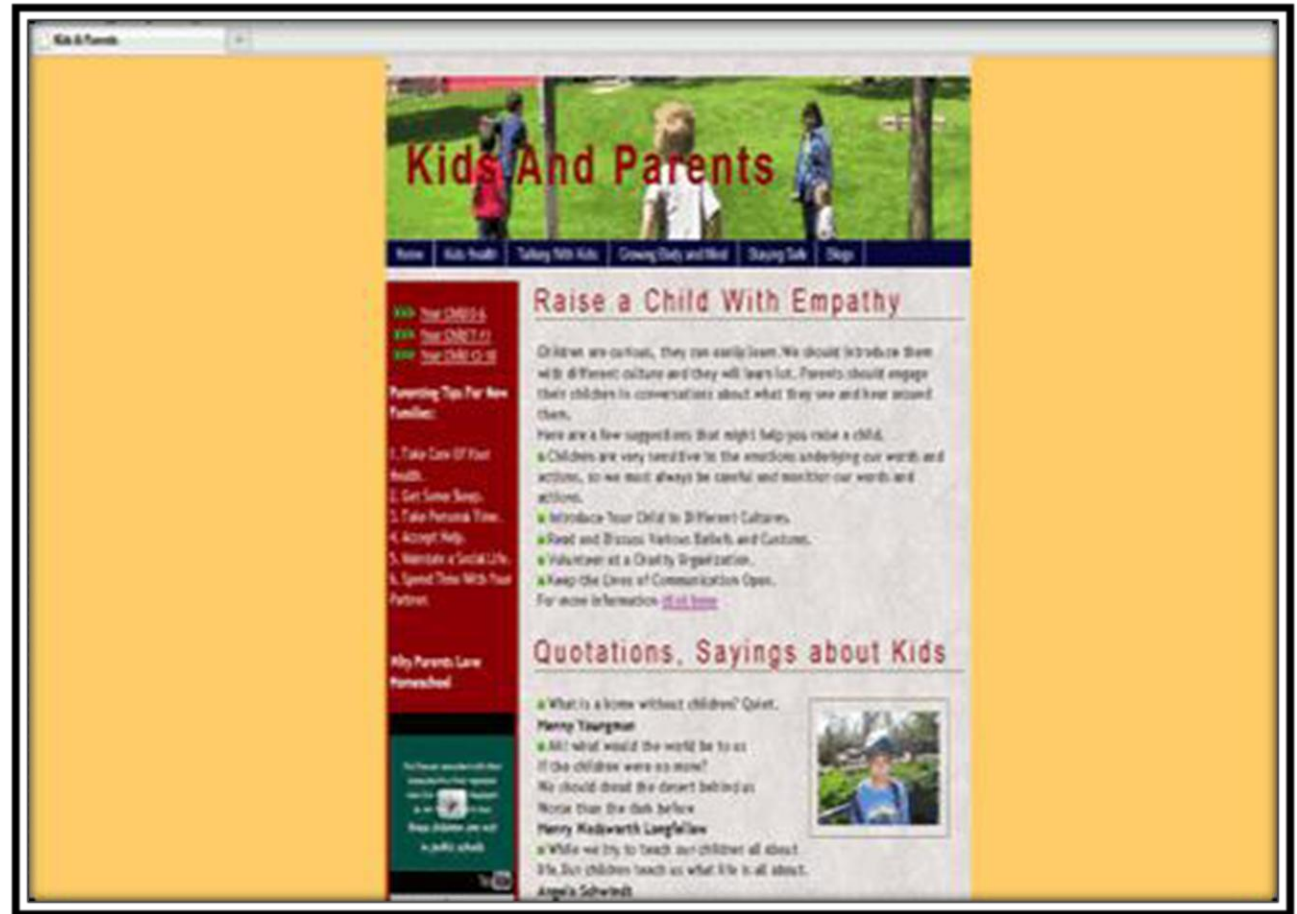




# Kids and Parents Website

<http://farrukhjabeen.info/kidsparents/>

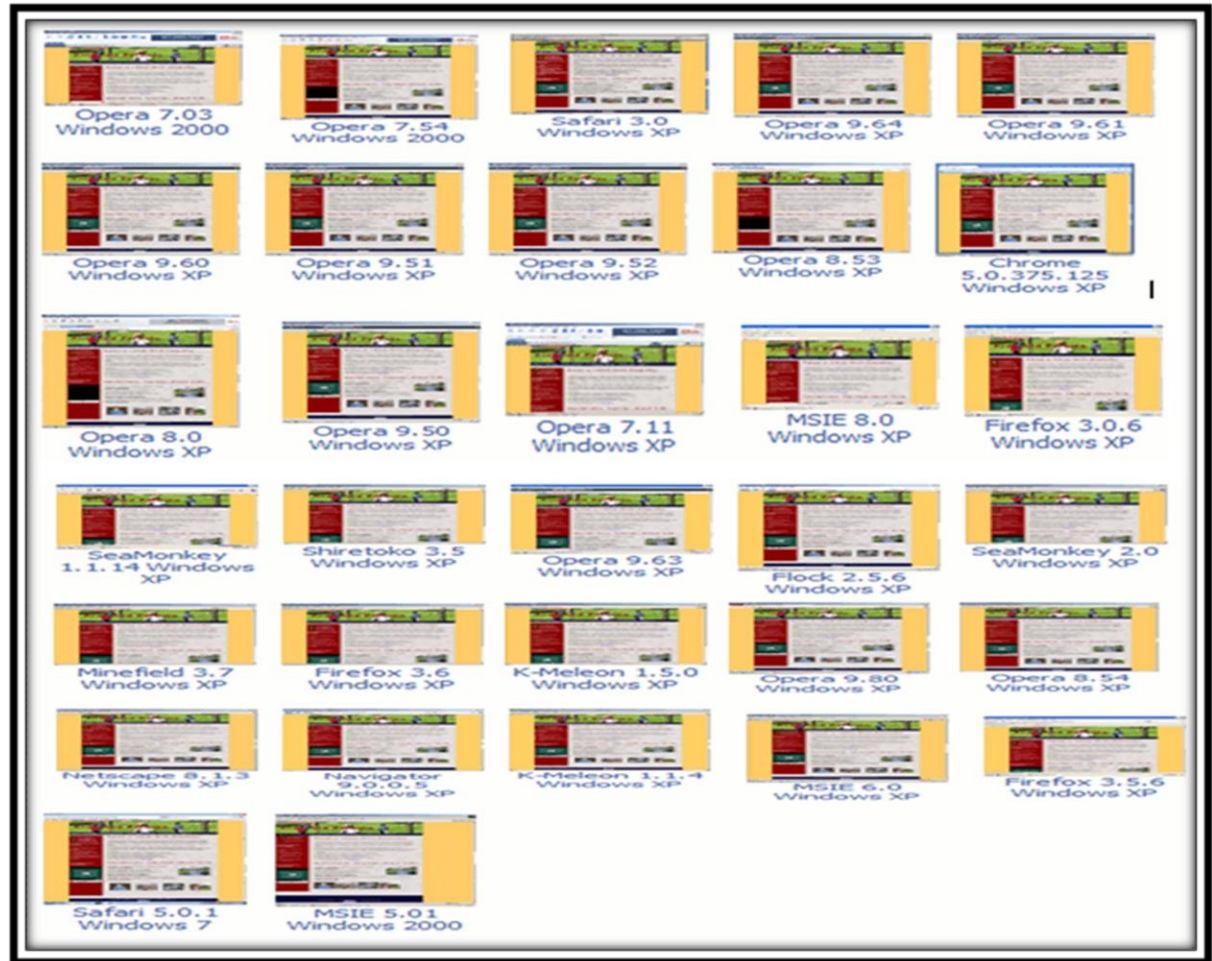
- Layout of Kids and Parents Website



# Kids and Parents Website

<http://farrukhjabeen.info/kidsparents/>

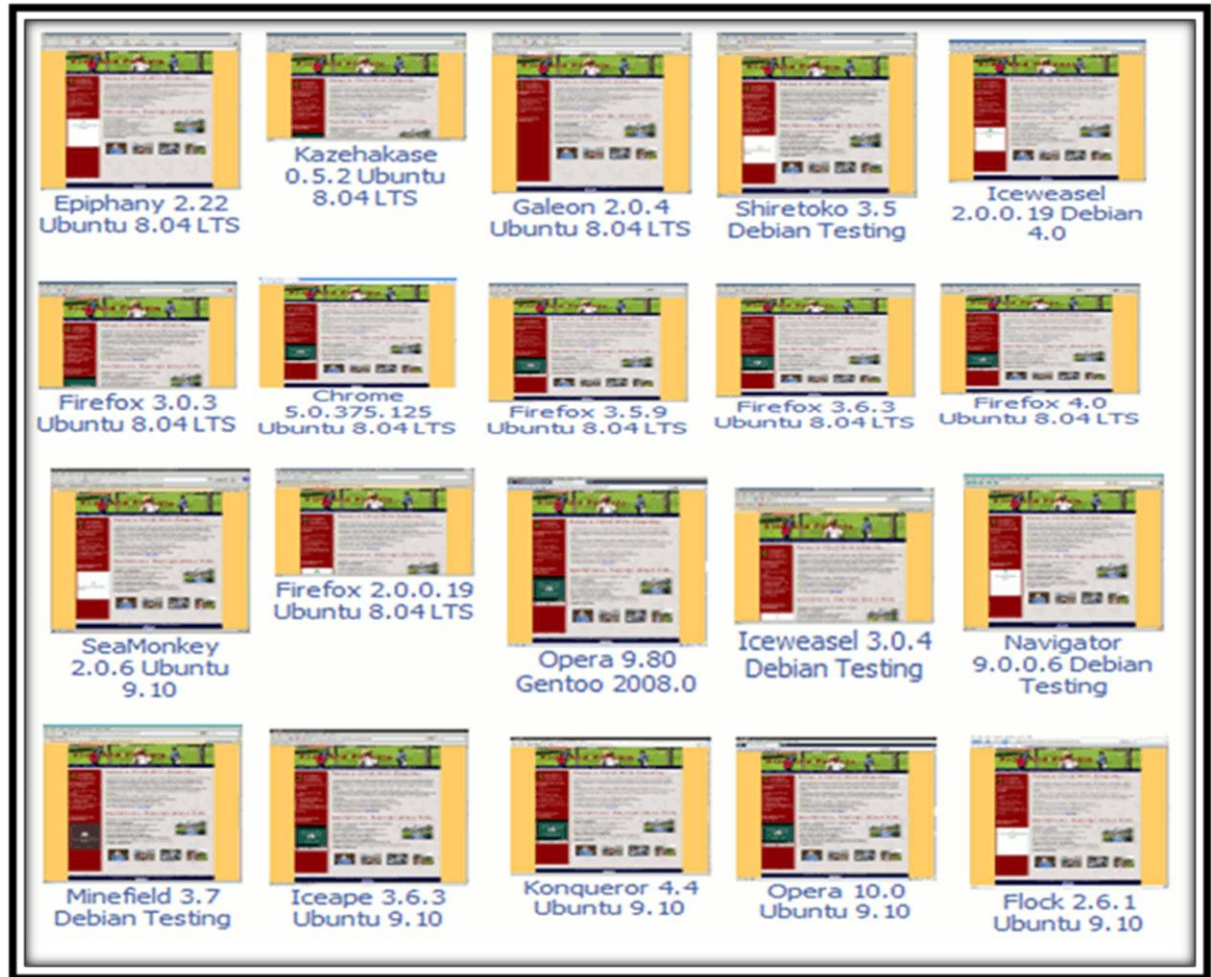
- Browser Compatibility Test for Windows



# Kids and Parents Website

<http://farrukhjabeen.info/kidsparents/>

- Browser Compatibility Test for Linux



# Kids and Parents Website

<http://farrukhjabeen.info/kidsparents/>

- Browser Compatibility Test for Mac OS X



# Desi Recipes Website

<http://farrukhabeen.info/recipes/>

- Layout of Desi Recipes website

The screenshot shows the homepage of the Desi Recipes website. The header is red with the site name 'Desi Recipes' in white. It includes a login section with 'Username' and 'Password' fields and a 'Sign In' button, and a search section with a 'Recipe Search' input field and a 'Search' button. Below the header is a blue navigation bar with links for 'Home', 'Appetizers', 'Breakfast', 'Main Course', and 'Desserts'. The main content area is divided into three columns. The left column, titled 'Specialities', lists various dishes with expandable arrows: Biryani, Chicken Kabab, Lamb Fry, Keema Paratha, Tandori Chicken, Samosa, Fried Prawns, and Fruit Custard. Below this is a 'Cooking Tips' section with two numbered tips. The middle column, titled 'Recipe Of The Week', features 'Spicy Burgers' with a photo of a burger and fries, and a caption: 'Prep Time: 15 Min , Cook Time: 10 Min, Ready In: 25 Min, Servings: 4'. Below the photo is an 'Ingredients' list. The right column, titled 'Spices And Herbs', contains a paragraph about the health benefits of spices and a small image of various spices in colorful containers, with a caption: 'Turmeric have cancer fighting power, Oregano have fungus'.

**Desi Recipes**

Username:  Password:

[Join Us Today!](#)

Recipe Search:


Home | Appetizers | Breakfast | Main Course | Desserts

### Specialities

- ▼ Biryani
- ▼ Chicken Kabab
- ▼ Lamb Fry
- ▼ Keema Paratha
- ▼ Tandori Chicken
- ▼ Samosa
- ▼ Fried Prawns
- ▼ Fruit Custard

### Recipe Of The Week

#### Spicy Burgers




Prep Time: 15 Min , Cook Time: 10 Min  
Ready In: 25 Min, Servings: 4

#### Ingredients

- 1 pound ground beef
- Salt according to taste
- 1 teaspoon minced garlic
- 1 green chilli crushed
- 1 teaspoon ground black pepper
- 1 teaspoon crushed red pepper flakes
- 2 tablespoon chopped fresh cilantro
- 1/2 teaspoon ground cumin

### Spices And Herbs

Spices and herbs have more disease fighting antioxidants than most fruits and vegetables. Spices can increase metabolism and have medicine properties. For example Cinnamon can lower the blood pressure and cholesterol in people. Rosemary and basil have anti-inflammatory power. Cumin and sage have dementia-fighting power. Cayenne and cinnamon have obesity fighting power. Coriander and cinnamon have sugar regulating powers. Lemon grass, nutmeg, bay leaves and saffron have calming effects on your mood.



Turmeric have cancer fighting power, Oregano have fungus

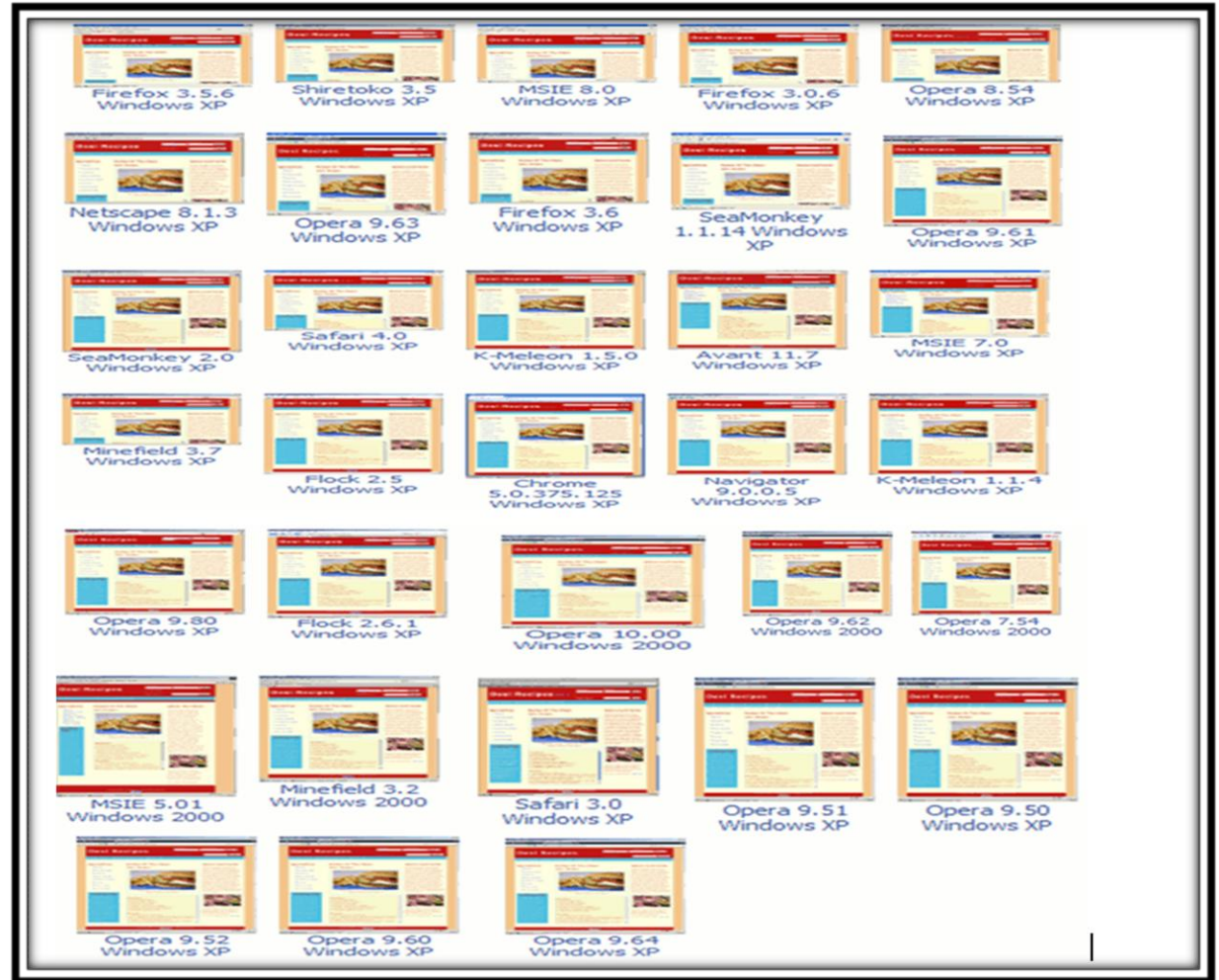
### cooking Tips

1. When you buy lettuce, do not wash and store in refrigerator. Wash when you want to use.
2. Use wooden or glass bowls to mix salads. Do not use metal bowls.

# Desi Recipes Website

<http://farrukhabeen.info/recipes/>

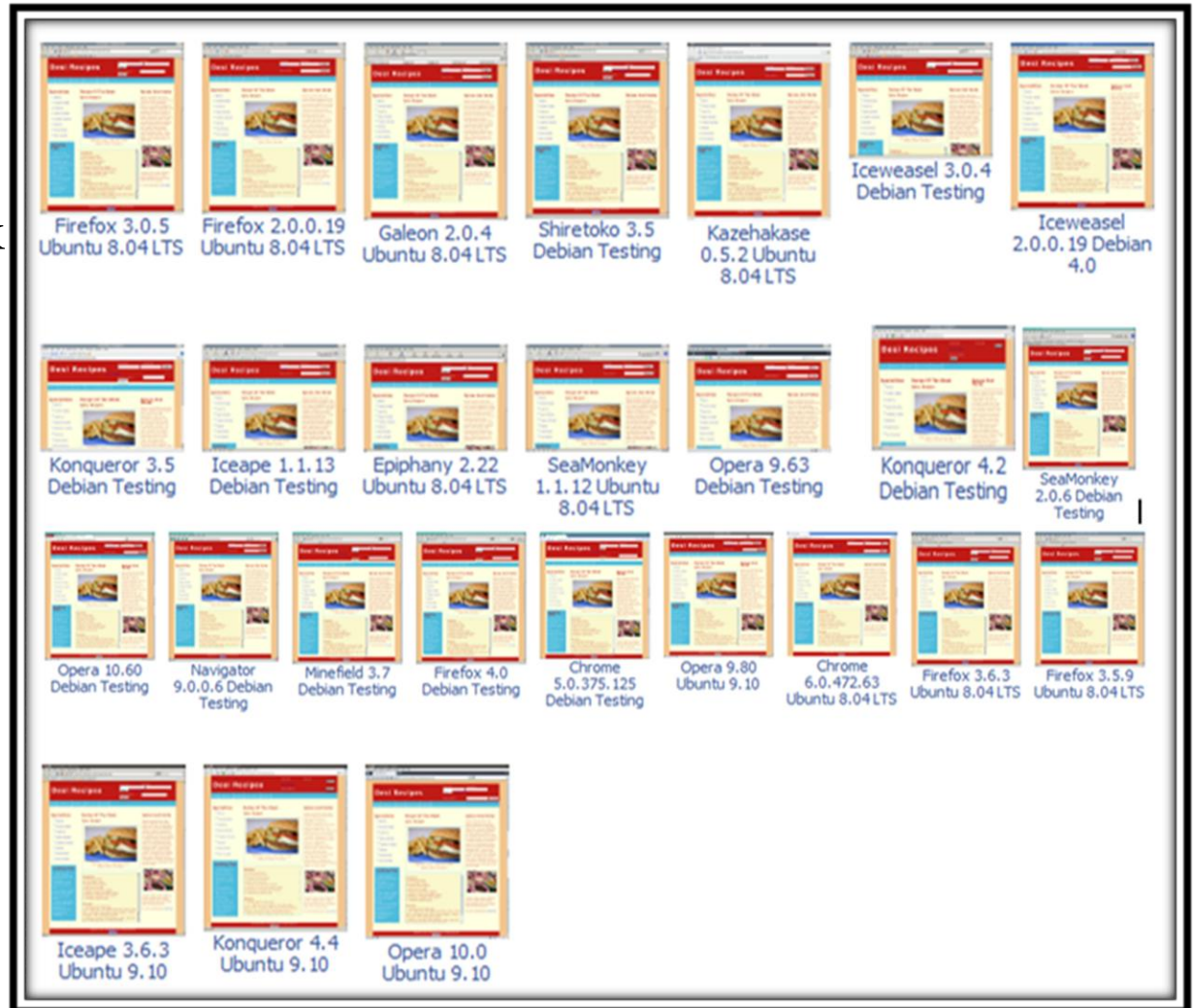
- Browser Compatibility Test for Windows



# Desi Recipes Website

<http://farrukhjaheen.info/recipes/>

- Browser Compatibility Test for Linux



# Desi Recipes Website

<http://farrukhabeen.info/recipes/>

- Browser Compatibility Test for Mac OS X





# Analysis of Developed Websites Using Heat-Maps

- Attention Wizard was used to create heat-maps for the three websites developed for this research.
- An attention heat-map is a combination of two elements:
  - Predicted attention (hot spots)
  - Eye gazing path.
- The hot spots that can be found on a generated heat-map show areas of attention concentration.
- The eye gazing path depicts the path that user's eyes take when they first get to the page.

# Heat-Maps of Health Website :

<http://farrukhjabeen.info/health/>

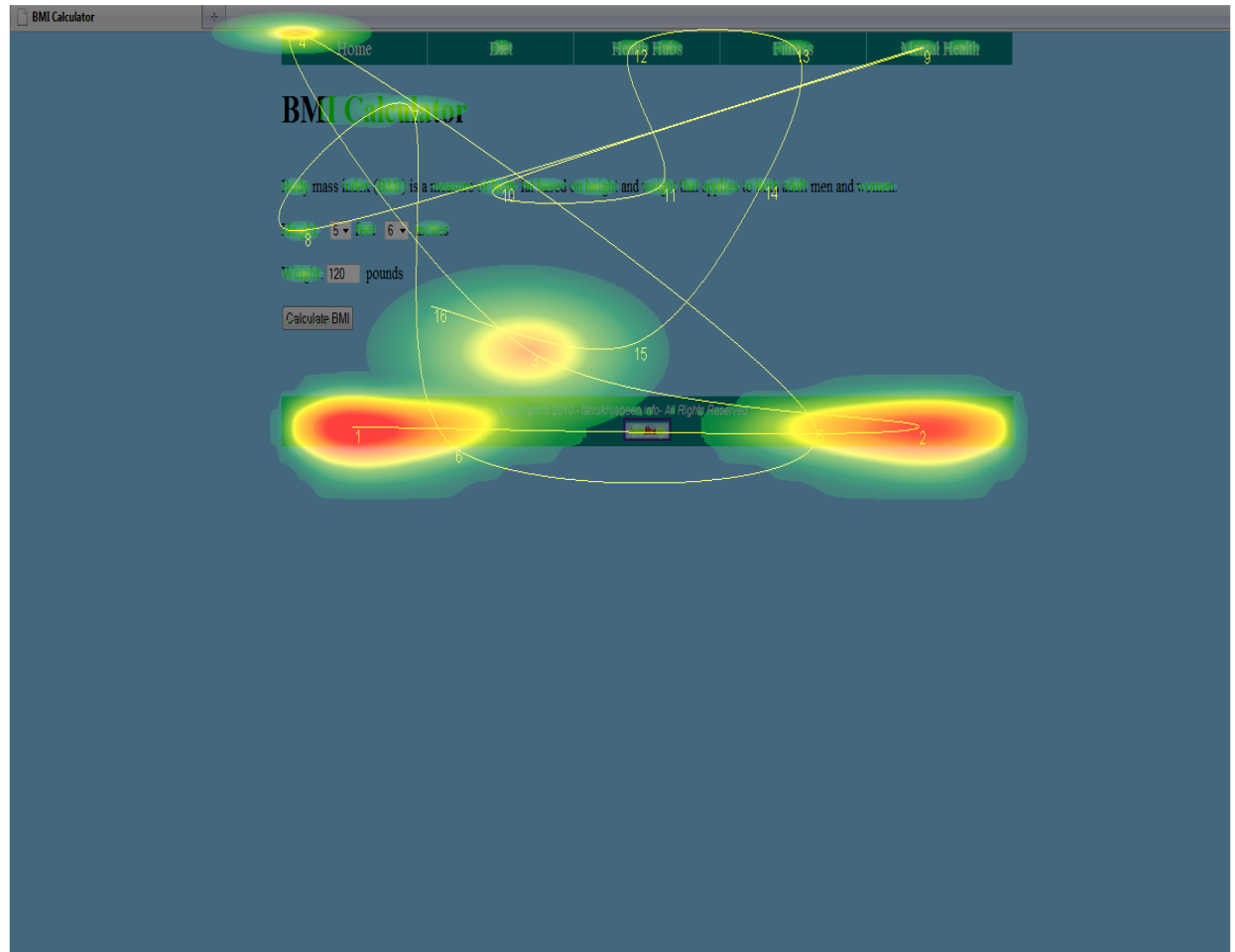
- Heat-Map of Health Website Home Page



# Heat-Maps of Health Website :

<http://farrukhabeen.info/health/>

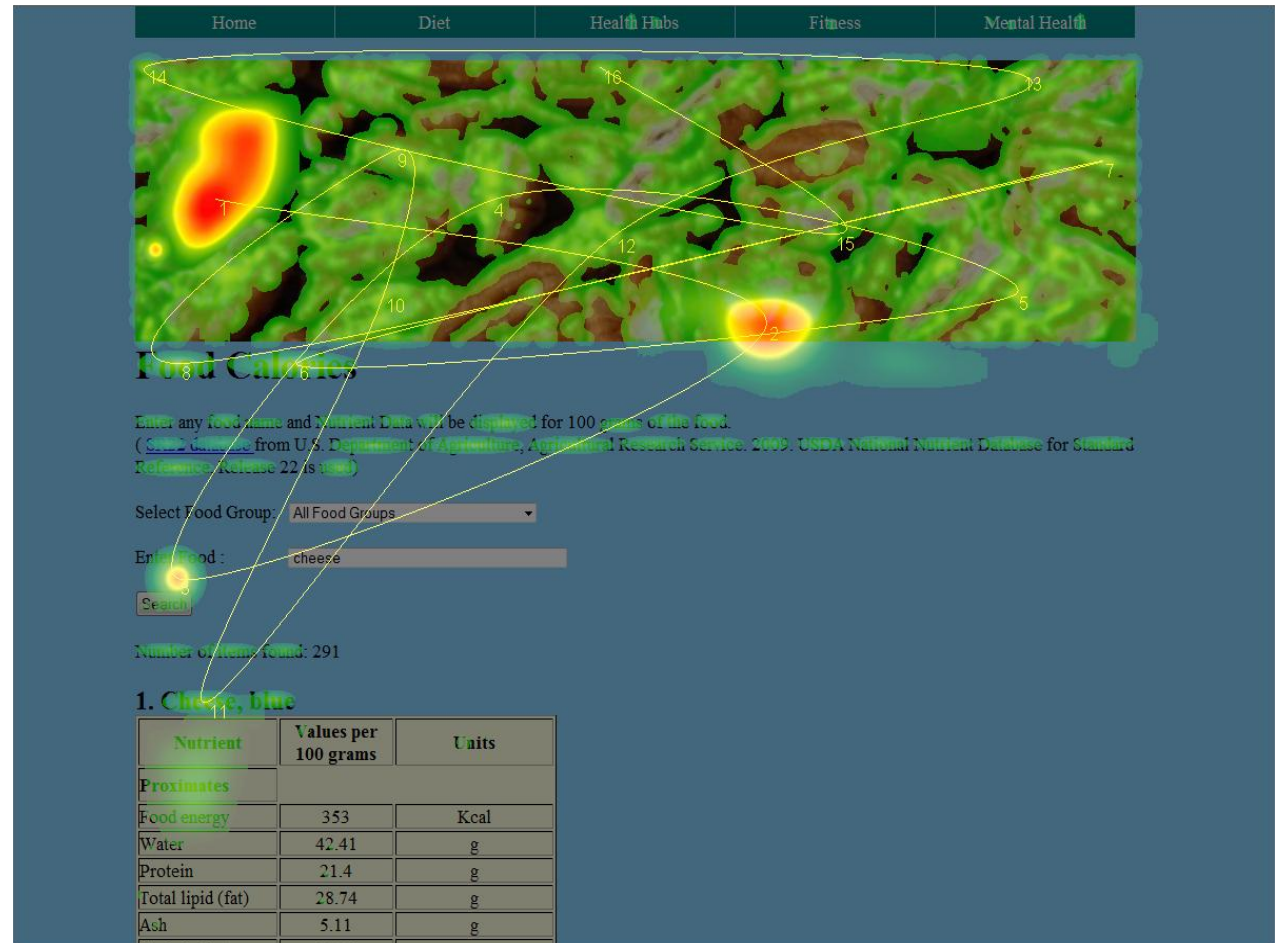
- Heat-Map of BMI Calculator Page



# Heat-Maps of Health Website :

<http://farrukhjabeen.info/health/>

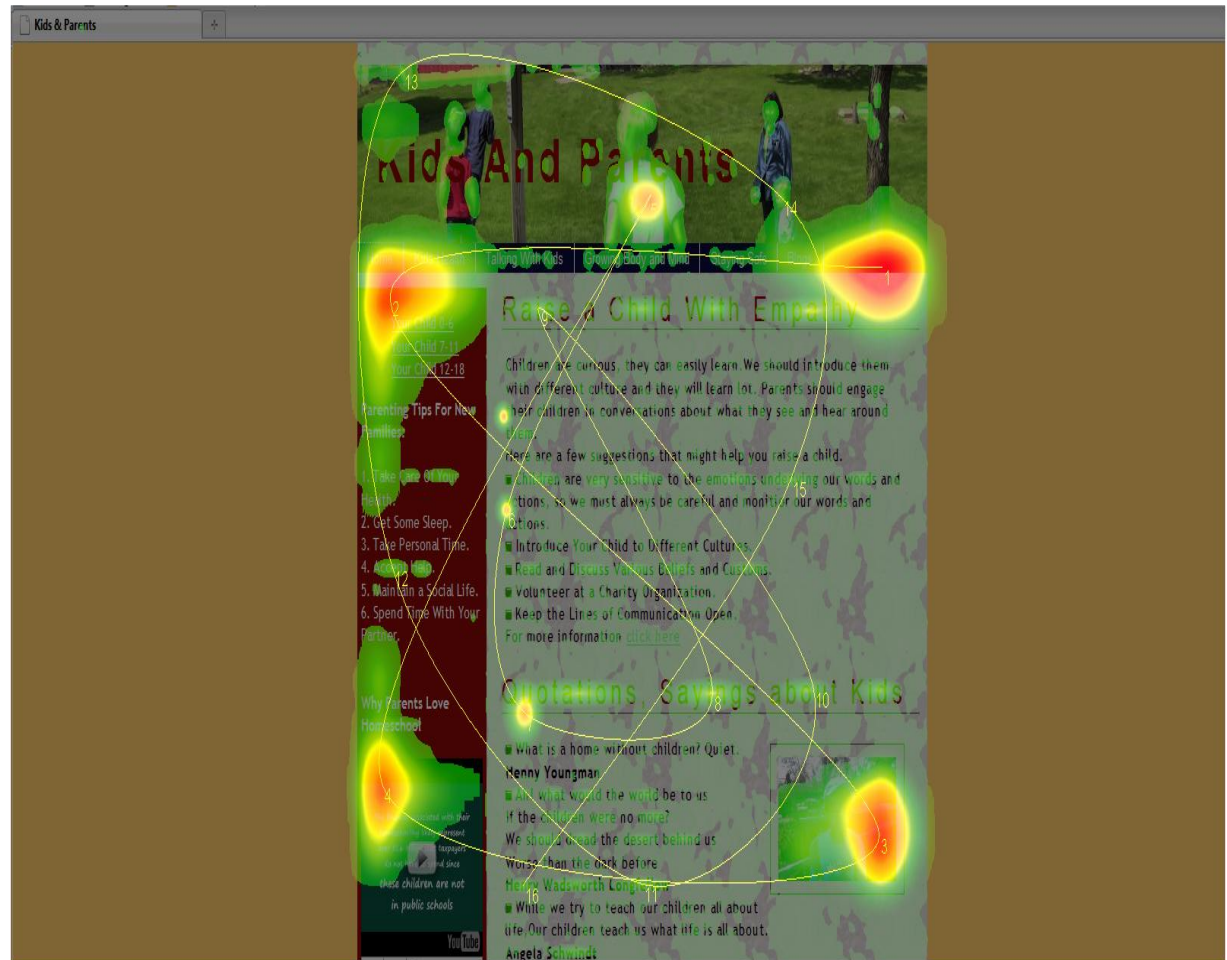
- Heat-Map of Food Calories Calculator Page



# Heat-Maps of Kids and Parents

Website : <http://farrukhjabeen.info/kidsparents>

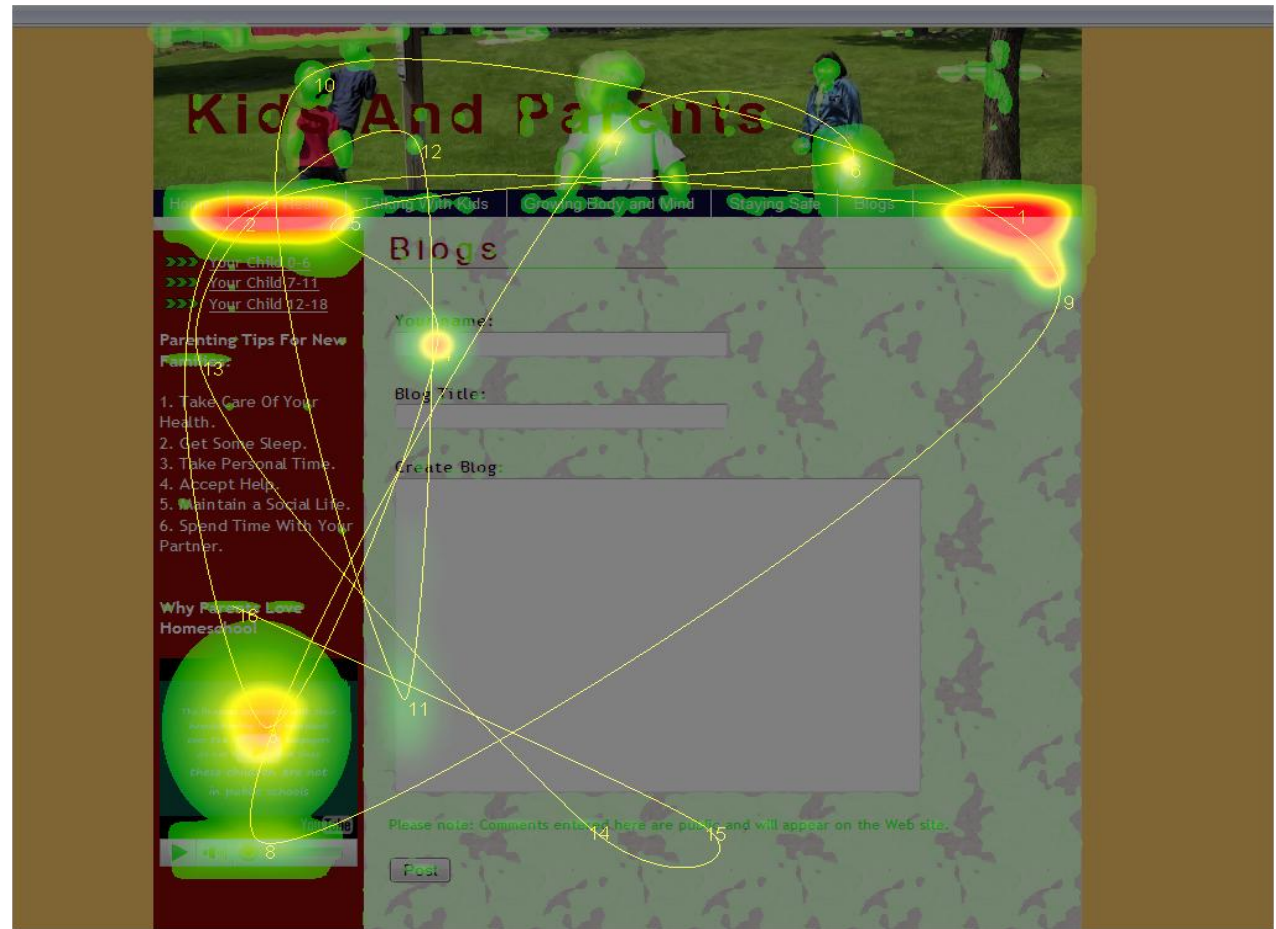
- Heat-Map of Kids and Parents Home Page



# Heat-Maps of Kids and Parents

Website : <http://farrukhjabeen.info/kidsparents>

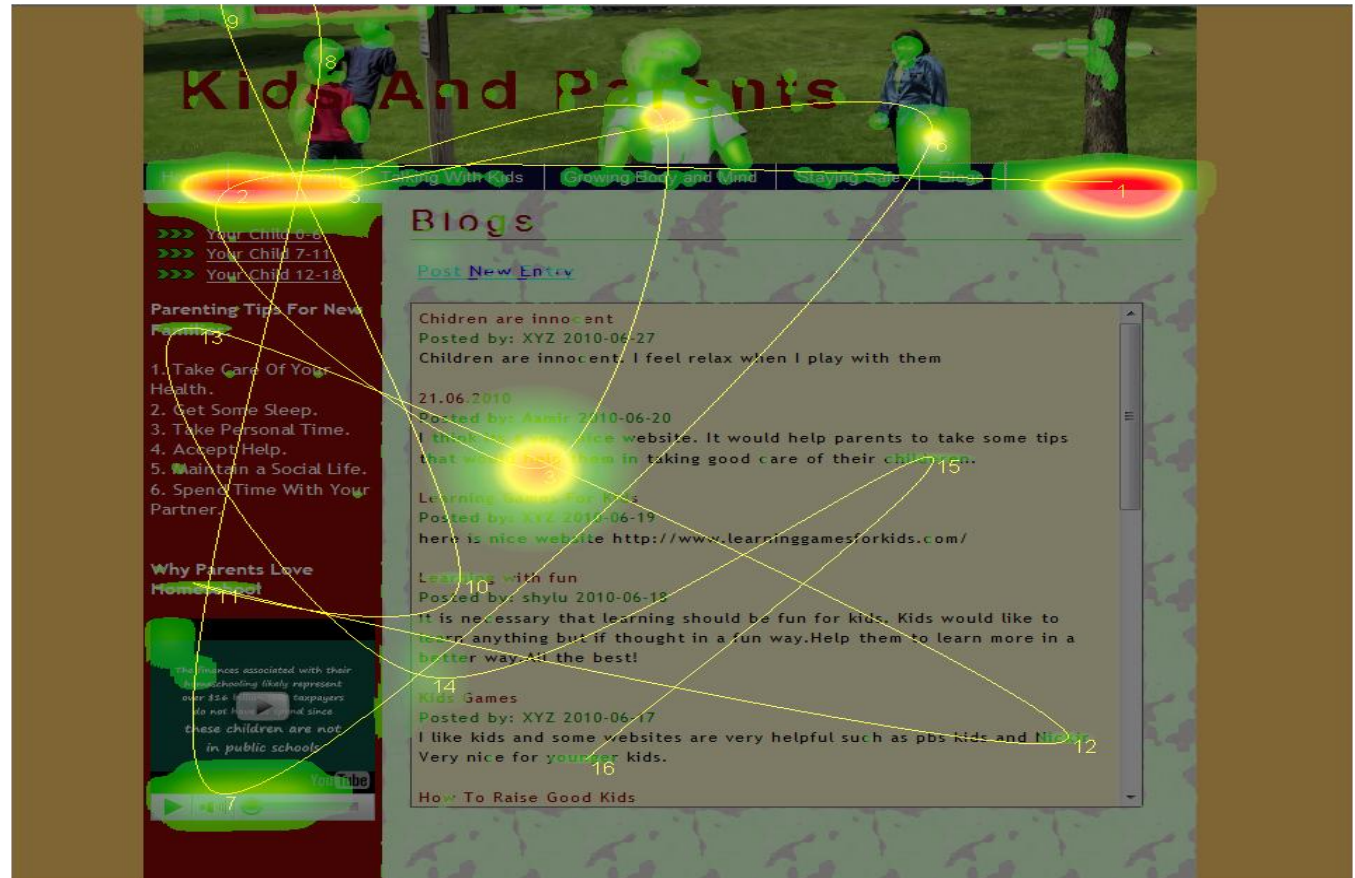
- Heat-Map of Blogs: Post New Entry Page



# Heat-Maps of Kids and Parents

Website : <http://farrukhjabeen.info/kidsparents>

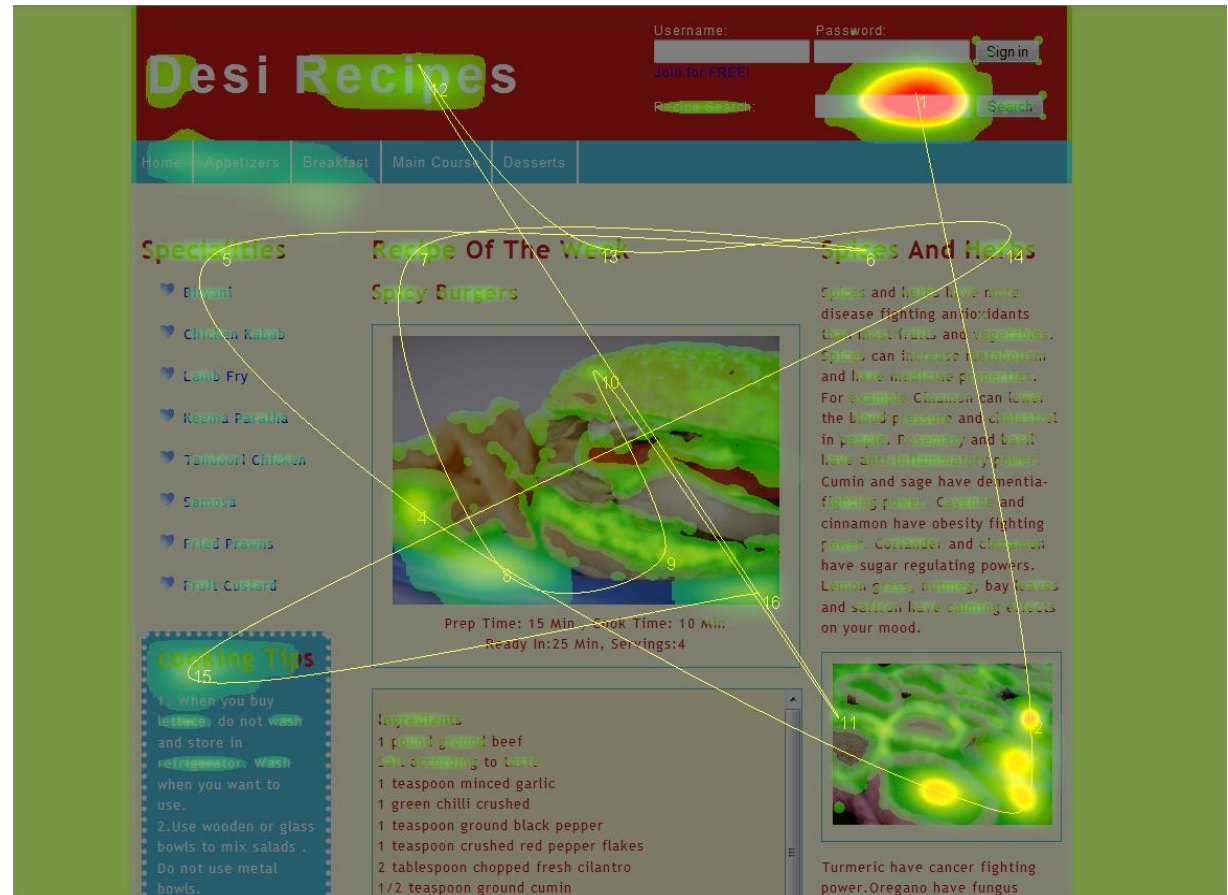
- Heat-map of 'Blogs' page.



# Heat-Maps of Desi Recipes Website :

<http://farrukhjabeen.info/recipes>

- Heat-map of 'Desi Recipes' website's home page.

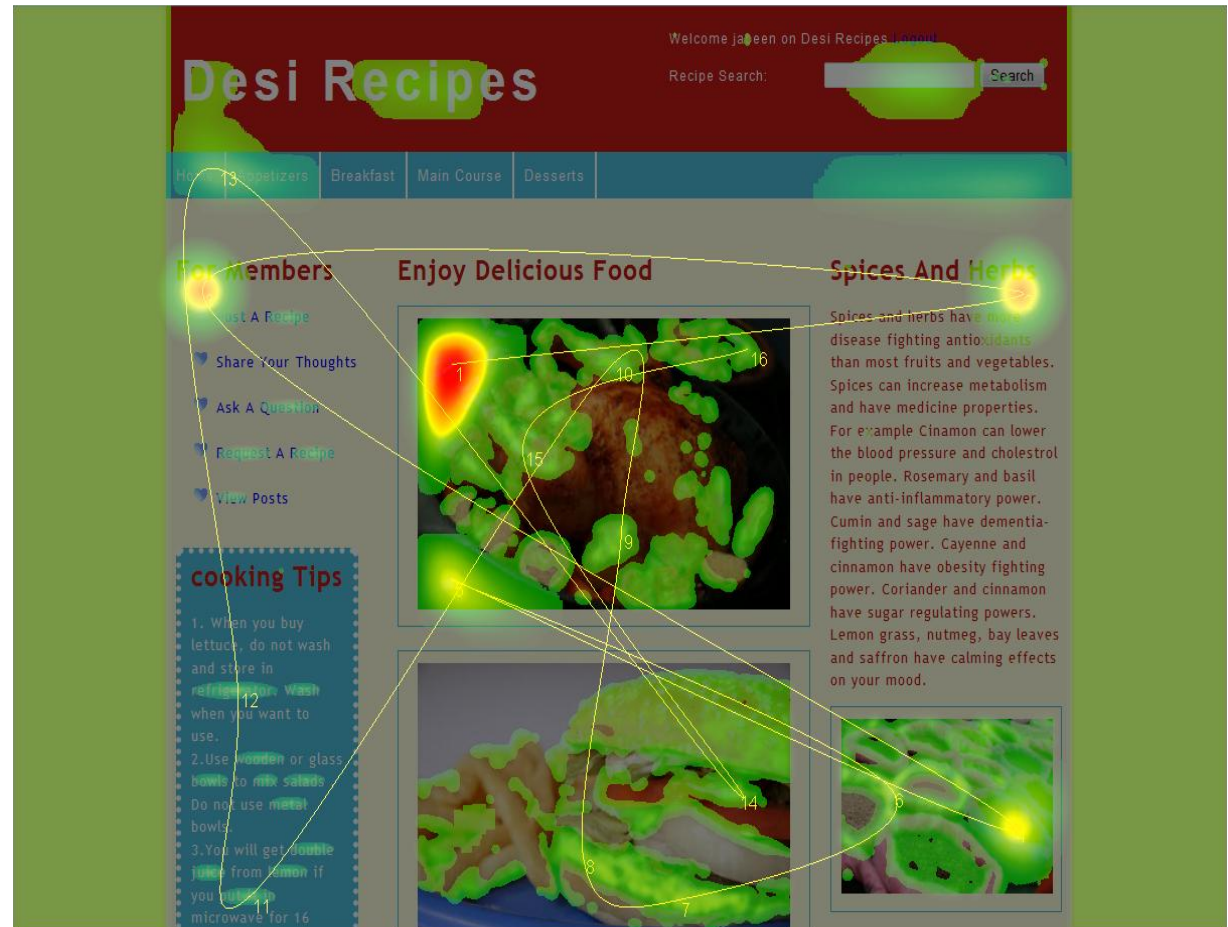




# Heat-Maps of Desi Recipes Website :

<http://farrukhjabeen.info/recipes>

- Heat-Map of User's Home Page



# Heat-Maps of Desi Recipes Website :

<http://farrukhjabeen.info/recipes>

- Heat-Map of Post a Recipe Form

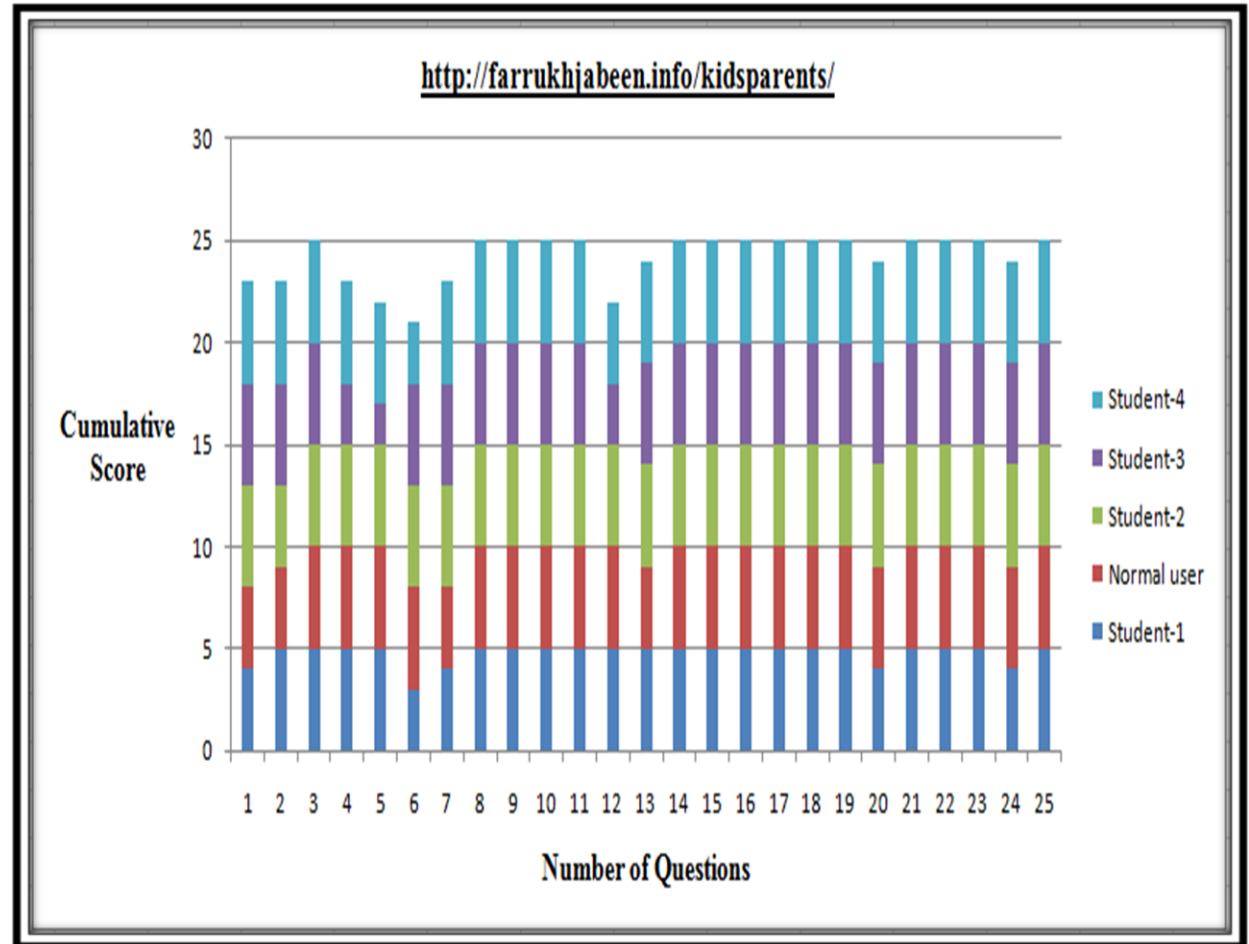
The image shows a browser window titled "Post A Recipe" with a heat-map overlay. The heat-map uses color gradients (red for high intensity, yellow for medium, green for low) and numbered arrows (1-13) to indicate user interaction points. The form fields and their corresponding interaction points are:

- 1: Title "Post A Recipe"
- 2: "Your name:" input field
- 3: "Recipe Name:" input field
- 4: "Recipe Type" dropdown menu (set to "Main Course")
- 5: "Recipe Description (200 lines about your recipe):" text area
- 6: "Upload recipe photo (optional):" button
- 7: "Number Of Servings:" input field
- 8: "Preparation Time:" input field
- 9: "Cooking Time:" input field
- 10: "Ingredients:" text area



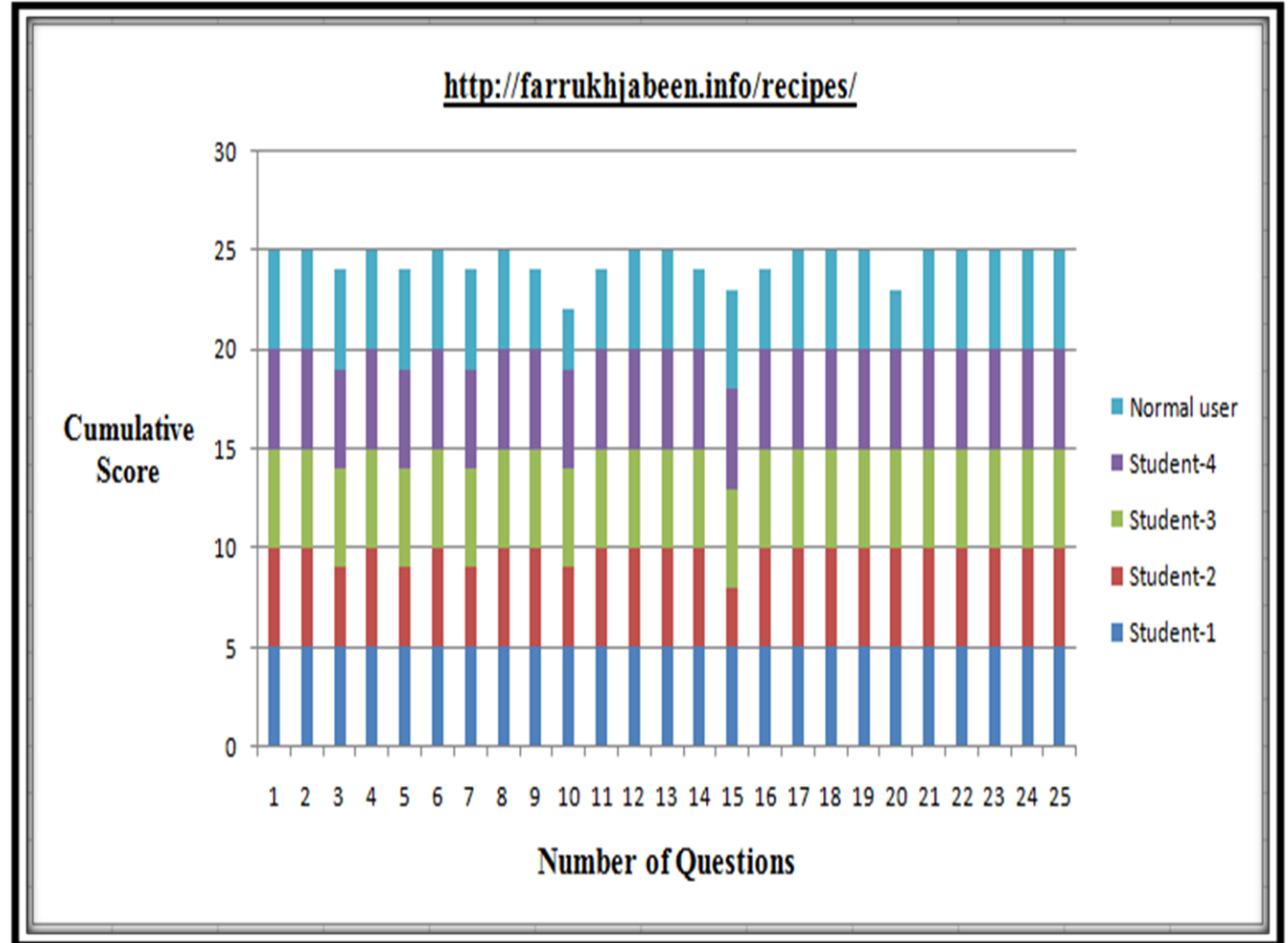
# Surveys

- Feedback Results for Kids and Parents Website



# Surveys

- Feedback Results for Desi Recipes Website



# Conclusions

- Eye movements are fundamental to any interaction with a visual system.
- Good visual design is important in a wide range of activities.
- This project developed three websites.
  - Analyzed the eye tracking data by creating heat-maps.
  - The heat-maps were created using AttentionWizard.
- Heat-maps assist the usability effort in various ways, based upon the website and its purpose.
  - Optimum placement of the call to action button or text.

# Conclusions

- An heat-map is not a substitute for actual landing page testing.
- This study found that images and graphics draw attention before accompanying text.
  - Increases the proportion of user generated activity
  - Convert more readers into buyers, and more visitors into subscribers.
  - Crucial role in the success of banner ads.
- A survey provides qualitative information on the user's perceptions.

# Future Work

- Use of eye movements as a usability evaluation technique in the ecommerce websites.
- While ecommerce has been around since the mid-90s, it has gained traction in recent years.
- Amazon, eBay, Yahoo, and Dell are some of the more successful businesses in this area.



# References

- 1. "Eye Tracking in Human-Computer Interaction and Usability Research: Current Status and Future Prospects" by Alex Poole and Linden J. Ball. Book chapter in Ghaoui, C. (ed.) "Encyclopedia of Human Computer Interaction" ISBN-10: 1591405629. Information Science Publishing, 2005.
- 2. "Eye tracking in Human Computer Interaction and Usability Research: Ready to Deliver the Promises" by Robert J.K Jacob, and Keith S. Karn, PhD. Book chapter in R. Radach, J. Hyona, and H. Deubel (eds.), "The Mind's Eye: Cognitive and Applied Aspects of Eye Movement Research" (pp. 573-605), ISBN-10: 0444510206. Elsevier, 2003.
- 3. "The Angle Velocity of Eye Movements" by Dodge and Cline. *Psychological Review*, 8,145-147, March 1901.
- 4. "Eye Tracking Methods for Improving Engineering Graphics Instruction" by Eric N. Weibe. *Proceedings of the Annual ASEE Meeting*. Washington, DC, 2005.
- 5. "Eyetracking Web Usability" by Jakob Nielsen, Kara Pernice, ISBN-10: 0321498364. New Riders Press, Berkeley, CA, USA 2009.
- 6. "Eye Tracking For People Who Don't Care About Vision OR How To Get More Dependent Measures" by Zenzi M. Griffin. Lecture notes in "Psych 290: Graduate Research Methods: How to do stuff", Stanford University 2001.
- 7. "Identifying Fixations and Saccades in Eye-Tracking Protocols" by Dario D. Salvucci, and Joseph H. Goldberg. *ACM Symposium on Eye tracking Research and Applications*, 2000.
- 8. "Identifying Web Usability Problems from Eye Tracking Data" by Claudia Ehmke, Stephanie. 21st British HCI Group Annual Conference on People and Computers: HCI...but not as we know it - Volume 1, 2007.
- 9. "Saccadic Eye Movements and Cognition" by Simon P. Liversedge and John M. Findlay. *Trends in Cognitive Sciences* volume 4, Issue 1 2000.
- 10. "Analysis of Eye Tracking Experiment Performed on a Tobii T60" by Chris Weigle and David C. Banks. In *proceedings of Visualization and Data Analysis*, 2008.
- 11. "How Users View Web Pages: An Exploration of Cognitive and Perceptual Mechanisms" by Rebecca A. Grier Aptima, Philip Kortum, and James T. Miller. Book chapter in Panayiotis Zaphiris, and Sri Kurniawan "Human Computer Interaction Research in Web Design and Evaluation". IGI Global, 2007.
- 12. "Eye tracking And Its Application in Usability and Media Research" by Michael Schiessl, Sabrina Duda, Andreas Tholke, and Rico Fischer. In *MMI-Interactive '03*, pages 41-50, 2003.
- 13. [http://en.wikipedia.org/wiki/Eye\\_tracking#cite\\_note-preventative-29](http://en.wikipedia.org/wiki/Eye_tracking#cite_note-preventative-29)
- 14. [http://www.newcarnet.co.uk/Lexus\\_news.html?id=5787](http://www.newcarnet.co.uk/Lexus_news.html?id=5787)
- 15. "Testing Websites with Eye Tracking" by Will Schroeder. [http://www.uie.com/articles/eye\\_tracking/](http://www.uie.com/articles/eye_tracking/) 1998.
- 16. "Usability Issues in Web Site Design" by Nigel Bevan. *Proceedings of UPA'98*, Washigton DC, 22-26 June 1998.
- 17. "Information Space. In C. Ghoul," by Benyon, D.R. *The Encyclopedia of Human Computer Interaction* IDEAL Publishing, 2005.
- 18. "Navigation Information Space: Web site design and Lessons from the built environment" by David Benyon. *PsychNology Journal* Volume 4, Number 1, pp.7-24, 2006.
- 19. "Usability for the Web: Designing Websites that Work (Interactive Technologies)" by Brinck T. , Gergle D., and Wood S., ISBN-10: 1558606580. Morgan Kauffman, London, 2001.
- 20. "Information Architecture for the World Wide Web, 2nd edition" by Rosenfeld, L. and Morville, P., ISBN-10: 0596527349. O'Reilly, Sebastopol, 2006.
- 21. <http://www.motive.co.nz/glossary/navigation.php>
- 22. "A Global Perspective on Web Site Usability" by Shirley A. Becker and Florence E. Mottay. *IEEE Software*, vol. 18, no. 1, pp. 54-61, Jan. /Feb. 2001.
- 23. "Sexy Web design" by Elliot Jay Stocks, ISBN-10: 0980455235. SitePoint Pty. Ltd, Australia, 2009.
- 24. "Eye tracking in Usability Research: What users really see" by Martina Manhartsberger, Norbert Zellhofer. *Usability Symposium 2005*.
- 25. "Do Interface Standards Stifle Design Creativity?" by Nielsen J, <http://www.useit.com/alertbox/990822.html>, 1999.

# References

- 26. "Could I have the Menu Please? An Eyetracking Study of Design Conventions" by J. D. McCarthy, M. A. Sasse, and J. Riegelsberger. In *Proceedings of HCI2003*, pages 401--414, Bath, UK, 2003.
- 27. <http://www.usability.gov/pdfs/chapter7.pdf>
- 28. <http://www.usability.gov/pdfs/chapter5.pdf>
- 29. "Web Form Design: Filling In the Blanks" by Luke Wroblewski, ISBN-10: 1933820241. Louis Rosenfeld, USA, 2008.
- 30. [http://www.lukew.com/resources/articles/WebForms\\_LukeW.pdf](http://www.lukew.com/resources/articles/WebForms_LukeW.pdf)
- 31. [http://www.cpartners.co.uk/thoughts/web\\_forms\\_design\\_guidelines\\_an\\_eyetracking\\_study.htm](http://www.cpartners.co.uk/thoughts/web_forms_design_guidelines_an_eyetracking_study.htm)
- 32. <http://www.quality-web-solutions.com/web-design-image.php>
- 33. <http://www.commercechemist.com/Blog/?tag=/eye+tracking>
- 34. "Identify Web Usability Criteria: The 'Scannic Model' by Shahizan Hassan and Feng Li. *Eighth European Conference on Information Technology Evaluation 2001*.
- 35. [http://www.poynter.org/content/content\\_view.asp?id=70472](http://www.poynter.org/content/content_view.asp?id=70472)
- 36. "Online Banner Advertising: Eye Tracking Research" by Steve Scherbak, VP Development New Media, Valassis Interactive. *Eye tracking research - Online Banners - Realeyes -20 11 2008 US*.
- 37. <http://www.poynterextra.org/eyetrack2004/advertising.htm>
- 38. "Banner Blindness: Web searches often miss 'obvious links' by J.P. Benway and D.M. Lane. *Internetworking, ITG Newsletter, 1998*.
- 39. "Validating the Use and Role of Visual Elements of Web Pages in Navigation with an Eye-Tracking Study" by Yeliz Yesilada, Caroline Jay, Robert Stevens and Simon. *Proceeding of the 17th International Conference on World Wide Web, 2008*.
- 40. <http://www.doshdosh.com/how-to-reduce-banner-blindness-and-buy-effective-ads-that-work/>
- 41. <http://www.w3schools.com/default.asp>
- 42. <http://www.wampserver.com/en/>
- 43. <http://www.attentionwizard.com/aw/overview.html>
- 44. [http://www.usda.gov/wps/portal/usda/!ut/p/c5/04\\_SB8K8xLLM9MSSzPy8xBz9CP0os\\_gAC9-wMJ8QY0MDpxBDA09nXw9DFxcXQ-cAA\\_1wkA5kFaGuQBXeASbmmu4uBge5hB5AxzA0UDfzyM\\_N1W\\_IDS7zdFRUfREAZXAypA!!/dl3/d3/L2dJQSEvUUt3QS9ZQnZ3LzZFRUDhNVIZMVDmXMEJUMTBJQ01IMURERDFUIDA!/?navid=SEARCH&q=sr22.mdb&Go\\_button.x=0&Go\\_button.y=0&site=usda](http://www.usda.gov/wps/portal/usda/!ut/p/c5/04_SB8K8xLLM9MSSzPy8xBz9CP0os_gAC9-wMJ8QY0MDpxBDA09nXw9DFxcXQ-cAA_1wkA5kFaGuQBXeASbmmu4uBge5hB5AxzA0UDfzyM_N1W_IDS7zdFRUfREAZXAypA!!/dl3/d3/L2dJQSEvUUt3QS9ZQnZ3LzZFRUDhNVIZMVDmXMEJUMTBJQ01IMURERDFUIDA!/?navid=SEARCH&q=sr22.mdb&Go_button.x=0&Go_button.y=0&site=usda)
- 45. <http://browsershots.org/>
- 46. <http://online-biz-guide.com/?p=208>
- 47. <http://bannerweaver.com/blog/banner-advertising/importance-banner-advertising/>
- 48. <http://www.wlct.org/tourism/etourism/advice sheets10.pdf>
- 49. <http://webdesign.vinsign.com/what-is-ecommerce-importance.html>
- 50. "Eye-Tracking: Characteristics and Methods: Eye-Tracking: Research Areas and Applications" by Daniel C. Richardson. *Encyclopedia of Biomaterials and Biomedical Engineering, 2004*.
- 51. [http://www.ergoestudio.com/descargas/eye-tracking\\_for\\_usability\\_e-commerce.pdf](http://www.ergoestudio.com/descargas/eye-tracking_for_usability_e-commerce.pdf)