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# The Structure of E-Government

- Developing a Methodology for Quantitative Evaluation -

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## Motivation

*"The UK is still struggling to get the public to use online and other electronic forms of government in spite of multi-billion pound investments in them"*

*Accenture, quoted in Financial Times, May 22nd 2006*

- e-government is big business (> 1% of GDP, £14 billion annually in UK alone) ...
- ... but lags behind e-commerce in many countries
- eg. UK
  - 39% of Internet users some government interaction online
  - BUT: 85% shop online!



## Motivation II

- need for evaluation
  - value for money
  - nodality/visibility - policy making capacity
  - aid future design of e-gov initiatives
- numerous studies (eg Accenture, UN ...)
  - mostly qualitative
  - all lack structural metrics
  - most lack user metrics

## Project in a Nutshell

- **aim:** establish metric for quantitative evaluation of (government) websites (user studies are expensive & obtrusive)
- **focus:** navigability & nodality
- **methods:**
  - link structure of websites
  - user experiments
- **process:**
  - Audit Offices
    - development of structural metrics (see paper)
  - Foreign Offices
    - test of metrics
    - user experiments



## Data Set

- Foreign Offices
  - Australia
  - United Kingdom
  - United States
- relatively well defined
- comparable roles
- English-speaking



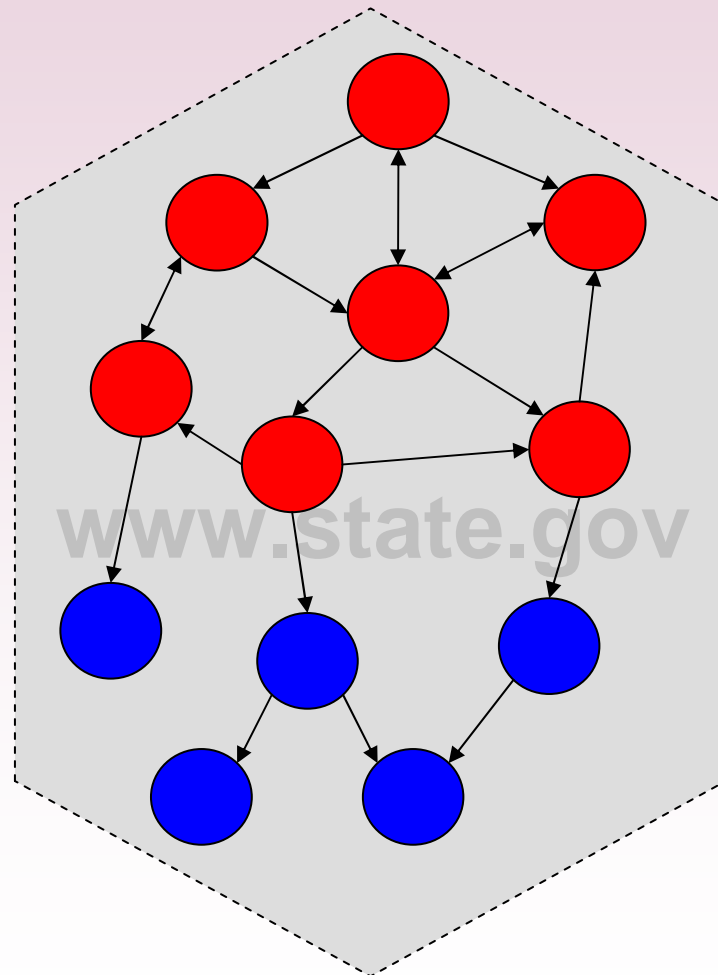
## Data Set

- websites crawled by Nutch
- only internal links

Country	Foreign Offices	Pages	Links	doc/pdf
Australia (AU)	<a href="http://www.dfat.gov.au">www.dfat.gov.au</a>	32,765	895,015	5%
United Kingdom (UK)	<a href="http://www.fco.gov.uk">www.fco.gov.uk</a>	23,570	430,489	10%
United States (US)	<a href="http://www.state.gov">www.state.gov</a>	129,246	2,506,066	10%

# Metrics

strongly  
connected  
component



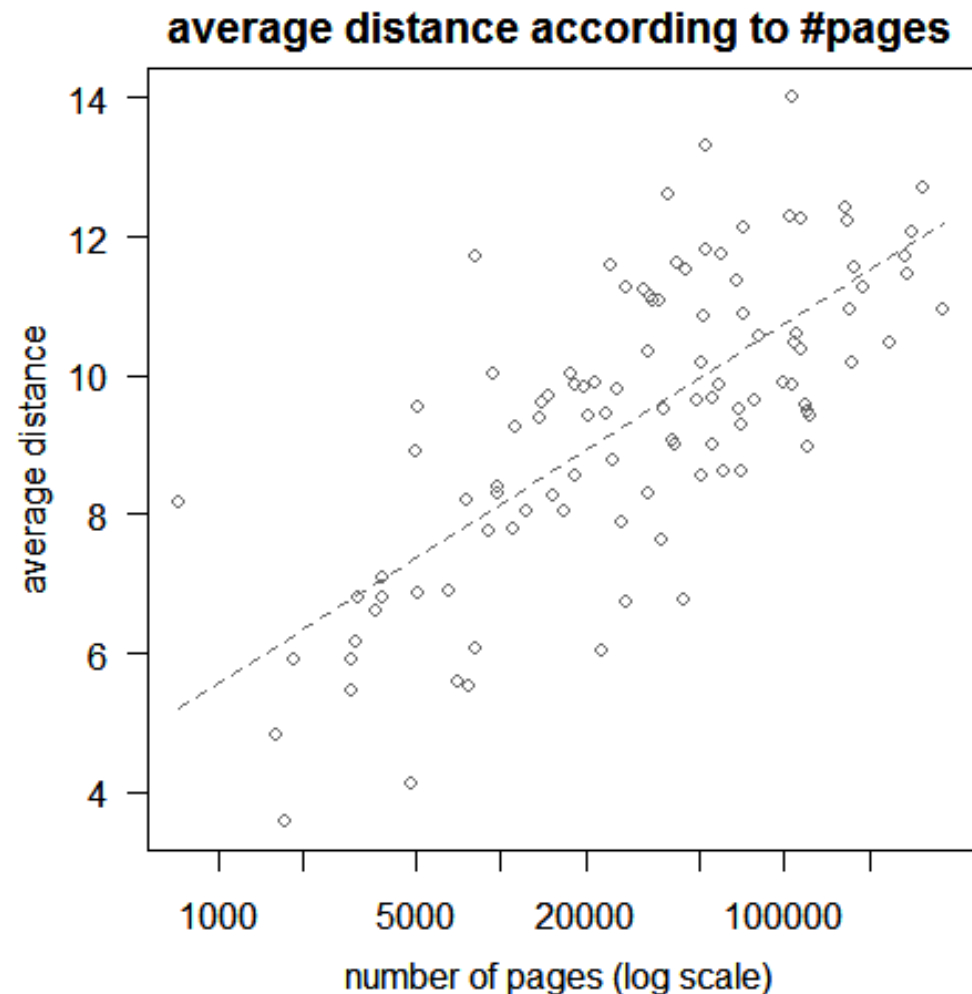
out  
component

main measures:

- i. is there a path between two pages
  - i. connected components
  - ii. unreachable pairs
- ii. how long is it
  - i. diameter
  - ii. average distance
  - iii. distance distribution

# Normalization of Metrics

- metrics influenced by number of pages of website
- Albert et al. (1999), Lu (2000): **log(size)**
- supported by own analysis of 110 UK university websites (Thelwall, 2005)
- *useful for structural comparison, not for benchmarking*







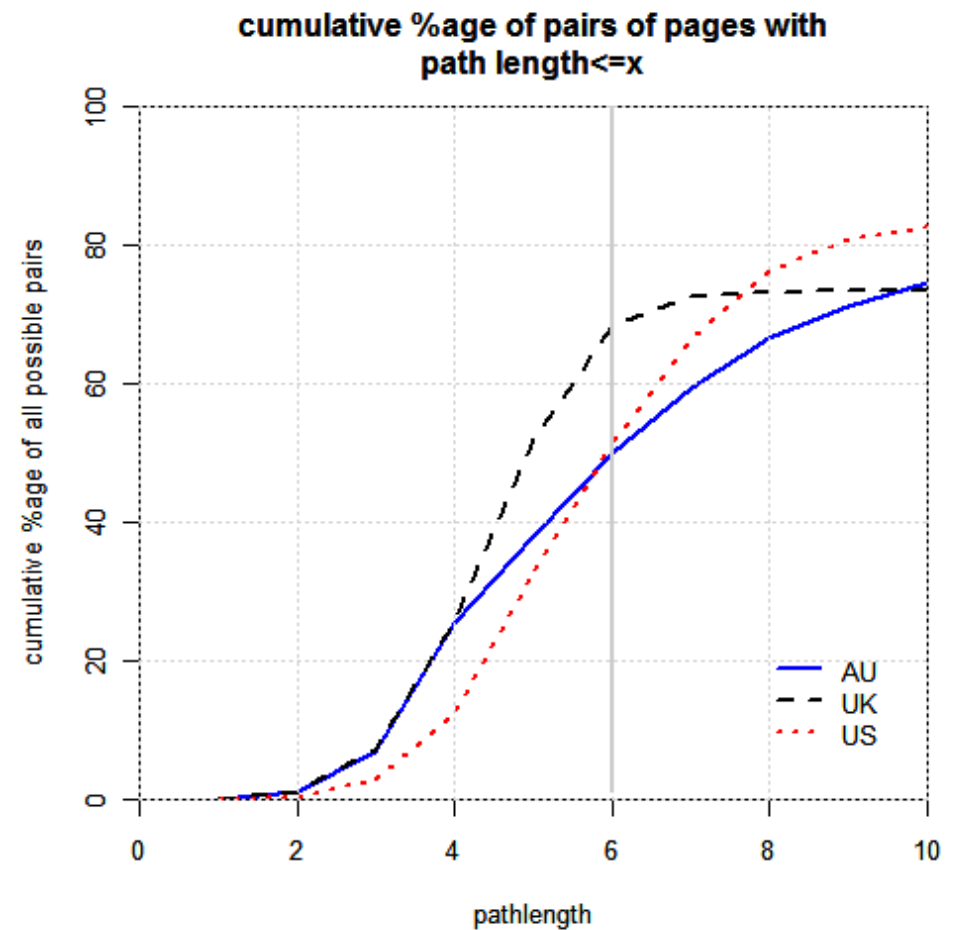
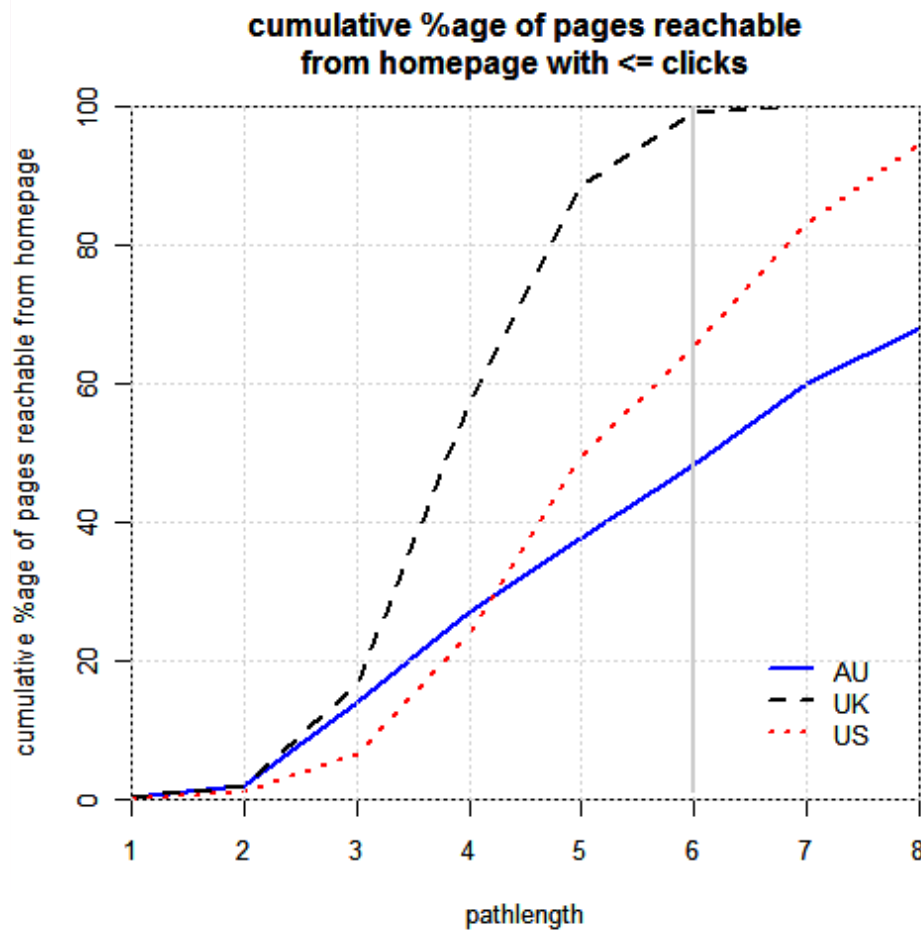
# Site Metric Results

	Average Distance	Diameter	Normalized		SCC	OUT	unreach-able pairs
			Average Distance	Diameter			
<b>AU</b>	8.1	38	1.80	8.42	95%	5%	5%
<b>UK</b>	4.9	10	1.12	2.29	73%	27%	27%
<b>US</b>	6.2	17	1.21	3.00	84%	16%	16%



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# Distribution of Distances from Homepage

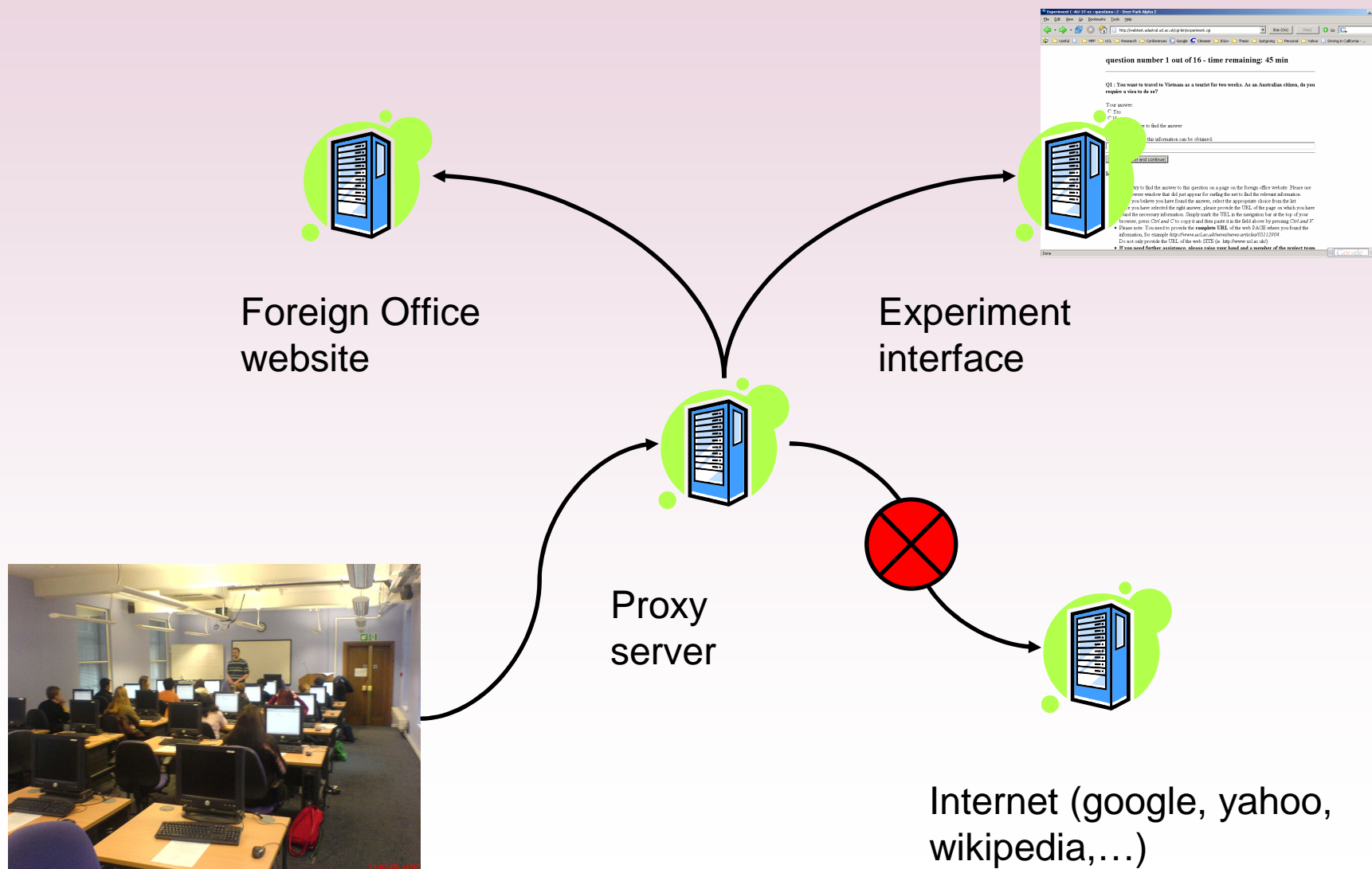




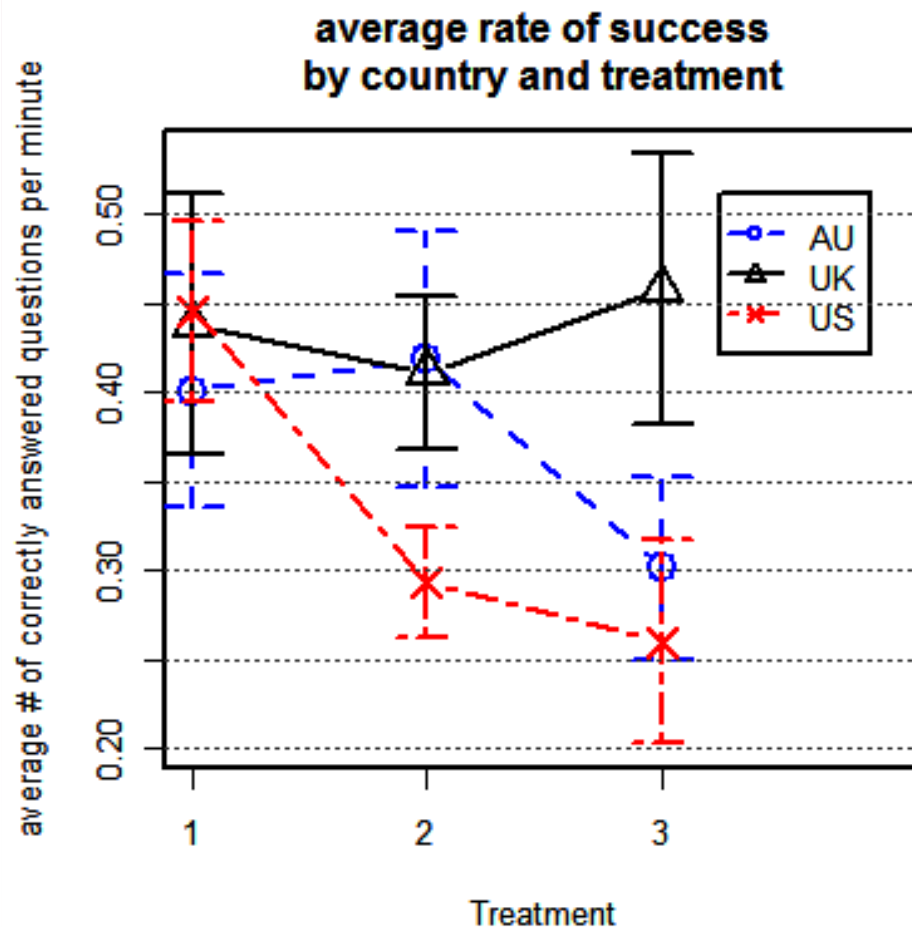
# User Experiment

- lab-based
- 10 questions related to foreign office information
- 3 treatments
  1. open access to whole WWW
  2. site only
  3. site only – no searching
- £5 for attendance + £0.50 per correct answer
- 135 subjects
- main measures
  - success: #correctly answered questions / minute
  - path length: #clicks to answer questions
  - time

# User Experiment Setup



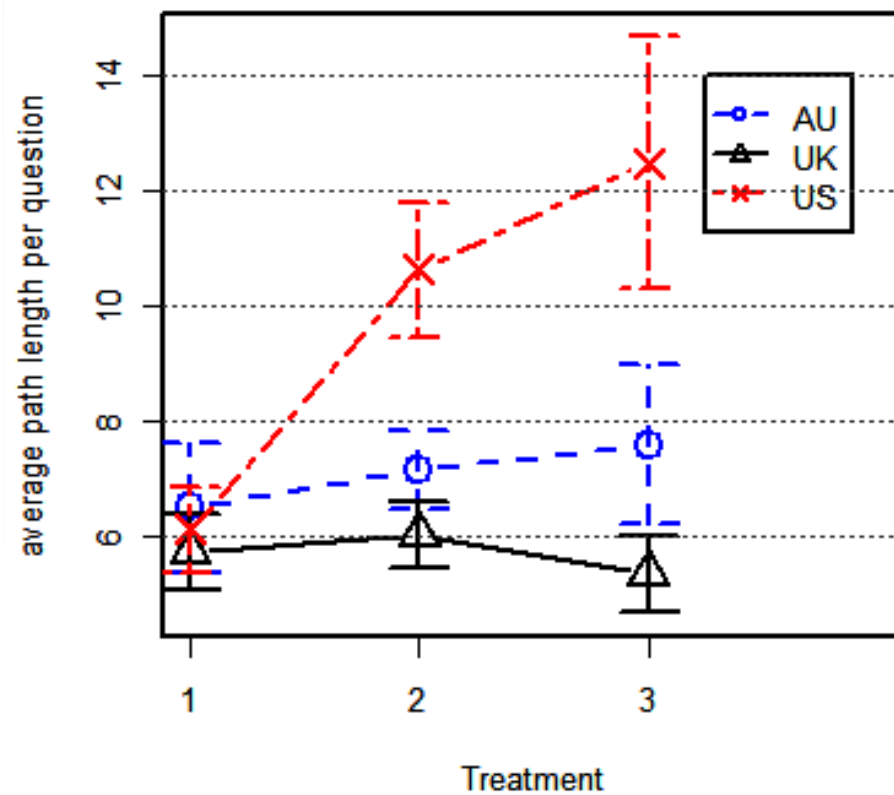
# Results of User Experiment



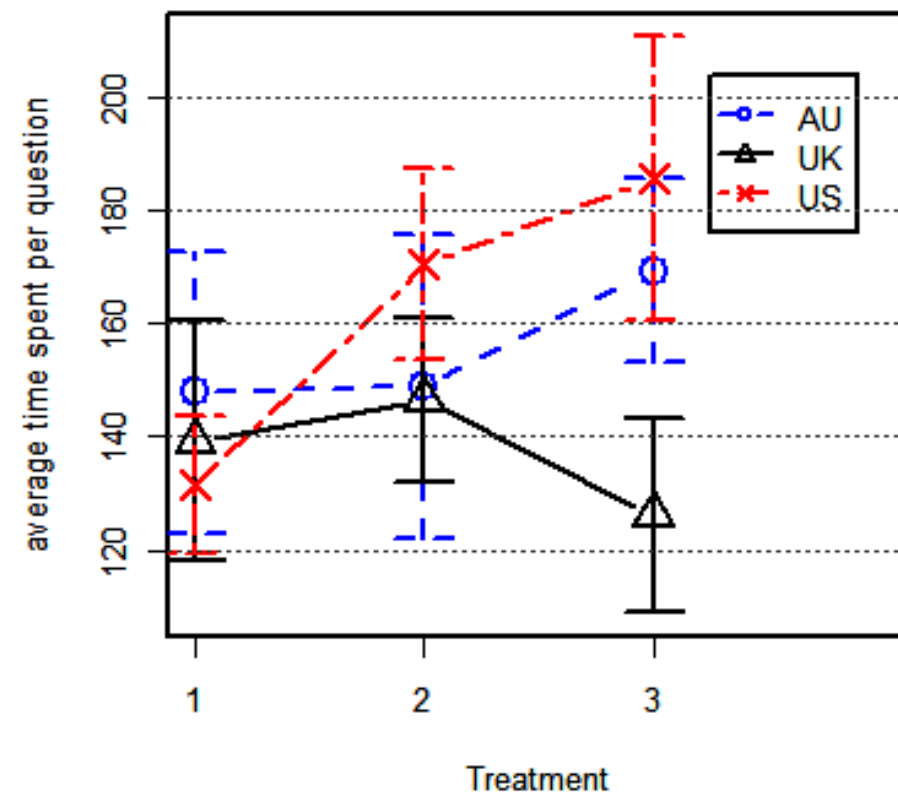
- no big differences for open access
- everybody uses search engine (average: 75%)
- information is found on sites navigability
- UK best, US worst
- AU benefits from internal search
- performance degrades without external search

# Results of User Experiment II

average path length  
by country and treatment



average time per question  
by country and treatment



# Summary Results

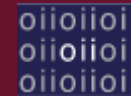
- metrics
  - sites differ
  - metrics differ for each site
    - size: 1. US 2. AU 3. AU
    - SCC: 1. AU 2. US 3. UK
    - average distance: 1. UK 2. US 3. AU
    - reachability: 1. UK 2. AU, US
- user experiment
  - everybody uses search engine – for good reason
  - users still navigate BUT start from within site
  - no variation in nodality ...
  - ... but variation in navigability: 1. UK 2. AU, US
  - internal search can offset bad structure
  - average 6 clicks to locate information



## Conclusion

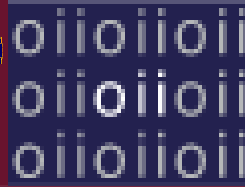
- metric selection is complex
- no single metric will do
- short distances help
- no direct influence of strongly connected component size
- reachability and average distance could explain navigability





## Recommendations

- nodality is crucial because most people search
  - getting properly indexed is most important
  - big spend on portal sites should be questioned (eg [direct.gov.uk](http://direct.gov.uk))
- internal search helps (use external engine!)
- no excuse for huge sites
- popular content should be reachable with few clicks
- related content should be clustered



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**Thank you for your attention!**

**Any questions?**

**additional information**

*WWW2006 proceedings:*

Petricek, V., Escher, T., Cox, I.J., Margetts, H. (2005):  
The Web Structure of E-Government - Developing a  
Methodology for Quantitative Evaluation.

*on the WWW:*

<http://www.governmentontheweb.org>

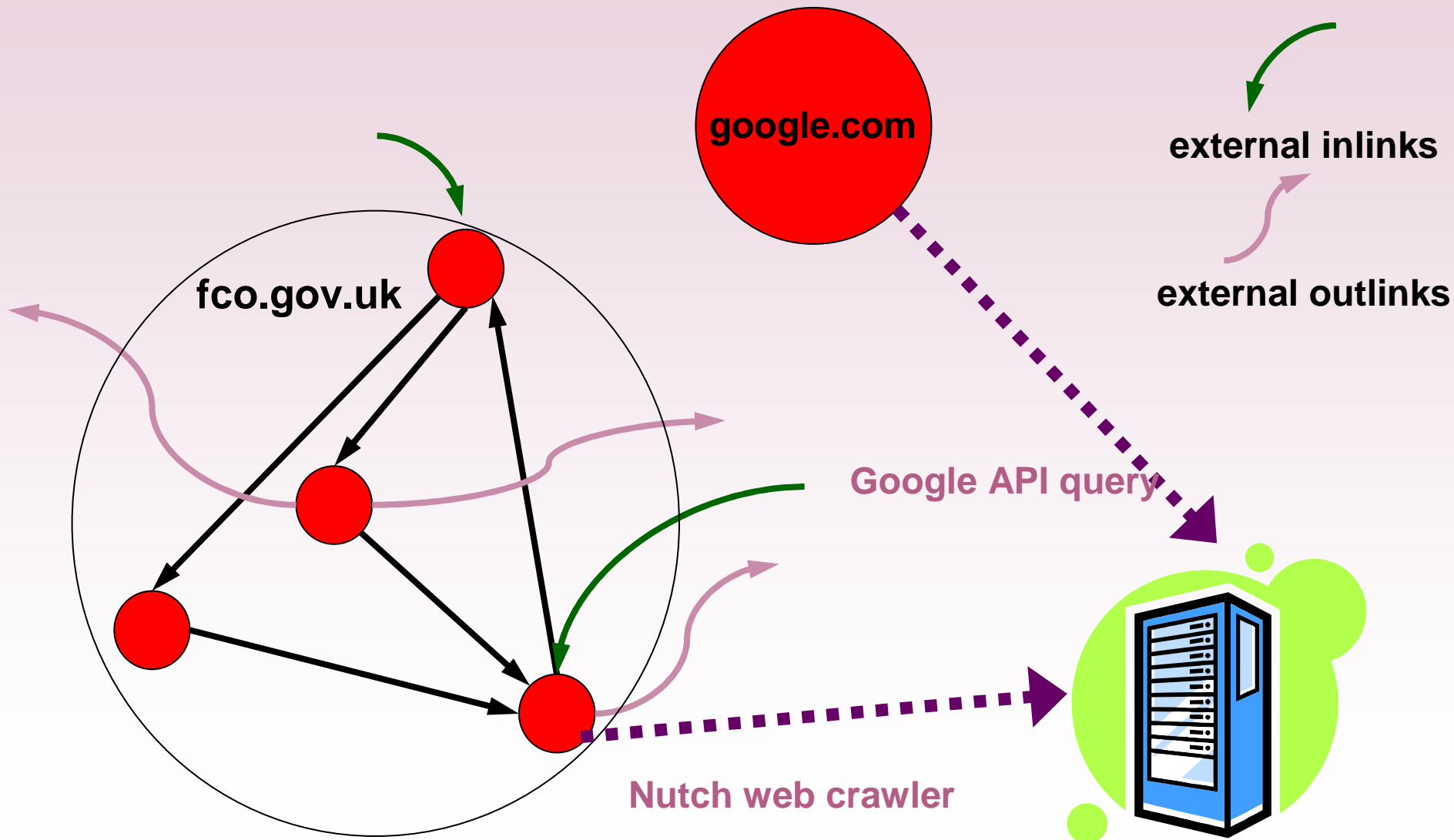


## References

- Albert, R., Jeong, H. and Barabási, A. *Diameter of the World-Wide Web*. Nature, 401 (September 1999), 130.
- Broder, A., Kumar, R., Maghoul, F., Raghavan, P., Rajagopalan, S., Stata, R. and Tomkins, A. *Graph structure in the web: Experiments and models*. 9th WWW 2000.
- Lu, Linyuan . *The Diameter of Random Massive Graphs* in Proceedings of the twelfth annual ACM-SIAM symposium on Discrete algorithms. (2000)
- Thelwall, M (2005): *UK University Web sites June-July 2005*. <http://cybermetrics.wlv.ac.uk/database/index.html>



# Method - Data Collection





## Information Found on Foreign Office Sites

	AU	UK	US
<i>external search used at least once</i>	87%	100%	100%
<i>average use of external search</i>	61% (0.4)	75% (0.3)	80% (0.3)
<i>average percentage of questions per user that were answered with foreign office site</i>	70% (0.1)	53% (0.2)	58% (0.1)
<i>average percentage of questions per user that were answered with government site from respective country</i>	83% (0.1)	73% (0.1)	80% (0.1)
<i>average percentage of questions per user that were answered with some government site (not necessarily from respective country)</i>	93% (0.1)	84% (0.1)	90% (0.1)



## User Experiment – Questions

1. You want to travel to Vietnam as a tourist for two weeks. As an Australian citizen, do you require a visa to do so?
2. What is the address of the Australian embassy in Berlin/Germany? Please state the house number!
3. Official Australian documents that are going to be used abroad often need to be authenticated by an official Australian institution, to indicate that the document is not a fake. Does the Australian Department of Foreign Affairs and Trade authenticate documents?
4. You want to go to China for three weeks. Recently there have been reports on cases of avian flu / bird flu. Does the government of Australia advise its citizens against travel to China because of avian flu?
5. *Did Australia sign the Ottawa Convention against landmines?*
6. What is the opinion of the Australian government concerning: Is it safe for its citizens to travel to Ivory Coast/Cote d'Ivoire?
7. What is the Internet address of the French embassy in Australia?
8. As an Australian citizen: what should you do if your passport got stolen whilst you are abroad?
9. *What is the first name of the Argentinean ambassador in Australia?*
10. As an Australian citizen: In case you are arrested and imprisoned in a foreign country - will an Australian official (i.e. consul) visit you if you wish so?
11. *How many staff is employed by the Australian Department for Trade and Foreign Affairs (at home and overseas)?*
12. What is the annual salary for Graduate Trainees starting to work for the Australian Department for Trade and Foreign Affairs?
13. What is the first name of the Australian ambassador in Israel?
14. *In which year was the current Australian Minister for Foreign Affairs born?*
15. *Does a Japanese citizen who wants to spend two weeks of holidays in Australia need a visa or an Electronic Travel Authority?*
16. *How many Australian Defence Force personnel are currently deployed in Iraq?*



# User Experiment Interface

Experiment B-AU-2-46 : questions : 1 - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

http://webtest.adastral.ucl.ac.uk/cgi-bin/experiment.cgi

Useful MFF UCL Research Conferences Google Citeseer EGov Thesis Justgiving Personal Yahoo Wedding ring

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**question number 1 out of 16 - time remaining: 45 min**

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**Q1 : You want to travel to Vietnam as a tourist for two weeks. As an Australian citizen, do you require a visa to do so?**

Your answer:

Yes

No

Did not manage to find the answer

URL of page where this information can be found:

**Instructions**

- Please try to find the answer to the question in the browser window that did just open.
- Once you believe you have found the answer, click on the "submit answer and continue" button.
- Once you have selected the right answer, click on the "submit answer and continue" button.
- Please note: You need to provide the URL of the page where you found the necessary information. Do not only provide the URL of the page you are currently on.
- **If you need further assistance, please contact the experimenter. We will come to help you.**

Australian Department of Foreign Affairs and Trade Homepage - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

http://www.dfat.gov.au/

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