

# Private Browsing: an Inquiry on Usability and Privacy Protection

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Published in WPES 2014

# What is private browsing?

- Introduced in 2005 in Safari 2.0
- A feature in most current web browsers
- Private browsing functionalities
  - Session browsing history is deleted
  - Cookies are deleted
  - Temporary files are deleted (differ in different browsers)
    - Sign-in password
    - Autofill information
    - Form data
- Protect against local users sharing the computer

# Motivation for user study

- Previous research looked at how private browsing is implemented (USENIX Security'10)
- No comprehensive user study on private browsing
- Do users understand private browsing?
- Any misconceptions?
  - Interpretation vs. Functionality
  - Potential privacy/security risk
- User study provides feedback for developers

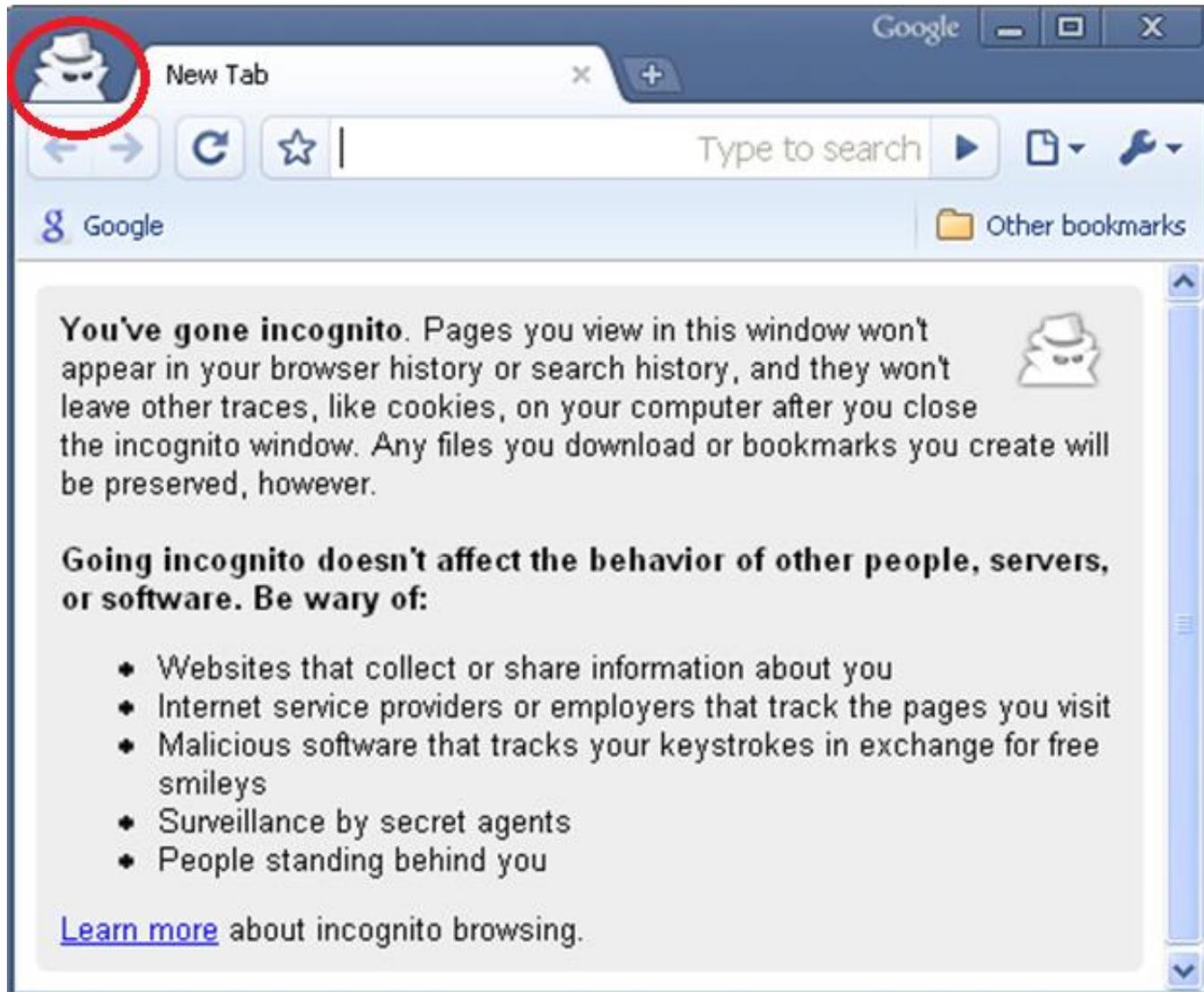
# Private browsing mode in different browsers

- Different browsers tested
  - IE 10
  - Firefox 30
  - Chrome 35
  - Opera 22
  - Safari 5
- Similar main functionality
  - Deleting browsing history and cookies
- Difference in visual indicators
- Difference in handling extensions
- Difference in deleting temporary files
  - Autofill information, form data, passwords, download list entries

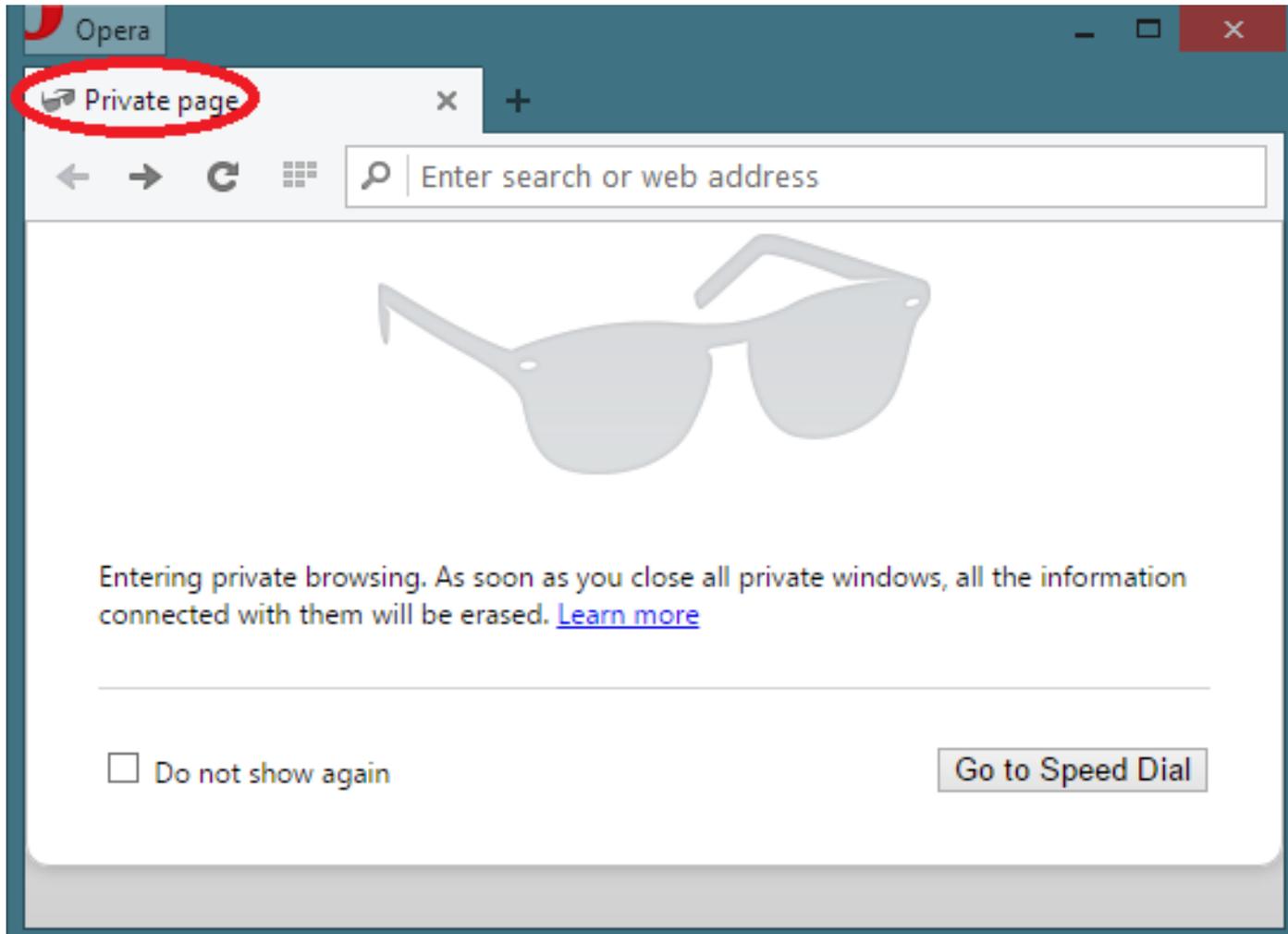
# Private browsing in Safari



# Incognito browsing in Google Chrome



# Private browsing in Opera



# Private browsing survey study

- Amazon Mechanical Turk recruitment
- 200 participants in US
- Familiar with Internet browsing
- 49% (N=98) females, 51% (N=102) males
- Age distribution
  - Age 18-37: 68%
  - Age 38-57: 27.5%
  - Age 58-68: 4.5%
- Various levels of education (from high school to graduate degree)

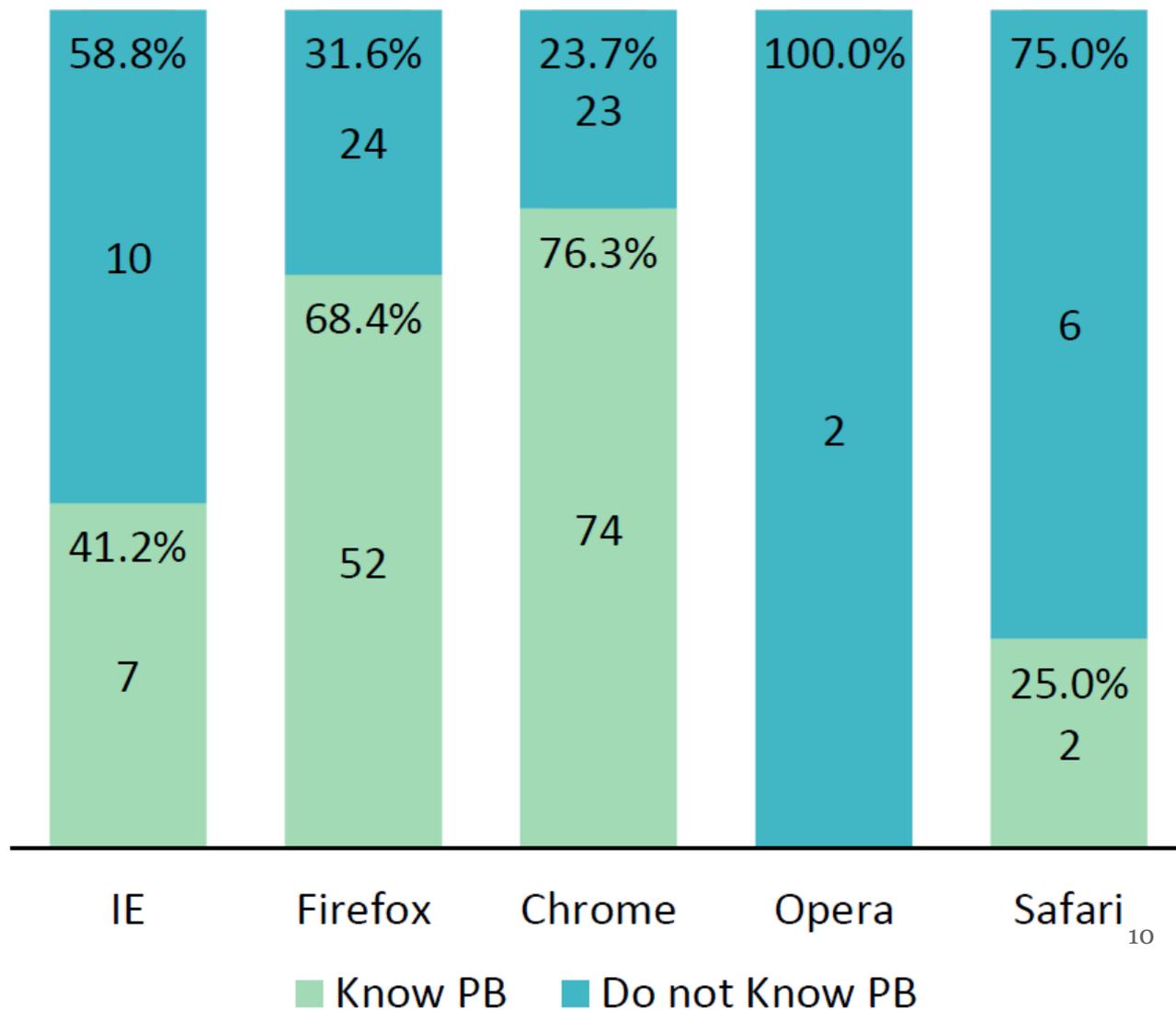
## Survey responses grouping (most used browser)

- IE: 8.5% participants
- Firefox: 38% participants
- Google Chrome: 48.5% participants
- Opera: 1% participants
- Safari: 4% participants

	Chrome	Firefox	IE	Safari	Opera
Survey result	48.5%	38%	8.5%	4%	1%
W3Schools	54.1%	27.2%	11.7%	3.8%	1.7%

# Awareness of private browsing

- About 1/3 of 200 participants didn't know about private browsing



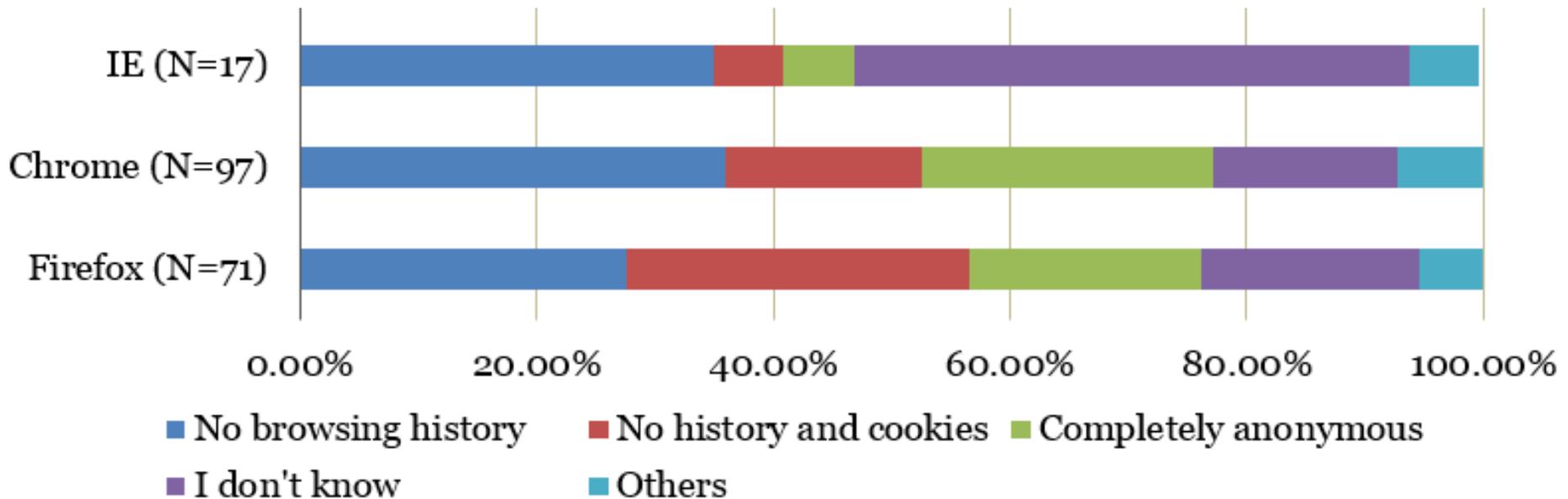
# Understanding of private browsing

- **Only browsing history was not saved (32.5%)**
  - P3 said, “From the browsing history, future users cannot see what you used the internet for.”
- **Both browsing history and cookies were not saved (20.5%)**
  - P101 said, “Incognito browsing doesn't generate any browsing history or tracking cookies, it's as though you're using the browser for the first time every time you use it.”

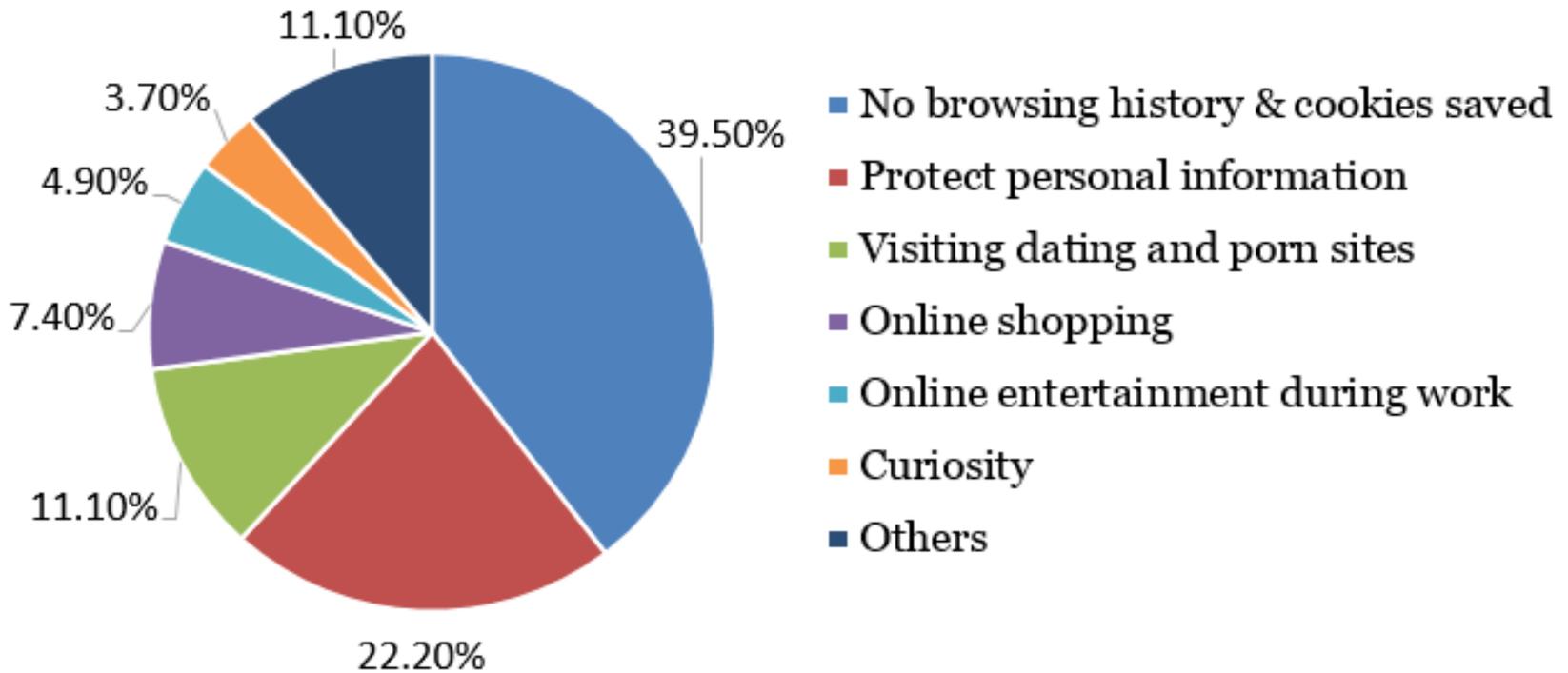
# Understanding of private browsing

- **Block websites and third party organizations from tracking personal online activity, completely anonymous browsing (20.5%)**
  - “No personal data is collected by websites”
  - “It prevents other websites entering browsing history and tracking online activity”
  - “All browsing history, cookies, cache get cleared, making browsing activity anonymous.”
- **Others (20.5%)**
  - “I guess the private mode is on, judging from the name.”
  - “Add-ons and scripts do not work on this feature.”

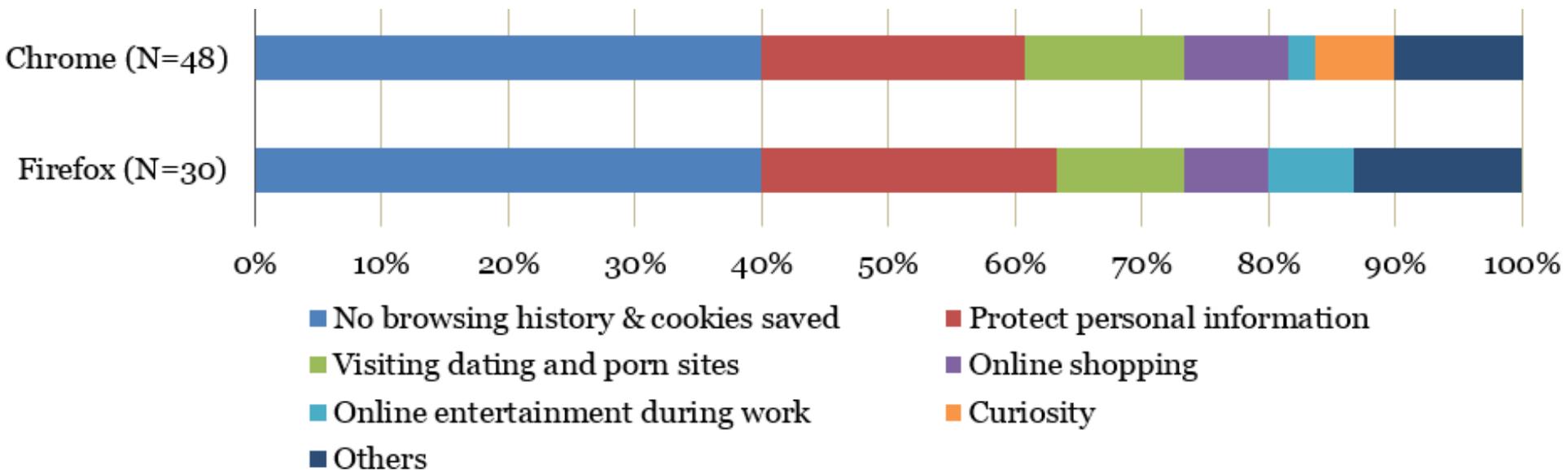
# Understanding of private browsing (responses comparison across different browsers)



# Reasons for using private browsing



# Reasons for using private browsing (responses comparison across different browsers)



# Websites visited in private browsing mode

Responses from 81 participants:

- No website preference: 28.4%
- Preference on some particular sites: 71.6%
- 49 different websites were listed in total
  - 18 porn and dating sites
  - 9 news and entertainment sites
  - 7 social networking sites
  - 6 finance and banking sites
  - 4 online shopping sites
  - 2 online workforce platform (Swagbucks and Amazon Mechanical Turk)

# When did people use private browsing?

Responses from 81 participants:

- Morning before work: 21%
- At work: 28.4%
- **At night after work: 39.5%**
- Late at night after 11pm: 28.4%
- Other (no preference on time): 13.6%

# Private browsing: benefits

Responses from 81 participants:

- Protect personal privacy (no browsing history saved): 59.3%
- No cookies stored: 13.6%
- Keep computer clean: 5%
- Prevent malicious site's attack (e.g. steal personal inform): 5%
- Speed up webpage loading: 3.7%
- Prevent virus attack & block ads online: 3.7%
- No benefit: 5%
- Not sure: 3.7%

# Private browsing: drawbacks

Responses from 81 participants:

- No drawbacks: 46.9%
- No browsing record when needed: 28.4%
- Sign-in information not available: 8.6%
- A mode without full browsing feature: 5%
- Others: 11%
  - Some agencies can still track on personal online activities
  - No saving options available
  - Encourages secrecy and dishonesty in a relationship
  - Not sure

# Conclusion

- Findings
  - One third of participants were not aware of this privacy-enhancing feature.
  - For people who knew or even used this feature, they had various misconceptions which could put them at risk.
  - Private browsing users in Firefox and Chrome have similar responses about their perceptions on the private browsing.
- Result implications
  - Better methods are needed for browsers to inform private browsing.
  - Emphasis about PB features should be provided to avoid misconceptions.

Questions?

Thank You!