Reinforcing bad behaviour: the misuse of security indicators on popular websites

Douglas Stebila
stebila@qut.edu.au

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How can users tell when a website is secure?

“secure” = “safe to enter personal information”

Welcome to Facebook

http://www.facebook.com/

facebook

Email

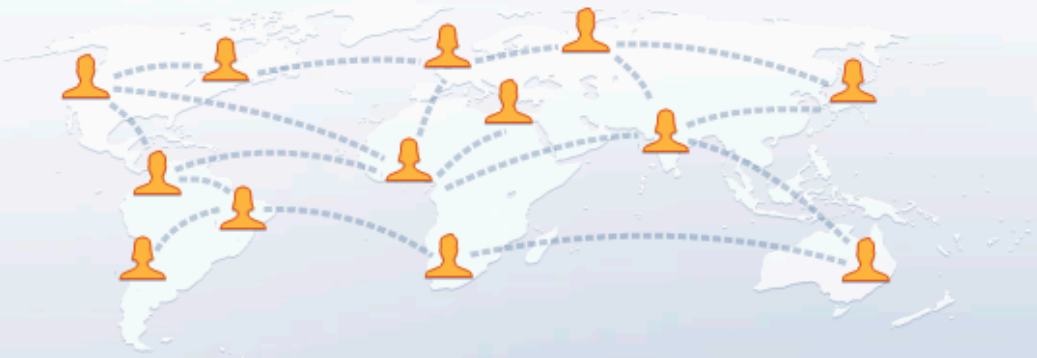
Password

Login

Keep me logged in

Forgot your password?

Facebook helps you connect and share with the people in your life.



Sign Up

It's free, and always will be.

First Name:

Last Name:

Your Email:

Re-enter Email:

New Password:

I am: Select Sex:

Birthday: Month: Day: Year:

Why do I need to provide this?

Sign Up

Create a Page for a celebrity, band or business.

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Secure Log In

Member Login

Account login

Member Login

Email address

PayPal password

Go to My account

Log In

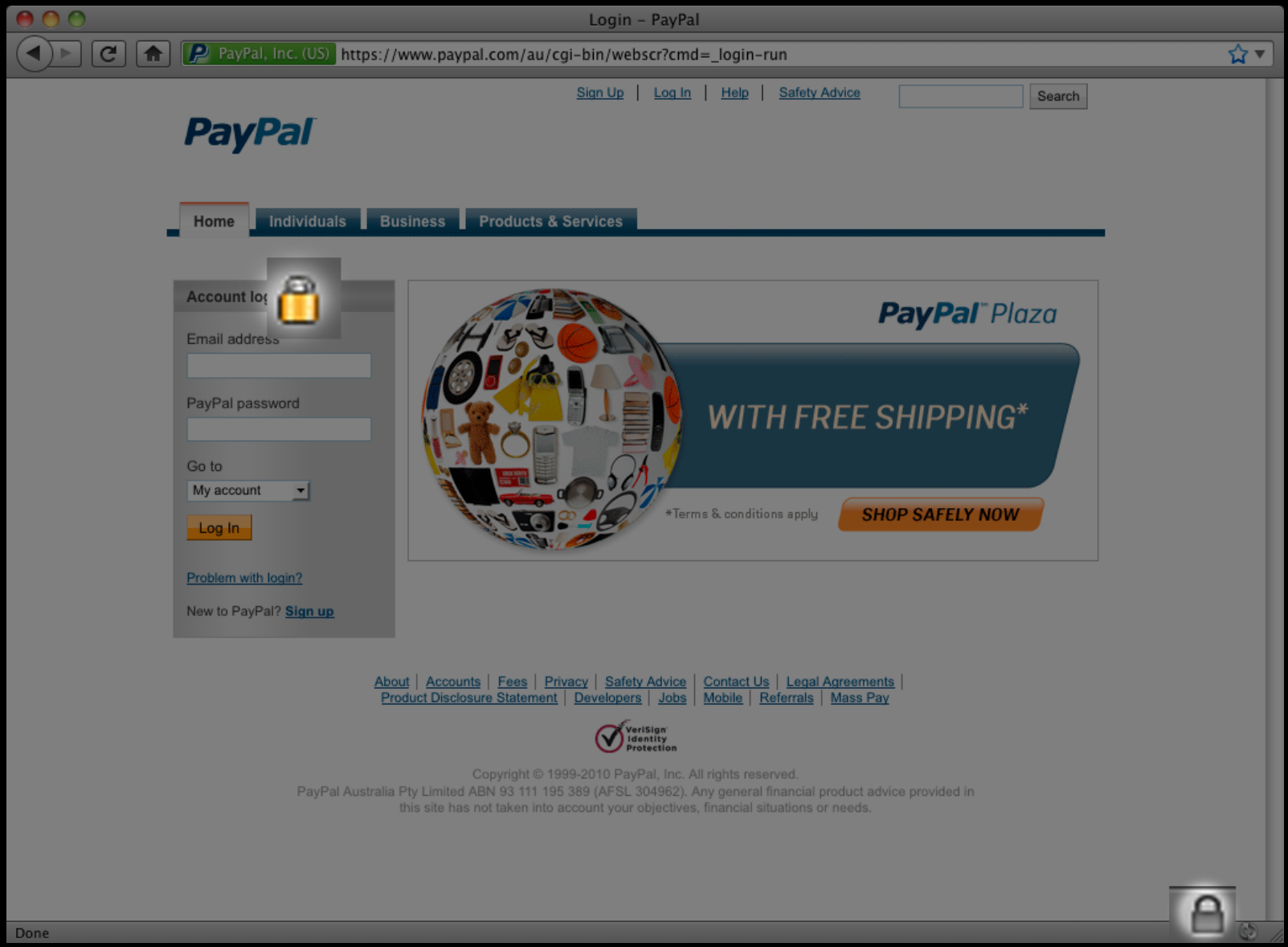
What criteria do people use to decide if a website is secure?

Consider criteria identified by Whalen and Inkpen[1] through eye-tracking and subject interviews.

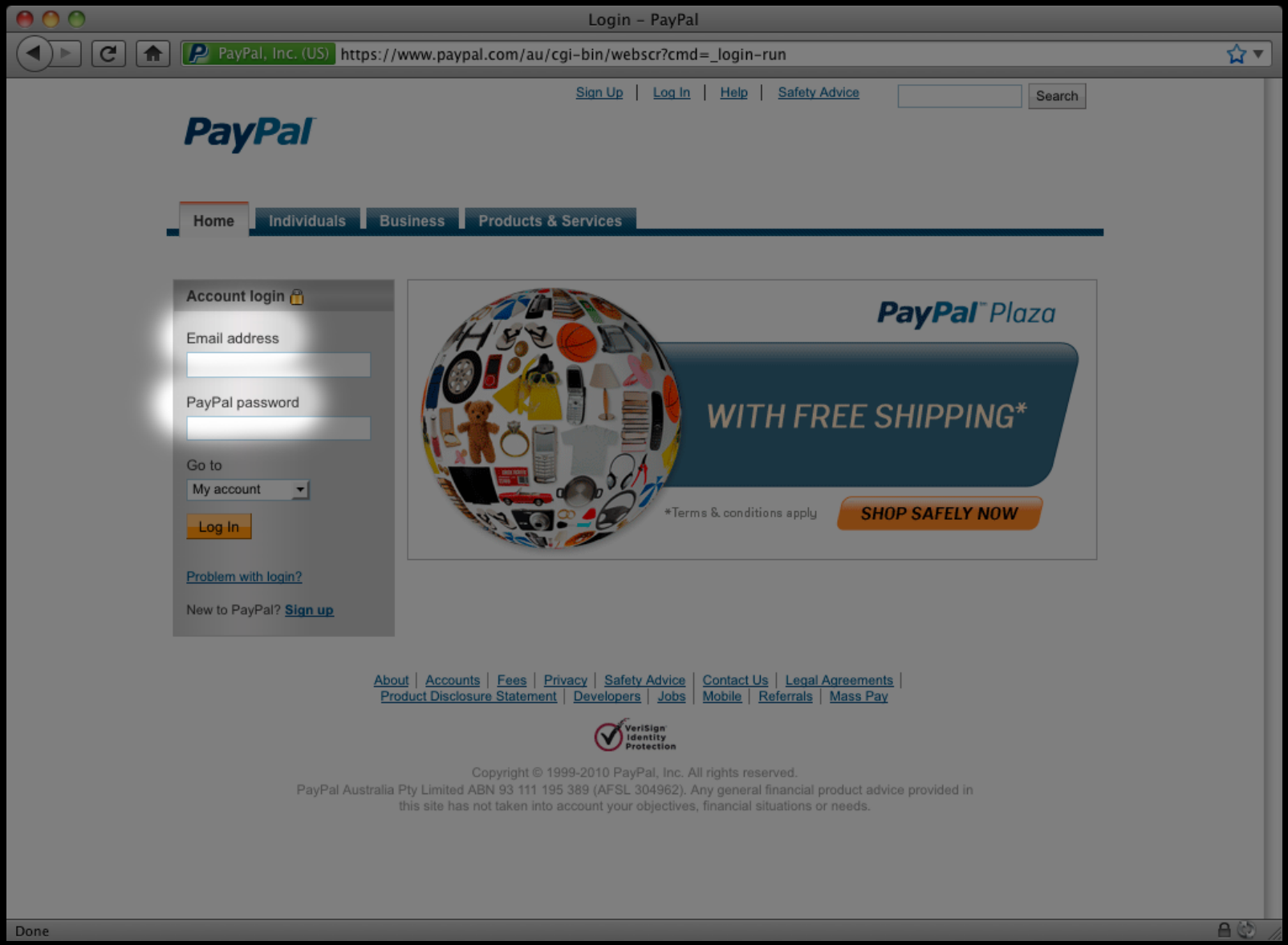
[1] Whalen, Inkpen. Gathering evidence: use of visual security cues in web browsers. *Graphics Interface,* 112:137–144 (2005)

“type of site” – 88%

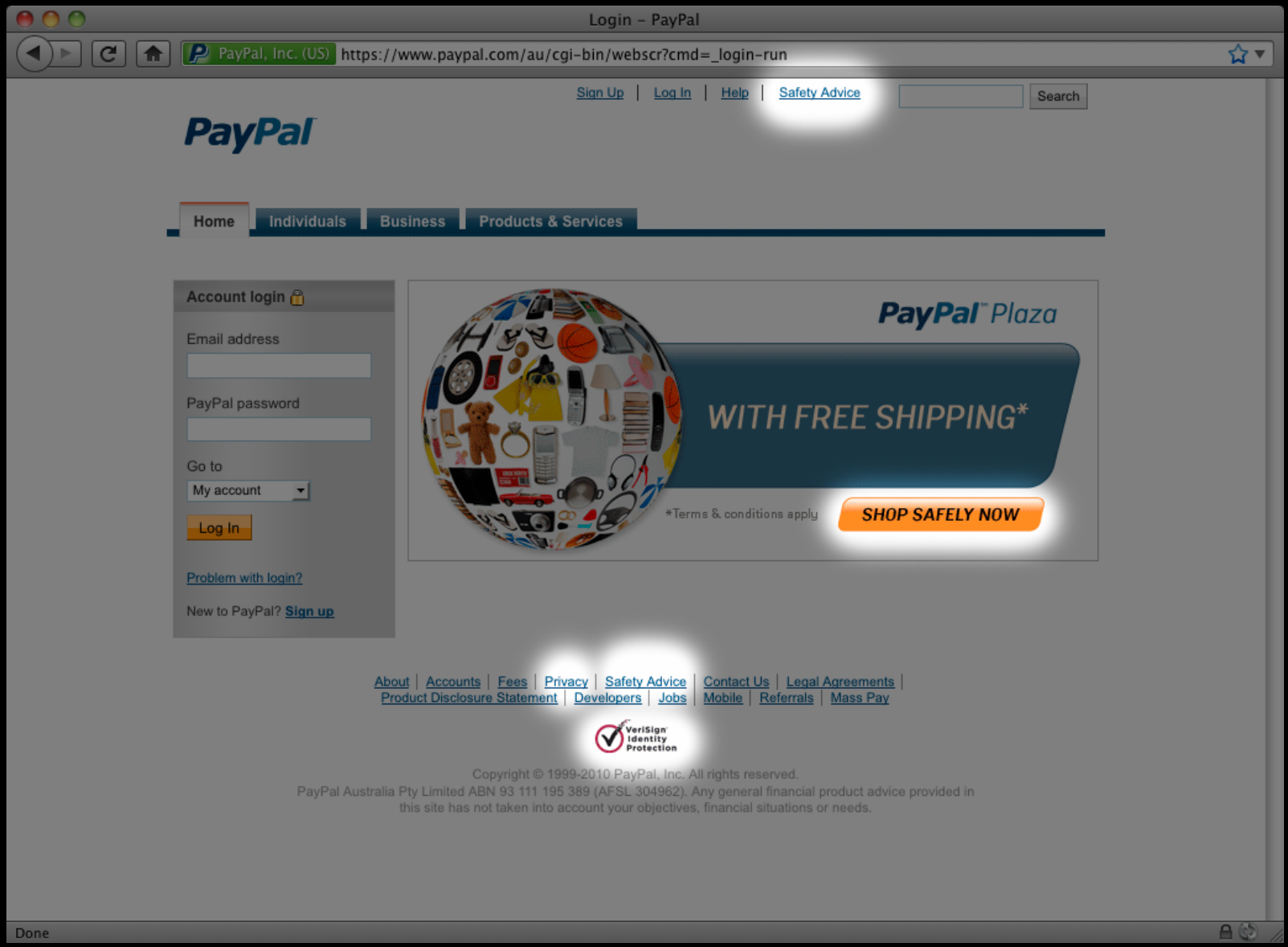
“lock or key icon” – 75%



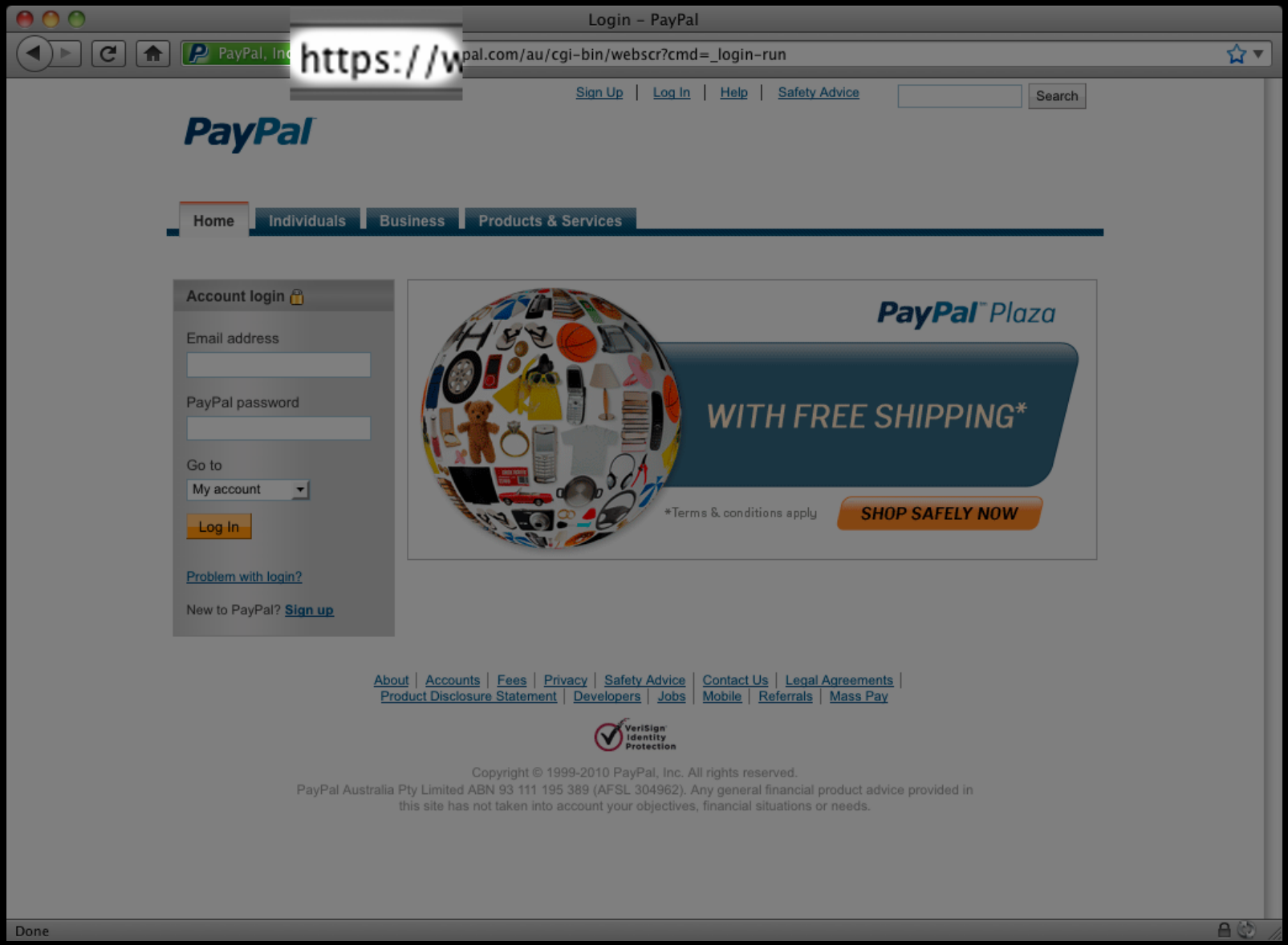
“type of information” – 69%



“site statements” – 50%



“https” – 50%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Done

“certificate” – 19%

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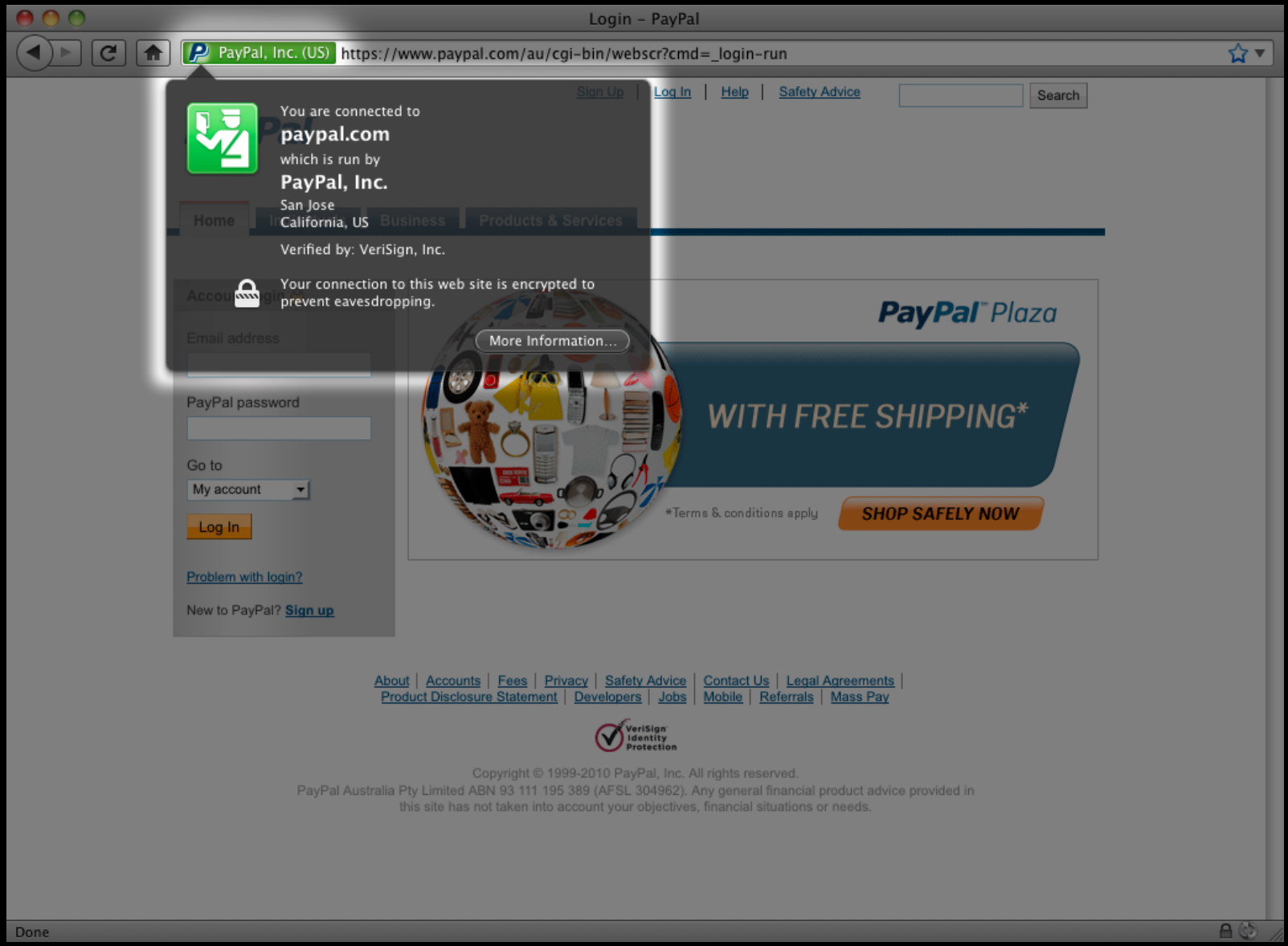

What criteria *should* people use to decide if a website is secure?

Narrow focus from a cryptographer's perspective:

- What criteria accurately convey the known security properties of the connection?
  - Use of the SSL / HTTPS protocol which encrypts all data and gives server-to-client authentication.

We can't trust anything provided by the server

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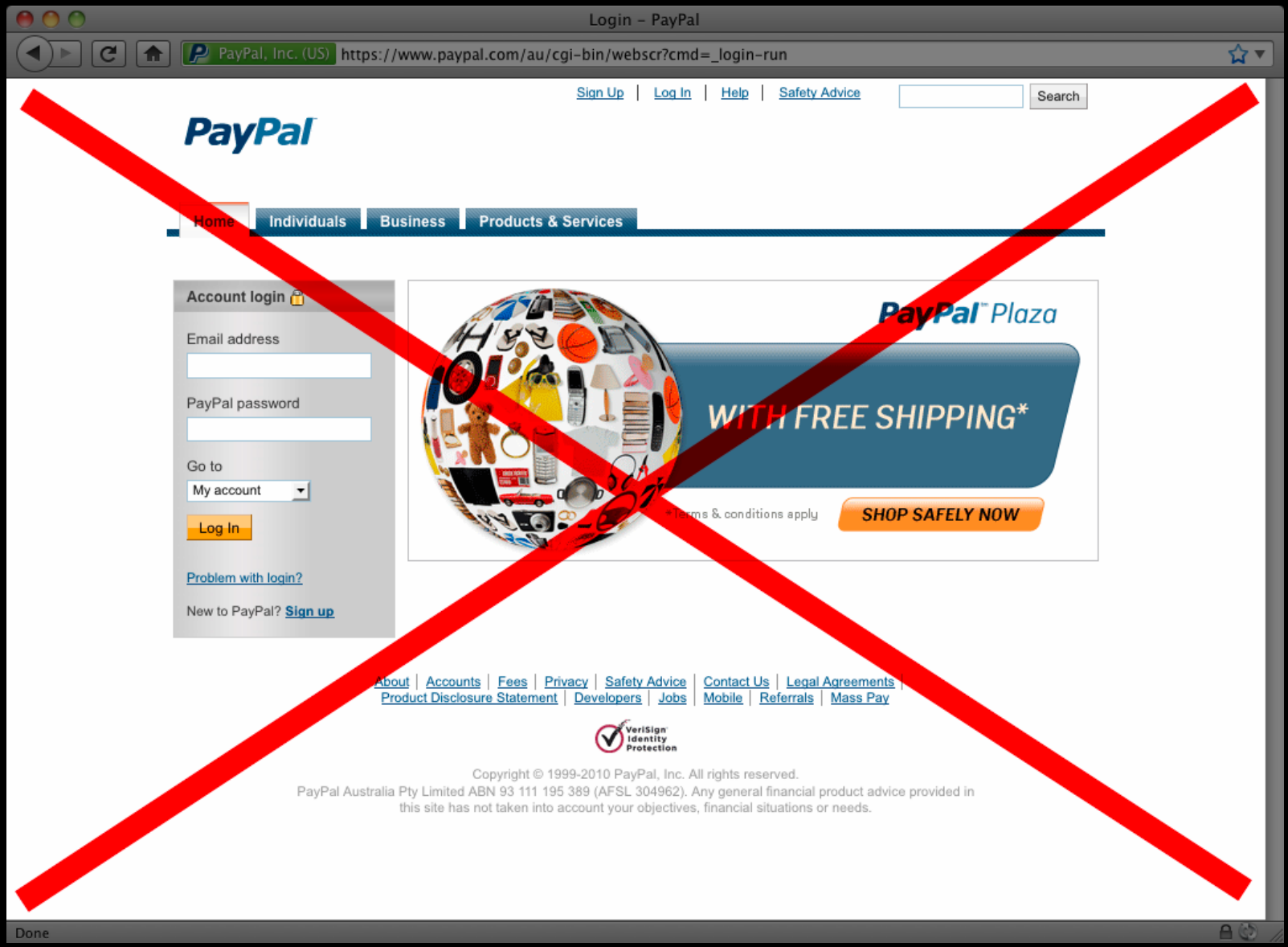
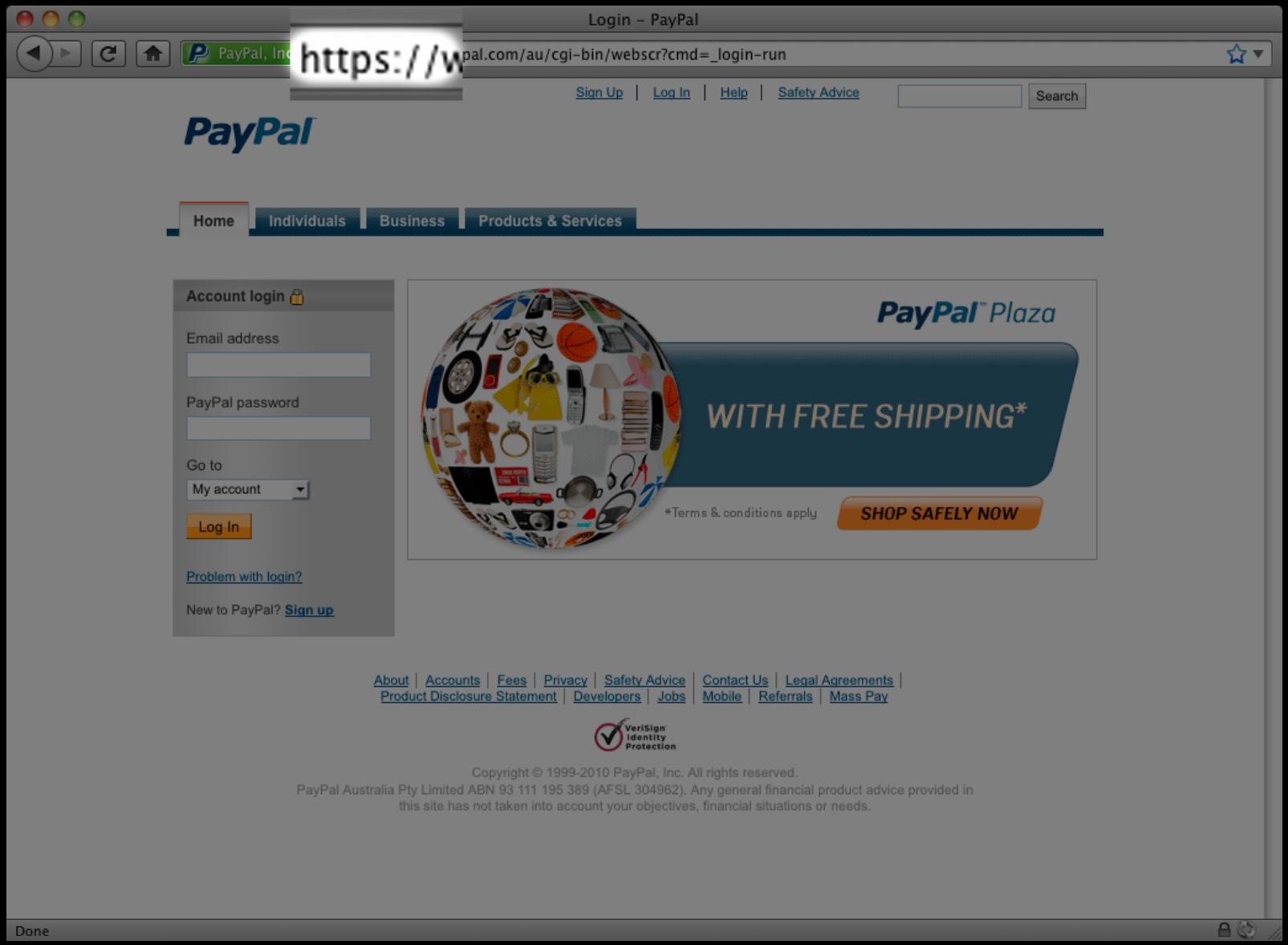
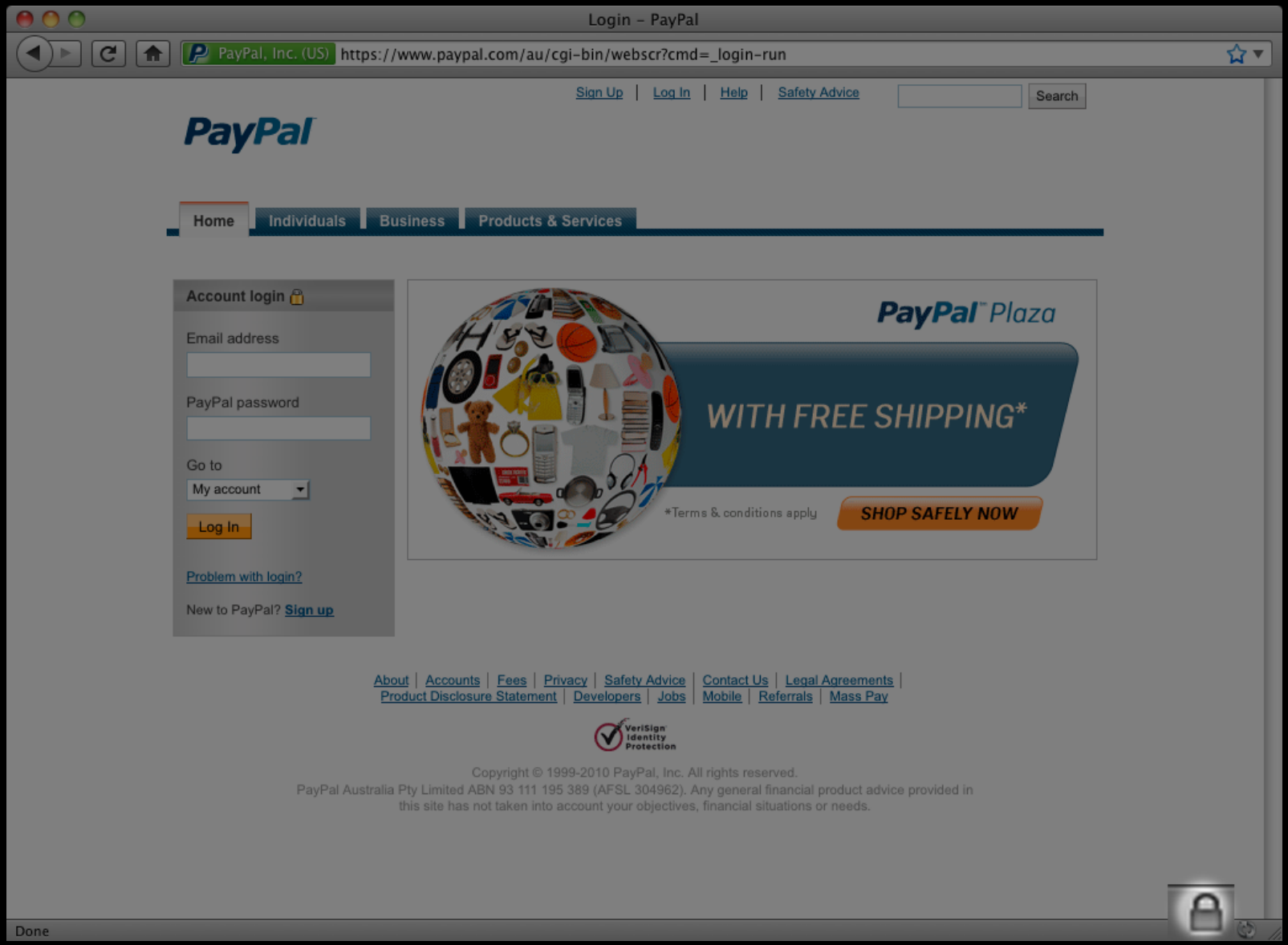


Security indicator: “https” in location bar



Security indicator: lock icon in browser chrome



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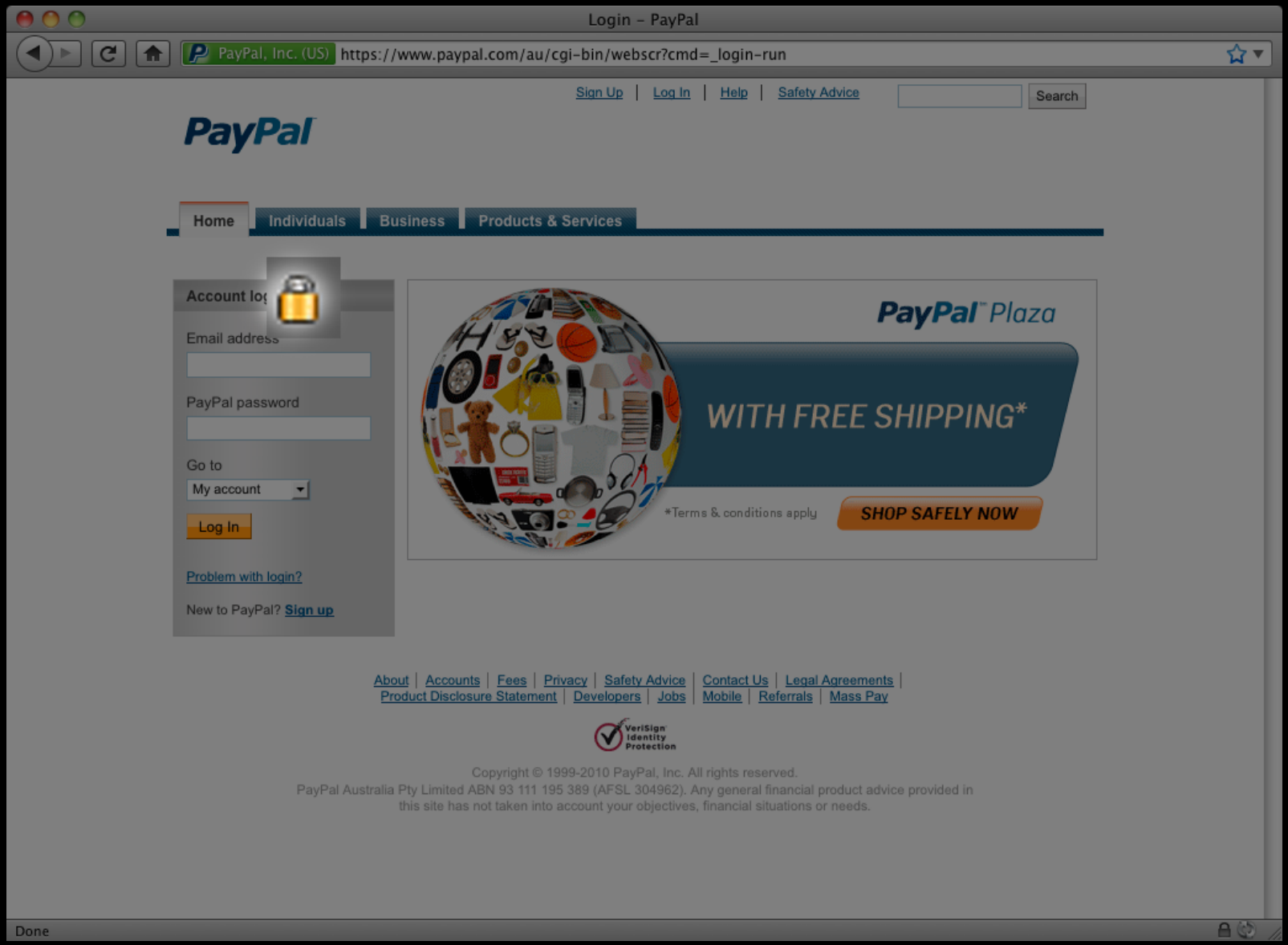

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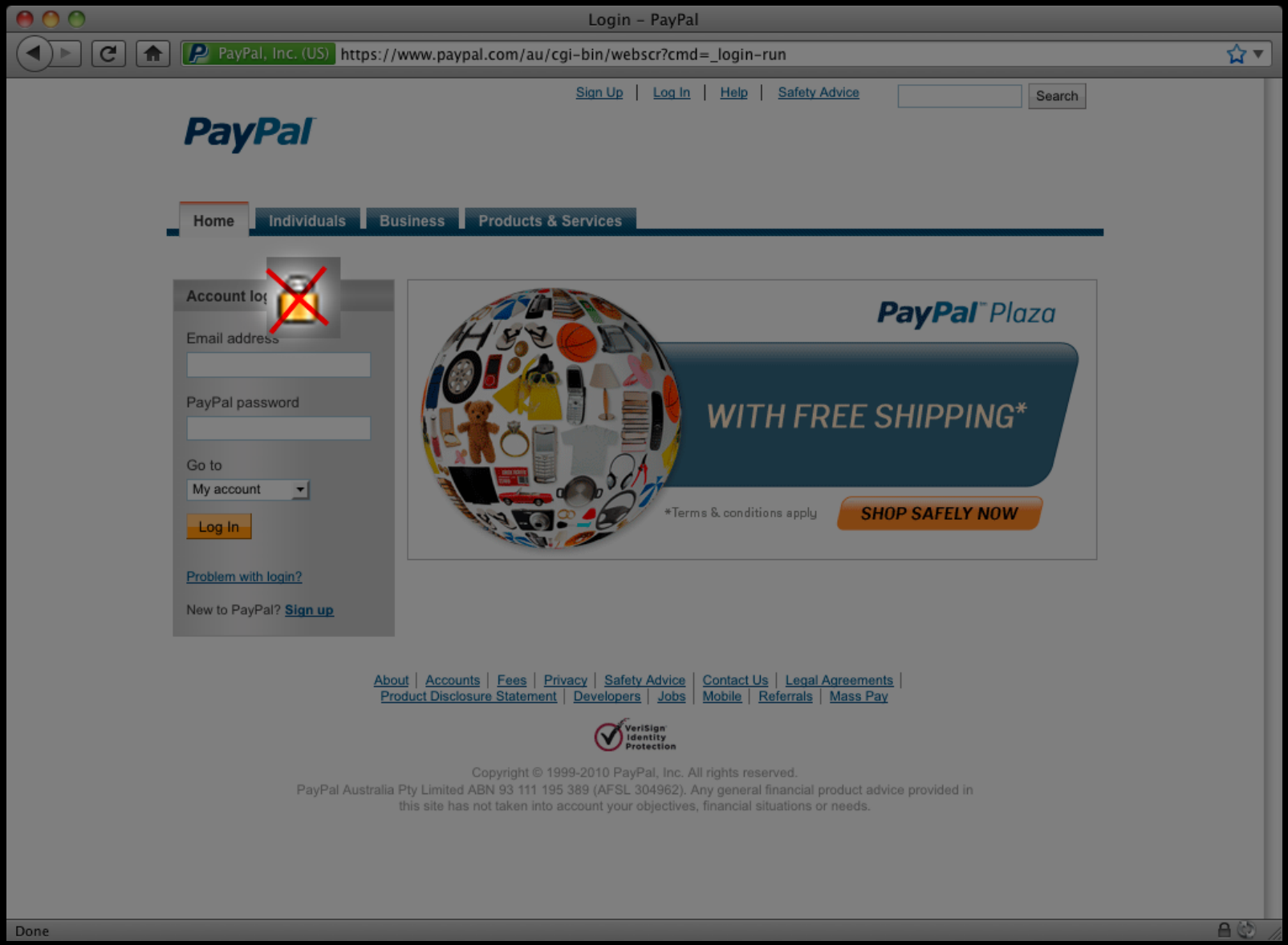
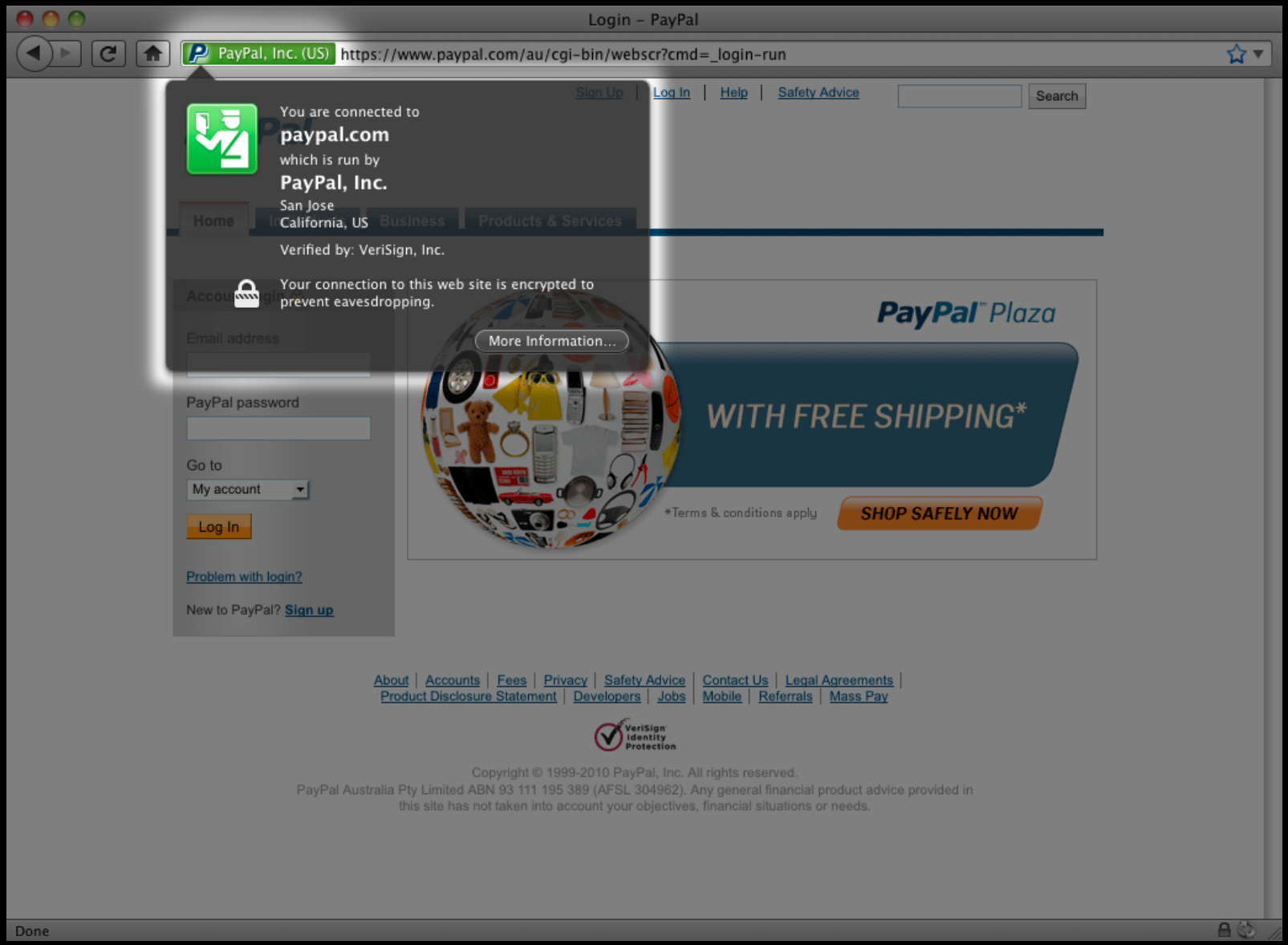


Security indicator: domain name correct

Security indicator: extended validation certificate



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PayPal password

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Done

http://www.facebook.com/

facebook

Email Password Login

Keep me logged in Forgot your password?

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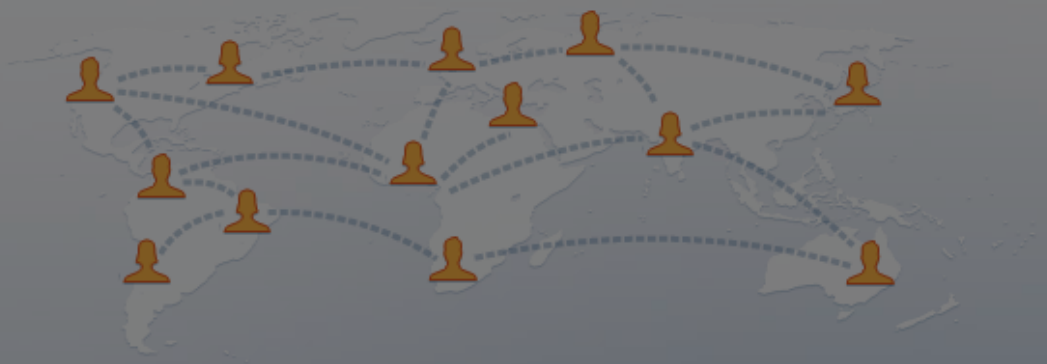

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First Name:

Last Name:

Your Email:

Re-enter Email:

New Password:

I am: Select Sex:

Birthday: Month: Day: Year:

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Criteria people use vs. security indicators

Criteria people use:

- “type of site” – 88%
- “lock or key icon” – 75%
- “type of information” – 69%
- “site statements” – 50%
- “https” – 44%
- “certificate” – 19%

Security indicators:

- https in location bar
- lock icon in browser chrome
- domain name correct
- extended validation certificate

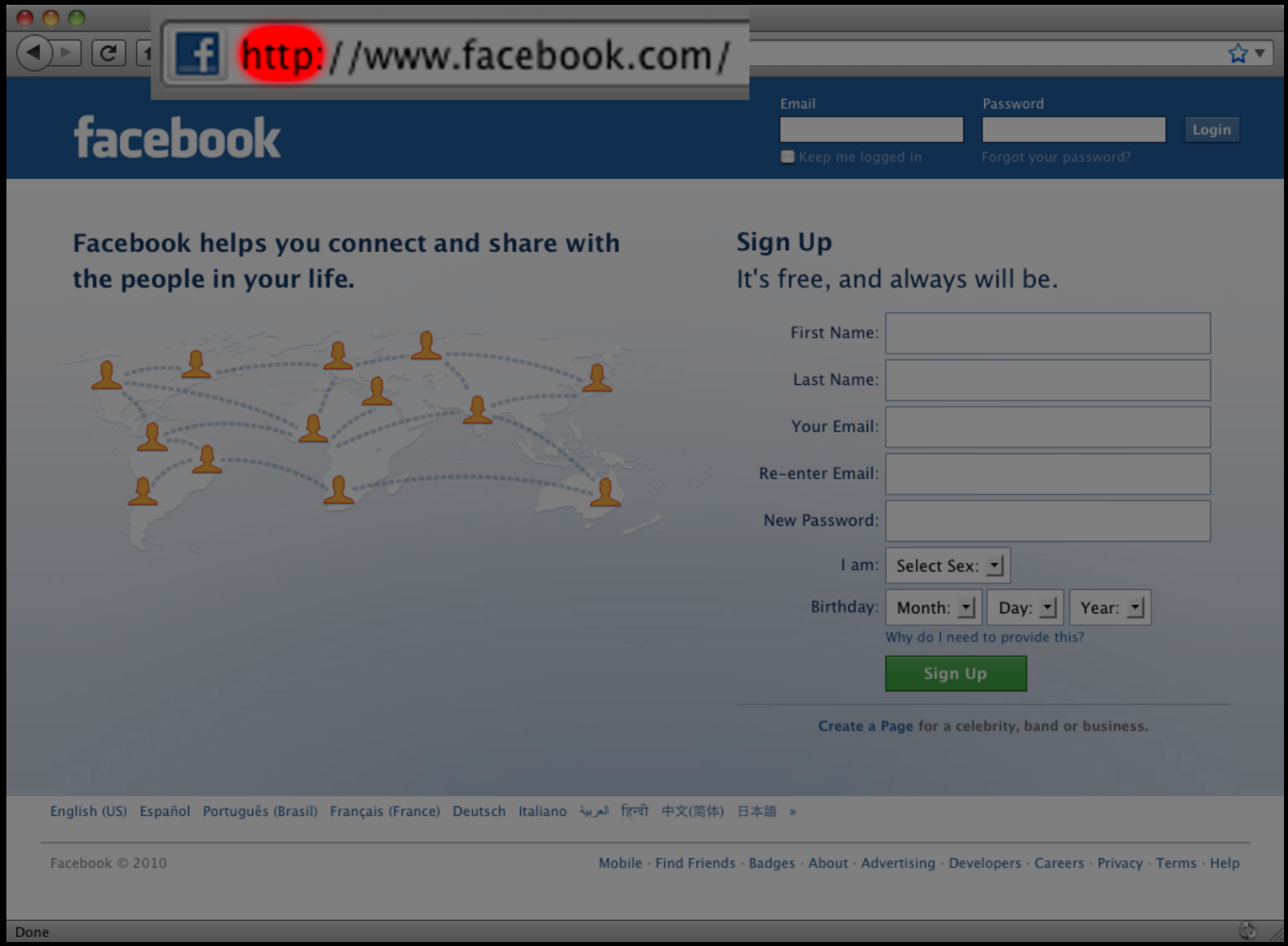
To what extent are security criteria and indicators misused on websites?

Widespread misuse of security criteria and indicators suggests users will become habituated to making bad security decisions.

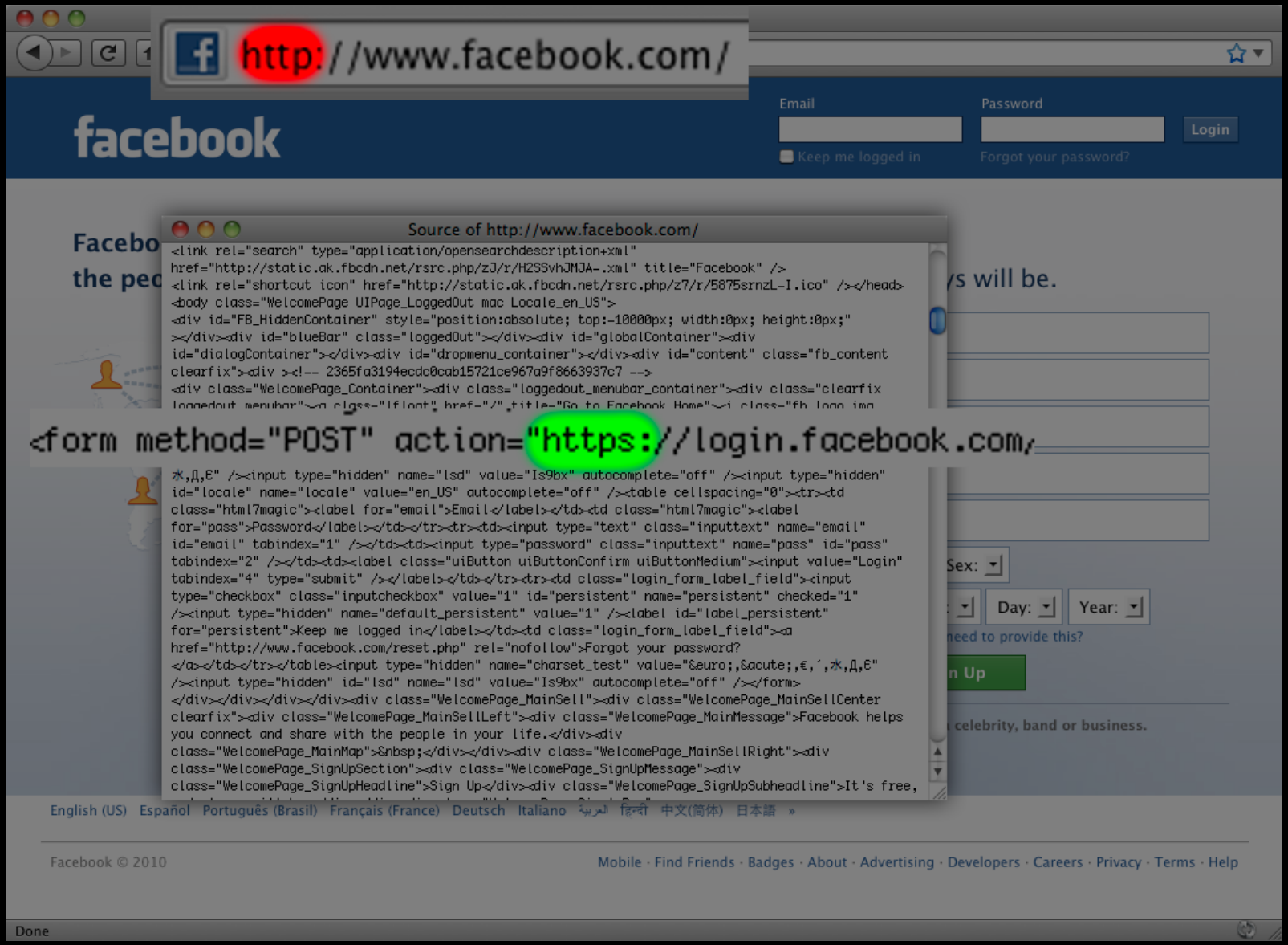
Methodology

- Identified security criteria and indicators from previous studies and expert analysis.
- Assembled list of 125 popular websites:
  - top 100 sites by traffic (as ranked by Alexa Topsites)
  - top banks in USA, UK, Canada, Australia
  - top 4 webmail services (Yahoo!, Hotmail, Gmail, AOL)
- Visited the website by typing in the domain name (hotmail.com).
- Checked for presence/absence of security criteria/indicators.

Misused indicator: login protocol vs. form protocol



Misused indicator: login protocol vs. form protocol

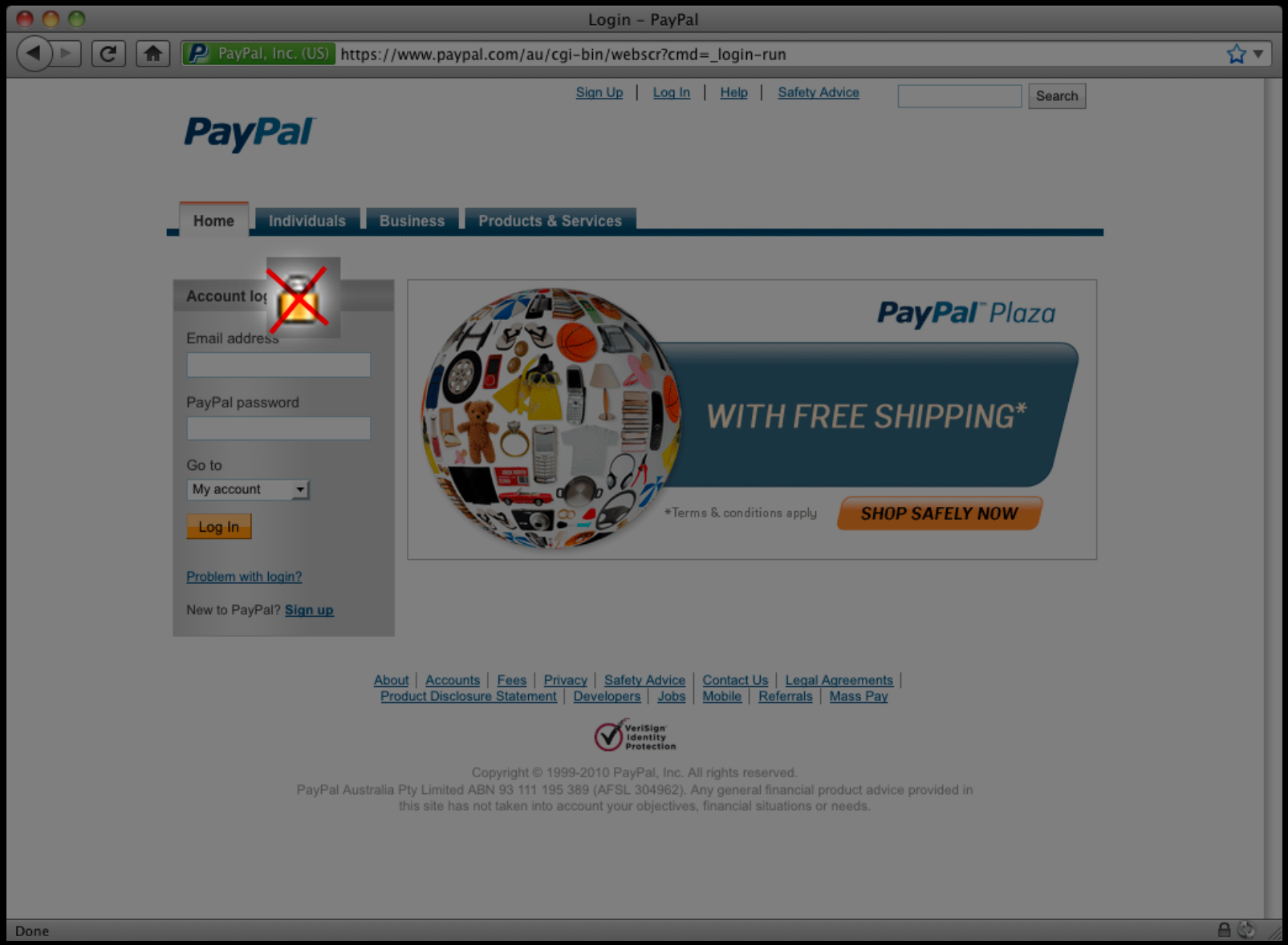


Misused indicator: login protocol vs. form protocol

Login page	Form submission		
HTTP	HTTP	45%	∗
	HTTPS	10%	×
	HTTPS w/EV cert.	5%	×
HTTPS	HTTPS	32%	✓
HTTPS w/EV cert.	HTTPS w/EV cert.	8%	✓

∗ HTTP form submission provides no protection whatsoever for usernames or passwords.

Misused indicator: lock icon on page or as favicon



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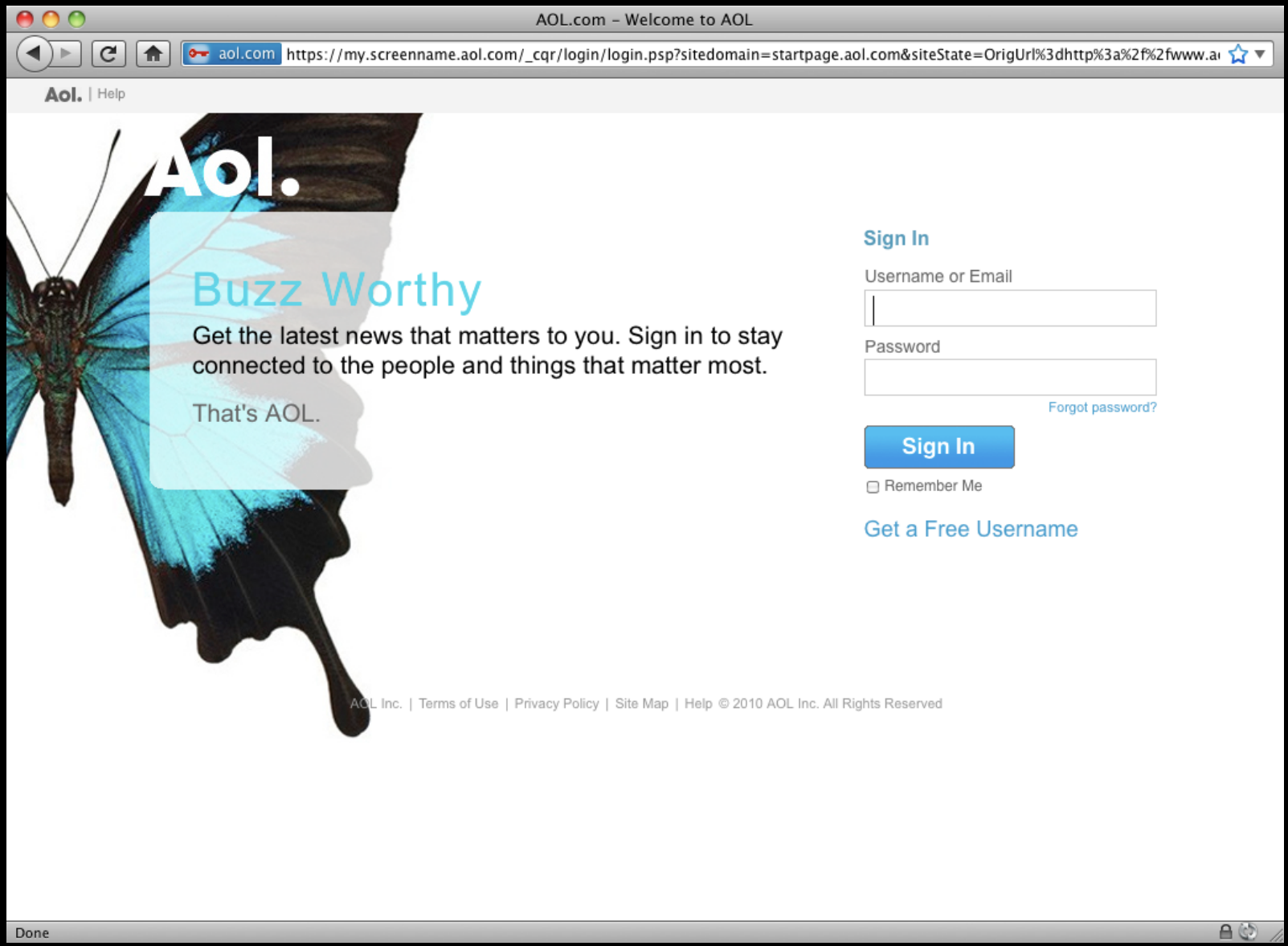
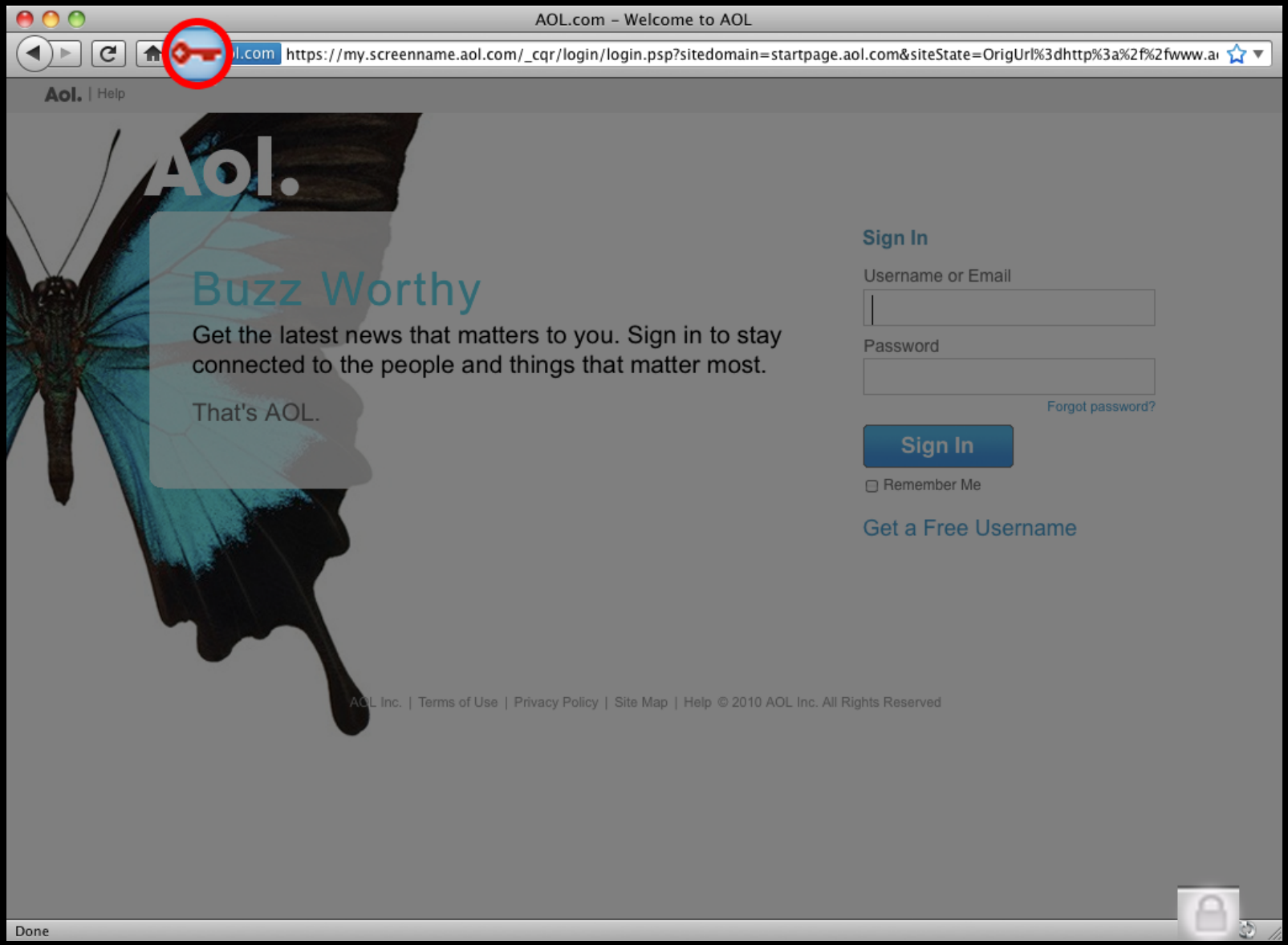


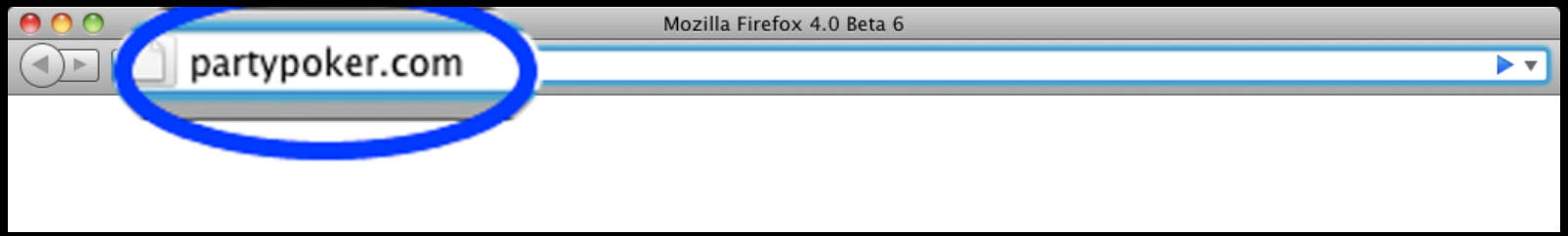
Misused indicator: lock icon on page or as favicon



Misused indicator: lock icon on page or as favicon

lock icon on HTTP pages	5%	××
lock icon on HTTPS pages	15%	×
banks with lock icon on HTTPS pages	70%	×
lock icon as favicon	2%	××

Misused indicator: mismatched domain name



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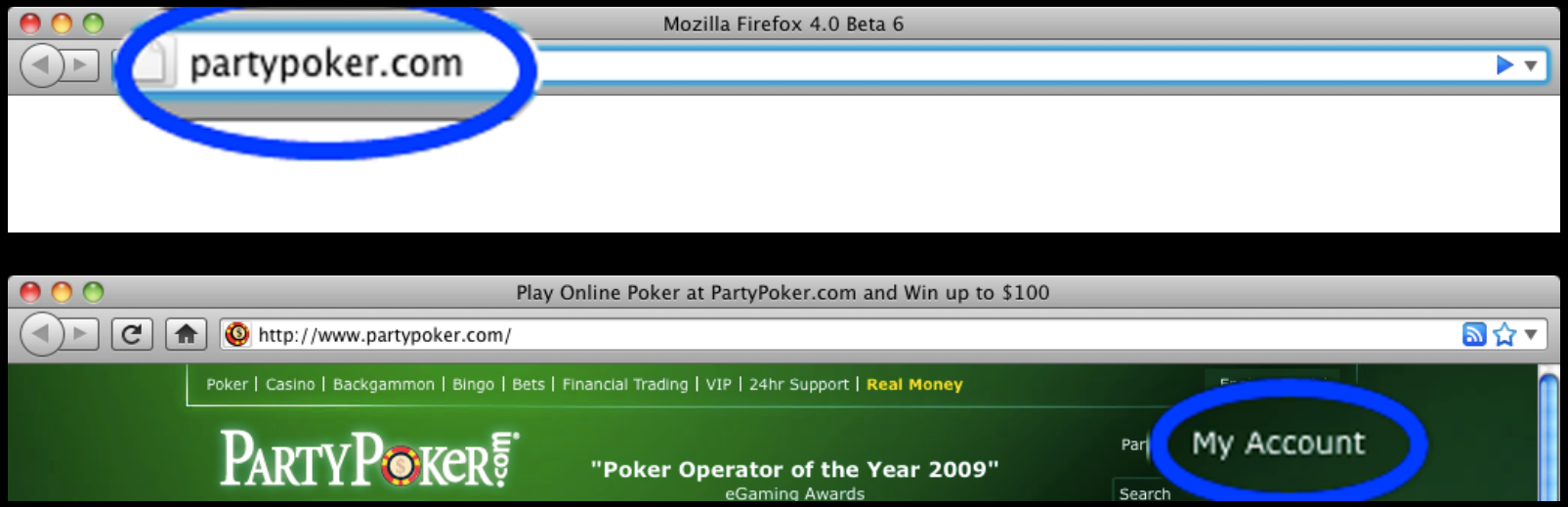

Misused indicator: mismatched domain name

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Is secure.partyaccount.com the right domain name to login to partypoker.com?

- Apparently, yes.

Misused indicator: mismatched domain name

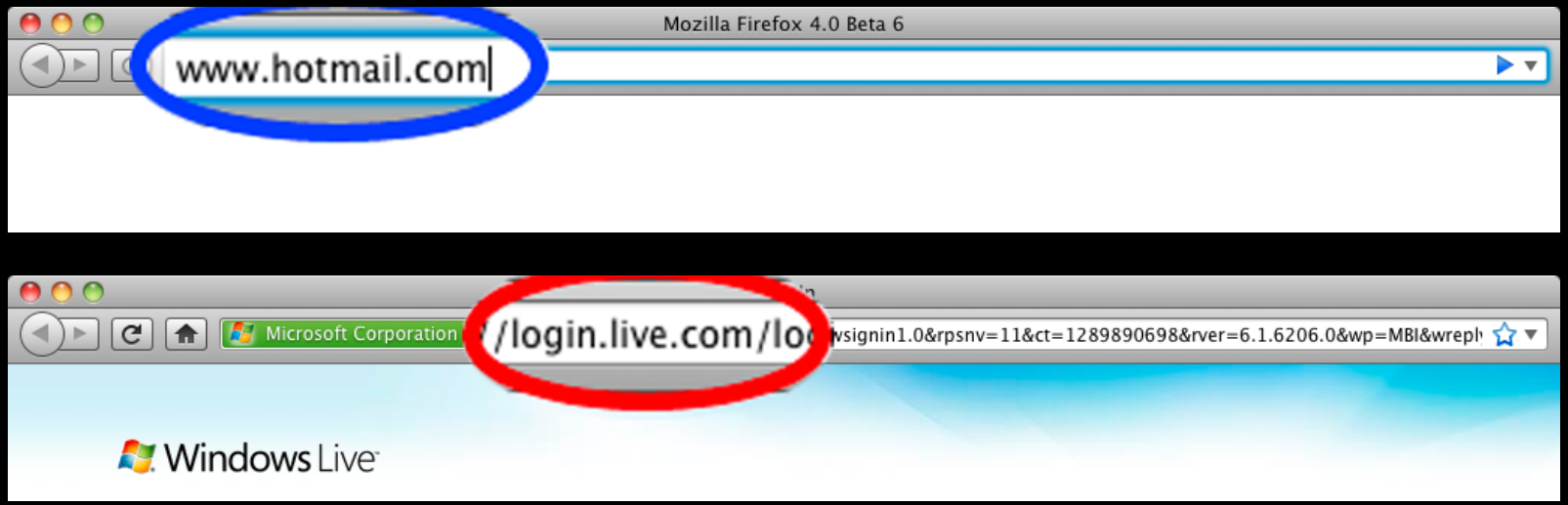
What about partypoker-account.com?

Misused indicator: mismatched domain name

What about partypoker-account.com?

- Definitely not! I could buy this domain name right now.

Misused indicator: mismatched domain name



Misused indicator: mismatched domain name

Match?	Example typed domain → login domain		
Exact match	google.com → www.google.com	57%	✓
Close match	yahoo.com → login.yahoo.com	30%	
No match	hotmail.com → login.live.com	13%	×

Misused indicator: complicated URL

- Complicated URL makes checking domain name harder
- "URL as UI"[2]

Complexity	Example	Avg. Len.		
Domain only	https://www.chase.com/	21.9	40%	✓
One path	https://www.blogger.com/start	32.9	17%	
More than one path component	https://www.google.com/accounts/ServiceLogin?uilel=3&service=youtube&passive=true&continue=http%3A%2F%2Fwww.youtube.com%2Fsignin%3Faction_handle_signin%3Dtrue%26nomobiletemp%3D1%26hl%3Den_US%26next%3D%252F&hl=en_US&ltmpl=sso	110.1	42%	×

[2] Jakob Nielsen. URL as UI, March 1999. http://www.useit.com/alertbox/990321.html

Summary of results

Misused security indicators	
HTTP login page with HTTPS form submission	15%
Lock icon on page or as favicon	23%
Hidden location bar	2%
Mismatched domain name	13%
Very complicated URL	42%

"Of the 125 sites we evaluated, only 5 avoided all misleading security indicators. Hence, a typical user will, much more often than not, be asked to make security decisions against best-practice recommendations on security indicators."

Design recommendations

- Deliver the page containing the login form over HTTPS.
- Don’t try to hide the location bar.
- Ensure the domain name of the login page matches the domain name of the site in question.
- Don’t use lock icons anywhere in the web page content.
- Try to use simple URLs, especially for the login page.

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- ... better user education.
  - Security indicators to look for

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- ... better web designer/programmer education.
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  - Stronger / simpler error messages.
  - More / simpler / different security messages.

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  - Security indicators to look for
- ... better web designer/programmer education.
  - Design recommendations to follow
- ... better web browser design (and evaluation of those designs!).
  - Stronger / simpler error messages.
  - More / simpler / different security messages.
- ... better web security technologies.
  - Single sign-on (with browser support?).
  - Cryptographically strong password-based mutual authentication.

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QUT isi Information Security Institute

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