



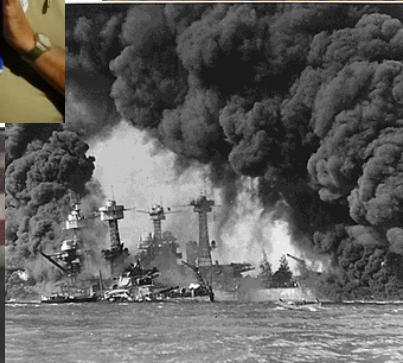
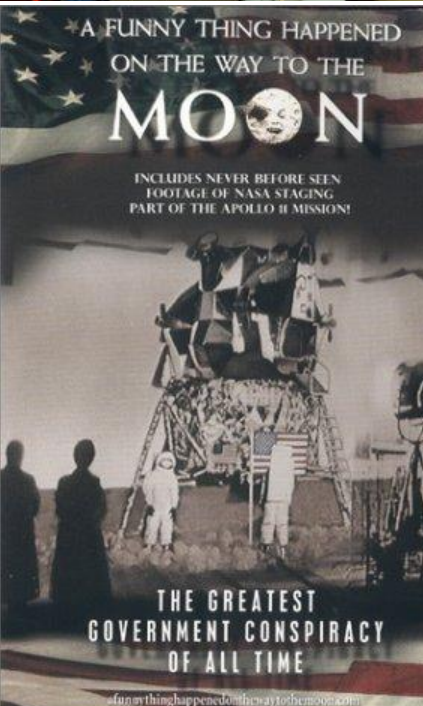
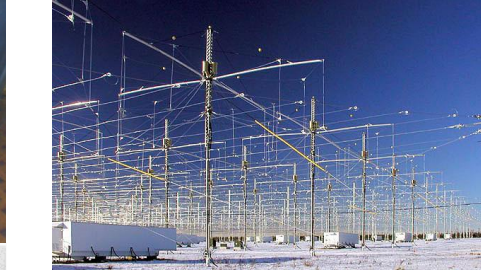
# Toward Computational Fact-Checking

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gciampag@indiana.edu



**CNetS**

Center for Complex Networks  
and Systems Research



# CHEMTRAILS

You think that's condensation you're breathing now?

WEEKLY WORLD NEWS

**WORLD EXCLUSIVE!**  
The bombshell report that will rock America

## ELVIS' TOMB IS EMPTY!

The King in his coffin... BUT WHERE IS HE NOW?

How to find and wed the man of your dreams

Phony surgeon does 300 operations - successfully!

ANNUIT COEPTIS - 13 Layers of Brick  
Great architect 'Lucifer' - 13 Original colonies  
NOVUS ORDO SECLORUM - 'Secular New Order' - 72 Bricks  
13 letters in motto 'E PLURIBUS UNUM' - 13 illuminated Stars  
'One of Many' - 13 enlightenened Colonies

13 Arrows, 13 leaves  
13 Berries - Different powers possessed by the 13 colonies

Phoenix not an eagle rising from the ashes, or ignorant world





**TONY PERKINS**

"We know from the social science that children do best with a mom and a dad."

— *PunditFact*



Social science without the science



**DUNCAN HUNTER**

"At least 10 ISIS fighters have been caught coming across the Mexican border in Texas" and there are "dozens more that did not get caught by the Border Patrol."

— *PolitiFact Texas*



Duncan aide disputes Homeland Security



**MICHELLE OBAMA**

"The unemployment rate for young people is down from a 10.6 percent high in 2009 to 2.6 percent today."

— *PolitiFact Wisconsin*



Down, but not that low



**JEANNE SHAHEEN**

Says Scott Brown co-sponsored legislation to let employers deny women coverage for mammograms.

— *PolitiFact New Hampshire*



An election-year exaggeration

source: <http://www.politifact.com/>

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## Sharp Decline in Percentage Saying Obama is a Christian

	<b>Mar</b>	<b>Oct</b>	<b>Mar</b>	<b>Aug</b>	<b>09-10</b>
<i>What is Obama's religion?</i>	<b>2008</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>Change</b>
	%	%	%	%	
Christian	47	51	48	34	-14
Muslim	12	12	11	18	+7
Other	2	2	1	2	+1
Don't know	36	32	34	43	+9
Refused	<u>3</u>	<u>3</u>	<u>6</u>	<u>2</u>	
	100	100	100	100	

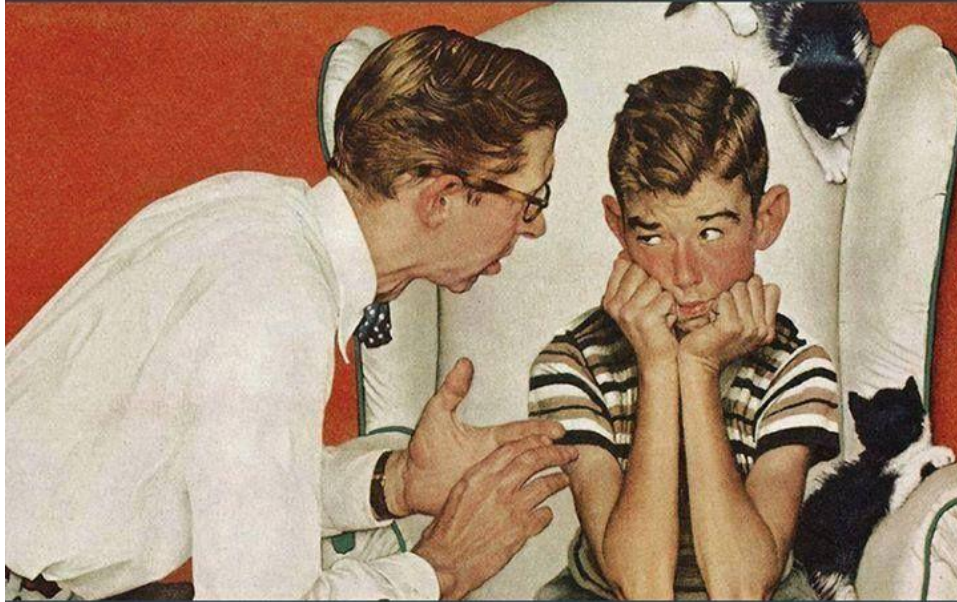
PEW RESEARCH CENTER July 21-August 5, 2010.  
Figures may not add to 100% because of rounding.  
"Do you happen to know what Barack Obama's religion is?  
Is he Christian, Jewish, Muslim, Buddhist, Hindu, atheist,  
agnostic or something else?"

---

Source: <http://www.pewforum.org/2010/08/18/growing-number-of-americans-say-obama-is-a-muslim/>



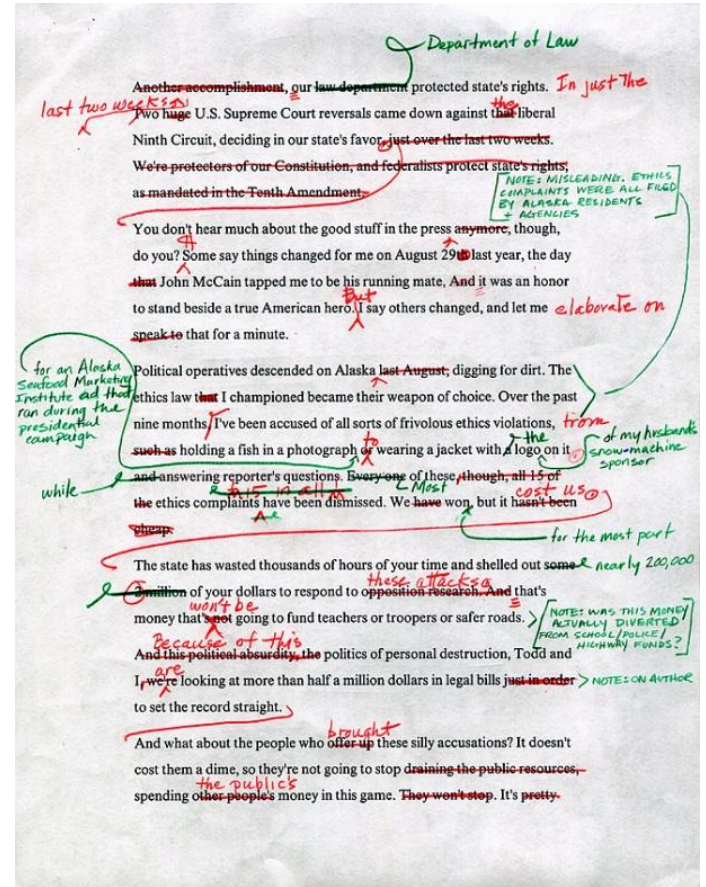
**"Now son, do you know what you did wrong?"**



**"Yes sir, I shared something on Facebook without checking facts & encouraged bullshit to propagate, leading to the dumbing-down of humanity."**

# Fact-checking

- ❖ Manual activity
- ❖ Only large organizations can afford dedicated depts
  - New Yorker, Der Spiegel, etc
- ❖ **Question:** is it possible to make it automatic?





STOP ~~FAKE~~ .ORG



FACTCHECK.ORG

**HEARSIFT**

Tracking misinformation with machine and human intelligence.

Tampa Bay Times  
PolitiFact<sup>®</sup>com

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The Glitch-Spotter is currently unavailable.

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- Supplements
- Web focuses
- Podcasts
- Videos
- News Specials

## Journal information

## News

*Nature* **438**, 900-901 (15 December 2005) | doi:10.1038/438900a; Published online 14 December 2005

Special Report

### Internet encyclopaedias go head to head

Jim Giles

**Jimmy Wales' Wikipedia comes close to Britannica in terms of the accuracy of its science entries, a *Nature* investigation finds.**

**UPDATE:** see details of how the data were collected for this article in the [supplementary information](#).

**UPDATE 2 (28 March 2006).** The results reported in this news story and their interpretation have been disputed by [Encyclopaedia Britannica](#). *Nature* responded to these [objections](#).

One of the extraordinary stories of the Internet age is that of Wikipedia, a free online encyclopaedia that anyone can edit. This radical and rapidly growing publication, which includes close to 4 million entries



subscribe to

**nature**

## FULL TEXT

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▲ Top





# Knowledge bases

- ❖ Reliable enough
  - Vandalism repaired in a matter of minutes [[Priedhorky 2007](#)]
- ❖ Large-scale systems
- ❖ Knowledge **networks**



**Barack Hussein Obama II** (us <sup>ⓘ</sup>/bəˈrɑːk huːˈseɪn ɵˈbɑːmə/, uk <sup>ⓘ</sup>/ˈbærək huːˈseɪn ɵˈbɑːmə/; born August 4, 1961) is the 44th and current President of the United States, and the first African American to hold the office. Born in Honolulu, Hawaii, Obama is a graduate of Columbia University and Harvard Law School, where he served as president of the *Harvard Law Review*. He was a community organizer in Chicago before earning his law degree. He worked as a civil rights attorney and taught constitutional law at the University of Chicago Law School from 1992 to 2004. He served three terms representing the 13th District in the Illinois Senate from 1997 to 2004, running unsuccessfully for the United States House of Representatives in 2000.

In 2004, Obama received national attention during his campaign to represent Illinois in the United States Senate with his victory in the March Democratic Party primary, his keynote address at the Democratic National Convention in July, and his election to the Senate in November. He began his presidential campaign in 2007 and, after a close primary campaign against Hillary Rodham Clinton in 2008, he won sufficient delegates in the Democratic Party primaries to receive the presidential nomination. He then defeated Republican nominee John McCain in the general election, and was inaugurated as president on January 20, 2009. Nine months after his election, Obama was named the 2009 Nobel Peace Prize laureate.

During his first two years in office, Obama signed into law economic stimulus legislation in response to the Great

## Barack Obama



Obama in front of the *Resolute desk* in the Oval Office of the White House on December 6, 2012

**44th President of the United States**

**Incumbent**

**Assumed office**

January 20, 2009

**Vice President** Joe Biden

**Preceded by** George W. Bush

**United States Senator  
from Illinois**

**In office**

January 3, 2005 – November 16, 2008


**Preceded by** Peter Fitzgerald

**Succeeded by** Roland Burris


source: [http://en.wikipedia.org/wiki/Barack\\_Obama](http://en.wikipedia.org/wiki/Barack_Obama)

{{Infobox officeholder  
|name = Barack Obama  
|image = President Barack Obama.jpg{{!}}border  
|alt = Barack Obama standing in front of a wooden writing desk and two flagpoles  
|caption = Obama in front of the [[Resolute desk|"Resolute" desk]] in the [[Oval Office]] of the [[White House]] on December 6, 2012  
|order = [[List of Presidents of the United States|44th]]  
|office = President of the United States  
|vicepresident = [[Joe Biden]]  
|term\_start = {{Start date|2009|1|20}}  
|predecessor = [[George W. Bush]]  
|jr/sr2 = United States Senate  
|state2 = [[Illinois]]  
|term\_start2 = {{Start date|2005|1|3}}  
|term\_end2 = {{Start date|2008|11|16}}  
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|successor2 = [[Roland Burris]]  
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|term\_start3 = January 8, 1997  
|term\_end3 = November 4, 2004  
|predecessor3 = [[Alice Palmer (politician)|Alice Palmer]]  
|successor3 = [[Kwame Raoul]]  
|birth\_name = Barack Hussein Obama II  
|birth\_date = {{birth date and age|mf=yes|1961|8|4}}  
|birth\_place = [[Honolulu]], [[Hawaii]], U.S.  
|nationality = American  
|party = [[Democratic Party (United States)|Democratic]]  
|parents = [[Barack Obama, Sr. |Barack Hussein Obama, Sr.]]<br>[[Ann Dunham|Stanley Ann Dunham]]


**Barack Obama**



**United States of America**





**Michelle Obama**



Obama in from  
Oval Office of t

**French Republic**  
*République française*

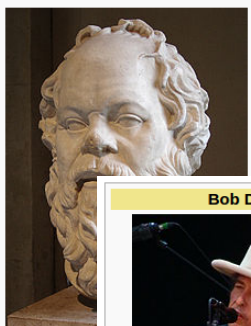




Flag National emblem

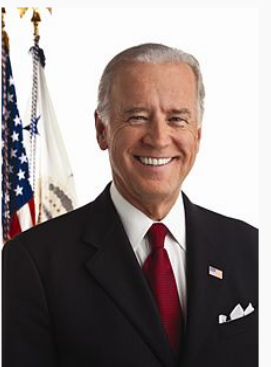
Motto: "Liberté, égalité, fraternité" (French)  
"Liberty, Equality, Fraternity"

Anthem: "La Marseillaise"

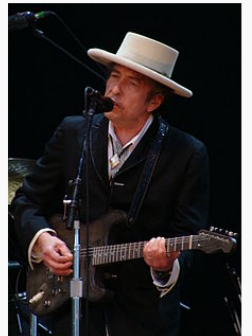
**Socrates**

**Joe Biden**



**Bob Dylan**



Dylan onstage at Azkena Rock Festival, Vitoria-Gasteiz, Spain, June 26, 2010

**Background information**

Birth name Robert Allen Zimmerman

**47th Vice President of the United States**

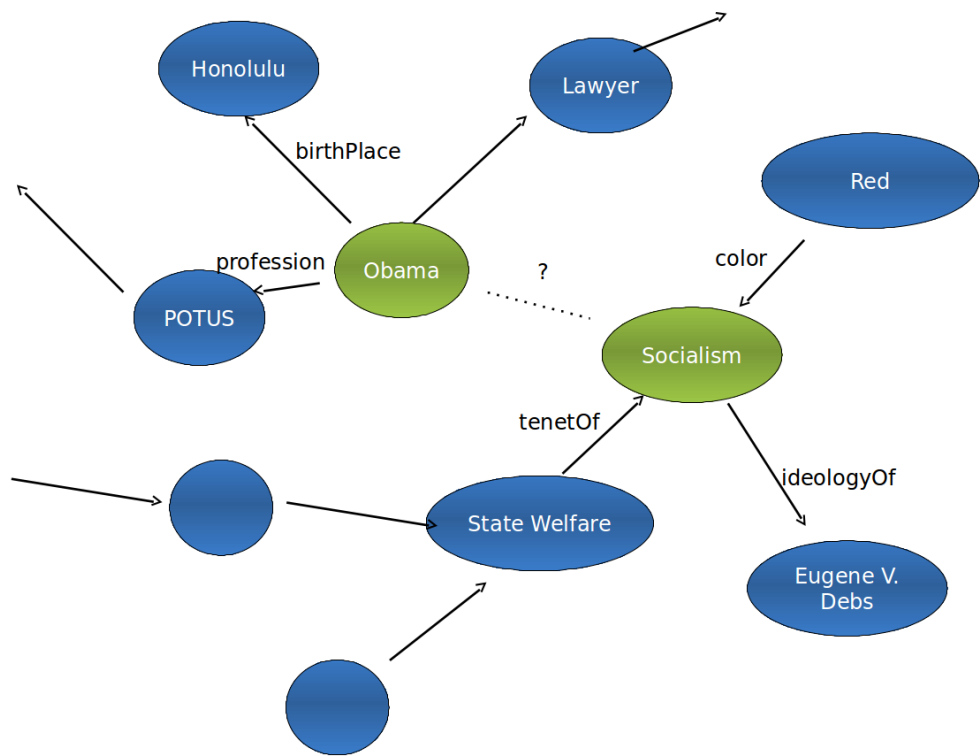
**Incumbent**

**Assumed office**  
January 20, 2009

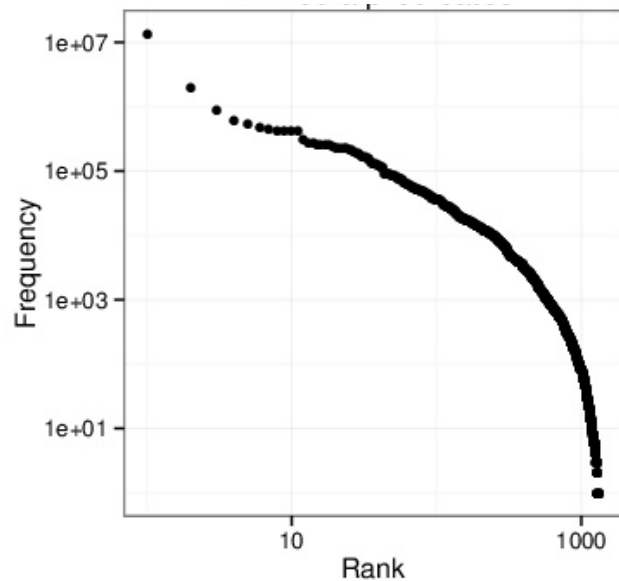
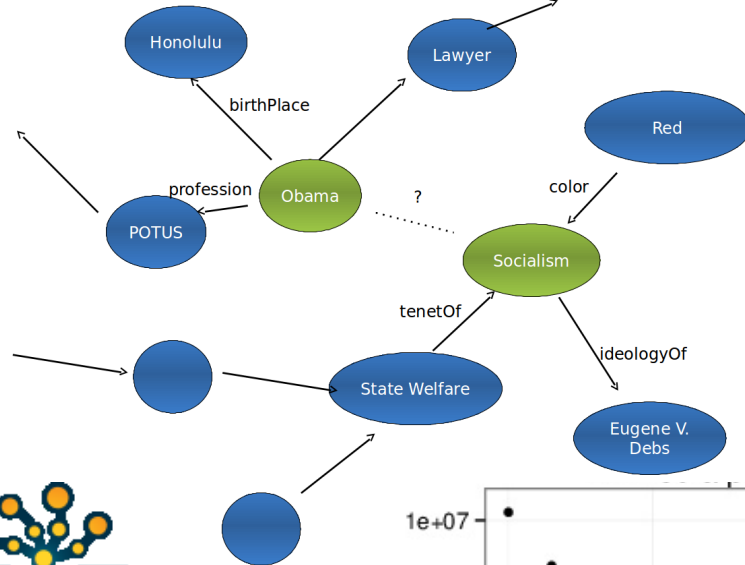
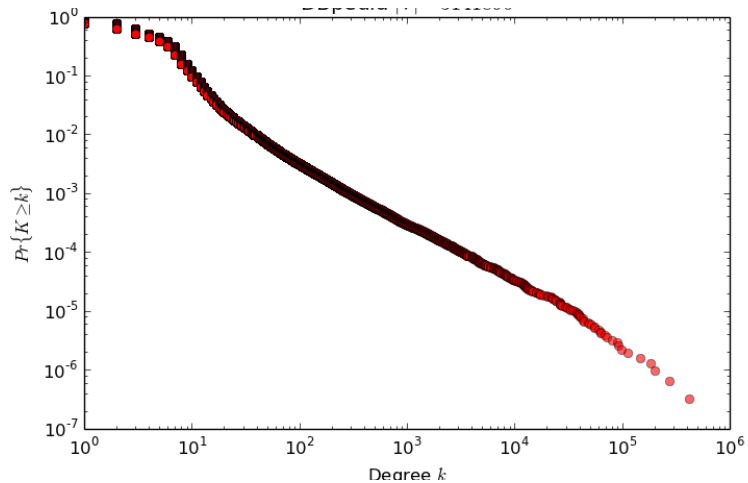
**President** Barack Obama

**Preceded by** Dick Cheney

**United States Senator from Delaware**



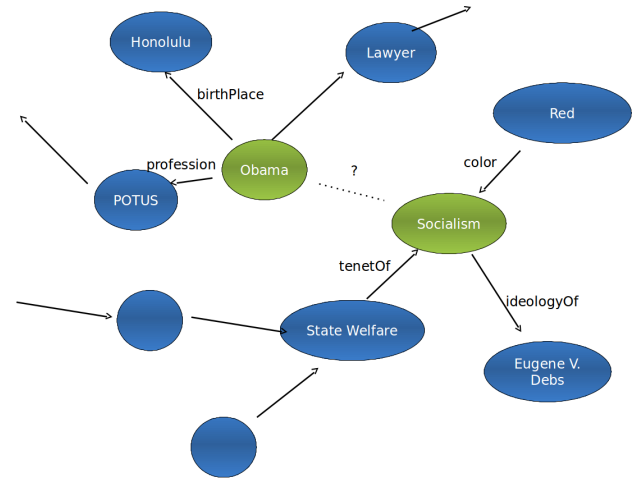


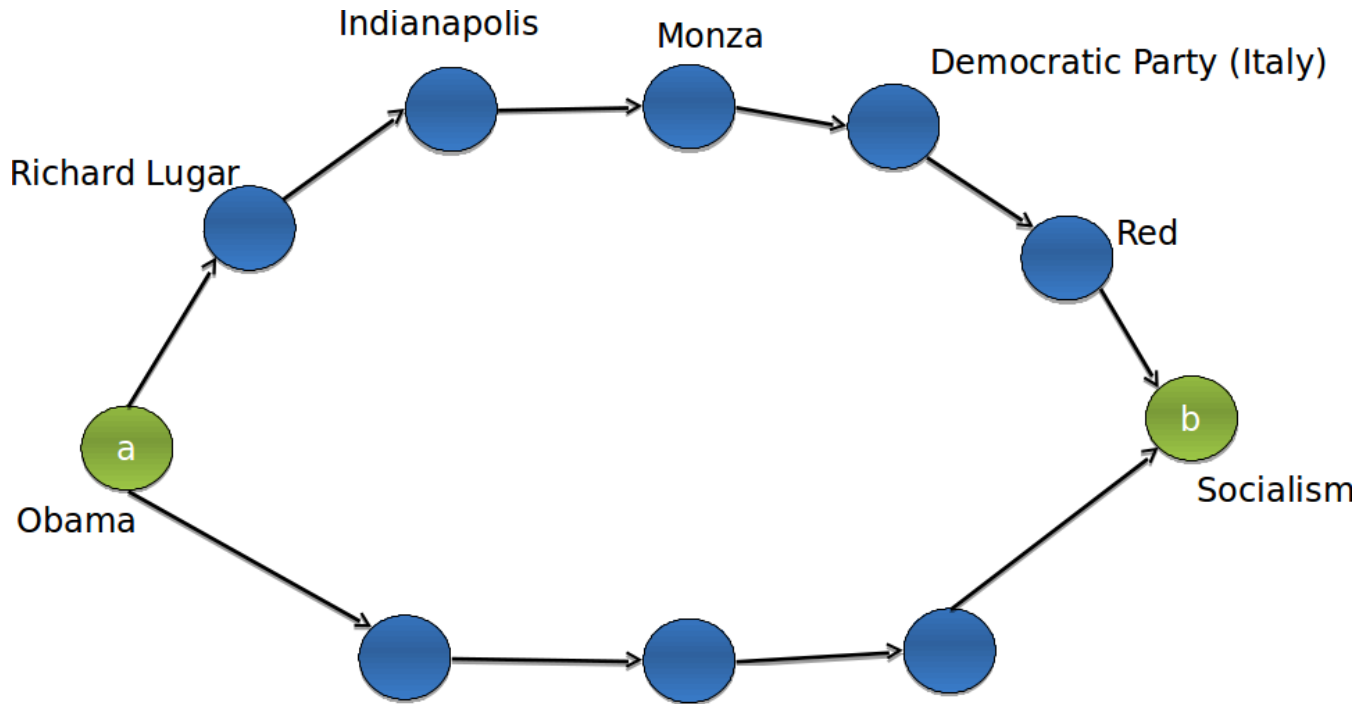


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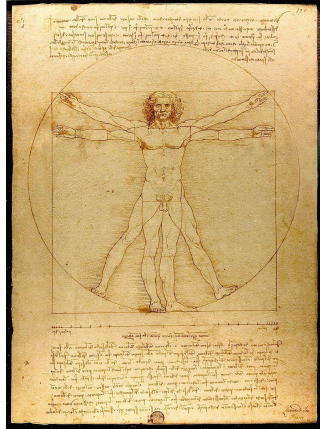
# Novel statement inference

- ❖ Amount of “work” needed to resolve a **novel** statement
- ❖ On a network:  
how hard it is to find a path between two nodes
- ❖ Graph closure

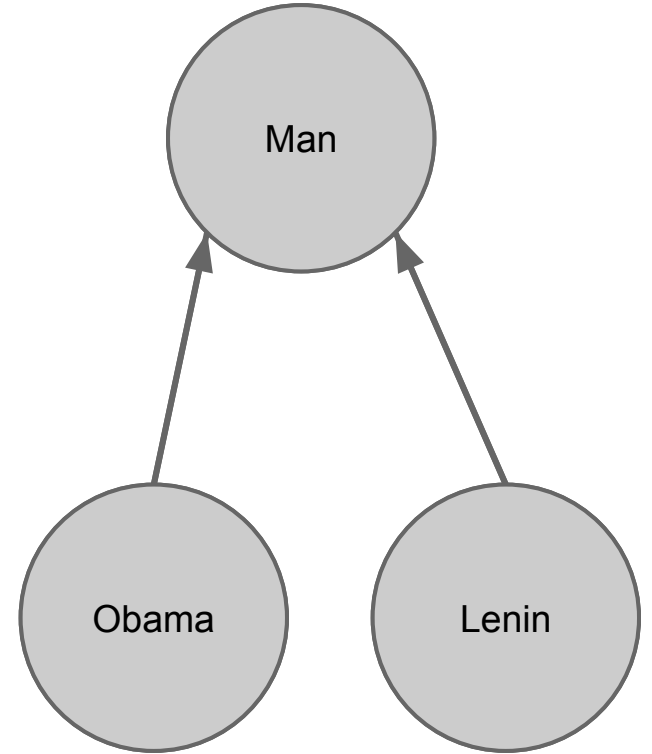




**Barack Obama**



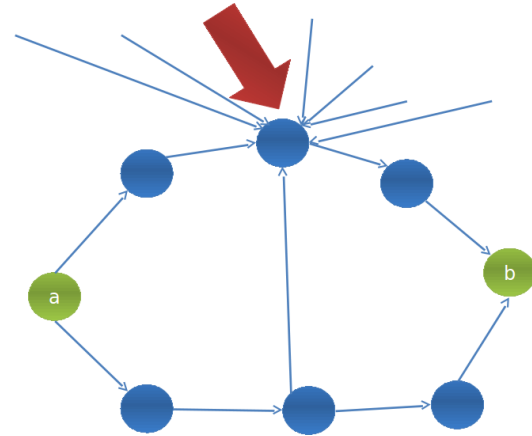
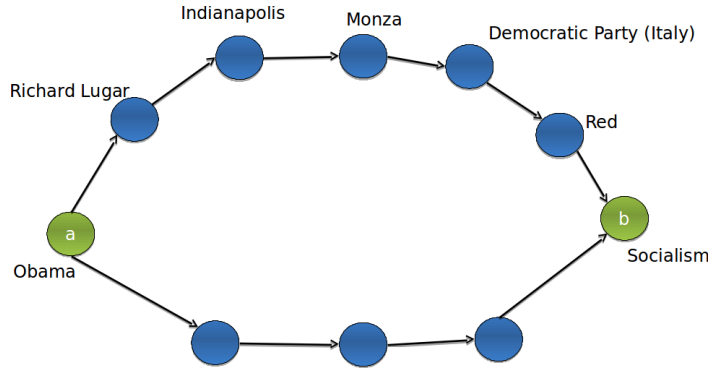
**Lenin**  
Ленин



Source: Wikipedia



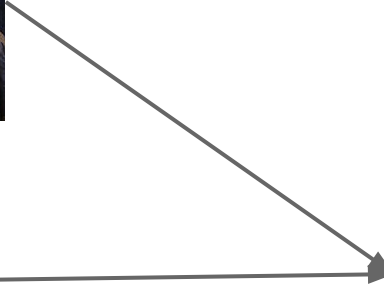
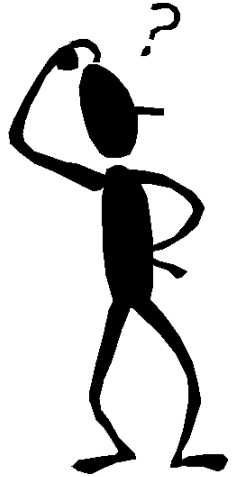
# Distance function



,

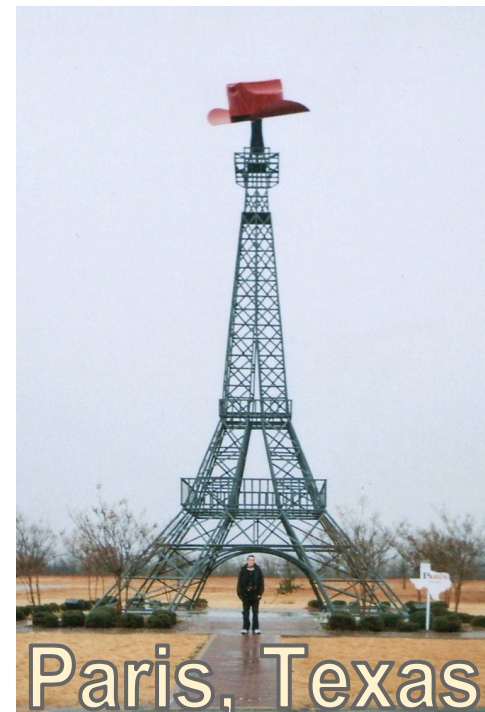
$$\mathcal{W}_u(P_{s,o}) = \mathcal{W}_u(v_1 \dots v_n) = \begin{cases} 1 & \text{if } n = 2 \\ \phi \left( \min_{i=2}^{n-1} \left\{ \log(k(v_i)) \right\} \right) & \text{if } n > 2 \end{cases}$$

# Validation



# Validation / 1

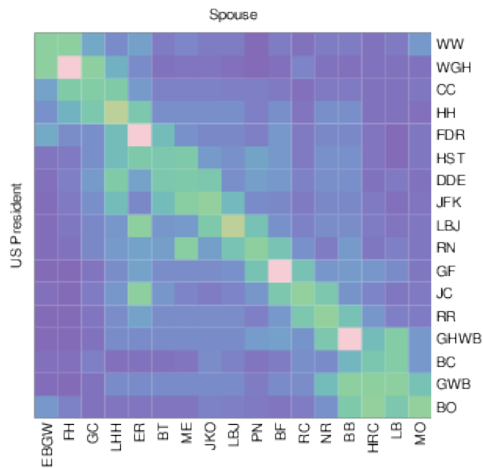
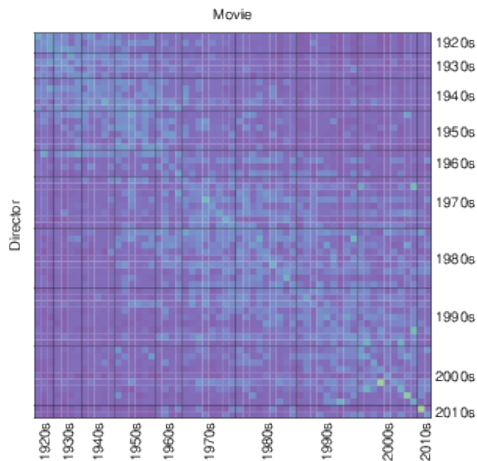
- ❖ Sanity check:
  - Is **Paris** the capital of **France**?
- ❖ Datasets:
  - **Oscars Best directors** vs movies
  - **US States** vs capitals
  - **World countries** vs capitals
  - **US presidents** vs spouses (20<sup>th</sup> c. onwards)
- ❖ Direct edges removed!



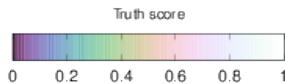
Source: Wikipedia



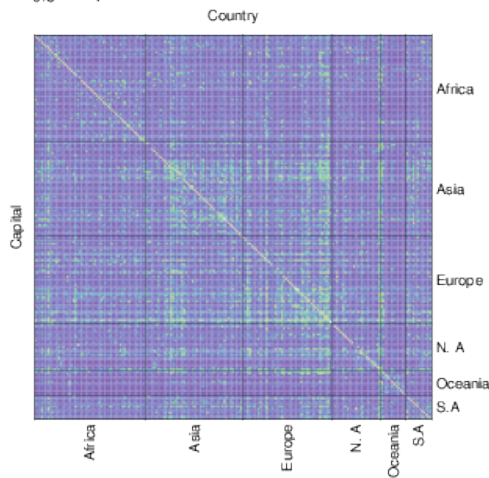
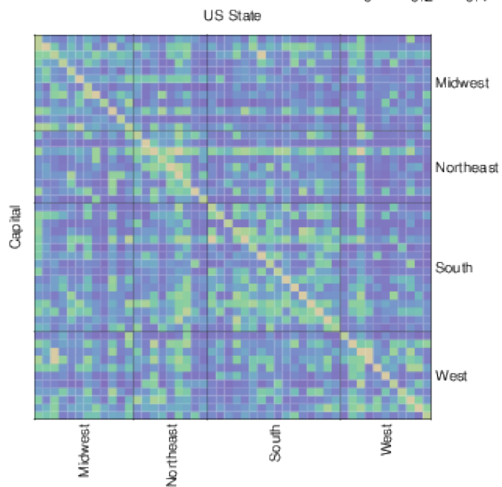
Acc. = 40%



Acc. = 82%



Acc. = 98%



Acc. = 87%



# Validation / 2



**a**

WIKIPEDIA  
The Free Encyclopedia

Article **Talk** Read **Edit** View history Search

## Steve Tesich

From Wikipedia, the free encyclopedia

**Stojan Steve Tesich** (Serbian: Стојан Стив Тешић, *Stojan Stiv Tešić*; September 29, 1942 – July 1, 1996) was a [Serbian-American](#) writer, journalist, and playwright. He was born in Belgrade, Yugoslavia, on September 29, 1942, but immigrated to the USA in 1957 with his family when he was 15 years old. His father died in 1962.

After settling in [East Chicago, Indiana](#), Tesich graduated from [Indiana University](#) in 1964 with a BA in Russian, where he was a member of [Phi Kappa Psi Fraternity](#). He then went on to do graduate work at [Columbia University](#), receiving an MA in Russian in 1967. He also wrote his first plays while at Columbia University. After

[Community portal](#) **Career** [\[edit\]](#)

**Steve Tesich**

**b**

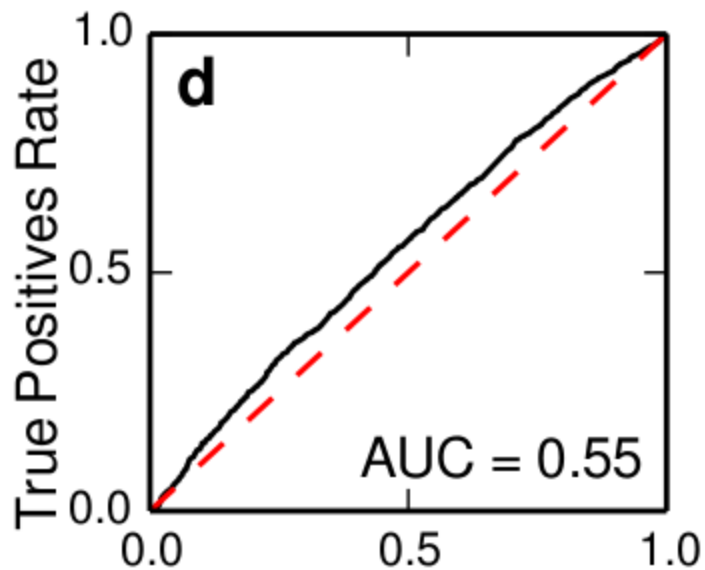


**c**

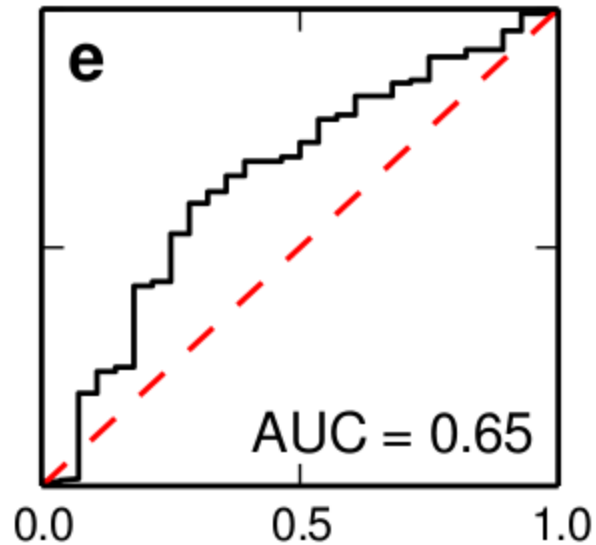
Created account Log in

Source: <http://googleresearch.blogspot.com/2013/04/50000-lessons-on-how-to-read-relation.html>

Institution



Degree





Random Guy @RandomGuy · 1h

Barack Obama is a #socialist !!!!!

source      target

noun      predicate      noun

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[dbpedia.org/resource/Barack\\_Obama](http://dbpedia.org/resource/Barack_Obama)

[dbpedia.org/resource/Socialism](http://dbpedia.org/resource/Socialism)

**Barack Obama**



U.S. President Barack Obama in front of the *Resolute* desk in the Oval Office of the White House, December 6, 2012

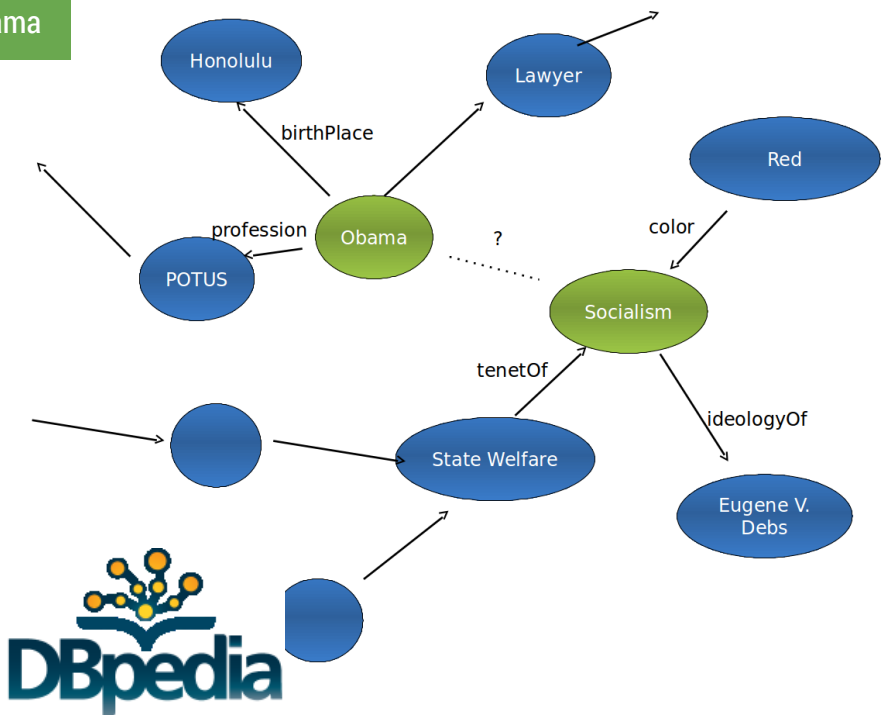
**44th President of the United States**

**Incumbent**

**Assumed office**  
January 20, 2009


**Vice President** Joe Biden

**Preceded by** George W. Bush



Part of a series on

**Socialism**



- Development** [show]
- Ideas** [show]
- Models** [show]
- Variants** [show]
- History by country** [show]
- People** [show]
- Organizations** [show]

# Thanks!



Filippo Menczer



Alessandro Flammini



Prashant Shiralkar



JAMES S.  
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SWISS NATIONAL SCIENCE FOUNDATION



Johan Bollen



Luis Rocha

[gciampag@indiana.edu](mailto:gciampag@indiana.edu)

