



# „Understanding“ the Web (of Data)

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## Named Entity Resolution

Saint-Étienne, August 26, 2014

Dr. Harald Sack  
Hasso-Plattner-Institute for IT Systems Engineering  
University of Potsdam

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## Named Entity Resolution

### Overview

#### (1) How to make sense of the Web?

and why we are not really content with it...

#### (2) Words and Meaning

to be able to better „understand“ the content

#### (3) Named Entity Resolution

from words to semantic entities...

#### (4) Application Scenarios

Exploratory Search and intelligent Recommendations

# **How Do You Make Sense of the Web...?**

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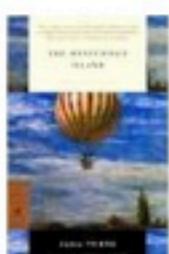
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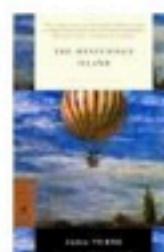
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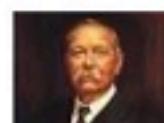
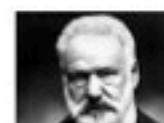
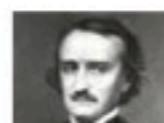
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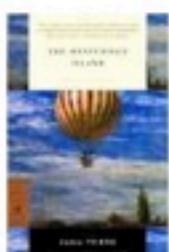
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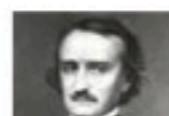
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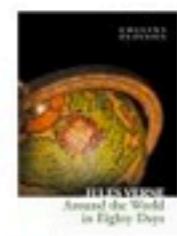
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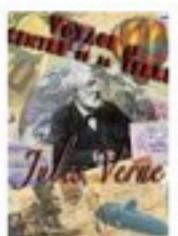
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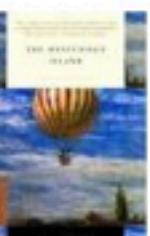
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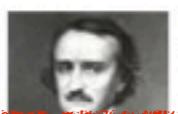
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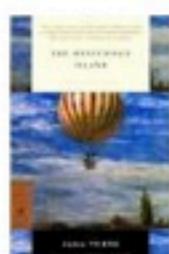
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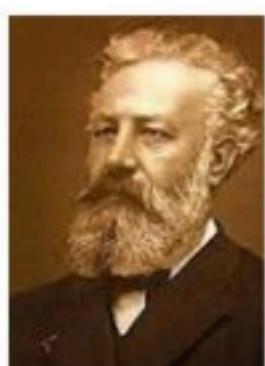
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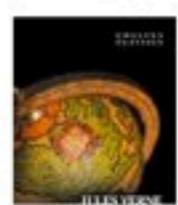
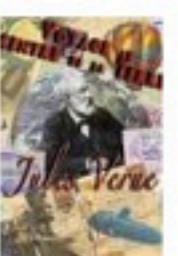
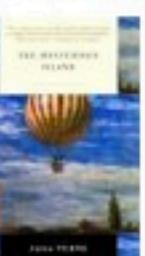
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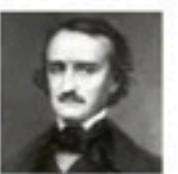
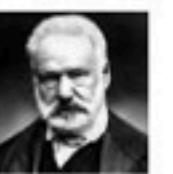
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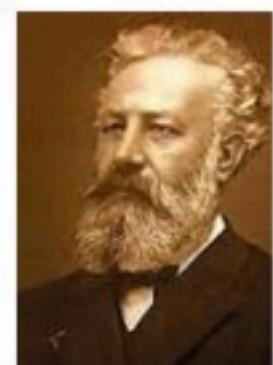
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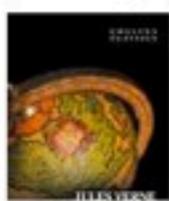
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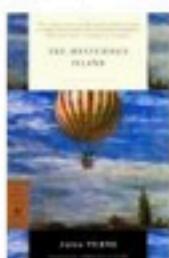
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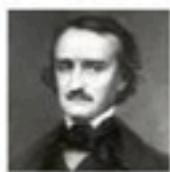
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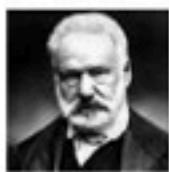
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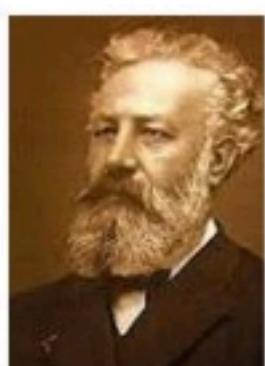
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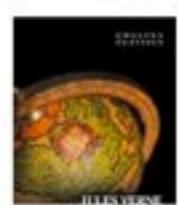
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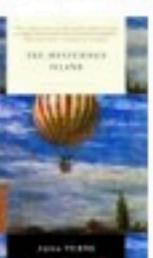
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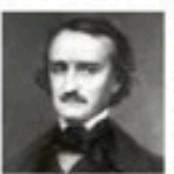
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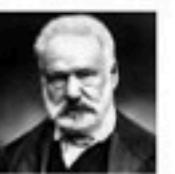
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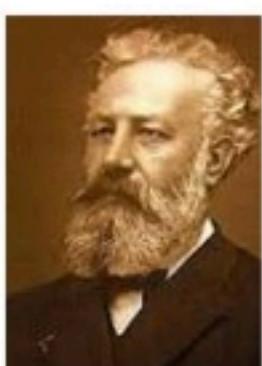
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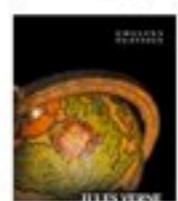
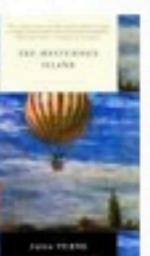
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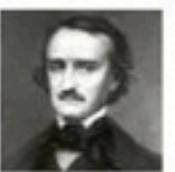
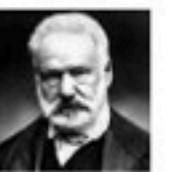
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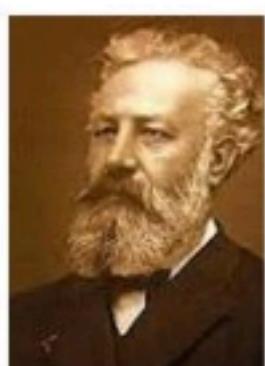
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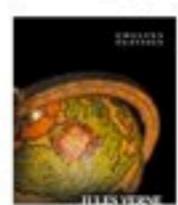
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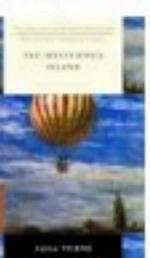
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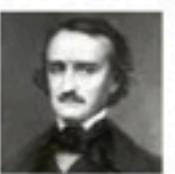
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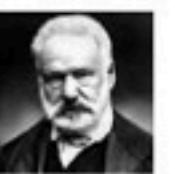
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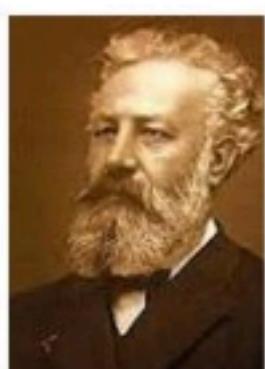
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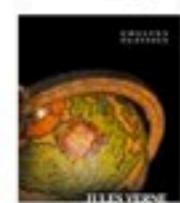
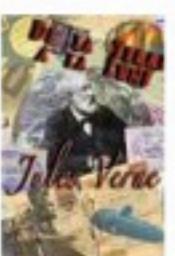
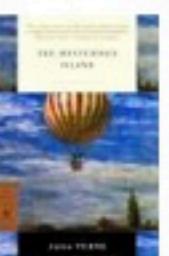
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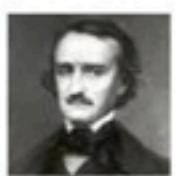
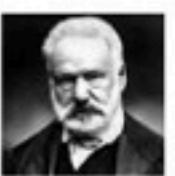
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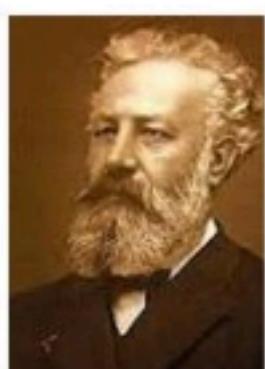
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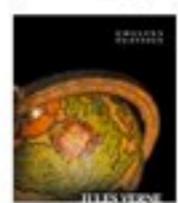
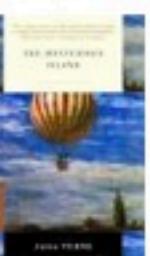
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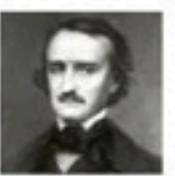
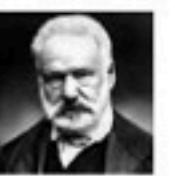
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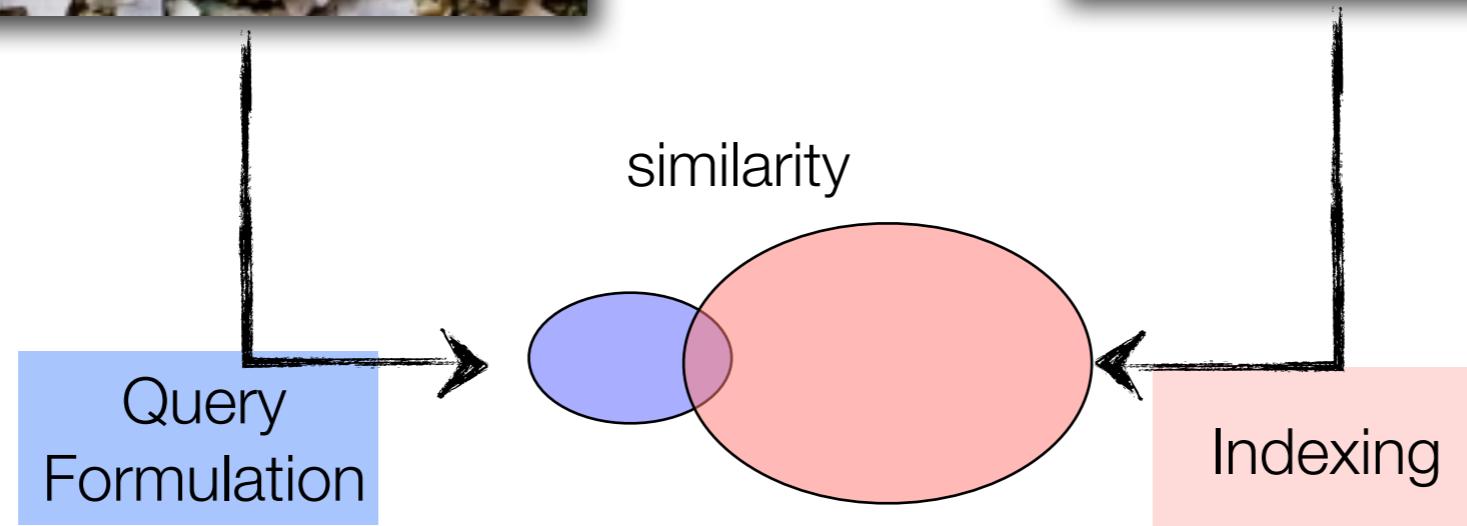


Set of Queries

Files of records



Set of Documents



Let's assume  
you are looking for  
something you  
don't know how to  
phrase the search  
correctly....

Let's assume  
you are looking for  
something you  
don't know how to  
phrase the search  
correctly....

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## Exercise 1:

Search this Book in Google image search.

The **query should not contain:**

- (1) the title
- (2) the author

An image of the book should be the **no.1 search result in Google image search.**

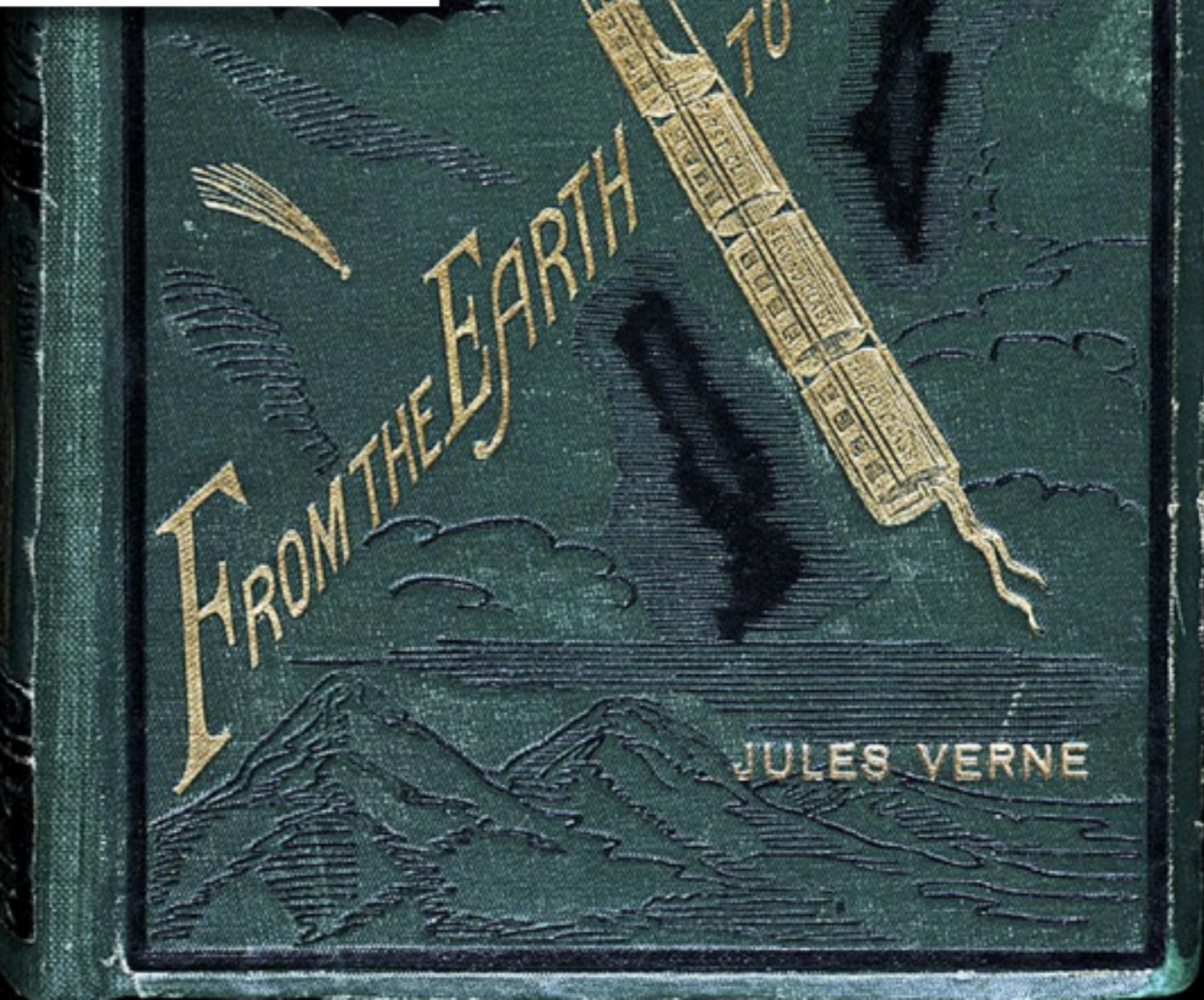
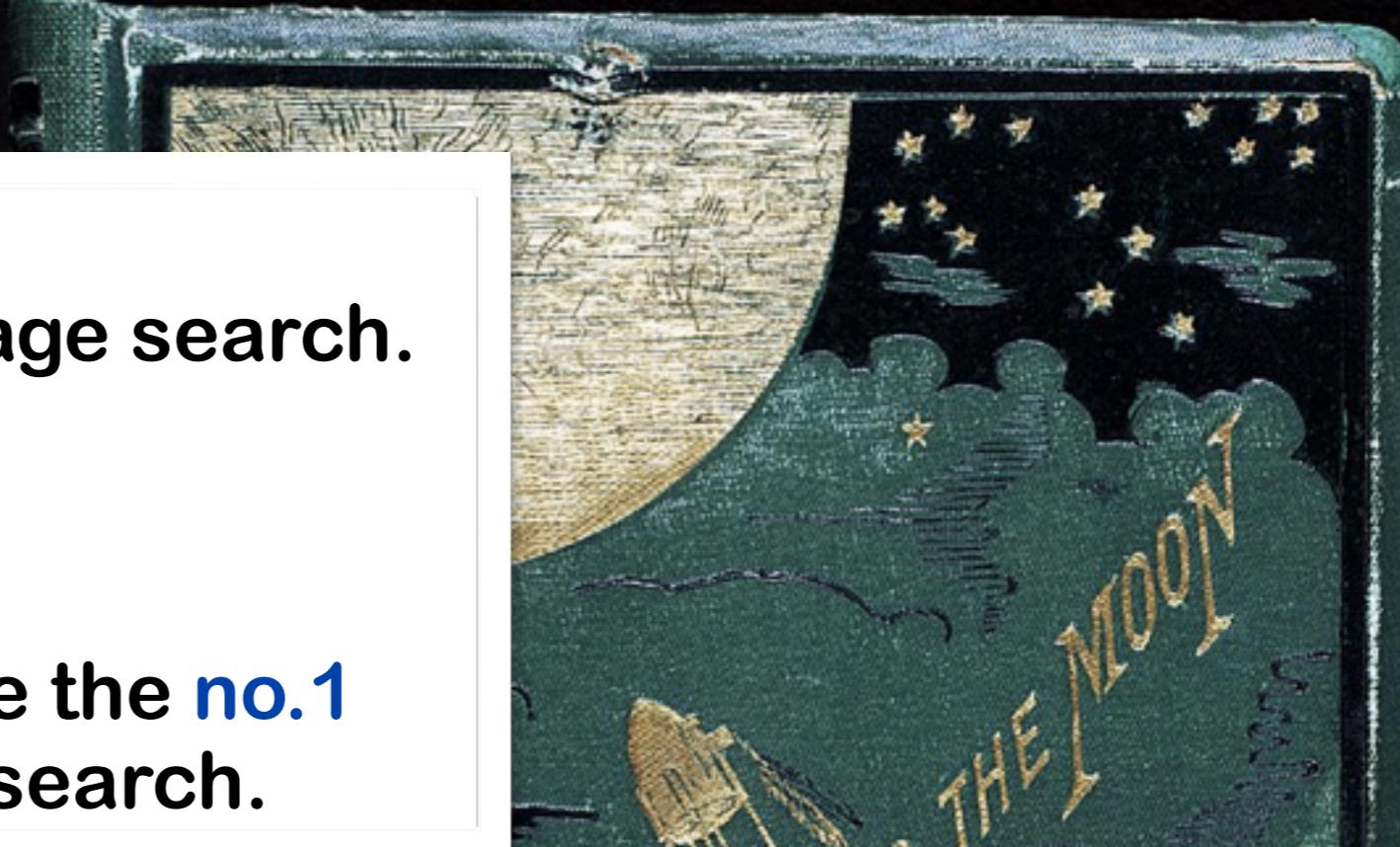
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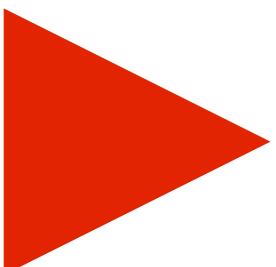
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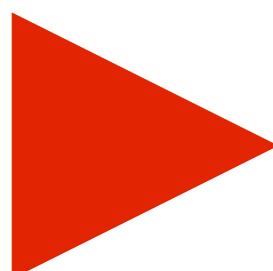


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- sometimes **simple query matching** with content or metadata alone is not sufficient to fulfill the user's information needs
  - what is missing are often the relational connections and circumstances, i.e. **contextual information** is needed to answer the query
  - therefore you have to **understand the meaning of the content**



## Semantic Analysis

- sometimes **simple query matching** with content or metadata alone is not sufficient to fulfill the user's information needs
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- therefore you have to **understand the meaning of the content**



## Semantic Analysis





# “Understanding“ the Web of Data

## Named Entity Resolution

### Overview

#### (1) How to make sense of the Web?

and why we are not really content with it...

#### (2) Words and Meaning

to be able to better „understand“ the content

#### (3) Named Entity Resolution

from words to semantic entities...

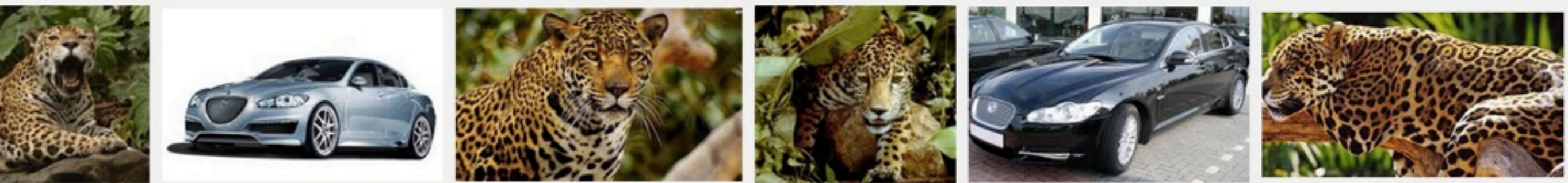
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Exploratory Search and intelligent Recommendations

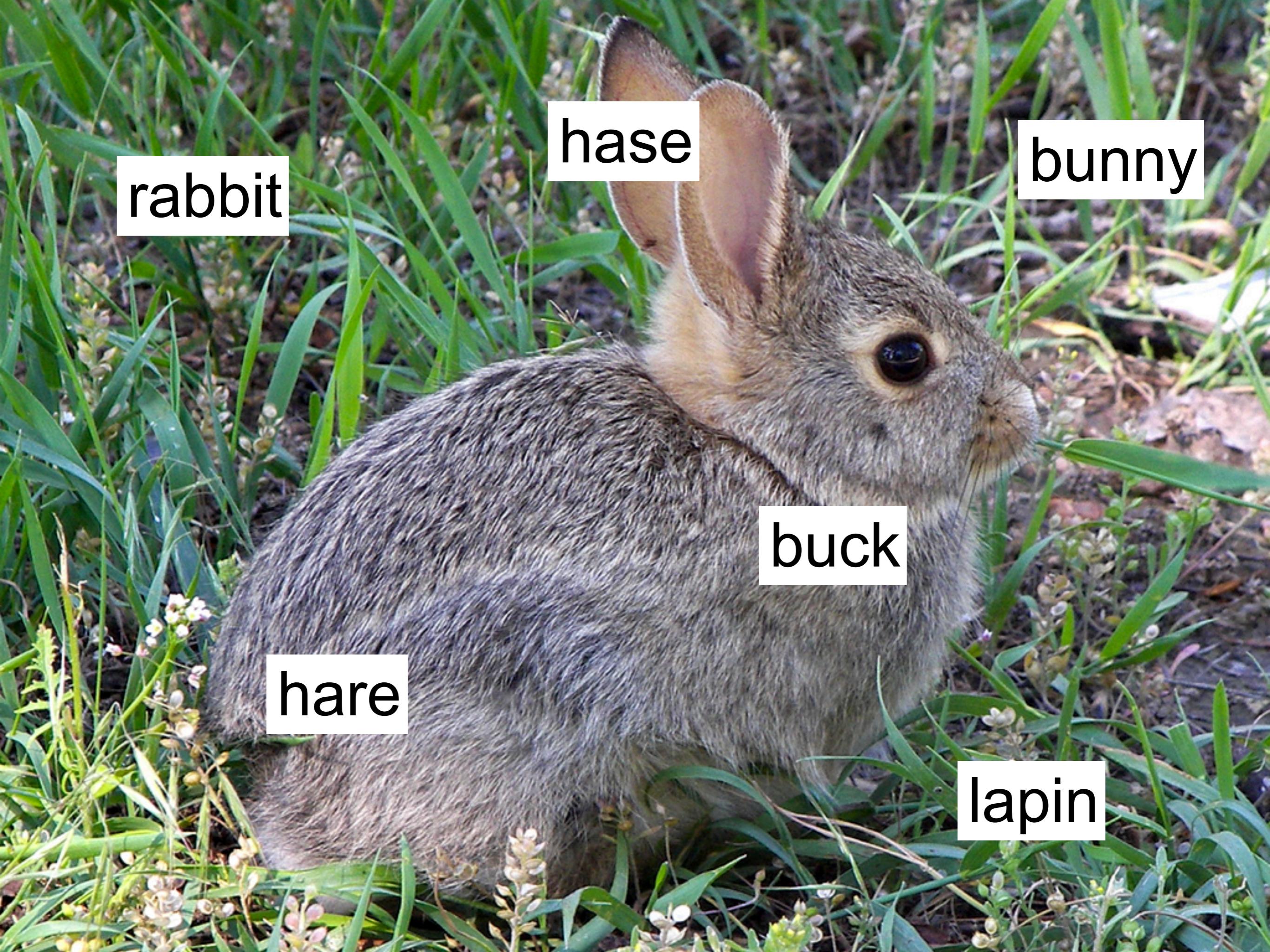
What is the  
Meaning of a  
Word?

# What is the Meaning of a Word?

Jaguar







rabbit

hase

bunny

hare

buck

lapin

# Meaning



Semant

Cognit

symbolizes

Concept

Symbol

refers to

Object

stands for

„Jaguar“

Experi

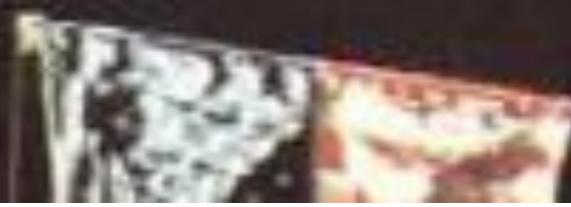
Pragmatics

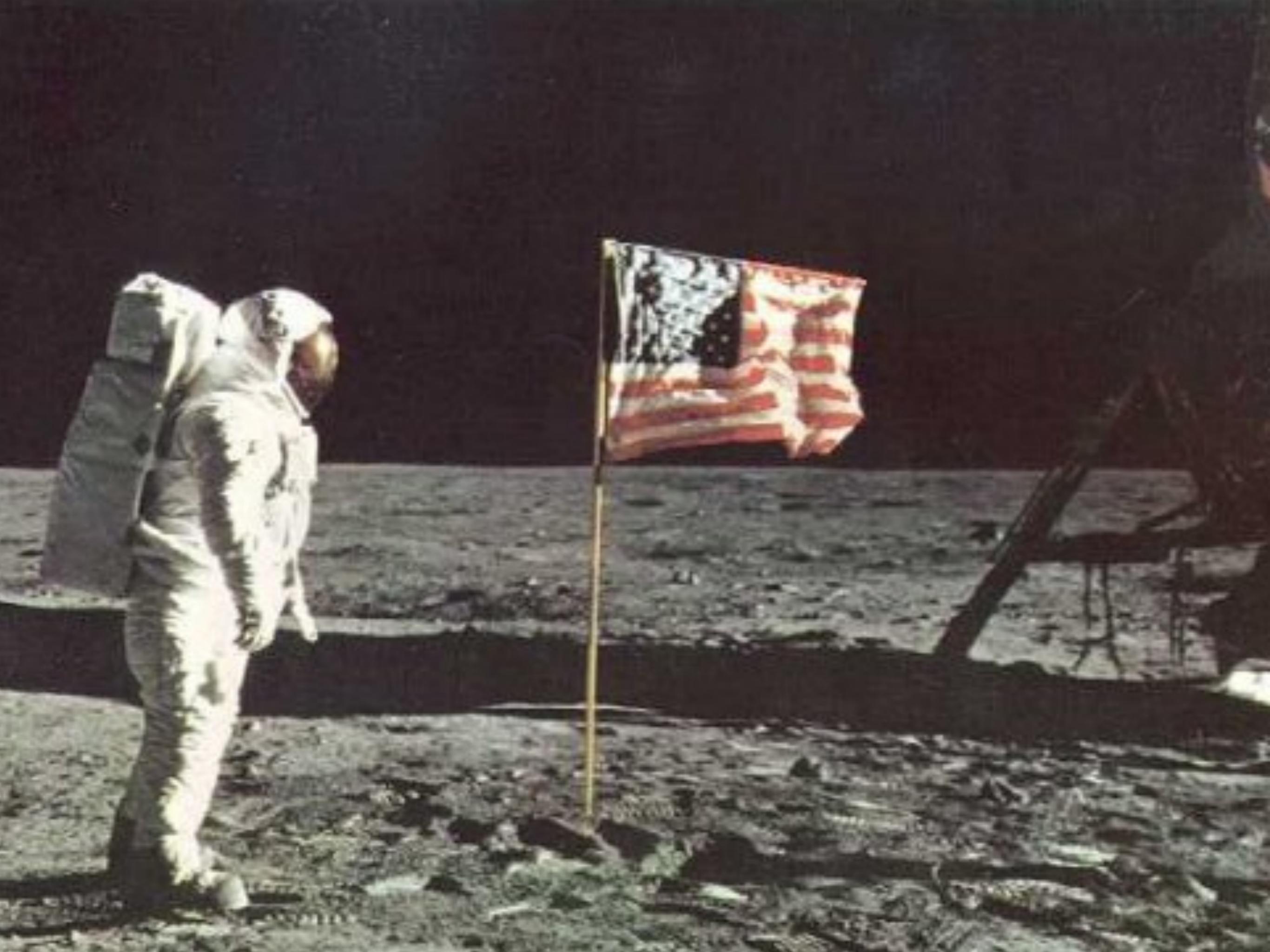


what does it  
mean to mean  
something?

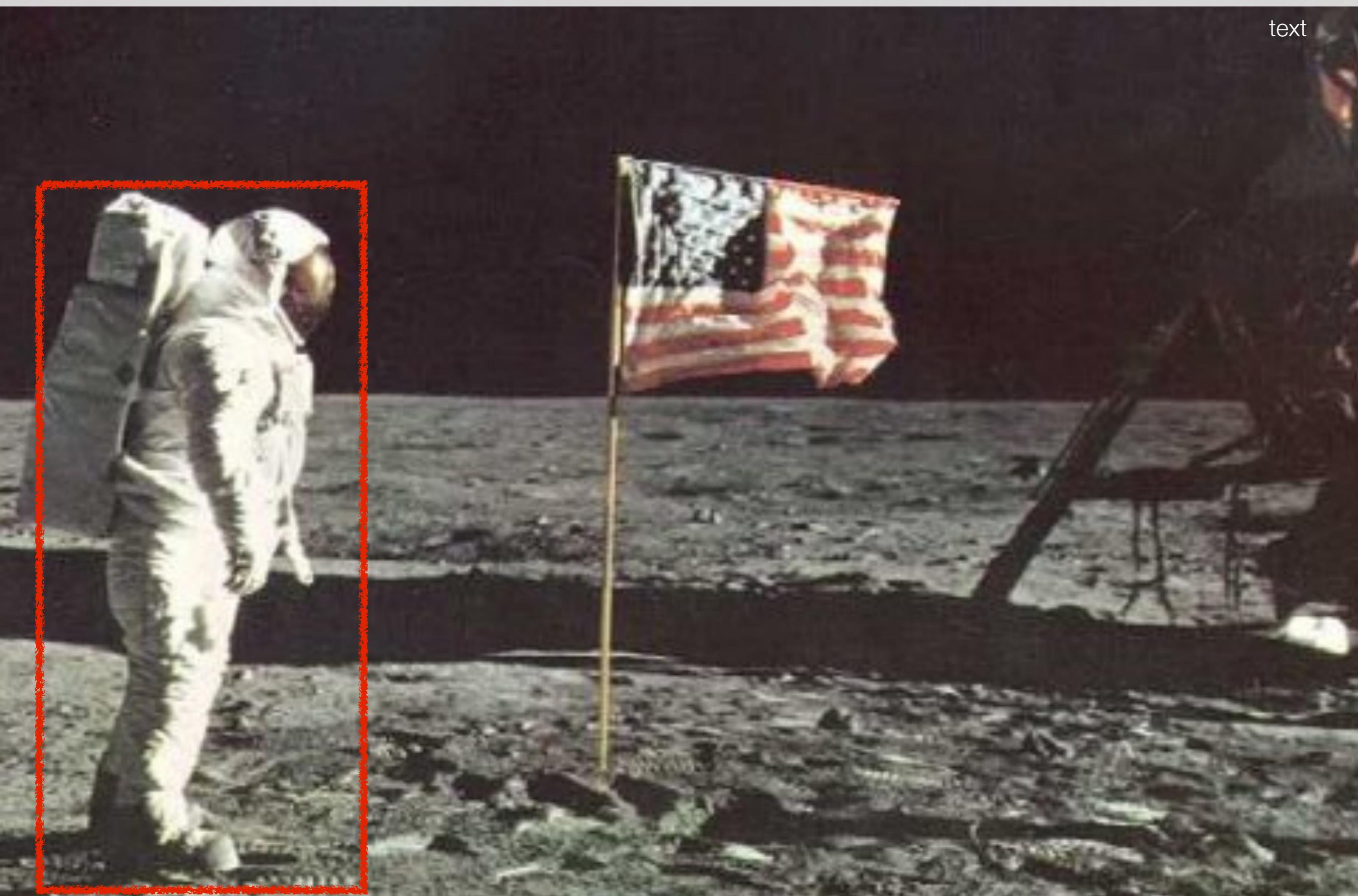
what does it  
mean to mean  
something?

How to represent Meaning?



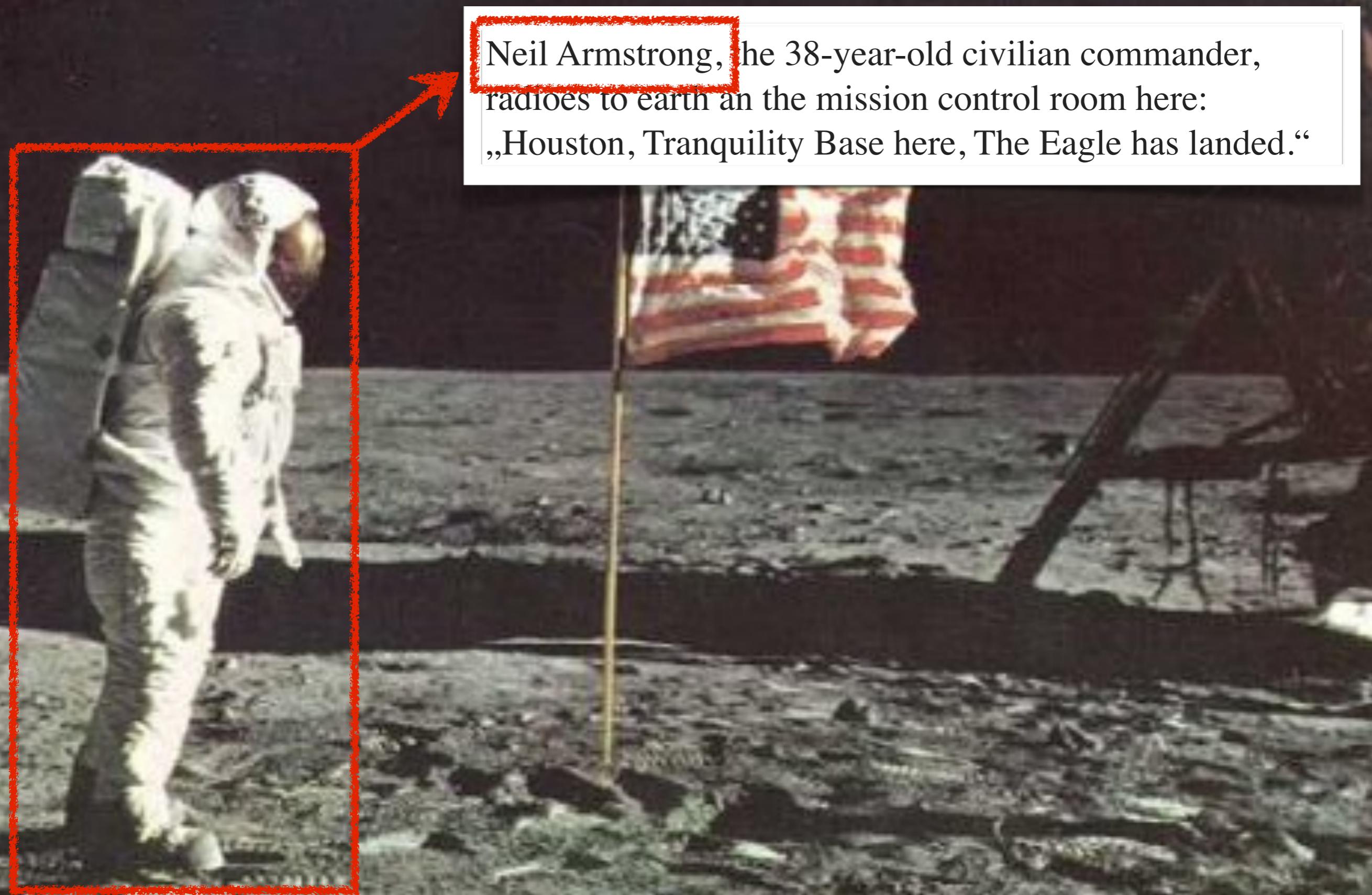


# From Raw (Text) Data to Semantic Entities



text

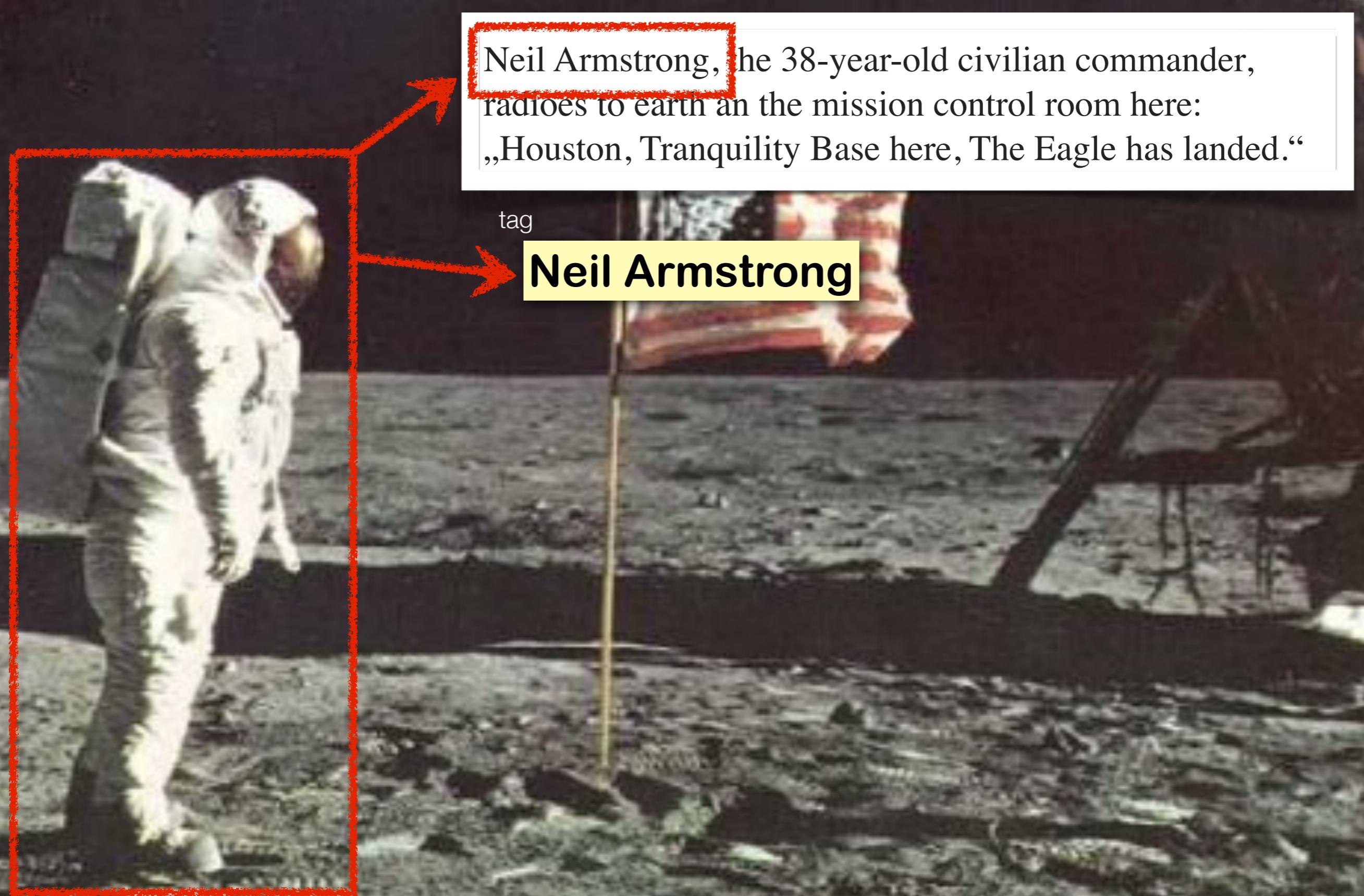
# From Raw (Text) Data to Semantic Entities



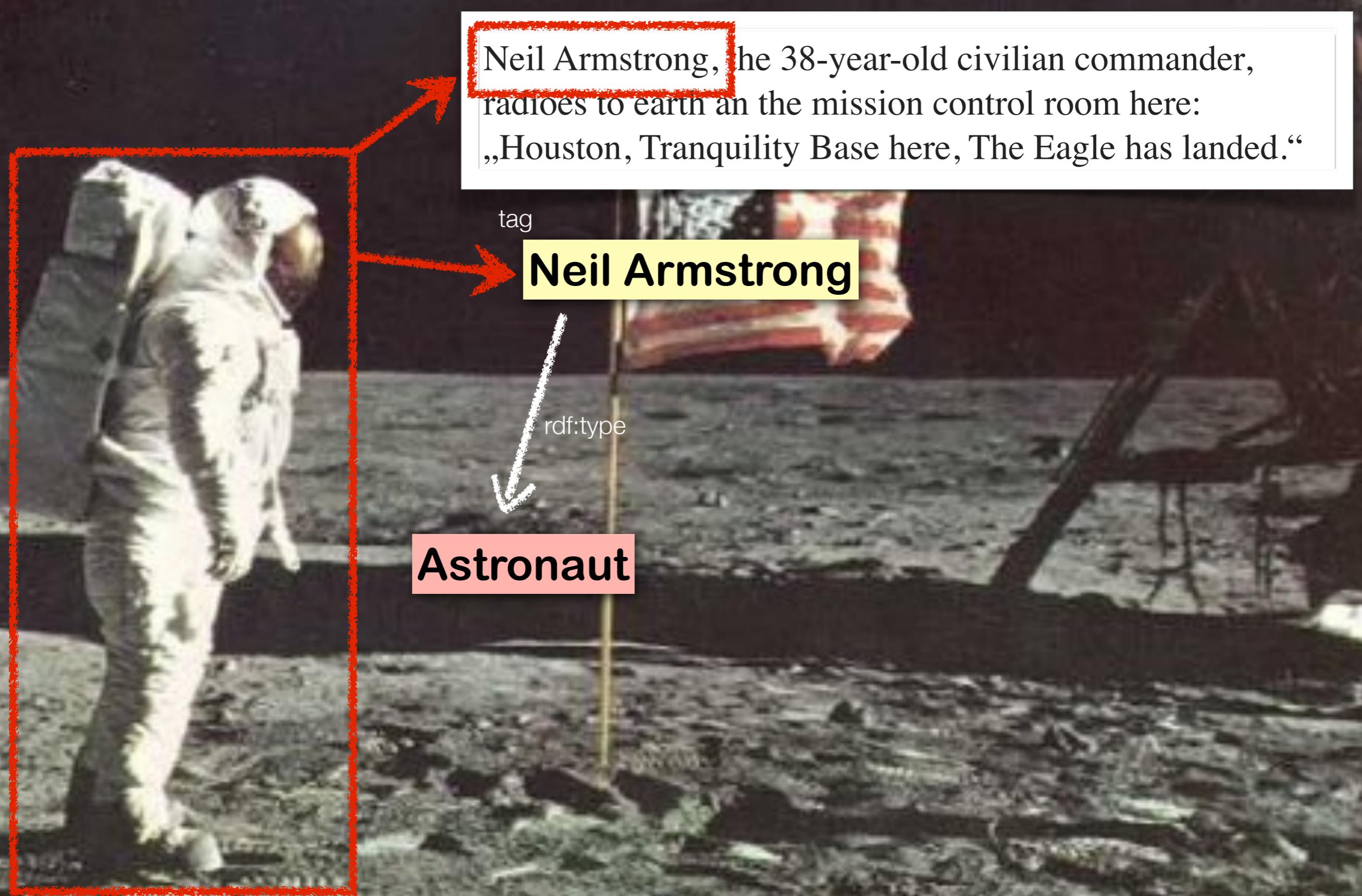
text

Neil Armstrong, the 38-year-old civilian commander, radios to earth an the mission control room here: „Houston, Tranquility Base here, The Eagle has landed.“

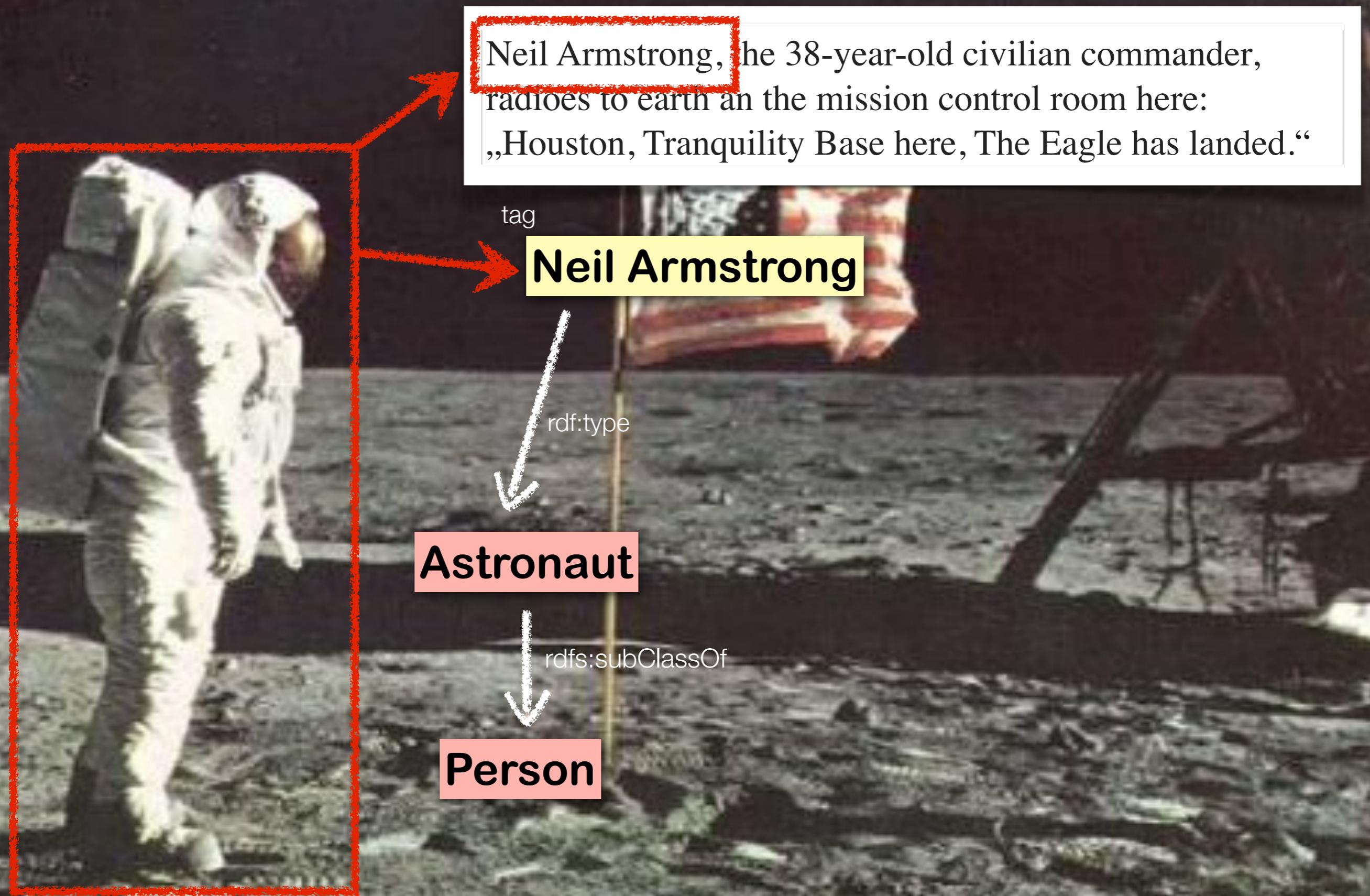
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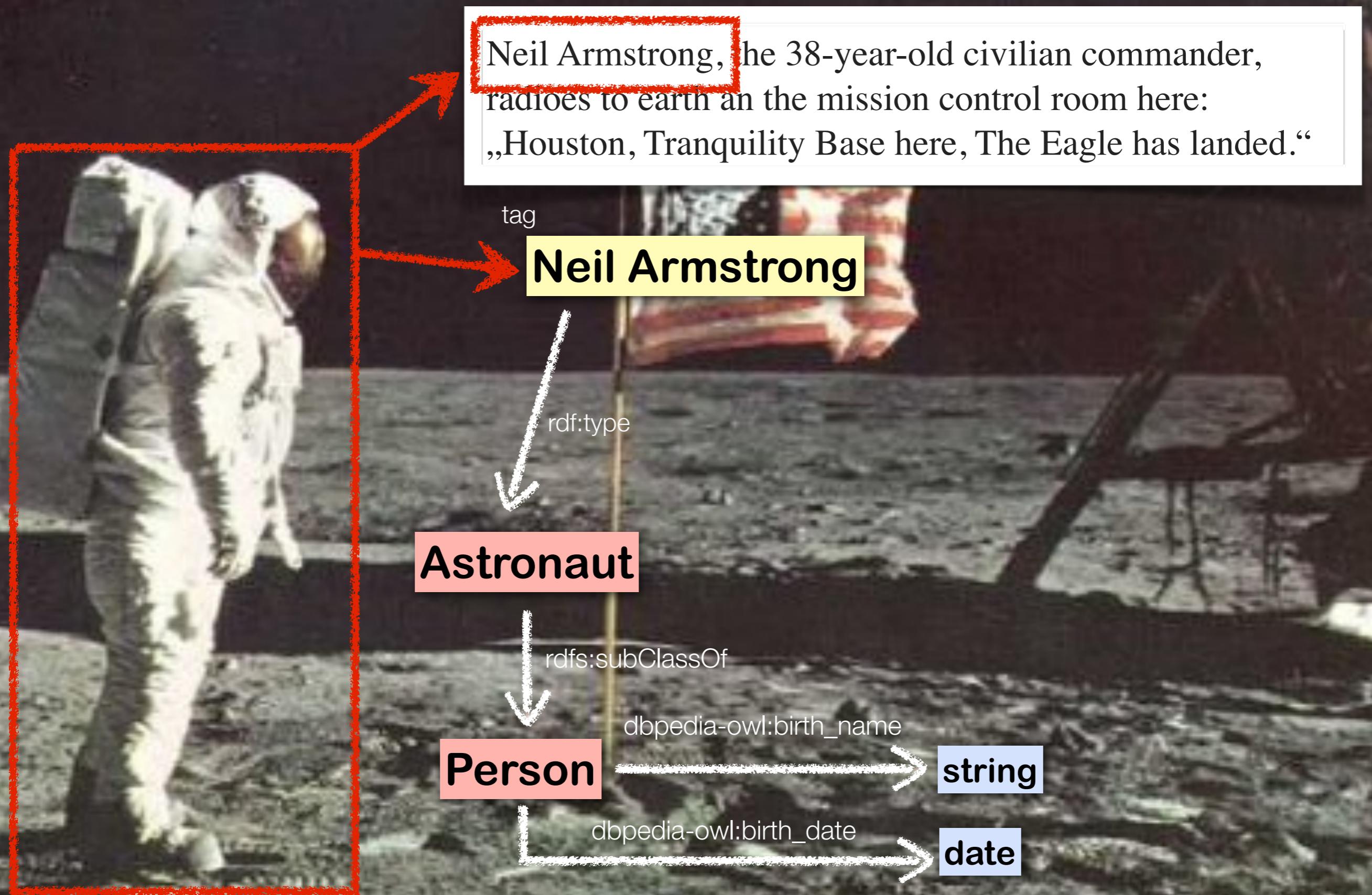
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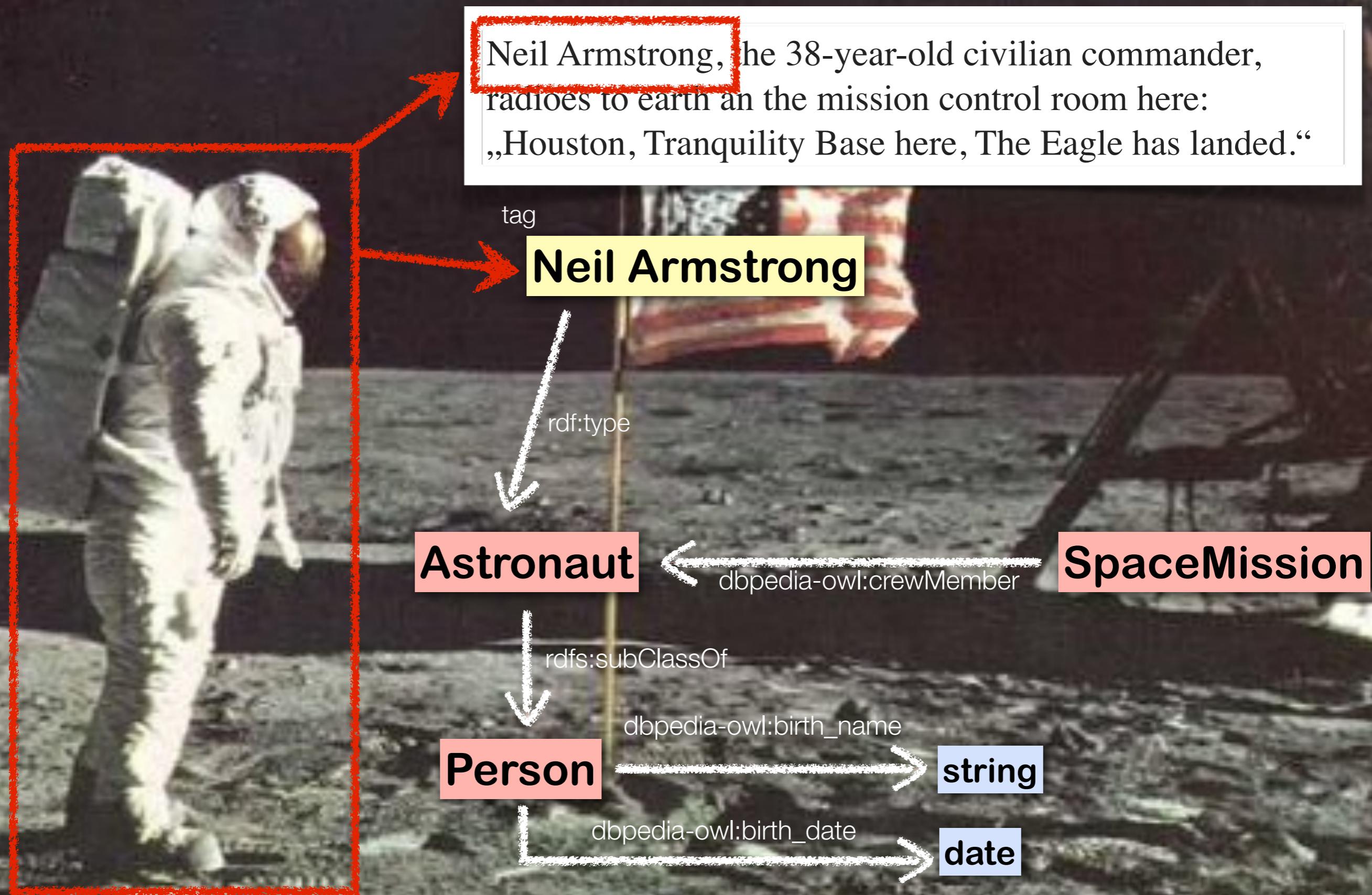
# From Raw (Text) Data to Semantic Entities



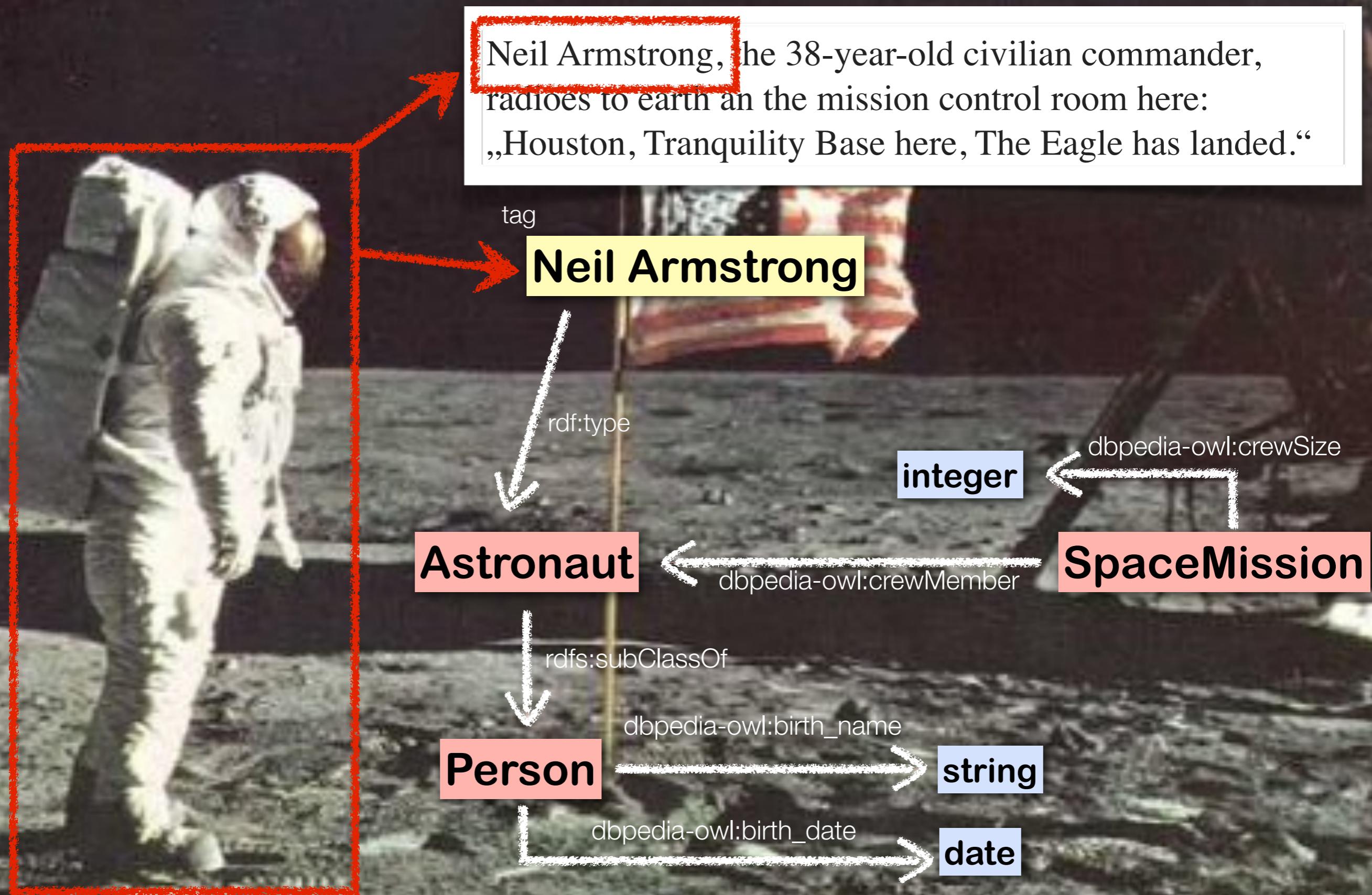
# From Raw (Text) Data to Semantic Entities



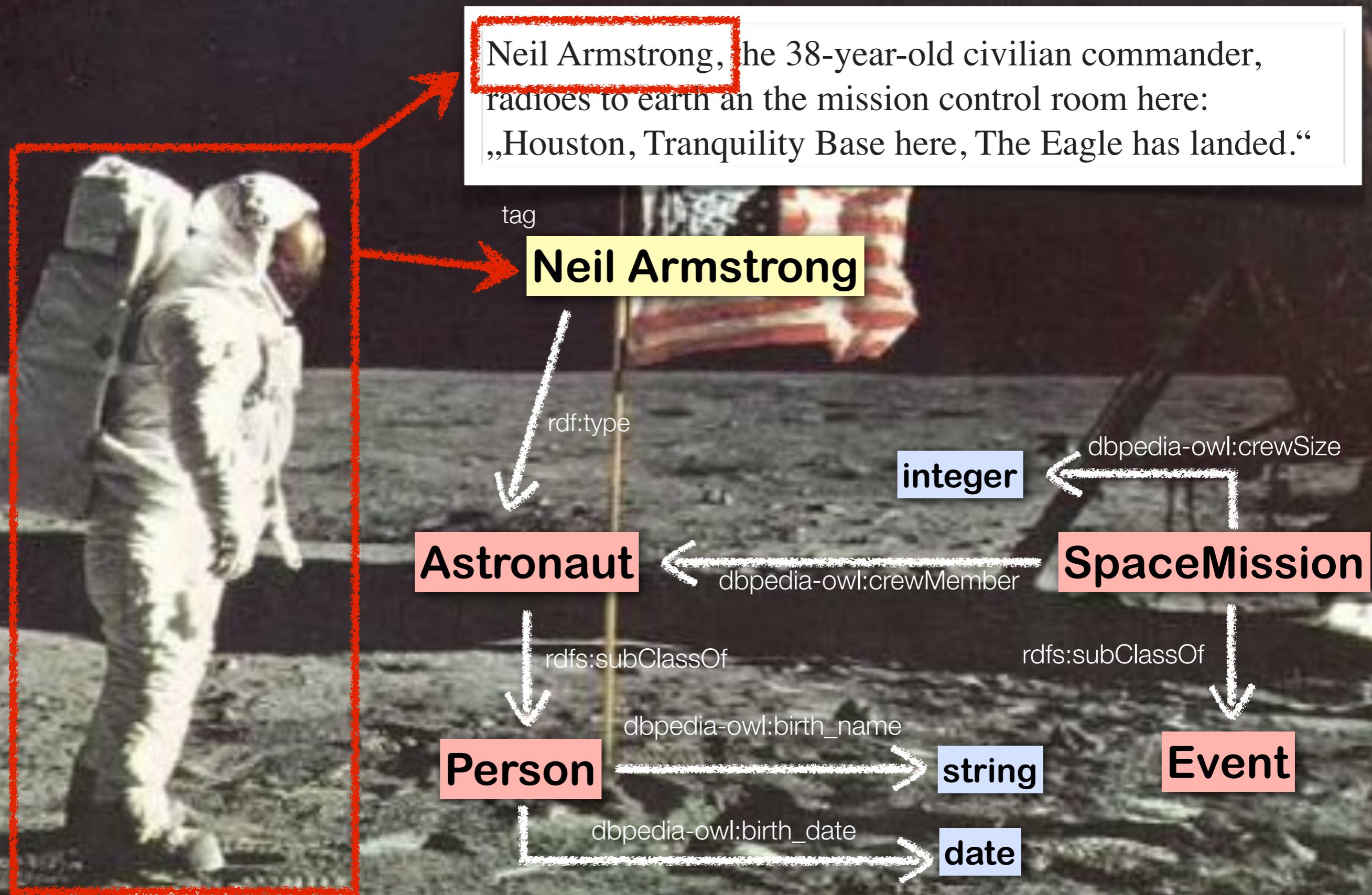
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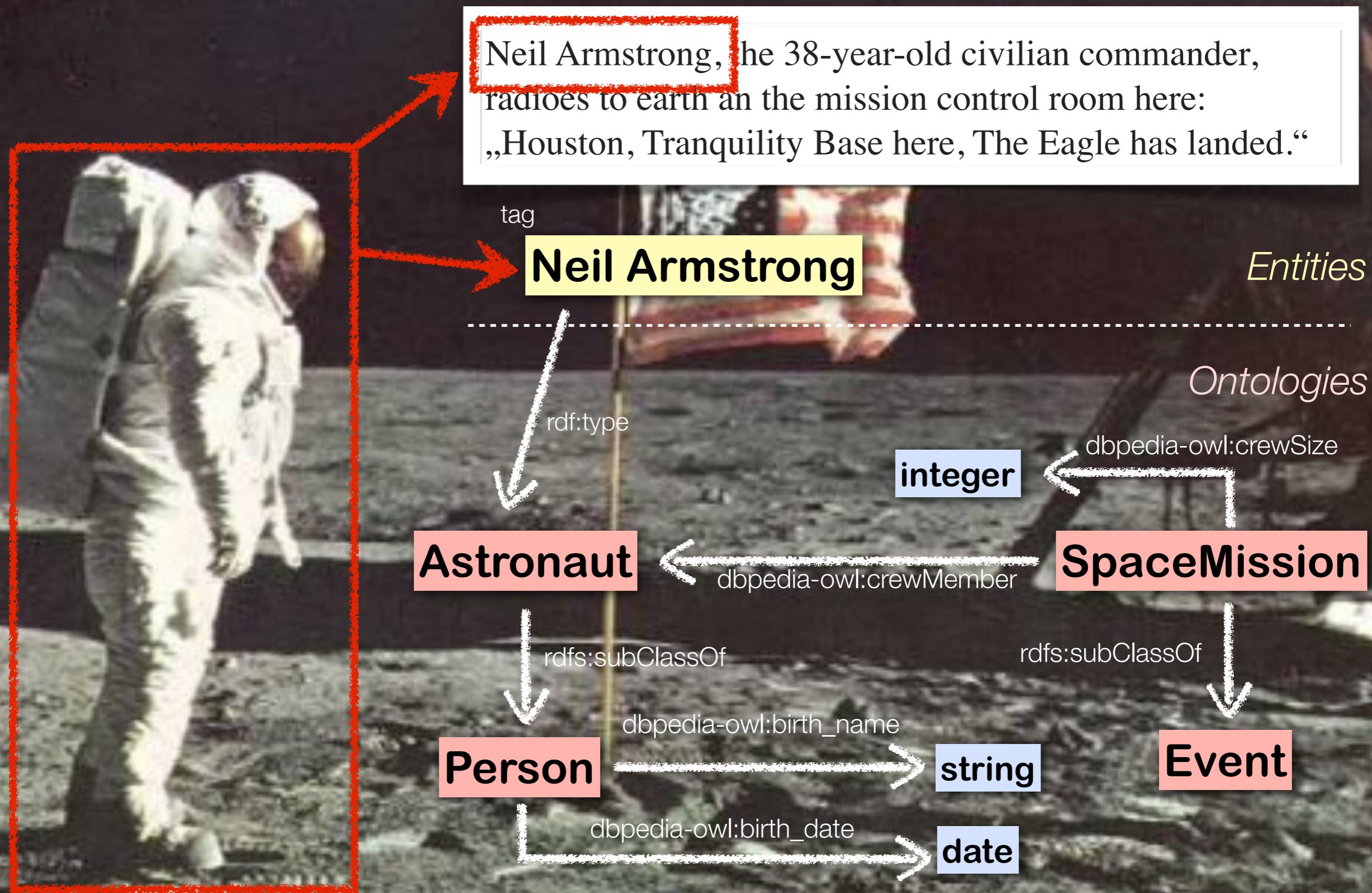
# From Raw (Text) Data to Semantic Entities



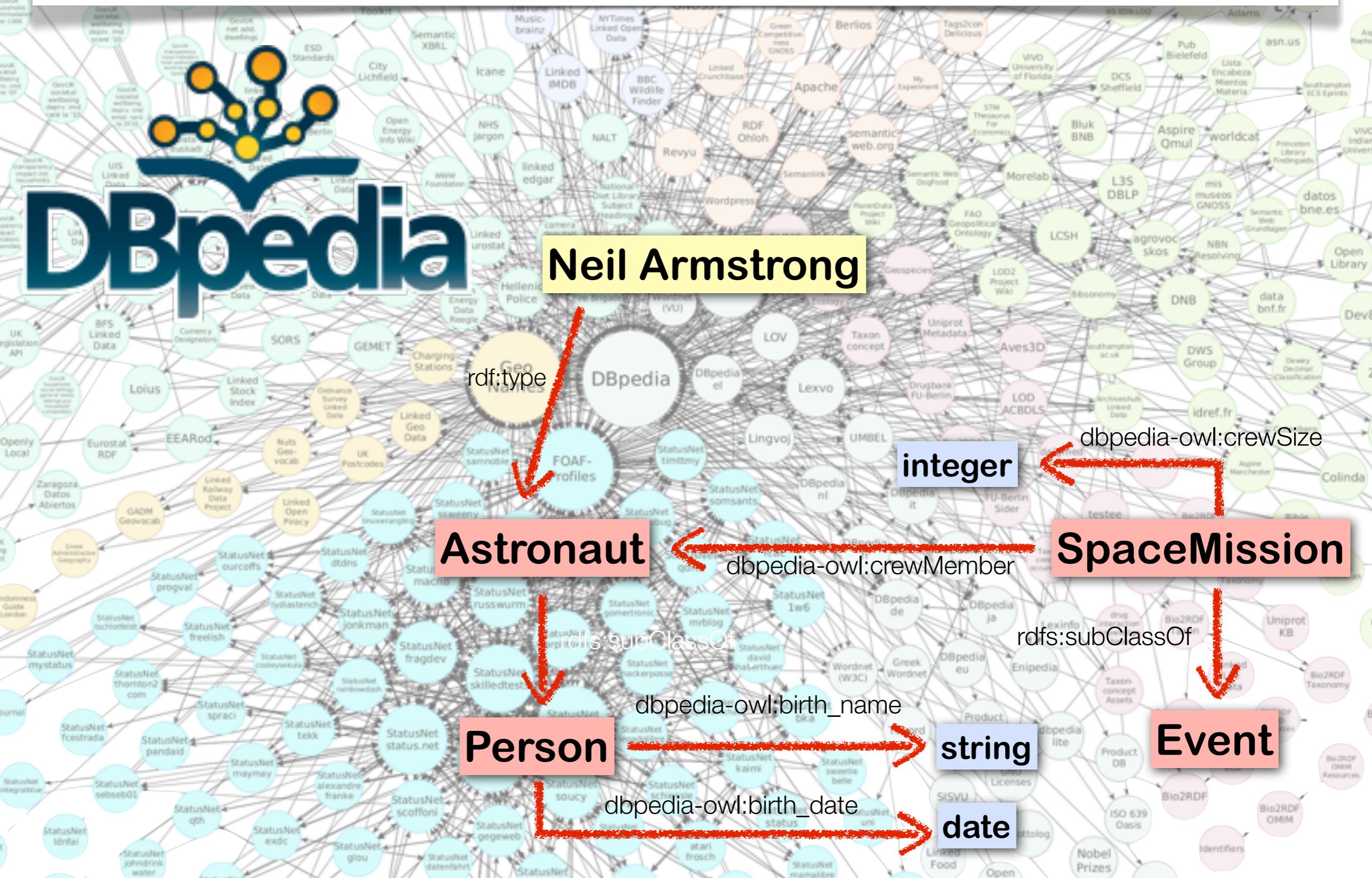
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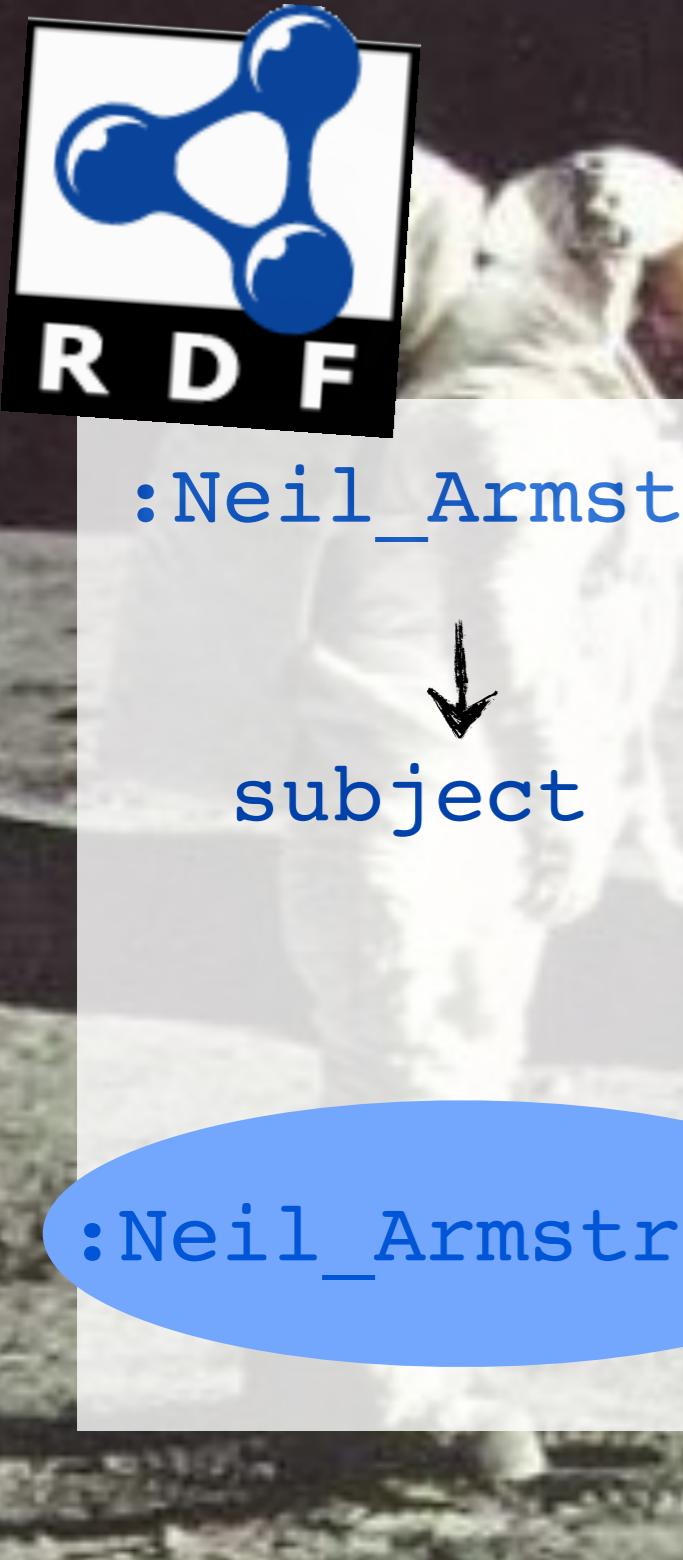
# From Raw (Text) Data to Semantic Entities



# Web of Data = Linked Open Data



# From Raw (Text) Data to Semantic Entities



## About: [Neil Armstrong](#)

An Entity of Type : [United States Air Force](#), from Named Graph : <http://dbpedia.org>, within Data Space : [dbpedia.org](#)



Neil Alden Armstrong (nascut el 5 d'agost de 1930) és un pilot d'avió, astronauta, pilot de proves, enginyer aeronàutic, professor d'universitat i Aviador Naval dels Estats Units. Va ser la primera persona en trepitjar la Lluna. El 1962, Armstrong va ser seleccionat per la NASA com a astronauta. Va servir de pilot comandant de reemplaçament per a la missió Gemini 5 al 1965.

### Property

[dbpedia-owl:Astronaut/timelineSpace](#)

### Value

- 0.5166666666666667
- 12372.0

[dbpedia-owl:abstract](#)

• Neil Alden Armstrong (nascut el 5 d'agost de 1930) és un pilot d'avió, astronauta, pilot de proves, enginyer aeronàutic, professor d'universitat i Aviador Naval dels Estats Units. Va ser la primera persona en trepitjar la Lluna. El 1962, Armstrong va ser seleccionat per la NASA com a astronauta. Va servir de pilot comandant de reemplaçament per a la missió Gemini 5 al 1965. El seu primer vol espacial va ser a bord de la nau Gemini 8 el 1966, on va ser-hi el comandant, sent un dels primers ciutadans americans en volar a l'espai (Joseph Albert Walker va ser el primer ciutadà americà en anar-hi, a bord de la X-15 Flight 90 pocs anys abans). En aquesta missió espacial, va fer la primera maniobra d'acoblament de dos naus espacials juntament amb David Scott. Malauradament la missió es va avortar poc després de l'acoblament per un mal funcionament dels impulsors de maniobra. El mateix any, va ser el pilot comandant de reserva per a la missió Gemini 11. El 1968 va ser el comandant de la tripulació de reserva de la missió orbital Apollo 8. Armstrong va estar apunt de morir durant un entrenament en un vehicle de recerca lunar (LLRV) el 6 de maig de 1969. El segon i últim vol espacial d'Armstrong va ser com a comandant de l'Apollo 11 aterrant a la Lluna el 20 de juliol de 1969. En aquesta missió, Armstrong i Buzz Aldrin van descendir del mòdul lunar i va passar-se 2 hores i mitja explorant mentre Michael Collins quedava en òrbita al mòdul de comandament. Armstrong ha rebut la Medalla d'Honor del Congrés dels Estats Units.

• Neil Alden Armstrong je bývalý americký pilot, astronaut a univerzitní profesor. Je prvním člověkem, který vstoupil na povrch Měsíce. Než se stal astronautem, sloužil jako pilot v námořnictvu Spojených států amerických, přičemž bojoval ve válce v Koreji. Po odchodu z námořnictva vystudoval letecké inženýrství na Drydenově letecké výzkumné stanici. V roce 1955 byl povýšen na kapitána. Na konci války byl zařazen do Národního komitétu pro leteckou výzkum (NACA), kde se při vývoji raketoplánu X-15 podílel. V roce 1962 byl jmenován členem posádky na misi Gemini 8. V roce 1966 byl jmenován členem posádky na misi Apollo 8. V roce 1969 byl jmenován členem posádky na misi Apollo 11. V roce 1971 byl jmenován členem posádky na misi Apollo 16. V roce 1972 byl jmenován členem posádky na misi Apollo 17. V roce 1974 byl jmenován členem posádky na misi Skylab 3. V roce 1975 byl jmenován členem posádky na misi Skylab 4. V roce 1977 byl jmenován členem posádky na misi STS-1. V roce 1985 byl jmenován členem posádky na misi STS-7. V roce 1999 byl jmenován členem posádky na misi STS-96. V roce 2001 byl jmenován členem posádky na misi STS-102. V roce 2002 byl jmenován členem posádky na misi STS-108. V roce 2005 byl jmenován členem posádky na misi STS-114. V roce 2007 byl jmenován členem posádky na misi STS-117. V roce 2009 byl jmenován členem posádky na misi STS-126. V roce 2011 byl jmenován členem posádky na misi STS-134. V roce 2012 byl jmenován členem posádky na misi STS-135. V roce 2013 byl jmenován členem posádky na misi STS-134. V roce 2014 byl jmenován členem posádky na misi STS-135. V roce 2015 byl jmenován členem posádky na misi STS-134. V roce 2016 byl jmenován členem posádky na misi STS-135. V roce 2017 byl jmenován členem posádky na misi STS-134. V roce 2018 byl jmenován členem posádky na misi STS-135. V roce 2019 byl jmenován členem posádky na misi STS-134. V roce 2020 byl jmenován členem posádky na misi STS-135. 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V roce 2008 byl jmenován členem posádky na misi STS-135. V roce 2009 byl jmenován členem posádky na misi STS-134. V roce 2010 byl jmenován členem posádky na misi STS-135. V roce 2011 byl jmenován členem posádky na misi STS-134. V roce 2012 byl jmenován členem posádky na misi STS-135. V roce 2013 byl jmenován členem posádky na misi STS-134. V roce 2014 byl jmenován členem posádky na misi STS-135. V roce 2015 byl jmenován členem posádky na misi STS-134. V roce 2016 byl jmenován členem posádky na misi STS-135. V roce 2017 byl jmenován členem posádky na misi STS-134. V roce 2018 byl jmenován členem posádky na misi STS-135. V roce 2019 byl jmenován čленem posádky na misi STS-134. V roce 2020 byl jmenován čленem posádky na misi STS-135. V roce 2021 byl jmenován čленem posádky na misi STS-134. V roce 2022 byl jmenován čленem posádky na misi STS-135. V roce 2023 byl jmenován čленem posádky na misi STS-134. V roce 2024 byl jmenován čленem posádky na misi STS-135. V roce 2025 byl jmenován čленem posádky na misi STS-134. V roce 2026 byl jmenován čленem posádky na misi STS-135. V roce 2027 byl

# From Raw (Text) Data to Semantic Entities



`:Neil_Armstrong rdf:type dbpedia-owl:Astronaut .`

↓  
subject

↓  
property

↓  
object

`:Neil_Armstrong`

`rdf:type`

`dbpedia-owl:Astronaut`

# Named Entity Resolution

text

image annotation

**Neil Armstrong**



Neil Armstrong, the 38-year-old civilian commander, radios to earth an the mission control room here: „Houston, Tranquility Base here, The Eagle has landed.“

About: [Neil Armstrong](#)

An Entity of Type : [NASA](#), from Named Graph : <http://dbpedia.org>, within Data Space : [dbpedia.org](#)

Neil Alden Armstrong ist ein ehemaliger amerikanischer Testpilot und Astronaut. Er betrat als erster Mensch den Mond.

Property	Value
<a href="#">dbpedia-owl:Astronaut/timeInSpace</a>	<ul style="list-style-type: none"><li>▪ 0.5166666666666667</li><li>▪ 12372.0</li></ul>
<a href="#">dbpedia-owl:abstract</a>	<ul style="list-style-type: none"><li>▪ Neil Alden Armstrong ist ein ehemaliger amerikanischer Testpilot und Astronaut. Er betrat als erster Mensch den Mond.</li><li>▪ Neil Alden Armstrong (born August 5, 1930) is an American aviator and former astronaut, test pilot, aerospace engineer, United States Naval Aviator. He was the first person to set foot on the Moon. Before becoming an astronaut, Armstrong and served in the Korean War. After the war, he served as a test pilot at the National Advisory Committee for Aeronautics Station, now known as the Dryden Flight Research Center, where he flew over 900 flights in a variety of aircraft. As a research project pilot on the F-100 Super Sabre A and C variants, F-101 Voodoo, and the Lockheed F-104A Starfighter. He also served as project pilot on the North American X-15, F-105 Thunderchief, F-106 Delta Dart, B-47 Stratojet, KC-135 Stratotanker and Pegasus. He graduated from the University of Southern California. A participant in the U.S. Air Force's Man In Space Soonest and X-20 Dyna-Soar programs, Armstrong joined the NASA Astronaut Corps in 1962. His first spaceflight was the NASA Gemini 8 mission in 1966, for which he became one of the first U.S. civilians to fly in space. On this mission, he performed the first manned docking of two spacecraft. Armstrong's second and last spaceflight was as mission commander of the Apollo 11 moon landing mission on July 20, 1969. Armstrong and Buzz Aldrin descended to the lunar surface and spent 2½ hours exploring while Michael Collins remained in the Command Module. For his spaceflights, Armstrong received the Congressional Space Medal of Honor.</li><li>▪ Neil Alden Armstrong es un ex astronauta de la NASA y el primer ser humano en pisar la Luna el 21 de julio de 1969, en la misión Apolo 11.</li><li>▪ Neil Alden Armstrong on entinen yhdysvaltalainen astronautti ja ensimmäinen Kuun pinnalla kävellyt ihmisen. Hän oli myös ensimmäinen avaruudessa kävellyt vieraalla taivaankappaleella. Nykyisin hän on eläkkeellä. Neil Armstrong syntyi Wapakonetaassa, Ohiossa Stephen ja Louise Engelin perheeseen. Hänen vanhempiensa olivat saksalais-irlantilaiset sukujuuret. Isä Stephen työskenteli Ohiossa ja äiti Louise työskenteli kahdessa yrityksessä. Neil Armstrongin vanhemmat olivat naimisissa ja hänen vanhempiensa olivat kaksi poikaa. Hänen vanhempiensa olivat myös sisko June ja veli James.</li><li>▪ Armstrong nacque in Ohio figlio di Stephen Koenig Armstrong e Viola Louise Engel, famiglia di origine tedesca. Combatté nella Seconda Guerra mondiale per l'esercito americano nella guerra di Corea. Ha frequentato la Purdue University, dove si laureò in ingegneria aeronautica nel 1955. Fu selezionato come pilota di test per la NASA nel 1962. Fu scelto per la missione Gemini 8, che fu la prima che vide l'aggancio di due oggetti orbitanti, nel 1966, ma subito dopo l'atterraggio, a causa di un malfunzionamento dei propulsori di manovra. Nel 1968 fu comandante dell'equipaggio di riserva nella missione Apollo 8, la prima missione con equipaggio a orbitare intorno alla Luna. Il 20 dicembre 1968 fu comandante della missione Apollo 11, la missione che portò il primo uomo sulla Luna. Durante la fase di avvicinamento alla Luna, Armstrong controllò manualmente il modulo lunare (LM) Eagle e lo pilotò fuori da una zona particolarmente rocciosa. Le sue prime parole furono: "Houston, Tranquility Base here. The Eagle has landed." Houston, qui è la base della Tranquillità. L'Aquila è atterrata. Quasi sette ore più tardi divenne il primo essere umano a camminare sulla Luna. Tocò il suolo lunare alle ore 2:56 UTC con lo scarpone sinistro. La sua celebre frase: "That's one small step for [a] man, one giant leap for mankind." Questo è un piccolo passo per un uomo, un grande salto per l'umanità." Dopo il pensionamento dalla NASA, Armstrong insegnò ingegneria all'Università di Cincinnati. È stato membro del consiglio di amministrazione della Boeing e della NASA, oltre che consulente per la NASA e la NASA Johnson Space Center.</li></ul>

# Named Entity Resolution

text

## Question:

Which ‘entities’ should be ‘understood’ to make sense of the content of the text?

A black and white photograph showing Neil Armstrong standing on the surface of the Moon. He is wearing a full space suit with a helmet. In front of him is the Lunar Module's descent stage, which has a small American flag attached to it. The background shows the dark void of space and the hilly terrain of the Moon's surface.

NY Times, July 1969

Neil Armstrong, the 38-year-old civilian commander, radios to earth from the mission control room here:  
„Houston, Tranquility Base here, The Eagle has landed.“



# “Understanding“ the Web of Data

## Named Entity Resolution

### Overview

#### (1) How to make sense of the Web?

and why we are not really content with it...

#### (2) Words and Meaning

to be able to better „understand“ the content

#### (3) Named Entity Resolution

from words to semantic entities...

#### (4) Application Scenarios

Exploratory Search and intelligent Recommendations

# Named Entity Resolution



Start with the Raw Text

## (1) Determine all **Named Entities**

Neil Armstrong, the 38-year-old civilian commander,  
radioes to earth an the mission control room here:  
„Houston, Tranquility Base here, The Eagle has landed.“

# Named Entity Resolution

Start with the Raw Text

## (1) Determine all **Named Entities**

Neil Armstrong, the 38-year-old civilian commander,  
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Start with the Raw Text

## (1) Determine all **Named Entities**

Neil Armstrong, the 38-year-old civilian commander,  
radioes to earth an the mission control room here:  
„Houston, Tranquility Base here, The Eagle has landed.“

name(s),  
noun(s),  
combination(s) of nouns,  
adjective(s) + noun(s),  
determiner + (adjectives) + noun(s)

...

# Named Entity Resolution

Start with the Raw Text

## (1) Determine all **Named Entities**

Neil Armstrong, the 38-year-old civilian commander,  
radioes to earth an the mission control room here:  
„Houston, Tranquility Base here, The Eagle has landed.“

use Part-of-Speech Tagger to determine **Named Entities**

- e.g. Stanford POS Tagger      stanford-postagger-2014-06-16.zip
- Tree Tagger online      <http://web4u.setsunan.ac.jp/Website/TreeOnline.htm>

### Exercise:

Determine POS-Tags for example text with tagger

# Named Entity Resolution

Start with the Raw Text

## (1) Determine all **Named Entities**

Neil Armstrong, the 38-year-old civilian commander,  
radioes to earth an the mission control room here:  
„Houston, Tranquility Base here, The Eagle has landed.“

use Part-of-Speech Tagger to determine **Named Entities**

```
Macintosh:stanford-pos harald$  
Macintosh:stanford-pos harald$  
Macintosh:stanford-pos harald$  
Macintosh:stanford-pos harald$ ./stanford-postagger.sh models/english-bidirectional-distsim.tagger astronaut.txt  
Loading default properties from tagger models/english-bidirectional-distsim.tagger  
Reading POS tagger model from models/english-bidirectional-distsim.tagger ... done [2.8 sec].  
Neil_NNP Armstrong_NNP _, the_DT 38-year-old_JJ civilian_JJ commander_NN _, radioes_NNS to_T0 earth_NN an_DT the_DT mission_NN c  
ontrol_NN room_NN here_RB :_ Houston_NNP _, Tranquility_NN Base_NN here_RB _, The_DT Eagle_NNP has_VBZ landed_VBN _.  
Tagged 30 words at 115.38 words per second.  
Macintosh:stanford-pos harald$
```

← → ⌂ [web4u.setsunan.ac.jp/Website/cmd/tt\\_win.cgi](http://web4u.setsunan.ac.jp/Website/cmd/tt_win.cgi)

Apps definitiv möglic 20 Google Kalender Pin It Projekte In Refind

Neil	NP	Neil
Armstrong		Armstrong
,	,	,
the	DT	the
38-year-old	JJ	38-year-old
civilian	JJ	civilian
commander	NN	commander
,	,	,
radioes	NNS	radioes
to	TO	to
earth	NN	earth
an	DT	an
the	DT	the
mission	NN	mission
control	NN	control
room	NN	room
here	RB	here
:	:	:
"	NN	"
;	:	;
Houston	NP	Houston
,	,	,
Tranquility	NP	Tranquility
Base	NP	Base
here	RB	here
,	,	,
The	DT	the
Eagle	NP	Eagle
has	VHZ	have
landed.	NN	landed."

Neil Armstrong, the 38-year-old civilian commander, radios to earth an the mission control room here:  
„Houston, Tranquility Base here, The Eagle has landed.“

# Named Entity Resolution

Start with the Raw Text

- Determine all **Named Entities**

Neil Armstrong, the 38-year-old civilian commander,  
radioes to earth an the mission control room here:  
„Houston, Tranquility Base here, The Eagle has landed.“

- is it two entities?
  - Neil and Armstrong
  - or is it only one entity?
  - Neil Armstrong
- what about: mission control room, The Eagle,....?

# Named Entity Resolution

Start with the Raw Text

- Determine all **Named Entities**

Neil Armstrong, the 38-year-old civilian commander,  
radioes to earth an the mission control room here:  
„Houston, Tranquility Base here, The Eagle has landed.“

## How to determine valid composita?

- test sequences of subsequent Named Entity candidates against a dictionary
- consider the longest sequence found in dictionary

Tranquility Base

wins over

Tranquility

Base

# Named Entity Resolution

Start with the Raw Text

## (1) Determine all **Named Entities**

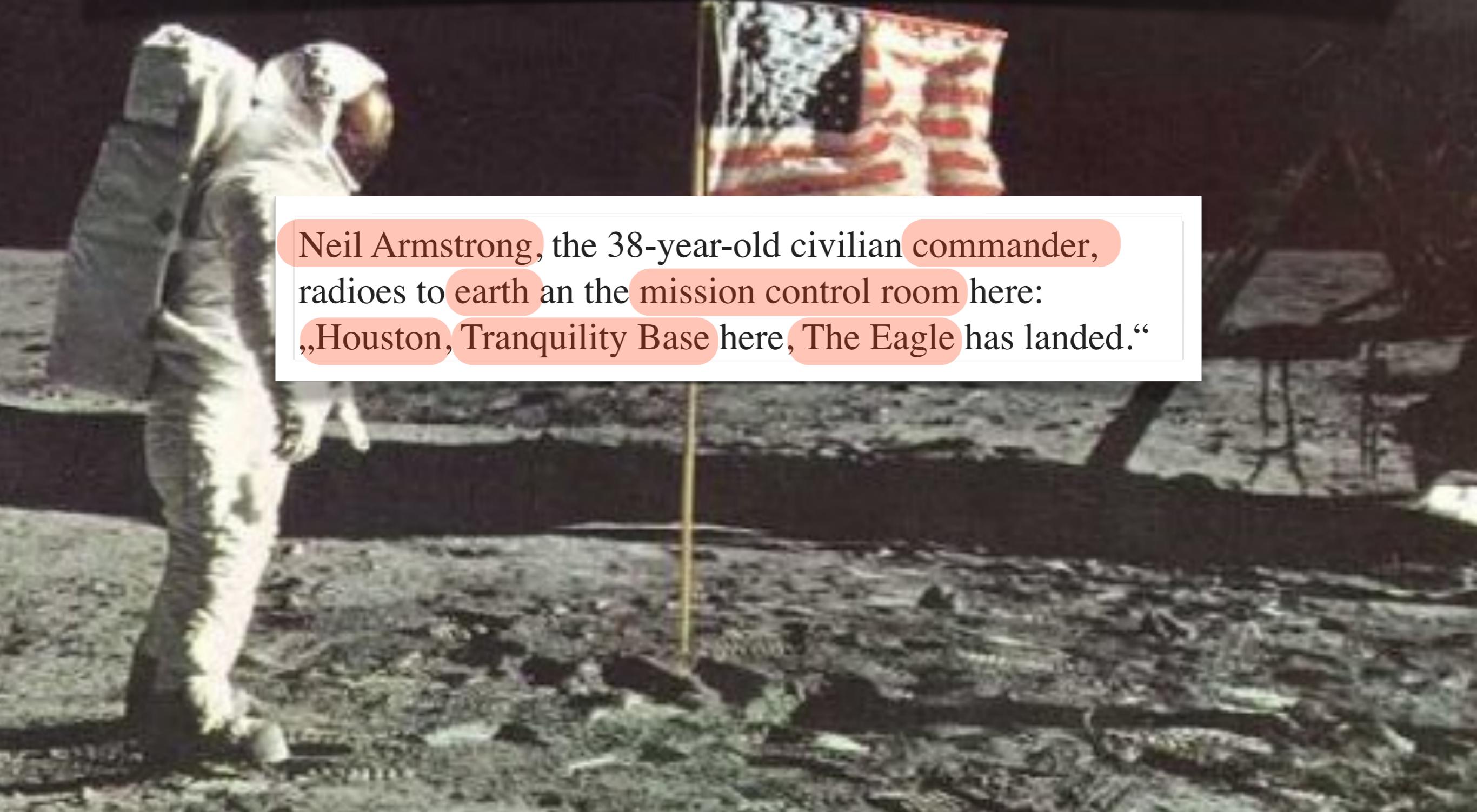
Neil Armstrong, the 38-year-old civilian commander,  
radioes to earth an the mission control room here:  
„Houston, Tranquility Base here, The Eagle has landed.“

### How to determine valid composita?

- ▶ test sequences of subsequent Named Entity candidates against a **dictionary**
  - consider the longest sequence found in dictionary
  - Dictionary: english.zip -> eng\_com.dic

# Task:

## Determine all Named Entities (correctly) from a given source text.



Neil Armstrong, the 38-year-old civilian commander, radios to earth an the mission control room here: „Houston, Tranquility Base here, The Eagle has landed.“

# Named Entity Resolution

Start with the Raw Text

- (1) Determine all **Named Entities**
- (2) Determine **Entity Type (Named Entity Recognition)**

Neil Armstrong, the 38-year-old civilian commander,  
radioes to earth an the mission control room here:  
,Houston,, Tranquility Base here, The Eagle has landed.“



person



organization



location



event

# Named Entity Resolution

Start with the Raw Text

- (1) Determine all **Named Entities**
- (2) Determine **Entity Type (Named Entity Recognition)**

Neil Armstrong, the 38-year-old civilian commander,  
radioes to earth an the mission control room here:  
,Houston,, Tranquility Base here, The Eagle has landed.“



person



organization



location



event

(1) <http://nlp.stanford.edu:8080/ner/>

# Named Entity Resolution

Start with the Raw Text

- (1) Determine all **Named Entities**
- (2) Determine **Entity Type (Named Entity Recognition)**

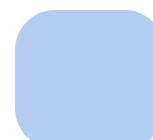
Neil Armstrong, the 38-year-old civilian commander,  
radioes to earth an the mission control room here:  
,Houston,, Tranquility Base here, The Eagle has landed.“



person



organization



location



event

- (1) <http://nlp.stanford.edu:8080/ner/>
- (2) <http://nerd.eurecom.fr/>

# Named Entity Resolution

Start with the Raw Text

- (1) Determine all **Named Entities**
- (2) Determine **Entity Type (Named Entity Recognition)**
- (3) Determine all possible **mappings for entity candidates**

Neil Armstrong

About: [Neil Armstrong](#)

An Entity of Type : [NASA](#), from Named Graph : <http://dbpedia.org>, within Data Space : [dbpedia.org](#)



Neil Alden Arm

Property

dbpedia-owl:As

dbpedia-owl:at

About: [Neil Armstrong \(ice hockey\)](#)

An Entity of Type : [agent](#), from Named Graph : <http://dbpedia.org>, within Data Space : [dbpedia.org](#)



Neil Armstrong (born December 20, 1932, in Plympton, Ontario) is a former professional ice hockey linesman, and is an Honoured Member of the Hockey Hall of Fame.

Property

dbpedia-owl:abstract

Value

- Neil Armstrong ist ein ehemaliger kanadischer Eishockey-Schiedsrichter in der National Hockey League (NHL). Armstrong begann seine Karriere 1957 und nahm an mehr Spielen teil als Gordie Howe. Insgesamt waren es in 22 Jahren 1.744. In seiner Jugend begann er zunächst normal Eishockey zu spielen, wobei klar war, dass er nicht in der NHL würde spielen können. Es bot sich ihm jedoch die Gelegenheit, Schiedsrichter zu werden, und so konnte er doch in dieser Liga arbeiten. Er stieg sehr schnell auf und wurde 1973 in Detroit dafür geehrt, dass er sein 1314tes Spiel leitete und den bis dahin von George Hayes gehaltenen Rekord durchbrach. 1978 zog er sich aus dem aktiven Sport zurück und wurde Talentscout bei den Montréal Canadiens. Sein Verdienst für den Sport wurde 1991 mit der Aufnahme in die Hockey Hall of Fame gewürdigt.
- Neil Armstrong (born December 20, 1932, in Plympton, Ontario) is a former professional ice hockey linesman, and is an Honoured Member of the Hockey Hall of Fame.

dbpedia-owl:birthDate

▪ 1932-12-20 (xsd:date)

dbpedia-owl:birthName

▪ Neil Armstrong

dbpedia-owl:birthPlace

▪ dbpedia:Ontario  
▪ dbpedia:Plympton-Wyoming

dbpedia-owl:birthYear

▪ 1932-01-01 00:00:00 (xsd:date)

dbpedia-owl:occupation

▪ dbpedia:Neil\_Armstrong\_(ice\_hockey)\_1  
▪ dbpedia:National\_Hockey\_League

dbpedia-owl:wikiPageID

▪ 1987461 (xsd:integer)

## About: Neil Armstrong

An Entity of Type : [NASA](#), from Named Graph : <http://dbpedia.org>, within Data Space : [dbpedia.org](#)



Neil Alden Armstrong ist ein ehemaliger amerikanischer Testpilot und Astronaut. Er betrat als erster Mensch den Mond.

Property	Value
<a href="#">dbpedia-owl:Astronaut/timeInSpace</a>	<ul style="list-style-type: none"><li>0.5166666666666667</li><li>12372.0</li></ul>
<a href="#">dbpedia-owl:abstract</a>	<ul style="list-style-type: none"><li>Neil Alden Armstrong ist ein ehemaliger amerikanischer Testpilot und Astronaut. Er betrat als erster Mensch den Mond.</li><li>Neil Alden Armstrong (born August 5, 1930) is an American aviator and former astronaut, test pilot, aerospace engineer, university professor, and United States Naval Aviator. He was the first person to set foot on the Moon. Before becoming an astronaut, Armstrong was in the United States Navy and served in the Korean War. After the war, he served as a test pilot at the National Advisory Committee for Aeronautics (NACA) High-Speed Flight Station, now known as the Dryden Flight Research Center, where he flew over 900 flights in a variety of aircraft. As a research pilot, Armstrong served as project pilot on the F-100 Super Sabre A and C variants, F-101 Voodoo, and the Lockheed F-104A Starfighter. He also flew the Bell X-1B, Bell X-5, North American X-15, F-105 Thunderchief, F-106 Delta Dart, B-47 Stratojet, KC-135 Stratotanker and Paresev. He graduated from Purdue University and the University of Southern California. A participant in the U.S. Air Force's Man In Space Soonest and X-20 Dyna-Soar human spaceflight programs, Armstrong joined the NASA Astronaut Corps in 1962. His first spaceflight was the NASA Gemini 8 mission in 1966, for which he was the command pilot, becoming one of the first U.S. civilians to fly in space. On this mission, he performed the first manned docking of two spacecraft with pilot David Scott. Armstrong's second and last spaceflight was as mission commander of the Apollo 11 moon landing mission on July 20, 1969. On this mission, Armstrong and Buzz Aldrin descended to the lunar surface and spent 2½ hours exploring while Michael Collins remained in orbit in the Command Module. For his spaceflights, Armstrong received the Congressional Space Medal of Honor.</li><li>Neil Alden Armstrong es un ex astronauta de la NASA y el primer ser humano en pisar la Luna el 21 de julio de 1969, en la misión del Apolo 11.</li><li>Neil Alden Armstrong on entinen yhdysvaltalainen astronautti ja ensimmäinen Kuun pinnalla kävellyt ihmisen. Hän oli myös ensimmäinen ihminen joka on kävellyt vieraalla taivaankappaleella. Nykyisin hän on eläkkeellä. Neil Armstrong syntyi Wapakonetassa, Ohiossa Stephen Koenig Armstrongin ja Viola Louise Engelin perheeseen. Hänenä on skotlantilais-irlantilaiset ja saksalaiset sukujuuret. Isä Stephen työskenteli Ohion hallinnolle ja perhe muutti isän perässä toistuvasti 15 vuoden ajan asuen kahdessa kymmenessä eri kaupungissa. Perheessä oli myös sisiko June ja velli Dean. Neil Armstrong oli naimisissa ja hänellä on kaksi poikaa. Hän oli nuorena innokas partiolainen.</li><li>Armstrong nacque in Ohio figlio di Stephen Koenig Armstrong e Viola Louise Engel, famiglia di origine tedesca. Combatté come pilota di jet per la marina militare americana nella guerra di Corea. Ha frequentato la Purdue University, dove si laureò in ingegneria aeronautica nel 1955. Diventò pilota civile e per la NASA testò l'X-15, in grado di raggiungere i 6.401 km/h. Fu selezionato come astronauta, sempre dalla NASA, nel 1962. Per il Programma Gemini comandò la missione Gemini 8, che fu la prima che vide l'aggancio di due oggetti orbitanti, nel 1966, ma subito dopo l'aggancio la missione fu interrotta a causa di un malfunzionamento dei propulsori di manovra. Nel 1968 fu comandante dell'equipaggio di riserva nella missione Apollo 8, che prevedeva anche orbite lunari. Il 6 maggio 1969 sfuggì alla morte in un incidente durante una esercitazione con il simulatore volante LLRV (Lunar Landing Research Vehicle). Nel luglio 1969, Armstrong comandò la missione di allunaggio Apollo 11. Durante la fase di avvicinamento, Armstrong prese i controlli manuali del modulo lunare (LM) Eagle e lo pilotò fuori da una zona particolarmente rocciosa. Le sue prime parole furono: « Houston, Tranquillity </li></ul>

**Exercise:**  
**Which information from DBpedia can be used to determine all candidate DBpedia entities for a given text (representing an entity).**

# Semantic Analysis

Named Entity Resolution



## Determine possible **Entity Candidates**

- we need a **Dictionary** that maps **semantic entities** to **all possible names**
- in DBpedia exist ca. **50 different properties** expressing names

rdfs:label	11,137,237
foaf:name	2,887,706
foaf:surname	981,923
dbpedia-owl:alias	42,543
dbpedia-owl:birthName	45,324
dbpedia-owl:formerName	20,137
dbpprop:commonName	3,847
dbpprop:conventionalLongName	3,787
dbpprop:alternateName	5,311
dbpprop:alternateNames	973
dbpprop:altName	894
dbpprop:fullname	141,961
dbpprop:formerName	780
dbpprop:formerNames	6,843
dbpprop:fullName	7,269
dbpprop:name	3,409,906
dbpprop:names	10,957
dbpprop:altNames	11,469
dbpprop:altname	3,105
dbpprop:alternativeNames	70,527
dbpedia-owl:longName	386
dbpprop:othername	6,222
dbpprop:othernames	8,773
dbpprop:otherNames	9,349

# Semantic Analysis

Named Entity Resolution

## Determine possible Entity Candidates

- we need a **Dictionary** that maps **semantic entities** to **entity candidates**
- in DBpedia exist ca. **50 different properties** (see table)

dbpedia-owl:formerName	26,137
dbpprop:commonName	3,847
dbpprop:conventionalLongName	3,787
dbpprop:alternateName	5,311
dbpprop:alternateNames	973
dbpprop:altName	894
dbpprop:fullname	141,961
dbpprop:formerName	780
dbpprop:formerNames	6,843
dbpprop:fullName	7,269
dbpprop:name	3,409,906
dbpprop:names	10,957
dbpprop:altNames	11,469
dbpprop:altname	3,105
dbpprop:alternativeNames	70,527
dbpedia-owl:longName	386
dbpprop:othername	6,222
dbpprop:othernames	8,773
dbpprop:otherNames	9,349
dbpprop:alias	16,990
dbpprop:nickname	45,394
dbpprop:nicknames	1,793
dbpprop:nativeNameLang	16,188
dbpprop:nativeName	79,660
dbpprop:officialName	188,622
dbpprop:conventionalLongName	3,783
dbpprop:eventName	1,154
dbpprop:latinName	703
dbpprop:carName	649
dbpprop:shipNickname	514
dbpprop:showName	30,225
dbpprop:realName	3,023
dbpprop:realname	2,516
dbpprop:nonProfitName	2,292
dbpprop:nameNative	1,903
dbpprop:cartoonName	1,462
dbpprop:oldname	1,422
dbpprop:shortname	1,003

# Semantic Analysis

## Named Entity Resolution

### Determine possible **Entity Candidates**

- we need a **Dictionary** that maps **semantic entities** to **entity candidates**
- in DBpedia exist ca. **50 different properties** to map names
  - + URI suffixes (/Neil\_Armstrong)
  - in DBpedia there are ca. **40 million names** for 9 million entities

dbpedia-owl:commonName	26,167
dbpprop:commonName	3,847
dbpprop:conventionalLongName	3,787
dbpprop:alternateName	5,311
dbpprop:alternateNames	973
dbpprop:altName	894
dbpprop:fullname	141,961
dbpprop:formerName	780
dbpprop:formerNames	6,843
dbpprop:fullName	7,269
dbpprop:name	3,409,906
dbpprop:names	10,957
dbpprop:altNames	11,469
dbpprop:altname	3,105
dbpprop:alternativeNames	70,527
dbpedia-owl:longName	386
dbpprop:othername	6,222
dbpprop:othernames	8,773
dbpprop:otherNames	9,349
dbpprop:alias	16,990
dbpprop:nickname	45,394
dbpprop:nicknames	1,793
dbpprop:nativeNameLang	16,188
dbpprop:nativeName	79,660
dbpprop:officialName	188,622
dbpprop:conventionalLongName	3,783
dbpprop:eventName	1,154
dbpprop:latinName	703
dbpprop:carName	649
dbpprop:shipNickname	514
dbpprop:showName	30,225
dbpprop:realName	3,023
dbpprop:realname	2,516
dbpprop:nonProfitName	2,292
dbpprop:nameNative	1,903
dbpprop:cartoonName	1,462
dbpprop:oldname	1,422
dbpprop:shortname	1,003

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## DBpedia 3.9 Downloads

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This page provides downloads of the DBpedia datasets. The DBpedia datasets are licensed under the terms of the [Creative Commons Attribution-ShareAlike License](#) and the [GNU Free Documentation License](#).  The downloads are provided as N-Triples and N-Quads, where the N-Quads version contains additional provenance information for each statement. All files are [bzip2](#) <sup>1</sup> packed. In addition to the RDF version of the data, we also provide a tabular version of some of the core DBpedia data sets as CSV and JSON files. See [DBpediaAsTables](#).

Older Versions: [DBpedia 3.8](#), [DBpedia 3.7](#), [DBpedia 3.6](#), [DBpedia 3.5.1](#), [DBpedia 3.5](#), [DBpedia 3.4](#), [DBpedia 3.3](#), [DBpedia 3.2](#), [DBpedia 3.1](#), [DBpedia 3.0](#), [DBpedia 3.0RC](#), [DBpedia 2.0](#)

See also the [change log](#) for recent changes and developments.

### Contents

- [1. Wikipedia Input Files](#)
- [2. Ontology](#)
- [3. Canonicalized Datasets](#)
- [4. Localized Datasets](#)
- [5. Links to other datasets](#)
- [6. Dataset Descriptions](#)
- [7. NLP Datasets](#)

## 1. Wikipedia Input Files

The datasets were extracted from [Wikipedia dumps](#) generated in late March / early April 2013. We used a [Wikidata](#) cross-language link dump from June 2013 to interconnect concepts between languages. See also all [specific dump dates and times](#).

## 2. Ontology

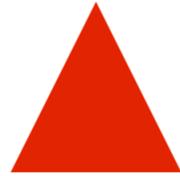
# Semantic Analysis

Named Entity Resolution



Determine possible **Entity Candidates**

[http://dbpedia.org/resource/Neil\\_Armstrong\\_\(disambiguation\)](http://dbpedia.org/resource/Neil_Armstrong_(disambiguation))



[http://dbpedia.org/resource/Neil\\_Armstrong\\_%28disambiguation%29](http://dbpedia.org/resource/Neil_Armstrong_%28disambiguation%29)



“Neil Armstrong”

# Semantic Analysis

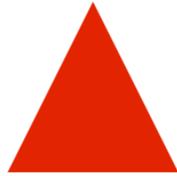
Named Entity Resolution



## Determine possible **Entity Candidates**

- URI suffixes

`http://dbpedia.org/resource/Neil_Armstrong_(disambiguation)`



`http://dbpedia.org/resource/Neil_Armstrong_%28disambiguation%29`



“Neil Armstrong”

# Semantic Analysis

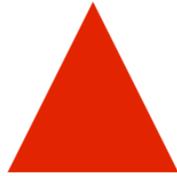
Named Entity Resolution



## Determine possible **Entity Candidates**

- URI suffixes

`http://dbpedia.org/resource/Neil_Armstrong_(disambiguation)`



`http://dbpedia.org/resource/Neil_Armstrong_%28disambiguation%29`



“Neil Armstrong”

- huge text files are easier transformed with UNIX command line tools:
  - `tr`, `sed`, `awk`

Unfortunately,  
DBpedia  
doesn't make it  
so simple for  
you...

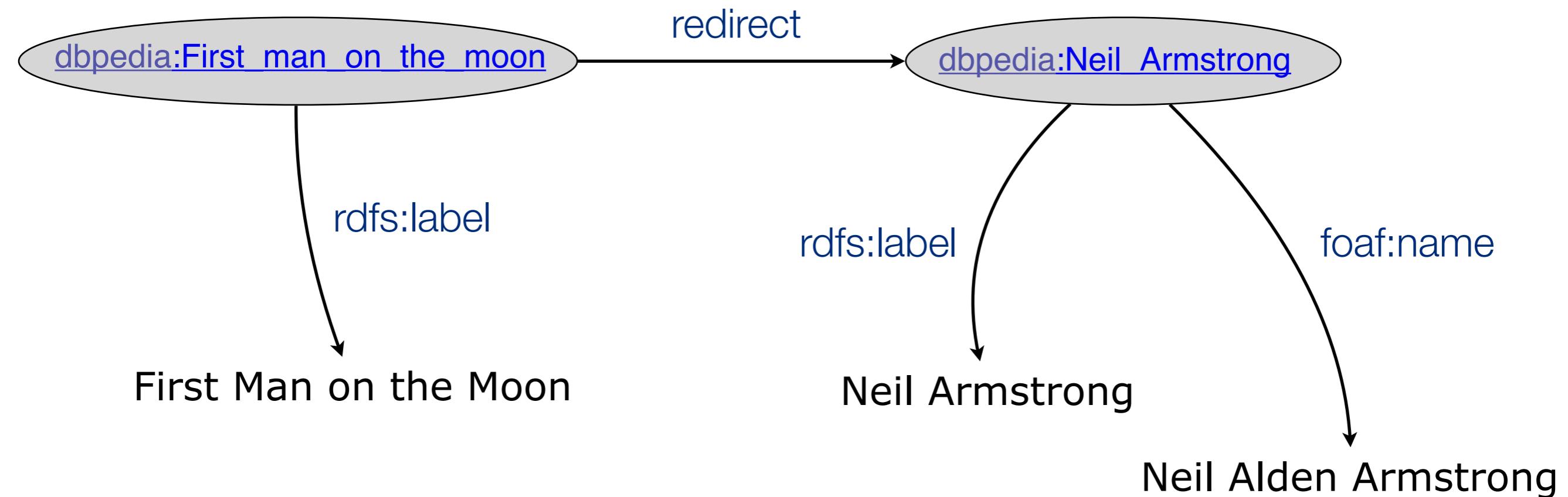
# Semantic Analysis

Named Entity Resolution



## Determine possible **Entity Candidates**

- **Synonyms:**
  - redirects via dbpedia-owl:wikiPageRedirects



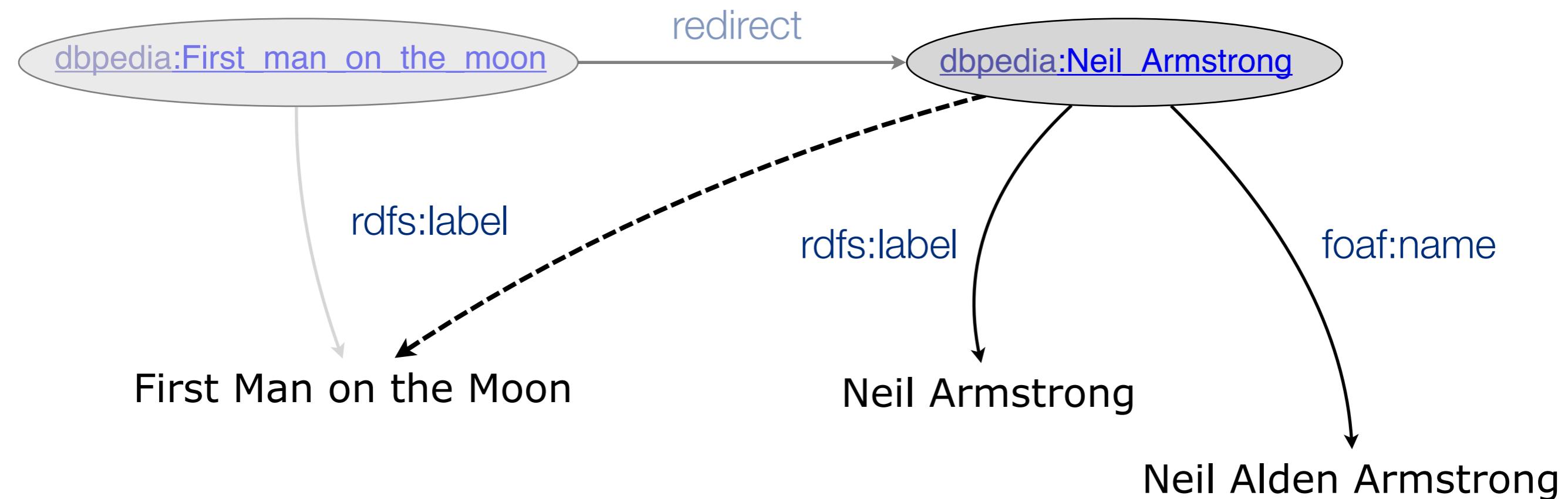
# Semantic Analysis

Named Entity Resolution



## Determine possible **Entity Candidates**

- **Synonyms:**
  - redirects via dbpedia-owl:wikiPageRedirects



# Semantic Analysis

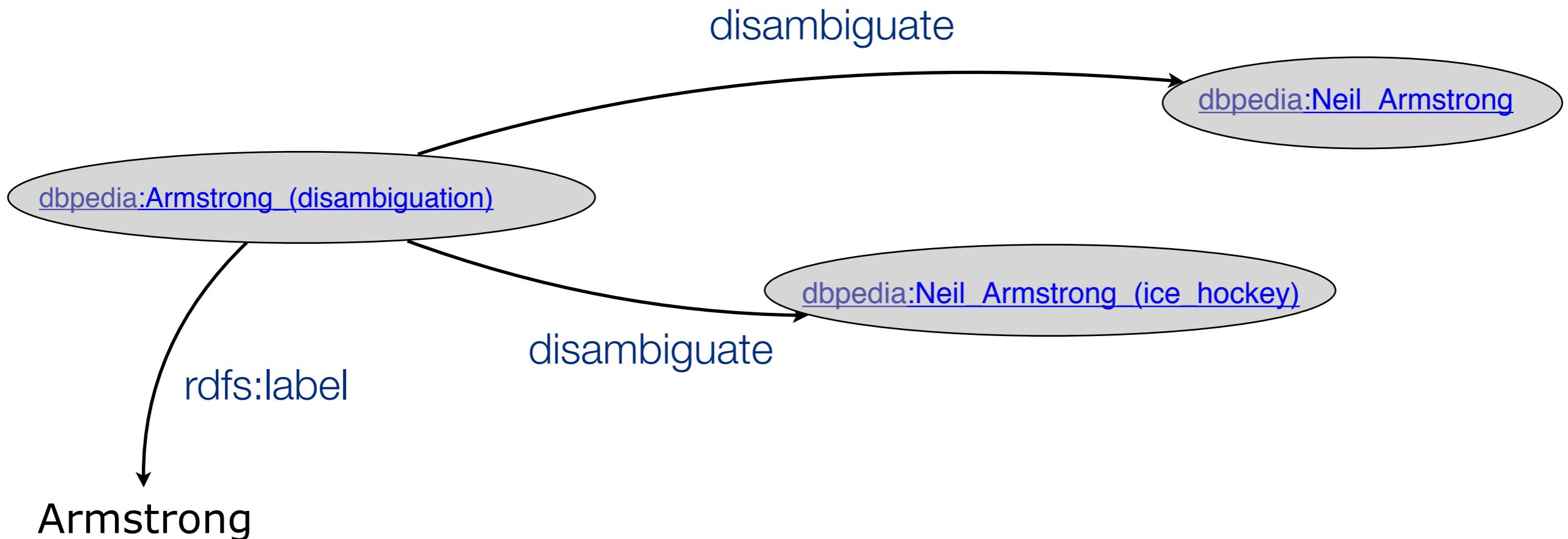
Named Entity Resolution



## Determine possible **Entity Candidates**

- **Homonyms:**

- disambiguation pages via  
`dbpedia-owl:wikiPageDisambiguates`



# Semantic Analysis

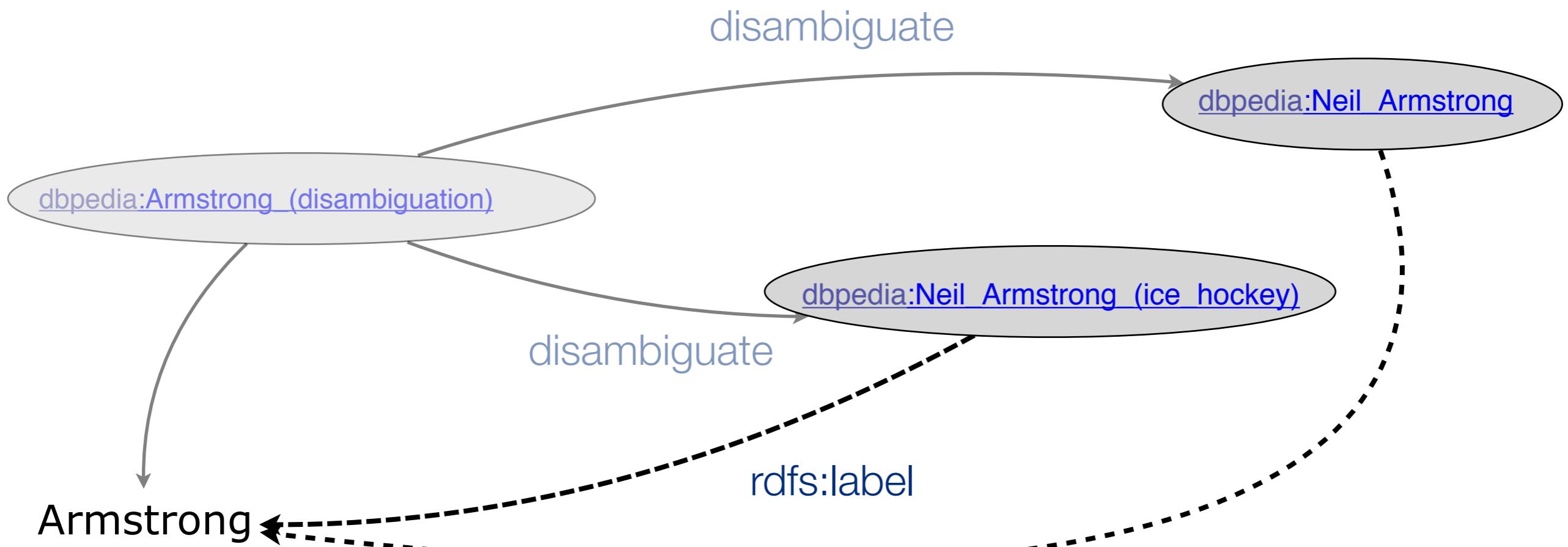
## Named Entity Resolution



## Determine possible **Entity Candidates**

- **Homonyms:**

- disambiguation pages via  
`dbpedia-owl:wikiPageDisambiguates`



It is even more  
complicated...

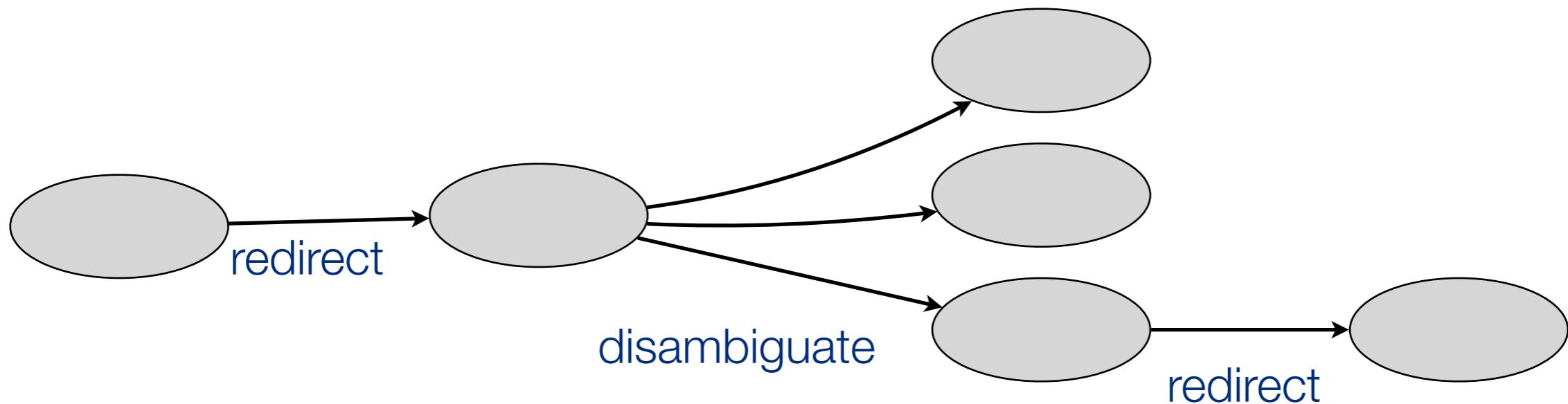
# Semantic Analysis

Named Entity Resolution



## Determine possible **Entity Candidates**

- **Resolve** Chains and Circles



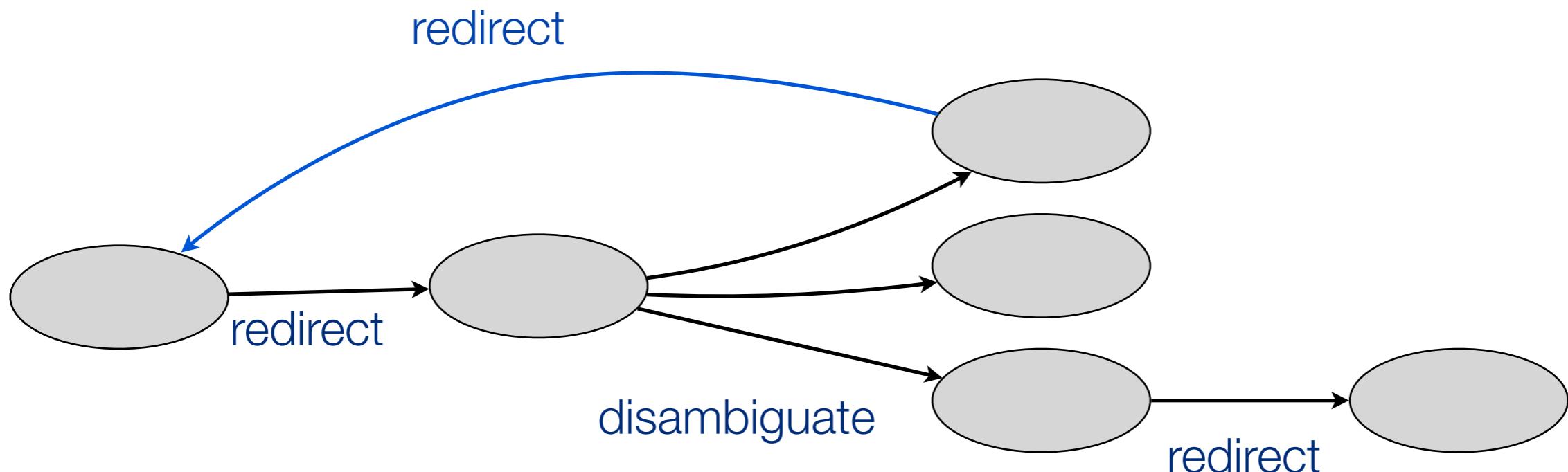
# Semantic Analysis

Named Entity Resolution



## Determine possible **Entity Candidates**

- **Resolve** Chains and Circles



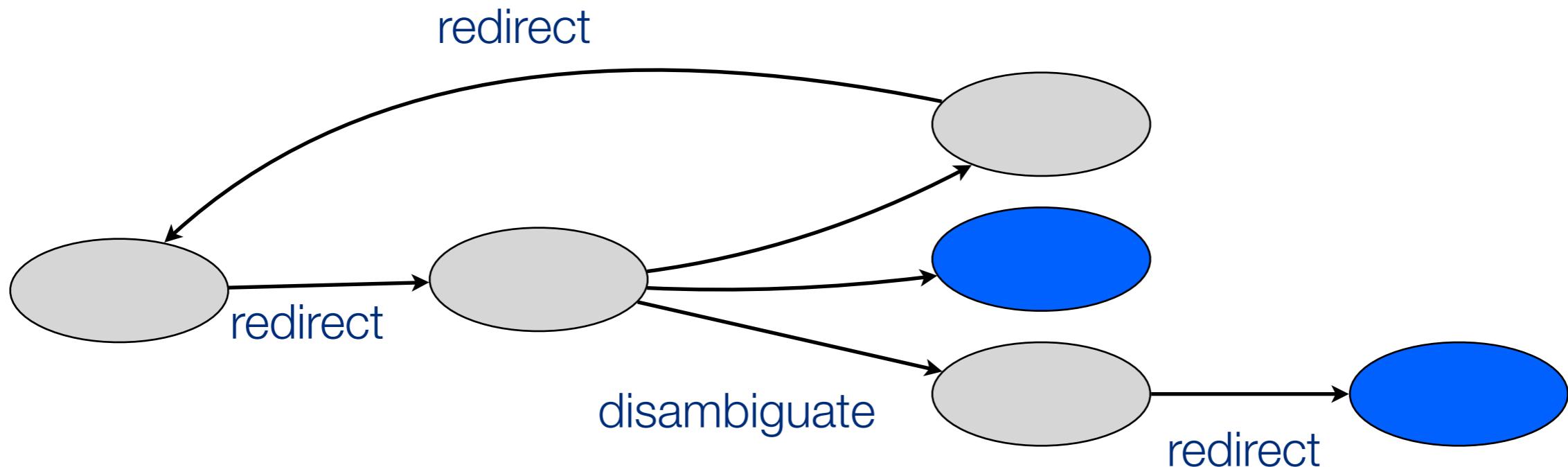
# Semantic Analysis

Named Entity Resolution



## Determine possible **Entity Candidates**

- **Resolve** Chains and Circles
- Collect all name references from redirect & disambiguation paths in the leaf nodes



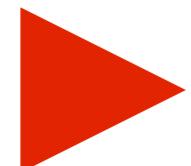
# Named Entity Resolution

Start with the Raw Text

- (1) Determine all **Named Entities**
- (2) Determine **Entity Type (Named Entity Recognition)**
- (3) Determine all possible **mappings for entity candidates**

text

Neil Armstrong

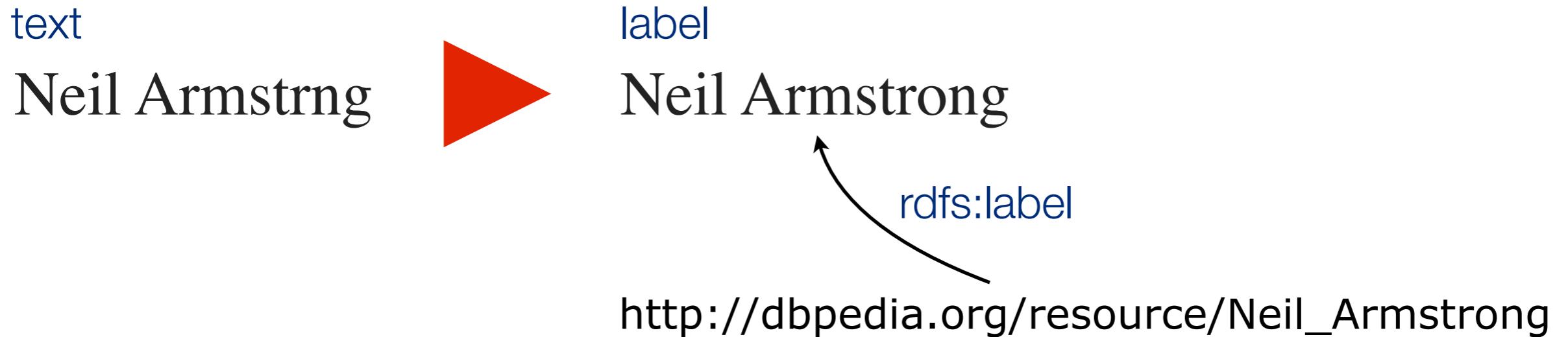


all labels for all DBpedia entities



**exact** string mapping vs. **fuzzy** mapping

# Fuzzy String Matching



- (1) Determine **String Similarity**
- (2) Match according to previously defined **Threshold**
- or
- (3) Apply **String normalization** to both text and label

# String Similarity Measures



- (1) Levenshtein Distance
- (2) Jaro-Winkler Distance
- (3) String Normalization via Stemming / Lemmatization

## (1) Levenshtein Distance

- Levenshtein distance between two words is the **minimum number of single-character edits**, i.e. insertions, deletions or substitutions required to change one word into the other
- Example:
  - determine Levenshtein Distance (**Armttrng**,**Armstrong**)
  - **Armttrng** → **Armstrng** (substitution of "s" for "t")
  - **Armstrng** → **Armstrong** (insertion of "o")
- 2 edit operations:  
Levenshtein Distance (**Armttrng**,**Armstrong**) = 2

## (2) Jaro-Winkler Distance

- designed and best suited for short strings such as **person names**
- normalized score: 0 equates to no similarity and 1 is an exact match.
- For two given strings  $s_1$  and  $s_2$ , the Jaro distance  $d_j$  is

$$d_j = \begin{cases} 0 & \text{if } m = 0 \\ \frac{1}{3} \left( \frac{m}{|s_1|} + \frac{m}{|s_2|} + \frac{m-t}{m} \right) & \text{otherwise} \end{cases}$$

$m$  is the number of **matching characters**  
 $t$  is half the number of **transpositions**

- match only if  $d_j \leq \left\lfloor \frac{\max(|s_1|, |s_2|)}{2} \right\rfloor - 1$

## (2) Jaro-Winkler Distance

- in addition, Jaro-Winkler gives a preference **boost**  $p$  for matching **prefixes**

$$d_w = d_j + (\ell p(1 - d_j))$$

where  $\ell$  is the **length of a matching prefix**

## (2) Jaro-Winkler Distance

- Example:

Given the strings **MARTHA** and **MARHTA** we find:

- $m=6$  (matching characters)
- $|s_1|=6$  (length  $s_1$ )
- $|s_2|=6$  (length  $s_2$ )
- mismatching characters **T/H** and **H/T**
- $t = 2/2 = 1$  (half the number of transpositions)
- Jaro:  $d_j = 1/3 (6/6 + 6/6 + (6-1)/6) = 0.944$
- Jaro-Winkler:  $d_w = 0.944 + (3 * 0.1(1 - 0.944)) = 0.961$   
with  $l=3$ ,  $p=0.1$

## (3) String Normalization

- process for reducing inflected (or sometimes derived) words to their stem, base or root form
  - e.g. cats → cat  
fishing → fish
- various algorithms available for
  - suffix stripping
  - lemmatisation
  - n-gram analysis, stochastic algorithms, etc.

# Determine possible **Entity Candidates**



## Task:

Try to determine all possible entities from list of labels for the example text.

Neil Armstrong, the 38-year-old civilian commander, radios to earth an the mission control room here:  
„Houston, Tranquility Base here, The Eagle has landed.“

# The Rest of the Mapping Process

# Semantic Analysis

## Named Entity Resolution

Text

Neil Armstrong, he 38-year-old civilian commander,  
radios to earth an the mission control room here:  
,Houston, Tranquility Base here, The Eagle has landed.“



Determine possible **Entity Candidates**

CandidateResources
<a href="http://wikidata.dbpedia.org/resource/Q1615">http://wikidata.dbpedia.org/resource/Q1615</a>
<a href="http://dbpedia.org/resource/Neil_Armstrong">http://dbpedia.org/resource/Neil_Armstrong</a>
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<a href="http://dbpedia.org/resource/Neil_Armstrong_Lunar_Outpost">http://dbpedia.org/resource/Neil_Armstrong_Lunar_Outpost</a>

- linguistic analysis (POS tagging)
- n-gram analysis
- normalization (stemming)
- encoding and spelling
- language dependent spellings
- abbreviations & acronyms
- type dependent spellings
- alternative names and synonyms
- fuzzy string mapping
- ...

# Semantic Analysis

## Named Entity Resolution

Text

**Neil Armstrong**, the 38-year-old civilian commander,  
radioes to earth an the mission control room here:  
,**Houston, Tranquility Base** here, The Eagle has landed.“



## Subsequent Filtering of **Entity Candidates**

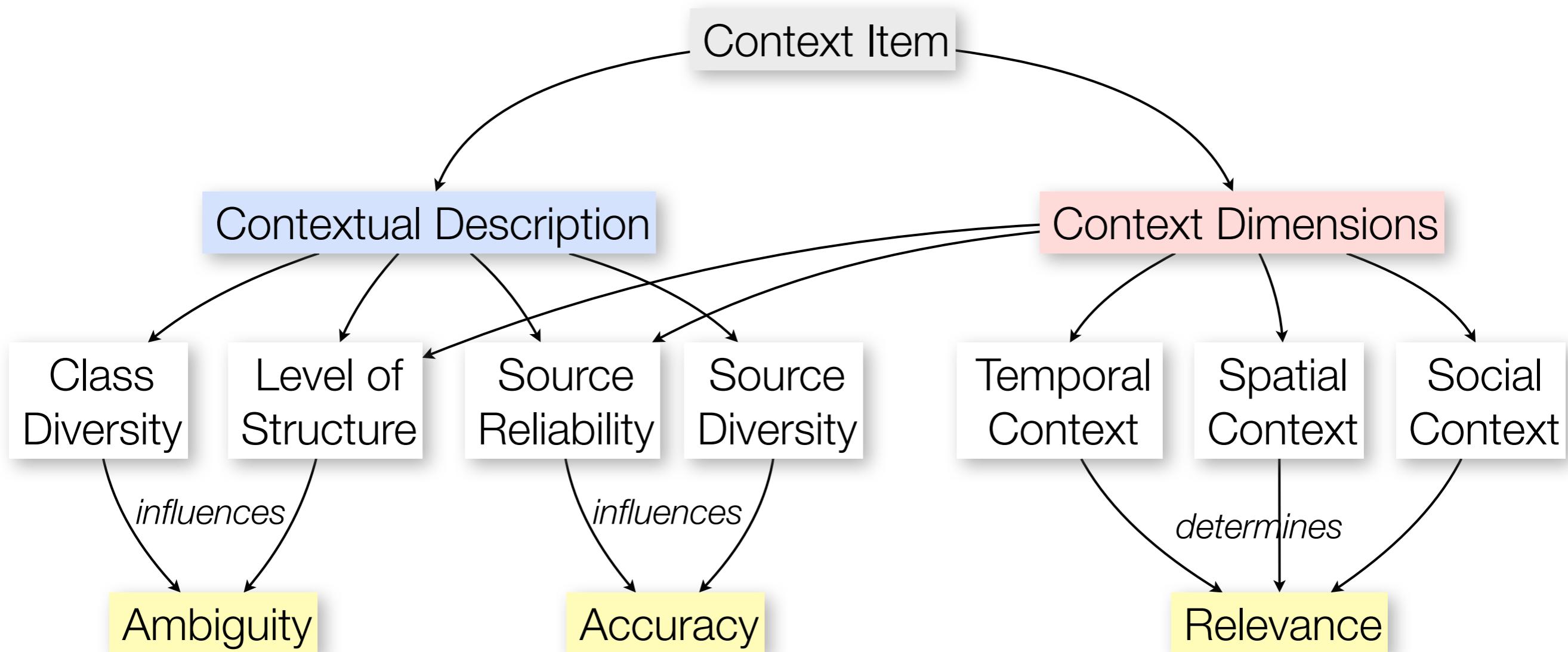
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- **Named Entity Tagging**
- **Persons**
- **Locations**
- **Organization**
- Time
- Date
- Money
- ...



### (3) Disambiguation of Correct Entity

- Which entity candidate to choose depends on the context
- **Context Analysis**
  - takes into account **Ambiguity**, **Accuracy**, and **Reliability** of source data and mapping



# Semantic Analysis

## Named Entity Resolution



Hasso  
Plattner  
Institut

**Neil Armstrong**, the 38-year-old civilian commander,  
radios to earth an the mission control room here:  
„**Houston, Tranquility Base** here, The Eagle has landed.“

### Neil Armstrong

#### CandidateResources

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### Houston

#### CandidateResources

<a href="http://dbpedia.org/resource/Houston">http://dbpedia.org/resource/Houston</a>
<a href="http://dbpedia.org/resource/Houston_Texans">http://dbpedia.org/resource/Houston_Texans</a>
<a href="http://dbpedia.org/resource/Houston,_Delaware">http://dbpedia.org/resource/Houston,_Delaware</a>
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<a href="http://dbpedia.org/resource/Houston_County">http://dbpedia.org/resource/Houston_County</a>
<a href="http://dbpedia.org/resource/Houston_Rockets">http://dbpedia.org/resource/Houston_Rockets</a>
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<a href="http://dbpedia.org/resource/Houston_(disambiguation)">http://dbpedia.org/resource/Houston_(disambiguation)</a>
<a href="http://dbpedia.org/resource/Category:Houston_Aeros_players">http://dbpedia.org/resource/Category:Houston_Aeros_players</a>
<a href="http://dbpedia.org/resource/Category:Houston_Colt_45s_players">http://dbpedia.org/resource/Category:Houston_Colt_45s_players</a>
<a href="http://dbpedia.org/resource/Houston_County,_Minnesota">http://dbpedia.org/resource/Houston_County,_Minnesota</a>
<a href="http://dbpedia.org/resource/Category:Houston_County,_Minnesota">http://dbpedia.org/resource/Category:Houston_County,_Minnesota</a>
<a href="http://dbpedia.org/resource/Houston_Independent_School_District">http://dbpedia.org/resource/Houston_Independent_School_District</a>
<a href="http://dbpedia.org/resource/Houston_Symphony">http://dbpedia.org/resource/Houston_Symphony</a>
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<a href="http://dbpedia.org/resource/USS_Houston_(CA-30)">http://dbpedia.org/resource/USS_Houston_(CA-30)</a>
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<a href="http://dbpedia.org/resource/Category:Houston_Astros_managers">http://dbpedia.org/resource/Category:Houston_Astros_managers</a>
<a href="http://dbpedia.org/resource/Category:Houston_Astros_players">http://dbpedia.org/resource/Category:Houston_Astros_players</a>
<a href="http://dbpedia.org/resource/Category:Houston_County,_Alabama">http://dbpedia.org/resource/Category:Houston_County,_Alabama</a>

### Tranquility Base

#### CandidateResources

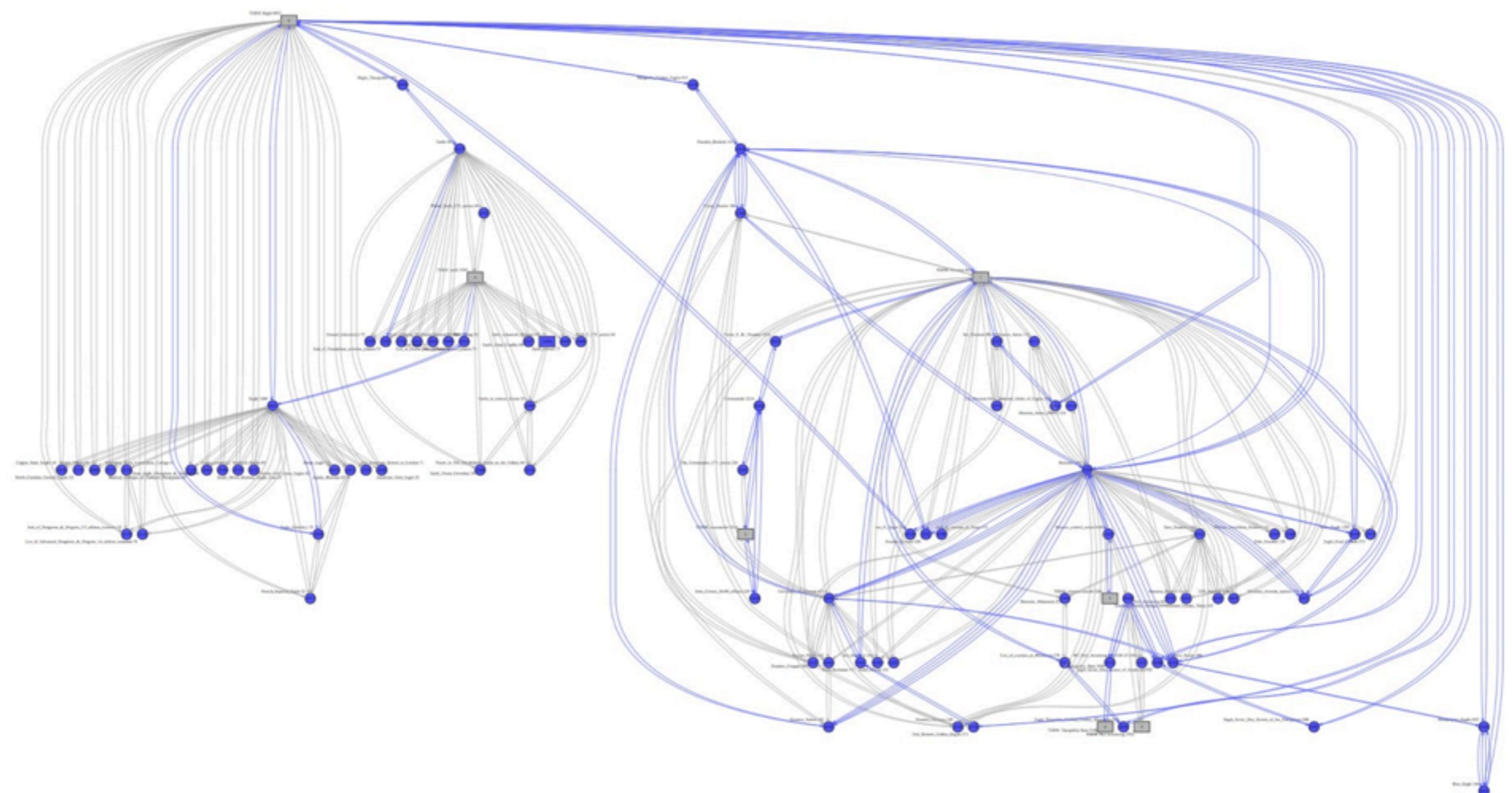
<a href="http://dbpedia.org/resource/Tranquility_Base">http://dbpedia.org/resource/Tranquility_Base</a>
<a href="http://wikidata.dbpedia.org/resource/Q732758">http://wikidata.dbpedia.org/resource/Q732758</a>

3,096 distinct entities

# (3) Disambiguation of Correct Entity

- Link Graph Analysis

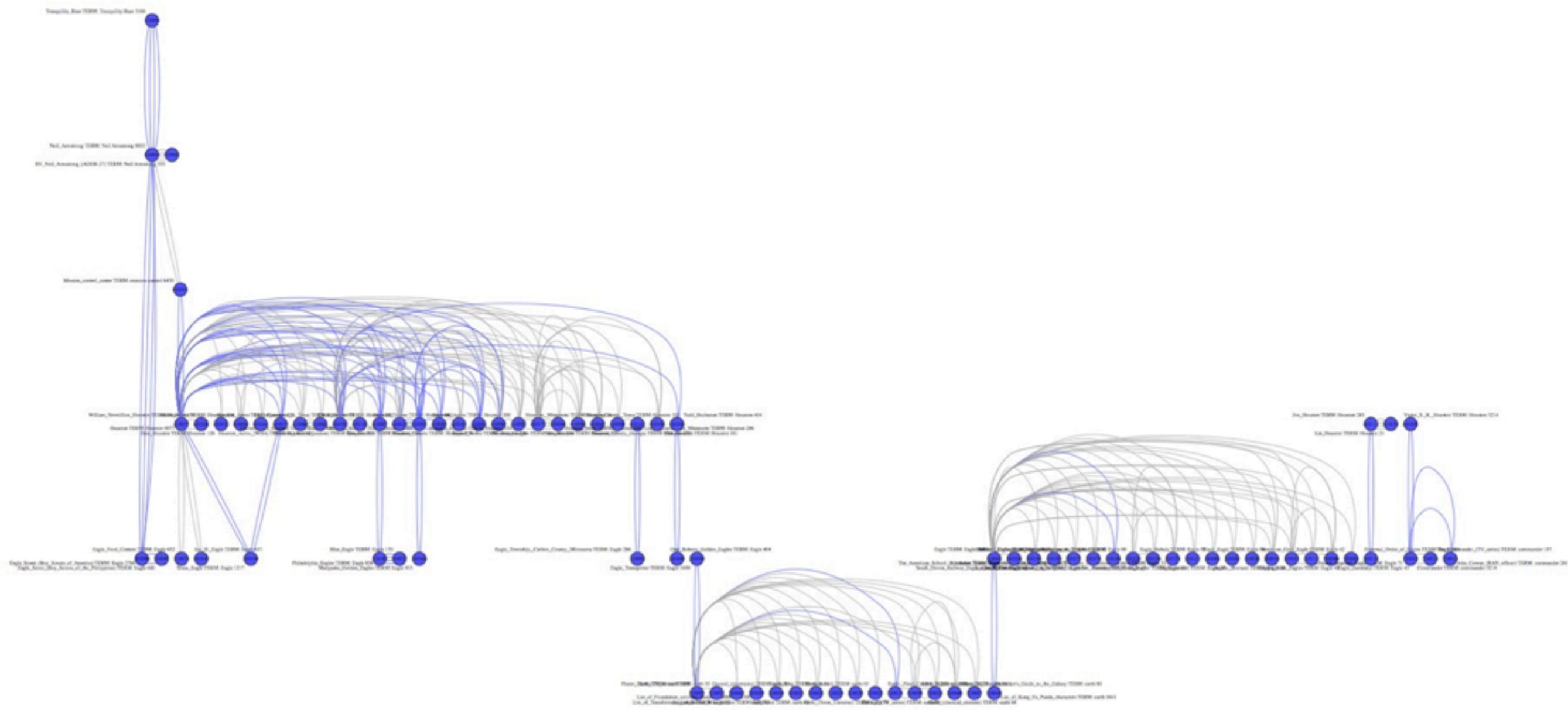
**Neil Armstrong**, the 38-year-old civilian **commander**,  
radios to **earth** an the **mission control room** here:  
**„Houston, Tranquility Base here, The Eagle has landed.“**



# (3) Disambiguation of Correct Entity

- Link Graph Analysis

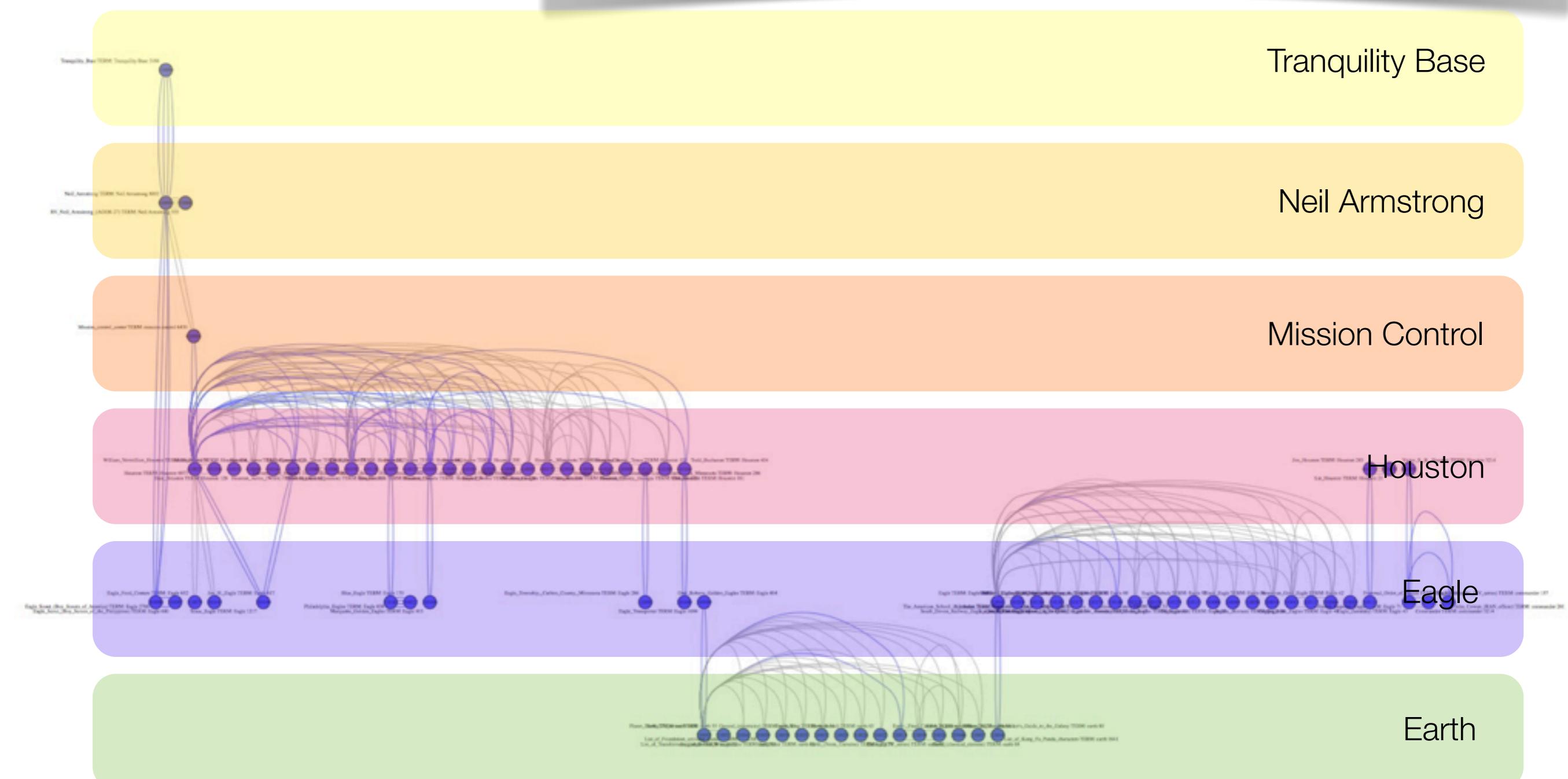
**Neil Armstrong**, the 38-year-old civilian **commander**,  
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# (3) Disambiguation of Correct Entity

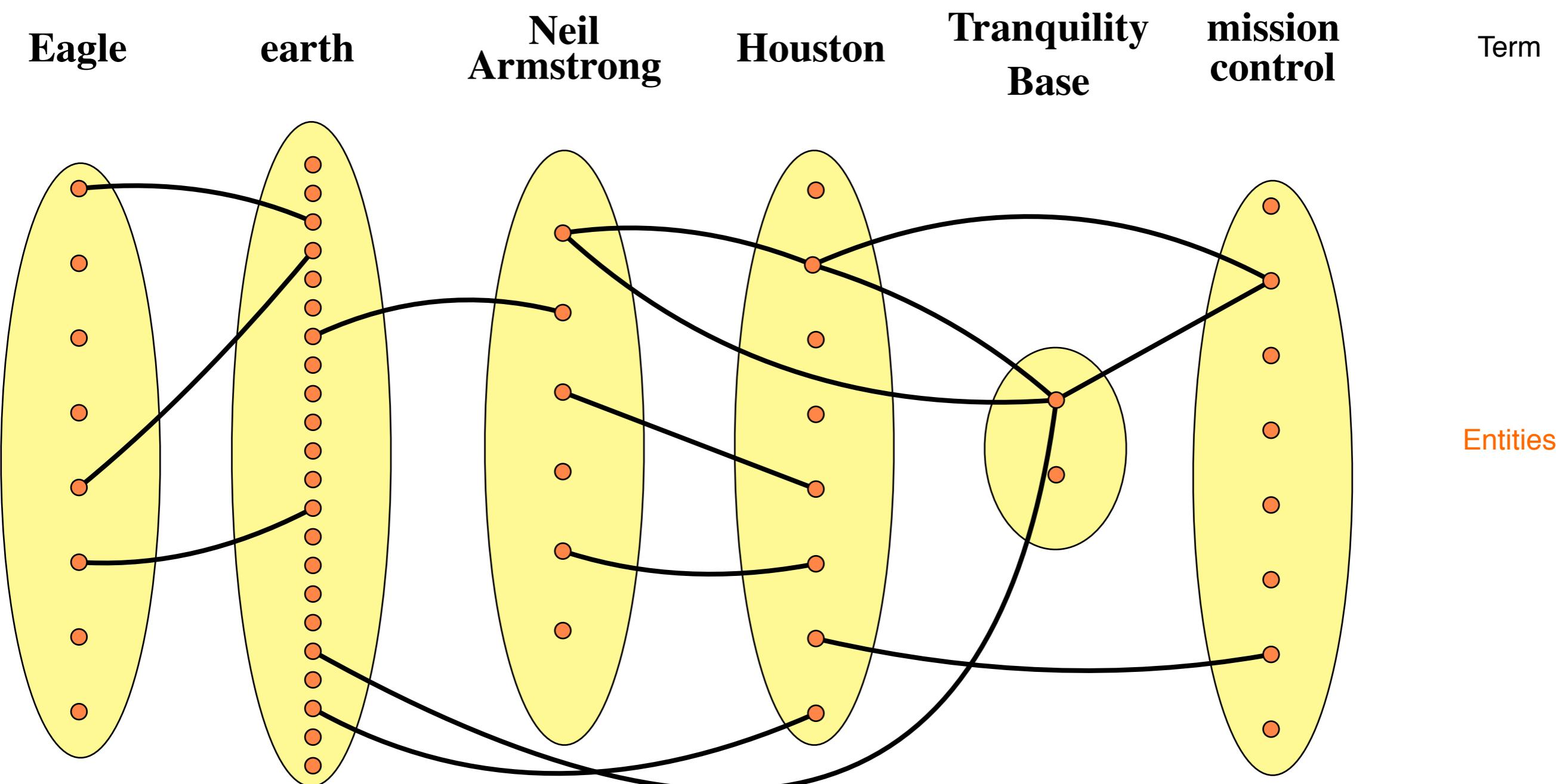
- Link Graph Analysis

**Neil Armstrong**, the 38-year-old civilian **commander**,  
 radios to **earth** an the **mission control** room here:  
**„Houston, Tranquility Base here, The Eagle has landed.“**



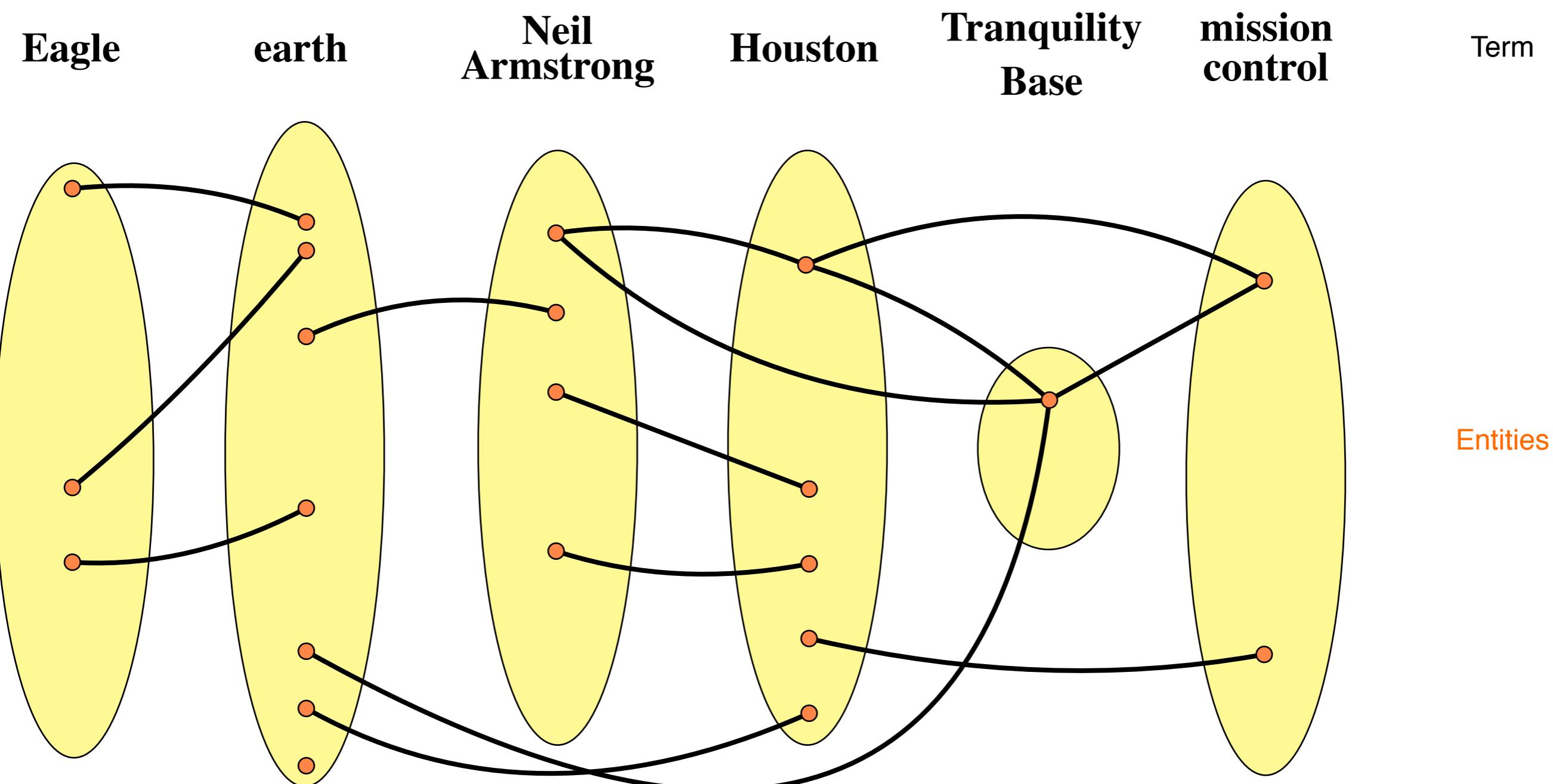
### (3) Disambiguation of Correct Entity

- **Link Graph Analysis**
- remove inner partition links
- identify **connected components**



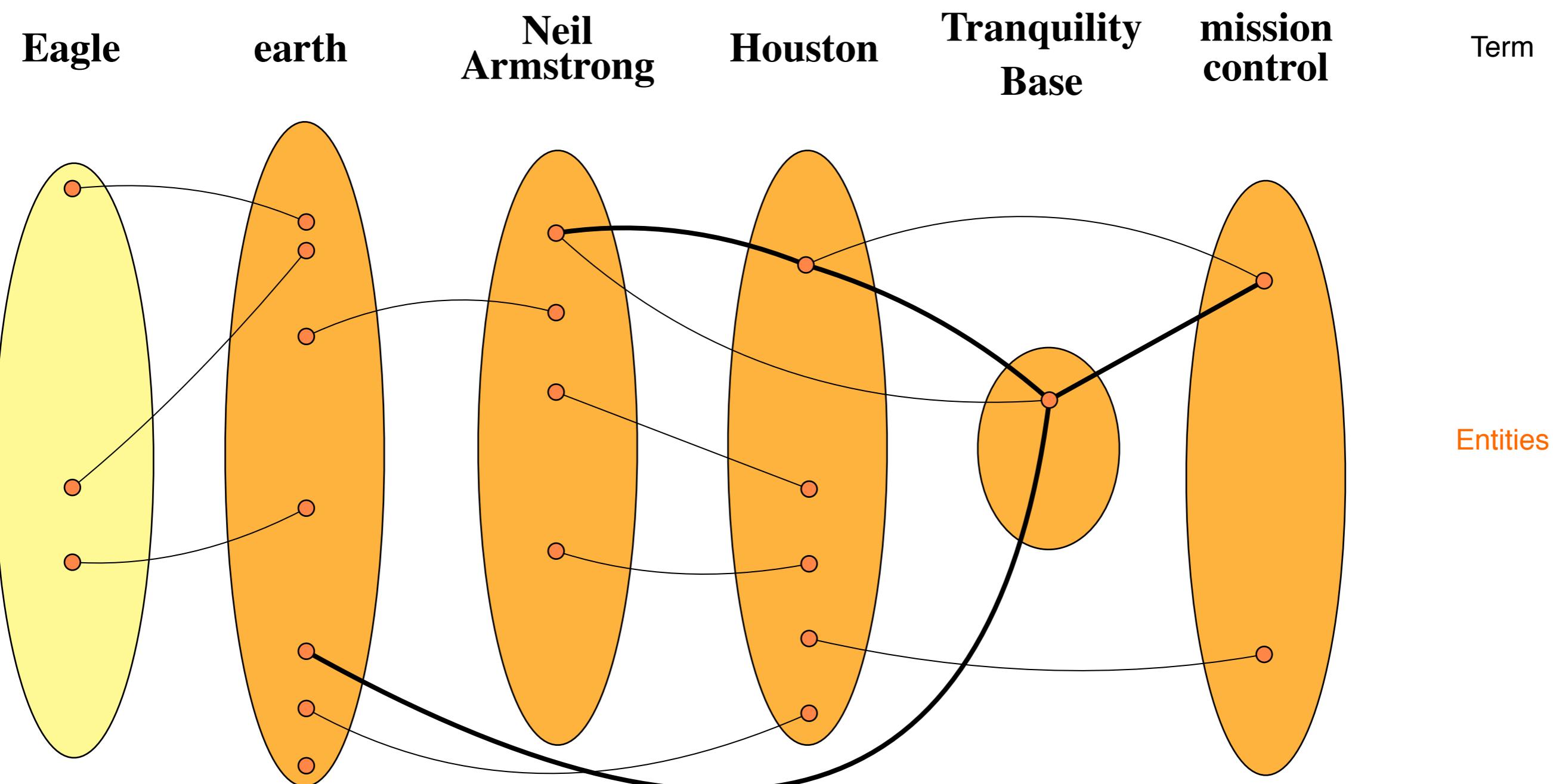
### (3) Disambiguation of Correct Entity

- **Link Graph Analysis**
- identify **connected components**
- remove nodes not connected to other term partitions



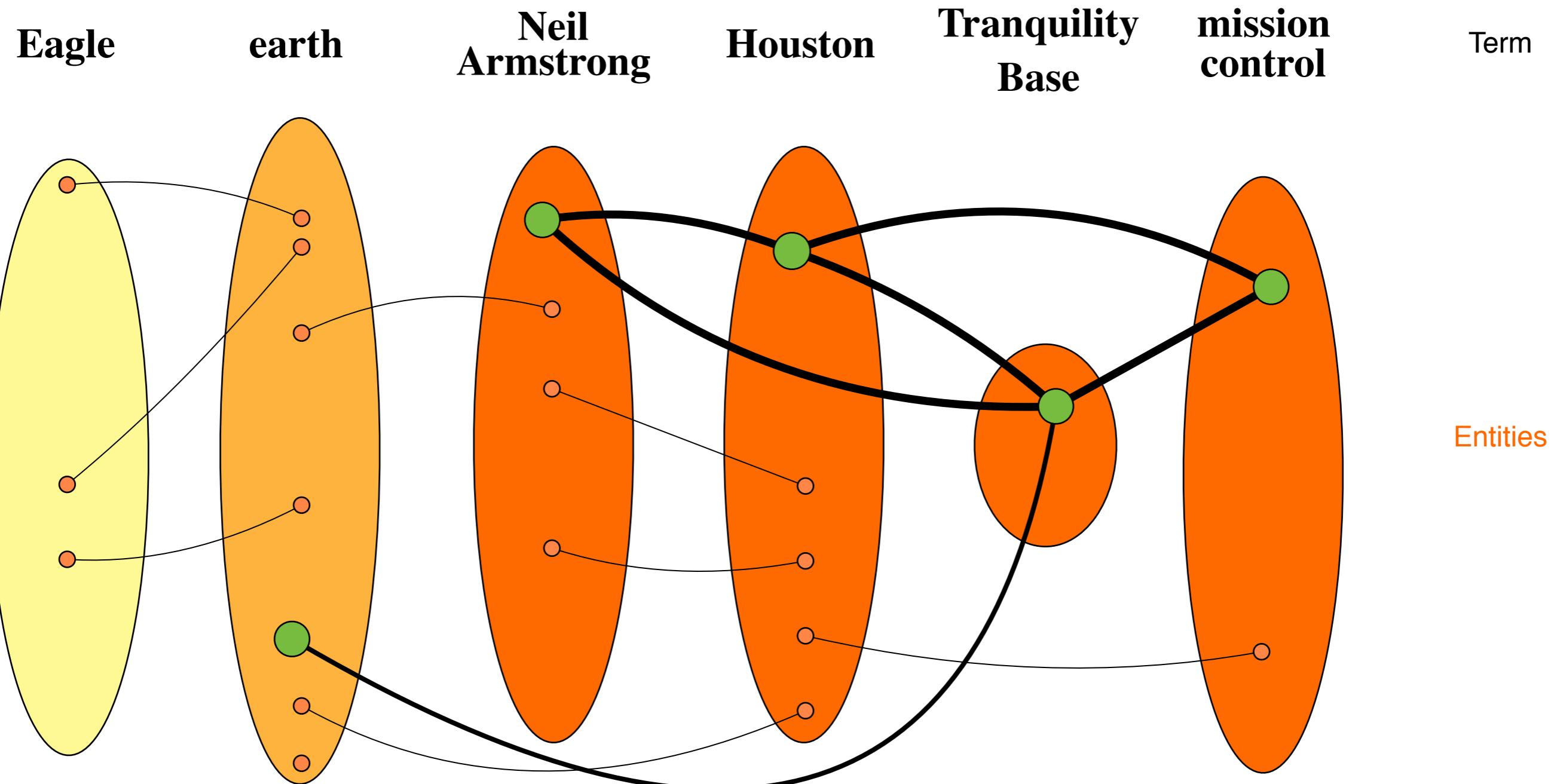
### (3) Disambiguation of Correct Entity

- **Link Graph Analysis**
- identify **connected components that cover the most term partitions**



### (3) Disambiguation of Correct Entity

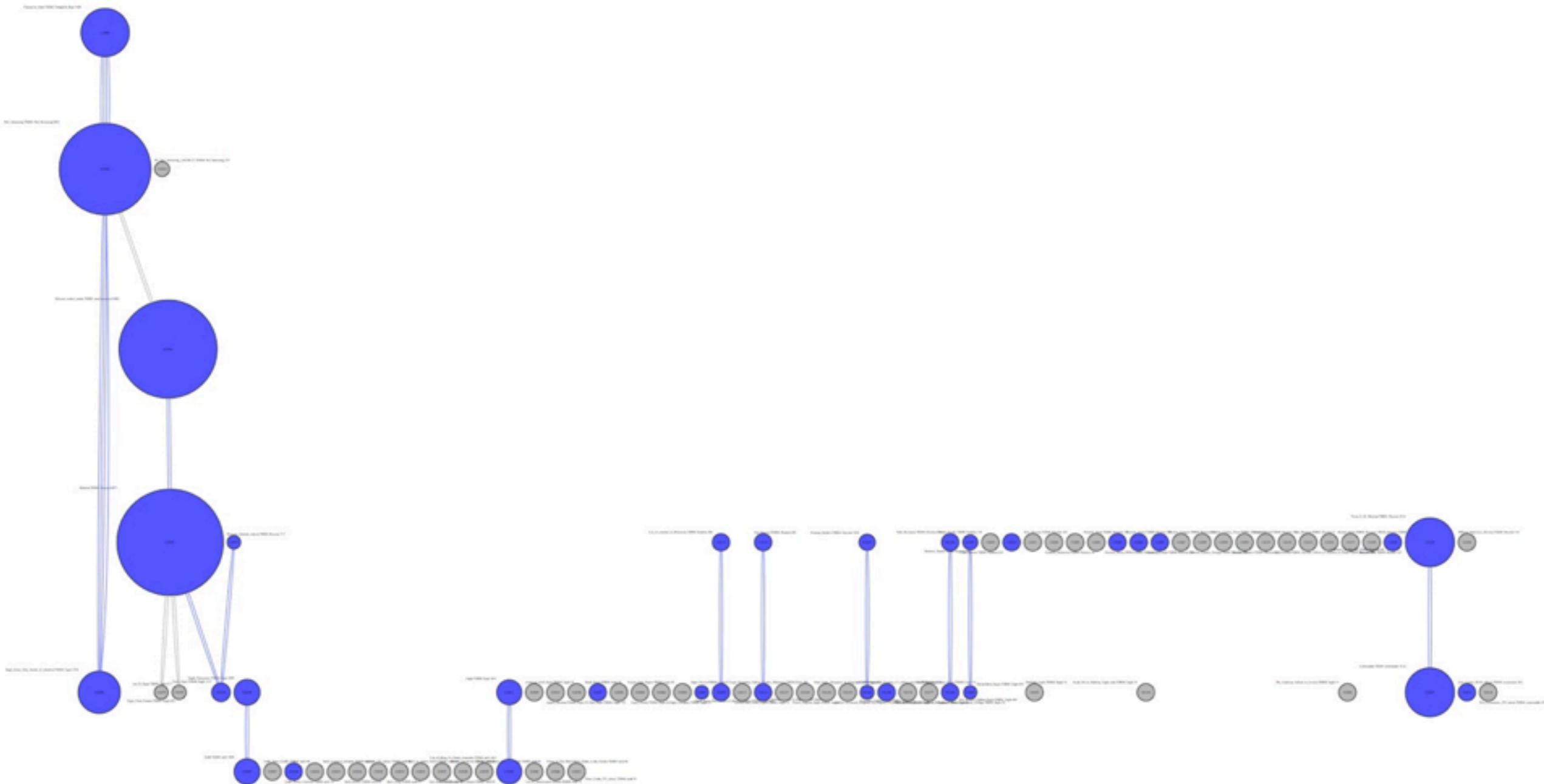
- **Link Graph Analysis**
- identify **connected components** that cover the most term partitions
- only **one node per partition** should be covered
- **strongly connected components** consolidate the disambiguation



## (3) Disambiguation of Correct Entity

- for our example

**Neil Armstrong**, the 38-year-old civilian **commander**,  
radios to **earth** an the **mission control** room here:  
**„Houston, Tranquility Base here, The Eagle has landed.“**

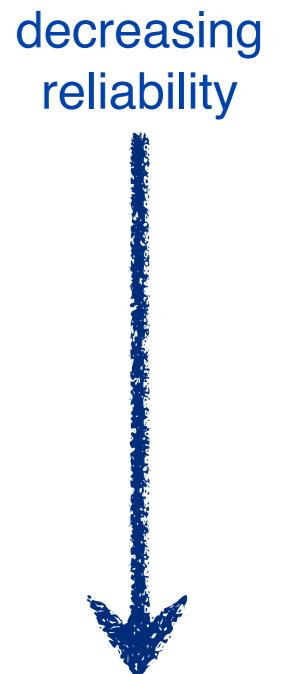


## General Approach

1. Apply most reliable method first
2. Try to solve remaining ambiguity by subsequent application of less reliable methods

## NER Algorithms

- Link Graph Analysis to detect connected components
- Co-Occurrence Analysis
- Popularity-Based Link Graph Analysis
  - In Degree, PageRank, Hubs&Authorities
- Negative Context Analysis



# Disambiguation of Correct Entity

- Co-Occurrence Analysis
- + Co-Reference Analysis

## Neil Armstrong

From Wikipedia, the free encyclopedia

For other people named Neil Armstrong, see [Neil Armstrong \(disambiguation\)](#).

**Neil Alden Armstrong** (August 5, 1930 – August 25, 2012) was an American astronaut and the first person to walk on the Moon. He was also an aerospace engineer, naval aviator, test pilot, and university professor. Before becoming an astronaut, Armstrong was an officer in the U.S. Navy and served in the Korean War. After the war, he earned his bachelor's degree at [Purdue University](#) and served as a test pilot at the National Advisory Committee for Aeronautics High-Speed Flight Station, now known as the Dryden Flight Research Center, where he logged over 900 flights. He later completed graduate studies at the University of Southern California.

A participant in the U.S. Air Force's Man in Space Soonest and X-20 Dyna-Soar human spaceflight programs, Armstrong joined the [NASA Astronaut Corps](#) in 1962. He made his first space flight, as command pilot of [Gemini 8](#), in 1966, becoming NASA's first civilian astronaut to fly in space. On this mission, he performed the first docking of two spacecraft, with pilot David Scott.<sup>[1]</sup>

Armstrong's second and last spaceflight was as mission commander of the [Apollo 11](#) moon landing, in July 1969. On this mission, Armstrong and [Buzz Aldrin](#) descended to the lunar surface and spent two and a half hours exploring, while [Michael Collins](#) remained in lunar orbit in the Command Module. Along with Collins and Aldrin, Armstrong was awarded the [Presidential Medal of Freedom](#) by [President Richard Nixon](#); President [Jimmy Carter](#) presented Armstrong the [Congressional Space Medal of Honor](#) in 1978; he and his former crewmates received the [Congressional Gold Medal](#) in 2009.

Armstrong died in Cincinnati, Ohio, on August 25, 2012, at the age of 82, after complications from coronary artery bypass surgery.<sup>[2][3]</sup>

Houston: 5

Tranquility Base: 3

Eagle: 13

Earth: 11

Mission Control: 5

## Tranquility Base

From Wikipedia, the free encyclopedia

For the [trance](#) group, see [Above & Beyond \(band\)](#).

**Tranquility Base** (Latin: [Statio Tranquillitatis](#)) is the site where humans first landed on the Moon and walked on another world, on the flight of [Apollo 11](#). American astronauts [Neil Armstrong](#) and [Buzz Aldrin](#) landed their [Apollo Lunar Module Eagle](#) at approximately 20:17:40 UTC on July 20, 1969. Six hours later, they left the spacecraft and spent 2 hours, 31 minutes on the lunar surface, examining and photographing it, setting up some scientific experiment packages, and collecting 47.5 pounds (21.5 kg) of dirt and rock samples for return to Earth. They lifted off the surface on July 21 at 17:54 UTC. Tranquility Base has remained unvisited since then.

Its lunar coordinates are 00°41'15"N, 23°26'00"E, in the south-western corner of the lunar lava-plain called [Mare Tranquillitatis](#) ("Sea of Tranquility"), east of the craters [Sabine](#) and [Ritter](#), north of the crater [Moltke](#), and near a [rille](#) unofficially called "U.S. Highway Number 1"<sup>[citation needed]</sup>.

### Contents [hide]

- 1 Site selection
- 2 Name
- 3 Status
- 4 Gallery
- 5 See also
- 6 Notes
- 7 External links

### Site selection [edit]

For more than two years, NASA planners considered a collection of 30 potential sites for the first

Houston: 2

Neil Armstrong: 3

Eagle: 5

Earth: 2

Mission Control: 1



Does this really  
work well...?

The Evaluation

# Evaluation - the very Basics

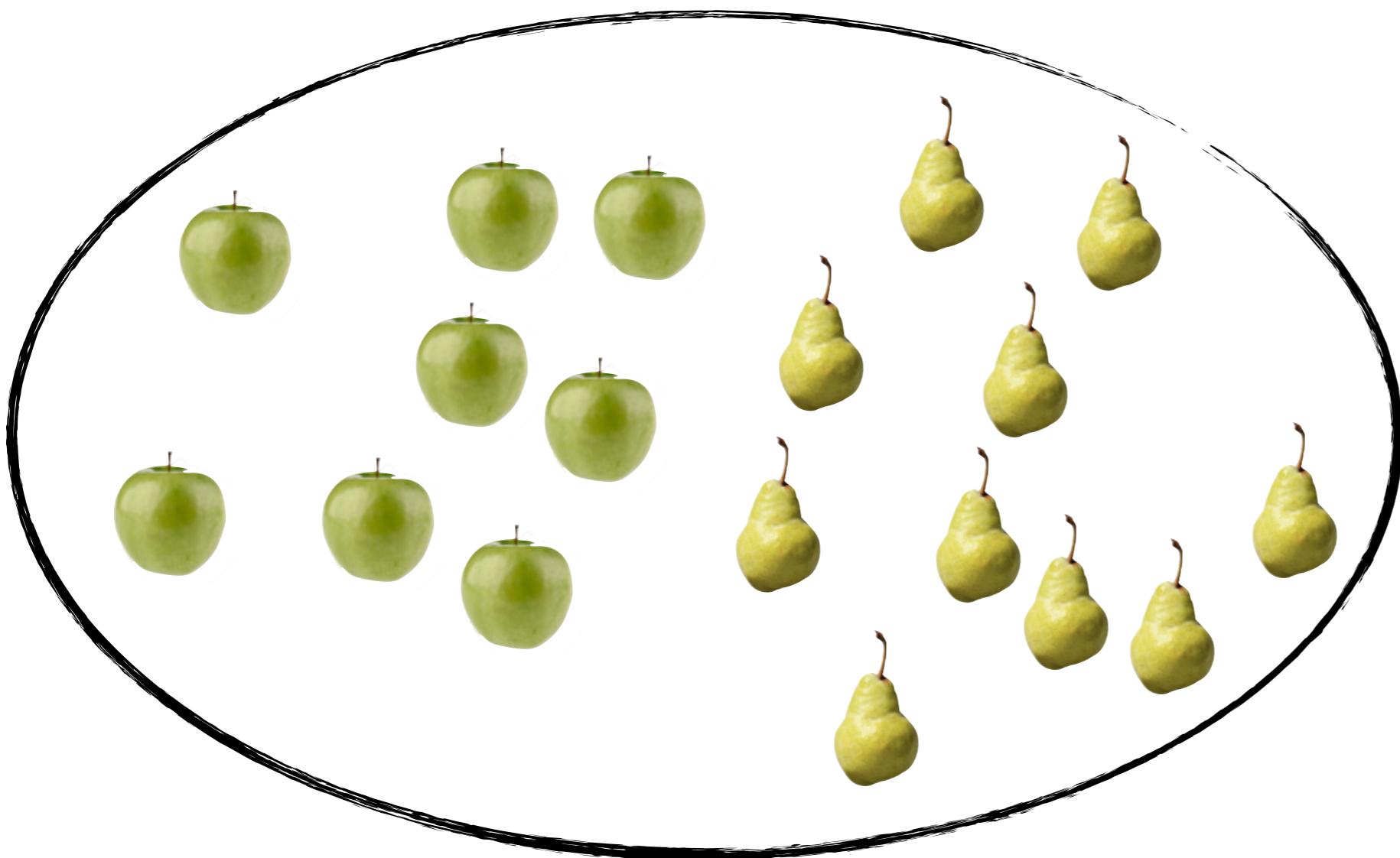


## Recall and Precision

# Evaluation - the very Basics

## Recall and Precision

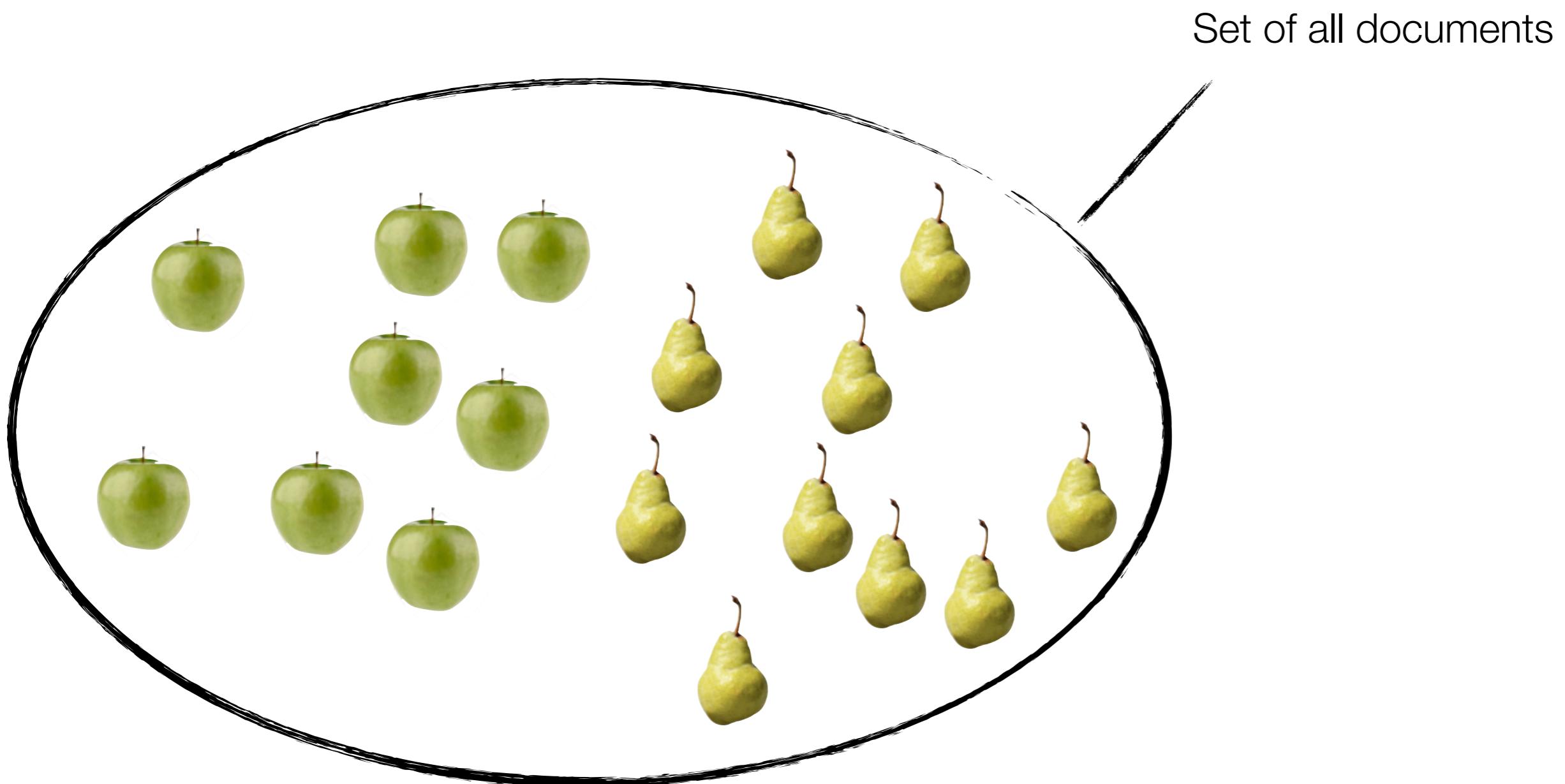
72



# Evaluation - the very Basics

## Recall and Precision

72



# Evaluation - the very Basics

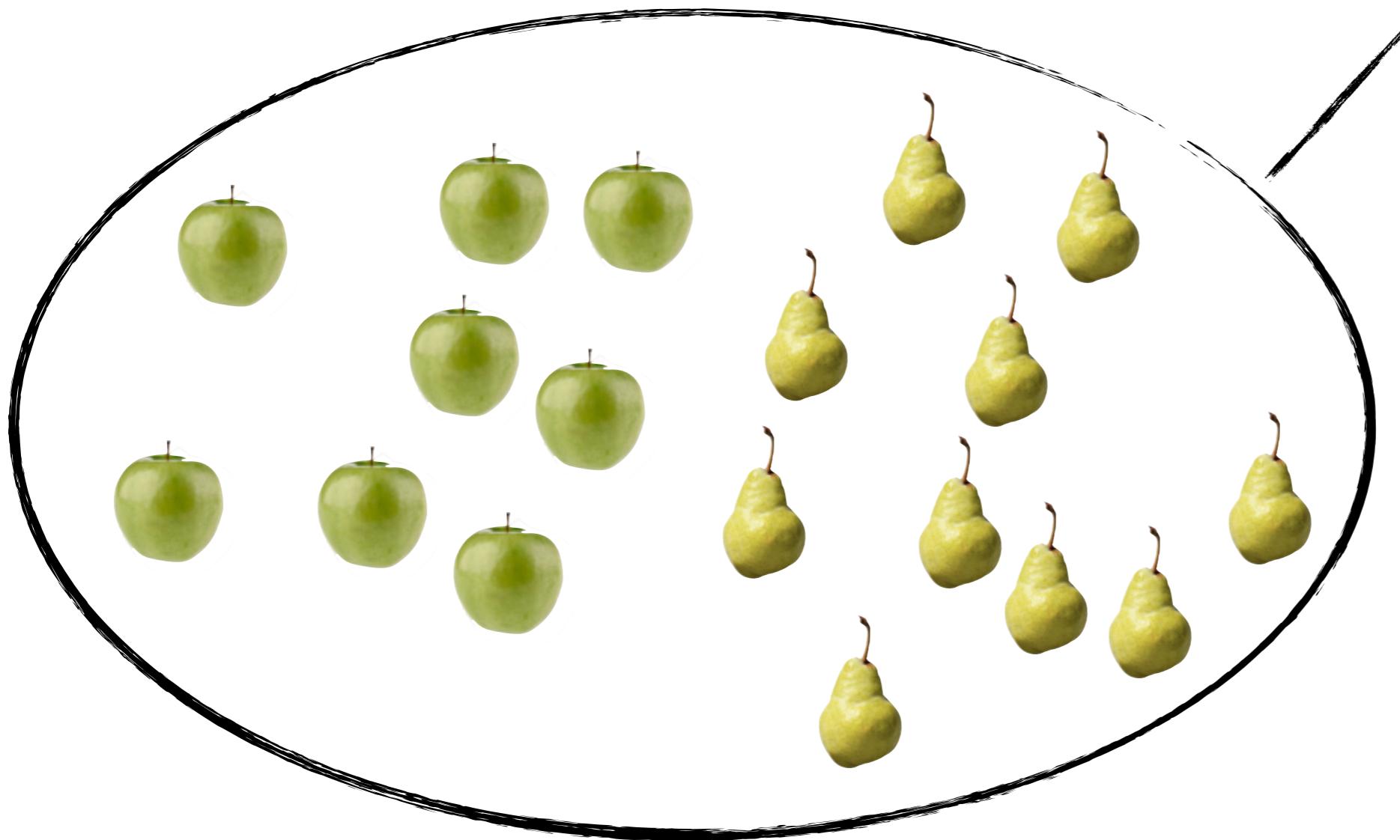
## Recall and Precision

72

Task: Find all



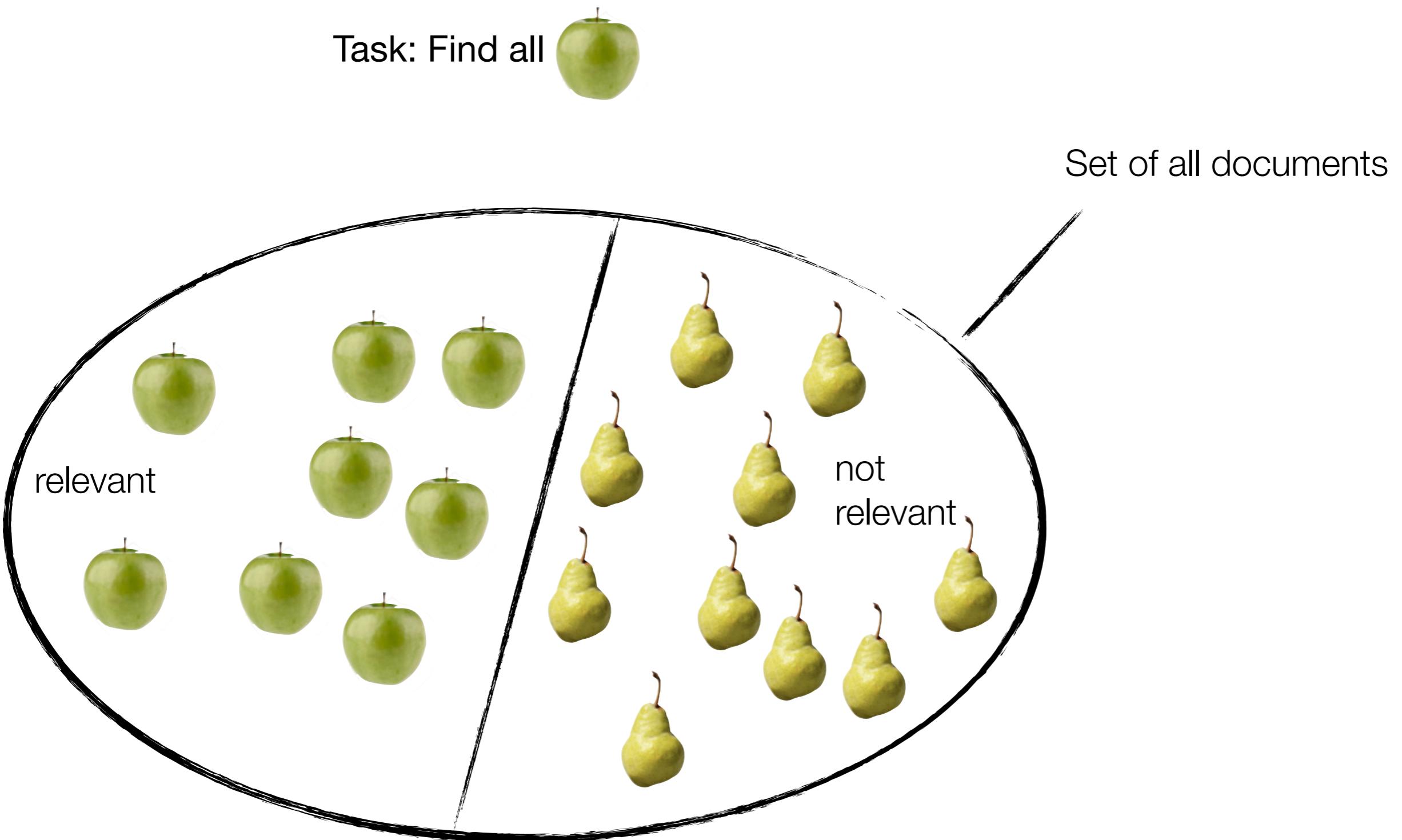
Set of all documents



# Evaluation - the very Basics

## Recall and Precision

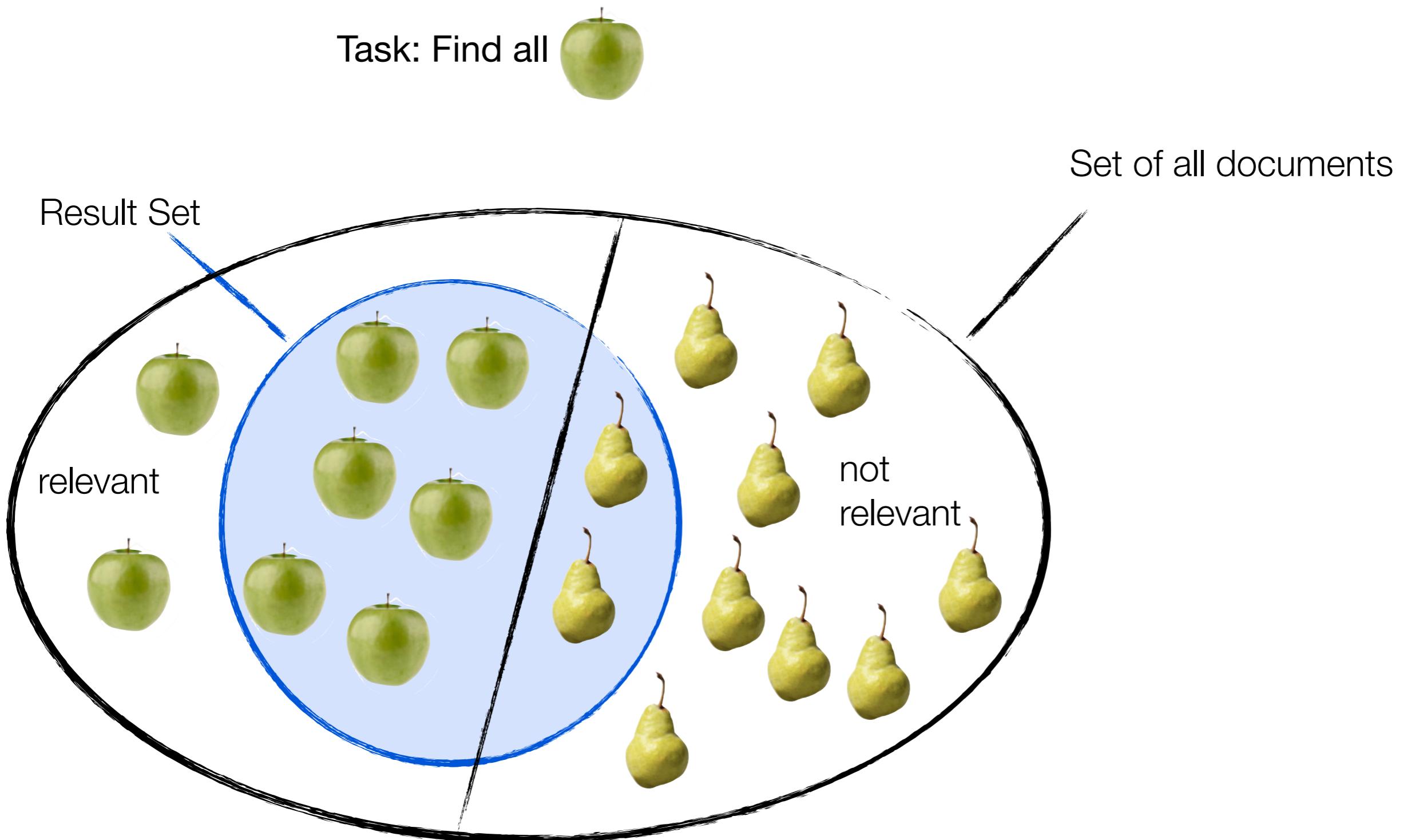
72



# Evaluation - the very Basics

## Recall and Precision

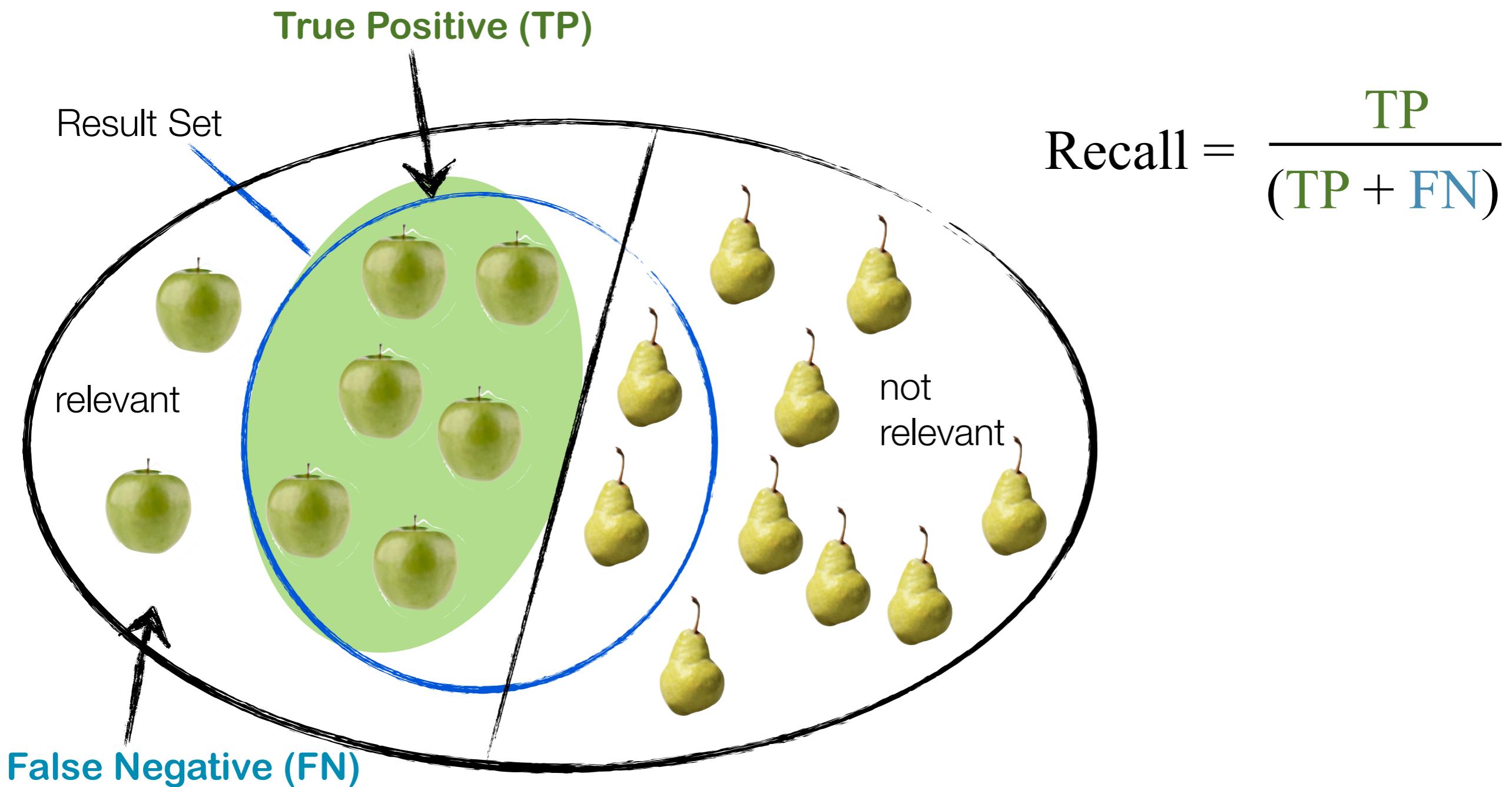
72



# Evaluation - the very Basics

## Recall and Precision

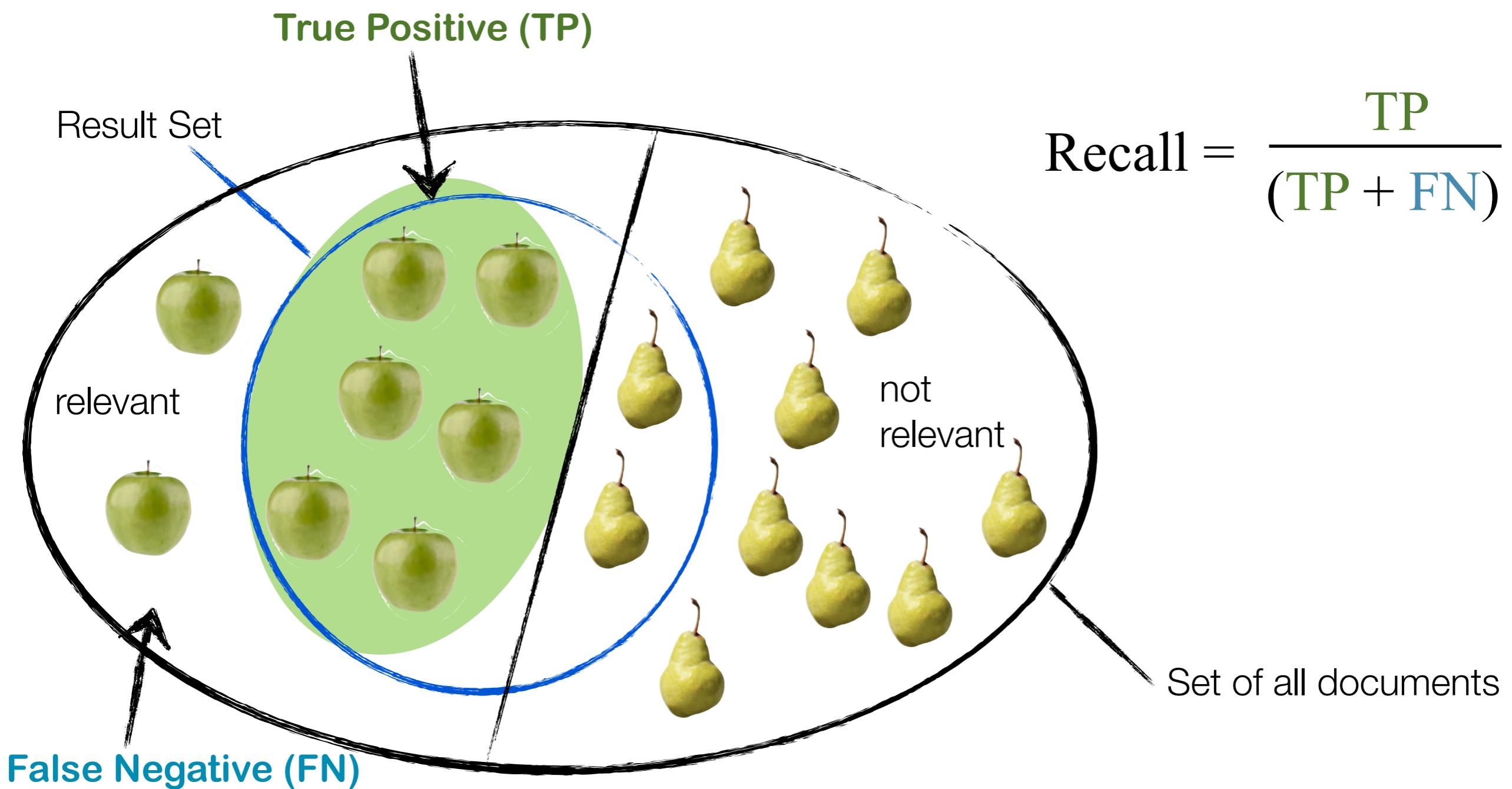
73



# Evaluation - the very Basics

## Recall and Precision

73

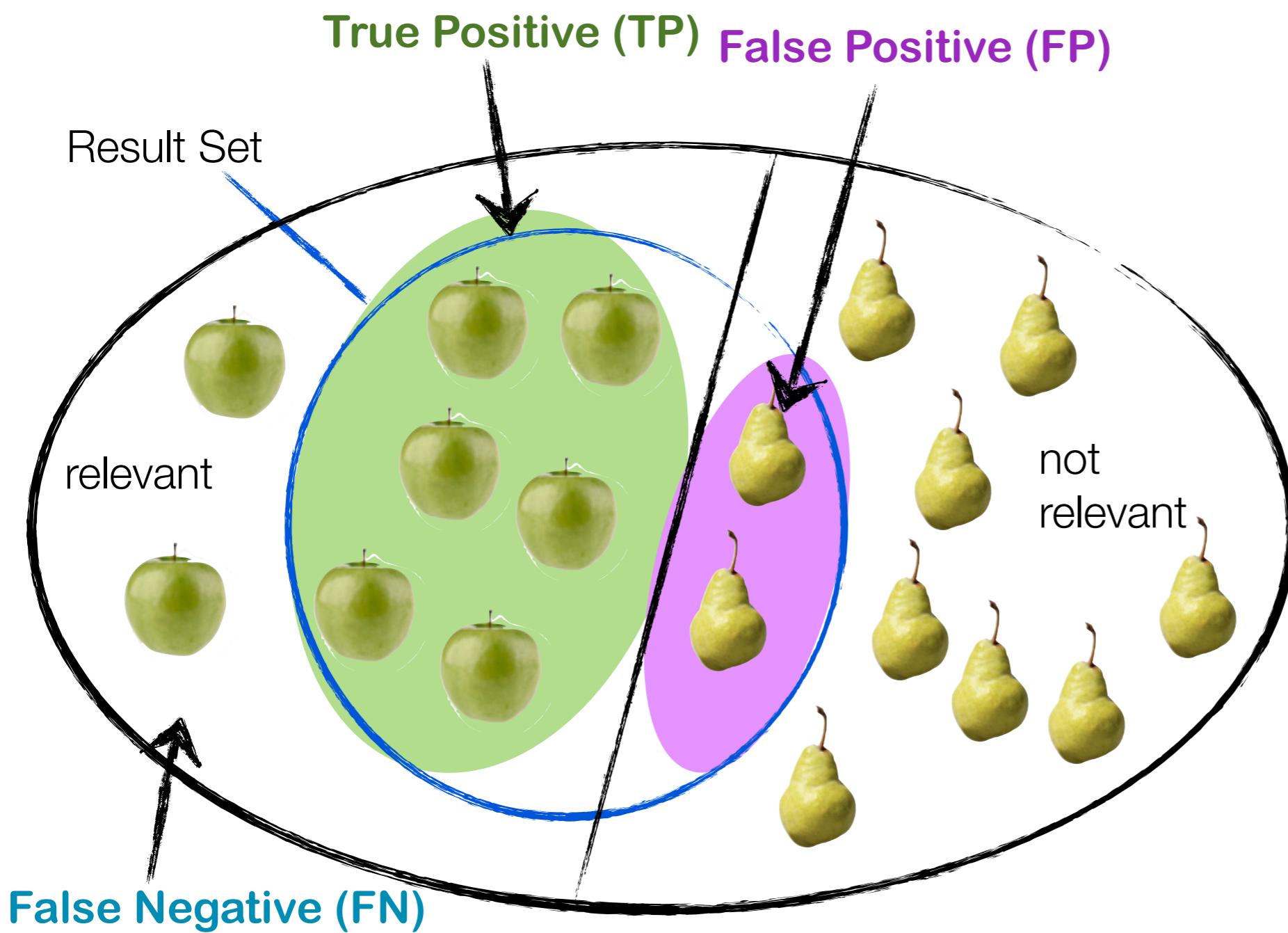


# Evaluation - the very Basics

## Recall and Precision

74

$$\text{Precision} = \frac{\text{TP}}{(\text{TP} + \text{FP})}$$

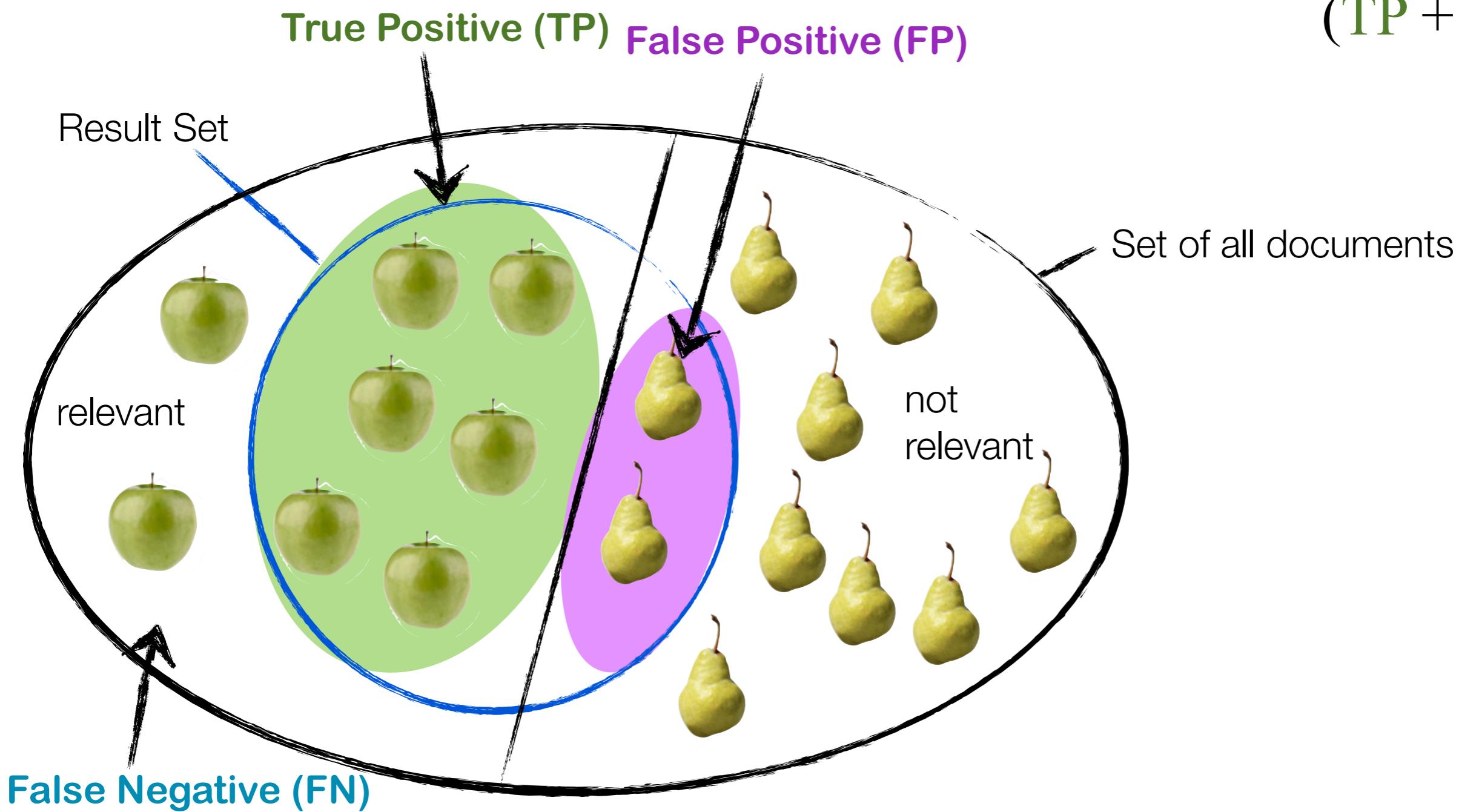


# Evaluation - the very Basics

## Recall and Precision

74

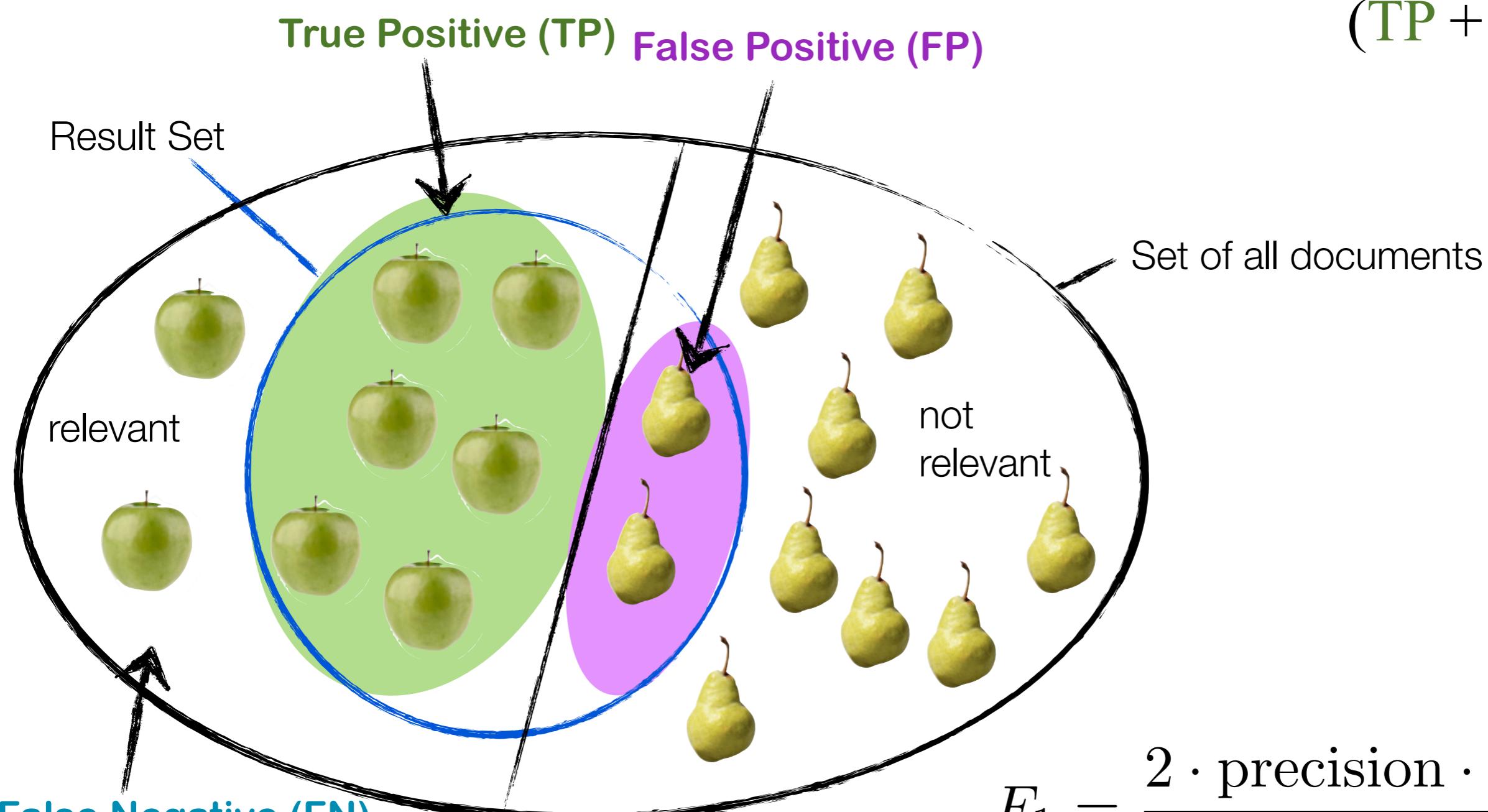
$$\text{Precision} = \frac{\text{TP}}{(\text{TP} + \text{FP})}$$



# Evaluation - the very Basics

## Recall and Precision

74



$$\text{Precision} = \frac{\text{TP}}{(\text{TP} + \text{FP})}$$

$$F_1 = \frac{2 \cdot \text{precision} \cdot \text{recall}}{\text{precision} + \text{recall}}$$

# **Exercise 3:**

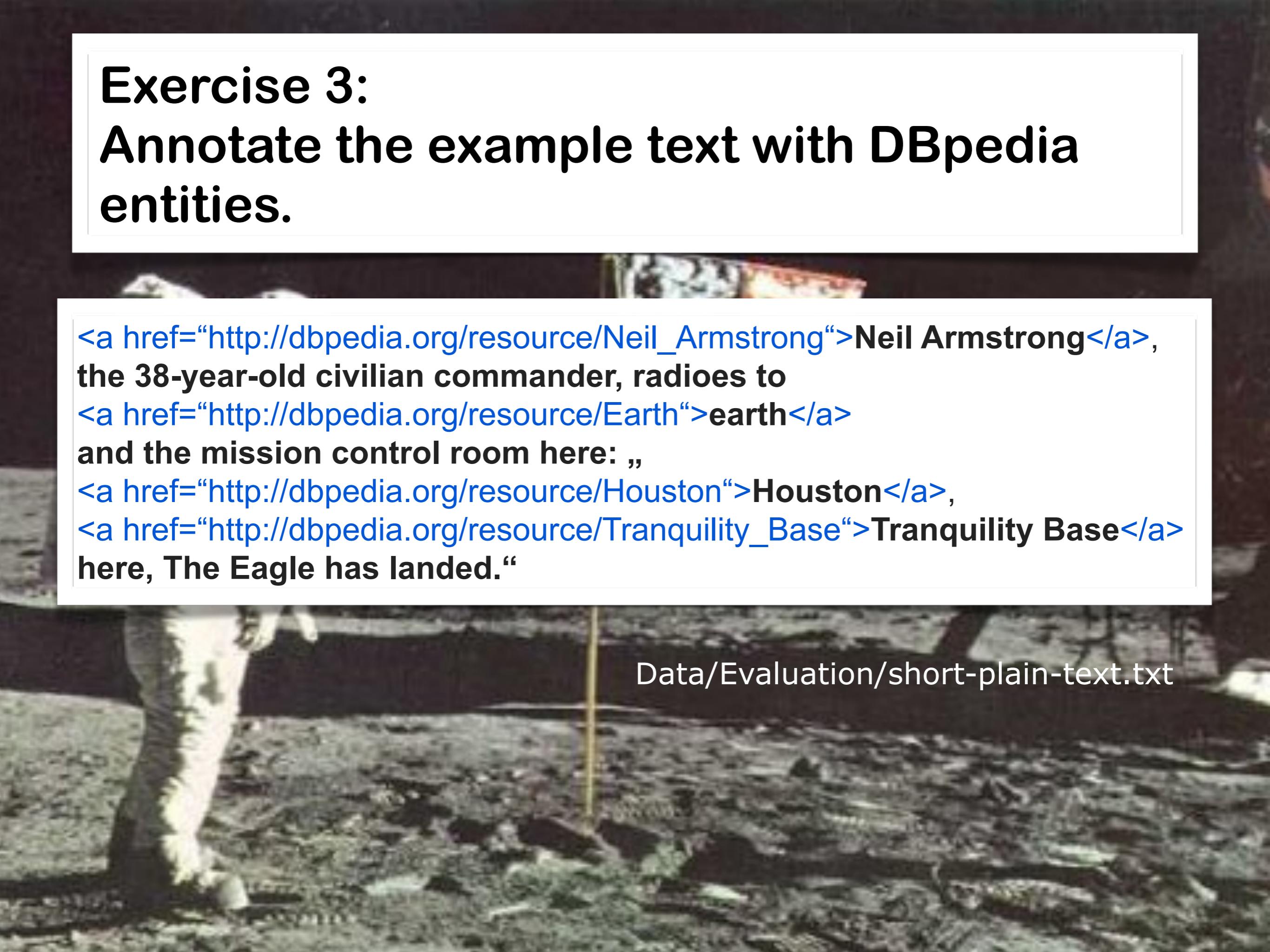
## **Annotate the example text with DBpedia entities.**



Data/Evaluation/short-plain-text.txt

# Exercise 3:

## Annotate the example text with DBpedia entities.



<a href="http://dbpedia.org/resource/Neil\_Armstrong">Neil Armstrong</a>,  
**the 38-year-old civilian commander, radios to**  
<a href="http://dbpedia.org/resource/Earth">earth</a>  
**and the mission control room here: „**  
<a href="http://dbpedia.org/resource/Houston">Houston</a>,  
<a href="http://dbpedia.org/resource/Tranquility\_Base">Tranquility Base</a>  
**here, The Eagle has landed.“**

Data/Evaluation/short-plain-text.txt

# **Exercise 3:** **Evaluate your annotated text against the** **ground truth.**



Data/Evaluation/short-plain-text.txt  
Data/Evaluation/short-anotated-text.txt  
Tools/mini-eval.zip

# SEMEX Demonstrator

<http://semex.hpi.uni-potsdam.de/semex>



Hasso  
Plattner  
Institut



## Context-driven Named Entity Mapping

### 2. Analysis Result

Neil Armstrong , the 38-year-old civilian commander, radios to earth an the mission control room here: „Houston, Tranquility Base here, The Eagle has landed .”

Found Entities Entity Table

Neil Armstrong Tranquility Base

Room Earth

The Eagle Has Landed

Mission control center



# “Understanding“ the Web of Data

## Named Entity Resolution

### Overview

#### (1) How to make sense of the Web?

and why we are not really content with it...

#### (2) Words and Meaning

to be able to better „understand“ the content

#### (3) Named Entity Resolution

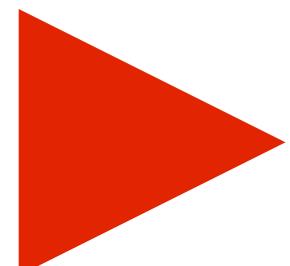
from words to semantic entities...

#### (4) Application Scenarios

Exploratory Search and intelligent Recommendations

# Semantic Search

- in difference to keyword based retrieval, query terms are matched with semantic entities (**Entity Based Retrieval**, EBR)
- How to match query terms to semantic entities?
  - Interpretation of natural language queries
  - Query string refinement / extension
  - Entity auto-suggestion / completion
- linguistic ambiguities of traditional keyword based search can be avoided

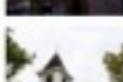


EBR enables **high precision and high recall retrieval**

# Entity Based Search

<http://www.yovisto.com/labs/autosuggestion/>

armstrong

12 Persons	10 Things	10 Places	1 MilitaryConflict	10 Organisations
5 MusicalArtists 5 Artists 1 Cyclist 1 Athlete 1 Astronaut	1 MeanOfTransportation 1 Aircraft	7 ArchitecturalStructures 5 Buildings 2 Airports 2 Infrastructures 2 AdministrativeRegions 2 PopulatedPlaces 1 NaturalPlace 1 LunarCrater 1 Stadium	1 Event	7 Companies 3 EducationalInstitutions 2 Schools 1 University
 <b>Louis Armstrong</b> MusicalArtist Artist Person	 <b>Armstrong County, Pennsyl...</b> Thing	 <b>Louis Armstrong New Orlea...</b> Airport ArchitecturalStructure	 <b>Kittanning Expedition</b> MilitaryConflict Event	 <b>Armstrong Whitworth</b> Company Organisation
 <b>Lance Armstrong</b> Cyclist Athlete Person Person	 <b>Armstrong Whitworth Whitl...</b> MeanOfTransportation Aircraft	 <b>Armstrong Tunnel</b> Building ArchitecturalStructure Place		 <b>Armstrong Whitworth Aircr...</b> Company Organisation
 <b>Neil Armstrong</b> Astronaut Person Person	 <b>William Armstrong, 1st Ba...</b> Thing	 <b>Armstrong (crater)</b> NaturalPlace LunarCrater Place		 <b>Armstrong Atlantic State ...</b> University EducationalInstitution Organisation
 <b>Billie Joe Armstrong</b> MusicalArtist Artist Person	 <b>Armstrong County, Texas</b> Thing	 <b>Armstrong-Poventud Reside...</b> Building ArchitecturalStructure		 <b>Armstrong World Industrie...</b> Company Organisation
 <b>Tim Armstrong</b> MusicalArtist Artist Person	 <b>Armstrong Gun</b> Thing	 <b>Armstrong Stadium</b> Stadium Building ArchitecturalStructure Place		 <b>Armstrong Group of Compan...</b> Company Organisation
 <b>Craig Armstrong (composer...)</b> MusicalArtist Artist Person	 <b>Archer &amp; Armstrong</b> Thing	 <b>Armstrong County, Pennsyl...</b> AdministrativeRegion		 <b>Armstrong Telephone Compa...</b> Company Organisation
 <b>Alexander Armstrong (comedian)</b> Person	 <b>Armstrong Township, Lycom...</b> Thing	 <b>Armstrong Airport</b> Airport ArchitecturalStructure Place Infrastructure		 <b>Armstrong Tools</b> Company Organisation
 <b>Alun Armstrong (actor)</b> Person	 <b>Clan Armstrong</b> Thing	 <b>Louis Armstrong House</b> Building ArchitecturalStructure Place		 <b>Armstrong Siddeley</b> Company Organisation
 <b>Rollo Armstrong</b> MusicalArtist Artist Person	 <b>CFS Armstrong</b> Thing	 <b>Armstrong Chapel United M...</b> Building ArchitecturalStructure		 <b>Robbinsdale Armstrong Hig...</b> School EducationalInstitution
 <b>Edwin Howard Armstrong</b> Person	 <b>Armstrong Township, India...</b> Thing	 <b>Armstrong County, Texas</b> AdministrativeRegion PopulatedPlace Place		 <b>Armstrong School District...</b> School EducationalInstitution Organisation

46

Willkommen

Search ...

Dresden

<http://semex.hpi.uni-potsdam.de/mggui-dev2/>

Einschränken

Personen 81

Walter Ulbricht 9	Gregor Strasser 8	Ernst Gelegs 8
Adolf Hitler 7	Max Ernst 7	Bertolt Brecht 6
Erich Honecker 5	Fifi Box 5	Horst Winter 5

Ereignisse

Erster Weltkrieg 7	Koalitionskriege 5	Schlacht an der S... 4
German Revolution... 1	Oktoberrevolution 1	Leningrader Block... 1
Spanischer Bürger... 1	Ten Years' War 1	

Orte

Dresden 46	Deutsche Demokrat... 40	Berlin 23
Deutschland 18	Leipzig 15	Europa 12
Verwaltungsgemeind... 12	Sowjetunion 11	Bezirk Mitte 9

Organisation

Krieg 16	Ziel 15	Sozialdemokratisc... 5
Sozialistische El... 5	Berliner AK 07 4	Showtime 4
ARD 3	Allgemeine SS 3	Christlich Demokr... 3

Konzepte

Jahr 40	Dokumentarfilm 36	Ministerium 35
Land (Deutschland... 35	Malerei 32	Arbeitsmarkt 30
Stadt 29	Mensch 28	Kultur 27

Bildinhalt

Aussenaufnahme 45	Tag 44	Stadtaufnahme 41
Innenraum 41	Einzelperson 34	Menschen Massen 28
Parks Felder Gru... 24	Gewaesser 22	Kleine Personengr... 21

ASR

OCR

Genres

Relevanz

Titel ▼ ▲

ID ▼ ▲

IX. Kunstausstellung

Info VCD

Alternativer Titel: IX. Kunstausstellung Dresden, Kunstausstellung Dresden

Farbe: F

Beschreibung: Diskussionsrunde über Gemälde ; Lager von Gemälden und Skulpturen; Stadt Dresden ; Besucher in

Rechtehalter: defa-spektrum GmbH

Sammlung: Ministerium für Auswärtige Angelegenheiten (MfAA)

Schlüsselwort: [Kunst, Malerei, Ausstellung]

Originaltitel: IX. Kunstausstellung Dresden

DDR - Magazin 1968/46 #1323

Info ASR VCD

Alternativer Titel: DDR - Magazin 1968/46

Farbe: sw

Beschreibung: [1. Bürgermeister aus Europa besuchten Dresden um die Erfahrungen der Städtebauer zu studieren. Sie betrachten ein Modell der Dresdner Innenstadt und die]

Produktionsort: Deutsche Demokratische Republik

Rechtehalter: defa-spektrum GmbH

Sprecher: Klaus Feldmann

Sammlung: Ministerium für Auswärtige Angelegenheiten (MfAA)

DDR - Magazin 1978/02 #1471

Info ASR VCD

Alternativer Titel: [GDR Magazine 1978/02, DDR - Magazin 1978/02]

Farbe: F

Beschreibung: [1. Text, Dresden's art treasures. This film gives impressions of and information about three Dresden]

Produktionsort: Deutsche Demokratische Republik

Rechtehalter: defa-spektrum GmbH

Sammlung: Ministerium für Auswärtige Angelegenheiten (MfAA)

Schlüsselwort: [Dresden, Geschichte, Wiederaufbau]

Das blaue Wunder (2/2) #4079

Info OCR VCD

Teil: 2

Film ID: Q6UJ9A00AETF

Kamera: Horst Donth

Regisseur: Claus Peter Eberwein

Lizenzgeber: DEFA-Stiftung

Sammlung: Cintec- Archiv

Schlüsselwort: [Dresden, Landschaft, Architektur]

Originaltitel: Das blaue Wunder (2/2)

Anzahl der Teile: 2

Herstellungsjahr: 1991

DDR - Magazin 1970/03 #1337

Info ASR VCD

Alternativer Titel: DDR - Magazin 1970/03

Farbe: sw

Beschreibung: Die Union Diplomatique in Brüssel hatte

Produktionsort: Deutsche Demokratische Republik

Rechtehalter: defa-spektrum GmbH

Sammlung: Ministerium für Auswärtige Angelegenheiten (MfAA)

C. Hentschel, H. Sack, et al.,  
Open up cultural heritage in video archives with mediaglobe, I2CS 2012

Willkommen

The interface features a top navigation bar with icons for search, user profile, and settings. A search bar at the top left contains the placeholder "Search ...". To its right is a dropdown menu showing "Dresden" with a close button. Below the search bar is a section for "Einschränken" (restrictions) with a "Relevanz" slider set to 81. On the far right are buttons for "Titel" (Title), "ID", and sorting arrows.

**Facets (Left Side):**

- Personen:** Walter Ulbricht 9, Gregor Strasser 8, Ernst Gelegs 8, Max Ernst 7, Bertolt Brecht 6, Erich Honecker 5, Fifi Box 5, Horst Winter 5.
- Ereignisse:** Erster Weltkrieg 7, Koalitionskriege 5, Schlacht an der S... 4, German Revolution... 1, Oktoberrevolution 1, Leningrader Block... 1, Spanischer Bürger... 1, Ten Years' War 1.
- Orte:** Dresden 46, Deutsche Demokrat... 40, Berlin 23, Deutschland 18, Leipzig 15, Europa 12, Verwaltungsgemeind... 12, Sowjetunion 11, Bezirk Mitte 9.
- Organisation:** Krieg 16, Ziel 15, Sozialdemokratisc... 5, Berliner AK 07 4, ARD 3, Allgemeine SS 3.
- Konzepte:** Jahr 40, Dokumentarfilm 36, Ministerium 35, Land (Deutschland... 35, Malerei 32, Arbeitsmarkt 30, Stadt 29, Mensch 28, Kultur 27.
- Bildinhalt:** Aussenaufnahme 45, Tag 44, Stadtaufnahme 41, Innenraum 41, Einzelperson 34, Menschen Massen 28, Parks Felder Gru... 24, Gewaesser 22, Kleine Personengr... 21.

**Search Results (Right Side):**

**Result 1: IX. Kunstausstellung**

**Details:** Alternative Titel: [IX. Kunstausstellung Dresden], Kunstausstellung Dresden, Farbe: F, Beschreibung: Diskussionsrunde über Gemälde; Lager von Gemälden und Skulpturen; Stadt Dresden; Besucher in

**Result 2: DDR - Magazin 1968/46**

**Details:** Alternative Titel: DDR - Magazin 1968/46, Farbe: sw, Beschreibung: [1. Bürgermeister aus Europa besuchten Dresden um die Erfahrungen der Städtebauer zu studieren. Sie betrachten ein Modell der Dresdner Innenstadt und die]

**Result 3: DDR - Magazin 1978/02**

**Details:** Alternative Titel: [GDR Magazine 1978/02, DDR - Magazin 1978/02], Farbe: F, Beschreibung: [1. Text , Dresden's art treasures. This film gives impressions of and information about three Dresden]

**Result 4: Das blaue Wunder (2/2)**

**Details:** Teil: 2, Film ID: Q6UJ9A00AETF, Kamera: Horst Donth, Regisseur: Claus Peter Eberwein, Lizenzgeber: DEFA-Stiftung

**Result 5: DDR - Magazin 1970/03**

**Details:** Alternative Titel: DDR - Magazin 1970/03, Farbe: sw, Beschreibung: Die Union Diplomatique in Brüssel hatte

# search facets

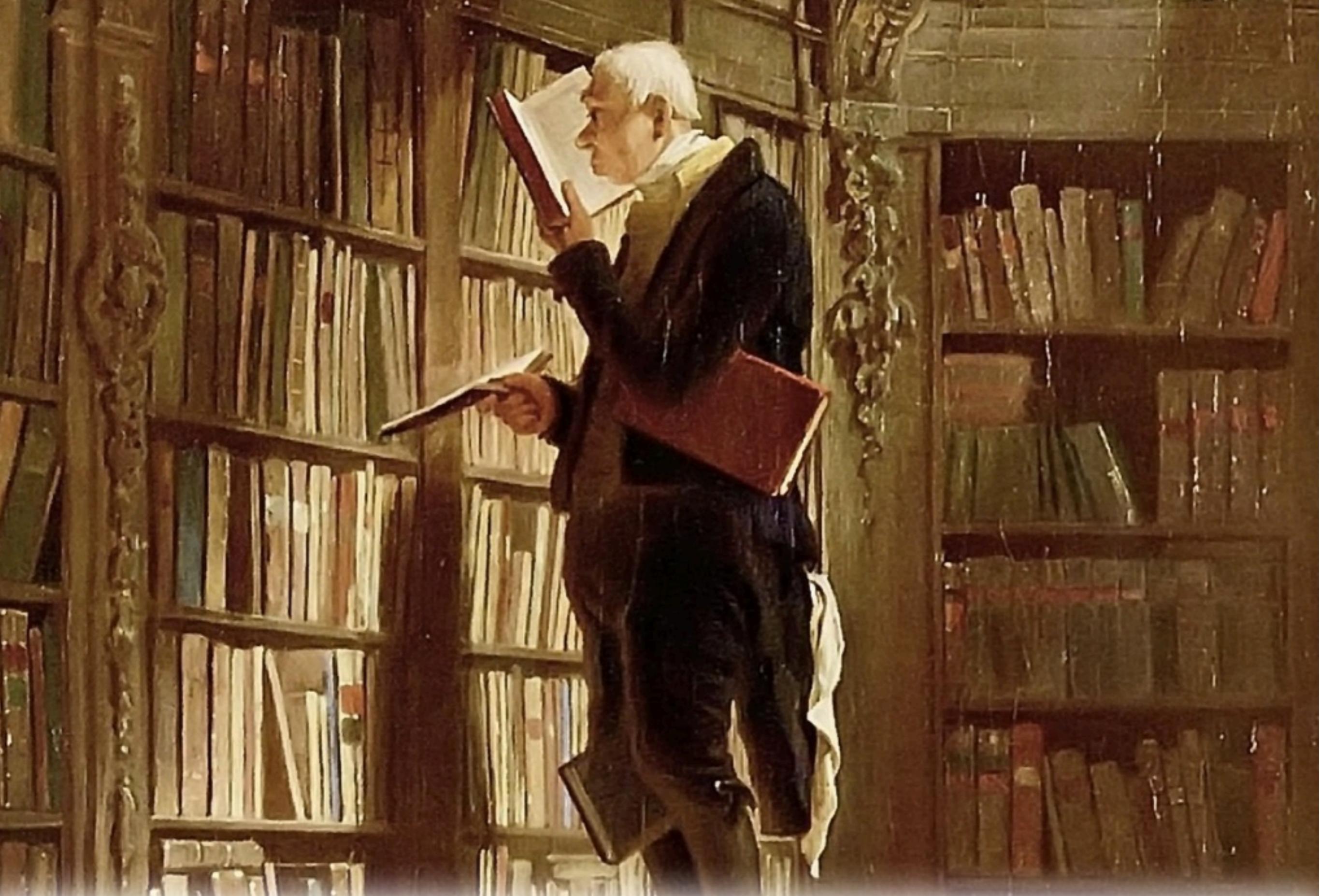
C. Hentschel, H. Sack, et al.,  
Open up cultural heritage in video archives with mediaglobe, I2CS 2012

# Search vs. Exploration



# Exploratory Search

- *What, if the user does not know, **which query string** to use?*
  - *What, if the user is looking for **complex answers**?*
  - *What, if the user **does not know the domain** she is looking for?*
  - *What, if the user wants to get an **overview about a specific topic**?*
- 
- **Exploratory Search** enables
  - ... to browse instead of search
  - ... useful suggestions & recommendations
  - ... to find something unexpected but useful (**Serendipity**)
  - ... content based navigation & exploration



(Traditional) Libraries also enable Browsing and Exploration

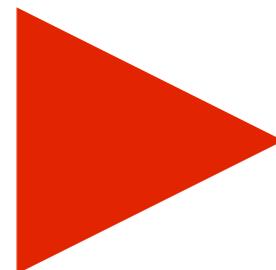
# Serendipity helps to improve the Quality of Discovery & Exploration

## Serendipity:

- finding a solution to a problem that is **relevant but not intentionally thought of**
- a recommended item is a serendipitous discovery if it is **interesting and positively surprising** because one was not in search for any of its kind

## Relevance:

- In the **general case**, often referenced (cited) facts are considered more relevant
- In the **special case**, the relevance of a fact must be adapted to the current (personal) **context**



combine **accurate** search results with **serendipitous** but **relevant** findings

# Exploratory Search based on Linked Open Data

Hasso  
Plattner  
Institut



About: From the Earth to the Moon

An Entity of Type :book, from Named Graph :<http://dbpedia.org>, within Data Space :[dbpedia.org](http://dbpedia.org)

From the Earth to the Moon (French: De la terre à la lune) is an 1865 novel by Jules Verne. It tells the story of the Baltimore Gun Club, a post-American Civil War society of weapons aficionados, and their attempts to build an enormous sky-facing Columbiad space gun and launch three people — the Gun Club's president, his Philadelphian armor-making rival, and a French poet — in a projectile with the goal of a moon landing.

Property Value

dbpedia-owl:abstract

- Von der Erde zum Mond ist ein Roman des französischen Autors Jules Verne. Der Roman wurde erstmals 1865 unter dem französischen Titel De la Terre à la Lune von dem Verleger Pierre-Jules Hetzel veröffentlicht. Die erste deutschsprachige Ausgabe erschien 1873 unter dem Titel Von der Erde zum Mond. Der englische Titel des Romans lautet From the Earth to the Moon. Es handelt sich um ein frühes Werk des Science-Fiction-Genres, das die Mondfahrt um etwa hundert Jahre vorwegnimmt. Allerdings geht es hier vor allem noch um die Vorbereitung des Abenteuers. Der Roman Reise um den Mond (Autour de la Lune) von 1870 setzte die Geschichte fort.
- From the Earth to the Moon (French: De la terre à la lune) is an 1865 novel by Jules Verne. It tells the story of the Baltimore Gun Club, a post-American Civil War society of weapons aficionados, and their attempts to build an enormous sky-facing Columbiad space gun and launch three people — the Gun Club's president, his Philadelphian armor-making rival, and a French poet — in a projectile with the goal of a moon landing. The story is also notable in that Verne attempted to do some rough calculations as to the requirements for the cannon and, considering the comparative lack of any data on the subject at the time, some of his figures are surprisingly close to reality. However, his scenario turned out to be impractical for safe manned space travel since a much longer muzzle would have been required to reach escape velocity while limiting acceleration to survivable limits for the passengers. The character of Michel Ardan, the French poet in the novel, was inspired by the real-life photographer Félix Nadar.

dbpedia-owl:author

- dbpedia:Jules\_Verne
- dbpedia:Henri\_de\_Montaut

dbpedia-owl:literaryGenre

- dbpedia:Science\_fiction

dbpedia-owl:mediaType

- dbpedia:Hardcover

dbpedia-owl:publisher

- dbpedia:Pierre-Jules\_Hetzel

dbpedia-owl:series

- dbpedia:Voyages\_Extraordinaires

dbpedia-owl:thumbnail

- [http://upload.wikimedia.org/wikipedia/commons/thumb/c/c4/From\\_the\\_Earth\\_to\\_the\\_Moon\\_Jules\\_Verne.jpg/200px-From\\_the\\_Earth\\_to\\_the\\_Moon\\_Jules\\_Verne.jpg](http://upload.wikimedia.org/wikipedia/commons/thumb/c/c4/From_the_Earth_to_the_Moon_Jules_Verne.jpg/200px-From_the_Earth_to_the_Moon_Jules_Verne.jpg)

dbpedia-owl:translator

- dbpedia:Lewis\_Page\_Mercier
- dbpedia:Walter\_James\_Miller
- dbpedia:Robert\_Baldick

dbpedia-owl:wikiPageExternalLink

- <http://www.literatureaudio.com/livre-audio-gratuit-mp3/verne-jules-de-la-terre-a-la-lune.html>
- <http://www.conceptualfiction.com>
- [http://www.conceptualfiction.com/from\\_earth\\_to\\_moon.html](http://www.conceptualfiction.com/from_earth_to_moon.html)
- <http://www.astronautix.com/vs/julongun.htm>
- <http://v.gleed.org/i/pg/moon/>
- [http://www.sil.si.edu/OnDisplay/JulesVerne100/Verne\\_ImagesSelected.cfm?book\\_id=SL28-090](http://www.sil.si.edu/OnDisplay/JulesVerne100/Verne_ImagesSelected.cfm?book_id=SL28-090)
- <http://www.gutenberg.org/text/12901>

dbpedia-owl:wikiPageID

- 245137 (xsd:integer)

dbpedia-owl:wikiPageLinkCount

- 131 (xsd:integer)

dbpedia-owl:wikiPageOutLinkCount

- 99 (xsd:integer)

dbpedia-owl:wikiPageRevisionID

- 546811982 (xsd:integer)

dbpprop:author

- Jules Verne

dbpprop:caption

- Cover of an early English translation

dbpprop:country

- France

dbpprop:englishPubData

- 1867 (xsd:integer)

dbpprop:genre

- dbpedia:Novel
- dbpedia:Science\_fiction

dbpprop:hasPhotoCollection

- [http://wifo5-03.informatik.uni-mannheim.de/ticknwrappl/photos/From\\_the\\_Earth\\_to\\_the\\_Moon](http://wifo5-03.informatik.uni-mannheim.de/ticknwrappl/photos/From_the_Earth_to_the_Moon)

dbpprop:illustrator

- dbpedia:Henri\_de\_Montaut

dbpprop:language

- French

dbpprop:mediaType

- Print

dbpprop:name

- From the Earth to the Moon
- From the Earth to the Moon; and, Round the Moon

dbpprop:nr

- 83 (xsd:integer)

dbpprop:publisher

- dbpedia:Pierre-Jules\_Hetzel

dbpprop:releaseDate

- 1865 (xsd:integer)

dbpprop:series

- Voyages Extraordinaires #4

dbpprop:titleOrig

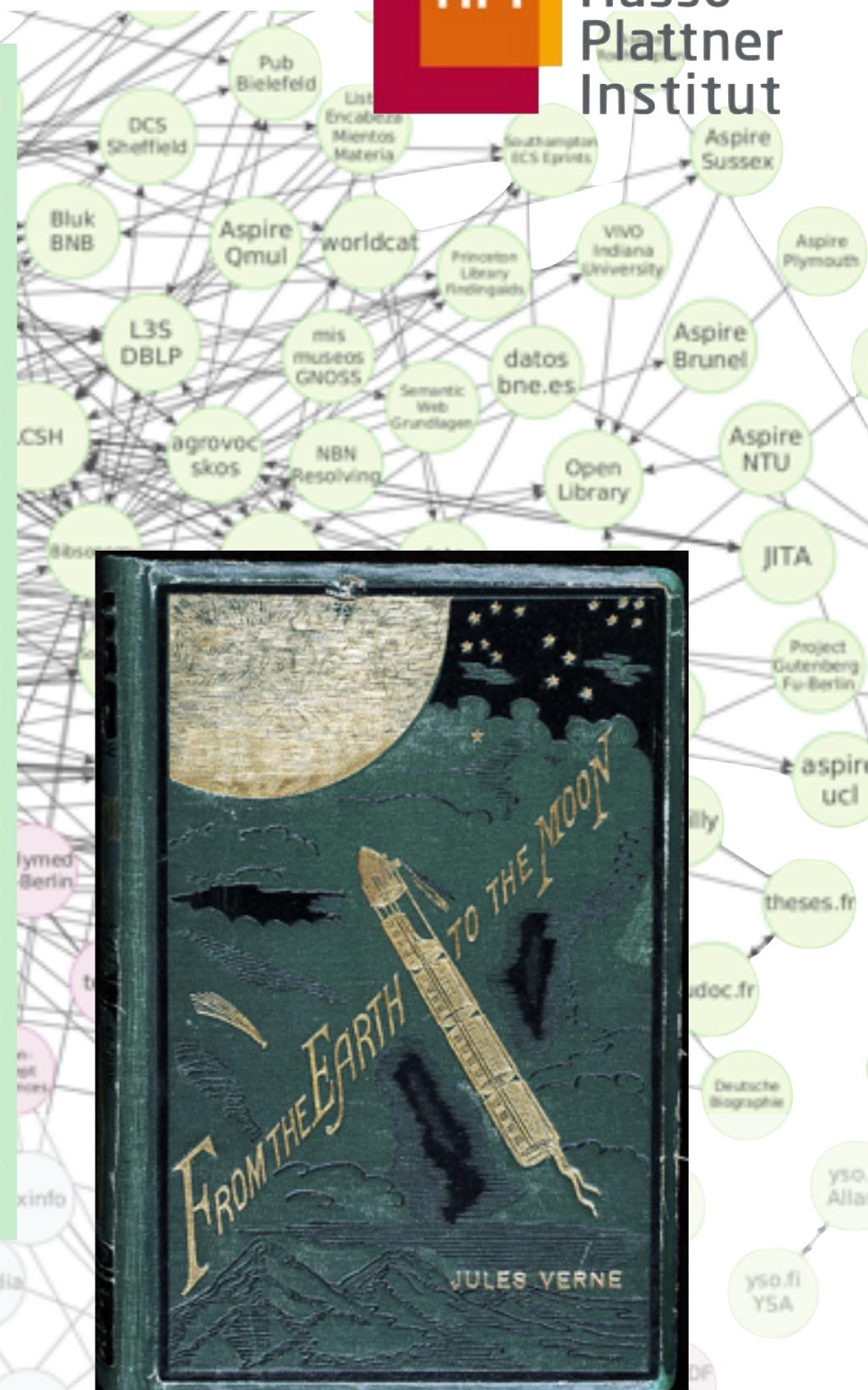
- De la terre à la lune

dbpprop:translator

- dbpedia:Walter\_James\_Miller
- Anonymous
- I. O. Evans
- Edward Roth
- Frederick Paul Walter
- Harold Salemson
- J. K. Hoyt
- Jacqueline and Robert Baldick
- Louis Mercier & Eleanor Elizabeth King
- Lowell Bair
- Thomas H. Linklater

dcterms:subject

- category:French\_science\_fiction\_novels
- category:Moon\_in\_fiction
- category:Novels\_by\_Jules\_Verne
- category:American\_Civil\_War\_novels



[http://dbpedia.org/page/From\\_the\\_Earth\\_to\\_the\\_Moon](http://dbpedia.org/page/From_the_Earth_to_the_Moon)

# Related Results: Siblings via Category Membership

About: From the Earth to the Moon

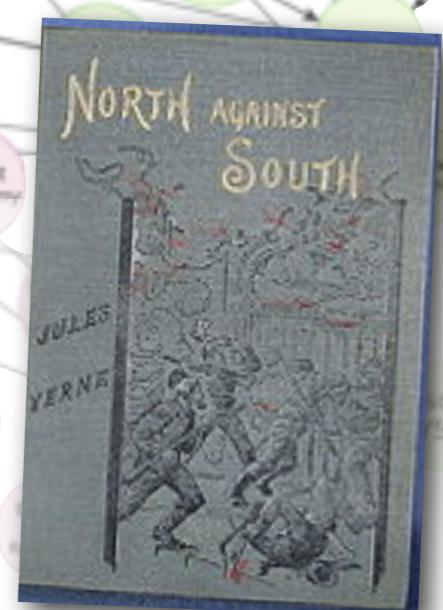
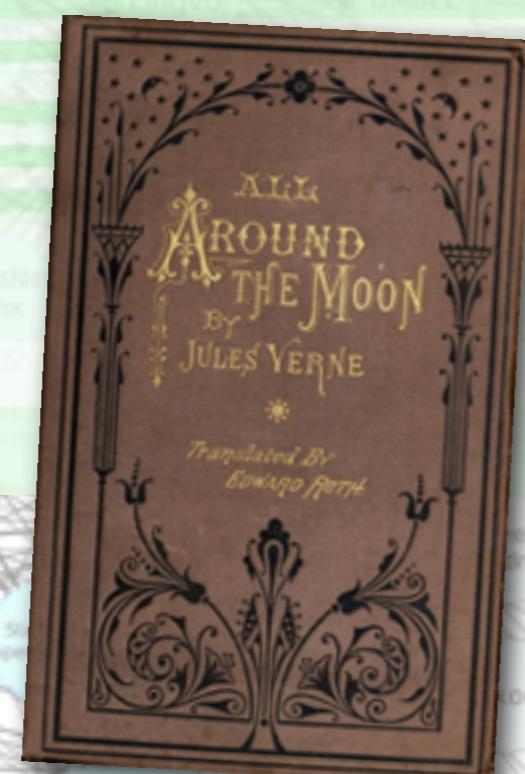
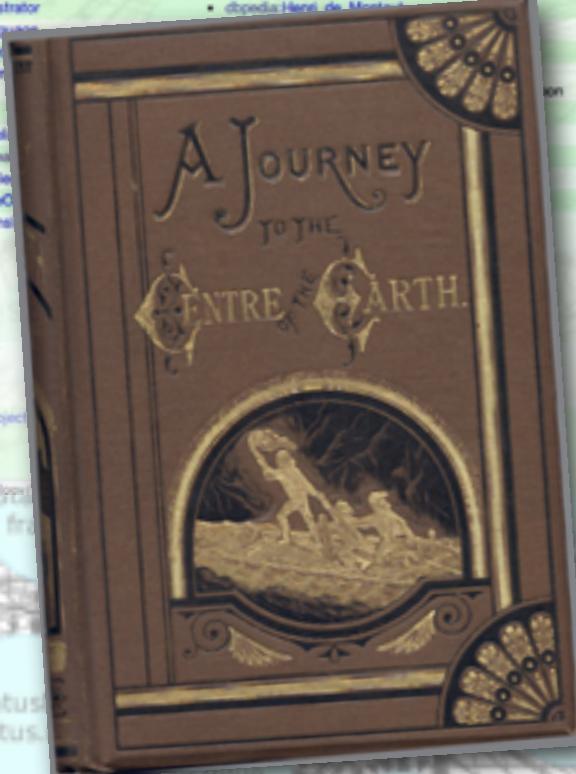
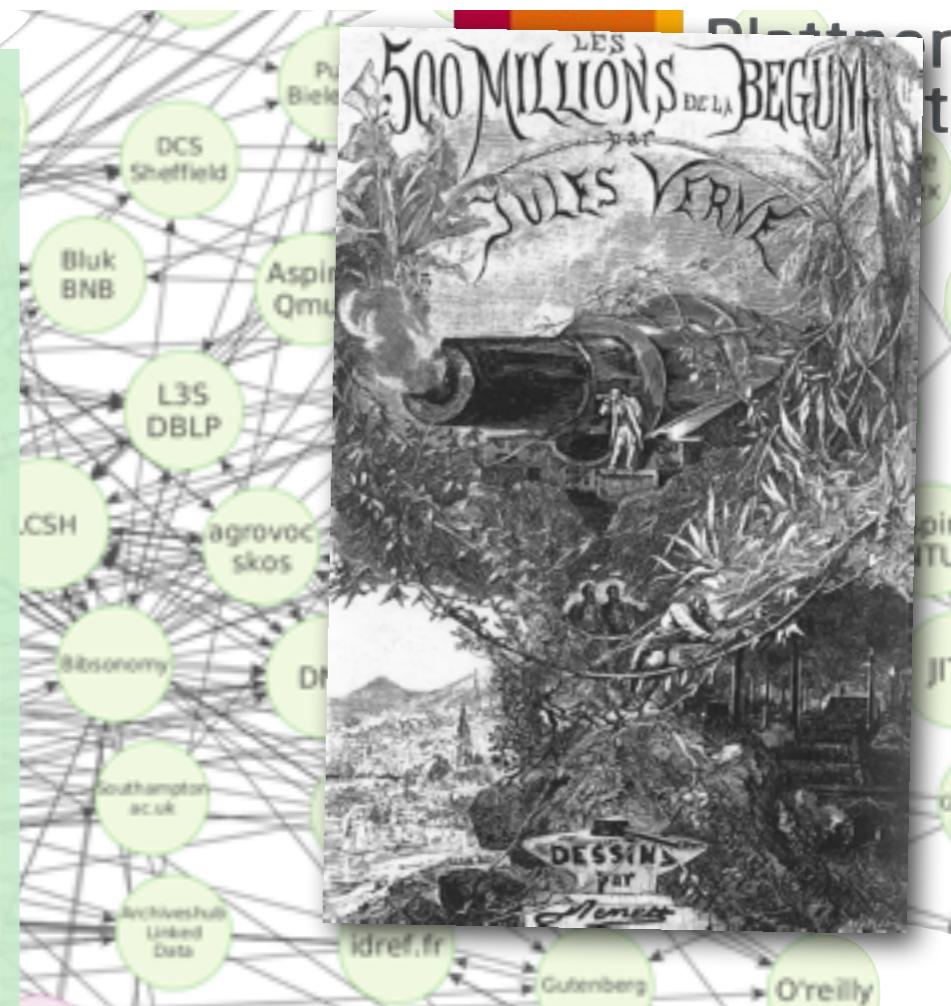
- category:French science fiction novels
- category:Moon in fiction
- category:Novels by Jules Verne
- category:American Civil War novels
- category:Novels set in Florida
- category:1860s science fiction novels
- category:1865 novels
- category:Fictional rivalries

DBpedia

is aficionados, and their attempts to build an enormous sky-lab.

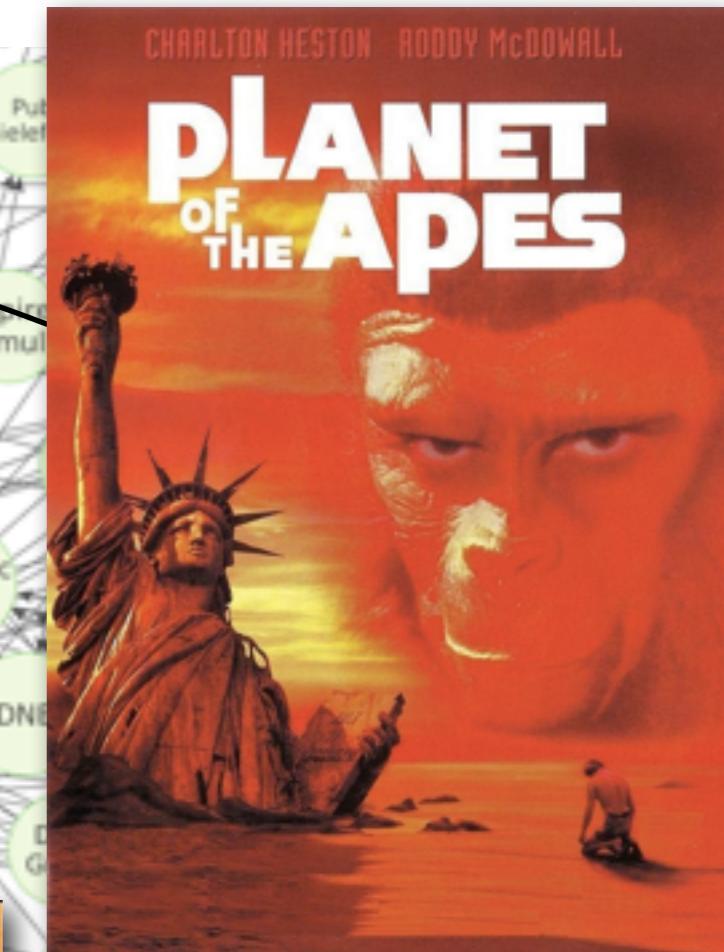
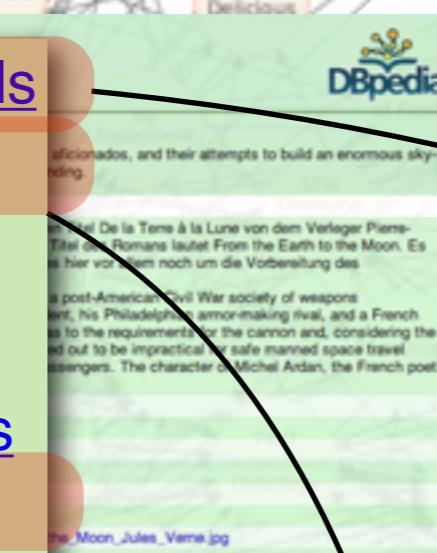
hen Titel De la Terre à la Lune von dem Verleger Pierre-Jules Hetzel ist der Titel des Romans lautet From the Earth to the Moon. Es handelt sich hier vor allem noch um die Vorbereitung des Projekts, eine post-American Civil War society of weapons manufacturers, his Philadelphia armor-making rival, and a French engineer who has to meet the requirements for the cannon and, considering the distance to the moon, has to be impractical for safe manned space travel with passengers. The character of Michel Ardan, the French poet and engineer, is based on the real-life French engineer and writer Jules Verne.

the\_Moon\_Jules\_Verne.jpg



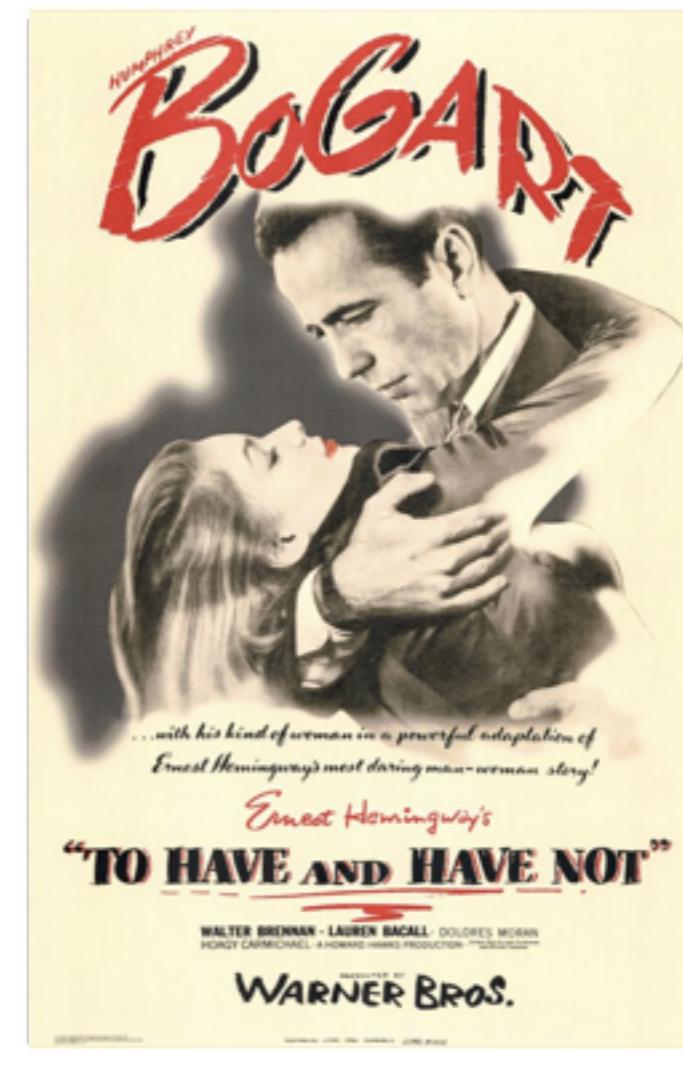
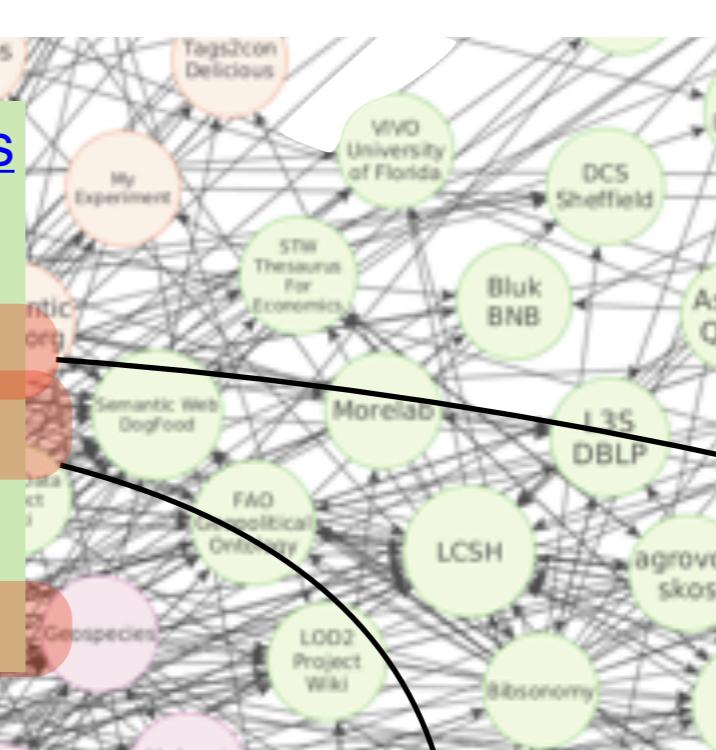
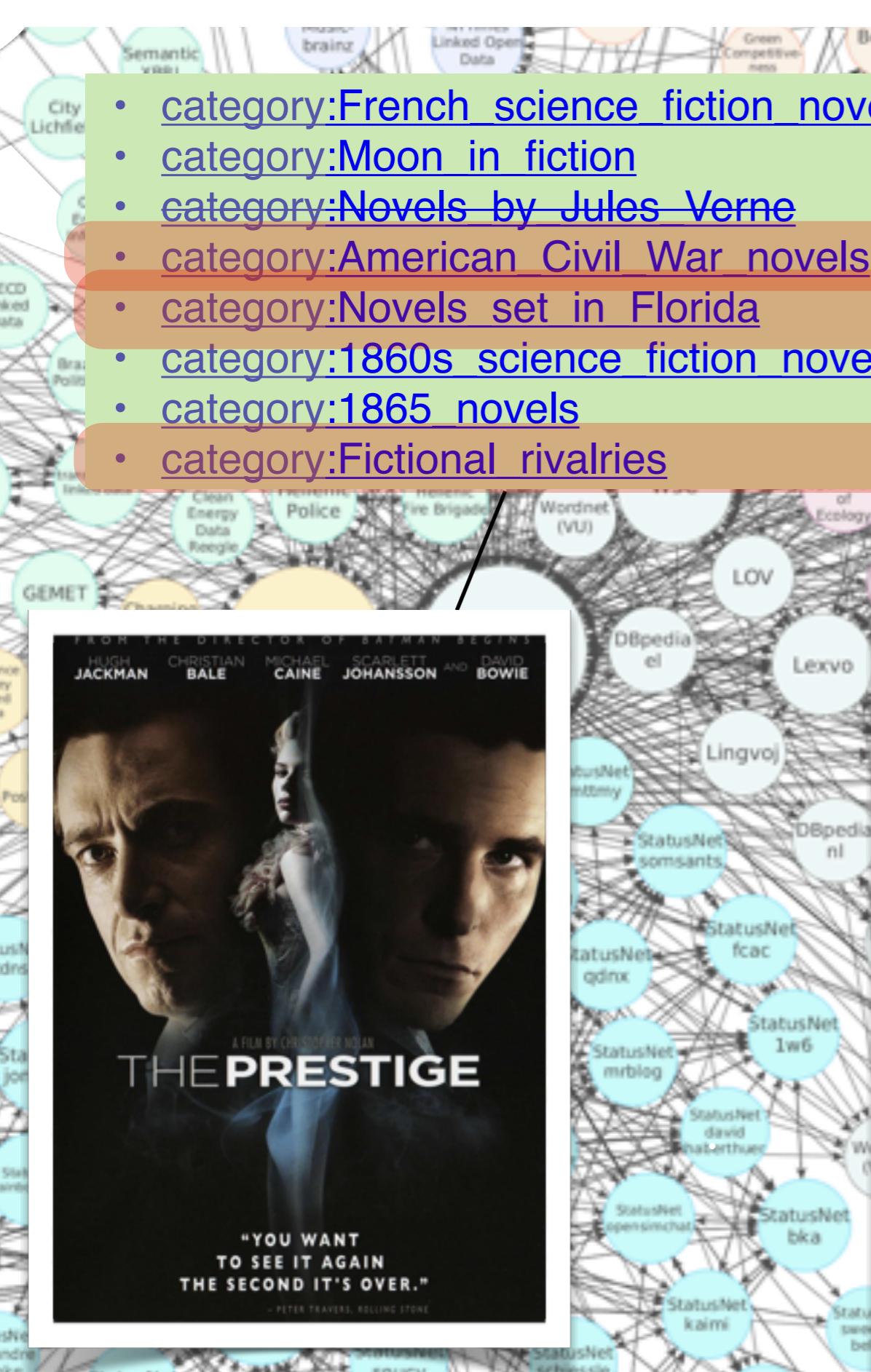
# Serendipity: Remove the most common Category...

- [category:French science fiction novels](#)
- [category:Moon in fiction](#)
- [category:Novels by Jules Verne](#)
- [category:American Civil War novels](#)
- [category:Novels set in Florida](#)
- [category:1860s science fiction novels](#)
- [category:1865 novels](#)
- [category:Fictional rivalries](#)



# Serendipity: Look for the most unexpected yet important

- [category:French science fiction novels](#)
  - [category:Moon in fiction](#)
  - [category:Novels by Jules Verne](#)
  - [category:American Civil War novels](#)
  - [category:Novels set in Florida](#)
  - [category:1860s science fiction novels](#)
  - [category:1865 novels](#)
  - [category:Fictional rivalries](#)



# Content-Based Recommendations

From the Earth to the Moon

Recommendations ▾

Sort by: Title Score Popularity Rotten Tomatoes Similarity Category Weight Custom Weight Rule Based

**A Trip to the Moon**  
The Moon in film From the Earth to the Moon Technicolor  
Science fiction film Films based on works by Jules Verne Jules Verne



Score 20.0

Popularity 987

Rotten Tomatoes 94.5

**The War of the Worlds (1953 film)**  
Films directed by Byron Haskin Technicolor Science fiction film  
1950s science fiction films Les Tremayne Byron Haskin



Score 15.0

Popularity 988

Rotten Tomatoes 67.0

**The Birth of a Nation**  
Ulysses S. Grant Films set in the 1860s American Civil War



Score 14.0

Popularity 290

Rotten Tomatoes 77.5



Hasso  
Plattner  
Institut

Industry Project:  
cENTERTAIN.me video recommendation

<http://mediaglobe.yovisto.com:8080/c.me-gui-0.0.1-SNAPSHOT2/>

# Exploratory Search with yovisto

91

**George Orwell**

**related place**  
[London \(83\)](#)

**influenced**  
[Kurt Vonnegut \(1\)](#)  
[Christopher Hitchens \(1\)](#)  
[Noam Chomsky \(17\)](#)  
[Ignazio Silone \(1\)](#)

**is also related to**  
[Catalonia \(1\)](#)  
[Burma \(2\)](#)  
[England \(58\)](#)

**birth place**  
[Bihar \(52\)](#)  
[British Raj \(16\)](#)

**influenced by**  
[Upton Sinclair \(1\)](#)  
[Jonathan Swift \(1\)](#)  
[Arthur Koestler \(1\)](#)  
[James Joyce \(1\)](#)  
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george orwell **Search** VIDEO INFO SPEAKER LECTURE UNIVERSITY

Exploratory Search [expand] Search Results Search time: 787ms / Results found: 105 Sort results: relevant | popular | recent

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**George Orwell**

related place  
[London \(83\)](#)

influenced  
[Kurt Vonnegut \(1\)](#)  
[Christopher Hitchens \(1\)](#)  
[Noam Chomsky \(17\)](#)  
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is also related to  
[Catalonia \(1\)](#)  
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birth place  
[Bihar \(52\)](#)  
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[Upton Sinclair \(1\)](#)  
[Jonathan Swift \(1\)](#)  
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[James Joyce \(1\)](#)  
[Charles Dickens \(34\)](#)  
[Gustave Flaubert \(1\)](#)

Facets

Type  
Video (92)  
Speaker (13)

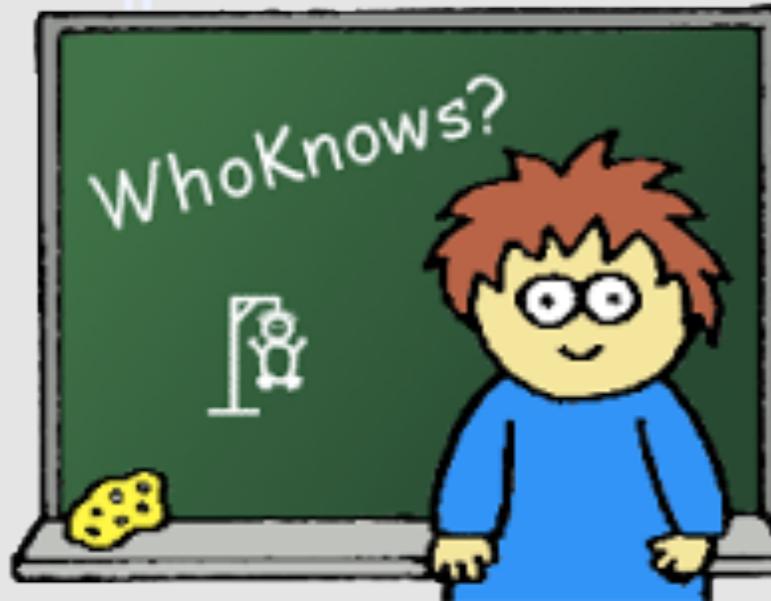
Category  
Computer Science (25)  
- Others - (21)  
Media and Communication Studies (8)  
Psychology (6)

Organization  
Friedrich-Schiller-Universität Jena (25)  
Berkeley - University of California (16)  
Yovisto Users (13)  
TED - Technology, Entertainment, Design (5)

Language  
de (48)  
en (42)

Popular Tags  
george (5)  
interpretation (3)  
john (3)  
auto (2)

# Game Based Evaluation and Annotation



<http://tinyurl.com/whoknowsgame>



<http://bit.ly/WhoKnowsMovies>



**FRancO**  
Current Fact Ranking Challenge

<http://s16a.org/fr/>

- A. Thalhammer, M. Knuth, H. Sack  
"Evaluating Entity Summarization Using a Game-Based Ground Truth", ISWC 2012
- L. Wolf, M. Knuth, J. Osterhoff, H. Sack:  
"RISQ! Renowned Individuals Semantic Quiz – A Jeopardy like Quiz Game for Ranking Facts", i-SEMANTICS 2011
- N. Ludwig, J. Waitelonis, M. Knuth, H. Sack:  
"WhoKnows? - Evaluating Linked Data Heuristics with a Quiz that Cleans Up DBpedia", ESWC 2011 and ITSE, 8:3, 2011



# **“Understanding“ the Web of Data**

## **Named Entity Resolution**

### **Overview**

#### **(1) How to make sense of the Web?**

and why we are not really content with it...

#### **(2) Words and Meaning**

to be able to better „understand“ the content

#### **(3) Named Entity Resolution**

from words to semantic entities...

#### **(4) Application Scenarios**

Exploratory Search and intelligent Recommendations

**Dr. Harald Sack**

Hasso-Plattner-Institut für Softwaresystemtechnik, Universität Potsdam  
Prof.-Dr.-Helmert-Str. 2-3, D-14482 Potsdam