

# Fundamentos de Neurociencia Cognitiva

*Language and thought*

# Introduction

- Language influences how you think?



(AP PHOTO)

# Plan for today

---

- **Language and thought**
- **Sapir-Whorf hypothesis – strong version**
- **Sapir-Whorf hypothesis – weak version**
- **Evidence from color perception/number**
- **Evidence from grammatical gender**

# Sapir-Whorf Hypothesis

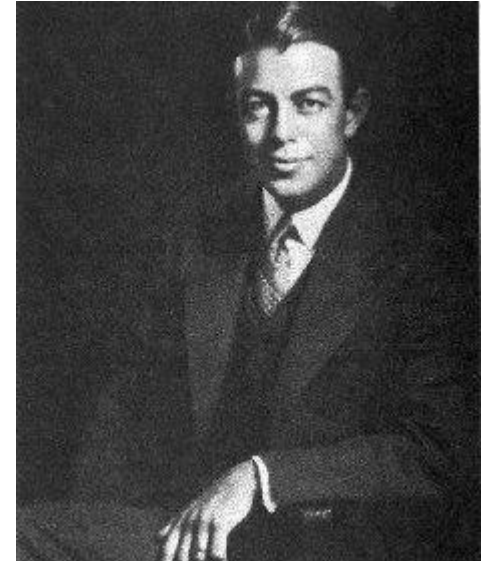
---

- **Strong version:**

**Language *determines* thought**

- **What you can think is determined by your language**

- **Speakers of different languages think differently!**



Benjamin Whorf  
(1897-1941)

# Sapir-Whorf hypothesis

---

- Early “evidence” – Eskimos have many more words for snow than English speakers.
- Eskimos see more types of snow than English (or Spanish) speakers

# Snowy evidence

---



# Snowy evidence

---

- **What are the facts (Pinker, 1997)?**
- **Reported number of words for snow in Inuit: 4, 7, 50, 100s**
- **English: Snow, sleet, flurry, frost, slush, glacier, hail, ice...**
- **AND, fewer words means cannot SEE difference?**

# Hopi language

---

- Hopi (Native American language) does not mark “time”.
- Hopi do not know what time is.

However: “Then indeed, the following day, quite early in the morning at the hour when people pray to the sun, around that time then he woke up the girl again”



# Linguistic determinism

---

- So, language *determines* thought?



# Pinker's arguments

---

- Arguments against linguistic determinism
- Language is not thinking because language has properties that thinking has not
  - Language is ambiguous
    - *Vi un avión volando hacia el sur*

# Pinker's arguments

---

- Arguments against linguistic determinism
  - Language has co-reference

*I met a tall black-haired guy yesterday.*

*The man was really smart.*

*But he needs to go to a hairdresser.*

# Pinker's arguments

---

- **Strong version of Sapir-Whorf hypothesis is unlikely.**
- **Weak version = linguistic relativism**

# Plan for today

---

- Language and thought
- Sapir-Whorf hypothesis – strong version
- Sapir-Whorf hypothesis – weak version
- **Evidence from color perception/number**
- Evidence from grammatical gender

# Sapir-Worf – Color Perception

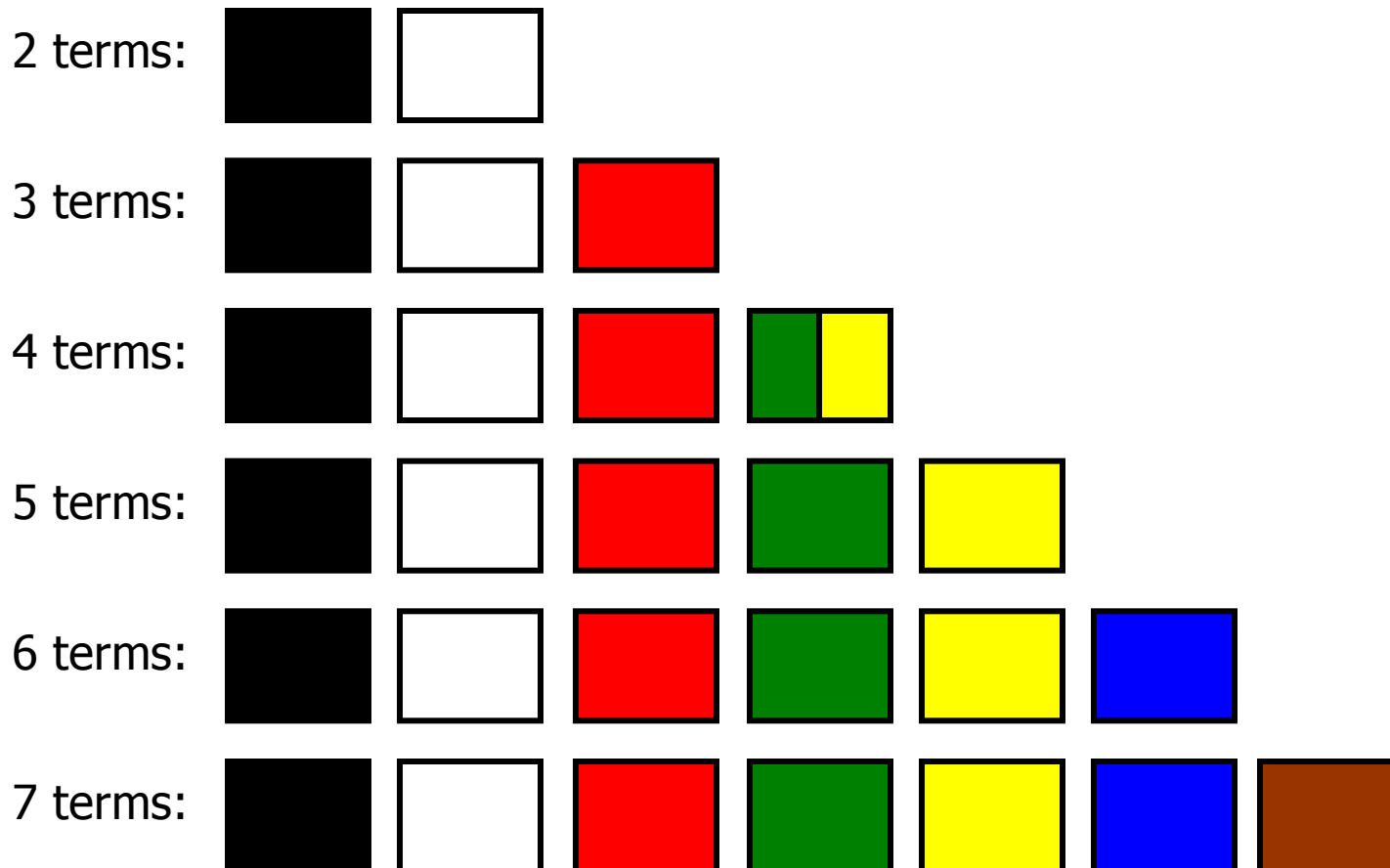
---

- **Is color perception universal, or determined by language?**
- **Three studies have addressed this issue:**

# Color Perception

Berlin & Kay (1969)

Languages differ predictably in their color terms



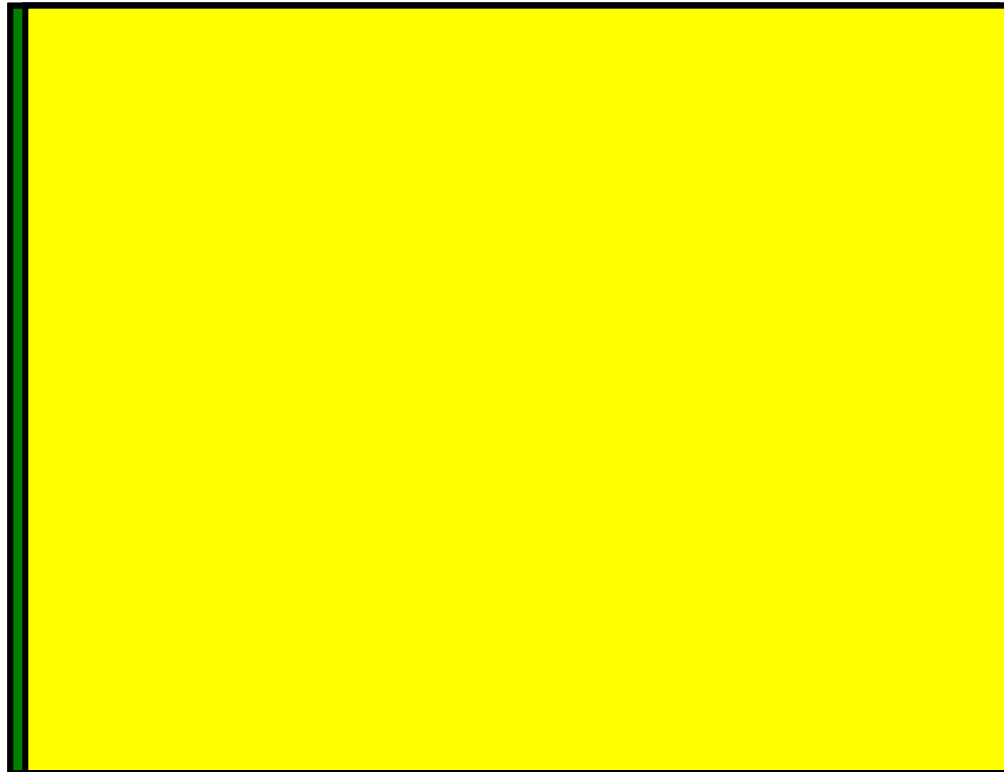
# Color Perception

---



Rosch (1972)

- If you only have two words for colors, how will you remember color?



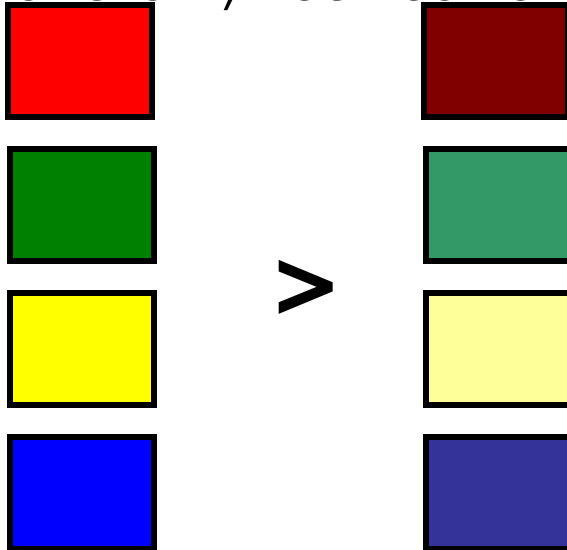




Rosch (1972)

# Color Memory

- A strong test of the Sapir-Whorf Hypothesis
  - If you only have two words for colors, how will you remember color?
  - The way we see colors determines how we learn words for them, not vice versa



Comparing Grand Valley Dani (in Irian Jaya, Indonesia) with American English speakers

# Color Perception

---

- **Both the Americans and the Dani had equal color perception and memory for different colors**
  - Even though the Dani only had two color categories
- **Color is biological; language does not shape thought?**

# Evidence for Sapir-Whorf

Roberson et al. (2000)

---

- **Participants: British & Berinmo (New Guinea tribe)**
  - British have eight color categories
  - Berinmo have five color categories
  
- **Do these color categories influence how we think?**

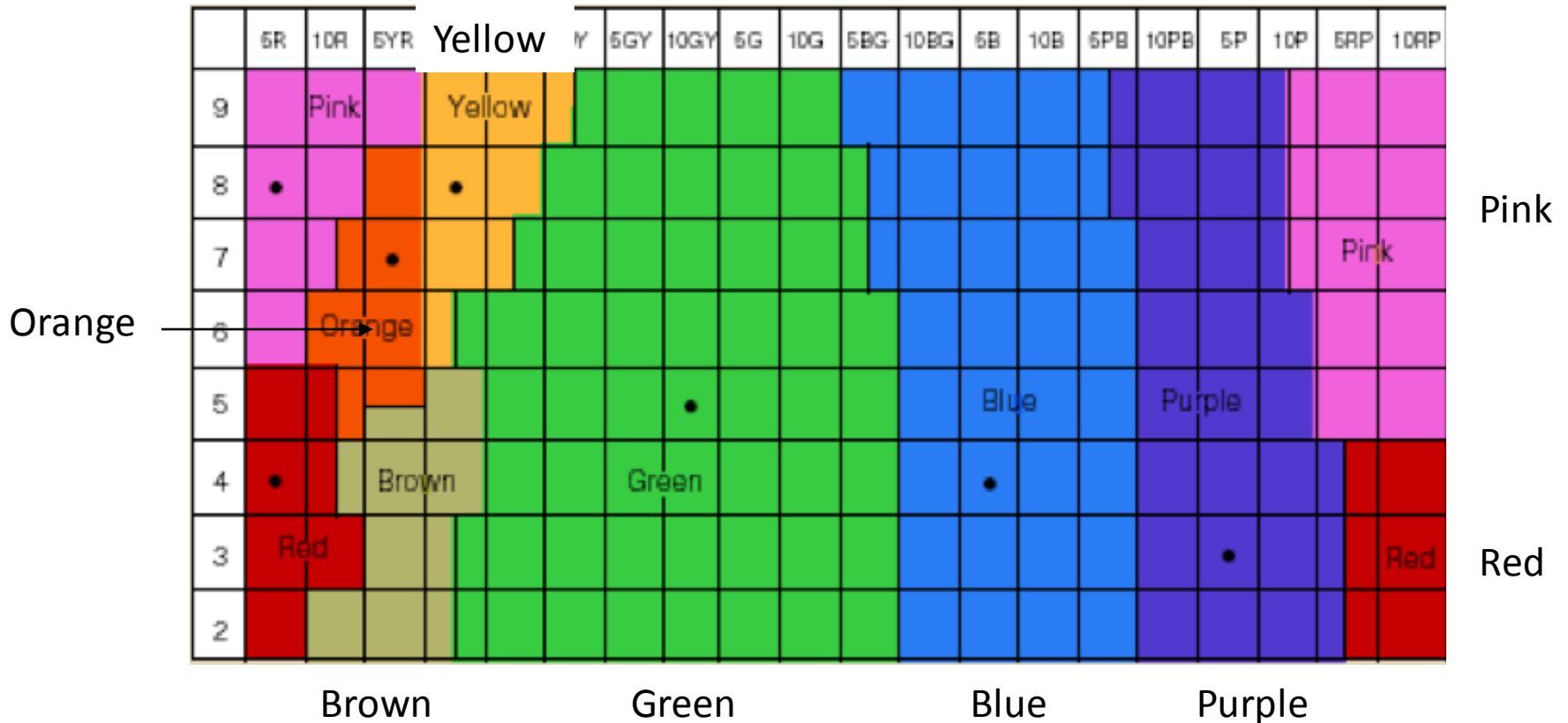
# Methods: Step 1

---

- **160 calibrated color chips**
  - Think paint samples from the store
- **Have participants place the colored chips into specific categories**

# British Color Classification

- 8 categories



# Berinmo Color Classification

---

- 5 categories

	5R	10R	5YR	10YR	5Y	Wor	Y	10GY	5G	10G	5BG	10BG	5B	10B	5PB	10PB	5P	10P	5RP	10RP
9	3	2	5	Wap	2				1	1			Wap	1	5	12	6	3		2
8				9	6	2	3										1			
7			2	5	4	4	1	1		2										
6		Mahi		2	1			2	3		1									
5	6	2			Wor	1		6	7	4	Nol	2	2						Mahi	3
4	19								5			3								11
3	2			Kel							1		1		1					1
2		1	1	3	4	6	12				2	1	4	3	4	4	Kel	2		

Nol
Kel

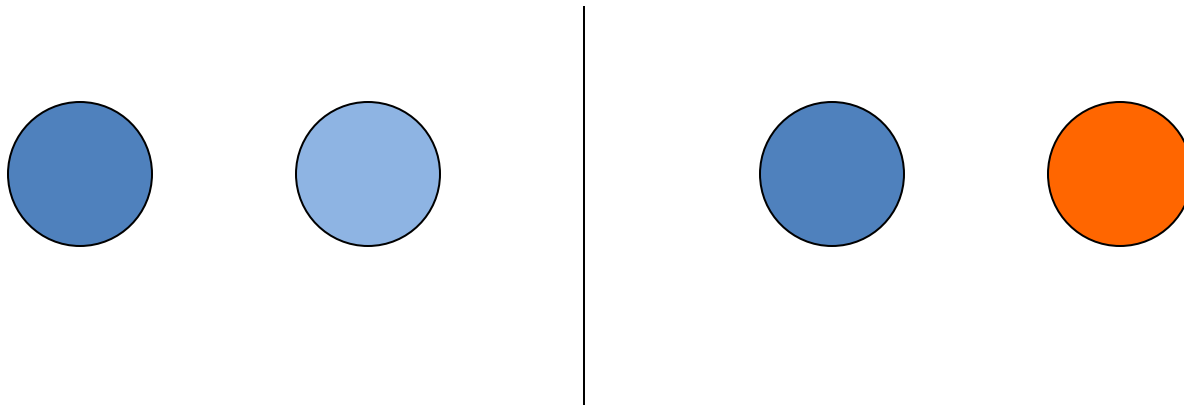
Wap

Mehi

# Methods - Step 2

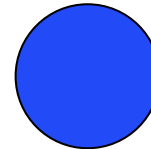
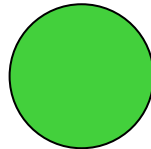
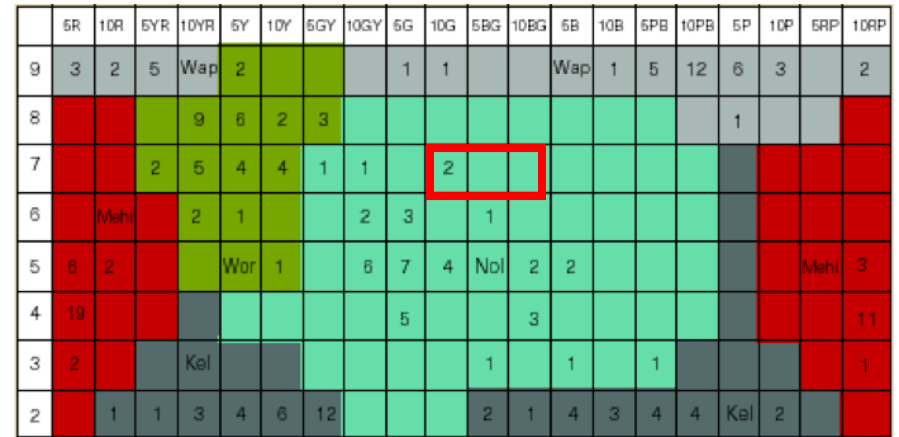
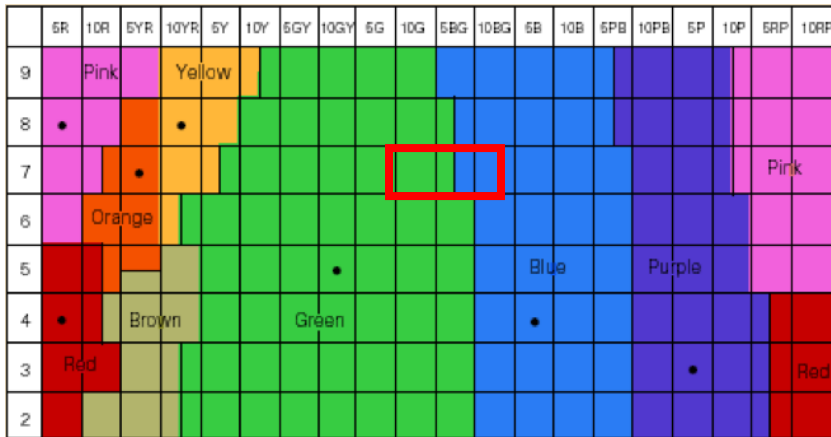
---

- **Categorical perception task**
  - More difficult to discriminate stimuli from the same category
- **Question: Same or different category?**



# Categorical perception task

- Give British and Berinmo:



- British faster than Berinmo

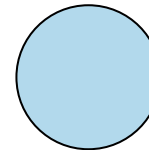
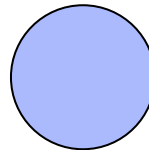


# Categorical perception task

- Give British and Berinmo:

	5R	10R	5YR	10YR	5Y	10Y	5GY	10GY	5G	10G	5BG	10BG	5B	10B	5PB	10PB	5P	10P	5RP	10RP
9	Pink	Pink	Yellow	Yellow	Green	Green	Green	Green	Green	Green	Blue	Blue	Blue	Blue	Purple	Purple	Purple	Purple	Pink	Pink
8	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
7	Pink	Orange	Orange	Orange	Green	Green	Green	Green	Green	Green	Blue	Blue	Blue	Blue	Purple	Purple	Purple	Purple	Pink	Pink
6	Orange	Orange	Orange	Orange	Green	Green	Green	Green	Green	Green	Blue	Blue	Blue	Blue	Purple	Purple	Purple	Purple	Pink	Pink
5	Red	Red	Red	Red	Green	Green	Green	Green	Green	Green	Blue	Blue	Blue	Blue	Purple	Purple	Purple	Purple	Pink	Pink
4	•	•	Brown	Brown	Green	Green	Green	Green	Green	Green	Blue	Blue	Blue	Blue	Purple	Purple	Purple	Purple	Red	Red
3	Red	Red	Red	Red	Green	Green	Green	Green	Green	Green	Blue	Blue	Blue	Blue	Purple	Purple	Purple	Purple	Red	Red
2	Red	Red	Red	Red	Green	Green	Green	Green	Green	Green	Blue	Blue	Blue	Blue	Purple	Purple	Purple	Purple	Red	Red

	5R	10R	5YR	10YR	5Y	10Y	5GY	10GY	5G	10G	5BG	10BG	5B	10B	5PB	10PB	5P	10P	5RP	10RP
9	3	2	5	Wap	2	2	3	3	1	1	1	1	1	Wap	1	5	12	6	3	2
8	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
7	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
6	Mehi	Mehi	Mehi	Mehi	2	1	1	1	2	3	1	1	1	1	1	1	1	1	1	1
5	6	2	2	2	Wor	1	1	1	6	7	4	Nol	2	2	2	2	2	2	Mehi	3
4	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
3	2	2	2	Kel	2	2	2	2	5	5	1	1	1	1	1	1	1	1	1	1
2	1	1	1	3	4	6	12	12	2	2	2	2	2	4	3	4	4	Kel	2	2



- Berinmo faster than British!

# What does this mean?

---

- **There is an influence of language on how you perceive colors**
- **If your language does not have names for colors, you perceive them in a different way (slower)**
- **This is evidence for linguistic relativism**

# Number

---

- Pirahã tribe in Amazon forest (Frank et al., 2008)
- Have no words for exact number
  - One, two, three, four, etc
- Have words for "fewer", "more".
- How do they perceive exact quantities?



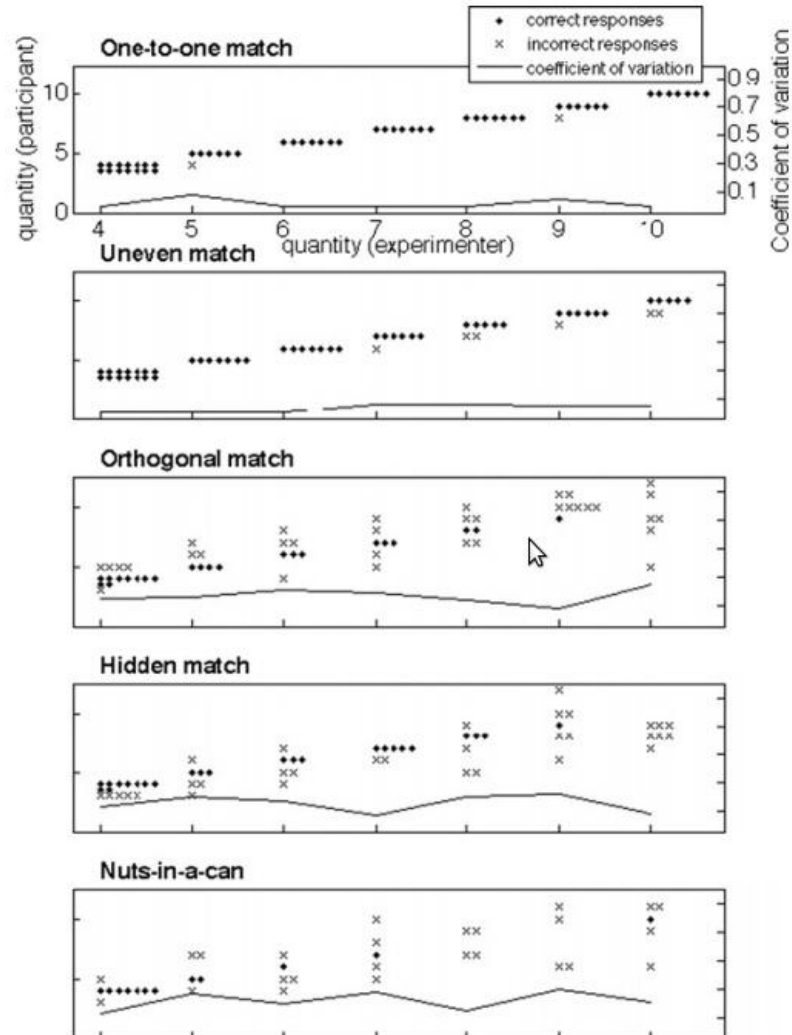
# Number

---

- **Several tasks**
  - Match
  - Uneven match
  - Orthogonal match
  - Hidden match
  - Nuts in a can

# Number

- Results



# Number

---

- **Two conclusions**
  - For simple tasks, can do task exactly even though no exact numbers. (match one-by-one requires concept of "one")
  - For difficult tasks, they cannot do it because language is necessary to encode number across time, space, modality
- **Language does not change basic perceptual/cognitive processing, but helps encode experience.**

# Sapir-Whorf

---

- **Summary**
- **How language influences thought?**
  - Linguistic determinism
  - Linguistic relativism

# Linguistic relativism

---

- **Language does not influence**
  - Basic / primitive (innate) concepts
    - Color perception, exact quantity
- **What about more abstract concepts?**



# Plan for today

---

- Language and thought
- Sapir-Worf hypothesis – strong version
- Sapir-Worf hypothesis – weak version
- Evidence from color perception/number
- **Evidence from grammatical gender**

# Grammatical gender

---

- **Sex, Syntax, and Semantics**
- **Many languages have grammatical gender**
- **“la manzana”, “el coche”**
- **When word has masculine or feminine gender, does that make you think about these words as more masculine or feminine?**



Lera Boroditsky

# Grammatical gender

---

- **El Puente (Spanish) – Masculine**
- **Die Brücke (German) – Feminine**



- **Do Spanish and German speakers think about bridges in different ways?**

# Grammatical gender

---

- **Spanish and German speakers presented with 24 objects**
- **Each object had opposite grammatical gender in other language (Masculine in Spanish, Feminine in German, and v).**
- **Write down three adjectives that best describes the object.**
- **Study conducted in English.**

# Grammatical gender

---

- Afterwards a group of English speakers rated all adjectives on masculinity and femininity.
- Results: Masculine adjectives with masculine gender words, feminine adjectives with feminine gender words. Even for the same objects!
- Bridge, feminine in German = beautiful, elegant, fragile, peaceful, pretty and slender
- Bridge, masculine in Spanish = big, dangerous, long, strong, sturdy and towering.

# Grammatical gender

---

- People's thinking about objects is influenced by the grammatical gender of words.
- Problems?
- What about cultural differences? Maybe bridges just *look* different in Spain than in Germany.

# Grammatical gender

---

- **Teach grammatical gender to English speakers.**
- **Had to learn gender marking for 12 objects (soupative or ousative)**
- **In each category there were 4 male or female objects (a man, a woman, etc) to signal the natural gender of the category.**
- **After some training, the subjects could category each object as masculine or feminine.**
- **Critically, whether object was in masculine or feminine category was counterbalanced**

# Grammatical gender

---

- Next, then again performed the adjective generation experiment, and afterwards adjectives were rated for masculinity and femininity.
- Found some results as before, when object was in masculine gender category, more masculine adjectives than in feminine category
- Violin in the feminine category = artsy, beautiful, creative, curvy, delicate, elegant, interesting, pretty and wooden.
- Violin in the masculine category = chirping, difficult, impressive, noisy, overused, piercing, shiny, slender, voluptuous, and wooden



# Grammatical gender

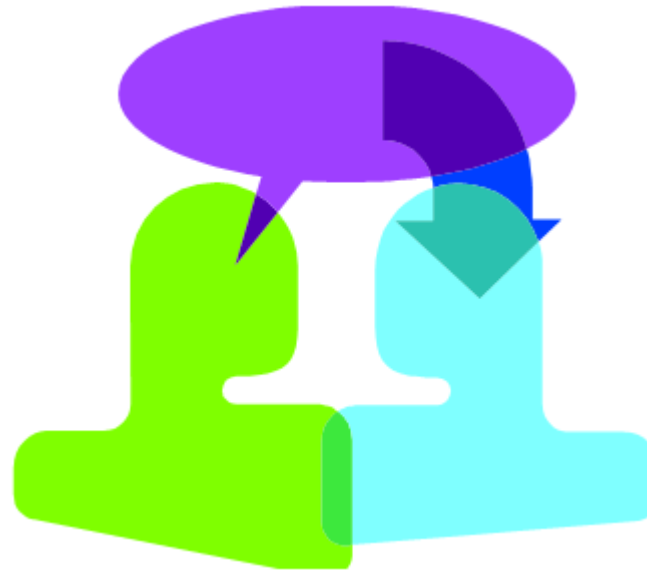
---

- Thus given that the same objects were used for the same group of people, cultural differences cannot explain this.
- Thus, grammatical gender influences how we think about objects.
- Further evidence that language influences thought

# Language and thought

---

- Linguistic relativism in everyday language



# Language and thought

---

- **But language has strong effects on thinking**
- **"the war on drugs"**
- **"the European crisis"**

# Language and thought

---

- Linguistic relativism has to be true
- How does language influence how you think?

# Language and thought

---

## 1. Sentences contain meaning

- Sentence meaning is the sum of the meaning of the words

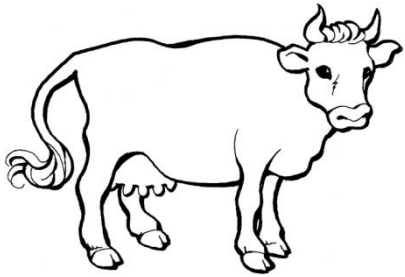
## 2. Sentences "prompt" meaning

- Sentences do not contain all meaning

# Language and thought

---

- The cow is brown
  - La vaca es marrón



+



=



# Language and thought

---

1. The child is safe – "el niño es seguro"
2. The beach is safe – "la playa está segura"
3. The shovel is safe – "la pala es seguro"

In (1) safe means "protected from harm", but not in (2) or (3).

- The meaning of a sentence is NOT the sum of the meaning of the parts!

# Language and thought

---

- A red pencil – un lápiz rojo



- A red apple – una manzana roja





# Language and thought

---

- **Pedro is the father of Maria**
  - "Pedro es el padre de María"
  
- **Child is the father of man**
  - "El hijo es el padre del Hombre"

# Language and thought

---

- **Language "prompts" thinking**
- **Language provides some instructions for thinking**
- **Thinking happens after language**

# Language and thought

---

- **Are language and thought the same thing?**
  - Unlikely, see Pinker (1994)
- **Does language influence thought?**
  - There is some evidence
    - Color perception, number
    - Grammatical gender, etc
- **How does language influence thought?**