



Lecture 7: Language and Thought

Cognition and Communication, Monday, Oct. 25th 2021

Kristian Tylén

Agenda

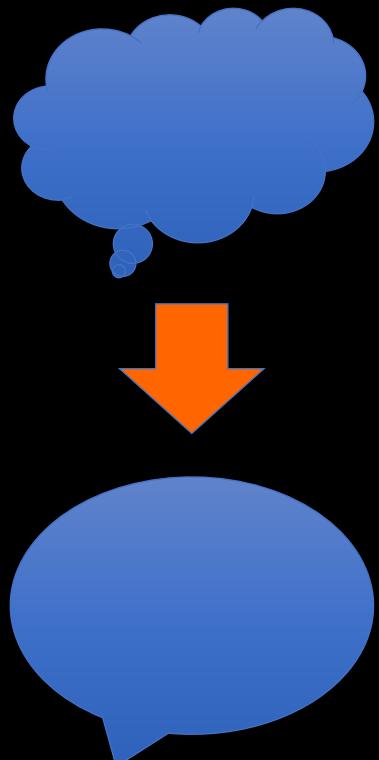
- Midterm evaluations
- The relation between thought and language
 - The Language of Thought Hypothesis
 - Embodiment
- Linguistic relativity (the Sapir-Whorf hypothesis)
 - Strong and weak linguistic relativity
 - Spatial frames of reference
 - Color
 - Grammatical gender

Midterm evaluations

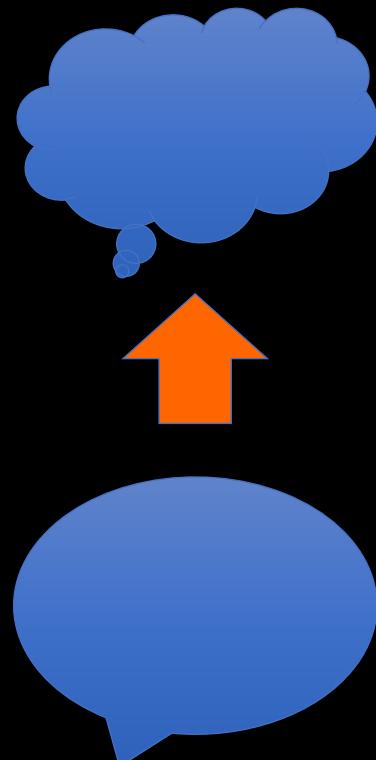
- How are we doing?
- What works well?
- What could be improved?
 - Lectures
 - Exercises
 - Readings
 - Python workshop

The relation between thought and language

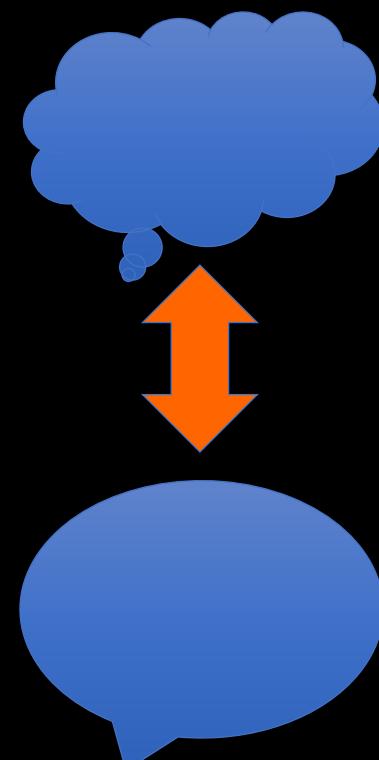
Language reflects
structure of thought



Thought is determined
by language

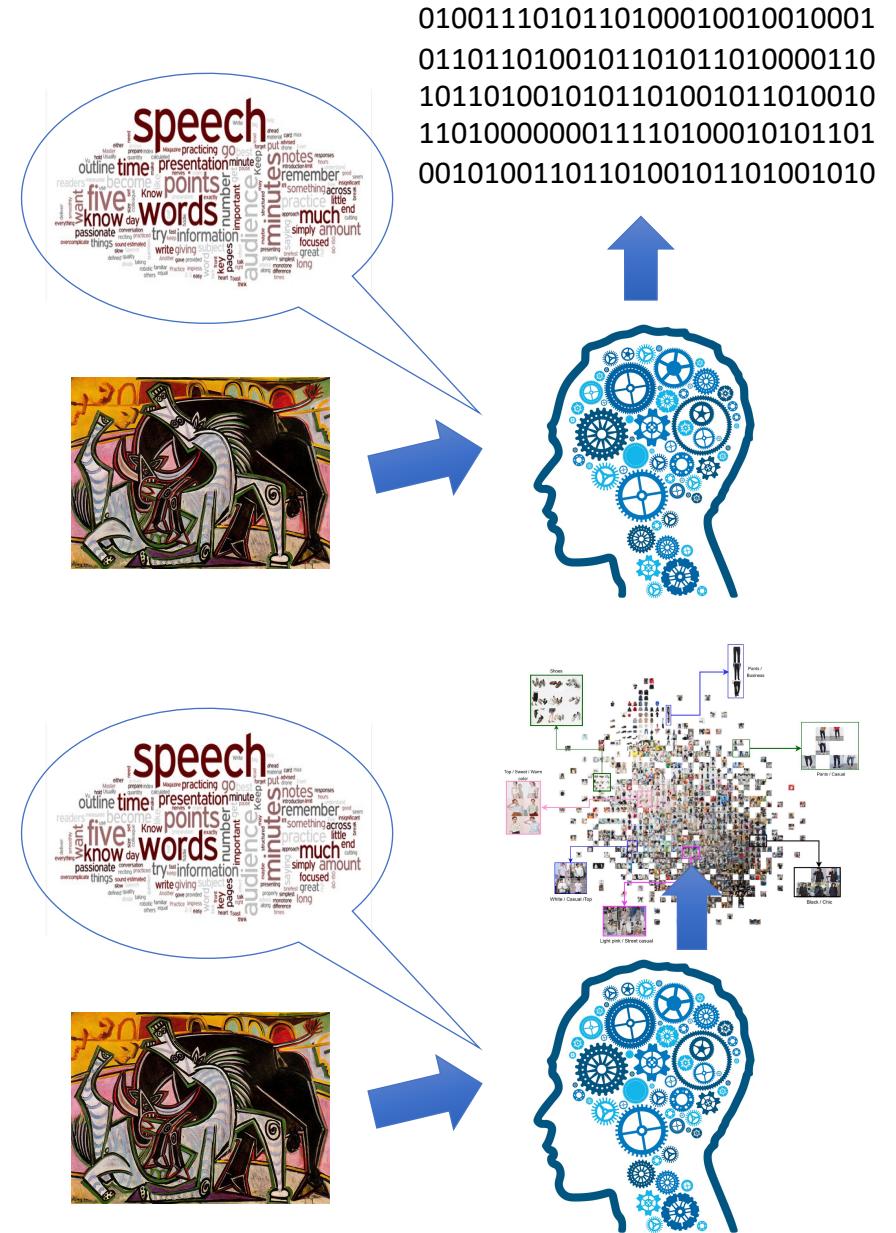


Bidirectional link between
language and thought



Approaches in cognitive science

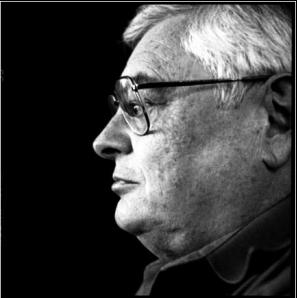
- Classical cognitivism:
 - Mind as computer metaphor
 - Thinking is manipulation of amodal/abstract symbols
 - Based on principles of formal logic
 - Universals
 - Embodied cognitive science
 - Thinking is multimodal (visual, tactile, auditory, olfactory, etc)
 - Linguistic and non-linguistic representations interact
 - Culture-specific (e.g. linguistic relativity)



Language and thought - two perspectives

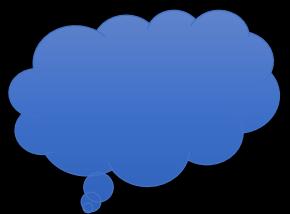
- Language and thought is the same thing
- Language is a reflection of thought
- Rely on the same “module” independent of other aspects of cognition
- Thought is carried out as algorithmic processing of amodal, symbolic information
- Assumptions of universality
- Thought and language are different things
- They interact
- Language is tightly interwoven with general cognition: rely on aspects of general cognition
- Thought is multimodal (visual, auditory, tactile etc.)
- Assumptions of cultural specificity/influence

Jerry Fodor: “The language of thought hypothesis” (LOTH)



- The Language of Thought Hypothesis (LOTH):
 - thinking takes place in a ‘mental language’: *mentalese*
- *Mentalese* is a complex combinatorial algorithm:
 - thought has (or rather is) syntax
 - The thought "John is tall" is composed of two sub-parts: [John], [tallness] → tJ
 - "John kissed Mary": kiss[SubjectJohn, ObjectMary]
- Language and thought is expressions of the same underlying universal and innate module
 - Related to the idea of Universal Grammar
- Therefore language is just a reflection of thought:
 - “knowing a natural language is knowing how to pair its expressions with mentalese expressions” (Fodor, 1998, p. 67)
- Great impact on early generations of AI

Language reflects
structure of thought



Embodied cognition

- we encode *modal* (eg. visual, auditory, bodily) information in representations
- *The ranger saw the eagle in the sky*
- *The ranger saw the eagle in the nest*

Research Report

LANGUAGE COMPREHENDERS MENTALLY REPRESENT THE SHAPES OF OBJECTS

Rolf A. Zwaan, Robert A. Stanfield, and Richard H. Yaxley

Florida State University

VOL. 13, NO. 2, MARCH 2002



Table 1. Object recognition latencies and accuracy in Experiment 1 and picture naming times in Experiment 2

Measure	Condition		
	Match	Mismatch	Neutral
Experiment 1			
Reaction time	697 (202)	761 (210)	—
Percentage correct	97 (6)	93 (7)	—
Experiment 2			
Reaction time	605 (115)	638 (128)	617 (125)

Note. Standard deviations are given in parentheses.

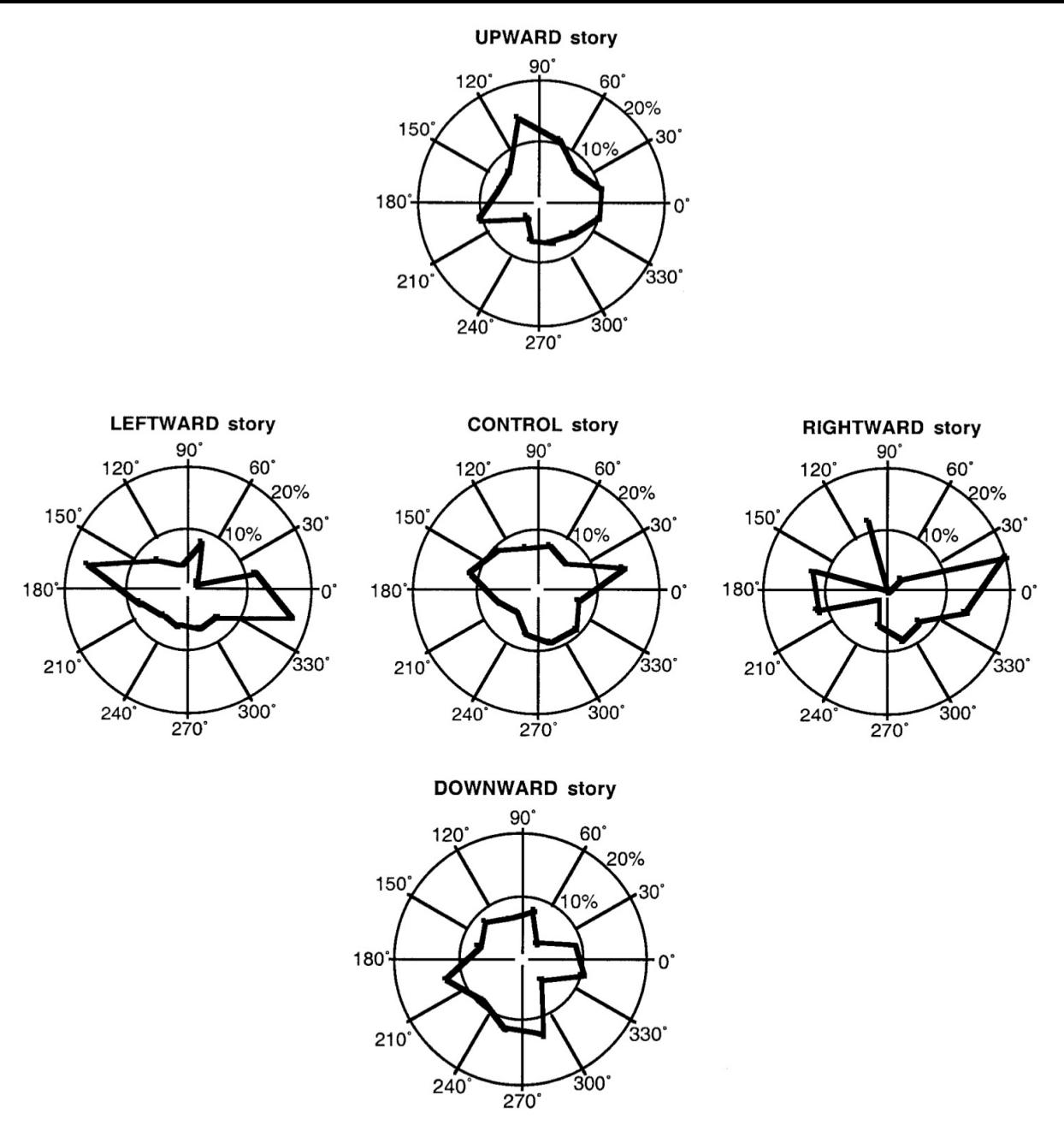
ORIGINAL ARTICLE

Michael J. Spivey · Joy J. Geng

Oculomotor mechanisms activated by imagery and memory: eye movements to absent objects

- Participants are eye-tracked looking at a black screen while listening to stories with spatial contents
- Upward story:
“Imagine that you are standing across the street from a 40 story apartment building. At the bottom there is a doorman in blue. On the 10th floor, a woman is hanging her laundry out the window. On the 29th floor, two kids are sitting on the fire escape smoking cigarettes. On the very top floor, two people are screaming.”
- In addition there was a downward, leftward, rightward, and control story

Results



Spivey & Geng (2001:237):
These results indicate that when people are imagining a complex event, they activate some of the same perceptual-motor mechanisms used for viewing that complex event. This suggests that oculomotor behavior responds to perceptually-based spatial mental models that are computed during language comprehension and mental representation.

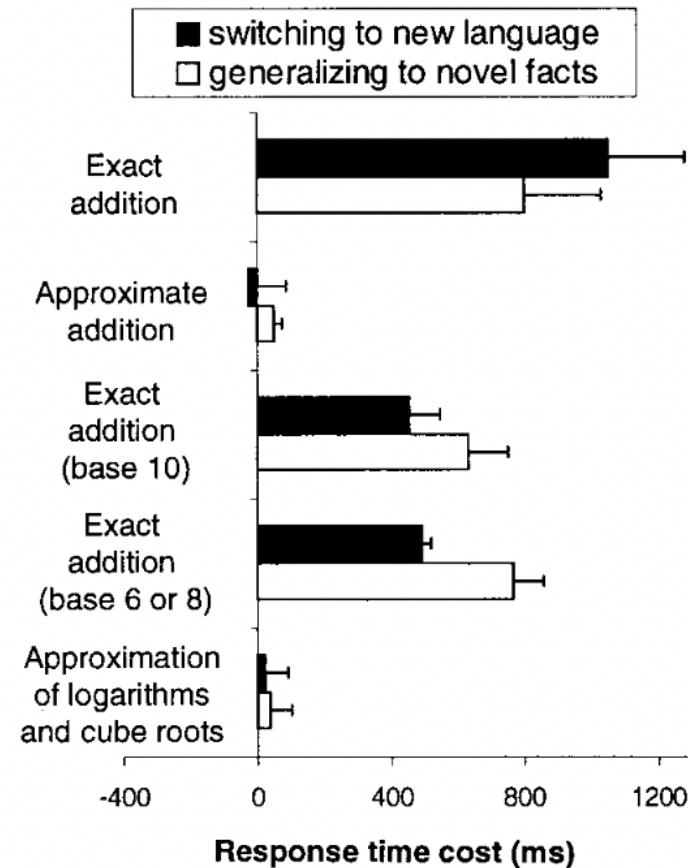
Evidence for embodied cognition

- Experiments suggest that if bilinguals learn math in one language they perform best when tested in the same language
- “When tested on trained exact addition problems, subjects performed faster in the teaching language than in the untrained language [...] provid[ing] evidence that the arithmetic knowledge acquired during training with exact problems was stored in a language-specific format and showed a language-switching cost due to the required internal translation of the arithmetic problem”

Sources of Mathematical Thinking: Behavioral and Brain-Imaging Evidence

S. Dehaene,^{1*} E. Spelke,² P. Pinel,¹ R. Stanescu,¹ S. Tsivkin²

7 MAY 1999 VOL 284 SCIENCE www.sciencemag.org



Languages carve up the world differently

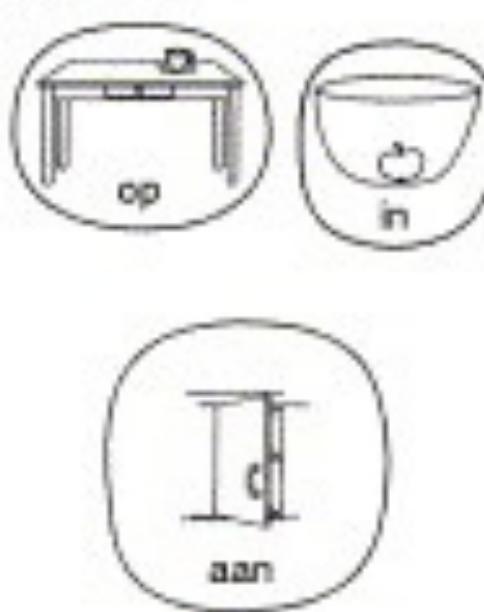
(a) English



(b) Finnish



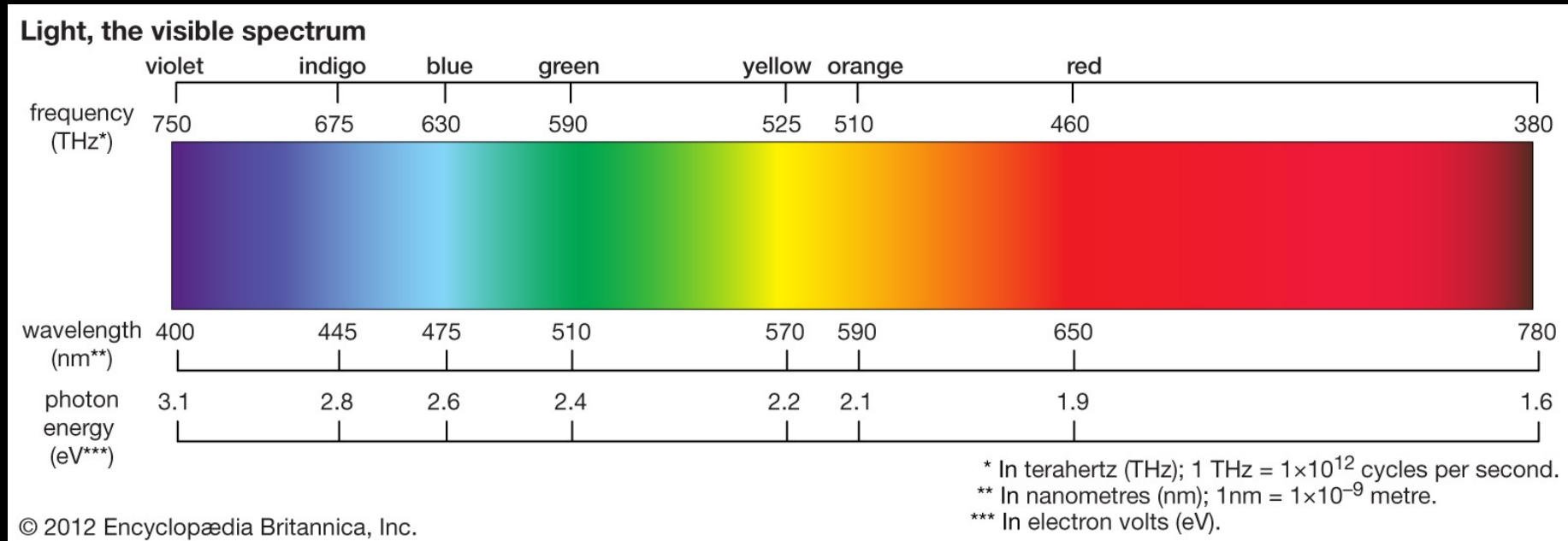
(c) Dutch



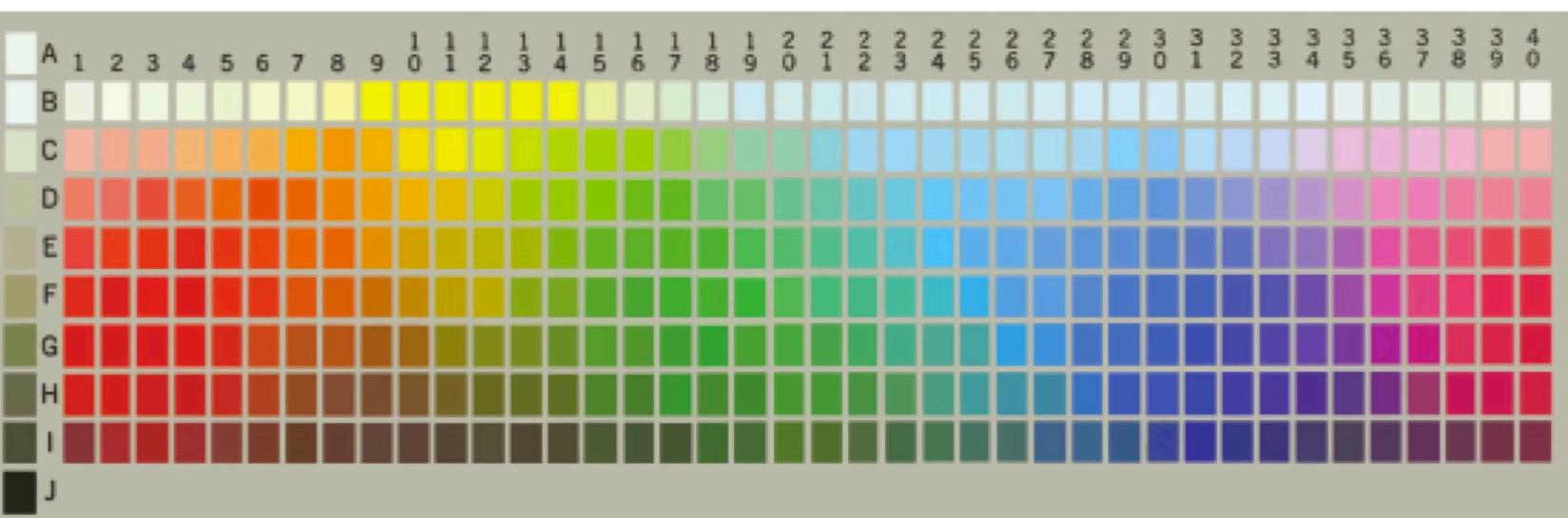
(d) Spanish



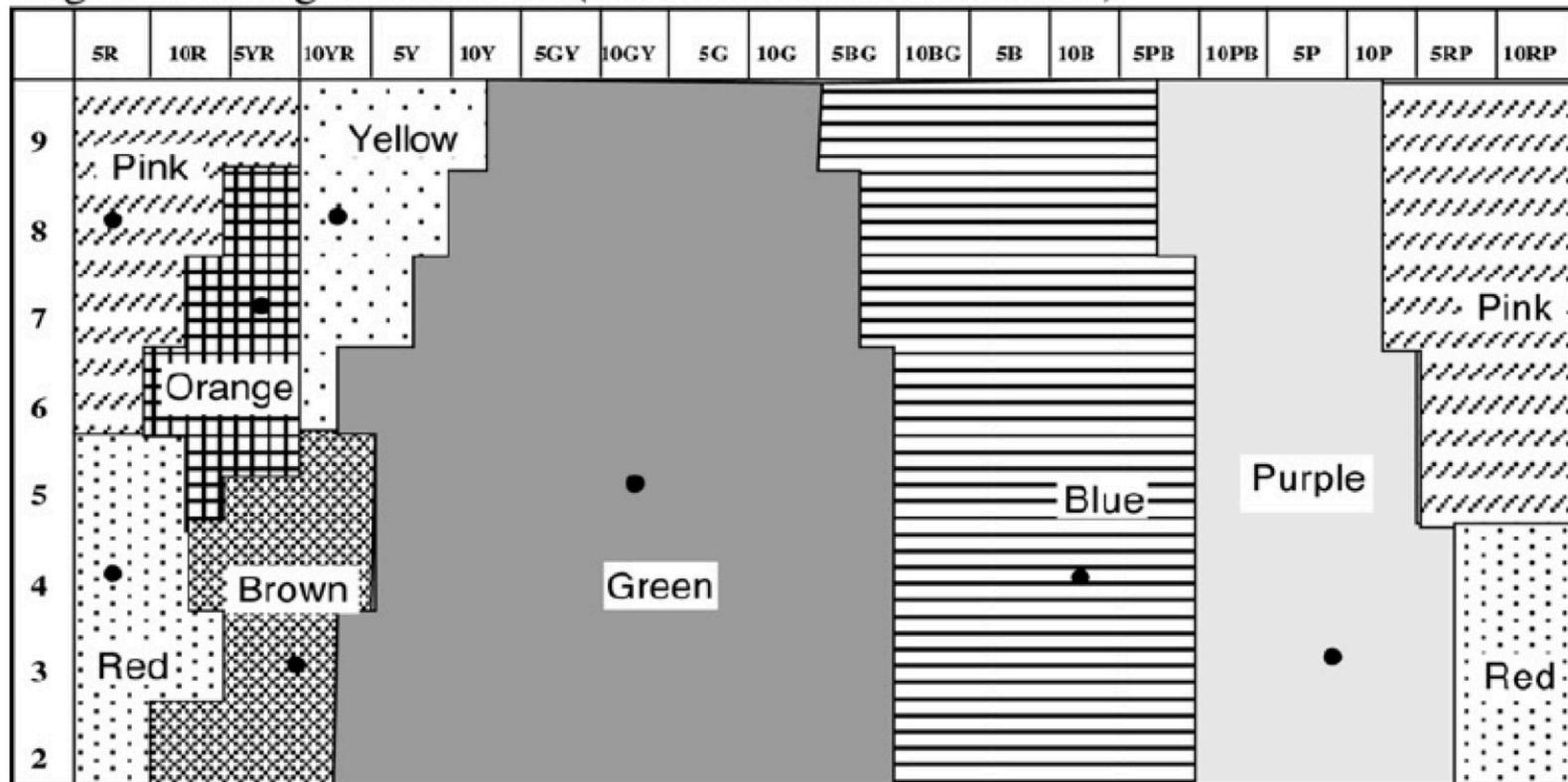
Color categories

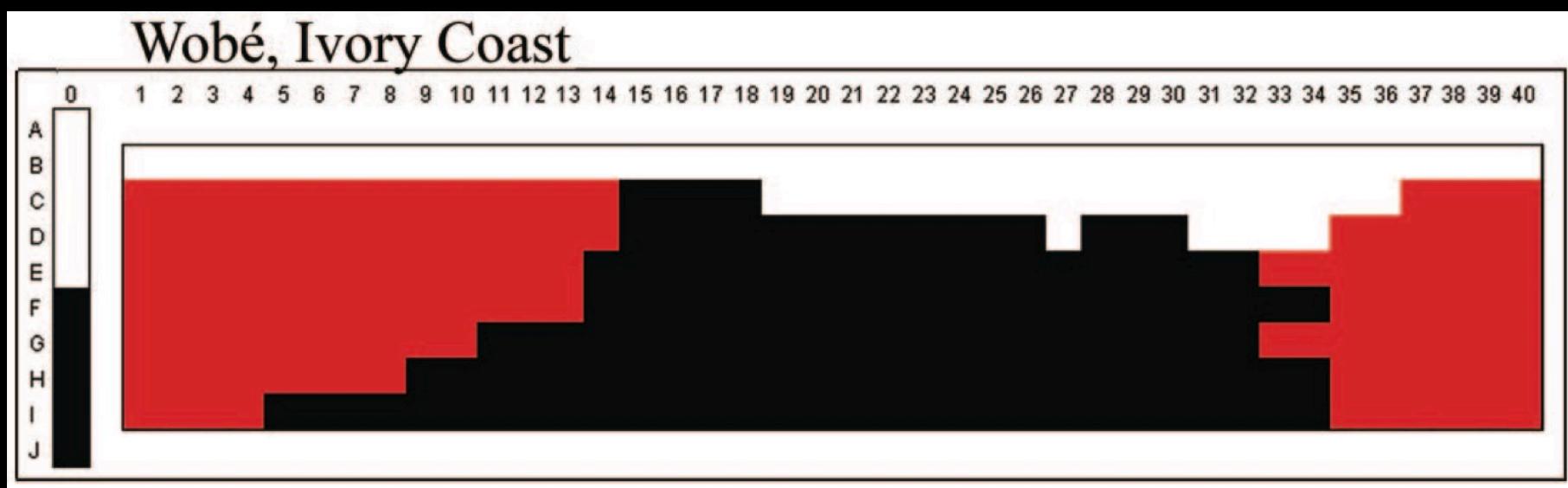
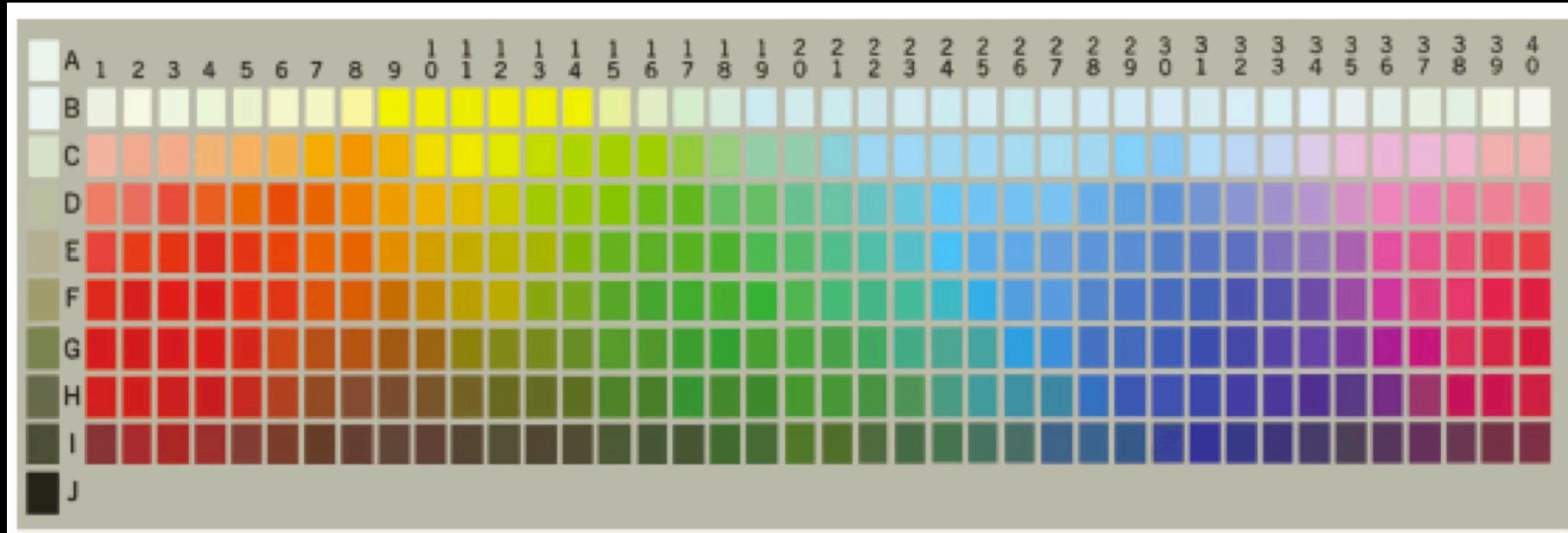


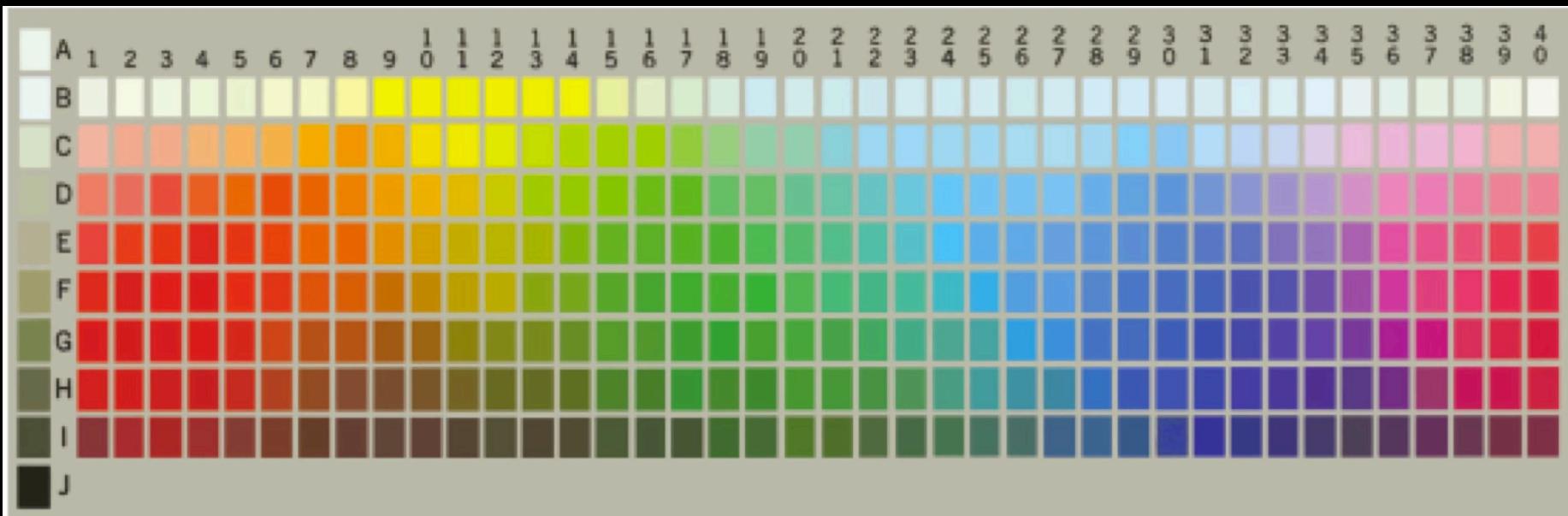
- Color perception: how much biology / how much culture?
- The number of basic color terms differ among the world's languages
- Does the color categories of our language affect our ability to distinguish colors?



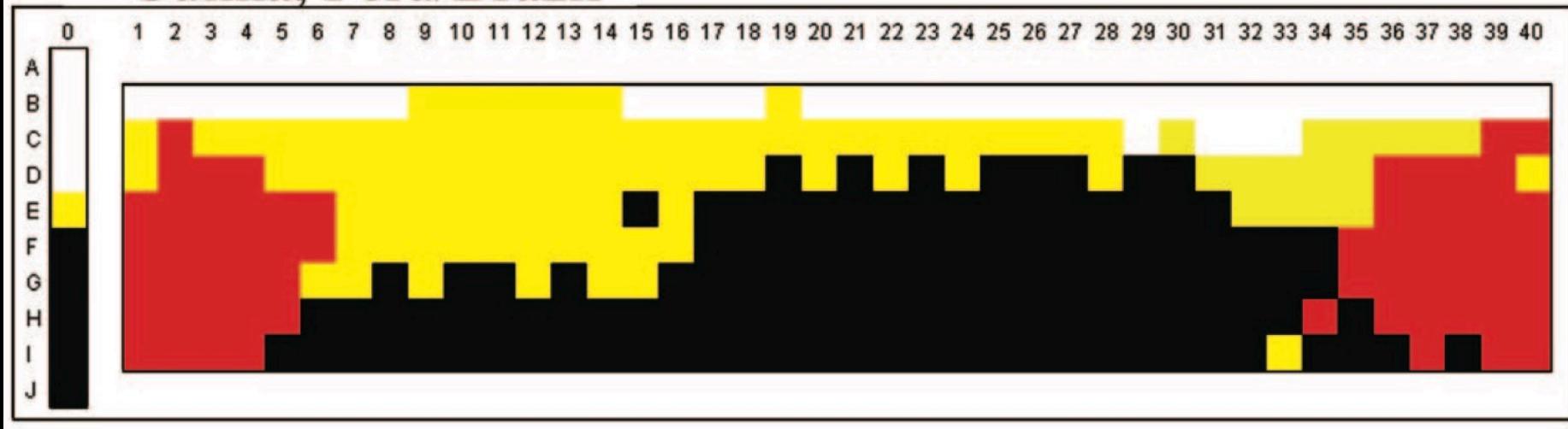
English naming distribution (from Roberson et al. 2000)

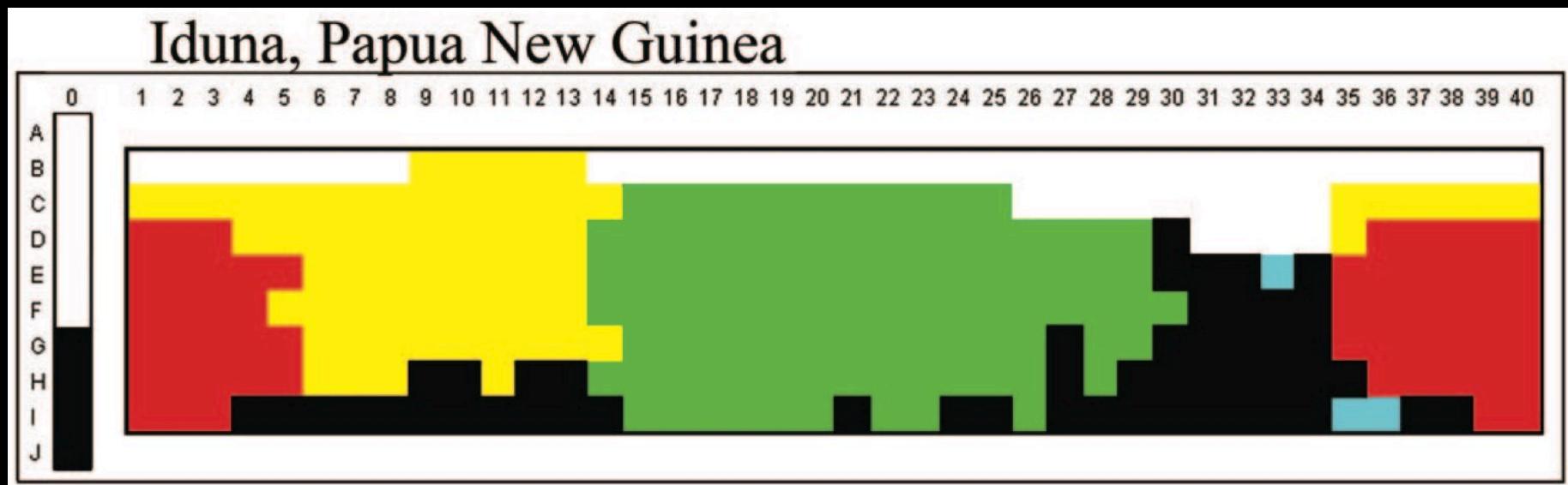
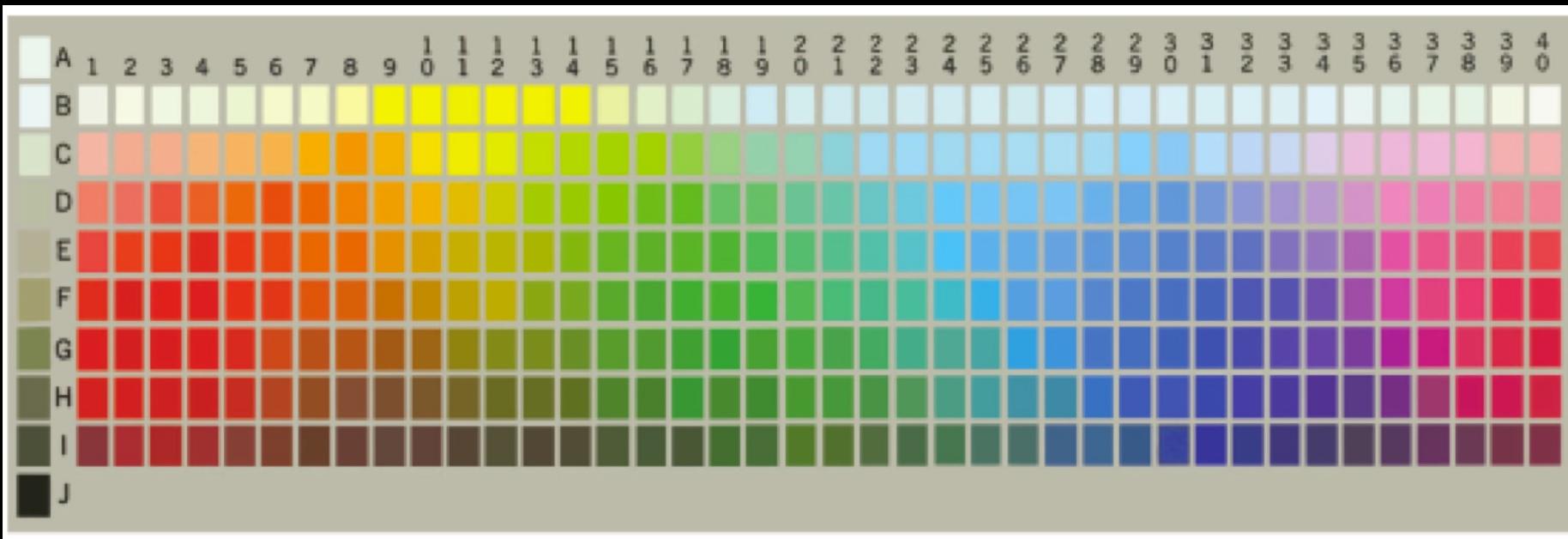


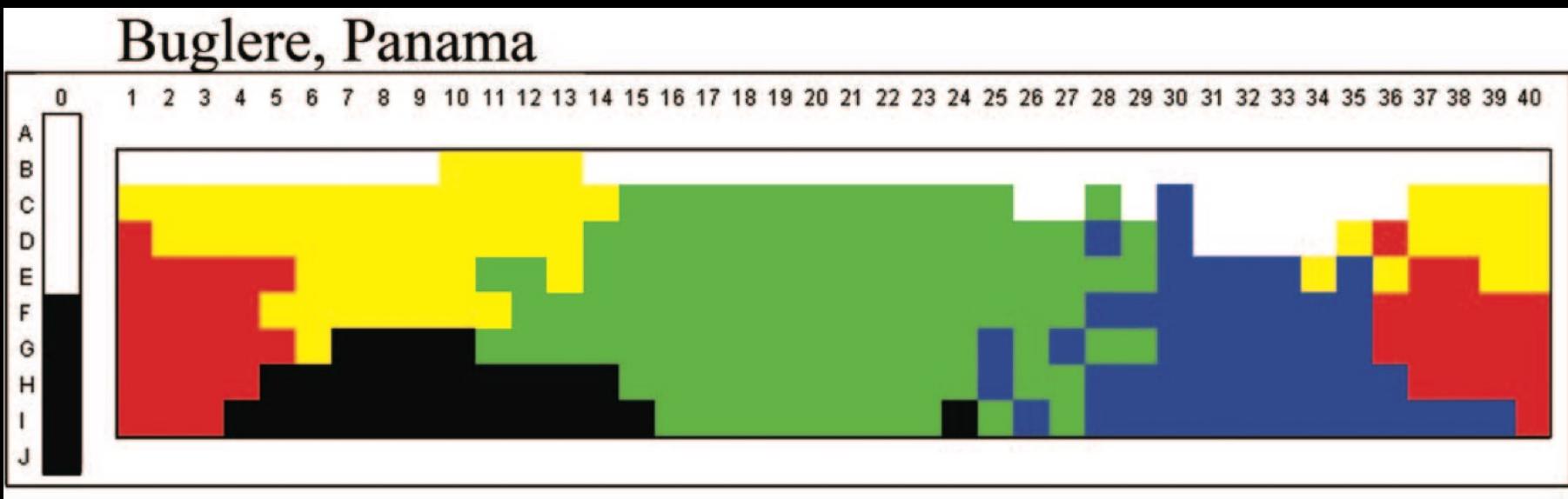
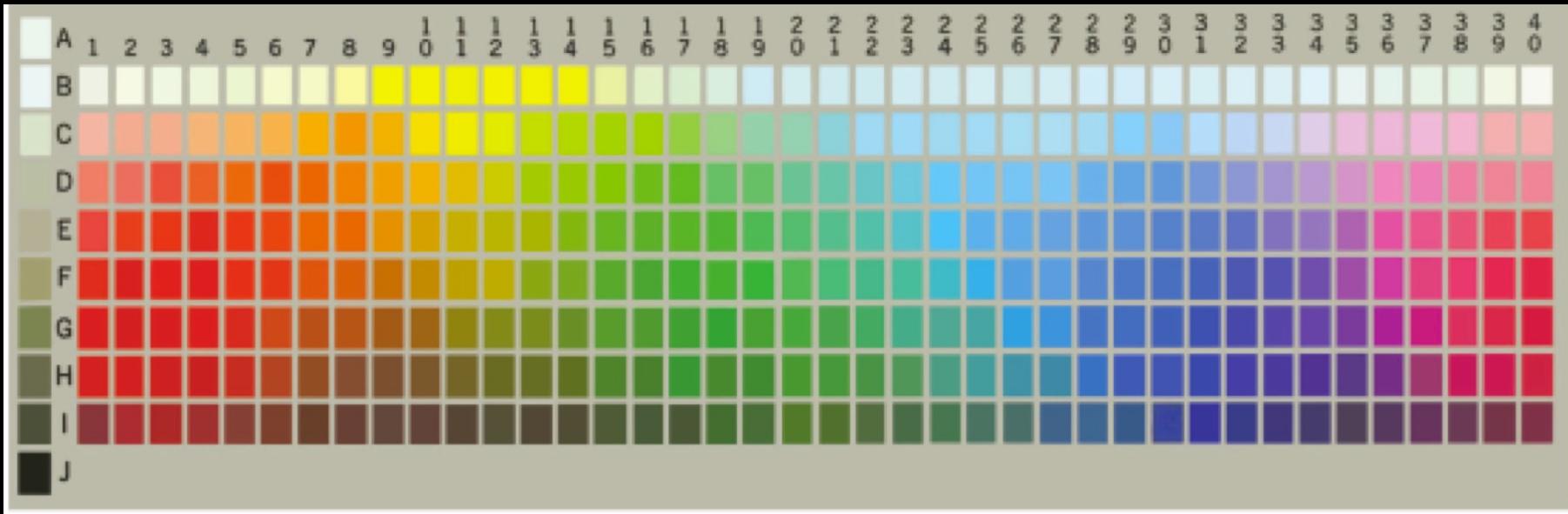




Culina, Peru/Brazil





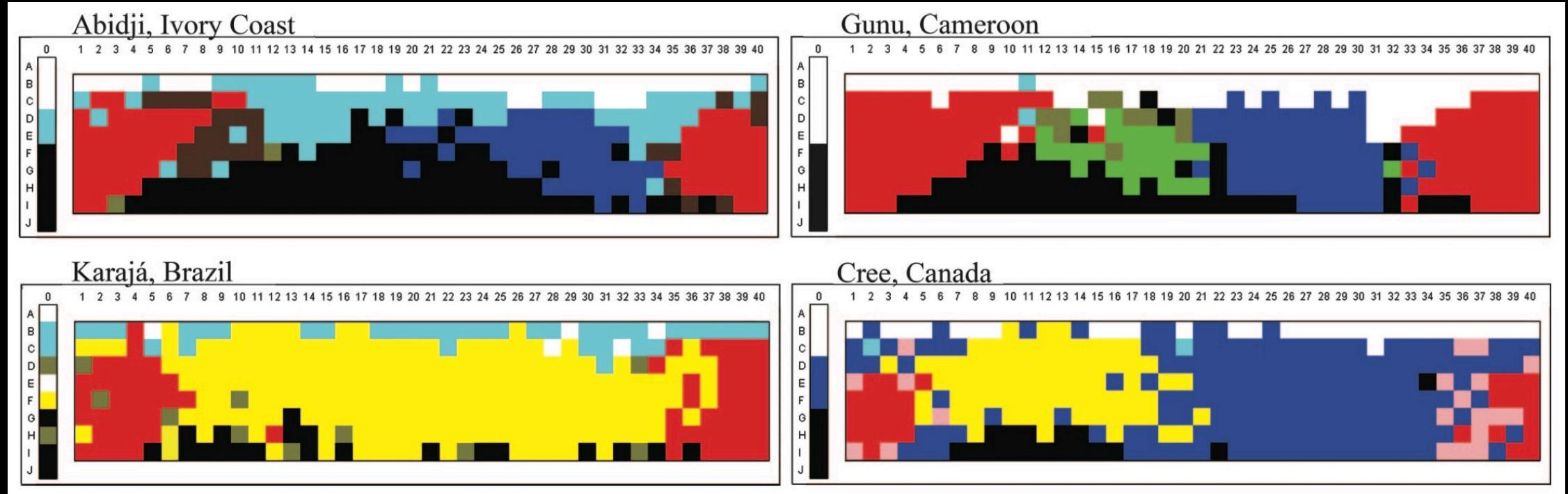


Color universals?

- Color categories in the world's languages are suggested to be hierarchically around six universal *focal colors* corresponding to the 'prototypes': black, white, red, green, yellow, and blue.
- If a language only has two color terms these are "black" and "white"
- If it has three, these are "black", "white" and "red", etc
- Thought to reflect the biological basis of color perception



But certain cultures/languages simply do not fit in



Linguistic relativity: Language influence thought



- Linguistic determinism/relativity:
 - The radical version:
language determines thought: we can only experience/think that which we have words for
 - The moderate version:
language influence thought: our non-linguistic cognition is partly influenced by our linguistic categories

The Sapir-Whorf hypothesis

- Edward Sapir (1884 – 1939)
 - "The 'real world' is to a large extent unconsciously built up on the language habits of the group... We see and hear and otherwise experience very largely as we do because **the language habits of our community predispose certain choices of interpretation**" (Sapir E. 1929:207)
- Benjamin Lee Whorf (1897 – 1941)
 - "We dissect nature along lines laid down by our native language. **Language is not simply a reporting device for experience but a defining framework for it**" (Whorf & Carroll, 1956:252)



Edward Sapir (1884-1939)
American anthropologist
and linguist



Benjamin L. Whorf (1897-1941) American linguist and fire prevention engineer

Linguistic relativity

- The particular way language represents the world (how it categorizes and conceptualizes experiences) influence how we:
 - Distribute attention
 - What we remember
 - How we represent entities and events in the mind
- Pinker, 1994:57: “[T]he famous Sapir-Whorf hypothesis of linguistic determinism, stating that people’s thoughts are determined by the categories made available by their language, and its weaker version, linguistic relativity, that differences among languages cause differences in the thoughts of their speakers [. . .] is wrong, all wrong.”
- Circularity of argumentation?
 - People speak differently and therefore they think differently. How do we know that they think differently? Well, they speak differently
- Solution?
 - Find evidence for differences in non-linguistic behavior associated with language specific structure

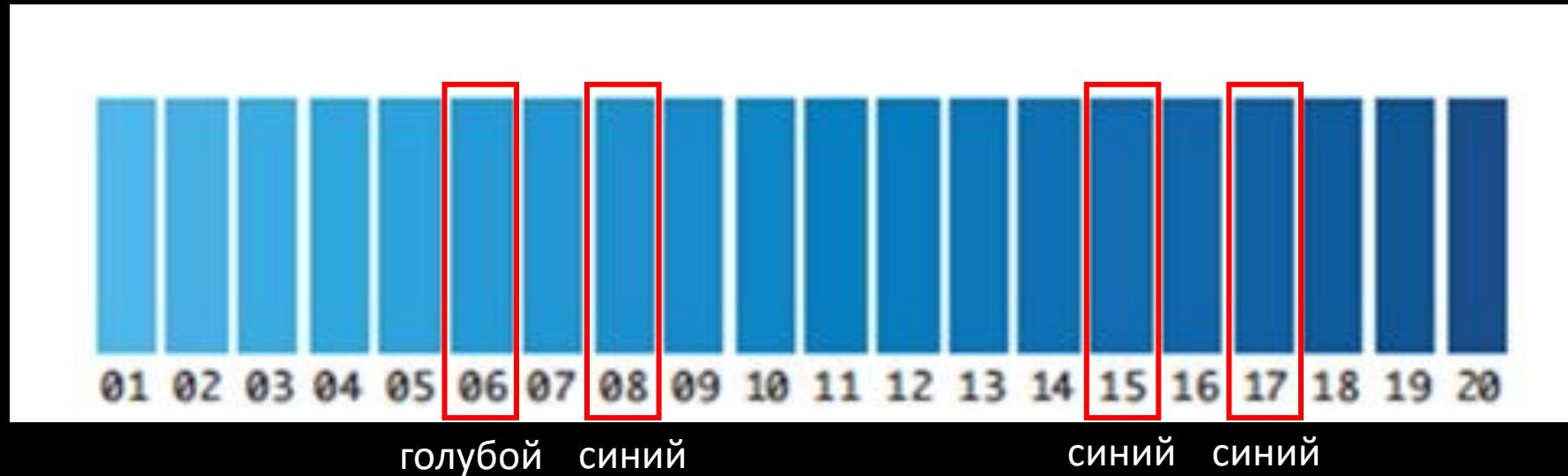
Russian Blues

In Russian, there is no word for the basic color “blue” – rather there is two colors:
голубой (goluboy - light blue) and синий (siniy – dark blue)



Russian Blues

- Within category boundery trials
- Across boundery trials

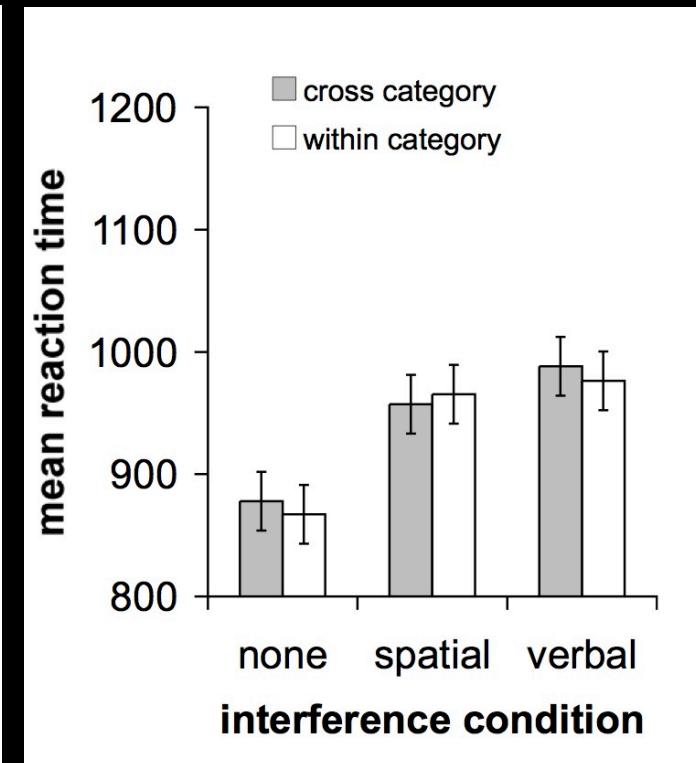
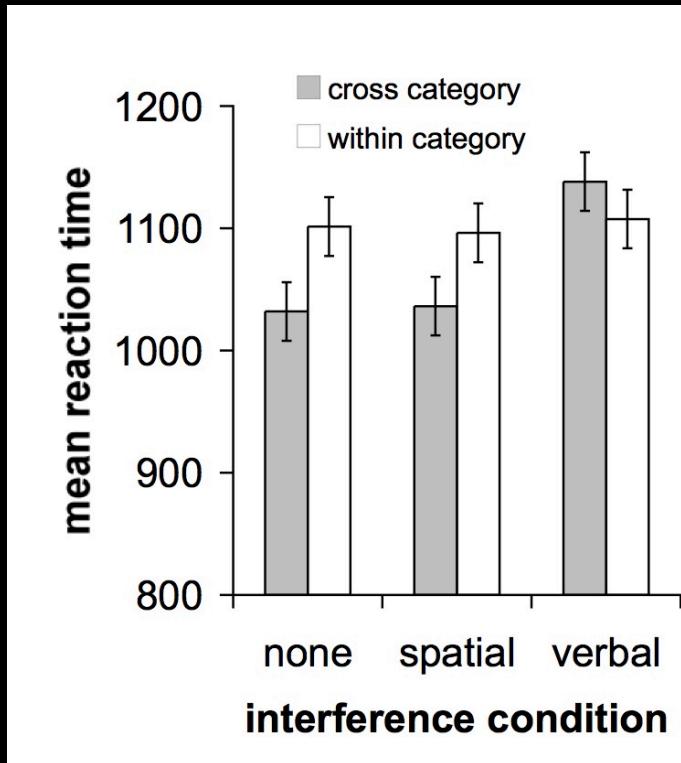


- Predictions for Russian and English participants?

Russian Blues

Three conditions:

1. a normal viewing, no-interference
2. a verbal-interference condition: subjects silently rehearsed digit strings
3. a control, spatial interference condition: subjects maintained a spatial pattern in memory



Spatial reference frames

Where is the pony?

Relative:

To the left

Absolute:

East of the fan



Intrinsic:

In front of the fan

(a)

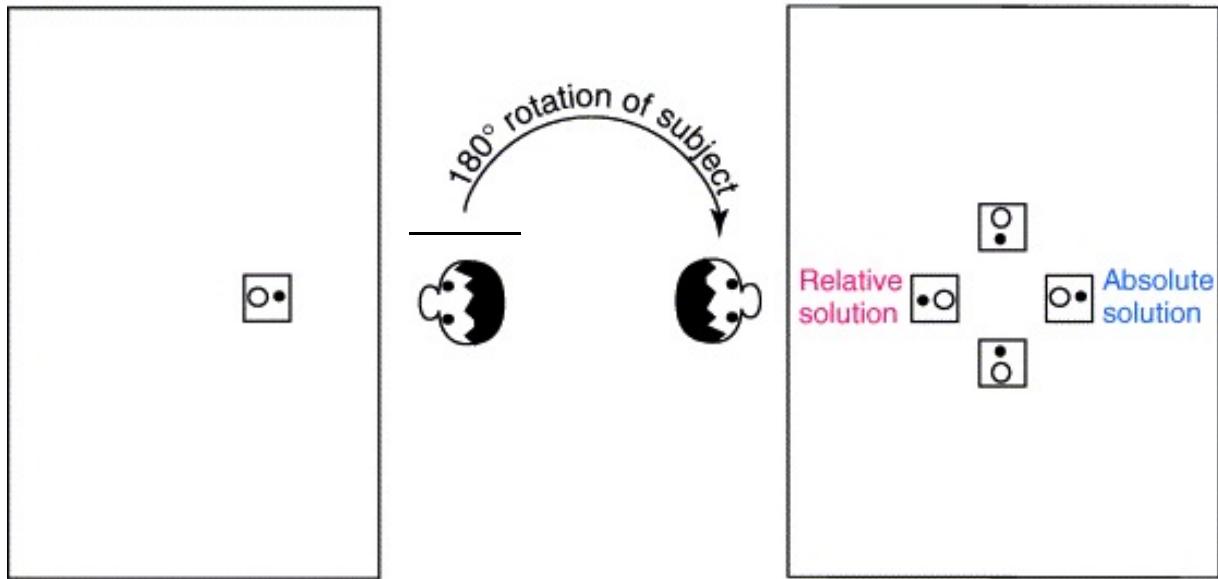
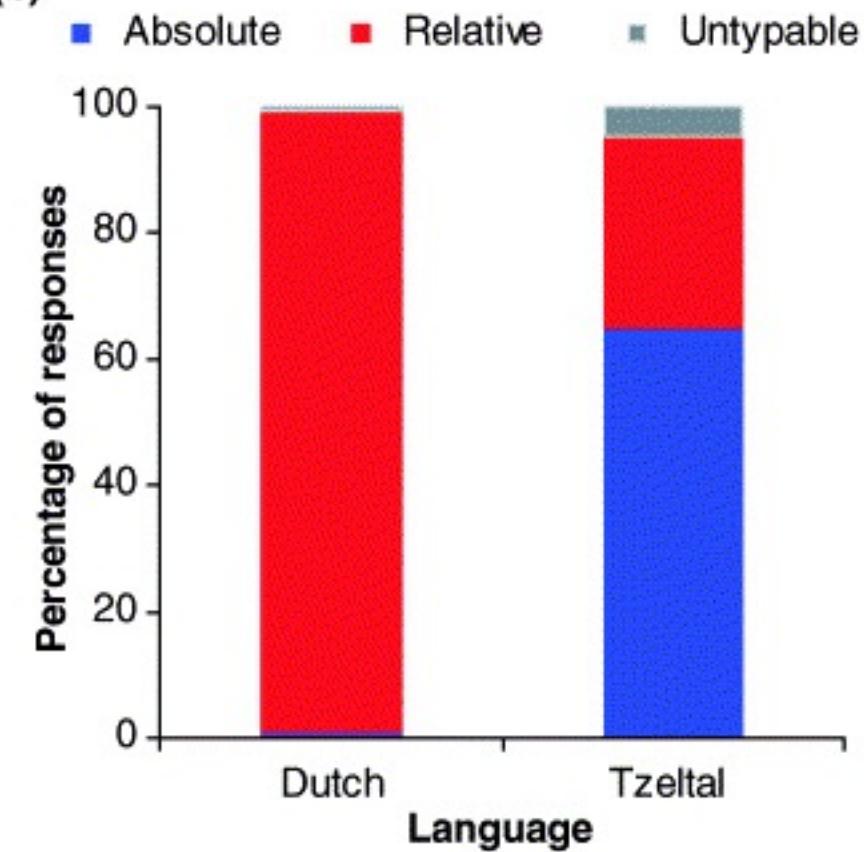


Table 1

Table 2

(b)



(a)

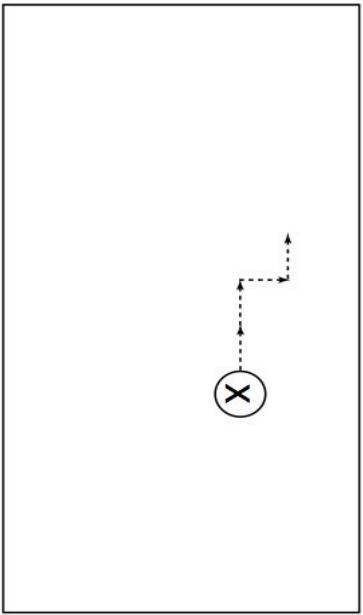


Table 1

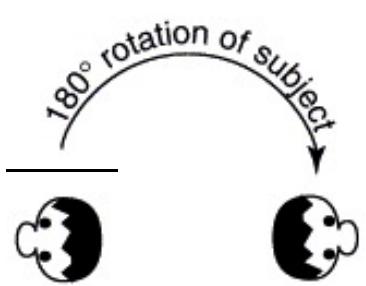
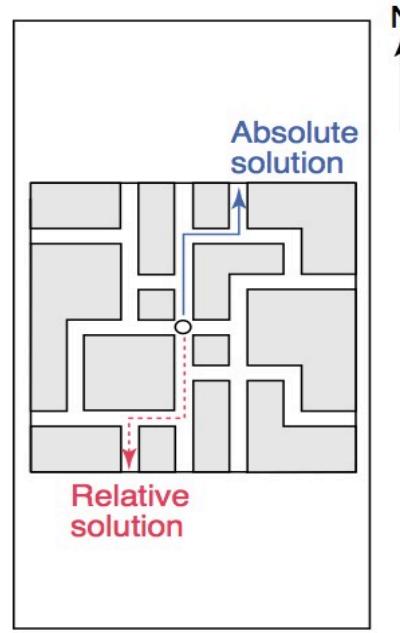
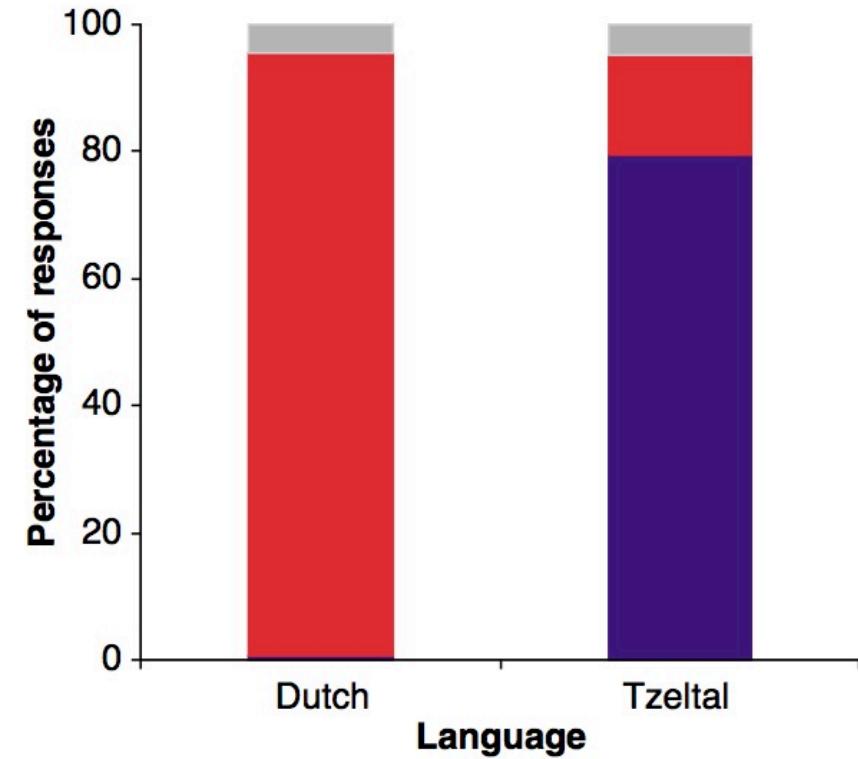


Table 2



(b)

■ Absolute ■ Relative ■ Untypable



Can Quirks of Grammar Affect the Way You Think? Grammatical Gender and Object Concepts

Philips & Boroditsky 2003

- Many languages use grammatical gender:
 - Objects are per definition male, female or neutral
 - Genders of objects differ across languages (often apparently arbitrarily):
 -  – feminine in German, masculine in Spanish
 -  – masculine in German, feminine in Spanish
 -  – feminine in German, Masculine in Spanish
 - Does the gender of an object affect how you mentally represent the object?

Can Quirks of Grammar Affect the Way You Think? Grammatical Gender and Object Concepts

Philips & Boroditsky 2003

- German-English and Spanish-English bilinguals were tested in English
- They were presented with person object pairs and asked to rate their similarity on a scale from 1 – 9
- Masculine in German/feminine in Spanish:
toaster, moon, spoon, broom, whale, frog, fox
- Feminine in German/masculine in Spanish:
clock, sun, fork, toothbrush, mouse, snail, cat
- Subjects found greater similarity between people and objects of matching gender than between people and objects of non-matching gender, $t = 3.08$, $df = 42$, $p < .0018$
- Replication with verbal interference task (repeating letters by an interval of 1 s), $t= 2.20$, $df= 13$, $p<.05$



Take home...

- There are different theoretical approaches to the relation between language and thought
- Classical cognitivism:
 - Thought is language-like and rely on the same underlying amodal symbolic rules (formal logic)
- Embodied cognition:
 - Thought is multimodal – relies on experiential/perceptual modal qualities
 - Language is a separate modality but tightly integrated with elements of general cognition
- Linguistic relativity:
 - Language influence perception: the categories of language influences how we mentally construe the world e.g. with respect to:
 - Color
 - Space
 - Grammatical gender

NB!!!

- Bring headphones for the exercises tomorrow!

