

# Grounding spatial language in non-linguistic cognition

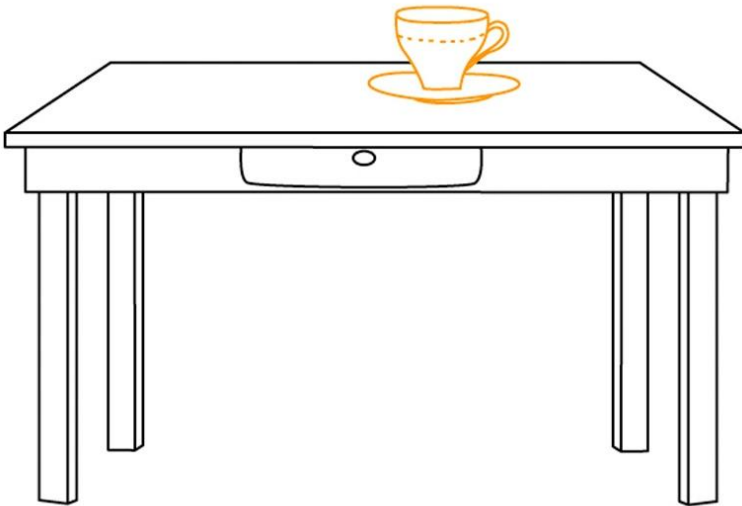
Evidence for universal *and* relative spatial semantics



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University of California, Berkeley

on

over

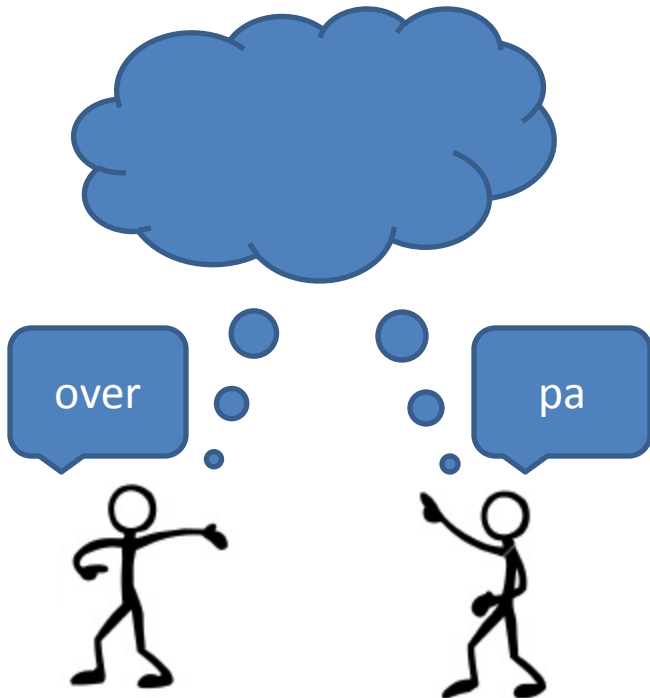


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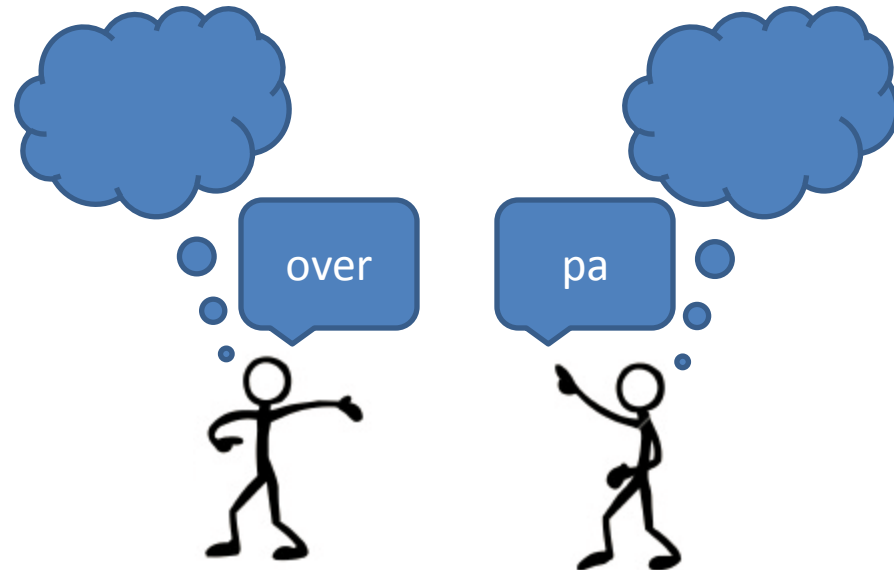
## Universal

Speakers share a universal conceptual repertoire.



## Relative

Speakers of different languages think about the world differently.

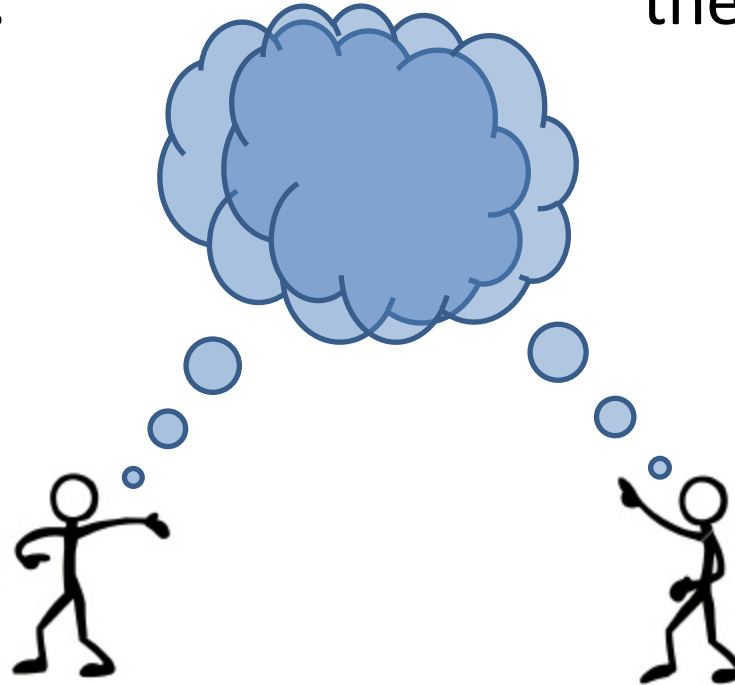


## Universal

Speakers share a universal conceptual repertoire.

## Relative

Speakers of different languages think about the world differently.



See e.g., Khetarpal et al (2010), Carstensen (2011).

Q: Do speakers of different languages share the concepts underlying language?



Yes

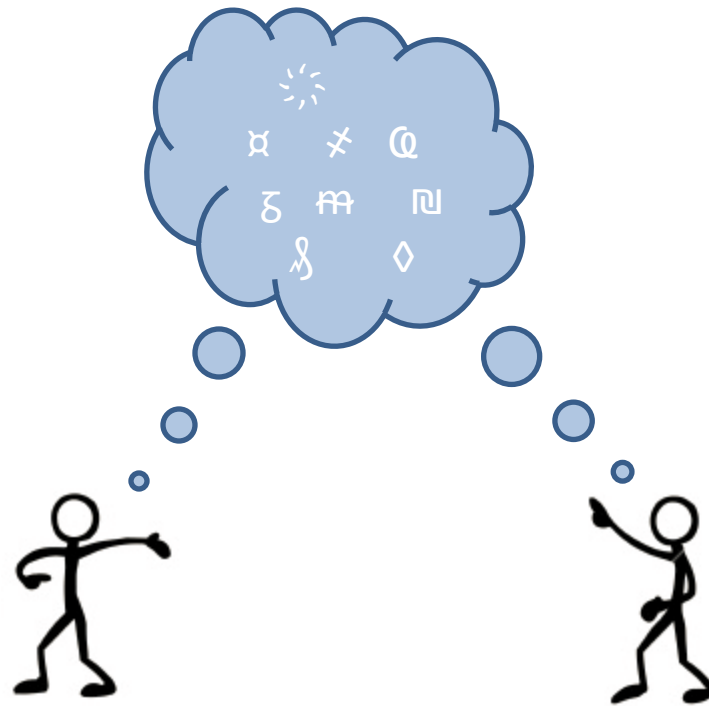


More  
interesting



No

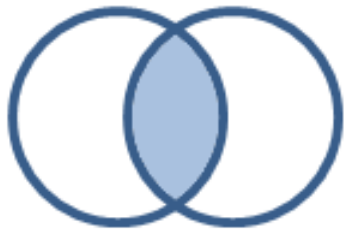
# Universal semantic primitives



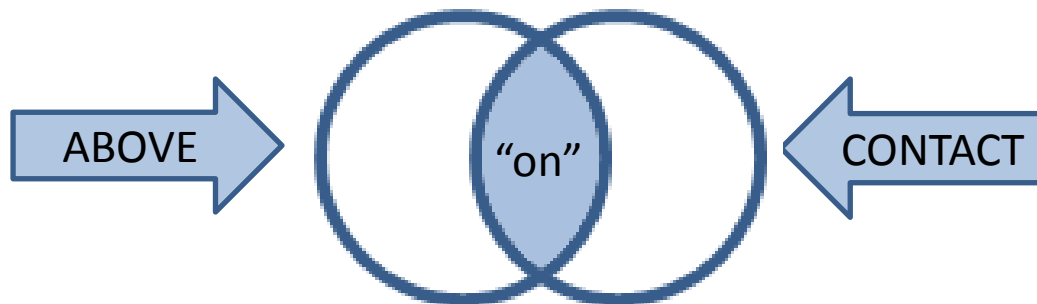
# Universal semantic primitives

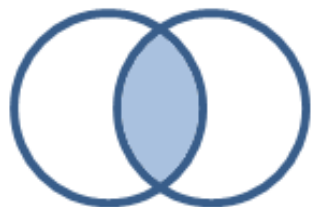


1. a set of semantic primitives is universally available to human cognition



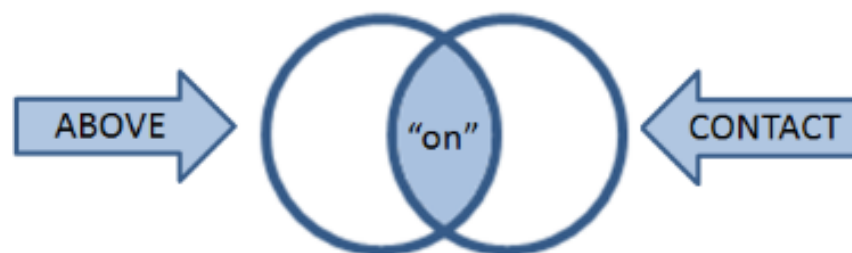
2. spatial categories in different languages can be obtained by composing such primitives in different ways





# Spatial categories from primitives

Primitive	Description
above	F higher than G
below	F lower than G
vertical equality*	F and G of equal height
support*	F supported by G
horizontal support*	F supported horizontally by G
front	F closer to viewer than G
back	G closer to viewer than F
viewpoint equality*	F and G equidistant from viewer
contact*	F in touch with G
surface contact*	F in surface contact with G
attachment*	F attached to G
adhesion*	F stuck to G
hanging*	F hung from G
piercing*	F pierces through G
impaled*	F impaled by G
proximity*	F in close proximity to G
containment*	F contained by G
encircled*	G circles F
circlement*	F circles G



Feist (2000, 2008)

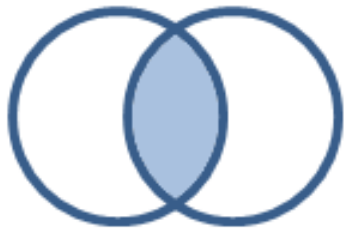
Xu & Kemp (2010)



# Universal semantic primitives



1. a set of semantic primitives is universally available to human cognition

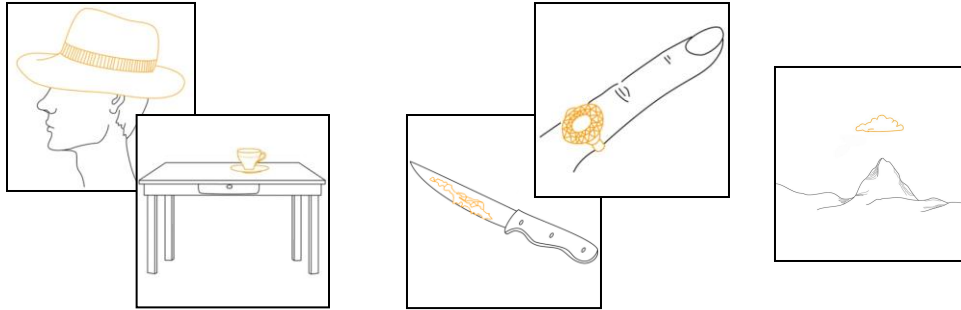


2. spatial categories in different languages can be obtained by composing such primitives in different ways



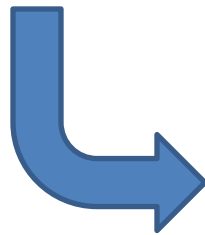


# Universal cognitive primitives?

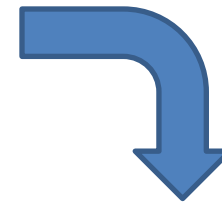


Participants sort scenes based on spatial relationship

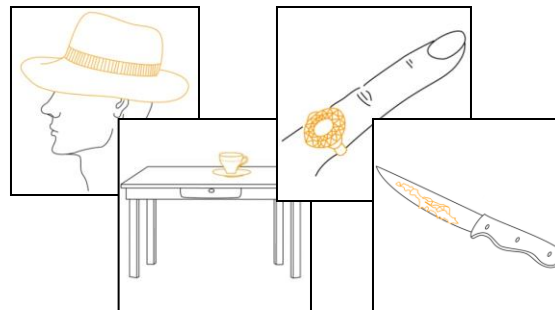
Malt et al. (1999)



Extract  
primitives



And name the  
scenes in their  
native language



on



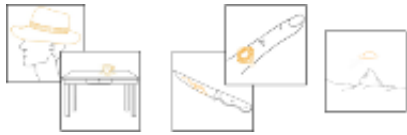
over





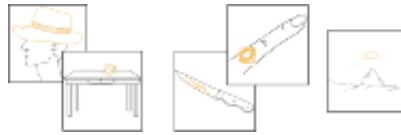
# Universal cognitive primitives?

English



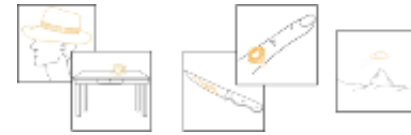
Extract  
features

Dutch



Extract  
features

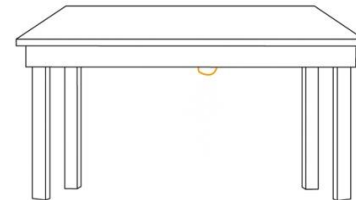
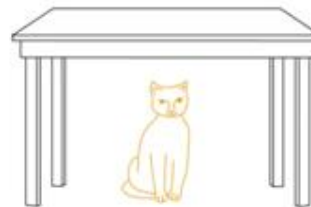
Chichewa

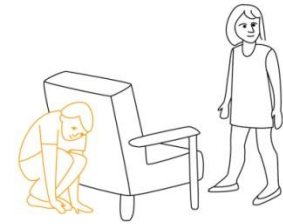


Extract  
features

Additive  
clustering  
(Lee, 2002)

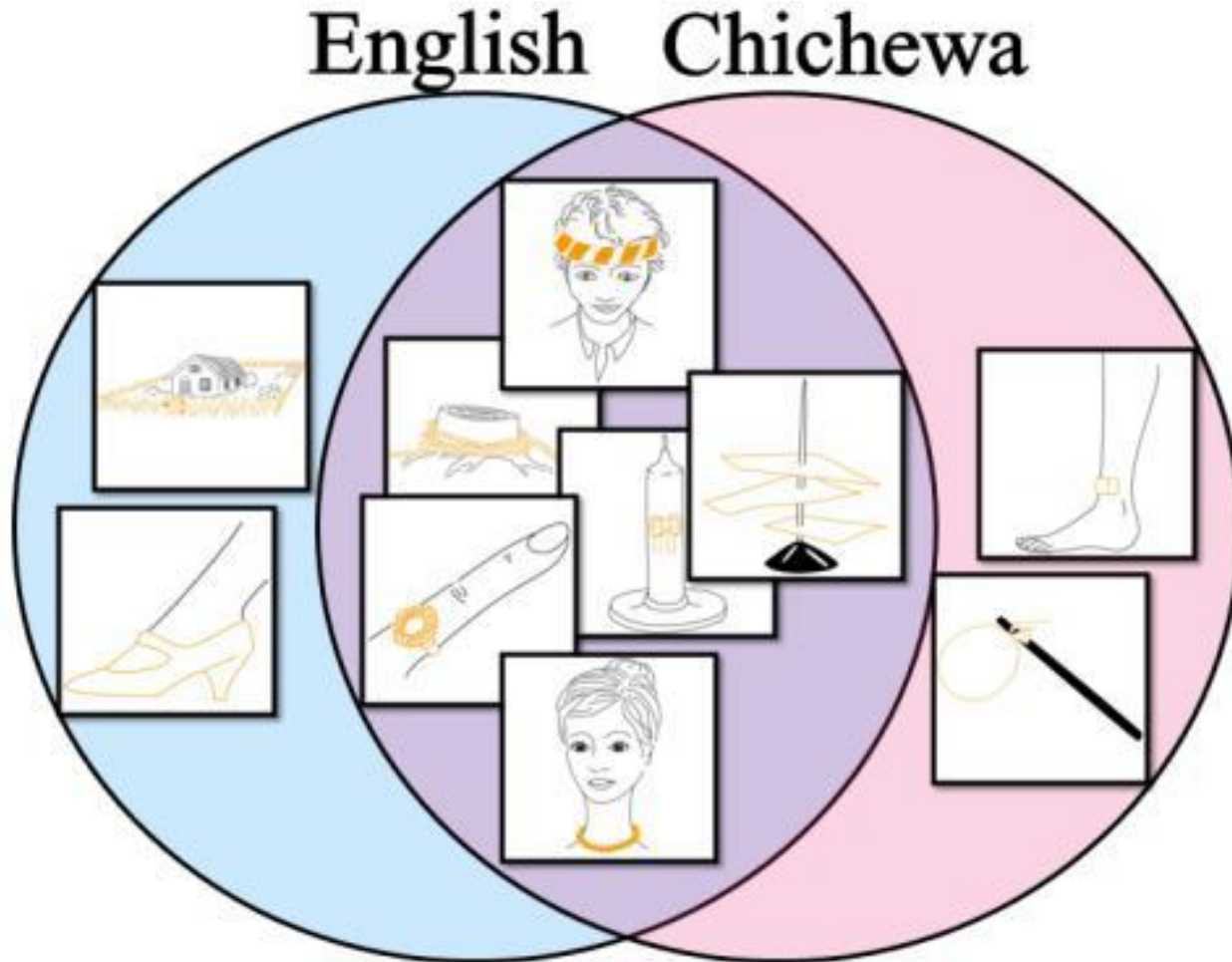
Feature = collection of scenes, e.g.







# Universal cognitive primitives?



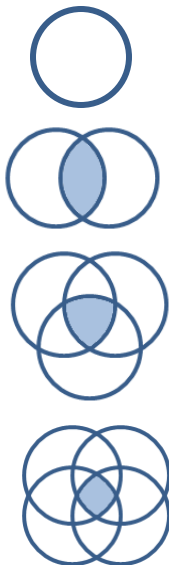


# Universal cognitive primitives?

English



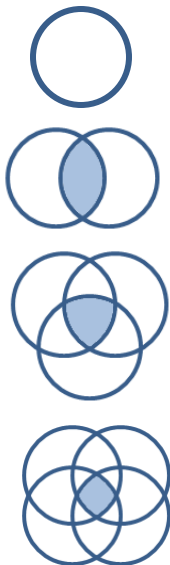
Extract  
features



Dutch



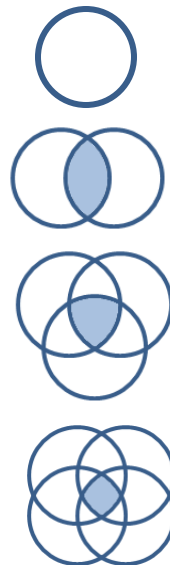
Extract  
features



Chichewa

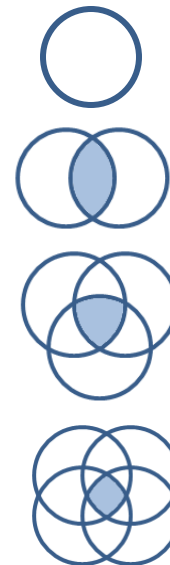


Extract  
features



Literature

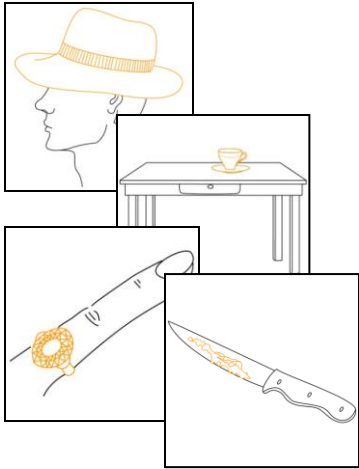
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containment*	F contained by G
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# Universal cognitive primitives?

Named category



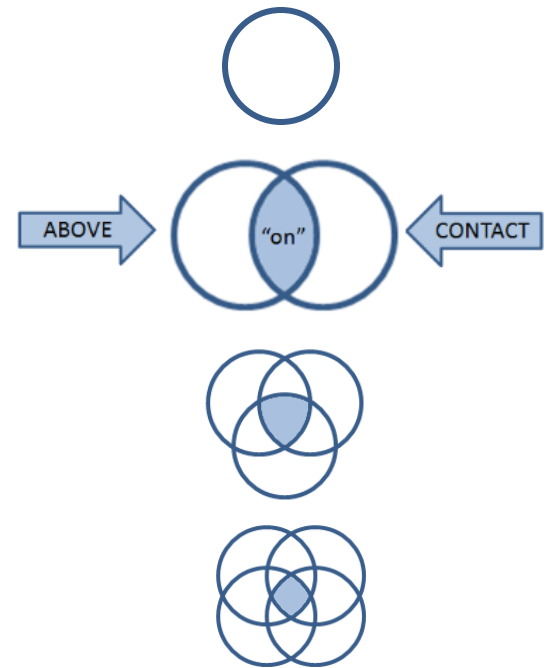
on



City-block

distance		
0		0
1		0
0	distance = 2	0
0		0
1		1
0		1
1		1
0		0
.		.
.		.
.		.

Possible models

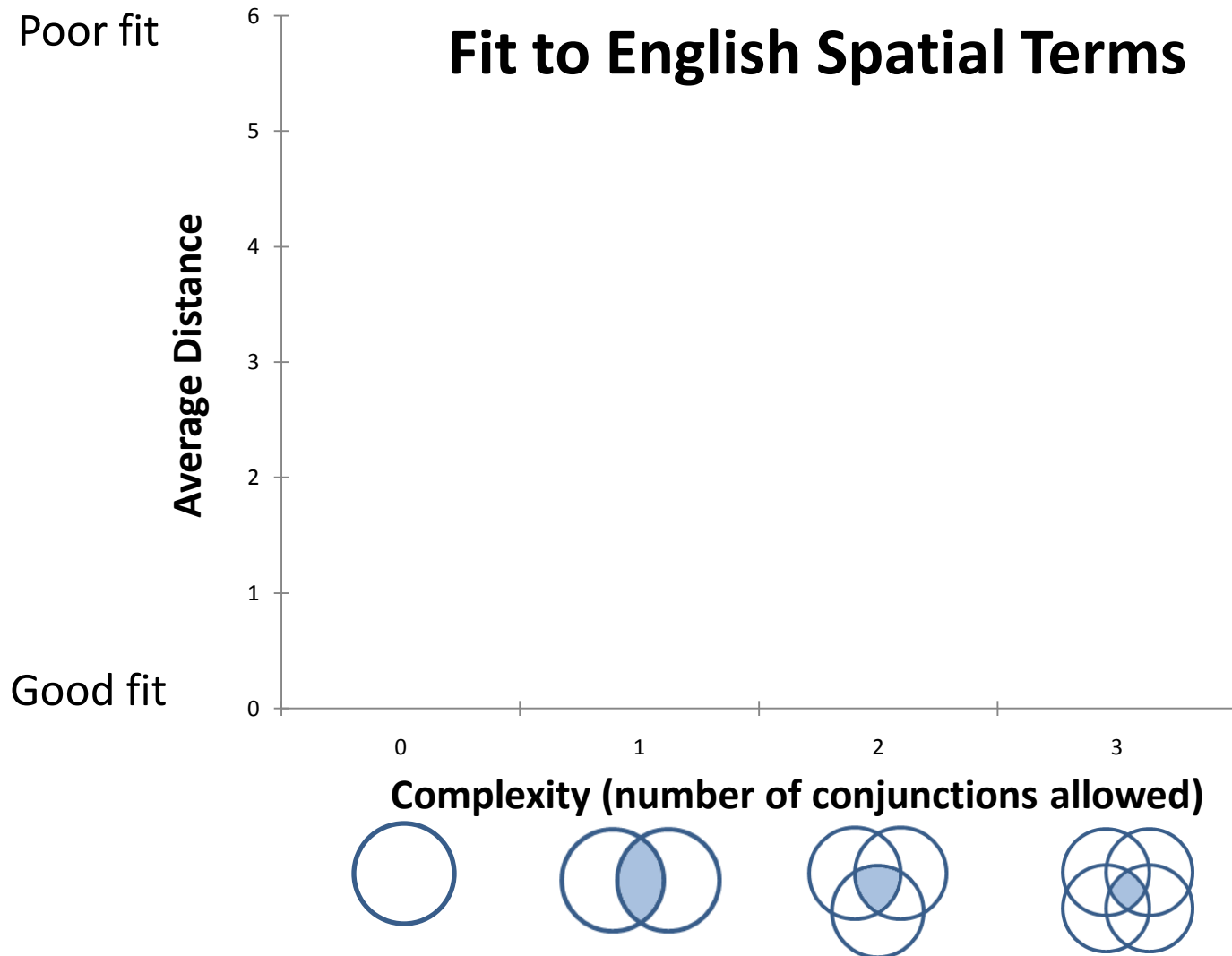




# Universal cognitive primitives?

Poor fit

## Fit to English Spatial Terms



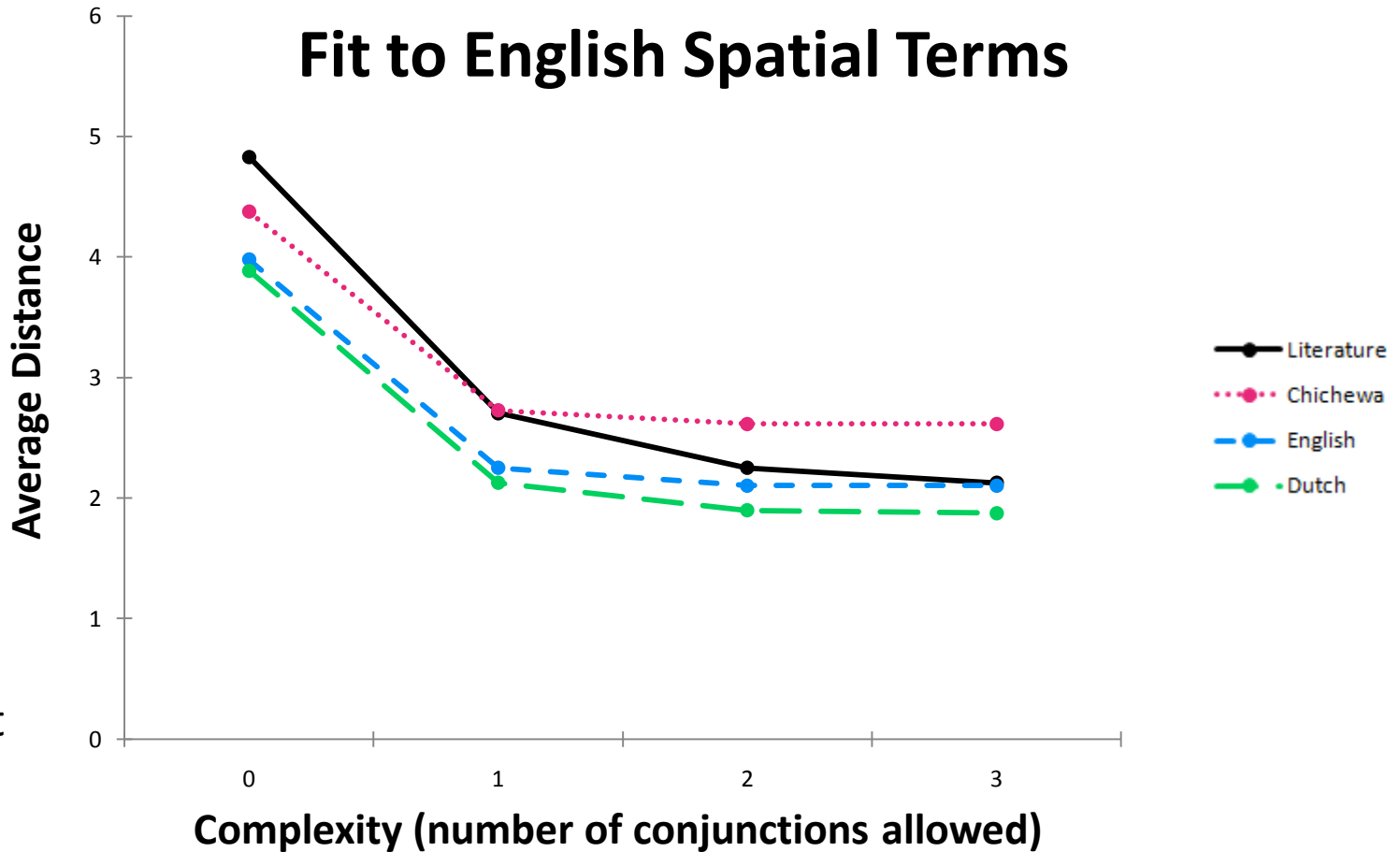




# Universal cognitive primitives?

Poor fit

## Fit to English Spatial Terms



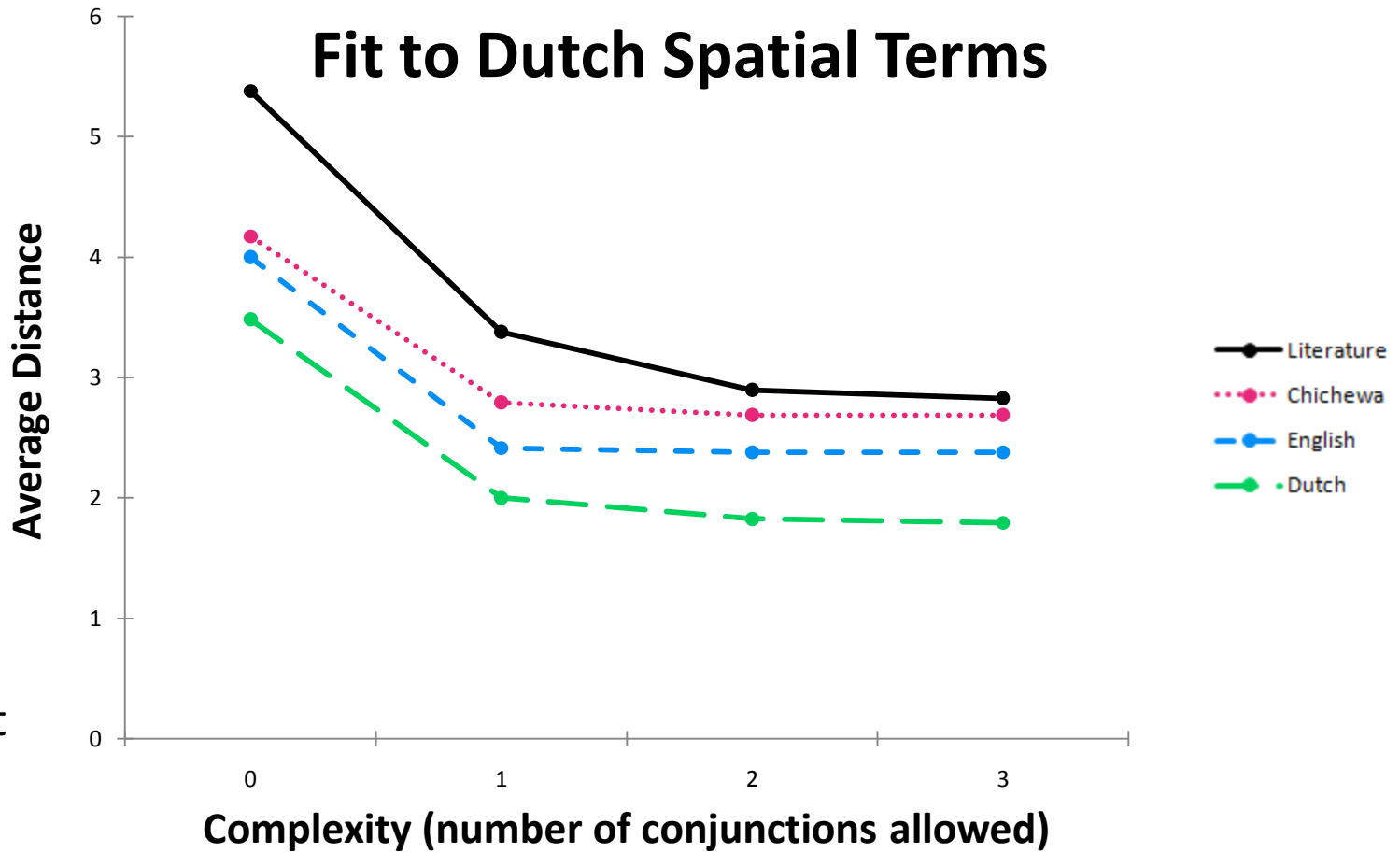
Good fit





# Universal cognitive primitives?

Poor fit



Good fit

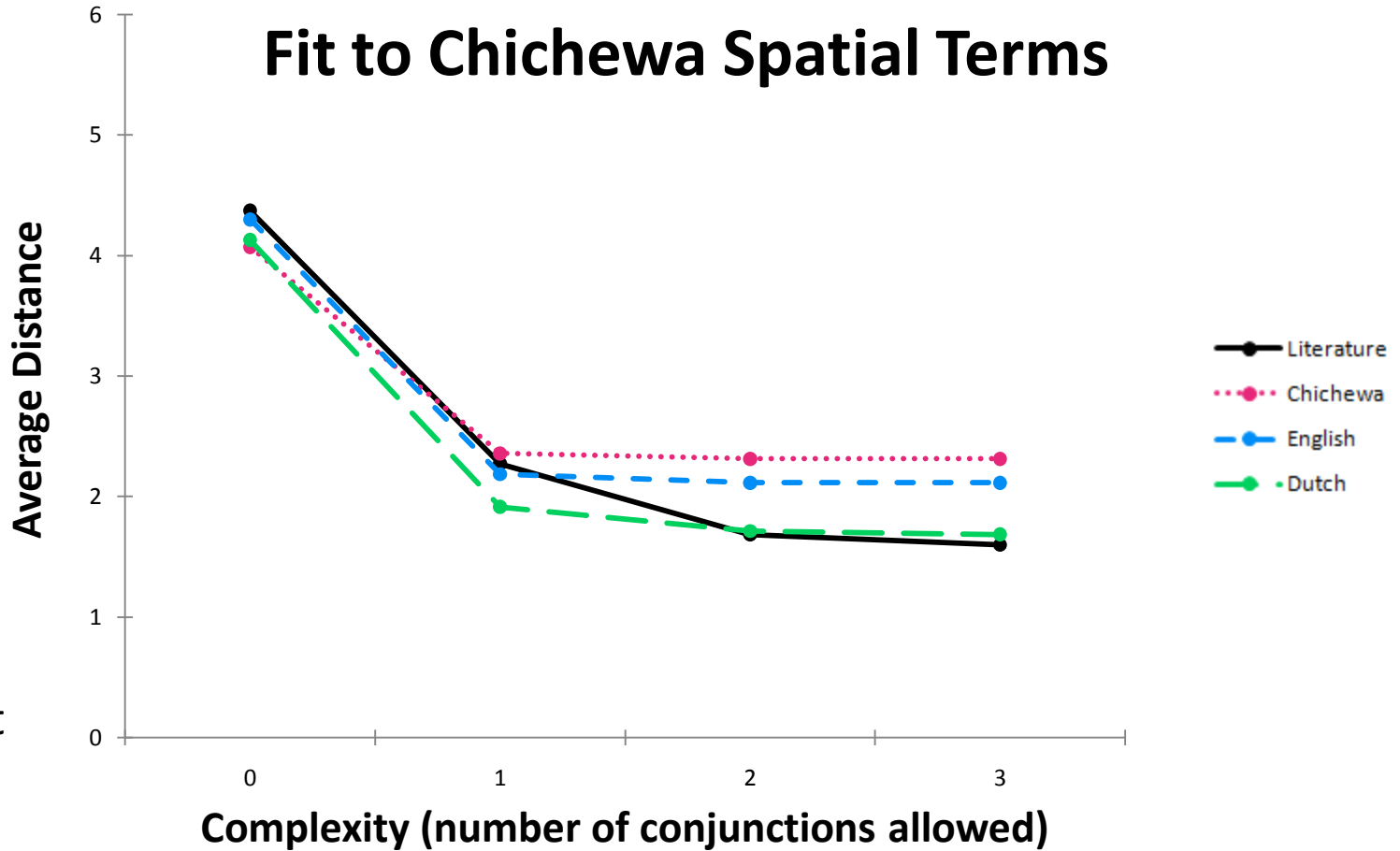




# Universal cognitive primitives?

Poor fit

## Fit to Chichewa Spatial Terms



Good fit

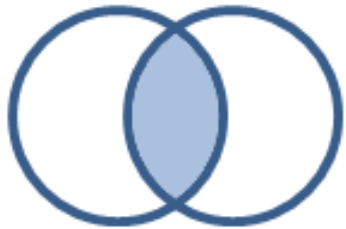


Nearly

# Universal semantic primitives



1. a set of semantic primitives is universally available to human cognition



2. spatial categories in different languages can be obtained by composing such primitives in different ways

Do speakers of different languages share the concepts underlying language?



Yes



More  
complex



No

Do speakers of different languages share the concepts underlying language?



Yes, but not entirely

# Thanks!



**Mike Pacer**



**Terry Regier**



**Naveen Khetarpal**



**Asifa Majid**