

Language & the Mind
LING240
Summer Session II, 2005

Lecture #8
Space

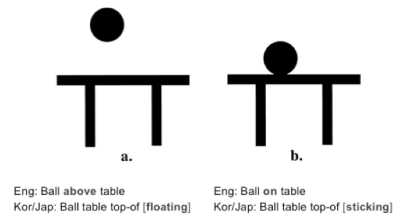
Partitioning of the World

- Languages vary in their semantic partitioning of the world
- Do speakers of differed languages carve up the world differently *even when they are not speaking?*
- Let's look at space & spatial relationships

Munnich, Landau & Doshier (2001)

- "Spatial Language and Spatial Representation: A Cross-linguistic Comparison"
- Languages vary in which aspects of spatial location must be obligatorily encoded

English vs. Korean/Japanese



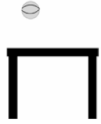
Whorfian Question

- Does the difference in obligatory encoding of 'contact' in spatial prepositions in English vs. Korean/Japanese influence nonlinguistic memory of spatial relations between objects?
- Language as lens?

M, L & D (2001) Study

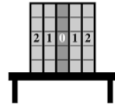
- 20 native English speakers
- 20 Native Korean speakers
- Give one half of each group a naming (language) task
- Give other half of each group a memory (nonlanguage) task
- Nobody gets both

Naming Task



Eng: The ball is _____ the table.
 Kor: Ball table _____.

Eng: Ball above table
 Kor/Jap: Ball table top-of [floating]



25 different positions tested

Naming Results

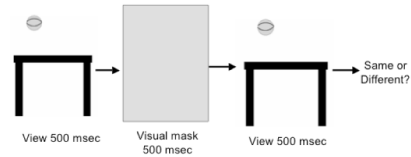
(Number of responses that encoded 'contact')

Korean Speakers				
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.05
0.30	0.25	0.20	0.30	0.30
Reference object				
English Speakers				
0.00	0.05	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
1.00	1.00	0.90	0.95	1.00
Reference object				

What do the naming (linguistic) results tell us?

- Whether it is optional or mandatory to mention 'contact' does result in a difference in the linguistic behavior of the speakers
- *Not terribly surprising to have a linguistic effect since it's a linguistic difference to begin with...*

Memory Task



Memory Results

Korean Speakers				
0.52	0.54	0.55	0.55	0.53
0.54	0.56	0.57	0.53	0.53
0.55	0.55	0.56	0.55	0.53
0.55	0.55	0.57	0.56	0.57
0.67	0.65	0.69	0.66	0.69
Reference object				
English Speakers				
0.51	0.52	0.56	0.56	0.52
0.52	0.54	0.56	0.57	0.54
0.55	0.56	0.55	0.55	0.55
0.52	0.53	0.56	0.56	0.54
0.66	0.64	0.71	0.61	0.66
Reference object				

If we're Whorfians, what do we predict will happen?

What do the memory (nonlinguistic) results tell us?

- Contact does aid spatial memory
- But no Whorfian effect: The difference in obligatoriness of mentioning contact in the two languages does NOT result in different nonlinguistic memory for contact relationships by speakers of the two languages

Gennari, Sloman, Malt & Fitch (2002)

- “Motion Events in Language and Cognition”
- Languages vary in how various features of motion events are encoded

Motion Event Components (Talmy)

- Figure object (moving object)
- Ground object (locational anchor for the figure object)
- Motion (move/go)
- Manner of motion (what type of movement)
- Path: (what direction the figure moves along w.r.t. the ground object)

Figure & Ground



Motion, Manner, & Path

- Motion—manner—path may be encoded in various ways
- Motion+path (exit, enter, climb)
- Motion+manner (skip, slide, scurry)

English: Hoggie scurried [along the wall]

Spanish, Hindi: Hoggie went-along the wall [scurrying]



Whorfian Question

- Does the difference in tendency to include manner vs. path in the linguistic expression of motion events in different languages influence nonlinguistic memory for those features of motion events?
- Language as lens?

G, S, M & F's Study

- 47 Native Spanish speakers
- 46 Native English speakers
- All students at Brown University

Design, Phase 1



carried X in
entered (carrying X)

- Everybody watches a series of movie clips that depict motion events
- 1/3 of each language group describes movies while watching ("naming first" group)
- Another 1/3 not given any instructions about speech ("free encoding" group)
- Another 1/3 made to repeat nonsense syllables while watching, which prevents linguistic encoding of the events ("shadow" group)

Design, Phase 2

- Everybody asked, "What did you see before?"



• Original



• Changed path

Design, Phase 3

- Everybody asked, "Which one is more similar to the first?"



• Original



• Changed manner



• Changed path

Design, Phase 4

- The 2/3rds of both groups who did not yet provide a description are asked to describe each event.



• Original

Description Results

- Original Spanish and English speakers *did* linguistically encode the events differently:
 - English speakers tended to assign the same verb to actions sharing manner
 - Spanish speakers tended to assign the same verb to actions sharing path
 - English speakers mentioned manner more often than Spanish speakers
 - Spanish speakers mentioned path more often than English speakers

What do the description results tell us?

- The difference in tendency to mention manner or path in the two languages does result in different linguistic behavior by speakers of the two languages
- *But again not surprising since it's a linguistic difference to begin with...*

Recognition (Memory) Results

- No differences between Spanish and English speakers on this nonlinguistic task
- No Whorfian effect of language influencing nonlinguistic perception

Similarity Judgment Results

- No differences between Spanish and English speakers in the "free encoding" and "shadowing" conditions
- But in the "describe first" condition, Spanish speakers did tend to choose events with a shared path as being more similar to the original event

Whorfian Effects?

- No - however, once people have encoded an event linguistically, that representation of the event may be drawn upon in subsequent nonlinguistic tasks

Boroditsky (2001)

- "Does Language Shape Thought?: Mandarin and English Speakers' Conceptions of Time"

How do we learn about time? nonlinguistic experience

- Experience teaches us (all) that:
 - Each moment happens only once
 - We can never go back in time
 - Events are temporally bounded (have a beginning time and an ending time)

In sum: We, the observers, experience continuous unidirectional change that may be marked by the appearance and disappearance of objects and events

How do we learn about time? linguistic experience

- Languages often use spatial metaphors in talk about time
- The spatial metaphors chosen are those that, like time itself, are one-dimensional and unidirectional
- Appropriate spatial terms: forward, up
- Inappropriate spatial terms: *narrow/wide*

Spatial Metaphors

- English: Time proceeds in a forward direction (horizontal metaphor)
 - We can never go back in time
 - I’m looking forward to your visit
 - He was ahead of his time
 - I’ve fallen behind schedule
- Mandarin: Time proceeds in both a forward direction and a downward direction (both horizontal and vertical metaphors)
 - front/back* used commonly, but also *up/down*

Whorfian Question

- Does the difference in the habitual use of vertical spatial metaphors in talk about time lead to differences in how speakers think about time?
- Language as a Lens?

Study 1: Difference in use of vertical metaphors = difference in how speakers think about time?

- Subjects
 - 26 native English speakers (students at Stanford)
 - 20 native Mandarin speakers (students at Stanford, but Mandarin was their only language until at least age 6)
 - Mean age at onset of English = 12.8

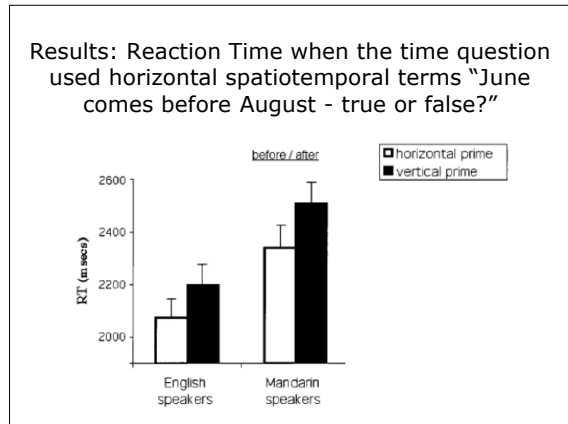
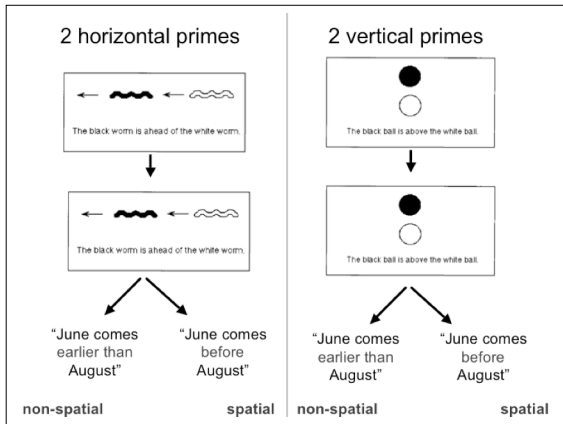
Logic Behind the Design: How are we testing the Whorfian Hypothesis?

- Language might affect thought by setting up a kind a mental model that can be used to solve nonlinguistic problems (to “think”)
- First you prime English or Mandarin speakers to think about spatial relationships (either horizontal or vertical)
- Then you ask them to judge a temporal relationship
- Then look to see if horizontal and/or vertical primes make you faster (or slower) at judging the temporal relationship (and whether your language background matters)

Their Prediction

“If horizontal spatiotemporal metaphors are processed by activating horizontal spatial knowledge, then people should be faster to understand such a metaphor if they have just seen a horizontal spatial prime than if they have just seen a vertical spatial prime”

“We expect this effect for both English and Mandarin speakers because both languages use horizontal spatiotemporal metaphors”



Author's Conclusion

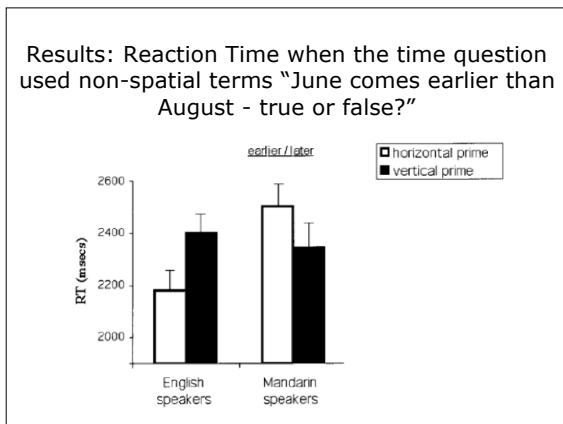
- Spatial knowledge can be used in the online processing of spatiotemporal metaphors (short-term Whorfian effect)
- Do we agree? Is this really evidence for a Whorfian effect? *Problem:* Whorfian effects predict that language will influence non-linguistic behavior. But their dependent measure was speed at answering a language question.

Hypotheses regarding possible long-term Whorfian influence on thinking about time

"If the metaphors frequently used in one's native language have a long-term effect on how one thinks about time, then even when people are not trying to understand a metaphor (e.g. when deciding whether "March comes earlier than April") they may still use spatial knowledge to think about time"

"If one's native language does have a long-term effect on how one thinks about time, then Mandarin speakers should be faster to answer purely temporal target questions (e.g. "March comes earlier than April") after seeing the vertical spatial primes than after the horizontal spatial primes."

"English speakers, on the other hand, should be faster after horizontal primes because horizontal metaphors are predominantly used in English."



Author's Conclusion

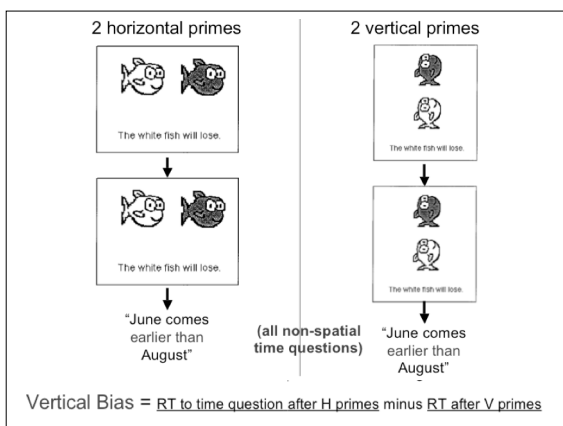
- Language-encouraged mappings between space and time come to be stored in the domain of time. That is, frequently invoked mappings become habits of thought.
- *In other words, she concludes that this is evidence of a long-term effect of language on thought (a long-term Whorfian effect).*
- Do we agree?

Study 2: How much and in what ways does learning new languages influence one's way of thinking?

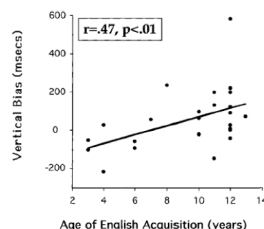
- Subjects: 25 native Mandarin speakers (students at Stanford who varied in age of first exposure to English from age 3 to age 13 and also varied in how long they had been speaking English). The minimum required for participation was 10 years of speaking English.

Whorfian Hypothesis

If learning new languages does change the way one thinks, then participants who learned English early on or had more English experience should show less of a "Mandarin" bias to think about time vertically



Results: The bias to think about time vertically was greater for Mandarin speakers who started learning English later in life. (However, there was no effect for length of exposure.)



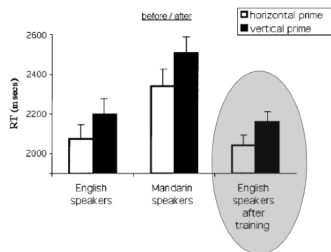
Seems pretty convincing, but...

- Is it really vertical spatial metaphors for time that are responsible for the vertical effects observed in the Mandarin speakers? (maybe it's the fact that Chinese is written top to bottom, or something else)
- And is lifelong (or decades long) experience with those metaphors necessary? How permanent is this language bias?

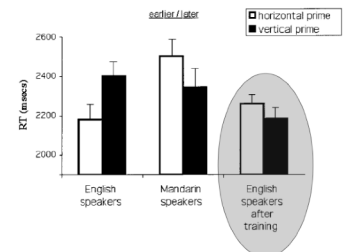
Study 3: Does teaching native English speakers to use vertical spatial metaphors for time make them behave more like Mandarin speakers?

- Subjects
 - 70 native English speakers (students at Stanford)
- Method
 - Told they would learn a new way to talk about time.
 - Given 5 example sentences that "use this new system":
 - Monday is above Tuesday
 - Friday is below Thursday
 - Then tested exactly as in study 1

Results: Reaction Time when the time question used horizontal spatiotemporal terms "June comes before August - true or false?"



Results: Reaction Time when the time question used non-spatial terms "June comes earlier than August - true or false?"



Some answers...

- Is it really vertical spatial metaphors for time that are responsible for the vertical effects observed in the Mandarin speakers? (maybe it's the fact that Chinese is written top to bottom, or something else)

YES, it really is vertical spatial metaphors, because English speakers trained to use them showed the same effect (and nothing else about the English speakers was similar to the Mandarin speakers—e.g. they weren't trained to write/read top to bottom)

- And is lifelong (or decades long) experience with those metaphors necessary? How permanent is this language bias?
- NO, in fact you can observe effects after 5 minutes of training

Author's Overall Conclusion

- "One's native language appears to exert a strong influence over how one thinks about abstract domains like time. Mandarin speakers relied on a 'Mandarin' way of thinking about time even when they were thinking about English sentences."
- "When sensory information is scarce or inconclusive (as with the direction of motion of time), languages may play the most important role in shaping how their speakers think."

A differing view on these results (Munnich & Landau, 2003)

- "Has Boroditsky shown an effect of language on nonlinguistic representations? **We do not think that her results can be interpreted this strongly.** Her task requires people to engage in linguistic processing in order to respond. Therefore, it could not show an effect on nonlinguistic representations."
- "But what the results do show is that different kinds of mental models can be linked to different sets of lexical items (which are language dependent). Further, when these mental models are engaged for the purposes of problem solving (in this case, linguistic problem solving), they will inevitably reflect the effects of language itself."

A differing view on these results (Munnich & Landau, 2003)

"Boroditsky also found that the response to priming shown by Mandarin speakers could be induced in native English speakers, by brief and simple training. This kind of flexibility suggests that any changes in 'thought' are relatively superficial and that they constitute habitual tendencies rather than permanent changes."

Spatial Categorization

Spatial categorization in English and Korean: IN/ON vs. KKITA

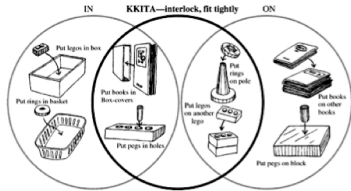


Fig. 1. An example is shown of the manner in which spatial relations are categorized in English and Korean. The scenes in the left circle show containment relations and the scenes in the right circle show support relations. Tight-fitting relations are shown in the center circle that intersects both containment and support relations.

McDonough, Choi & Mandler (2003)

- “Understanding Spatial Relationships: Flexible infants, Lexical Adults”
- Does knowing Korean/English affect nonverbal spatial categorization or spatial thought?
- Development: What do infants have in terms of understanding spatial language?

McDonough, Choi & Mandler (2003)

- Preferential Looking Technique
- Subjects: 9, 11, and 14-month infants as well as Korean-native and English-native adults

Experiment #1: English Preferences

- 14 infants each from 9, 11, and 14-month age groups and 32 undergraduates
- Familiarization: 6 video-taped scenes showing a particular action & scenes shown in pairs
 - 1/2 participants familiarized with tight-fitting containment
 - 1/2 participants familiarized with loose-fitting containment
 - Participants *not* told what they were looking for
- Test: one screen showing familiar non-native relation & one showing novel non-native relation
- Additional Test for adults: Shown 4 relations, 3 of familiar kind and 1 of novel - asked which one does not belong?

Experiment #1: Results

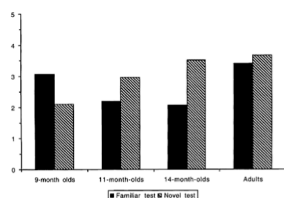


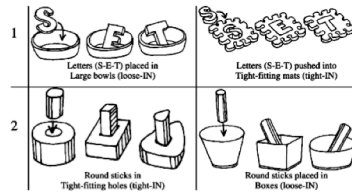
Fig. 2. The results of Experiment 1 showing the interaction in the infant data involving Scene and Age. The adult data are also shown to the right of the infant data.

- Preference for novel relation increases with age
- Also, 78% of adults got the “odd man out” task right

Experiment #2: More English

- Tight-fitting containment vs. loose-fitting containment
- Subjects: 8 infants each from 9, 11, and 14-month groups as well as 32 undergraduates
- Familiarization & then Test

Experiment #2: Test Scenes



Experiment #2: Results

- All infants preferred familiar relation
 - No preference in adults
- Infants pick up on the difference between tight-fitting and loose-fitting while adults don't.*
- Only 38% of adults got the "odd man out" task right - and only 58% of those could explain why

Experiment #3: Korean

- Tight-fitting containment vs. loose-fitting containment (native relation)
- Subjects: 4 infants from 9, 11, and 14-month group and 20 adult Korean immigrants
- Same familiarization & test technique as experiment #2

Experiment #3: Results

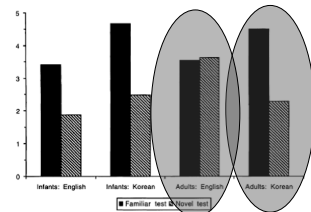


Fig. 4. Results from Experiments 2 and 3 showing both the infant data (infants raised in English-speaking homes and infants raised in Korean speaking homes) and adult data (English and Korean speakers).

- Perform same as infants in preferring familiar relation
- Also, 80% of adults got the "odd man out" task right and all could explain it

So some support for Whorf after all?

- Forget that English speakers couldn't explain the difference - that's a linguistic task
- But only 38% of them got the difference right vs. 80% of the Koreans
- Support for language influencing habitual methods of nonlinguistic (in this case spatial) thought/problem-solving?

Describing Spatial Relations

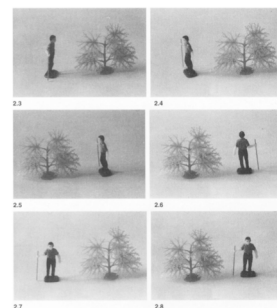


FIGURE 3. The photographs from set 2 depicting inverse relations.




(Pederson et al. 1998)

LANGUAGE COMMUNITY	PLAYER-PAIRS	DISTINGUISHING PROPOSITION	
		PROPOSITIONS TRUE OF PHOTOS 2.3, 2.4 & 2.7 AND NO OTHERS	PROPOSITIONS TRUE OF 2.5, 2.6 & 2.8 AND NO OTHERS
Arandic	4	'man standing in east'	'man standing in west'
Tzeltal ^a	3	'tree standing downhill of man'	'tree standing uphillwards of man'
Haijōm ^b	4	'man stands in "land of soft sand"'	'man stands in "river land"'
Longgu ^c	1	'tree standing on side towards sea'	'tree standing on inland side'
Tamil	4	'tree on north'	'tree on south'
Totonac	2	'tree stands east'	'tree stands west'
Yucatec	4	'man is on my side'	'man is on your side'
Belhare ^d	3	'tree right of man'	'tree left of man'
Kgalagadi ^e	1	'man at left'	'man at right'
Japanese	3	'man is at left side of tree'	'man is at right side of tree'
Dutch	3	'man standing to left of tree'	'man standing to right of tree'
Kilivila	6	(no functional equivalent)	(no functional equivalent)
Mopan ^f	3	(no functional equivalent)	(no functional equivalent)

TABLE 4. Cross-linguistic functional equivalents.

(Pederson et al. 1998)

Figure & Ground

Spatial Frames of Reference

- *Intrinsic* - features of ground object
- *Relative* - features of speaker
- *Absolute* - features independent of speaker or figure/ground

INFORMATION TYPE (FRAME OF REFERENCE)	LANGUAGE
Intrinsic alone	Kilivila (Austronesian) Mopan (Mayan)
Relative Participant derived (and intrinsic) information	Japanese (Uncertain) Dutch (Indo-European)
Absolute Geo-cardinal derived (and intrinsic) information	Arandic (Pama-Nyungan) Tzeltal (Mayan) Longgu (Austronesian)
Mixed cases (relative plus absolute) Participant and geo-cardinal (and intrinsic) information	Belhare (Tibeto-Burman) Haijōm (Khoisan) Kgalagadi (Bantu) Tamil (Dravidian) Totonac (Totonacan) Yucatec (Mayan)

TABLE 5. Grouping of languages by information type (transverse axis, men-and-tree set 2).

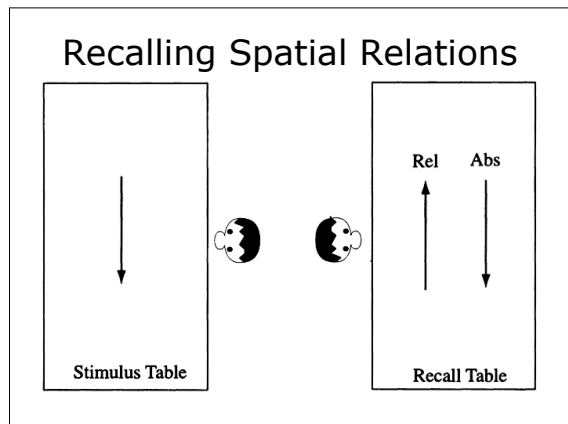
(Pederson et al. 1998)

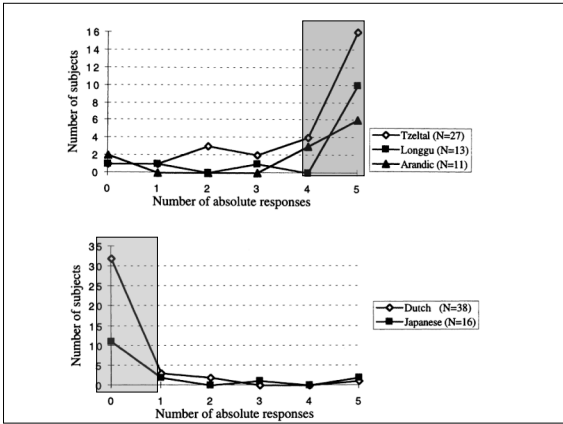
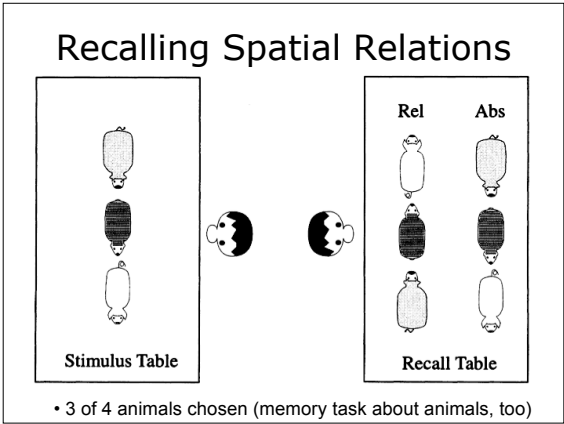
Which sounds more natural?

There's a bee sitting on your left shoulder.

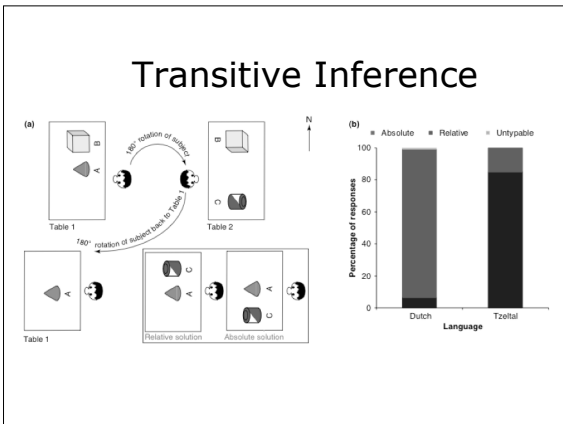
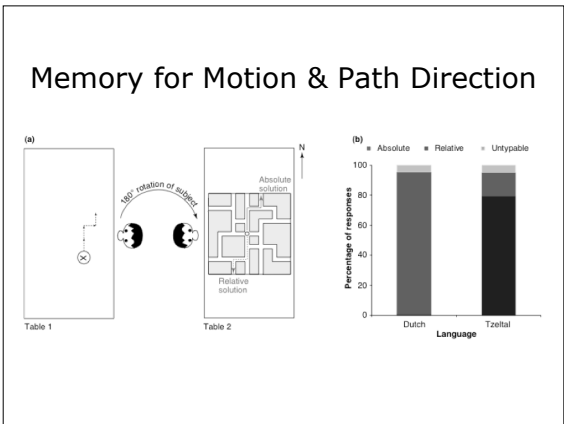
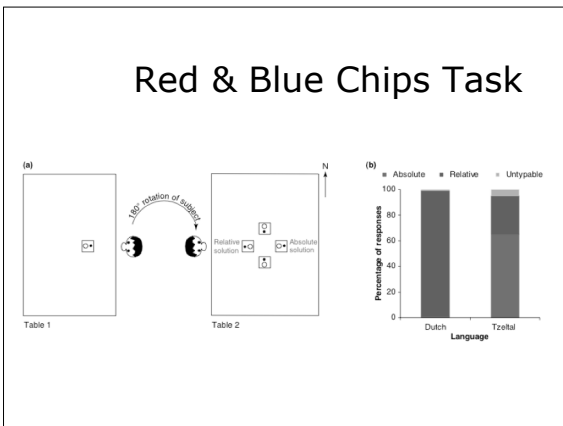
There's a bee sitting on your north shoulder.

(Pederson et al. 1998)





- ### 4 other tasks as well
- red and blue chips task (visual recognition memory of 2D shapes)
 - completed path task (recognition memory, inference)
 - Motion maze task (recognition-memory, cross-modal interpretation)
 - transitive inference (memory, inference) -





Turning the tables: language and spatial reasoning Peggy Li, Lila Gleitman*

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Lila Gleitman

Abstract

This paper investigates possible influences of the lexical resources of individual languages on the spatial organization and reasoning styles of their users. That there are such powerful and pervasive influences of language on thought is the thesis of the Whorf-Sapir linguistic relativity hypothesis which, after a lengthy period in intellectual limbo, has recently returned to prominence in the anthropological, linguistic, and psycholinguistic literatures. Our point of departure is an influential stream of *cross-linguistic studies that suggest to show that spatial reasoning is strongly affected by the*

One way to investigate the direction of causality is by changing the language spoken by one cultural group, maintaining their spatial environments in other regards, to see if their reasoning or categorization behavior changes as well. For example, consider the well-

Based on this reasoning, Section 2 of this paper presents two experimental studies of the malleability of spatial reasoning strategies *within a single* (English-speaking) *linguistic community*. Specifically, our question is this: if we manipulate the circumstances in which monolingual English speakers solve the spatial rotation problem, will they readily shift between the egocentric and allocentric strategies? An analogue to this within-language

Note, they say: egocentric = relative, allocentric = absolute

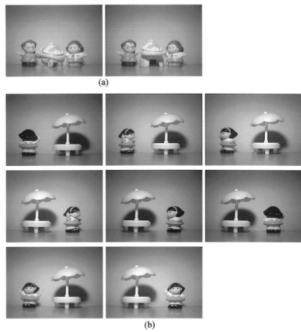


Fig. 3. The Man and Tree task: (a) sample distracter items; (b) test items. In this adaptation of the Brown and Levinson (1993) task we used pictures with an umbrella and a girl rather than a tree and a man.

English established as egocentric = relative (Li & Gleitman, 2002)

The Landmark Factor

This experiment and those that follow altered the context in which subjects carried out the Animals in a Row task by adding implicit landmark or bearing cues of various kinds, both on and outside the experimental tabletops. For after all, the results found for the Dutch and Tenejapan subjects might be attributable to the differential availability of such landmark information in a laboratory room versus in some other spatial setting, e.g. an outdoor environment or a cluttered room. This landmark factor varied in the studies

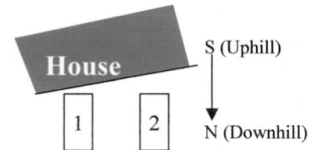


Fig. 4. Test environment for the Tenejapan subjects (following Brown & Levinson, 1993).

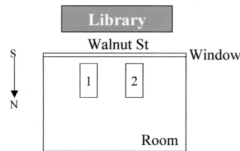


Fig. 5. Test environment for the indoor conditions of Experiment 2a. The University Library is to the south of the tables just as was the house in Fig. 4.

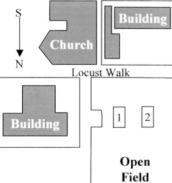


Fig. 6. Test environment for the Outdoor condition of Experiment 2a. Buildings are to the south and southeast of the grassy test area.

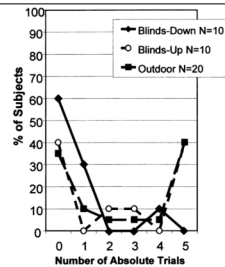


Fig. 7. Proportions of absolute choices in Blinds-Down, Blinds-Up, and Outdoor conditions. Subjects in the Blinds-Down condition predominantly chose the relative response. In the other conditions, subjects were divided in their preference for either all absolute responses or all relative responses.

given side of the first table? The toy animals can under rotation be placed in the same direction relative to the spatial layout defined by the landmarks surrounding the tabletops or in the same direction relative to one's own body position facing a tabletop.

(Li & Gleitman, 2002)

Absolute & Relative Ducks

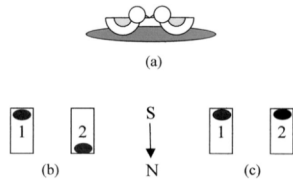


Fig. 8. Landmark cues. (a) The duck toy; (b) Relative duck placement, before and after rotation; (c) Absolute duck placement, before and after rotation.

(Li & Gleitman, 2002)

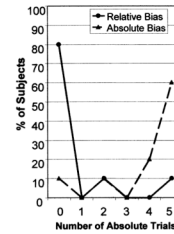


Fig. 9. Proportions of absolute choices in Experiment 2a (Relative versus Absolute Ducks). The subject's preference for absolute or relative response is produced by the positioning of the ducks.

2.2.2.3. Discussion The results of these variations on the original experiments suggest once more that the subjects' problem is to decide which side of the second table corresponds to a given side of the first table. In the prior experimental variants, it was shown that subjects used the landmark cues in the world beyond the tabletop to make the choice, where such landmark cues were made available (Blinds-Up and Outdoors conditions). In the present variants, the placement of the kissing duck trivially directs this choice within the frame of reference of the tabletop itself.

(Li & Gleitman, 2002)

Newcombe & Huttenlocher, 2000). Subjects in the tabletop task are told only to "make it the same" after the rotation, a blatantly ambiguous command (though the ambiguity is of course mitigated when properties associated with the stimulus array such as the landmark cues of Experiment 2b are informative or suggestive). Many subjects in laboratory-savvy populations like our American undergraduate one will now protest and ask for clarification; much more rarely (and usually after rather than during the test) participants from the traditional populations may also voice their recognition of the ambiguity. But in this task the experimenter does not then disambiguate her utterance ("just do it however you think...") so the subjects are left to guess her intent. The pragmatics of language use in English can now serve as an implicit cue: likely if one American is speaking to another about object placement in this small-scale apparatus, it will be in the style of making spatial reference common in the community – left-right, not east-west. For the Tenejanos, of course the opposite likelihood obtains.

The phenomenon that the Levinson-Pederson group have tellingly and informatively exposed is that communities of speakers choose among potential linguistic resources and regularly (or "habitually") prefer to say either "the spoon to the north of your teacup" or "the spoon to the left of your teacup" even when their language contains both kinds of lexical item. Speakers in different communities have, as Whorf termed it, a preferred "fashion of speaking" of spatial relations. This work has been justly acclaimed for the

Why the differences?



Of course the present authors do not know too much about traditional unschooled cultural groups who live in faraway places. Large disparities between investigator and investigated make it difficult to interpret either naming practices or experimental responses across these cultural divides. Indeed, PDWLKS rightly caution us not to add new languages to the sample without being well-acclimated anthropologists on the site. Luckily one does not have to go all the way to Chiapas or Papua-New Guinea to find communities that favor landmark-based spatial terminology: one of us is a native of a highly urbanized culture whose members live and work all crammed together on a skinny little island, about 16 miles long, at the mouth of the Hudson River; namely, Manhattan Island. Culturally diverse (some would even say "literate") as this community is, its residents share a small, stable, geographical landscape, rich in mutually known landmarks. Likely this is why their terminology for locations in the community is absolute and – like

(Li & Gleitman, 2002)



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Returning the tables: language affects spatial reasoning

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simply reflects antecedently existing conceptual distinctions. We here show that Li and Gleitman did not make a crucial distinction between frames of spatial reference relevant to our line of research.

Stephen Levinson



Our response must focus on the fundamental conceptual issues involved in the study of spatial frames of reference, but readers should know that the essential phenomenon that provoked our investigations is the following. In a nutshell: there are human populations scattered around the world who speak languages which have no conventional way to encode 'left', 'right', 'front', and 'back' notions, as in 'turn left', 'behind the tree', and 'to the right of the rock'.² Instead, these peoples express all directions in terms of cardinal directions, a bit like our 'East', 'West', etc. Careful investigation of their non-linguistic coding for recall, recognition, and inference, together with investigations of their dead-reckoning abilities and their on-line gesture during talk, shows that these people think the way they speak, that is, they code for memory, inference, way-finding, gesture and so on in 'absolute' fixed coordinates, not 'relative' or egocentric ones (the full details can be found in Levinson (in press), but the studies are now being replicated across the world by other scholars; see, for example, Wassmann and Dasen (1998)). The phenomenon should be of fundamental interest to cognitive science as showing human variability where least expected, and should not be lost sight of in disagreements about its correct interpretation.

Classifications of frames of reference

	Orientation-free		Orientation-bound	
	Allocentric	Intrinsic	Absolute	Egocentric
Description falsified under rotation of viewer	No	Yes	No	Yes
Description falsified under rotation of Ground (i.e. reference object)	Yes	No	No	No

Of all of our experiments, Li and Gleitman have chosen to replicate the very simplest ('Animals-in-a-row' – see Levinson (in press) for the many converging results from other experiments) and have gone on to simplify it further. The task in essence consists of presenting participants with a row of three animals on a table, rotating the participants 180 degrees, and making them reconstruct the array on another table so that to their satisfaction it matches the first. In our experiment, it was a crucial part of the design that participants' attention was deflected from the *direction* of the stimulus by being required to memorize the *order and identity* of three toy animals drawn from a larger set of four (Levinson, 1996b, p. 114). It was presented as a memory test, first without rotation, then with rotation (and both accuracy of order and direction were coded), and the participant was walked up to 20 m between stimulus and response.

Li and Gleitman set out to ask in their Experiment 2b "Can landmark information, if it is salient enough, completely determine the degree to which a single population solves spatial-problems?". As 'landmarks' they used 'duck ponds', big colorful symmetrical objects. They placed one of these on both the stimulus and response tables of the same Animals task as before: in their 'relative' condition they placed the duck ponds always to the participants' right on both tables; for the 'absolute' condition, they placed the ducks always to the south of both tables (and thus with left/right alternation under rotation). The results were that under the 'absolute' condition, participants lined up the animals facing the duck ponds, and in the relative condition they did the same, with the animals in the reverse direction.

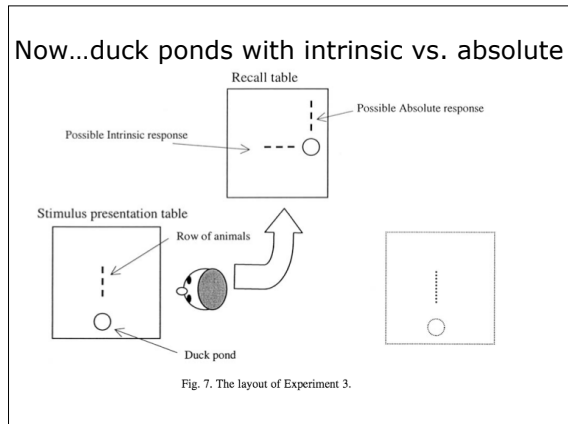
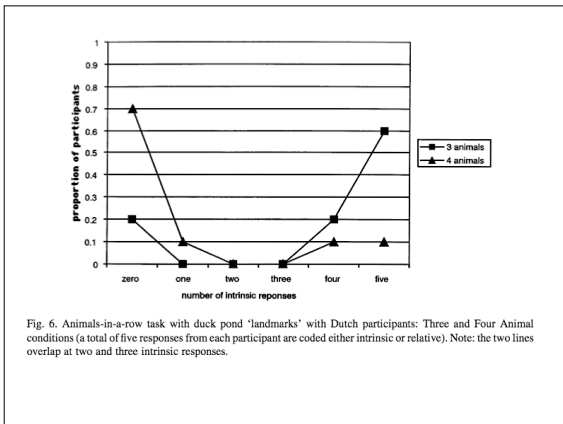
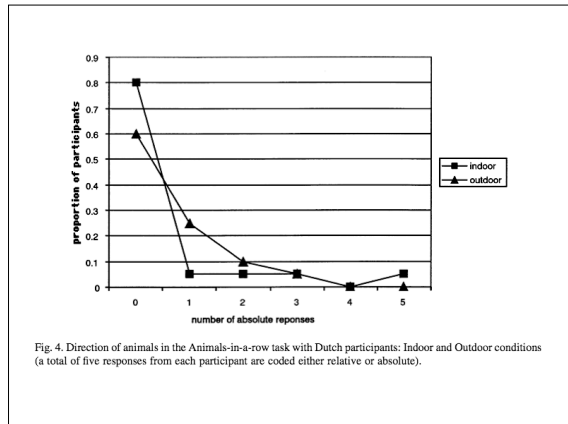
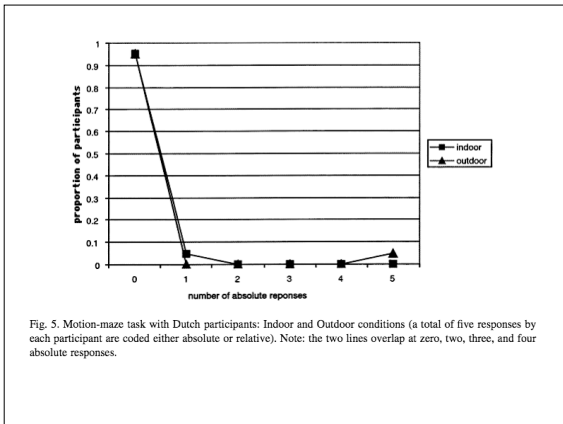
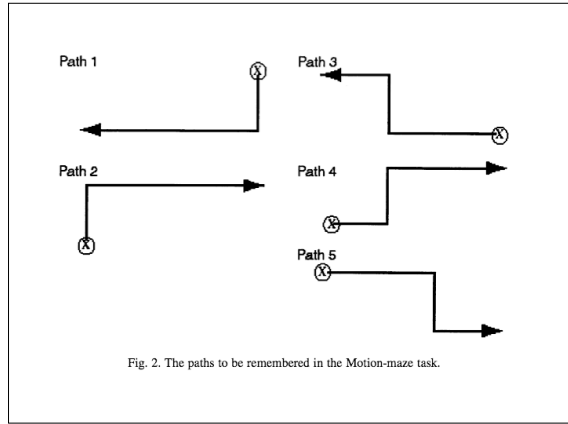
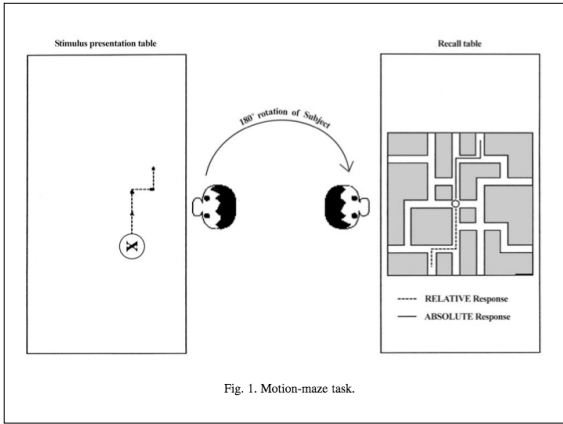
One has to note immediately that these are obviously not 'landmarks' in any normal sense, since identical objects are replicated in different locations (you don't expect to have clones of the local cathedral on neighboring streets!), and the landmark objects are clearly relatively small and movable. Rather, they will be interpreted by participants as part of the scene to be replicated. What participants clearly did was use the large, bright objects as an orientational cue – they were treating the whole assemblage, both duck ponds and animals, as one array to be reproduced. What kind of coordinate system is involved in maintaining the internal arrangements of an array while its orientation is varied? An orientation-free frame of reference of course – what we call an intrinsic frame of reference (see Levinson, 1996b, pp. 147ff). So what Li and Gleitman actually tested was whether they could bias

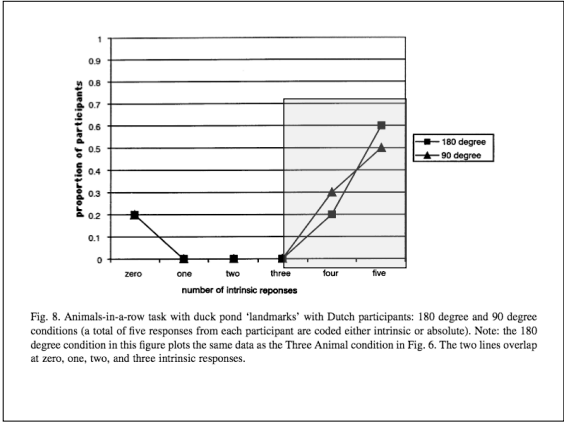
Absolute systems presuppose a conceptual 'slope', or series of infinite parallel lines across the environment. You can't walk around such a conceptual slope, in the way you can walk around a tower. The two systems have long been distinguished in studies of navigation: absolute systems are involved in dead-reckoning, landmarks in piloting, and they involve quite different procedures (Gallistel, 1990). Third, Li and Gleitman therefore imagine that the linguistic and conceptual systems under investigation as 'absolute' by our project are entirely familiar to English speakers, who, they suggest, could at the drop of a hat say "Give me the spoon that's northeast of your teacup" (p. 7). They can't because they can't routinely compute it, anymore than they can instantly give you their telephone numbers in binary code. But the 'absolute' language populations we have been interested in do routinely use such statements, can instantly compute them, and remember everything of whatever scale in terms of the locally relevant conceptual slope, as can be shown not only through memory experiments but also by examining their unconscious gestures during speaking. This is a truly interesting phenomenon, of considerable importance to our understanding of the 'psychic unity' of the species, and nothing is gained by shoving it under a terminological rug.

system in disguise.¹⁶ At night, in an alien city, facing a device never seen before (namely a sink with two taps), one Tenejapan asked another, "Which is the hot tap, the uphill (southern) or the downhill (northern) one?". They maintain a constant sense of absolute orientation, presumably by running a continuous background computation of egocentric heading with respect to abstract bearings, integrating multiple internal and external cues to achieve this.¹⁷ This is the phenomenon that we are trying to capture.



University of Nijmegen





But...

- If memories are encoded linguistically, does this neutralize Whorfian claims? Are these results really showing nonlinguistic thinking?
- Maybe someone should redo with a little linguistic shadowing for verbal interference...