

Annual Report for Period:06/2011 - 05/2012

Submitted on: 05/31/2012

Principal Investigator: Bohnemeyer, Juergen .

Award ID: 1053123

Organization: SUNY Buffalo

Submitted By:

Bohnemeyer, Juergen - Principal Investigator

Title:

Spatial language and cognition beyond Mesoamerica

Project Participants

Senior Personnel

Name: Bohnemeyer, Juergen

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: O'Meara, Carolyn

Worked for more than 160 Hours: No

Contribution to Project:

Will participate in the Meronymy Conference of 2013

Name: P?rez B?ez, Gabriela

Worked for more than 160 Hours: Yes

Contribution to Project:

Conducted fieldwork on Zapotec. Will participate in the Meronymy Conference of 2013.

Name: Romero Mendez, Rorigo

Worked for more than 160 Hours: No

Contribution to Project:

Will participate in the Meronymy Conference of 2013

Name: Benedicto, Elena

Worked for more than 160 Hours: No

Contribution to Project:

Will conduct fieldwork on Sumu Mayangna.

Name: Capistr?n, Alejandra

Worked for more than 160 Hours: No

Contribution to Project:

Will participate in the Meronymy Conference of 2013

Name: Gutierrez Morales, Salome

Worked for more than 160 Hours: No

Contribution to Project:

Will conduct fieldwork on Soteapanec (Sierra Popoluca). Will participate in the Meronymy Conference of 2013.

Name: Polian, Gilles

Worked for more than 160 Hours: No

Contribution to Project:

Will conduct fieldwork on Tseltal. Will participate in and help organize the Meronymy Conference of 2013

Name: Smythe-Kung, Susan

Worked for more than 160 Hours: No

Contribution to Project:

Will participate in the Meronymy Conference of 2013

Name: V?zquez, Juan Jes?s

Worked for more than 160 Hours: No

Contribution to Project:

Will conduct fieldwork on Chol. Will participate in the Meronymy Conference of 2013.

Name: Eggleston, Alyson

Worked for more than 160 Hours: No

Contribution to Project:

Will conduct fieldwork on Sumu Mayangna and Nicaraguan Spanish. Will participate in the Meronymy Conference of 2013.

Name: Nikitina, Tatiana

Worked for more than 160 Hours: No

Contribution to Project:

Will conduct fieldwork on Wan. Will participate in the Meronymy Conference of 2013.

Name: Burenhult, Niclas

Worked for more than 160 Hours: No

Contribution to Project:

Will conduct fieldwork on Jahai. Will participate in the Meronymy Conference of 2013.

Name: Hsiao, Huichen

Worked for more than 160 Hours: Yes

Contribution to Project:

Conducted fieldwork on Mandarin and Taiwanese

Name: Van Gijn, Rik

Worked for more than 160 Hours: Yes

Contribution to Project:

Unfunded collaborator, conducted fieldwork on Yurakar?. Will participate in the Meronymy Conference of 2013.

Name: Hirtzel, Vincent

Worked for more than 160 Hours: Yes

Contribution to Project:

Unfunded collaborator, conducted fieldwork on Yurakar?. Will participate in the Meronymy Conference of 2013

Post-doc

Graduate Student

Name: Peralta, Valent?n

Worked for more than 160 Hours: No

Contribution to Project:

Will participate in the Meronymy Conference of 2013.

Name: Hernandez Green, Nestor

Worked for more than 160 Hours: No

Contribution to Project:

Will participate in the Meronymy Conference of 2013

Name: Hernandez Gomez, Maria de Jesus

Worked for more than 160 Hours: No

Contribution to Project:

Will conduct fieldwork on Otom?. Will participate in the Meronymy Conference of 2013

Name: Herrera Castro, Samuel

Worked for more than 160 Hours: No

Contribution to Project:

Will conduct field work on Huave. Will participate in the Meronymy Conference of 2013

Name: Tucker, Randi

Worked for more than 160 Hours: Yes

Contribution to Project:

Research Assistant for project from June 2011 - November 2014

Name: Lovegren, Jesse

Worked for more than 160 Hours: Yes

Contribution to Project:

Conducted fieldwork on Vietnamese. Will conduct fieldwork on Mungbam. Will participate in the Meronymy Conference of 2013.

Name: Nguyen, Duylinh

Worked for more than 160 Hours: Yes

Contribution to Project:

Conducted fieldwork on Vietnamese.

Name: Olstad, John

Worked for more than 160 Hours: Yes

Contribution to Project:

Conducted fieldwork on Japanese.

Name: Nakagawa, Natsuko

Worked for more than 160 Hours: No

Contribution to Project:

Will assist in Japanese data collection, coding, and analysis.

Undergraduate Student

Technician, Programmer

Other Participant

Research Experience for Undergraduates

Organizational Partners

Max Planck Institut Fur Psycholinguistik

The Max Planck Institute for Psycholinguistics hosted a training workshop for the PI and project members Rik Van Gijn, Vincent Hertz, Niclas Burenhult, and Tatiana Nikitina.

CIESAS Sureste

CIESAS Sureste in San Cristobal de las Casas, Mexico, will host collaborative meetings with project members who are based in Mexico, and will host the Meronymy Conference in 2013.

Universidad Nacional Autonoma De Mexico

The Universidad Nacional Autonoma de Mexico (UNAM) in Mexico City, Mexico, will host collaborative meetings with project members who are

based in Mexico. In July 2012, the PI will meet with project members there to discuss coding and analysis of data, and planning for the meronymy conference in 2013.

Other Collaborators or Contacts

Dr. Pius Tamanji, at Universit? de Yaound? I in Cameroon, has been provided a set of Ball & Chair stimulus photographs in conjunction with his potential collaboration with project member Lovegren.

Activities and Findings

Research and Education Activities: (See PDF version submitted by PI at the end of the report)

The project 'Spatial Language and Cognition beyond Mesoamerica' follows up on the research begun in late 2007 by the PI and an overlapping research team in the project 'Spatial Language and Cognition in Mesoamerica (Award # BCS-0723694). It also carries on the informal name 'MesoSpace'. The current project has four main goals: to investigate (i) possible linguistic determinants of reference frame selection, (ii) possible non-linguistic (cultural/demographic and environmental) determinants of reference frame selection, (iii) the extent to which the Principle of Canonical Orientation (POCO) is adhered to in the languages of the world, and (iv) the typology of meronym systems. The question of linguistic and non-linguistic determinants of reference frame use has come to play a key role in the debate on possible relativistic ('Whorfian') effects of language onto thought: Levinson (1996, 2003), Pederson et al 1998, and others propose that community-specific linguistic practices of frame use condition speakers to adopt similar frame types in nonlinguistic cognition, whereas Li & Gleitman (2002) hypothesize that the apparent effect of language can be accounted for in terms of factors such as topography, population geography, literacy, and education driving frame use in both discourse and cognition. POCO (Levelt 1984, 1996) states, simply put, that object-centered intrinsic reference presupposes the reference entity or 'ground' to be in canonical vertical orientation. The effect of this principle can be illustrated with a ball placed on top of the underside of the seat of an inverted chair: an English speaker is likely to find it somewhat unusual to say in this situation that the ball is 'under' the chair. As it turns out, however, native speakers of Yucatec Maya and other Mesoamerican languages produce such descriptions readily in response to stimuli involving non-canonically positioned grounds. Finally, meronyms are object part designators such as body part terms. Whereas European languages tend to have relatively large inventories of meronyms for specific object classes (e.g., houses have 'roofs', cans have 'lids', bottles have 'caps', tables have 'tops', etc.), many Mesoamerican languages have general-purpose meronyms whose meanings are defined in geometric terms and which are applied across object classes. The projects explores the cognitive principles involved in meronymy, the

extent to which general-purpose meronyms rely on body part metaphors (as described for Ayoquesco Zapotec by MacLaury 1989, but rejected for Tseltal Maya by Levinson 1994), and the use of meronyms in spatial descriptions, in particular their effect on reference frame selection.

In pursuit of these goals, different tasks will be run with different language populations.

Task development

The current project makes use of tasks and stimuli developed for the first MesoSpace project ('Spatial Language and Cognition in Mesoamerica'; Award # BCS-0723694): the 'Ball & Chair' referential communication task, the 'New Animals' recall memory task, the Meronym Picture Book elicitation stimuli, the 'Novel Objects' referential communication tasks, and demographic and topographic surveys. In addition to these tasks, two new tasks and accompanying stimuli were developed: the 'Extended Ball & Chair' pictures (to be used in a referential communication task identical to the original Ball & Chair task), and the 'Talking Animals' referential communication task.

The original Ball & Chair (B&C) pictures consist of four sets of 12 photographs featuring a ball and a chair in varying spatial configurations. These are used in a picture-to-picture matching referential communication task inducing speakers to make explicit the spatial configurations in the pictures so as to distinguish and identify them while a screen between them prevents them from sharing their field of vision. The goal of this tool is to study preferences for the use of particular spatial frames of reference in manipulable space. B&C was designed to improve in various ways on the Men & Tree stimulus, in particular by avoiding suppression of object-centered FoRs. Another complication that B&C avoids is the use of pictures of toys - representations of representations, which makes it hard for the participants to consistently operate within the same scale. B&C sessions are recorded with at least five pairs of speakers per language.

The 'New Animals' task is a recall memory task requiring participants to commit arrays of farm animal toys located on a table to memory and then to reproduce them on a different table after turning 180 degrees. This task is designed to study preferences for frames of reference in recall memory to see whether these align with those in discourse. New Animals is modeled closely on the Animals-In-A-Row task originally released as part of the Max Planck Institute for Psycholinguistics' Cognition and Space Kit (Danziger 1993). The differences are six test trials per participant rather than five and prescribed rather than merely constrained arrays for the test trials. The task is conducted with 20 native speakers per language.

The Meronym Picture Book aims to inventory the meronyms of the language and determine to what extent the same meronyms are used

across human, animal, and plant bodies and artifacts. The picture book is realized as part of the field manual. It features images of humans and various animals, plants, and Western and Mesoamerican (MA) artifacts (equivalents appropriate for the non-MA populations will be substituted). The pictures are designed for elicitation targeting descriptors of the parts and locative descriptions with respect to them. The procedure introduces the concept of 'parts' with appropriate examples to be negotiated with the speakers and then asks them to color the parts of each stimulus entity, label the parts, and describe the location of a fly or coin with respect to some of them. This task is conducted with 10 speakers per language.

The Novel Objects stimuli consist of nine objects of novel shape, which do not resemble any artifacts or living creatures known in MA or Euro-American culture. There are two tasks associated with the Novel Objects. The first targets labels for the parts of the objects (meronyms), the second locative descriptions with respect to the parts. Both tasks are realized as referential communication tasks (see above). The participants match parts of the stimuli designated by bits of play dough and coins placed around them, respectively, through verbal instructions. One aim of the Novel Objects study is to test to what extent speakers agree on how to label object parts without being able to rely on convention and without needing to establish global interpretations of the objects first. Both MacLaury's (1989) account of Ayoquesco Zapotec meronymy and Levinson's (1994) of Tenejapan Tseltal meronymy predict that this should be possible. A second goal is to test for distinctive properties predicted by the two accounts that should allow the researcher to classify the meronym system of their field language with respect to the types described by Levinson (1994) and MacLaury (1989).

The demographic survey collects information from each participant about their age, gender, education level, use of a second language (for many populations, a dominant language in combination with their native, marginalized language), and habits of reading and writing. The topographic survey collects information about salient topographic features of the field site and how speakers in spatial discourse use those features. These are all factors that have been hypothesized to influence the frames of reference that are used or preferred by speakers (Li & Gleitman 2002). By collecting this data, MesoSpace will be able to perform quantitative analyses on the use of spatial frames of reference by speakers of different languages, environments, and different demographic factors.

Additional stimuli, the 'Extended Ball & Chair' picture set and the 'Talking Animals' task, have been added to the battery of tasks described above. The Research Assistant (RA) Randi Tucker, the PI, and project

member Perez Baez designed and developed three additional sets of the Ball & Chair picture stimuli for use in the proposed studies on population-specific practices of frames-of-reference use. The photos were designed so as to afford application of the notional relators 'above' and 'below' an equal number of times in disaligned-absolute, disaligned-intrinsic, and aligned absolute and intrinsic perspective and application of the four notional horizontal relators 'in front of', 'behind', 'left of', and 'right of' an equal number of times in disaligned-relative, disaligned-intrinsic, and aligned relative and intrinsic perspective (cf. Carlson-Radvansky & Irvin 1993 on aligned and disaligned interpretations of spatial descriptions). In addition, the overall number of items that feature the chair in non-canonical orientation was increased. The new sets are administered following the protocol developed for the original Ball & Chair photo stimuli. Tucker piloted the Extended Ball & Chair stimuli with University at Buffalo undergraduates in April 2011. After analyzing these data, Tucker produced another version of the sets to improve upon problems discovered in the originals. The PI piloted the second version with Yucatec speakers at his field site in Quintana Roo in July 2011, to discover that further improvements to the pictures were necessary. In December 2011, Perez Baez produced the final version of the 'Extended Ball & Chair' pictures. To date, these finalized stimuli have been run with speakers of Mandarin (by Hsiao), Japanese (by Olstad), Vietnamese (by Lovegren and Nguyen), and Zapotec (by Tucker and Perez Baez).

The PI and the RA developed the 'Talking Animals' referential communication task, which involves a referential communication design similar to that of Ball & Chair (and the Novel Objects tasks), i.e., two participants match stimuli across a screen that prevents them from sharing their fields of vision. However, the stimuli consist of four distinct spatial configurations formed with the toy animals of the New Animals task. The researcher builds each configuration for one of the participants, the 'director', who then instructs the other participant, the 'matcher', to build the same configuration on their side of the screen. The Talking Animals task is carried out with 40 pairs of participants per population. Tucker piloted the Talking Animals task with University at Buffalo undergraduates in April 2011. The PI ran the task with Yucatec speakers at his field site in Quintana Roo in July 2011. Upon discovering that the participants experienced considerable difficulty with the task, the PI designed a training phase in which participants describe a configuration without the screen preventing shared vision. When both participants feel that they understand the goal of the task, the screen is put in place and the task proceeds as originally designed. To date, the Talking Animals task has been run with speakers of Mandarin (by team member Hsiao), Japanese (by team member Olstad), Vietnamese (by team members Lovegren and Nguyen), Yucatec (by the PI), and Zapotec (by Tucker and Perez Baez).

Data collection

To date, data has been collected on Mandarin, Japanese, Vietnamese, Yucatec, Yurakare, and Zapotec (see attached pdf for details).

Data collection for Mandarin and Japanese is currently ongoing. For these two language groups, researchers are collecting data from multiple populations. Hsiao is currently running Ball & Chair, New Animals, Talking Animals, and the demographic and topographic surveys with Mandarin-Taiwanese bilinguals. She will run these same tasks with Mandarin and Taiwanese monolinguals, and possibly Mandarin-English bilinguals.

Olstad, with the assistance of team member Nakagawa, is running the same tasks with urban and rural Japanese speakers on the island of Okinawa and in mainland Japan.

Lovegren, with the assistance of Nguyen, collected Vietnamese data in Long My, Hau Giang province, Southern Vietnam in January 2012. He ran Ball & Chair, New Animals, Talking Animals, Meronym Picture Book, Novel Objects, and the demographic and topographic surveys, and presented preliminary findings in a meeting of the Semantic Typology Lab at the University at Buffalo in March 2012. Further analysis is ongoing.

The PI collected Yucatec data using Extended Ball & Chair and Talking Animals in July 2011. The Extended Ball and Chair data was problematic due to the nature of the photos and will be treated as pilot data. The PI plans to rerun the task with the finalized stimuli in August of 2012. The Yucatec Talking Animals data was coded and is still being analyzed.

Van Gijn and Hirtzel, in an unfunded field trip, collected data on Yurakare in summer 2010 using the Ball & Chair, Novel Objects, and Meronymy Picture Book tasks. Analysis is ongoing.

Perez Baez and Tucker collected data on Isthmus Zapotec with the Extended Ball & Chair and Talking Animals tasks in April-May 2012. Coding and analysis are ongoing. In the same field site, Perez Baez and Tucker piloted Talking Animals and New Animals with passive bilingual speakers of Juchitan Zapotec whose dominant language is Spanish and who can passively understand Zapotec but do not necessarily speak it. The tasks were carried out in Spanish with two pairs of younger speakers (the passive bilinguals in this field site tend to be under 25).

Meetings/training

During the reporting period, project personnel have held weekly meetings in conjunction with the Semantic Typology Lab at the University at Buffalo.

In November 2011, the PI and Tucker held a training workshop at the University at Buffalo for project members Hsiao, Lovegren, Nakagawa, and Olstad. In May 2012, the PI and Tucker held a training workshop at the

Max Planck Institute for Psycholinguistics in Nijmegen, The Netherlands for project members Burenhult, Hirtzel, Nikitina, and Van Gijn. These training workshops also functioned as project meetings at which hypotheses, methods, and analyses were discussed.

At the start of her field trip in April 2012, Tucker met with project members Hernandez Gomez, Polian, Herrera, Romero Mendez, Hernandez Green, and Perez Baez in Oaxaca City, Mexico to discuss the new stimuli and tasks and their plans for field work and data collection.

Findings:

Goals

The current project has four main goals: to investigate (i) possible linguistic determinants of reference frame selection, (ii) possible non-linguistic (cultural/demographic and environmental) determinants of reference frame selection, (iii) the extent to which the Principle of Canonical Orientation (POCO) is adhered to in the languages of the world, and (iv) the typology of meronym systems.

The project 'Spatial Language and Cognition in Mesoamerica' (Award # BCS-0723694) has produced evidence from the MA area suggesting that the pervasive use of geometrically based meronyms in spatial descriptions biases the speakers of a language against the use of relative FoRs, and therefore may be a linguistic determinant of reference frame selection. However, Mesoamerican (MA) languages are believed to form a sprachbund, so they might share the two correlated features - shape-based meronyms as a central resource of spatial descriptions and a bias against relative frames - independently of one another. To strengthen the case for a causal relation, the investigation is being extended to non-MA languages that likewise make pervasive use of geometric meronymies in their spatial descriptions. For the current project, the non-MA languages that show initial evidence of involvement of geometric meronymy in spatial representations are Jahai (Mon-Khmer language spoken in Malaysia; team member Burenhult), Mungbam (Benue-Congo language spoken in Cameroon; team member Lovegren), Yurakare (unclassified language spoken in central Bolivia; team members Hirtzel & Van Gijn), and Wan (Southeastern Mande language spoken in Cote d'Ivoire; team member Nikitina). If the use of shape-based meronyms in spatial representations biases the speakers in favor of non-relative FoRs, then this preference should be observed in these non-MA languages as well. A further goal is to determine what qualitative and quantitative properties of meronym use in particular ? if any ? affect FoR selection.

The interest in possible non-linguistic determinants of reference frame selection derives from Li & Gleitman's (2002) hypothesis that the apparent effects of language onto frame use in memory and reasoning reported

in Levinson (1996, 2003) and Pederson 1998 may be reduced to non-linguistic factors such as literacy, education, population geography, and topography driving population biases in the use of spatial frames of reference in both discourse and nonlinguistic cognition. In contrast, Levinson (1996, 2003) and Pederson et al (1998), inter alia, suggest that language is a determinant in its own right and possibly specifically serves a mediating role, allowing the members of a community to converge on a particular pattern of FoR use in response to those other factors. One of the stronger pieces of evidence in support of Li & Gleitman's position is the finding that across the world, larger, urban, better educated, and more literate populations tend to gravitate towards relative FoRs. The languages whose speakers crosslinguistic research has shown to have a strong bias towards relative FoRs are all spoken in large, urbanized, industrialized societies with extremely high levels of literacy and education: Dutch, English, German, and Japanese. In contrast, languages that have been shown to make little or no use of relative FoRs are spoken by small, rural, pre-industrial societies whose members are often less literate and have received less formal education. A bias in favor of absolute frames and a (near) absence of relative ones has been attested in several Australian languages. Outside Australia, a similar profile has been established for Hai//om (Khoisan, Namibia), Longgu (Oceanic, Solomons), and the Tseltal of Majosik', Chiapas. By far the largest language in which a strong preference for geocentric FoRs has been attested is Balinese (Wassmann and Dasen 1998). The Balinese were also one of only two highly literate populations (with a history dating back to the spread of Hinduism on Bali in the 1st century AD) with a geocentric bias known before the start of the current project, the other being Indians whose schooling involves Sanskrit schools (Vajpayee et al 2008). However, these cases do not seem particularly problematic for Li & Gleitman's argument. The use of the geocentric system is deeply engrained in religion and culture and thus easily attributable to non-linguistic factors. In India, Hindi speakers make regular use of (celestially-based) cardinal direction terms as well as relative and intrinsic FoRs in manipulable space. However, the proportion of relative usage in the mix is relatively more pronounced in urban communities, whereas the use of absolute frames is more pronounced in rural ones (Mishra et al 2003). Moreover, as in the case of Balinese, the use of geocentric terms is linked to Hindu religious practices and traditions. Vajpayee et al (2008) show that among 11-15-year-old Hindi-speaking children in the city of Varanasi in northern India, those attending Sanskrit-medium schools consistently use absolute FoRs more frequently in both discourse and internal cognition than their age mates who attend Hindi-medium schools.

It is evident that the problem of discerning between language and other cultural factors as possible triggers of FoR choice is an intricate one that is not going to be solved in one fell swoop. The role of any of the cultural factors Li & Gleitman adduce in FoR selection is far from clear to begin with. For instance, the ability to discriminate between left-right mirror images is positively correlated with literacy in a Roman script (Danziger and Pederson 1998) and thus possibly with habituation in the use of relative FoRs. However, Japanese speakers patterned with populations literate in Roman scripts on the mirror image discrimination task. Danziger and Pederson (1998) attribute this to the teaching of rōmaji, a Roman script for Japanese, in school; but rōmaji is not widely used among native speakers in everyday practice.

An alternative explanation may be the teaching of 'stroke orders' for kanji and other writing systems based on the Han characters across the Sinosphere: for reasons of efficiency, children are taught to produce the strokes the characters are composed of in a particular order and orientation, left-right and top-down. Li & Gleitman (2002) and Mishra et al (2003) suggest that urbanites may be habituated to egocentricity by their constant need to navigate city streets. However, while the distinction between left turns and right turns is egocentric, it can be encoded purely with respect to the body of the observer as ground, without extrinsic projection of the FoR. This does not presuppose relative FoRs in the sense of Levinson (1996, 2003), and there is in fact no evidence that the ability to make this distinction varies across populations.

Another possible factor in FoR use Li & Gleitman (2002) adduce is the interaction of topography and geographic cohesion of the community. Populations that employ geocentric frames anchored to entities or features of the local environment (rivers, mountains, seashores, etc.) presumably inhabit areas in which those entities/features are salient. However, topography and geographic distribution of the population merely constrain the use of FoRs modeled on aspects of the local environment. They do not constrain the use of any other types of FoRs ? including celestially-based geocentric systems - and they crucially do not explain why those populations that do employ frames anchored to the local environment do so. Not, that is, unless one assumes that any population that has a suitable feature in its local environment exploits it for modeling FoRs on it ? which is clearly not the case for most English-speaking riverine or mountainous (etc.) communities. The MesoSpace project aims to make a contribution in precisely this area, by studying populations that are closely matched in terms of their environment, modes of production, and literacy, with language being the potential major differentiating factor ? the position of Li and Gleitman predicts that language should not be able to make a fundamental difference in cognitive performance here.

In sum, it remains very much unclear what the source of the apparent correlation between large, urbanized, literate societies and the preference for relative FoRs is. MesoSpace aims to shed new light on this

correlation by examining a group of urbanized, highly literate populations for some of whom preliminary evidence suggests a preference for intrinsic over relative FoRs. If it can be confirmed that literate, urban

populations are not necessarily biased in favor of relative FoRs, the question is which factors do determine the use of FoRs in such populations. In cases where alternative factors ? such as religious practices in

Bali - are not in evidence, the door for a community bias in FoR use being a cultural habitus that is not fully determined by the community's environment or by other aspects of the culture, but is codified in the

language of the community, becomes wide open. Such an outcome should not be surprising. Anthropologists have long ago stopped trying to find strong determinants for a group's spiritual or cosmological beliefs.

Similarly, linguists are unable to strictly predict on cultural and environmental grounds what kind of color term system, demonstrative system, or tense-mood-aspect system a given language has. There appears to be

no reason to assume that the relation between cultural and environmental factors and FoR use in language and cognition is any more direct.

Findings

The Vietnamese data was collected by Jesse Lovegren, assisted by Duylin Nguyen, in Long My, Hau Giang province, Southern Vietnam. Eighty native speakers of Vietnamese were recruited to participate in the various

elicitation tasks. Lovegren found that in the New Animals recall memory experiment, geocentric and egocentric responses occurred with roughly equal frequency (binomial $p(16;20) = 0:01$). In the Talking Animals task,

orientation descriptions were employed more frequently than were location descriptions. Within the orientation descriptions, landmark descriptions appear to be employed more frequently than do relative descriptions. Since this comparison is important, Lovegren calculated the 95% confidence intervals for the proportion of animals for which an orientation description was given, which used a landmark or relative

strategy (bootstrap method, 5000 iterations, varbin cmd. in R pkg. aod). For landmark descriptions, $\hat{p} = 0:878$, $SE = 0:02$, $CI = (0:8447;0:9104)$. For relative descriptions, $\hat{p} = 0:20$, $SE = 0:03$, $CI = (0:1522;0:2521)$.

The confidence intervals clearly do not overlap, so the difference is significant. As for location descriptions, the difference between the two most significant response types, intrinsic and relative, is not significant.

In the population as a whole, we see that there is a preference for the use of landmark-based orientating strategies in the Talking

Animals game, and a preference for geocentric solutions in the New Animals experiment, in line with the predicted alignment between linguistic and nonlinguistic usage preferences.

Lovegren tested the Talking Animals data for possible correlation with demographic variables, using a single binary variable ('COMB'), which has the value 1 for a participant whose daily routine involves reading and/or who has 11 or more years of education and 0 for everyone else. He found a significant effect for COMB for models of the use of orienting strategies. For the model of relative strategies, the null hypothesis (that $\beta_1 = 0$) is rejected, with $p = 0.01$, and for the model of landmark strategies, the null hypothesis is rejected at $p = 0.008$.

The model suggests that education and literacy may be driving some of the variation in the use of strategies for giving orientation descriptions. This result may help to discourage two especially strong types of

hypotheses: first, they discourage the hypothesis that education and literacy in a Roman-script orthography are factors strong enough by themselves to promote a relative strategy in a population. This finding is

highly significant: is the first time that a bias toward the use of relative frames in small-scale space has been disconfirmed in a population that is highly literate in an orthography based on the Roman alphabet.

The younger participants were mostly high school students and university students, who have daily experience reading and writing. Older adult participants all have at least some level of education, though most have

very little regular interaction with written media. Those coded as zero for the education-literacy variable are best described as semiliterate. Danziger & Pederson 1998 report the ability to discriminate between

enantiomorphs to be positively correlated with literacy in a Roman script, suggesting a possible link between the use of the Roman alphabet and habituation in the use of relative FoRs. Lovegren's Vietnamese data

discourage this interpretation. However, secondly, Lovegren's results also discourage the hypothesis that education and literacy play no role whatsoever in affecting linguistic frame of reference use.

Training and Development:

The research assistant, Tucker, organized and participated in weekly meetings of the Semantic Typology Lab. The lab provides an environment in which project members and University at Buffalo graduate students and faculty members have benefited from discussion of methodological issues and findings of the project.

During the training workshop that was hosted at the University at Buffalo, November 11-14, 2011, the PI and project members Hsiao, Lovegren, Nakagawa, Olstad, and Tucker, along with a number of UB graduate students from outside the project, convened to discuss the goals of the project and

also gained hands-on experience regarding how to run the tasks relevant to the project. Tucker gained experience organizing and leading a training workshop of international collaborators. The PI held another training workshop at the Max Planck Institute for Psycholinguistics in Nijmegen, The Netherlands, May 21-24, 2012. In attendance were project members Burenhult, Hirtzel, Nikitina, and Van Gijn. Tucker met with project members Hernandez Gomez, Polian, Herrera, Romero Mendez, Hernandez Green, and Perez Baez in Oaxaca City, Mexico, April 20-22, 2012, to discuss the new stimuli and tasks and their plans for field work and data collection.

Hsiao has trained two female graduate students, Yu-Xin Cheng and WeiHsuan Lo, as project assistants on MesoSpace experiments and has reviewed background articles with them. These students have gained valuable experience with linguistic tasks, participants, and the data that is produced.

Through their work with MesoSpace, graduate student project members are building collaborations and presenting research at foreign universities. In May 2012, Lovegren gave a lecture at Universit? de Yaound? I in Cameroon, introducing the concepts of grammaticalization, meronymy, and semantic typology to a group of about 60 graduate students. He has also opened discussions about MesoSpace with Dr. Pius Tamanji at the same university, and has provided him a set of Ball & Chair stimuli photos. Olstad is currently working with Japanese students at Aizu University to complete transcription of the linguistic data. He plans to present his MesoSpace research at the University of the Ryukyus and Okinawa International University. During her field trip, Tucker was introduced linguists and prominent members of the Juchit?n Zapotec community, with whom she hopes to collaborate in the future.

The field trips provide the MesoSpace researchers with practical experience in the research methodology of semantic typology - collecting data on linguistic categorization with nonverbal stimuli instantiating the cells of an etic grid and performing semantic and pragmatic analyses to get at language-specific intensions of semantic categories. For some of the members of the team (which includes nine graduate students and two researchers who defended their dissertations within the last year) this is the first exposure they have had to this approach. The project is contributing to the training and academic advancement of nine graduate students, five of whom are women, and three of whom are Mexican citizens. The project provides excellent training opportunities for the students. They are instructed in cutting-edge methods of semantic typology and spatial semantics and gain hands-on experience in field research and in the analysis of data under the direction of the PI and through the discussion of the results with their peers during the project meetings and the symposium on meronymy. They

are also provided with multiple opportunities to publish their results in edited volumes and scientific journals, and to thus further their academic careers.

Outreach Activities:

MesoSpace advances the description of eight indigenous minority languages of Mexico and Nicaragua (Chol, Huave, Otomi, Sierra Popoluca, Sumu Mayangna, Tzeltal, Yucatec, Zapotec), and of four indigenous minority languages beyond Mesoamerica (Jahai, Mungbam, Wan, Yurakare). All of these must be considered at least somewhat endangered and most of the smaller languages as severely endangered. All of the indigenous minority languages of the sample are severely under-described in comparison to the larger languages of the sample: Japanese, Mandarin, Taiwanese, and Vietnamese. Three of the project members are native speakers of indigenous languages and thus members of marginalized ethnic minorities who are empowered to become agents, rather than mere subjects, of the scientific study of their languages and cultures. The project also furthers the collaboration of research institutions in Europe, Mexico, Cameroon, Taiwan, and the U.S., thereby helping to integrate a global academic community.

Journal Publications

Books or Other One-time Publications

Web/Internet Site

URL(s):

<http://www.acsu.buffalo.edu/~jb77/Mesospace.htm>

<http://mesospace.wordpress.com/>

Description:

The project website (hosted on the PI's professional website) contains a description of the project, a list of project members and affiliations, short descriptions of the languages included in the MesoSpace sample, along with a map locating the languages. The site also features researcher materials, NSF annual reports, and handouts from presentations of MesoSpace results. The webpage was developed during the first MesoSpace project. Plans for an overhaul bringing additional content and a shift of emphasis to the new project are at an advanced stage and will be implemented momentarily.

The project blog contains up-to-date information on the activities of the project such as stimuli development, field research activities, meeting and workshop organization, publication progress, and IRB requirements.

Other Specific Products

Product Type:

2012 Field Manual

Product Description:

This product is a revision of the 2008 Field Manual for the project. It was designed as a resource for project members regarding the objectives of the project and it provides guidelines on how to run the tasks and analyze the data.

Sharing Information:

?Pre-release? versions of the 2012 Field Manual are available on the project website:

<http://www.acsu.buffalo.edu/~jb77/MesoSpaceManual2008.pdf>

Contributions

Contributions within Discipline:

The work of the MesoSpace project is making significant contributions to (i) the scientific description of individual languages; (ii) linguistic typology, the study of the distribution of language structures, sounds, and linguistically expressed meanings across languages; and (iii) the theory of language.

(i) The project examines the use of spatial frames of reference in 17 languages of Bolivia (Yurakare), Cameroon (Mungbam), Cote d'Ivoire (Wan), Japan, Malaysia (Jahai), Mexico (Chol, Huave, Otomi, Sierra Popoluca, Sumu Mayangna, Tzeltal, Yucatec, Zapotec), Nicaragua (Sumu Mayangna, Nicaraguan Spanish), Taiwan, and Vietnam. Reference frames are conceptual coordinate systems used to interpret spatial representations ? linguistic and cognitive representations of the location, orientation, and motion of objects in space. For many of these languages, few published accounts of the use of reference frames are available ? the MesoSpace research is mapping vast swathes of terra incognita here. Some of these languages are endangered, and moreover, there is evidence suggesting that the use of reference frames by the speakers of small minority languages such as the languages of the Americas is rapidly changing under the influence of dominant contact languages. The work of the MesoSpace team may in some cases represent the last best opportunity of obtaining scientific records of many of these unique cultural systems of spatial knowledge.

The project is also exploring a second, related domain of spatial language, namely so-called 'meronyms', terms for object parts. Many languages in the Mesoamerican area, as well as Jahai, Mungbam, Wan, and Yurakare, make pervasive use of meronyms as a resource for the expression of spatial relations. The project documents both the use of meronyms in spatial descriptions and the conceptualization of part-whole relations or 'mereology' that underlies the assignment of meronyms to objects. These systems are strikingly different from what is found in better studied languages, and individual languages appear to vary surprisingly in terms of their mereologies.

(ii) Until recently, it was universally taken for granted by linguists and cognitive scientists that the use of spatial frames of reference is innate and does not vary with language and culture. All human populations were assumed to show the same bias in favor of egocentric, 'relative' representations found in speakers of English or Japanese, who would describe, say, a ball as being 'left of' or 'in front of' a chair depending on the viewpoint of the speaker (or, more generally,

an observer). In the late 1970s, the first reports emerged indicating that Aboriginal people of Australia tend to make almost exclusively use of geocentric or 'absolute' frames, describing, in the above example, the ball as being 'west of' or 'south of' the chair.

Crosslinguistic research on this phenomenon began in the 1990s. It was quickly discovered that there is in fact a bewildering array of different kinds of frames across human populations, often modeled, for example, after local topographic features such as mountain slopes or the courses of rivers. It became apparent that there is enormous variation across cultures in terms of which reference frames their members prefer for solving a given task. And this variation was found to have profound consequences for spatial cognition. Frames of reference are not mutually translatable: if one remembers the ball exclusively as being 'west of' the chair, this will not allow one to determine later where it was with respect to the chair from the perspective of the observer. Conversely, if the location of the ball is remembered in egocentric terms, its location in absolute or geocentric space cannot be inferred from this representation. Consequently, people tend to memorize spatial information in the same frames they prefer to communicate it linguistically.

These findings raise important questions about the boundary between innate and cultural knowledge in spatial cognition and the relationship between spatial cognition and language. In order to be able to address these questions, it is vitally important to survey the linguistic systems and cognitive styles used by the speakers of different languages according to standardized scientific methods and protocols. This is the job of semantic typology, a subfield of linguistic typology. The members of the MesoSpace research team have been undertaking the largest survey of the use of spatial frames of reference to date and also the most comprehensive in a single large geographic area, the Mesoamerican cultural and linguistic area. In doing so, they have also pioneered the application of methods of semantic typology to such an area. This 'areal' approach to typology opens up unique opportunities for isolating linguistic, cultural, and topographic/environmental factors influencing spatial cognition. Preliminary results are presented in more detail in the Findings section of this report.

The overarching theoretical goal of MesoSpace is to help adjudicate between two competing explanations that have been proposed to account for the observed covariation between reference frame use in language and thought. One view, championed by Peggy Li and Leila Gleitman of the University of Pennsylvania, holds that reference frames are indeed innate, as traditionally assumed, and that the observable differences across populations in the use of reference frames in speech and thought alike are driven by adaptations to the environment, such as the local topography. Salient land and water forms such as mountains and rivers may serve as the models or 'anchors' for so-called geocentric frames in 'upriver'/'downriver' or 'uphill'/'downhill' systems. Population density, infrastructure (road systems!), and literacy and education level are likewise factors Li and Gleitman suggest may play a role. Thus, among the populations surveyed around the world thus far, relative frames are preferred mostly among members of large-scale, industrialized, urbanized, and highly educated and literate societies, whereas the cultures in which they play a minor or no role tend to be small-scale traditional societies whose members are

often less educated and literate due to the effects of economic marginalization.

In contrast, the position advanced most prominently by Stephen Levinson of the Max Planck Institute for Psycholinguistics argues that, while the ability to learn any kind of frame is probably innate, familiarity with particular frame types is mostly cultural. Reference frames are culture-specific styles of thinking and talking about space. Children growing up in a particular community must learn the use of frames appropriate in their culture by observing older children and adult members of the community. Since language is the most sophisticated system for the production of external representations of thought humans (or any other animal species, as far as we can tell today) have at their disposal, language is expected to play a powerful role in the cultural transmission and diffusion of every culture's cognitive style. In this sense, language has the power to structure and shape thought, an idea known in the cognitive sciences as 'Whorfian' in reference to the American linguist Benjamin Lee Whorf, who famously proposed it in the 1930s. However, Whorf did probably not quite have the understanding of the mind as a computational system of thought that humans and animals are innately endowed with, which was ushered in by the 'cognitive turn' of the 1950s. He has often been understood to hold that our thinking is largely derived from and determined by our native languages. Modern versions of the hypothesis of language-on-thought effects are commonly distinguished from this deterministic interpretation as 'Neo-Whorfian'.

For the languages of the MesoSpace sample, Li and Gleitman's innatist hypothesis predicts that the use of reference frames in both language and thought should primarily depend on the local topography, population density, and infrastructure, and the speaker's level of literacy and education. The native language and whatever second languages a person may speak should at most play a secondary role. In contrast, the Neo-Whorfian hypothesis of Levinson and colleagues predicts that people's use of reference frames depends primarily on the languages they speak and only in second respect on other factors such as those suggested by Li and Gleitman. Adaptations to environmental factors are undoubtedly real; but they occur, not at the 'ontogenetic' level of the development of an individual's speech and thought patterns, but at the 'phylogenetic' level of the cognitive development of the community, and thus proceed at a time-scale that exceeds any individual's personal experience. The Mesoamerican linguistic and cultural area, with its impressive diversity in languages, cultures, natural environments, and socio-demographic profiles, offers a natural laboratory for testing these predictions. Beyond Mesoamerica, project members are collecting data from language communities of high population density, infrastructure, literacy, and education in Taiwan, Japan, and Vietnam.

A central typological hypothesis of the MesoSpace project is the idea that the pervasive reliance on meronyms for the expression of spatial relations may bias the speakers of a language against the use of relative frames. The rationale behind this idea is that both relative and intrinsic reference requires the use of meronyms in the languages in question. Whereas Western languages have large, specialized meronymic vocabularies assigned according to the functions of the parts, many Mesoamerican languages have general-purpose meronyms that

are assigned across arbitrary classes of objects according to the geometry of the parts and the whole. For example, English speaker identify the 'handle' and 'blade' of a knife as major parts and extend the terms 'handle' and 'blade' to parts of other objects that have similar functions, such as the handle of a container or the blade of a circular saw. In contrast, in Yucatec Maya, the handle of the knife is identified as its 'leg' on the basis of its shape and position in the geometric structure of the knife. 'Leg' is not applied to the handle of a container, which is most likely its 'ear'; instead it is used for example in reference to a lamp post. There is no word that translates 'blade'. Instead, both planar surfaces of the blade of the knife are identified as the knife's 'fronts', and this term extends to other salient flat or convex surfaces of arbitrary objects, but not to the blade of a circular saw, which would be (a part of) the saw's 'belly'. Since both intrinsic and relative reference to an object require the assignment of meronyms to it in languages such as Yucatec and relative reference is done on the basis of the geometry of the observer's body rather than that of the geometry of the reference object, the pervasive practice of assigning meronyms to an object on the basis of its shape habituates speakers against relative interpretations. This hypothesis is currently being tested by the members of the project in their respective field languages inside and outside Mesoamerica and so far has held up to these tests.

The discovery of the intrinsic use of terms for vertical relations regardless of the orientation of the reference object vis-?-vis the gravitational vertical in Yucatec and other project languages has resulted in the creation of new stimuli to further investigate this phenomenon. For example, a ball resting on top of the underside of an inverted chair may be naturally described as being 'under' the chair in these languages. This phenomenon, which confounds previous assumptions about the universal dominance of gravitational absolute frames in vertical reference, could be a direct consequence of the use of meronyms for the expression of vertical relations and the overall preference for intrinsic reference in languages such as Yucatec.

Previous reports suggest that the principles governing the assignment of meronyms are not uniform across Mesoamerican languages, but may vary from language to language. It is an important part of the MesoSpace agenda to examine and compare the meronymies found across the area, and in other languages of the world. For example, in Yucatec, meronym assignment depends mostly only on the canonical orientation of the object in the vertical, not on its actual orientation. In contrast, in some languages, the assignment of the terms appears to depend strictly on the object's actual orientation, such that the 'head' is whichever part is highest in the field of gravity at the time of reference. In such languages, purely intrinsic descriptions of vertical relations such as that illustrated for Yucatec above should be impossible. This prediction is currently being tested.

(iii) The findings of the MesoSpace project have significant potential implications for the theory of spatial frames of reference and the debate about language as a possible formative factor in forging culture-specific habits or practices of cognition.

The discovery of the crosslinguistic variation in reference frame use

and the alignment between population-specific preferences for frames in discourse and cognition has greatly fueled the debate about the possible role of language as a causal factor in non-linguistic cognition ? in other words, the so-called Sapir-Whorf Hypothesis or linguistic relativity hypothesis, according to which 'language influences thought.' Proponents of a 'Whorfian' or 'relativistic' interpretation of the alignment argue that since cultures differ in their preferences or habits of spatial cognition, their members must learn their group's preferences from observable behavior, and thus foremost from language use. Opponents claim instead that the observable cultural differences are shallow and easily mutable in response to factors such as literacy and the environment. On these accounts, spatial cognition is uniform across populations in terms of abilities and merely diverse in terms of the use of these abilities.

The MesoSpace work on meronyms discussed in the previous subsection directly bears on this question. If meronyms can be confirmed to be a linguistic factor influencing reference frame use in both language and spatial memory and reasoning, this would strengthen the relativistic view of habits of reference frame use as deeply culturally entrenched and of language as playing a key role in the intergenerational transfer and cultural diffusion of these habits.

The members of the MesoSpace team are also exploiting the unique affordances of the Mesoamerican cultural and geographic area to test the possible role of nonlinguistic factors in influencing reference frame selection. A statistic analysis based on linguistic, cognitive, population-geographic, and topographic data from the communities of the MesoSpace sample is currently underway, and data is being collected from additional languages in Asia to extend this analysis. The application of multivariate descriptive statistics to the study of crosslinguistic variation is currently at the forefront of typological research. The techniques and perspectives of statistical analysis the MesoSpace researchers have been developing are genuinely new in their application to semantic typology, the study of variation and uniformity in how different languages represent reality.

Contributions to Other Disciplines:

Spatial frames of reference are a subject studied across the cognitive sciences, by linguists, anthropologists, psychologists, and computer scientists. The project's contributions to the theory of spatial frames are thus relevant to these disciplines as well. In a similar vein, the linguistic relativity hypothesis is of key concern, not merely to linguists, but to all cognitive scientists. The group's efforts to isolate linguistic and non-linguistic factors influencing reference use thus make a contribution with a potential impact far beyond the discipline of linguistics.

Contributions to Human Resource Development:

The project contributes to the training and academic advancement of ten graduate students and nine junior scholars who defended their dissertations within five years before MesoSpace was launched. Eight of these are Mexican citizens; three of them are native speakers of indigenous languages; and ten of them are women. In all, twelve of the 25 members of the MesoSpace team are women and ten are citizens of Mexico.

Contributions to Resources for Research and Education:

The project continues the intensive collaboration between the University at Buffalo, the Max Planck Institute for Psycholinguistics, the Centro de Investigaciones y Estudios Superiores en Antropología Social (CIESAS) Sureste, and the Laboratorio de Linguística of the Instituto de Investigaciones Antropológicas of the Universidad Nacional Autónoma de México (UNAM) in Mexico City begun during the first MesoSpace project. There are also collaborations beginning between the University at Buffalo and the Université de Yaoundé I in Cameroon (where project member Lovegren has presented and made contacts), the National Taiwan Normal University (where Hsiao works and is training students in semantic typology), and the Smithsonian Institution (where Perez Baez works and may host project members in the future).

Contributions Beyond Science and Engineering:

Conference Proceedings

Special Requirements

Special reporting requirements: None

Change in Objectives or Scope: None

Animal, Human Subjects, Biohazards: None

Categories for which nothing is reported:

Any Journal

Any Book

Contributions: To Any Beyond Science and Engineering

Any Conference

Field research completed as of May 25, 2012

Researcher	Language	Field Site(s)	Dates of Study	Participants Enrolled
Bohnmeyer (PI)	Yucatec	Yaxley, Municipio Felipe Carrillo Puerto, Quintana Roo, Mexico	Jul. 14, 2011 – Aug. 12, 2011	Ext B&C: 5 x 2 TA: 43 x 2 Demographic survey: 83 x 1
Hsiao	Mandarin-Taiwanese (bilingual)	Taipei, Taoyuan, Yunlin, Chiayi, Kaohsiung; Taiwan	Apr. 17 - 20, May 4 -6, 2012 (ongoing)	B&C: 5 x 2 NA: 20 x 1 TA: 40 x 2
Lovegren & Nguyen	Vietnamese	Long My, Hau Giang province, Vietnam	Jan. 11, 2012 – Feb. 7, 2012	Ext. B&C: 5 x 2 NA: 20 x 1 TA: 40 x 2 NO: 5 x 2 Pic books: 6 x 1
Olstad	Japanese	Tokyo, Kawasaki, Aizu, Fujinomiya, Naha; Japan	Mar. 17, 2012 – ongoing	Ext. B&C: 10 x 2 NA: 40 x 1 TA: 90 x 2
Pérez Báez & Tucker	Juchitan Zapotec	La Ventosa, Oaxaca, Mexico	Apr. 25 – May 6, 2012	Ext B&C: 6 x 2 TA: 37 x 2
Hirtzel & Van Gijn	Yurakaré	La Misión (Cochabamba Department, Bolivia); Cochabamba (Cochabamba Department, Bolivia)	Oct. 10, 2010 – Nov. 1, 2010	B&C: 5x2 Meronyms: 2 NO: 5x2

Ball & Chair (B&C); Extended Ball & Chair (Ext. B&C); New Animals recall (NA); Talking Animals (TA); Novel Objects (NO); Meronymy picture book (Pic book)