Diversity in representing space within and between language communities

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Abstract

Few areas of cognition are as fundamental to our lives as representing physical space. However, the way languages represent space varies widely, as does non-linguistic spatial behaviour. Research on spatial language casts light on the relationship between language and conceptual structure, and across linguistic and non-linguistic modalities. Most research in this domain treats languages as individual data points, typologizing them on the basis of, for example, preferred Frame of Reference (FoR) (e.g., Levinson 2003; Majid et al. 2004), such as the egocentric viewpoint-based 'relative' FoR (terms like *left* and *right*), versus a geocentric or 'absolute' FoR (terms like *north* and *south*). The papers in this special collection demonstrate that considerable variation exists in spatial language *within* as well as between language communities, and that a diverse array of factors interact to drive this variation, from terrain to group-level cultural practices and associations, from individual demographic diversity to innate cognitive biases. Drawing on the notion of Sociotopography (Palmer et al. 2017), the papers in this special collection explore the interaction of factors that shape spatial behaviour in language and beyond.

1. Variation in spatial language and cognition[1]

Traditional Western thought since Aristotle – and especially since Kant – has considered human spatial reasoning to be fundamentally egocentric and anthropocentric (for a review see Levinson 2003: 6–16; Levinson and Brown 1994). It was therefore assumed that all languages encode spatial relations egocentrically, even if additional strategies are possible in some languages. Further, it has been argued that children acquire egocentric spatial language (e.g., *left*, *right*) before geocentric spatial language (e.g., *north, south*) (e.g., Clark 1973; Miller and Johnson-Laird 1976; Piaget and Inhelder 1956).

Since the late 1990s, however, considerable evidence has emerged that languages display one or more dominant spatial referential strategy – often non-egocentric – and that the strategy speakers use in non-linguistic spatial reasoning corresponds to their dominant linguistic strategy. For example, in experiments where participants memorize a spatial stimulus such as an array of toy

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animals before turning 180 degrees to recreate the same array on another table, it is possible to recreate the array 'egocentrically' (e.g., by remembering that the animals were facing left) or 'geocentrically' (e.g., by remembering that the animals were facing north) (Pederson et al. 1998). The choice of solution in this non-linguistic task tends to match the dominant strategy used in the language spoken by the participant, and it has been claimed that this cross-modal correspondence provides evidence for linguistic relativity, with a probable influence of language on spatial cognition (Dasen and Mishra 2010; Levinson 2003; Majid et al. 2004; Pederson et al. 1998). This argument has attracted criticism (e.g., Gallistel 2002; Li and Gleitman 2002; Newcombe 2005). However, counter-evidence presented has in turn been challenged on methodological and conceptual grounds, and the debate is far from settled (see Li and Gleitman 2002 vs. Levinson et al. 2002; Li et al. 2011 vs. Bohnemeyer and Levinson 2011). More recent work has explored the possibility that linguistic spatial representations are not arbitrary but are shaped by the topographic environment in which a language is spoken, suggesting that the environment ultimately underpins both linguistic and non-linguistic spatial behaviour (e.g., Palmer 2015). Furthermore, for some languages, a history of language contact appears to play a role alongside the environment (e.g., Heegård and Liljegren 2018).

However, most research to date characterizes spatial reference patterns at the level of whole languages, focusing on differences or similarities between languages. Now a small but growing body of research has begun to reveal considerable diversity in spatial language and non-linguistic behaviour among speakers *within* language communities. Languages make a range of spatial referential strategies available to their speakers, but speakers vary in which strategies they prefer, and in which contexts. Some variation correlates with environment, with evidence of urban vs. rural differences (e.g., Tamil: Pederson 1993; 2006; Hindi and Nepali: Dasen and Mishra 2010) as well as other kinds of environmental differences (e.g., between coastal and inland speakers of Ewe, a Niger-Congo language of Ghana and Togo: Ameka and Essegbey 2006). However, much variation also correlates with individual demographic variables such as gender (e.g., Mopan Maya: Danziger 1999; US English: Lawton 2001) and age (e.g., Iwaidja, northern Australia: Edmonds-Wathen 2012, this collection; Gurindji and Gurindji Kriol, northern Australia: Dunn et al. Forthcoming; Meakins 2011; Meakins and Algy 2016; Meakins et al. 2016). Moreover, an individual may vary between different strategies according to the nature of the specific task (e.g., Bohnemeyer 2011). While much of the documented variation concerns the use of linguistic spatial representations, there is also some evidence of variation in non-linguistic behaviour according to demographic variables such as occupation (e.g., Ancash Quechua: Shapero 2016, 2017) and again according to the demands of the specific task (e.g., Mishra et al. 2003; Senft 2001; Wassmann and Dasen 1998).

Variables like location, gender, age and communicative context may be relevant partly for the same reasons they are relevant to many sociolinguistic studies (e.g., of sociophonetic or socio-grammatical variation). For example, just as other aspects of language change over time, we might expect spatial reference to change too, and such changes may be reflected in differences across age groups within a community. In addition, at a specific point in time, variation according to gender, age or other factors may index some social meaning or reflect divergent usage among different 'communities of practice' (in the sense of, e.g., Eckert and McConnell-Ginet 1992; Meyerhoff 2002). However, there is another, possibly more important reason why age, gender and other social variables are relevant to spatial language and cognition: spatial conceptualizations have been argued to have a close relationship with the environment, and different social groups interact with the environment(s) around them in different ways. We will return to this point shortly.

The body of research outlined above points to diversity in spatial language and non-linguistic behaviour within communities that is at least as great as the diversity in these respects observed between languages. It is notable in particular that a growing number of studies reveal language-internal variation according to multiple social and environmental variables. In US English, for example, Lawton (2001) finds that men use cardinal directions more than women, but also that cardinal directions are more common among speakers in the Midwest and West than in the Northeast and South, and among speakers who live in areas with a grid-like pattern of roads. In some languages, social variables and environmental variables are closely interrelated. For example, in Yucatec Maya, men but not women use cardinal direction terms, reflecting occupational and cultural practices specific to men in Yucatec society (Bohnemeyer 2011; Bohnemeyer and Stolz 2006; Le Guen 2011). A similar situation has been reported for Mopan Maya (Danziger 1999).

Dhivehi (Indo-Aryan, Maldives) provides a useful illustration of how spatial reference in a single language can vary according to several social variables linked to differing levels of environmental engagement (Lum 2018). In the Maldives, rural Dhivehi speakers use geocentric language more than urban speakers, but importantly, fishing communities in rural Laamu Atoll use geocentric language more than non-fishing communities living on the same atoll, while the age and gender of speakers also corresponds with variation in strategy preference. A key difference between Maldivian fishing and non-fishing communities is that in fishing communities, a significant proportion of the population spends considerable time working on small fishing vessels out at sea, returning to land for only one or two days a week. In the relatively featureless environment of the open ocean, the sun and stars provide the only salient cues for orientation, fostering a system of cardinal directions.[2] In such an environment, very few landmarks are available for navigation, and egocentric strategies like relative 'left' and 'right' terms are of limited use, since successful wayfinding depends on understanding one's position and bearing in absolute space rather than relative to a constantly shifting viewpoint (see also Tenbrink, this collection). In other Maldivian communities, however, people tend to stay on the island and work indoors or on small farms. In these islands, local landmarks compete with cardinal directions, and egocentric strategies like relative 'left' and 'right' terms are also more effective (consider, for example, the location of a building with respect to a neighbouring building from the perspective of somebody standing on the street). Crucially, this effect applies at the level of the group as well as the individual. While in all locations tested, fishermen use cardinals more than indoor workers, indoor workers on islands where the dominant subsistence mode is fishing use cardinals more than indoor workers on islands where it is not. The extent to which engagement with the open ocean prevails in a community correlates with an increased level of cardinal use, regardless of a speaker's individual occupation.

Variation in Dhivehi spatial language according to age and gender appears to relate to this difference between land and sea too. Due to traditional gender roles, only men work on fishing vessels, while women stay on the island and typically work indoors or around the house. In addition, due to modernization and an increasingly diversified economy, young men are far less likely to enter the fishing industry than previous generations. It is probable that the greater use of cardinal directions by older speakers and by men therefore reflects the traditional fishing economy

[2] Modern fishing vessels in the Maldives are equipped with GPS devices – these also support the use of cardinal directions above other strategies, an effect also observed for Kalaallisut (Inuit, Greenland) (McMahan et al. this collection; see this paper Section 3).

and the gendered nature of this work, illustrating a close relationship between Dhivehi spatial language and a network of intertwined factors including age, gender, occupation, community, and environmental engagement.

In light of findings such as these, recent discussion of spatial language and cognition increasingly acknowledges that spatial representations are shaped by an interplay of environmental, social, cultural and linguistic factors that is much more complex than previously recognized (Bohnemeyer et al. 2014; Bohnemeyer et al. 2015; Dasen and Mishra 2010). In particular, the evidence from Dhivehi and another atoll-based language, Marshallese (Oceanic, Marshall Islands; Schlossberg 2019), prompted the development of 'Sociotopography', an approach that seeks to understand this complex interplay of factors in shaping spatial representations (Palmer et al. 2017; 2018a; 2018b). In the Sociotopographic Model, it is proposed that while the environment and language both play a role in shaping conceptualizations of space, neither is deterministic, and the influences are multi-directional. The key insight of sociotopography is that spatial behaviour, both linguistic and non-linguistic, results from the complex interaction of factors of all types, from perceptually salient topography and affordances of that topography, through sociocultural practices and cultural associations assigned to aspects of the landscape, to the nature of each person's individual engagement with world. Culture is embedded in landscape, and landscape is permeated with cultural knowledge, to the extent that it is construed in diverse ways by different communities – see Turk and colleagues' distinction between 'terrain' (the physical shape and texture of land) and 'landscape' (an 'ethnophysiographic' system of physical, utilitarian, cultural and spiritual relationships that people have with terrain [Turk et al. 2011; Turk 2016]). Some of the key interactions and relationships in the Sociotopographic Model are represented in Figure 1.

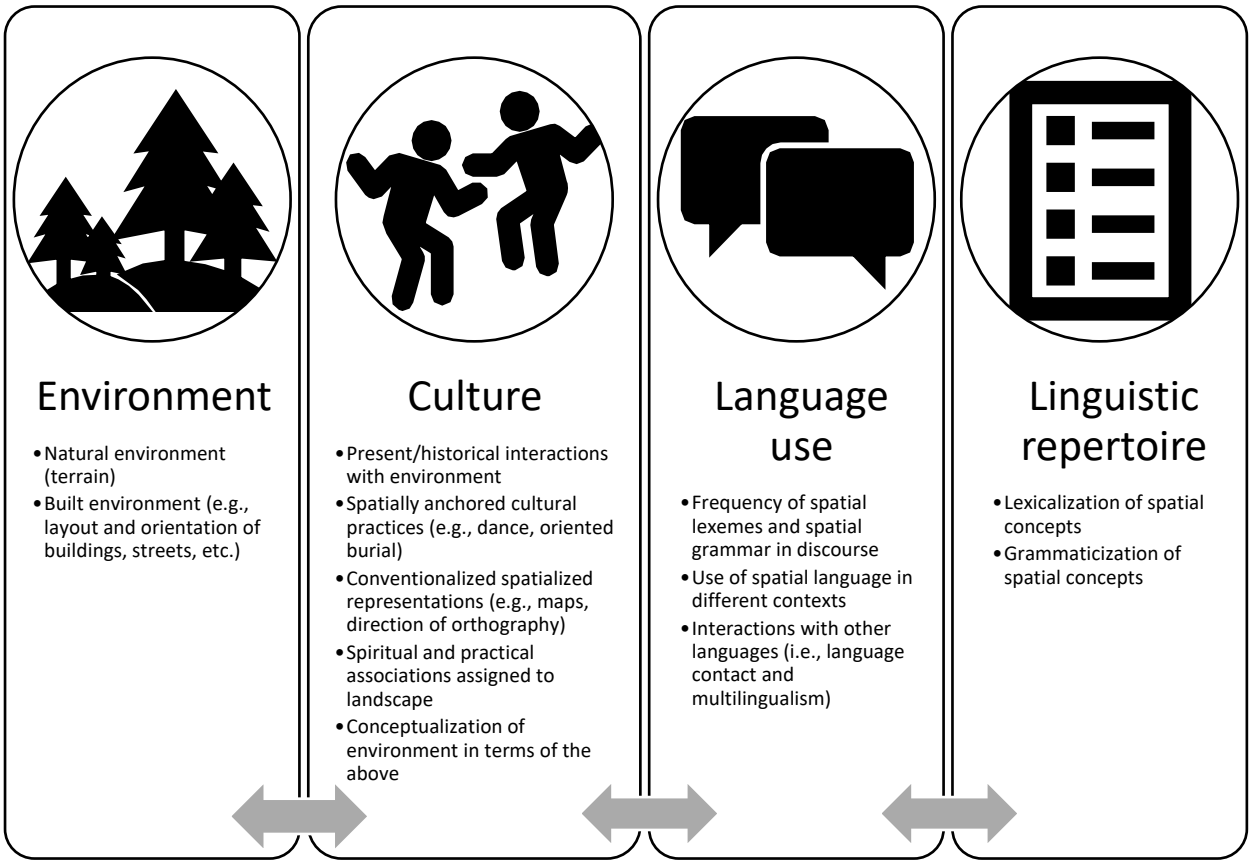

Figure 1: The Sociotopographic Model (adapted from Palmer et al. 2017)

2. Frames of reference

Languages encode a variety of spatial relations including motion events, deixis, posture, topological relations and others (Levinson and Wilkins 2006). While various kinds of spatial relations are addressed throughout this special collection, most papers in the collection are concerned in particular with spatial frames of reference (or 'FoRs'). A frame of reference is a strategy for projecting a spatial domain, path or orientation off an entity. For example, a frame of reference may be employed to represent an angular relationship in space between a 'figure' (or referent) and a 'ground' (or relatum), such that the figure can be located with respect to a particular angle or 'search domain' projected off the ground (Levinson 2003). For example, in the English sentence *The ball is in front of the chair*, the figure (the ball) is represented as located in a domain projected off a particular facet (the front) of the ground object (the chair).

Several approaches to classifying FoRs have been influential in the recent literature on spatial language and cognition (see Lum 2018: 47–89 for a discussion). Building on existing distinctions between egocentric and non-egocentric ('allocentric') space and between intrinsic and non-intrinsic ('extrinsic') spatial relations (e.g., Clark 1973; Levelt 1989: 48–52; Miller and Johnson-Laird 1976: 394–405; O'Keefe 1993), Levinson and collaborators (Levinson 1996; 2003; Pederson

et al. 1998) proposed three FoRs: 'intrinsic', anchored in a perceived intrinsic facet of the ground (e.g., *in front of the chair*, where the anchoring facet is the ground object chair's own intrinsic front); 'relative', anchored in a viewpoint (e.g., *in front of the chair*, where the projection is off the facet of the chair closest to the viewpoint, regardless of the chair's own orientation); and absolute, anchored in bearings external to the figure-ground array (e.g., *north of the house*, where the anchor is abstract fixed cardinal bearings, or *uphill from the house*, where the anchor is a vector abstracted from a feature of the surrounding landscape). Relative and absolute can both be regarded as extrinsic relations as those relations are not anchored in the ground object, but outside the figure-ground array in a viewpoint or external bearings. Levinson distinguishes between the intrinsic, relative and absolute frames not merely on a conceptual basis, but on demonstrable differences in their logical properties that result from the conceptual distinctions, such as felicity under rotation of various arguments of the spatial relation, or the frame's capacity to support inferential reasoning.

Recognising that an important component of the distinction between relative and absolute was the egocentric nature of the former and allocentric (i.e., non-egocentric) nature of the latter, Danziger (2010) extended this to the intrinsic frame to distinguish between a 'direct' (egocentric intrinsic) frame (e.g., *in front of* ***me***) and an 'object-centred' (allocentric intrinsic) frame (e.g., *in front of* ***the chair***). Over time, the term 'absolute' was used by some authors in a broader way than originally defined by Levinson to include references that invoke landscape features but are not abstracted from them (such as *seaward*, invoking the actual location of the sea), leading to confusion around whether the term was intended to refer to all allocentric extrinsic relations or only Levinson's narrower category of abstracted vectors. In response, a more fine-grained classification developed by Bohnemeyer and collaborators (Bohnemeyer 2011; Bohnemeyer and O'Meara 2012; Bohnemeyer et al. 2015) included a geocentric frame of reference with three subtypes: 'absolute', vectors abstracted from the landscape (e.g., *north*, or *downriver* in the sense of, e.g., towards the southeast in a region with a river that flows broadly northwest to southeast); 'geomorphic', directions tied closely to actual landscape features (e.g., *downriver* in relation to the twists and turns of a river at any specific location); and 'landmark-based' vectors towards or away from a topographic feature (e.g., *mountainward*), developing de León's (1994: 858) notion of geocentric as fixed points of reference based on landscape, social landmarks, or cardinal directions – in effect the full range of allocentric extrinsic frames. Bohnemeyer and collaborators also recognise that in some references in which the anchor is a landmark, that landmark is a speech act participant (a 'SAP-landmark') (Polian and Bohnemeyer 2011: 878; Romero-Méndez 2011: 930–933). In these cases, the reference is egocentric, in contrast with the non-egocentric nature of geocentric landmarks. Table 1 presents the basic classification of frames of reference that has emerged from this body of work. The papers in this special collection largely employ FoR terms as shown in Table 1, except where otherwise specified.

FoR			Example	Anchor
Egocentric	Relative (extrinsic)		*The ball is in front of the chair.* (from the viewer's perspective)	Viewpoint
	SAP-Landmark (extrinsic)		*The ball is toward me from the chair.*	Landmark (=SAP)
	Direct (intrinsic)		*The ball is in front of me.*	Ground (=SAP)
Allocentric	Object-Centered (intrinsic)		*The ball is in front of the chair.* (from the chair's own front)	Ground (≠SAP)
	Geocentric (extrinsic)	Environmental Landmark	*The ball is mountainward from the chair.* *The ball is toward the door from the chair.*	Landmark (≠SAP)
		Geomorphic	*The ball is downriver from the chair.*	Environmental axes/gradients
		Absolute	*The ball is north of the chair.*	Abstracted axes

Table 1: A classification of spatial frames of reference (FoRs) (adapted from Bohnemeyer et al. 2015: 175; Bohnemeyer et al. this collection)

3. About this special collection

The goal of this special collection is to explore and develop the approach of sociotopography by bringing together papers discussing complex systems of linguistic and non-linguistic spatial representations and how these are shaped by factors including the topographic environment, its affordances, cultural construals of landscape, group-level cultural practices, gender, occupation, intergenerational change, language contact, communicative context, cognitive or linguistic modality, and more. It brings together researchers working on spatial reference in diverse languages and in diverse environmental and sociocultural contexts in order to cast new light on the interplay of the linguistic, conceptual, sociocultural and environmental forces at work, both cross-linguistically and within languages. In the discussion that follows, articles from this special collection are cited in **boldface.** Several contributions to this special collection have been developed from earlier versions presented at the workshop *Sociotopography: the interplay of language, culture and environment*, held in conjunction with the 2017 meeting of the Association of Linguistic Typology at the Australian National University, Canberra.

Some papers in the collection illustrate how the physical environments in which languages are spoken play a key role in shaping aspects of their spatial systems. **Hoffmann et al.** present findings from the first large-scale survey of spatial systems in Australian languages and **Pappas and Holton** present the most complete typological survey to date on the spatial systems of Austronesian languages. These authors demonstrate that referential systems may invoke diverse salient features of the environment, from coastlines to ruggedness of terrain, from path of the sun and seasonal winds to river drainage and even tidal flow, with individual languages often invoking multiple such environmental features in complex systems. **Pappas and Holton** take this an important step further by testing for sociotopographic correlations and effects through a quantitative analysis of geocentric spatial systems in the context of four variables, two environmental and two sociocultural. The environmental variables are: a community's proximity to a coastline (inland, coastal or both); and ruggedness of terrain (degree of variation in altitude),

the latter a valuable refinement over a simplistic presence or absence of mountains. The sociocultural variables are language distribution (from highly localised to widely distributed across a large region); and primary economic activity (from subsistence to highly diversified), the latter potentially a proxy for degree of engagement with the topographic environment (see discussion of Dhivehi in Section 1; Palmer et al. 2017, 2018a, 2018b). They find that proximity to coast and primary economic mode correlate significantly with geocentric axial system.

Extending sociotopography to nonverbal linguistic modalities, **Tkachman** observes a tendency for village sign languages to use geocentric FoRs far more than urban deaf community sign languages, which instead prefer a conflated intrinsic-relative FoR. This conflated intrinsic-relative FoR is afforded by the visual-manual modality and is therefore specific to sign languages. Although the intrinsic component of this composite FoR may be egocentric or allocentric, the relative component is egocentric, so this FoR is inherently (partly) egocentric. Tkachman's findings are therefore consistent with the urban-rural divide reported for spoken languages, in which urban communities are more likely to favour egocentric strategies (see Section 1), demonstrating that the relationship between FoR and urbanization holds across modalities.

However, although each of those studies demonstrate at least partial responses to environment, the environment in such responses is itself not an objective entity. Invoking the environment in spatial systems is mediated by cultural construals of the environment itself, and considerable cross-cultural diversity exists here too. The interplay between environment and sociocultural factors shapes linguistic representations of landscape, and consequently spatial systems invoking that landscape. **Hill** shows that in several Australian languages, this involves attending to the shape or material composition of landforms rather than their size, often reflecting attention to utilitarian factors such as suitability for hunting or the availability of water or useful or edible vegetation, or to essential traits of kinship groups associated with individual landscape types. Primacy of shape and function rather than size in conceptualising landscape is similarly found in Kalaallisut (Inuit, Greenland) (Grenoble et al. 2019; **McMahan et al.**). **Nagaya** reports that in Lamaholot (Austronesian, Eastern Indonesia), the vertical axis maps on to a core cosmological distinction manifest in a range of spatio-cultural practices including sleeping and burial positions and religious rituals. This affects how the vertical axis maps onto a geocentric mountain-sea opposition, and a sacred counter-clockwise direction linking the two. Geocentric terms consequently refer to varying directions, with scale a key factor. These studies show that communities construct culture-specific models and conceptualize their environment accordingly. The nature of these culture-specific construals of landscape and the resulting sociocultural salience of varying topographic features adds an additional dimension to sociotopographic mediation between environment and conceptual representations of space.

Nagaya's discussion of Lamaholot brings another issue to the fore: the potentially egocentric nature of the ground object in geocentric relations (e.g., *north of me*). Lamaholot displays differing interpretation of some spatial terms depending on whether the ground object is implicit (and thus interpreted as egocentric), or explicitly expressed. Differing potentials of implicit and explicit grounds are under-investigated but may be more significant than previously recognized. **Hoffmann et al.** find that a number of Australian languages actually prohibit the overt expression of the ground in some spatial systems, with the ground interpreted as the speaker, or in dyadic relations, each item is the ground of the other. It seems some spatial relations in some language communities are only conceptualised with the speaker as ground.

Other papers in the collection explore variation within communities. Every language provides its speakers with a range of strategies for spatial reference, and demographic differences may correlate with strategy preferences that vary from speaker to speaker (see Section 1). Factors such as education, literacy and bilingualism are particularly relevant in some languages and communities, as **Lin and Hsiao** show for Taiwanese speakers of Mandarin and Southern Min. Age also correlates with strategy selection in many languages, but often seems to be a proxy for other factors, (see Dhivehi in Section 1). Several papers in this special collection offer further examples of intergenerational shifts in spatial language, with shifts towards egocentric strategies and/or away from geocentric strategies. For example, **Ursini** finds a more restricted use of the geocentric uphill-downhill axis in Aquilan (a Central Italian dialect) among younger speakers compared to older generations. However, while age-based variation in spatial reference is typically reported as a variable with respect to the age of the *speaker*, **Edmonds-Wathen** shows that in Iwaidja, variation in referential strategy choice is also sensitive to the age of the *addressee*: older speakers use absolute FoR more frequently than younger speakers overall, but significantly less when addressing younger speakers than when addressing their peers.

Age variation implies that a change in a spatial referential system may be in progress, but the nature and mechanisms of evolution of spatial systems is under-investigated. In many parts of the world, new technology, food sources and patterns of urbanization are replacing more traditional ways of life. These changes in lifestyle bring about changes in sociocultural interaction with the environment, affecting spatial referential systems and preferences (e.g., Lum 2018). Several papers in this special collection offer explanations for intergenerational change along these lines. A shift from extensive use of absolute FoR among older speakers of Traditional Negev Arabic to heavy use of relative FoR among speakers of Young Negev Arabic corresponds to a shift from nomadic pastoralism to sedentary urban modes and the adoption of egocentrically orienting domains such as literacy and car driving (**Cerqueglini**). Among Kalaallisut speakers, urbanization, a reduction in hunting, and new technologies such as GPS have led to increasing disengagement of spatial language from topography, with an increase in abstract cardinal interpretations of previously coastally anchored terms, and reduced interpretability of purely geomorphic terms (**McMahan et al.**). For Yine (Arawakan, Peru/Brazil), **Robbers**' exploratory comparison of Traditional Yine and Young Yine descriptions of the Ball & Chair photographs suggest a replacement of the language's riverine-based geocentric system with the relative FoR, correlating with Spanish bilingualism and changes in subsistence mode and other lifestyle factors. Changes in the landscape itself and even in climate prompt changes in lifestyle by altering affordances, again affecting spatial systems. For example, climate change has made previously stable wind directions unreliable for Kalaallisut speakers, undermining the use of wind-based directional terms (**McMahan et al.**).

Individual demographic factors such as age, bilingualism, and occupation (individual-level subsistence mode), among others, may correlate with variation between individuals within a language community. However, variation in choice of available spatial referential strategy by individual speakers also occurs, based on a range of communicative and functional factors. **Edmonds-Wathen's** findings (above) of variation in Iwaidja based on the age of the addressee are one such example. Task-based variation also occurs, with speakers deploying whichever of the spatial referential systems available to them in their language is most suited for the communicative task at hand. Specific spatially-relevant tasks may also involve specialised terminology reflecting their specialized spatial environments. These terms are available to individuals familiar with those functional domains, to be deployed as and when required, but unavailable to some other speakers unfamiliar with those domains. For example, **Tenbrink** observes that among English speakers

specialized activities such as sailing, horse riding and dancing involve distinctive spatial environments that foster highly specialised uses of spatial terminology necessary for effective communication in those domains.

It is often difficult, however, to tease apart the diverse factors at play in the interaction between environment, sociocultural factors, and representations of space. The first step is to identify significant correlations. Identifying causality in correlation is a challenge of a different order. In their investigation of the relationship between sociotopographic factors and spatial systems, **Pappas and Holton** developed a statistical model to test for correlations between geocentric spatial axis types and the sociotopographic variables outlined above. Their results demonstrate the value of quantitative analyses in identifying significant correlations, and in the testing of specific variables to identify which are significant. The sociotopographic model posits that correlations between linguistic behaviour and the environment exist in part because speakers respond to that environment when constructing spatial referential systems, via the sociocultural interactions, associations and construals present in speakers' relationships with their environments. However, while apparent correlations are relatively easy to observe, quantitative methods can test for their significance, and careful ethnographic research can identify plausible mediating sociocultural factors, evidence of mechanisms for a causal relationship is more elusive. **Nölle and Spranger** hypothesize the adaptation of language to external variables such as social or physical environment, proposing a new methodology that combines lab-based experiments with computer modelling to simulate the emergence and evolution of spatial referencing systems. These experiments require participants to evolve a spatial grammar to communicate about the disposition of objects, with preliminary trials showing that conceptualization strategies can become conventionalized through repeated interactions. Other experiments allow the isolating and testing as controlled individual variables specific factors that descriptive work has revealed to be significant. For example, in preliminary trials for two Virtual Reality experiments Nölle and Spranger found that English-speaking participants used more geocentric references on a salient mountain slope than in a forest.

Finally, although it has been assumed that cross-modal representations of space underlie both linguistic and non-linguistic behaviour, with strategy choices correlating across modalities, growing evidence is emerging of mismatches. Spatial terms employing absolute FoR are completely absent from Murrinhpatha, for example, yet speakers make extensive use of absolute FoR in performing non-linguistic tasks (Blythe et al. 2016; Gaby et al. 2016). As **Bohnemeyer et al.** observe, such mismatches always seem to involve geocentric strategies in non-linguistic behaviour where they are not dominant in the language, and never relative strategies in that situation. In this special collection, **Cerqueglini** reports that in Negev Arabic, although the absolute FoR has been completely lost in the language of young speakers, they continue to employ absolute FoR when performing non-linguistic tasks. Similarly, **Lin and Hsiao** note that in Taiwan, Mandarin-Southern Min bilinguals prefer relative FoR in language but use absolute FoR in non-linguistic tasks.

Taken together, the papers in this special collection show that variation is ubiquitous in human spatial behaviour. This includes variation between and within language communities on the basis of diversity in the physical environment as well as in sociocultural construals and conceptual representations of that environment. It includes diversity of strategy preference in linguistic versus non-linguistic behaviour, along with variation within language communities on the basis of group-level practices, intra-community diversity, and even variation in usage within individual speakers

in different contexts. However, patterns can be detected within all this variation. Sociotopography seeks to model those patterns, a research program in its earliest stages. Each paper in this special collection brings empirical evidence to bear on an aspect of this program or proposes new methods or lines of enquiry for future research.

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