

Cognitive Change Without Linguistic Change: The Rise of Egocentric Frames of Reference in the Hai||om

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A long Western tradition in philosophy, psychology, and neuroscience has assumed a cognitive universal: humans think about space primarily egocentrically, relative to the left, right, front, and back of their own bodies. This assumption has been challenged by substantial cross-cultural variation in spatial cognition and language: Preferring to use egocentric frames of reference to talk about space seems to be limited to globalized, industrialized societies or groups heavily influenced by such societies. Outside such groups, many indigenous languages prefer geocentric frames of reference, relying on cardinal directions (east/west/north/south) or environmental features (uphill/downhill) to describe spatial relations.

Speakers of egocentric and geocentric languages not only prefer to talk, but also prefer to think egocentrically and geocentrically, respectively—revealing substantial cognitive diversity in a fundamental domain of cognition. Where does this cognitive diversity come from? So far, the dominant explanation has been the Whorfian hypothesis: Preferring to talk egocentrically causes people to also think egocentrically, even when not using language. If this is true, then a population that is having a shift in their frames of reference should have a linguistic shift before a cognitive shift, but not vice versa. Here, we provide evidence suggesting an ongoing shift in spatial cognition—but not language—within a culture, showing that Whorfian views are insufficient on their own to explain cognitive diversity in spatial frames of reference.

Hai||om people from rural Namibia have consistently been shown to prefer geocentric FoR both in language and cognition (Neumann & Widlok, 1996; Haun et al. 2006; Widlok, 2007; Haun & Rapold, 2009; Haun et al. 2011). In the present study, we returned to the same Hai||om village roughly two decades after the original research. Our goal was to conceptually replicate the robust pattern that Hai||om prefer to talk and think geocentrically, using the most standard and widely used frame of reference tasks and drawing on a wide, age-diverse sample of adults.

In Study 1, 30 Hai||om participants completed two tasks. First, in the cognitive, animals-in-a-row task, participants studied an array of animals and then were asked to reconstruct the array from memory after 90 degree rotation. There are at least two correct solutions for what counts as the same. If participants memorized the animals egocentrically, as all facing left, they should reproduce them facing left after rotation; if they memorized them geocentrically, as all facing east, they should reproduce them all facing east (Fig. 1a). Second, in the linguistic, director-matcher task, the director was asked to describe simple scenes (i.e. different spatial relationships between a toy bucket and a toy dog) to the matcher so that the matcher can build the same scene (Fig. 1c). The scenes can be described using egocentric (e.g. “the bucket is to the left of the dog”), geocentric (e.g. “the bucket is to the east/sunrise of the dog”), mixed, or object-centered language (e.g. “the bucket is behind the dog”).

Much to our surprise, in the cognitive task, Hai||om participants showed a strong preference for egocentric frames of reference: 28 of 30 participants (93%) rearranged the animals egocentrically after rotation. This contrasts sharply with earlier data from the same community collected in 2005 (Haun et al., 2011), in which 100% of trials showed a geocentric preference and no egocentric responses (Fig. 1b). We fit a Bayesian categorical regression model both to the present and the historical data. Our results revealed very strong evidence for an egocentric shift in Hai||om: The 95% HPD interval for the difference in the probability of egocentric outcomes when comparing the current data to the historical data excluded zero (0.66-0.84) and indicated a mean increase of 0.75. However, Hai||om speakers showed no such egocentric shift in language use: In the director-matcher task, they described spatial relationships among objects primarily using geocentric strategies, just like they did in the past (Neumann & Widlok, 1996; Fig. 1d). Critically, unlike what we observed in the cognitive task, we did not observe a greater preference for egocentric FoR in language: the 95% HPD interval for the difference in the probability of egocentric outcomes when comparing the current to the historical data did not exclude zero (-0.22-0.09) and had a negative posterior mean (-0.05).

Using close adaptations of the original task, we observed different cognitive preferences among the Hai||om across two time points, suggesting a change in spatial cognition over time. However, this difference may reflect sampling or methodological variation rather than historical change. Haun et al. (2011) tested children aged 7–11, whereas we tested adults aged 23–66. In addition, although our task closely matched the original, small procedural differences existed and any of these differences could, in principle, account for the divergent results.

In Study 2, conducted two years after study 1, we ran a direct replication of the cognitive task by Haun and colleagues (2011) to rule out explanations based on measurement changes or sampling differences across the two time points. Testing both age-matched participants (children ages 7-11) and retesting the original participants now as adults two decades later in the same paradigm, we found robust evidence that Hai||om show a greater preference for egocentric FoR compared to the past (Fig. 2).

Comparing new data to historical data from the same community, we found that contemporary Hai||om show a greater preference for egocentric frames of reference compared to previous reports, suggesting an egocentric shift in their cognition. Surprisingly, we document no such shift in their language. Together, these results show that cognitive shifts in spatial reference frames can occur without parallel changes in language. Non-linguistic factors appear to be at play in promoting the rise of egocentric thinking in Hai||om people. We suggest that increased exposure to egocentric material culture (e.g. cars, books, screens) from urban centers may foster egocentric thinking by making egocentric distinctions behaviorally relevant and by representing space egocentrically. Material culture, rather than language, may therefore be a key driver of diversity in spatial thought.

Figure 1

Study 1: Hai||om's preferred spatial frames of reference in cognition and language across time.

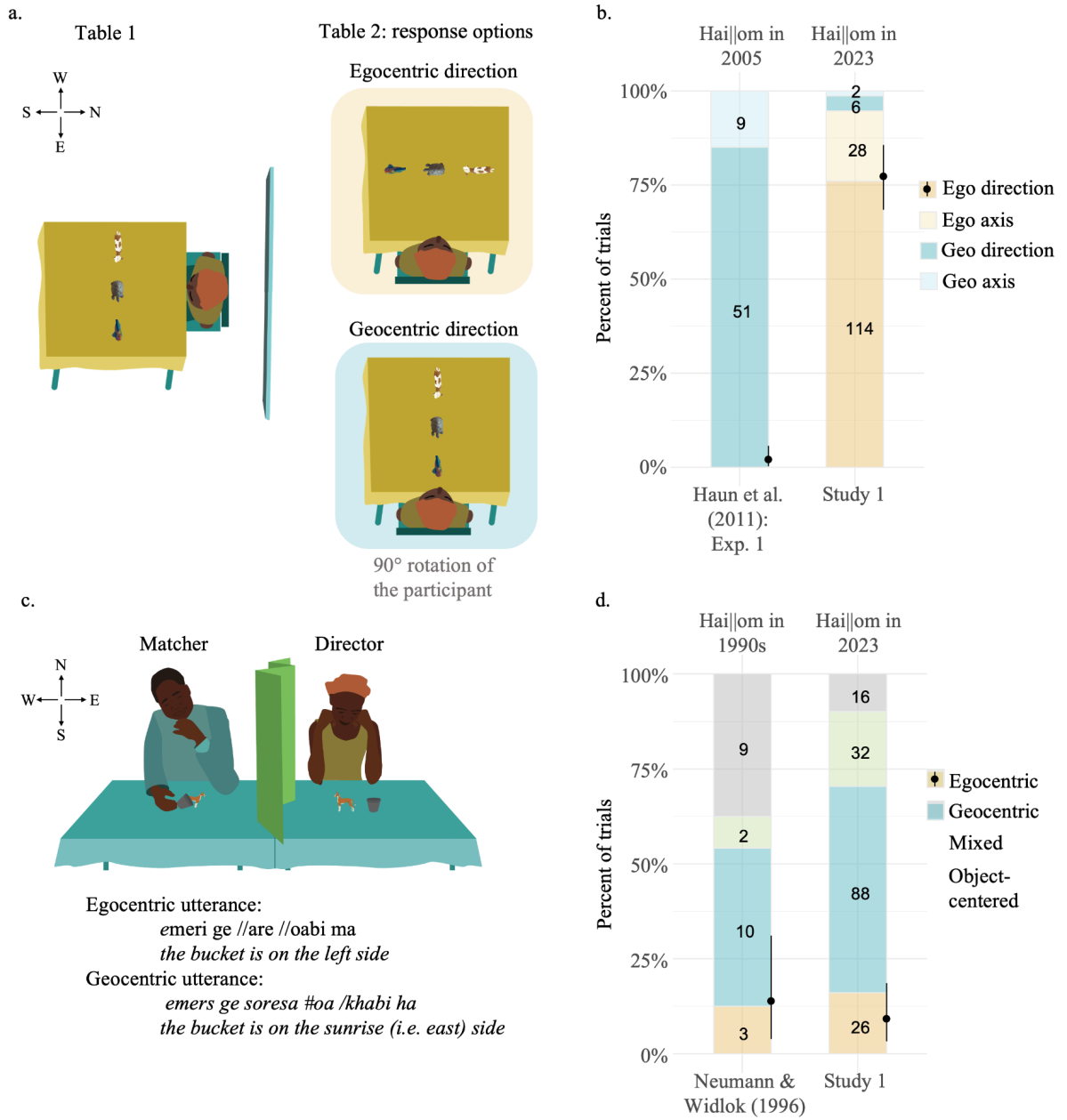


Figure 2

Study 2: Hai||om's preferred spatial frames of reference in cognition across time in direct replications of the same task.

