

Spatial Language and Vision: The Geocentric Frame of Reference in Blind Traditional Negev Arabic Speakers

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Introduction

Spatial concepts have a special status in the study of the relationship between language and cognition. They are fundamental constituents of conceptual structures (Lakoff and Johnson 1980), deeply connected to motor and visual skills (Landau 2010 & Marotta 2013), on one hand, yet subject to language-specific and culture-specific elaborations (Levinson 2003), on the other. In the field of perceptual psychology, bottom-up theories suggest that direct and immediate perception through the affordances (physical and functional properties) of objects and events is the basis of conceptualization (Gibson 1979), while top-down theories posit that cognitive processes guide and interpret perception (Gregory 1966). In this respect, the nature of spatial representations and, in particular, their acquisition, remain subjects of debate (Meini 2013).

1 Hypothesis and Expected Results

If linguistic conceptualization derives directly from sensory experience (De Vega et al. 2008), the linguistic representations of congenitally blind speakers should be substantially different from those of sighted speakers of the same language. At the same time, if conceptualization is at least in part independent of sensory experience and based on linguistic categorization (Mahon & Caramazza 2008; Bedny & Saxe 2012), lack of visual information should only superficially influence conceptual structures (Marotta 2013). I tested this hypothesis, comparing linguistic representations of static, projective spatial relations on the horizontal plane in sighted (TNA) and blind (BTNA) Traditional Negev Arabic speakers.

Previous studies (Alloway et al. 2006; Amedi et al. 2003) revealed that in congenitally blind subjects, other processes that enable the formation of mental images (Ishai & Sagi 1995), among them linguistic categorization (Vigliocco et al. 2009), partially

compensate for visual deficiencies. Thus, I expected to find similarities in TNA and BTNA linguistic projective spatial representations.

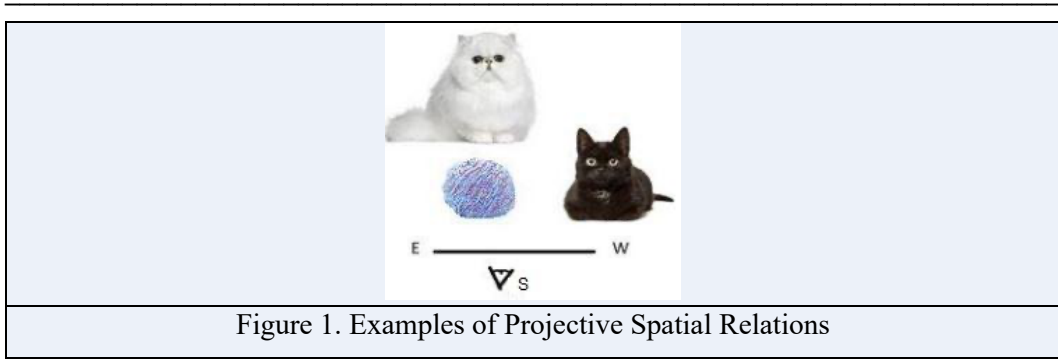
TNA is of particular interest in disambiguating the role of language in conceptualization. As Cerqueglini (2015; 2022) demonstrated, TNA spatial linguistic representations display an extraordinary degree of cultural elaboration, encoded in a culture-specific ontology of objects in space—based on the interplay of culture-based parameters, routine affordances, and axial constraints—all reflected in a complex spatial grammar (Section 4). TNA culture-based ontological parameters (e.g., cultural familiarity) often prove stronger than functional/metrical affordances, which seem to play an important role in blind speakers' spatial experience (Gallese & Lakoff 2005; Barsalou 2008). In TNA, small-scale descriptions often rely on cardinal directions (geocentric frame of reference, Section 3), which seem remote from direct experience. Furthermore, BTNA speakers over the age of 75 received no special teaching or training of the type modern societies provide individuals with special needs. Thus, the similarity of linguistic representations among BTNA and TNA speakers offers solid evidence to support top-down theories, demonstrating linguistic and cultural constraints' significant effects on conceptualization.

2 Traditional Negev Arabic

TNA is a cluster of closely related tribal dialects of North-West Bedouin Hījāzi Arabic spoken in the Negev region (southern Israel) by women and men over age 75 who never received formal education (Cerqueglini & Henkin 2016).

3 Spatial Frames of Reference

Frames of Reference (FoRs) are coordinate systems projected on spatial arrays to locate any object (Figure, F) in relation to another object (Ground, G) (Levinson 2003). FoRs are of three basic types: object-centered, based on inherent facets of G (e.g., the front region of a G-building is where the main door is located); ego-centered, based on the coordinates projected by the speaker (S) (e.g., in English, the front region of a G-tree is projected by S, as trees are considered not to have any inherent front side); or geocentric, based on external coordinates such as cardinal directions. Let us examine Figure 1:



According to the geocentric FoR, ‘F-ball of wool is east of G-black cat.’ For the object-centered FoR ‘F-ball of wool is on the right side of G-black cat,’ according to G’s inherent bodily partition. The ego-centered FoR can be used via Reflection (‘F-black cat is on the right side of G-ball of wool’; ‘F-white cat is behind F-ball of wool’), 180° Rotation (‘F-black cat is on the left side of G-ball of wool’; ‘F-white cat is behind F-ball of wool’), or Translation (F-black cat is on the right side of G-ball of wool’; ‘F-white cat is in front of G-ball of wool’).

4 TNA Frames of Reference

TNA FoRs have been described by Cerqueglini (2015; 2022). Except for minor cross-dialectal variations (Cerqueglini 2019), TNA projective spatial linguistic representations are quite homogeneous. On a small scale, along the front/back axis, the object-centered FoR applies only to culturally salient, familiar, faceted Gs (man/horse/knife). Ego-centered representations on the front/back axis are applied only by the strategy of translation (Section 3) to familiar, (culturally) symmetric Gs (stone/tree/sheep) when FG are aligned in the middle of S’s visual field. Lateral representations, non-culturally salient or modern Gs, and different axial conditions in relation to S are treated geocentrically. The right/left opposition is not lexicalized. Figure 2 presents the TNA FoR system:

Features Attributed to G	Small Scale	[+Familiar] [+Faceted] man/horse/donkey/knife	▶	Object-Centered FoR
		[+Familiar] [-Faceted] tree/stone/ sheep/goat	▶	Ego-Centered FoR
		FGS [+Aligned]	▶	
	FGS [-Aligned]	▶		
	Geographic Scale	[-Familiar] shoe/key/cow/dinosaur/computer	▶	Geocentric FoR
		city/mountain/river	▶	

Figure 2. The FoR System in TNA

Culture-specific criteria (cultural saliency, familiarity) have proved stronger than anatomical, functional, and geometric properties. Thus, G-sheep/goat attract not the object-centered FoR, but the ego-centered FoR with Figure-Ground-Speaker (FGS) aligned and the geocentric FoR in all other axial conditions (Cerqueglini 2015). G-cow/dinosaur always attract the geocentric FoR because they are unfamiliar and not culturally salient. (For elders, cows symbolize a sedentary lifestyle foreign to the Bedouin.) Similarly, G-shoe/key/computer, also not culturally salient, are treated geocentrically.

5 Methodology

I tested 12 TNA/12 BTNA informants in their hometowns (Ksēyfiḥ, Raḥaṭ, Sgīb as-Salām) on static linguistic projective spatial representations on a small scale. Both groups were recruited through the local health and social assistance system among individuals in appropriate psychophysical condition who were willing to participate. They were tested on the same experiments and received identical instructions, as detailed below. Stimuli consisted of toy objects available for haptic interaction and attached to cardboard bases so that their mutual position/orientation could not be modified by tactile interaction. Informants were familiarized with the toy objects (TNA, visually; BTNA, haptically), and the names of the objects were agreed upon before the tests.

A. The Individual Test, based on Levinson et al. (1992). Stimuli consisted of 18 spatial FG arrays (432 trials). F was a stone. Nine Gs were selected according to TNA spatial ontology (Section 4): for object-centered FoR, man/horse/knife; for ego-centered FoR, tree/pillow/sheep; and for geocentric FoR, chair/cow/dinosaur. FG arrays were arranged consecutively on a table. Two arrays were tested for each G. The informant was asked *wīn ad-dims min G?* ‘where is the stone in relation to G?’ for each array, where G was the TNA noun of the G-object. Maximal response time was 5 seconds.

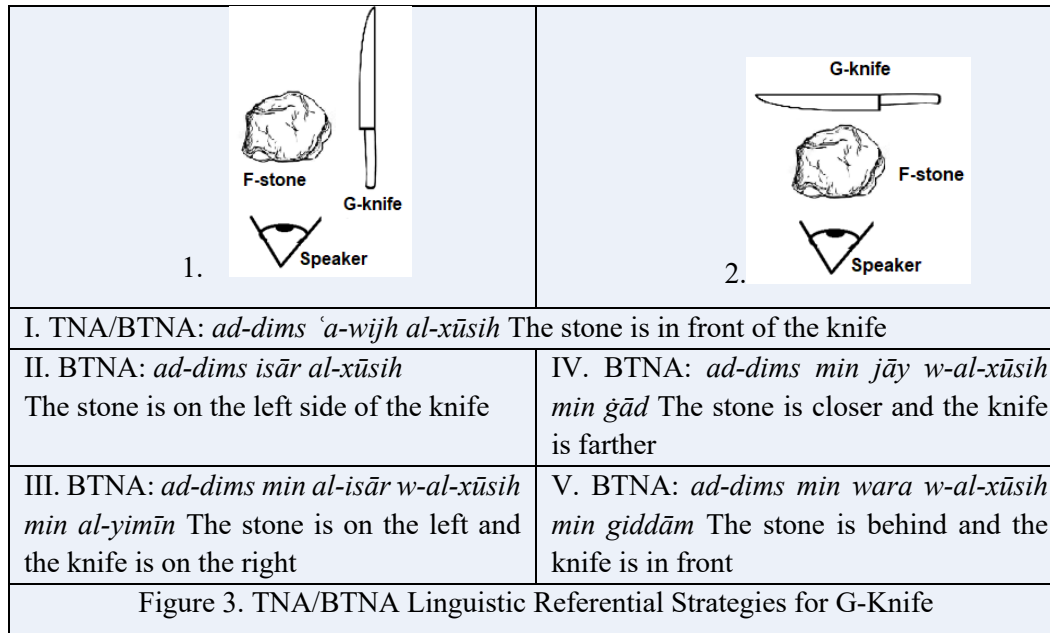
B. The Communicative Test, adapted from Bohmeyer (2011). Two informants from the same TNA/BTNA group were tested together twice, so every informant was tested both as D(irector) and M(atcher) on 2 different arrays of stimuli (48 trials). DM sat in the same room, facing the same direction. For TNA, DM were separated by a screen to prevent them from seeing each other. D received a 30x30 cm box with low edges that contained an arranged spatial scene with 6 toy objects: knife/horse/stone/sheep/chair/cow. M received the same box and objects as D and had to arrange them within 30 seconds according to D’s instructions to reproduce the array given to D. M could ask 2 questions. (Questions/replies have been excluded from the results as they appear in different numbers for different Gs).

6 Data Analysis

This section reports qualitative data yielded from experiments A and B, comparing general tendencies shown among TNA and BTNA speakers with Gs that in TNA attract different FoRs: G-knife (TNA object-centered FoR), G-sheep (TNA ego-centered FoR/geocentric FoR), and G-chair and G-cow (geocentric FoR). Percentages of agreement in TNA responses for each array are never lower than 97% and confirm Cerqueglini’s results (2015; 2022). BTNA results for each G are based on experiment A (12 informants x 2 trials) and B (12 informants x 2 trials).

6.1 G-Knife

Figure 3 provides examples of TNA/BTNA response types for G-knife. According to TNA spatial ontology, G-knife is inherently faceted, its blade being its ‘face’ or front region.



In TNA, scenes 1 and 2 are treated according to the object-centered FoR because of the properties attributed to G-knife (Section 4). In BTNA, 18 of 48 scenes with G-knife (37.5%) produced object-centered responses (Figure 3, Response I), while 30 (62.5%) produced ego-centered responses (Figure 3, Responses II, III, IV, and V).

6.2 G-Sheep

Figure 4 provides examples of TNA/BTNA response types for G-sheep. In the TNA spatial ontology, G-sheep is culturally non-faceted. Therefore, it is treated egocentrically by

translation with FG aligned in the middle of S's visual field (Figure 4, Response I) and geocentrically in all other axial conditions (Figure 4, Response III).

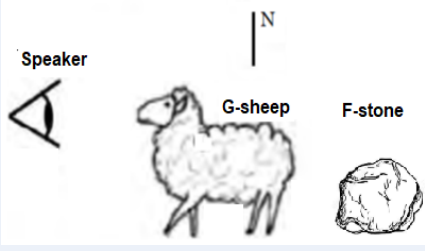
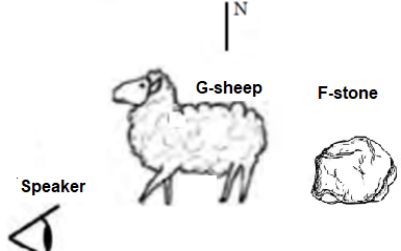
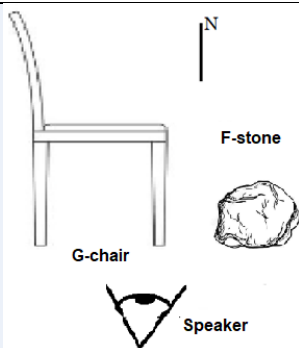

 <p>1.</p>	 <p>2.</p>
<p>I. TNA: <i>ad-dims min al-xarūf w-gād</i> The stone is from the sheep and away</p>	<p>III. TNA: <i>ad-dims šarg al-xarūf</i> The stone is east of the sheep</p>
<p>II. BTNA: <i>ad-dims min al-xarūf w-gād</i> The stone is on the farther side of the sheep in relation to the position of the speaker</p>	
<p>Figure 4. TNA/BTNA Linguistic Referential Strategies for G-Sheep</p>	

Figure 4, Response II shows that in BTNA speakers, different axial conditions of FGS alignment produce no substantial differences, as both scenes are treated egocentrically.

6.3 G-Chair

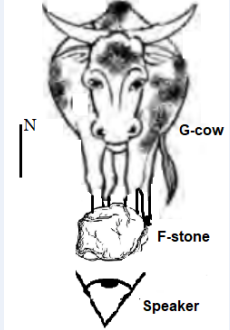
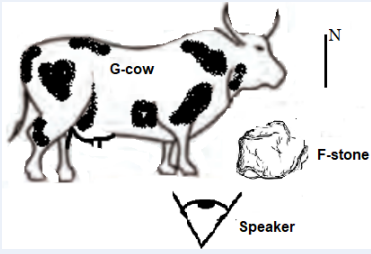
Figure 5 provides examples of TNA/BTNA speakers' responses for G-chair. In TNA spatial ontology, G-chair is non-familiar/non-culturally salient and is treated geocentrically, as shown in Figure 5, Responses I and III.

 <p>1.</p>	 <p>2.</p>
<p>I. TNA/BTNA: <i>ad-dims šarg al-kursiy</i> The stone is east of the chair</p>	<p>III. TNA/BTNA: <i>ad-dims janūb al-kursiy</i> The stone is south of the chair</p>
<p>II. BTNA: <i>ad-dims min al-yamīn w-al-kursiy min al-isār</i> The stone is on the right and the chair on the left</p>	<p>IV. BTNA: <i>ad-dims min jāy w-al-kursiy min gād</i> The stone is closer and the chair is farther</p>
<p>Figure 5. TNA/BTNA Linguistic Referential Strategies for G-Chair</p>	

Interestingly, Responses I and III show that BTNA speakers master the geocentric FoR and the culture-specific rules for its application. Of 48 BTNA informants' responses to arrays entailing G-chair, 22 (45.8%) were geocentric and 26 (54.2%) ego-centered along the right/left and the front/back axis, as shown in Responses II and IV.

6.4 G-Cow

Figure 6 reports examples of TNA/BTNA responses for G-cow. In TNA spatial ontology, G-cow is non-familiar/non-culturally salient and is treated geocentrically, as shown in Figure 6, Responses I and II.

 <p>1.</p>	 <p>2.</p>
<p>I. TNA/BTNA: <i>ad-dims jinūb al-bagarah</i> The stone is south of the cow</p>	<p>II. TNA/BTNA: <i>ad-dims šarg al-bagarah</i> The stone is east of the cow</p>
<p>Figure 6. TNA/BTNA Linguistic Referential Strategies for G-Cow</p>	

Interestingly, for both scenes 1 and 2, all TNA and BTNA speakers used the geocentric FoR. Indeed, consistently with the TNA spatial ontology and similarly to G-chair, G-cow is unfamiliar/not culturally salient. Yet, unlike G-chair, G-cow is unavailable in the informants' daily experience.

7 Discussion

Like other languages (Cattaneo & Vecchi 2011), BTNA seems to behave similarly to TNA. Indeed, as shown in Figure 3, Response I, Figure 5, Responses I and III, and Figure 6, Responses I and II, BTNA speakers master TNA FoRs and their G-based distribution. Linguistic and cultural constraints are evident as BTNA speakers can apply geocentric strategies on a small scale based on lack of familiarity and cultural saliency, as Figure 6 shows. Nonetheless, in the case of common objects in daily use, e.g., G-knife and G-chair, most of the BTNA informants preferred ego-centered strategies over object-centered and geocentric ones. TNA treats familiar, culturally salient Gs (knife) according to the object-

centered FoR and non-culturally salient Gs (chair/cow) according to the geocentric FoR along the front/back axis, while lateral representations are only geocentric. BTNA treats all frequently used Gs (knife/chair, but also coffeepot/key/shoe) egocentrically by translation. BTNA speakers develop the right/left opposition, projected onto Gs egocentrically by translation, especially when Gs are functionally aligned with S (e.g., G-knife handle is towards S. Compare Responses III and V in Figure 3). Thus, in BTNA, tools used as body extensions in daily actions assume S's partition, regardless of their cultural saliency, supporting Gibson's theory of perceptual affordances (1979). G-stone/tree/sheep/goat are treated egocentrically by translation, independently of FG's alignment to S's visual field. Yet, notably, animals that are culturally non-faceted in TNA (i.e. whose sides are not distinguished for projective spatial representations, like sheep/goat, see Cerqueglini 2015; 2022), not familiar (dinosaur), and not culturally salient (cow) never produce object-centered representations, i.e., cultural and linguistic constraints are firmly established in BTNA.

8 Conclusion

The extension of ego-centered strategies and the decline of axial constraints in small-scale contexts in BTNA compared to TNA show that semantic representations, while constrained by language/culture, are also influenced by the specific conditions in which speakers interact with objects. Yet, interestingly, both TNA and BTNA speakers show similar mastery of geocentric representations in culturally-constrained contexts. Indeed, though seemingly remote from direct experience, cardinal directions are fundamental concepts in TNA, symbolizing ethical and esthetic values (Cerqueglini & Henkin 2016), and the geocentric FoR is the TNA default strategy in all doubtful cases (Section 4). Assuming the abstractness of geocentric concepts and following Gregory's hypothesis on the constraining force of top-down language effects (1970), BTNA mastery of the geocentric FoR may be explained both by its cultural saliency and frequency of use and by the fact that the more abstract the conceptual structure, the more active the top-down language effects. This hypothesis and the acquisition of the geocentric FoR in BTNA will be explored in future studies.

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