Linguistic vs. tactile experience in object classification

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Abstract

This study explores object conceptualization through linguistic and cognitive testing of frames of reference (FoRs) in 12 sighted (TNA)/blind (BTNA) speakers of Traditional Negev Arabic. FoRs are coordinate systems projected onto spatial arrays to locate any object (Figure, F) in relation to another object (Ground, G). FoRs are object-centered, based on inherent facets of G; ego-centered, based on the coordinates projected by the speaker; or geocentric, based on cardinal directions. TNAs select FoRs based on values culturally attributed to Gs, while cognition is geocentric. BTNA FoRs generally align with TNA, but BTNAs prefer ego-centered over object-centered and geocentric linguistic FoRs with frequent, easily graspable Gs, using ego-centered right/left representations, absent from TNA. In order to distinguish linguistic effects from tactile ones, TNAs and BTNAs were tested for FoRs on novel objects through the tactile channel, showing that BTNAs' haptic world experience causes linguistic and cognitive choices not apparent in TNAs.

Keywords: Bedouin Arabic, ontologies, dominant hand, space in language and cognition, semantic representations in congenitally blind people

Aim of the present study

If conceptualization derives directly from sensory experience (De Vega et al. 2008), linguistic and cognitive 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 partly independent of sensory experience and based on linguistic categorization (Bedny & Saxe 2012), lack of visual information should only superficially influence conceptual structures (Marotta 2013). The present study aims to disambiguate the role of language vs. non-visual, haptic experience in object conceptualization through linguistic and cognitive testing of spatial frames of reference (FoRs; Levinson 2003) in 12 sighted (TNA) and 12 blind (BTNA) speakers of Traditional Negev Arabic. Spatial concepts are deeply connected to motor and visual skills (Landau 2010), yet subject to language-specific and culture-specific elaborations (Levinson 2003). In the field of perceptual psychology, bottom-up theories suggest that direct perception through the affordances 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).

Frames of reference

FoRs are coordinate systems projected onto spatial arrays to locate any object (Figure, F) in relation to another object (Ground, G). FoRs are of three types: object-centered, ego-centered, and geocentric. Let us observe Figure 1:

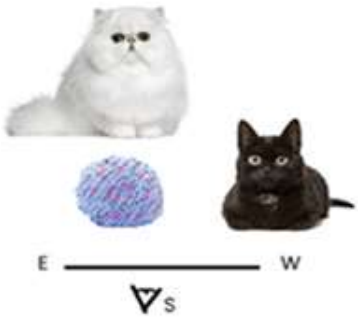

Figure 1. Example of a Spatial Array.

In the object-centered FoR, the coordinate system is anchored on G based on perceived intrinsic asymmetries in the object itself, e.g., 'F-ball of wool is in front of G-white cat'. In the ego-centered FoR, the coordinates are projected from S according to sub-strategies, among which: Reflection 'F-white cat is behind F-ball of wool,' and Translation 'F-white cat is in front of G-ball of wool.' The geocentric FoR relies on abstracted coordinates, like cardinal directions, e.g., 'F-ball of wool is east of G-black cat'.

Negev Arabic cultural ontology of objects

TNA is a cluster of North-West Bedouin Ḥijāzi Arabic dialects spoken in the Negev (Israel) by women/men over age 75 without formal education. BTNAs received no special instruction/training of the type modern societies provide special needs individuals. According to Cerqueglini (2022), TNAs select among FoRs based on values culturally attributed to Gs. 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 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. Interestingly, TNA cognition is only geocentric. According to Cerqueglini (2023), BTNAs' linguistic and cognitive FoRs generally align with those of TNAs. Nonetheless, BTNAs prefer ego-centered over object-centered and geocentric FoRs with highly frequent (knife/cup/glass) and easily graspable Gs (coffee pot/tray) in both language and cognition. Furthermore, BTNAs frequently use ego-centered

right/left representations, absent from TNA, in which *yimīn* 'right' and *yisār* 'left' only distinguish between hands.

Hypothesis

Considering the discrepancies between TNAs' and BTNAs' linguistic and cognitive FoR systems, BTNA cognitive data could be interpreted as language-driven, i.e., shaped by the constraining force of BTNAs' linguistic representations. An alternative hypothesis could be that the differences shown by BTNAs' linguistic and cognitive representations compared to those of TNAs are the effects of the non-visual, sensory (tactile, motor, and other) experience of the world that characterizes BTNAs. I set out to examine these hypotheses by testing the informants linguistically and cognitively on the same arrays through the haptic channel, using the dominant hand (DH) once and the non-dominant hand (NDH) once.

Methodology

I tested the effects of the tactile channel vs. linguistic constraints on linguistic and cognitive object conceptualization among TNAs and BTNAs. Novel objects without assigned nouns were used to neutralize linguistic effects, and the tactile channel was the only experiential channel permitted (TNAs were blindfolded). Twelve FG stimulus arrays were arranged one after the other on a table accessible to the informant's touch, attached to a base so they could not be moved. F was a ping-pong ball. Gs were 12 novel objects selected according to a set of different functional and geometric properties: two levels of graspability and axial asymmetry. Informants were individually tested on the same arrays twice—once using DH and once using NDH. The maximum reaction time was five seconds. For each array, informants were asked in their language to say where the ball was in relation to the other item.

The individual cognitive test followed the same protocol and consisted of the Recall Memory Task (Levinson 2003: 154–160). Each informant was tested on four arrays twice, once using DH and once NDH. Each array consisted of three stimulus objects. The maximum reaction time was five seconds.

Results

In 23% of TNA and 14% of BTNAs' linguistic responses, informants attributed an existing noun to G (62% of TNA and 38% of BTNA DH responses, 35% of TNA and 24% of BTNA NDH responses). With named Gs, linguistic FoR was G-based (TNA 83% and BTNA 21% DH responses; TNA 17% and BTNA 7% NDH responses). Geocentric FoR was applied in all other cases. BTNAs diverged from TNAs regarding G-based FoR selection, as the ego-centered FoR took over the others, frequently in DH responses with asymmetrical, easily graspable Gs (69% vs. 16% of NDH responses). TNAs' cognition was always geocentric. BTNAs' cognition was exclusively geocentric

in NDH responses and ego-centered in 57% of DH responses, of which 67% were not elicited from Gs named in the linguistic test.

Discussion and conclusion

In linguistic tasks, TNAs tended to name objects to a greater extent than BTNAs. The attribution of nouns to the novel objects occurred mainly when the haptic exploration took place through DH. Once the Gs received a noun, i.e., were identified with existing objects, the FoR selection occurred according to TNA G-based norms. The G-based FoR selection occurred in TNAs and BTNAs with significant discrepancies. Depending on Gs' functional and geometrical characteristics, BTNAs' classification deviates from TNA cultural classification of Gs and applies ego-centered strategies, including the right/left distinction, especially with easily graspable Gs. In TNAs and BTNAs, non-named Gs frequently attracted geocentric strategies. BTNA cognition was dominantly geocentric. But BTNAs used the ego-centered FoR, especially when DH was used, in both language and cognition, suggesting that tactile experience influences linguistic and cognitive representations. BTNAs ego-centered cognitive responses occurred in many cases in which Gs were not attributed nouns in the linguistic tests, excluding strong linguistic constraints on cognitive choices. The sensorimotor channel activated in the haptic experience of the reality of BTNAs drives the expansion of the ego-centered FoR in both BTNA language and cognition.

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