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Age, Gender, and Task Type Effects on Embodied Metaphor Comprehension in Persian-Speaking Children

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1. Introduction

Metaphor comprehension in childhood is a significant area of inquiry in cognitive linguistics and developmental psychology, as it reveals how children connect bodily experiences to abstract mental representations. Classical views treated metaphor as merely ornamental, but cognitive linguistics—especially following Lakoff and Johnson's (1980) conceptual metaphor theory—redefined metaphor as a cognitive mechanism rooted in embodied experience. In this view, metaphors grounded in sensory-motor domains such as the eyes, ears, hands, and feet reflect perceptual schemas shaped by early bodily interaction with the world.

Child development theories, particularly Piaget's (1952; 1958), shed light on how metaphor comprehension evolves. Children in the concrete operational stage (7–11 years) primarily rely on perceptual cues and tangible reasoning, while those entering the formal operational stage (around age 12) develop the capacity for abstraction, mental manipulation, and cross-modal integration. This developmental shift suggests that younger children more easily process metaphors grounded in direct bodily experience (e.g., hand-

based metaphors), whereas older children can interpret metaphors involving distal senses such as vision and audition.

Despite extensive research on figurative language, developmental patterns of embodied metaphor—especially across different sensory-motor domains—remain underexamined in Persian-speaking populations. Little is known about whether age, gender, and task type (visual vs. auditory) interact to influence children's comprehension. The present study addresses this gap by investigating how Persian-speaking children aged 8 and 12 interpret metaphors related to the eyes, ears, hands, and feet in visual and auditory tasks. The findings contribute to embodied cognition theory, developmental linguistics, and pedagogical approaches to teaching figurative language.

2. Literature Review

Metaphor comprehension develops through a combination of cognitive maturation, sensory-grounded experience, and social interaction. Piagetian theory provides the foundation for understanding how children shift from concrete to abstract reasoning. During early childhood, metaphor comprehension is limited to concrete comparisons, but as cognitive structures mature, children gain the ability to infer nonliteral meanings, interpret contextual cues, and integrate multiple modalities.

Prior studies emphasize the role of sensory experience in shaping metaphor comprehension. Preschool studies (e.g., Bialeka-Pikul, 2003) show gradual improvement in simple metaphor interpretation. Gibbs (2006) and Mead (2010) demonstrate that exposure to rich linguistic and interactional environments significantly facilitates growth in figurative understanding. Gender-related differences have also been observed, with findings such as Shin et al. (2014) indicating that girls often outperform boys in figurative comprehension due to earlier neural and linguistic maturation.

Persian-language studies offer additional insight. Golfam and Ranginkaman (2007) found a clear developmental progression in preschool children. Sadeghi (2013) and Raghibdoost (2015) documented steady growth through early and middle childhood. Shoja'e Razavi et al. (2016) showed that embodied metaphor comprehension appears as early as ages 2–5. Jafari et al. (2023) observed that although 8-year-old boys and girls performed

similarly, gender differences became marked by age 12, with girls showing significantly higher performance. However, no existing Persian study has simultaneously examined age, gender, and task type across distinct sensory-motor metaphor categories. The present research fills this gap.

3. Methodology

This study used Soltani's (2013) standardized test of embodied metaphor comprehension, covering four sensory-motor domains (eyes, ears, hands, feet). The instrument contained 60 items in two modalities. In the visual modality, children heard a metaphor and selected the correct meaning from three pictures (abstract, literal, distractor). In the auditory modality, metaphors appeared in short narratives and children chose the intended meaning from three spoken options. Vocabulary was controlled for familiarity.

The sample consisted of 160 Persian-speaking children: 80 eight-year-olds and 80 twelve-year-olds, with equal numbers of boys and girls. Cluster-random sampling was applied in districts 1, 4, 20, and 22 of Tehran. Scores were coded as 1 for correct responses and 0 for incorrect or missing ones. Normality was tested using Shapiro–Wilk, and variance homogeneity using Levene's test. Depending on assumptions, analyses included t-test, Welch test, Mann–Whitney U, one-way ANOVA, Welch ANOVA, Kruskal–Wallis, and Dunn's post-hoc tests, with significance set at $\alpha = 0.05$.

4. Results and Discussion

The results showed clear developmental differences. Eight-year-olds performed best on hand-related metaphors, reflecting reliance on tactile experience typical of the concrete operational stage, and performed weakest on eye-related metaphors, especially in the auditory task. Twelve-year-olds showed stronger modality–sensory alignment: eye metaphors were best understood visually, ear metaphors auditorily, and foot metaphors also improved with age. These findings indicate a shift from action-based interpretation toward more integrated, modality-specific processing.

Gender patterns varied by age. At eight, girls scored higher on hand metaphors in the visual task, while boys performed slightly better on foot metaphors in the auditory modality. By twelve, girls clearly outperformed boys in both ear- and hand-related metaphors, which aligns with earlier linguistic maturation in girls. No gender difference appeared in eye-related metaphors.

Task effects also emerged. In the auditory modality, ear-related metaphors were significantly better understood than eye-related ones ($p = 0.008$), while the visual modality showed no significant differences. These results support the claim that congruence between sensory grounding and task modality strengthens with age, consistent with embodied cognition theory

5. Conclusion

The study highlights several developmental patterns in embodied metaphor comprehension. First, children showed clear improvement from age eight to twelve. Second, their interpretation shifted from reliance on tactile and manual experience toward more abstract and modality-aligned processing. Third, gender differences became pronounced at age twelve, with girls performing better in several sensory-motor categories. Fourth, task modality influenced comprehension, particularly the auditory advantage for ear-related metaphors. Overall, the findings support embodied cognition theory and suggest that instruction in figurative language should consider both developmental level and modality. Future research with broader samples and cognitive measures is recommended.

Keywords: developmental linguistics; embodied metaphor; gender differences; modality; Persian-speaking children; sensory-motor grounding.

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