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From Embodiment to Metaphor: A Study on Social Cognitive Development and Conceptual Metaphor in Persian-Speaking Children

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Abstract

This study explores the metaphoric comprehension of normal Persian-speaking children, as well as theories of cognitive development and cultural and social impacts. The researchers discuss the improvement of the understanding of ontological conceptual metaphors through age growth and cognitive development, and how it helps to expand children's thoughts and knowledge of the world. In this study, 121 normal native Persian-speaking children from the age of 5 to 13 with no language and cognitive disorders participated. Pearson correlation and one-way ANOVA were used to examine the relationships between pairs of variables. The results showed that children start to comprehend abstract concepts and primary ontological metaphors at about 5 years of age, which is in contrast with what Piaget has implied. Children's metaphorical comprehension improved progressively with age, social, and cognitive development as other studies have also implied, and they understood more complex types of metaphors by age growth.

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1. Introduction

Before the 20th century, a metaphor was considered a figure of speech with rhetorical and lexical meaning (Lakoff & Johnson, 2003). Metaphor, as a rhetorical figure of speech, used to be defined by the formula 'A is B', which expresses one thing in terms of another such as 'Achilles is a lion'. In this sense, the metaphor is formed based on implicit comparison. In recent years, unlike the traditional point of view which regarded metaphor as a matter of pure literary language and with the emergence of cognitive linguistics in the 1980s, metaphor processing and comprehension have attracted the attention of researchers from different angles and aspects in various fields. Many studies with different perspectives have been done by philosophers, psychologists, linguists, and cognitive scientists on metaphorical issues. In recent studies of cognitive linguistics, there has been a great emphasis on metaphor studies in cognitive models, communications, and human culture. Most of these recent studies are empirical, and they are applied in the theory of mind and semantics, in particular in the domain of importance of thought and metaphorical acts in everyday life of human beings (Gibbs, 2008).

If we admit that metaphors might be the natural output of the human mind to find new ways related to the linguistic systems and cognitive activities, it is time to investigate metaphorical theories based on the underlying nature of abstract thought and cognitive developments. In recent studies of metaphor, researchers have been involved in the exploration of the preliminary areas of metaphor production, and how metaphors are processed or constructed in the brain. For instance, McGeoch, Brang, and Ramachandran (2007) indicated that metaphors tie with synaesthesia and pruning genes, and Citron and Goldberg (2014) reported that in the processing of metaphors regarding the sense of taste, there had been more activity in the right Inferior parietal lobe, angular gyrus, SMA, and middle cingulate cortex of participants. As Benedek, Beaty, Jauk, Koschutnig, Fink, Silvia, and Neubauer (2014) pointed out in another study, one of the areas involved in the comprehension of metaphorical language is left Inferior Parietal Lobe, and they have seen the process of metaphor production associated with high activity of bilateral parahippocampal and fusiform gyri, left lingual gyrus, and right posterior cerebellum. In this study, the researchers have also attempted to find how metaphors are comprehended and may be produced by analyzing the children's age and stages of cognitive development, which was introduced by Piaget (1972). In the next couple of paragraphs, we will analyze embodiment theory and the studies on conceptual metaphors, considering neurological factors such as mirror neurons and areas of the brain regarding metaphorical processes.

2. Theoretical Framework

2.1. Embodiment Theory

Some researchers (e.g., Gibbs, 2005; Johnson, 1987; Lakoff, 1987; Lakoff & Johnson; 1999) indicated that embodiment is essential to the process of conceptualization and for something to become meaningful. In conceptual metaphor theory, metaphors are common and a fundamental part and process of language and the mind which Kövecses (2008), Lakoff (1993), and Winter (2001) referred to it as the embodiment of the metaphors. This follows from the fact that metaphor processes are often based on our interaction with our physical and social environment through bodily sensations. Cognitive science has always been developed under the influence of embodiment theory even though there is still considerable debate on what the theory of 'embodiment' actually implies (Anderson, 2003; Rohrer, 2001; Ziemke, 2003). As we are neural and genetic beings, our brain takes input from the rest of the body, and language and cognition are embedded in our brain (Johnson, 1987). According to Lakoff and Johnson (2003), language reflects embodied cognition and is not only independent of our body, but it also emerges out of our abilities and sensory-motor system. All human concepts have been categorized and constructed through the inputs of one's body by sensory-motor neurons. These concepts and categories shape our interpersonal relations. Thus, embodiment and experiences constrain us as they do our language (Lakoff & Johnson, 2003). Gallese (2009) proposed that some of our sensory-motor perceptual experiences from the external world are transferred to our brain by

the mirror neuron system, and they provide us with an embodied cognition which constrains our language. Different neural mechanisms affect the neural networks and conceptual perception of an event, and then these networks and perceptions make a new experience, and its results are the personality traits and external behaviors that construct our cognition (Gallese & Lakoff, 2005).

Feldman and Narayanan (2004) proposed the neural theory of language to induce language learning and understanding, explaining how the functions of neurons, including emotions and social cognition, interact in the brain. The neural theory of language was first simulated in semantics by Feldman (2006). This theory does not look for finding a specific area of the brain responsible for language processing, but it seeks to find neural circuitries in different areas of the brain. According to Feldman, Dodge, and Bryant (2009), language learning is embodied in the neural theory of language since it interacts with the environment by the use of analytic techniques through the embodied neural system. Therefore, culture, as an environmental experience, plays a vital role in neural network complexities and synapses to integrate complex concepts.

Edelman (2004) suggested that language is not prewired or fixed in the brain, but it is reorganizing the structure and function of the brain by neural networks and leads to learned behavior. He proposed neural population thinking in which neurons wire together, fire together, and construct neural bindings. These neural network bindings through development are initially biological and then based on experimental conditions and synapses. Finally, these neural networks appear to be as reentrant pathways, emerging out of the interaction between neural developmental networks and empirical-environmental networks. Lakoff and Johnson (2003) located the theory of conceptual metaphor within the neural theory of language and proposed several advantages for it. They declared that we could find an explanation for universal or primary metaphors, and on the other hand, we can link the co-activation of two domains and the recruitment of neural circuitry and finally lead them to computational modeling. Lakoff (2009) has argued about the neural theory of metaphor in relation to the neural theory of language. He indicates that to figure out metaphors, and then human thoughts, we have to study the relation between the brain and the body. Lakoff (2009) proposed that our conceptual system is fundamentally metaphorical in thought and action; however, the basis for our thought, action, and experience in our everyday life would also seem to be metaphorical.

2.2. Conceptual Metaphor

Cognitive scientists such as Lakoff and Johnson (2003), Kövecses (2000), and Wray (2002) believe that metaphor is a regular activity of thinking and metaphors appear a lot in our everyday language. Lakoff and Johnson (2003) introduced metaphor to have a conceptual domain. In the cognitive linguistic perspective, conceptual metaphor is defined as understanding one conceptual domain in terms of another (Kövecses, 2010). Lakoff and Johnson (2003) defined conceptual metaphors in which one abstract concept from a target domain is perceived by another concept that is more concrete and experiential from the source domain. Therefore, conceptual metaphors include two domains of target and source. The target domain is abstract and cannot be experienced while the source domain is concrete and can be experienced through our bodily interactions. Lakoff and Johnson (2003) categorized conceptual metaphors into three overlapping types of metaphor, including structural, orientational, and ontological. In the present study, we investigate ontological metaphors which are related to ideas, emotions, activities, and events which are basic concepts of sensory-motor neural processing and embodied cognition. Their source domains consist of the emotional and bodily concepts which are included in the first stage of development (sensory-motor, birth to two years old) that was proposed by Piaget (1972). Therefore, they may be processed earlier than other types of metaphors since they are embodied through senses at an early age. In ontological metaphors, we perceive an abstract emotion, event, idea, and activities in terms of more concrete substances and entities which can be experienced by our body (Lakoff & Johnson, 2003). One of the primary source domains in metaphors is the human body since it is the most embodied and stable source for humans,

while the target domains comprise of abstract concepts like emotions, thoughts, and desires. Kövecses (2002) proposed personification to be one of the types of ontological metaphors. Children usually personify things and objects to relate them to their senses and bodies in order to understand it better. In the following examples, we can see ontological metaphors as 'Inflation is an entity':

Inflation is lowering our standard of living.
Inflation is eating up our profits.
If there's much more inflation, we'll never survive.
We need to combat inflation.
Inflation makes me sick.

On the other hand, conceptual metaphors include primary and complex types based on the level of complexity. Grady (1997, 2005) and Johnson (1997) claim that 'primary metaphors' are the types of conceptual metaphors which are grounded in a universal bodily experience and correlate an abstract domain to an everyday subjective and sensory-motor experience, like 'warm relation' [Affection is heat sensation]. On the other hand, complex metaphors are supposed to be the combination of at least two primary metaphors into a conceptual structure and are indirectly embodied (Grady, 1997, 2005; Lakoff & Johnson, 1999). 'Negotiations are on track' (Figure 2), for instance, can be categorized as a complex metaphor since it relies on two primary metaphors: Metaphor 1 [Progressing is heading towards a destination] + Metaphor 2 [Progressing is following a path].

2.3. Piagetian Theories of Cognitive Development

In the following section, we review Piagetian theories of cognitive development and how abstract concepts and reasoning are comprehended and produced by children according to their age growth and cognitive development stage, as implied by Piaget and Inhelder (1964). The most influential studies in developmental psychology have been conducted by Piaget (Piaget, 1954, 1962; Piaget & Inhelder, 1964). According to Piaget's theory, children are active thinkers who are actively engaged with the world around them and endeavor to comprehend their environmental actions and construct a better understanding of the world by passing through several distinct cognitive stages (Siegler & Ellis, 1996). He claimed that children's knowledge composes of basic units of knowledge named schemas applied to modify past experiences and serve as a basis for conceptualizing new ones. Children transit from one stage of operation to another and modify their schemas by a joint operation of assimilation and accommodation through adapting to their environment (Piaget, 1954). The assimilation hypothesis can be broadly defined as new learning experiences, which are the integration of external elements into a previously existing knowledge structure (Block, 1982). For instance, a child sees a tiger and calls it a cat. On the other hand, accommodation is when the child tries to modify his/her existing schemas with the new information or environmental experience, and a change in the schemas happens. To use the tiger example again, the child learns about the tiger as a cat with stripes and names the cats as tigers. According to Piaget (1981), a balance between assimilation and accommodation, which he named equilibrium is necessary to the child, since it restructures the cognitive schemas in interaction with the environment. Piaget (1977) proposed that cognitive development is a constant active process through which children investigate and experiment with their understanding of how the world works. Piaget (1981) introduced four developmental stages in which qualitative changes gradually happen in children's thought, and intellectual growth and knowledge are created. The sensorimotor is the first stage, which includes children's movement and sensation, and they discover the world through actions such as grasping, sucking, listening, and looking. He believes that during the final part of this period, which is from birth to two years old, representational thought emerges. Pre-operational stage (2 to 7 years old) is the next stage, and in this period, the child uses symbols and language as the sign of intelligence. The child's imagination is developed, but they still think non-logical. The next stage is the concrete operational stage (7 to 11 years old), in which the child applies logical and systematic manipulation of symbols to think and talk about concrete objects. Social behaviors emerge, and egocentric thought diminishes. In the last stage, the formal operational stage (11 to adult

years), which we are dealing with more in our study, the logical use of symbols occurs to point to abstract ideas and concepts. Adolescents, ages 11 through 18, can understand pure abstractions, such as philosophical and higher mathematical concepts. During this period, children can take into consideration possibilities and hypothetical actions as opposed to real events, which they could have thought about in the last stages. In the middle or end of adolescence, individuals become better in the comprehension of the sorts of higher-order, abstract logic inherent in metaphors, analogies, and proverbs. Cometa and Eson (1978) have justified in an experiment that understanding of metaphorical utterances develops simultaneously with the formal operational stage. However, in some other studies by Gardner (1974), children demonstrated some basic understanding of figurative language in specific conditions and Gentner (1977) as well showed that already preschool children could map human body parts onto pictures of trees and mountains. Grzywna (2007) has investigated children of different ages by various experiments related to metaphoric concepts and claimed that children of 4 through 5 could comprehend some specific types of metaphors. Piaget (1972a) claimed that only 35 percent of teenagers in developed countries could obtain formal operations. Bjorklund and Causey (2004) proposed that children's cognitive development is determined by a combination of heredity and environment, and parents can enhance their child's cognitive development and intellectual ability through environmental factors such as learning materials, early age experiences, and reading to and talking with.

The aim of the current study, therefore, is to use experimental data – obtained with the Conceptual Metaphor Test – to investigate four stages of Piagetian cognitive development theories regarding the processing of primary and complex metaphors. In the following section, we analyze how primary and complex ontological conceptual metaphors are comprehended differently according to the age and cognitive development level out of complexities of neural circuitries and cognitive development of children. In other words, the current study explores if the age of ontological conceptual metaphor comprehension in Persian-speaking children and Iranian culture is consistent with the age which Piaget has proposed in his developmental stages.

3. Methodology

3.1. Participants

A total of 121 kindergarten and elementary school children of the First District of Qom participated, about 30 in each age category: 5-7, 7.1-9, 9.1-11, and 11.1-13 years. These age categories were selected to include both preschool and post-school children, three stages of Piagetian cognitive development (preoperational stage, operational stage, formal operational stage), and both sexes (boy and girl). Moreover, no studies with similar objectives have been done on such a broad age group. All participants had Persian as their first language, and none of them were bilingual. The children were tested by the Raven IQ test to be of normal intelligence. Their parents filled out a questionnaire related to the individual developmental and environmental information of the children. The children whose parents or psychologists had detected them to have language and developmental disorders like SLI, ADHD, and ODD were excluded from the study.

3.2. Materials

3.2.1. The Standard English Metaphor Test

Nippold, Leonard, and Kail (1984) designed an experiment that considers both the syntactic structure and the semantic area of items used in metaphors. Two syntactic types of metaphors include predicative and proportional, which the former contains one topic and one vehicle (e.g., *The bird was a rainbow*) and looks like a primary metaphor, while the latter contains two topics and two vehicles at an underlying level with one topic not represented at the surface level (e.g., *Tommy was a ship that had no captain*) and implies the structure of a complex metaphor. As Nippold et al. (1984) also proposed in their tests, there was a distinction between perceptual and psychological metaphors semantically. Finally, the test includes four subtests (9 items each), and it is organized according to the complexity level and ontological concepts. The first two groups have tested primary metaphors (including perceptual and psychological concepts

sequentially), and the second two groups have tested complex metaphors (including perceptual and psychological concepts sequentially). The Standard English Metaphor Test (Nippold et al., 1984) has been chosen, translated, and localized into the Persian language. This test has been selected due to the psychological and perceptual qualities of the items which are included since they are related to ontological and embodied concepts of the human mind. This Persian test was validated by five linguists to be translated and localized. The metaphor test was finally piloted with 10 children, and its validity and reliability were assessed. The validity of the translated test was confirmed by a cognitive linguist, a cognitive semantics expert, a linguist, and a neuropsychologist. The reliability of the test was calculated with ten children. It was given to the children twice with a one-week interval. The analysis revealed the reliability of 0.90 between these two sets of data. Table 1 presents the reliability of the test.

Table 1
Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.90	.88	36

The following is a sample question of the metaphor test in English and then Persian.

The bird was a rainbow flying in the sky.
That means the bird:

a. was very colorful b. was making a nest

3.2.2. Individual Feature Questionnaire

This questionnaire was designed by (Ashayeri & Firoozalizadeh, 2019) to control the social, cultural, cognitive, and even financial conditions of children. It includes questions about the birth and growth of children, parental features, and language acquiring conditions of the children. Based on this questionnaire, bilingual, ADHD, ISL, and cognitively disabled children were excluded from our studies. Other normal children were included in the Raven IQ test.

3.2.3. Raven's Progressive Matrices

Raven's Progressive Matrices (Raven's Matrices IQ Test) is the test of nonverbal intelligence. It is usually a 60-item test designed in measuring the level of both intellectual development and abstract reasoning. It is the most common and popular test administered to groups ranging from 5-year-olds to the elderly. The IQ of all participants was measured to check whether it is normal or within the normal range (see Table 2).

Table 2
Descriptive Analysis for IQ Test

	Mean	Standard Deviation	N
age	8.99	2.43	121
IQ	108.91	13.75	121

3.2.4. Word Recognition Task

The Word Recognition Task (Grzywna, 2007) is a task that is given to the children to check whether they recognize the words included as tenor or vehicle in the metaphor test. If the children did not have any idea of what the word was, either they were excluded from the study or taught the meaning of the word.

3.2.4. Semantic Features Task

We used this task (Grzywna, 2007) to check if the children know the semantic features which show similarity and relation between tenor and

vehicle in every metaphor item. For example, we asked them, 'what is tall?' to see if they know the understanding of the word 'height'. Each child who had an understanding of these features was included in the metaphor test.

3.3. Procedure

3.3.1. Performance

An Individual Feature Questionnaire was given to the parents to fill out. This test is used to control the developmental, cognitive, and cultural information of children. A psychologist would check the answers of the parents based on the children's files in kindergarten and school. Before the experiment began, the children had been checked by a word recognition task to see whether they knew the concrete words which were included in each item of metaphor test to play the role of tenors and vehicles. Then, the researchers checked out how the children were familiar with the semantic features appearing in the metaphor items through the semantic features task. Once the metaphor test was ready, a total number of one hundred twenty-one children were tested for both their IQ and their metaphor comprehension, and their voices were recorded. The children were told not to be stressed out since there is no failing or passing based on this test. The younger children who had not been under examination or testing accepted the condition which the examiner had promised them and were more relaxed, whereas the older children experiencing school, specifically older girls, were somehow stressed out.

3.3.2. Transcription and Scoring

The children's answers to the metaphor and IQ tests were recorded. Every item of the metaphor test had two alternatives to choose from. The children were told to choose either A or B, or read the answer aloud. The order of metaphoric sentences and their answers was randomized. The time devoted to answering every item was 60 seconds, so the whole test took about 36 minutes to be done since the numbers of items were 36. Each item had one score if they answered it correctly. Finally, the total score of the metaphor test is 36 if the children answer all of the questions correctly. Finally, the children were given some gifts, which the researchers promised to give them if they were patient enough to do the whole test.

4. Results

The hypothesis was that the age of the comprehension of abstract thoughts and ontological metaphor comprehension in normal native Persian-speaking children would be different from the age which Piaget has demonstrated in his cognitive developmental stages.

In order to evaluate the different parts of this hypothesis, first, the descriptive statistics of the groups of data were computed (Table 3).

Table 3
Descriptive Statistics for Sex, Age, IQ, and Metaphor Test

	N	Minimum	Maximum	Mean	Std. Deviation
Sex	121	1	2	1.44	.49
Children's age	121	5	13	8.99	2.43
Metaphor Test	121	6	34	20.32	6.69
Children's IQ (Raven)	121	89	140	108.91	13.75
Valid N (listwise)	121				

Table 4 checks the normality assumption of the data. The Kolmogorov-Smirnov test indicates that the sex, age, IQ, metaphor scores, and school do not follow a normal distribution ($p < 0.05$).

Table 4
One-Sample Kolmogorov-Smirnov Test for Normality of Data

		sex	age	IQ	Metaphor Scores	school
N		121	121	121	121	121
Normal Parameters[a,b]	Mean	1.44	8.99	108.91	20.32	1.72
	Std. Deviation	.49	2.43	13.75	6.69	.44
Most Extreme Differences	Absolute	.36	.09	.11	.08	.45
	Positive	.36	.07	.11	.07	.27
	Negative	-.31	-.09	-.11	-.08	-.45
Test Statistic		.36	.09	.11	.08	.45
Asymp. Sig. (2-tailed)		.00[c]	.00[c]	.00[c]	.05[c]	.00[c]

In order to employ Spearman rho, the linearity of the pairs of variables was investigated first, which showed that the relationship between children's age growth and the metaphor test scores is almost linear (see Figure 1).

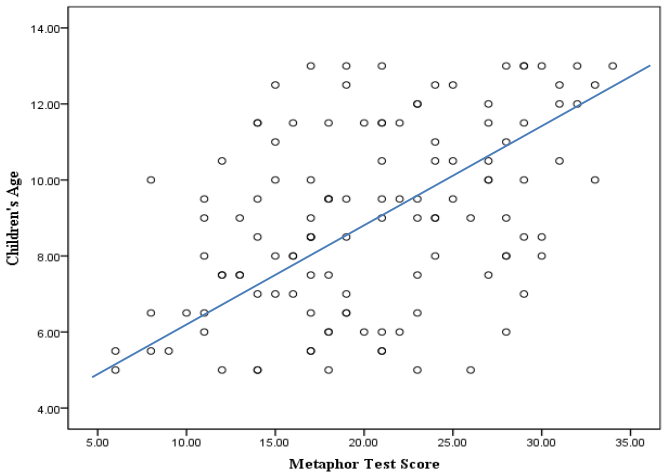

Figure 1
Scatter Plot for the Relationship between Children's Age (5-13) and Metaphor Test Scores

Table 5 and Figure 2 present the data by taking gender differences as one of the factors affecting the metaphor test scores. By the analysis of metaphoric comprehension of female and male children, the researchers conclude that there is no significant difference between the way girls and boys in different age groups process metaphors; however, the boys traverse a more linear understanding by age growth, whereas the girls' improvement of metaphor understanding is not so observable as boys and stops or decreases after 11 years old.

Table 5
Independent Samples Test between Age and Metaphor Test Scores

	Levene's Test for Equality of Variances		*t*-test for Equality of Means				
	F	Sig.	*t*	*df*	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Metaphor Test Scores	3.37	.06	-.34	119	.73	-.42	1.22
			-.35	118.97	.72	-.42	1.20

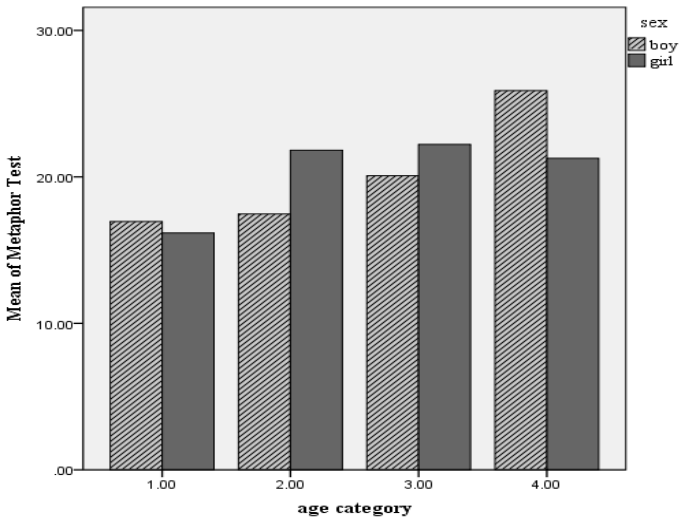

Figure 2
Bar Graph for the Relationship between Gender Type (5-13) and Metaphor Test Scores

Table 6 could be considered as the first observed assumption of Spearman's rho correlation, which would test the null hypothesis related to this research question while examining the interaction of age and ontological conceptual metaphor test scores. The frequency distribution of responses to the metaphor test was analyzed based on the number of metaphor items each child demonstrated an understanding of, as reported in Table 7. The results indicated that there is a significant correlation between the ages in terms of their conceptual metaphor scores; $p<0.000$, $r=.433$.

Table 6
Correlation Results for Metaphor Test Scores and Age

		age	Metaphor Test
Spearman's rho of Age and Metaphor Test	Correlation Coefficient	1	.433**
	Sig. (2-tailed)	.	.000
	N	121	121

** Significant ($p<0.05$)

Table 7
Categories of Age and Conceptual Metaphor Subtests

Age Category	Categories of Metaphor Test				Total
	Primary1	Primary2	Complex1	Complex2	
5 to7 years	5	15	11	2	33
7.1 to 9 years	0	17	9	6	32
9.1 to 11 years	1	9	12	4	26
11.1 to 13 years	0	5	14	11	30
Total	6	46	46	23	121

Table 8 compares the relationship between children's age categories (5-7, 7.1-9, 9.1-11, and 11.1-13) and metaphor subtest scores. The Chi-Square Test determines that there is an association between two categorical variables; age and metaphor subtests, Chi-square=26.201 with *df* of (9), and p-value of 0.002.

Table 8
Chi-Square Tests between Age Groups and Metaphor Subtests

	Value	*df*	Asymptotic Significance (2-sided)
Pearson Chi-Square	26.20[a]	9	.002
Likelihood Ratio	27.57	9	.001
Linear-by-Linear Association	17.45	1	.000
N of Valid Cases	121		

Evidently, in Table 9 and Figure 3, there were significant differences between the means of different age groups in terms of the complexity level of the metaphor test F (3, 177) = 7.105, *p*= .000; however, the differences in four age groups in primary1 type of metaphors violated the data. In the first age category (5 to 7), the children could have a little understanding of primary1 metaphors, while in the next three groups, they performed poorly in the test. Surprisingly, the children of the last age category (11.1 to 13) have not only acted better than the last groups, but they have also scored lower.

Table 9
One-Way ANOVA between Age Groups and Metaphor Subtests

	Metaphor Subtests				
	Sum of Squares	*df*	Mean Square	*F*	Sig.
Between Groups	12.77	3	4.25	7.10	.00
Within Groups	70.10	117	.59		
Total	82.87	120			

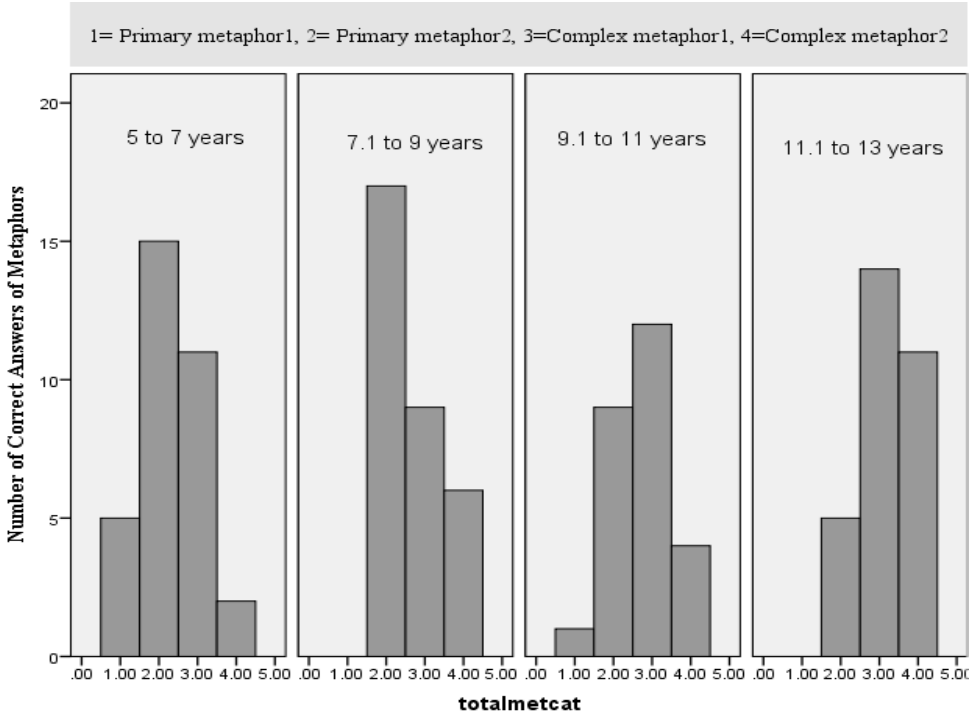

Figure 3
Bar Graph for the Relationship between Children's Age Categories (5-7, 7.1-9, 9.1-11 and 11.1-13) and Metaphor Subtest Scores

Table 10 shows the results of one-way ANOVA to find the differences between age groups in metaphor tests. As shown in Table 10, there is a significant difference between the first age group (5 to 7 years) and the fourth group (11.1 to 13 years), p=.000; as well as a significant difference between the second age group (7.1 to 11 years) and fourth group (11.1 to 13 years), p=.033.

Table 10
One-Way ANOVA for Multiple Comparisons between Age Groups and Metaphor Subtests

Dependent Variable: Metaphor Subtests

Tukey HSD

(I) age groups	(J) age groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
5-7	7.1-9	-.35	.19	.26	-.85	.14
	9.1-11	-.42	.20	.15	-.95	.10
	11.1-13	-.89**	.19	.00	-1.40	-.38
7.1-9						
	9.1-11	-.07	.20	.98	-.60	.45
	11.1-13	-.54**	.19	.03	-1.05	-.03
9.1-11						
	11.1-13	-.46	.20	.11	-1.00	.07

** Significant (p<0.05)

5. Discussion

The current study explored the age of metaphor processing and comprehension. These findings enriched our understanding of the early stages of metaphoric and abstract thought comprehension, showing that by five years, and maybe a little earlier, infants linked several common abstract thoughts and ideas to their more concrete objects or things. This finding was in contrast with that of Inhelder and Piaget (1964), who regarded the age of eleven and formal operational stage as the age in which the children use their intelligence and logic to process abstract concepts and metaphors. In another study, Vosniadou and Ortony (1986) implied that children comprehend some abstract concepts from the age of 3 or 4, and as their cognitive development improved, their metaphoric competency improved. By comparing other studies' results with ours, it can be assumed that from the time of Piaget up to now, the physical and social environments, culture, and world interactions, which are keys to cognitive development, have become more complicated. As a result, children's brain, including cognitive development and executive functions, which are an embodied experience, has turned to be more complicated and improved. Therefore, the children's age of performance and comprehension of higher cortical processes, such as conceptual metaphor is younger than what Piaget assumed. An actual developmental difference in the rate or final level of development could be seen in some societies which provide more overall environmental and cultural experiences to their children (Piaget, 1966). The difference between the age of abstract understanding in Iran among Persian-speaking children and the children whom Piaget and other researchers studied may be related to the different cultural impacts and traditional beliefs which they experience through their life span.

According to Piaget (1966), the final factor which affects children's cognitive development is cultural and educational transmission, and they learn skills and beliefs through formal and informal education. Besides, Sharifian (2017, as cited in Derakhshan, 2019) proposed that language plays an important dual role in cultural conceptualization and cultural cognition emerges out of social and linguistic interactions across the members of the speech community across time and space. In this study, by the growth of age and education, metaphor comprehension improved and children could comprehend more complex metaphors only in older ages. Therefore, the formal education of the children has had a high impact on their cognitive development besides their metaphorical understanding. Moreover, cognitive development and language development correlate and as Piaget implied, learners interact with their environment and integrate new knowledge and information into existing knowledge which leads to a state of equilibrium, and language is part of this information. On the other hand, Vygotsky (1978) maintained that speech is a vital psychological tool in the child's development of thinking, and tasks which are challenging promote cognitive development growth; thus, we could argue that the complexity of the items of the metaphor test played a role in the older children's better performance as well as in their cognitive development.

The beginning age of school and formal learning is 7 in Iran; however, the children in the current study could comprehend primary metaphors before reaching this age. Thus, the results of our research are in line with those of Lakoff and Johnson (2003), who proposed that conceptual metaphors have been part of our everyday language since early childhood and preschool age, that is 5 in our study, and the types of conceptual metaphors which are comprehensible at earlier ages are ontological mapping and relating the abstract domain to the available bodily experiences of the child while interacting with the outside world. The first category of children (5 to 7 years) was able to comprehend the first group of primary metaphors, which are more straightforward than the three other groups while the other three age categories that were passing their school ages could not. This could be due to the children's stress while testing, which the school examination, scoring, teacher, and parent expectations brought to the children. Preschool children are free from any worries and anxieties related to testing and face validity of the test since they have not felt the pressure of those factors, as mentioned earlier, thus they may perform better than older children. Children of 5 and 6 years of age are more risk-takers in a test than older children since they have not tasted punishment as the

way the older ones have felt after school. Another reason for this outstanding performance could be related to children's heuristic properties of the mind, which have not been conventionalized by any system yet.

Both boys and girls improved in their metaphor test as they grew older, but boys had a more linear improvement. The girls' performance in the two middle-age categories (7.1 to 9 and 9.1 to 11) was stable, and finally, at 11.1 to 13, they performed poorly in comparison with both boys and the former female groups. This unusual performance could be related to synaptic pruning, which is a natural process that occurs in the brain between early childhood and the onset of puberty. According to Duffau (2016), during synaptic pruning, the brain eliminates extra synapses which allow the neurons to transmit an electrical or chemical signal to another neuron and this state leads the brain areas to have less neural networks, connections, and neural plasticity which are necessary to the improvement of learning mechanism. The female children of the last age category performed poorly on the metaphor comprehension because they were at the beginning of the puberty age and they might have had more synaptic pruning in their brain, which brings about a little malfunction in cognitive and language development. Finally, the children were not able to comprehend the complex types of metaphors before the "preoperational" stage of Piaget's cognitive development or the age of 6 in which they were conditioned to learning and memorizing. Their view of the world is normally egocentric. Complex types of conceptual metaphors are usually based on mappings of two primary metaphors, and the egocentric view of children and low function of different components of memory might distort this mapping. Very young children can mostly process and comprehend every conditioned behavior, and complex metaphors are not usually conventional to be involved in conditioned behavior.

In this study, children's metaphorical comprehension improved progressively with age and cognitive development growth. Other studies (Billow, 1975; Carriedo, Corral, Montoro, Herrero, Ballestrino, & Sebastián, 2016; Johnson & Pascual-Leone, 1989; Özçalişkan, 2005) have also implied that children understand more complex types of metaphors by age growth. Language and cognition are embedded in our brains. The brain takes its input through the rest of our body, which is in contact with culture and the environment. Abstract concepts and conceptual metaphors are part of our everyday language, as Lakoff and Johnson (2003) implied. Thus, their comprehension and production are under the impact of culture and the environment. The brain's neural circuitries and networks that help us conceptualize our world through the interactions with it may be more complicated and developed if the world and culture around are more complicated and developed. This paper presents experimental research on children's understanding of ontological conceptual metaphors, which are more based on bodily experiences and concrete substances and entities to process. In this paper, we argued that children process and comprehend abstract concepts earlier (age 5) than the age Inhelder and Piaget (1964) proposed (age 11), and this level of comprehension is under the impact of cognitive development of the brain which could be different from culture to culture. The more the brain is wired and developed, the better the comprehension of more complex types of metaphor is. Thus, neural plasticity can be a considerable factor affecting higher cortical processing of a metaphoric and abstract language.

For further study, more experimental research (fMRI and Gene candidates) needs to be done on the neural networks of primary and complex ontological conceptual metaphors in the brain of normal and control (children with language disabilities) native Persian-speaking children through their cognitive development and age growth.

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Appendix
Metaphor Test

تست های استعارهٔ مفهومی نوع هستی شناختی

این جملات استعاری وگزینه های مورد نظر، توسط نیپولد و همکارن (۱۹۸٤) در آزمایشی استفاده شده است. این آزمون برای این پژوهش، ترجمه و بومی سازی شده است.

۱. سربازها دانه های بلال بودند که در جاده حرکت می کردند. این جمله یعنی سربازها ..... .

الف. در صف های منظم بودند.

ب. اسلحه دست شان بود.

۲. خورشید یه توپ بزرگی بود که در آسمان قرار داشت. این جمله یعنی خورشید..... .

الف. گرد و تابان بود.

ب. گرم و سوزان بود.

۳. گوشواره های مریم چرخ های کامیونی بودند که از گوش اش آویزان بودند. این جمله یعنی گوشواره هایش ..... .

الف. بزرگ و گرد بودند.

ب. پلاستیکی بودند.

۴. دماغ علی هویجی بود که روی صورتش قرار داشت. این جمله یعنی دماغش ..... .

الف. بزرگ بود.

ب. خون می آمد.

۵. پرنده رنگین کمانی بود که در آسمان پرواز می کرد. این جمله یعنی پرنده ..... .

الف. رنگارنگ بود.

ب. لانه می ساخت.

۶. امین نی قلیان بود. این جمله یعنی امین..... .

الف. دراز و لاغر بود.

ب. نفس نفس می زد.

۷. دندان های حسن دانه های مرواریدی بودند که در دهانش قرار داشتند. این جمله یعنی دندان هایش ..... .

الف. سفید بودند.

ب. لب پریده بودند.

۸. زرافه تیر چراغ برق باغ وحش بود. این جمله یعنی زرافه ..... .

الف. بلند بود.

ب. قوی بود.

۹. عمو رضا بشکه ای توی مغازه بود. این جمله یعنی عمو رضا..... .

الف. چاق بود.

ب. قوی بود.

۱. پرستار ، مادری در کنار کودکان بود. این جمله یعنی پرستار ..... .

الف. مهربان بود.

ب. پول دوست بود.

۲. مغز حامد جارو برقی بود. این جمله یعنی مغز حامد..... .

الف. همه چیز را یاد می گرفت.

ب. خالی بود.

۳. مربی موقع صحبت کردن با تیم آتشفشان بود. این جمله یعنی مربی..... .

الف. عصبانی بود.

ب. داغون بود.

۴. آقای امینی شمری در برابر کارگرها بود. این جمله یعنی آقای امینی ..... .

الف. رئیس بازی در می آورد.

ب. ناراحت بود.

۵. پلیس سگ شکاری بود که در خیابان راه می رفت. این جمله یعنی پلیس..... .

الف. دنبال دزد ها می گشت.

ب. بوق خطر می زد.

۶. صحبت های زن دم نوشی برای پسر گمشده بود. این جمله یعنی صحبت های زن..... .

الف. حال پسر را بهتر کرد.

ب. تند تند بود.

۷. زهرا دوربینی بود که کودکان را در صحنه نمایش تماشا می کرد. این جمله یعنی زهرا ..... .

الف. نمایش را دید و همه چیز را به یاد می سپرد.

ب. کنار دوستش نشسته بود.

۸. احسان نُقل مجلس بود. این جمله یعنی احسان ..... .

الف. گرم صحبت با مهمان ها بود.

ب. همه ی غذا ها را خورد.

۹. مادر طوفانی بود که با پسرک صحبت می کرد. این جمله یعنی مادر ..... .

الف. خیلی عصبانی بود.

ب. خیلی شلخته بود.

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۱. لانه ی مرغ قلکی بود که پول نداشت. این جمله یعنی لانه ی مرغ ..... .

الف. شاخه نداشت.

ب.. تخم مرغ نداشت

۲. آشپز لباسی بود که باید شسته می شد. این جمله یعنی آشپز ..... .

الف. سرش شلوغ بود.

ب. کثیف بود.

۳. موهای امیرعلی چمنی بود که قیچی نشده بود. این جمله یعنی موهایش ..... .

الف. ریخته و کچل بود.

ب. بلند و نامرتب بود.

۴. **انگشت مهری خلال دندانی بود که روش بشقاب گذاشته بود. این جمله یعنی انگشتش ..... .**

الف. شکسته و خمیده بود.

ب. لاغر و با انگشتر بزرگ بود.

۵. **سر بهرام توپ تنیسی بود که پُرز نداشت. این جمله یعنی سرش ..... .**

الف. طلایی بود.

ب. کچل بود.

۶. **کیف آرش مهمونی بود که خوراکی نداشت. این جمله یعنی کیف آرش ..... .**

الف. دسته نداشت.

ب. پول نداشت.

۷. **زانوی محمد گوجه فرنگی بود که له شده بود. این جمله یعنی زانوش ..... .**

الف. خیس بود.

ب. خون می آمد.

۸. **برف شکری بود که با پودر شکلات قاطی شده بود. این جمله یعنی برف ..... .**

الف. آب شد.

ب. کثیف بود.

۹. **صورت سمانه شیرینی بود که توش کشمش داشت. این جمله یعنی صورتش ..... .**

الف. چروک داشت.

ب. خال داشت.

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۱. **عمه پری زنبوری بود که نیش نداشت. این جمله یعنی عمه پری ..... .**

الف. شکمو و تنبل بود.

ب. بدجنس و بی خطر بود.

۲. **کشتی گیر گربه ای داخل قفس قناری ها بود. این جمله یعنی کشتی گیر..... .**

الف. درحال بازی بود.

ب. برنده شده بود.

۳. **نقاش درخت سیبی بود که میوه نداشت. این جمله یعنی نقاش ..... .**

الف. رنگ آمیزی نمی کرد.

ب. نقاشی بلد نبود.

٤. **مریم درخت بی ریشه ای بود. این جمله یعنی مریم ..... .**

الف. خیلی خنگ بود.

ب.خیلی تنها بود.

۵. **دایی احمد نوزادی بود که جاش و خیس کرده بود. این جمله یعنی دایی احمد ..... .**

الف. پیر بود.

ب. بداخلاق بود.

٦. **معلم ماشینی بود که برق نداشت. این جمله یعنی معلم ..... .**

الف. کتاب می خواند.

ب. نمیتوانست کار بکند.

۷. عمو مجید شیر برنج بود. این جمله یعنی عمو مجید ..... .

الف. مهربان بود.

ب. حوصله سربر بود.

۸. دختربچه، عروسکی بود که در قفسه اسباب بازی ها مانده بود. این جمله یعنی دختربچه ..... .

الف. لباس های قشنگ می پوشید.

ب. تنها و دور از دوستانش بود.

۹. مهدی هواپیمایی بود که خلبان نداشت. این جمله یعنی مهدی ..... .

الف. پول نداشت.

ب. کار بلد نبود.