

SPATIAL CONCEPTS RELATED TO EXPRESSIVE LANGUAGE IN PRESCHOOL CHILDREN

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ABSTRACT. This study “Spatial concepts related to expressive language in preschool children” offers a new perspective of the spatial framework theory in preschool children in Romania. The study investigates the language abilities related to spatial concepts following the three major axes: up-down, in front-behind, left-right correlated with language production/ expressive language. During this research 143 preschool children were tested with three types of tasks: *concrete tasks*, *symbolic representations tasks* (spatial concepts were approached through visual representations) and *verbal tasks* to evaluate their spatial concepts. The results demonstrate the relation between spatial concepts and language development; the way the language develops from concrete object manipulation to verbal production is intermediated by symbolic representations, this way makes the difference between emergent abilities and mastered abilities using spatial reference. This research also underlines the acquired stages within the three different spatial axes: up-down (emergent in the age range of 3-4, mastered in the age range of 4-5), in front-behind (mastered from the age range of 4-5 as similar results are obtained in 5-6) and left-right (emergent in the age range of 5-6).

Keywords: *spatial concepts, expressive language, preschool children, pre-acquisitions, basic concepts*

ABSTRAKT. Dieser Studie „Gebietliche auffassung der ausdrucksvollen sprache bei den vorschulkindern“ zeigt eine neue Perspektive über die Theorie des gebietlichen Bezugssystems bei den Vorschulkindern. Die Studie untersucht die sprachlichen Fähigkeiten in gebietlicher Auffassung und berücksichtigt drei wichtige Hauptlinien: aufwärts-unterwärts, vor-nach, links-rechts der sprachlichen Produktion/ausdrucksvollen Sprache entsprechend. In dieser Studie wurden 143

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Vorschulkinder getestet mit drei Typen von Aufgaben: *konkrete Aufgabe*, *Darstellungsaufgaben* (gebietliche Auffassungen wurden angesprochen durch visuelle Darstellungen) und *mündliche Aufgaben* um ihre gebietliche Auffassung auszuwerten. Die Ergebnisse beweisen die Beziehung zwischen die gebietliche Auffassung und die Entwicklung der Sprache; wie die Sprache sich entwickelt aus dem Umgang mit konkreten Gegenstände bis zu der mündlichen Produktion ist dazwischengelegt durch die symbolischen Darstellungen, so es macht den Unterschied zwischen auftauchenden Fähigkeiten und beherrschte Fähigkeiten den gebietlichen Bezug benutzend. Dieser Studie betont die erworbenen Phasen in drei verschiedenen gebietlichen Hauptlinien: aufwärts-unterwärts (auftauchend zwischen der Altersgruppen 3-4, beherrscht zwischen dem Alter 4-5), vor-nach (auftauchend zwischen der Altersgruppen 4-5 und dieselben Ergebnisse sind zwischen 5-6 zu finden) und links-rechts (auftauchen zwischen den Altersgruppen 5-6).

Schlüsselwörter: *gebietliche Auffassung, ausdrucksvolle Sprache, Vorschulkinder, vor dem Erlernen, Grundbegriffe.*

Basic concepts

Understanding the spatial concept relation with language is decisive in language development. The spatial concepts are involved in almost all our activities, in everyday life; they play an important role in learning reading and writing.

Children begin to achieve their basic concepts in the first months of life. The infants begin to develop these basic concepts manipulating different objects, toys and instruments or interacting with other people.

Bracken (1987) developed the Bracken Concept Development Program for teachers to assess the preschool children aged 2 years, 6 months through 7 years, 11 months and to offer a great example of general principles to use in the instruction. This instrument is a great tool for teachers and parents to help their children to achieve the basic concepts in order to develop their “foundational language” (Bracken, Crawford, 2010). These basic concepts are essential for children to understand simple directions, different tasks and to be able to participate in a conversation (Boehm, Classon, & Kelly, 1986; Bracken, 1986)

Scott-Little et al. (2003) followed Bracken’s basic concept list (1987) and included the following concept categories in preschool standards: colors, letters, numbers/counting, size/comparisons, shapes, direction/position, self-/social awareness, texture/materials, quantity, time/sequence. Each category is divided in other subcategories and each subcategory has some concept examples.

There are many scales developed to measure basic concepts for different ages. The most popular scales are: Integrated Developmental Scale (Anca, Bodea Hațegan, 2012), the test of “Logopaedic Centre Romel” (Iossifova, 2014), Brigance Inventory of Early Development, Portage, MacArthur Communicative Development Inventories. Token Test for Children - Second Edition (TTFC-2) is a reliable and effective screening measure for assessing receptive language in children ages 3 years 0 months to 12 years 11 months. These scales offer a whole picture about the appropriate age these concepts are achieved in typical development.

Spatial concepts

Tversky (1990, 2001, 2005) categorized the spatial concepts in: space of the body, the space around the body, the space of navigation, the spaces created by people to augment their cognition. Morrison and Tversky (2005) studied the space of the body using different tasks to evaluate the major body parts: head, arm, hand, chest, back, leg, foot. The results indicate that “naming seems to activate the functional aspects of bodies” (Morrison and Tversky 2005, p.696). The space around the body concept category include the three major axes: head/feet, front/back and left/right spatial concepts Tversky, Kim, and Cohen, (1999). Space of navigation is a general concept involving the space we know from our direct contact (experience), from maps or from descriptions. The last category identified by Tversky, (2005) space is created by people to augment their cognition, uses mental representation to describe a specific route and involves a high level of abstraction.

Scott-Little et al. (2003) included in the direction/position category the following subcategories: three-dimensional direction (under, over, right, left), internal/external (inside, outside, around), relative proximity (near, far, beside), self/other perspective (my right, your right, my left, your left), front/rear (in front of, behind, forward, backward), specific locations (edge, corner), cardinal directions (north, south, east, west).

Spatial Framework Theory

The Spatial Framework Theory highlights the importance of the mental spatial framework involving the axes of the body, head/feet, front/back, and left/right for people to remember the location of different objects around the body. Franklin and Tversky (1990) studies support the Spatial Framework Theory; people construct a mental spatial framework out of these three axes of the body. According to their studies the first axis achieved is head/foot axis followed by front/back axis and left/right axis.

Language development

Language development is based on basic concepts acquisition according to Roulin (1991 apud Bodea Hațegan, 2013). Thus basic concepts are the starting point in acquiring oral language, which on its turn is the starting point for acquiring written language.

Göksun, Lehet., Malykhina.& Chatterjee (2013) studied the naming and gesturing spatial relation in focal brain injured individuals. The individuals with damage to the left posterior, middle frontal gyres, the left inferior frontal gyrus, and the left anterior superior temporal gyrus proved to have difficulties in naming spatial relations.

Thus, this research is focused on establishing identifying the milestones of development regarding different basic concepts within three preschool age ranges (3/4, 4/5, 5/6 years old). The differences among the three age ranges are also underlined by the different used tasks: *concrete tasks*, *symbolic representations tasks* (spatial concepts were approached through visual representations) and *verbal tasks*.

Hypothesis

There are significant differences between the data collected using concrete tasks and verbal tasks no matter the age range, regarding spatial references usage.

There are significant differences between the data collected using symbolic representations asks and verbal tasks no matter the age range, regarding spatial references usage.

Method

Stimuli. Six spatial concepts were selected following the *Spatial Framework Theory*: “up”, “down”, “in front”, “behind”, left “and “right”. These concepts were evaluated using three types of tasks: concrete tasks, symbolic representations based tasks and verbal tasks. Some examples of concrete tasks are: “Put the car down!”, “Put the dog in front of the house!”, “Take the ball with your right hand!”. Example of tasks on the worksheet: “Circle what is behind the...”. Example of verbal tasks: “What is drown on the upper side of the paper?”, “Where is the ball compared to the bear?”, “What is on the right side of Pinocchio?”

These types of tasks were different for each group according to their age.

Participants

There were 143 preschool children in this study. All these children belong to a kindergarten in an urban area in the north-west side of Romania (Zalău town). These participants are divided in three groups according to their aged: 44 preschool children aged 3-4, 40 preschool children aged 4-5 and 59 preschool children aged 5-6.

Table 1.

Participants in the research

Number of participants	Age range
44	3-4
40	4-5
59	5-6

Procedure

Each child selected in this group solved individually concrete tasks, symbolic representations tasks (spatial concepts were approached through visual representations) and verbal tasks following the trainer's instruction. The children in first group aged 3-4 years, were tested with concrete tasks, symbolic representations tasks and verbal tasks on the following concepts: "up" and "down". The children in the second group aged 4-5 years, were tested with concrete tasks, symbolic representations based tasks and verbal tasks on the following concepts: "up", "down", "in front" and "behind". The last group of children aged 5-6 years was tested with concrete tasks, symbolic representations tasks and verbal tasks on the following concepts: "up", "down", "in front", "behind", "right" and "left" as it is presented in the table 2.

Table 2.

Spatial concepts tested for each group age

Group age	Spatial concepts concrete tasks	Spatial concepts symbolic representations based tasks	Spatial concepts verbal tasks
3-4 years old	"up", "down"	"up", "down"	"up", "down"
4-5 years old	"up", "down", "in front", "behind"	"up", "down", "in front", "behind"	"up", "down", "in front", "behind"
5-6 years old	"up", "down", "in front", "behind", "right", "left"	"up", "down", "in front", "behind", "right", "left"	"up", "down", "in front", "behind", "right", "left"

Results and discussions

The differences between the three types of tasks: concrete tasks, symbolic representations tasks and verbal tasks bring into light data about the relation between verbal development and spatial references. It was expected that the concrete tasks to be the less difficult type of tasks offered to all the participants in the research whereas the most difficult ones to be the verbal material based tasks. Considering the mean value of the answers, for the three groups of participants in the research, this assumption is confirmed (see table 3). The symbolical representation tasks have an intermediate level of difficulty. Once spatial reference concepts are verbally used, visual symbolic representations are also correctly manipulated.

This study proves in this way the need to gradually approach these spatial concepts; they bring together non-verbal and verbal development.

Table 3.

Statistical descriptors of the answers

Type of tasks	Spatial reference	Age range	Mean	N	Std. Deviation	Std. Error Mean
Concrete tasks	up-down	3-4	.90	42	.297	.046
Symbolic tasks	up-down	3-4	.71	42	.457	.071
Verbal tasks	up-down	3-4	.67	42	.477	.074
Concrete tasks	up-down	4-5	.95	40	.221	.035
Symbolic tasks	up-down	4-5	.90	40	.304	.048
Verbal tasks	up-down	4-5	.93	40	.267	.042
Concrete tasks	in front-behind	4-5	.95	40	.221	.035
Symbolic tasks	in front-behind	4-5	.88	40	.335	.053
Verbal tasks	in front-behind	4-5	.80	40	.405	.064
Concrete tasks	up-down	5-6	.98	43	.152	.023
Symbolic tasks	up-down	5-6	.95	43	.213	.032
Verbal tasks	up-down	5-6	.95	43	.213	.032
Concrete tasks	in front-behind	5-6	.93	43	.258	.039
Symbolic tasks	in front-behind	5-6	.93	43	.258	.039

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Type of tasks	Spatial reference	Age range	Mean	N	Std. Deviation	Std. Error Mean
Verbal tasks	in front-behind	5-6	.86	43	.351	.053
Concrete tasks	right-left	5-6	.70	43	.465	.071
Symbolic tasks	right-left	5-6	.56	43	.502	.077
Verbal tasks	right-left	5-6	.51	43	.506	.077

The fact that “up-down” concepts are correctly used in 3-4 year age range is also demonstrated by the fact that the mean average value of the answers is high, above .90, it going up (.98- participants aged 5-6 years) along with the improvement of speech and with the usage of other spatial referents. Even if the “up-down” concepts are correctly used in 3-4 years age range, during the 4-5 years age range significant improvements of the usage can be identified. Thus the mean values of the two groups’ results are compared by using t test for independent samples, for all the three types of tasks. Results prove that children aged 4-5 years, improve their verbal abilities and the symbolic abilities, related with “up-down” spatial concepts. In table no. 4 t test results are presented in order to prove that children from the two groups aged 3-4 and 4-5 years obtain similar results when comparing their answers for the concrete task (Levene’s test is not significant, then the group variance is equal, and $t=-.721$, $p>.05$), while they obtain significantly different results when comparing their answers in symbolic (Levene’s test is significant, then the group variance is unequal, and $t=-2.312$, $p<.05$) and verbal tasks (Levene’s test is significant, then the group variance is unequal, and $t=-3.411$, $p>.01$). It can be seen that along with the increasing of the abstractization level, the differences between the two groups are more significant, this proves the fact that during 4-5 years age important acquisitions for symbolic representations of the “up-down” spatial concepts are identified.

Table 4.

T test comparing 3-4 and 4-5 years old group regarding “up-down” spatial concepts

Type of task	Levene’s Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	t	df	Sig. (2-tailed)
Concrete tasks	2.136	.148	-.721	82	.473
Symbolic tasks	25.008	.000	-2.312	74.981	.024
Verbal tasks	65.318	.000	-3.411	67.941	.001

In order to prove that the “up-down” spatial concepts are acquired and mastered in the three types of tasks, in the age range of 3-4 and 4-5, a comparison between the 4-5 and 5-6 groups was also performed. Results in t test prove the fact that not significant results between the two groups were identified, as it can be seen from the table no. 5.

Table 5.

T test for comparing 4-5 and 5-6 years old group regarding “up-down” spatial concepts

Type of task	Levene’s Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	t	df	Sig. (2-tailed)
Concrete tasks	1.699	.196	-.646	81	.520
Symbolic tasks	3.613	.061	-.934	81	.353
Verbal tasks	1.177	.281	-.539	81	.591

The other pair of spatial reference concepts “in front-behind” is correctly used by participants in the research with ages in the range 4-5, their performances going up along with age, especially the verbal abilities of using these spatial concepts. Comparing the results obtained by the two groups of participants, 4-5 year age range and 5-6 years age range, when “in front-behind” spatial concepts were evaluated, no significant results were obtained. This means that the two groups of participants score similarly, and that even though results obtained in solving the tasks improve along with age, spatial abilities for “in front-behind” are completely achieved at 4-5 years old. Table no. 6 presents the results calculated for the t test.

Table 6.

T test for comparing 4-5 and 5-6 years old group regarding “in front-behind” spatial concepts

Type of task	Levene’s Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	t	df	Sig. (2-tailed)
Concrete tasks	.564	.455	.374	81	.709
Symbolic tasks	2.934	.091	-.845	81	.400
Verbal tasks	2.147	.147	-.729	81	.468

“Left-right” spatial concepts are the most difficult reference concepts to use, the mean value of the results is at .70 even if the tasks performed were concrete, and even lower when the tasks involved different degree of abstractization (.56 mean value of the answers when the symbolic representation tasks were used and .50 when verbal tasks were used).

These results prove that spatial reference concepts such as “left-right” still need to be improved along with the following age range, these concepts are very important for academic achievement, aspect also underlined by Bracken, Crawford (2010).

Regarding the first hypothesis of the research results prove the fact that there are significant differences between the answers children offer for concrete tasks and verbal tasks, but just in the case of the spatial references that are in an early stage of mastering.

Thus, participants with ages in the range 3-4 scored significantly different in the concrete tasks and in the verbal tasks for the spatial items “up” and “down” ($t=3.186$, $p>.01$), participants with aged 4-5 years scored significantly different in the concrete tasks and in verbal tasks for the spatial concepts “in front” and “behind” ($t=2.623$, $p>.01$) and participants aged 5-6 years scored significantly different in the concrete tasks and in the verbal tasks for spatial concepts “left” and “right” ($t=2.710$, $p>.01$).

These results underline the fact that emergent spatial abilities are easily trained, introduced and developed using concrete tasks. The verbal tasks are extremely important in communicative abilities development, thus, they have to be part of the speech intervention program; in this way it is established the relation between concrete and symbolic, between speech prerequisites and verbal abilities.

The results conclude that when different spatial concepts are mastered no differences can be underlined when scoring in the three types of tasks. Thus, participants aged 4-5 years obtain no significant results among the three types of tasks, when “up” and “down” spatial concepts were evaluated and participants in the research aged 5-6 years obtain no significant results among the three types of tasks, when “up”, “down”, “in front” and “behind” spatial concepts were evaluated.

These results underline the fact that at the age of 3-4 years children have emergent abilities for using spatial reference concept for “up” and “down”, while children with ages in the rages 4-5 and 5-6 master the using of “up” and “down” spatial concepts. “In front” and “behind” spatial concepts are already mastered by 4-5 years old children, while 5-6 years old children do not score significantly different in these spatial tasks. “Left” and “right” spatial concepts are emergent in children aged 5-6 years.

After analyzing the obtained results it is important to expand the research in a future study and to introduce other groups of participants aged 2-3 years and 6-7 years, covering the whole period of time for the developing of the spatial abilities. In the group of children aged 2-3 years, “up-down” spatial concepts should also be introduce, while in children aged 3-4 years “in

front-behind” spatial concepts should be introduced, and in children aged 4-5 years “left-right” spatial concepts should be introduced. It is important to expand this research to get more reliable results, to underline the milestones achievement in the main three axes of spatial concepts for Romanian children.

The data collected using visual symbolic representation tasks prove the above underlined aspects differentiating between mastered and emergent abilities using different tasks even if the second hypothesis of this research was not confirmed.

Table 7.

Comparisons between symbolic representation based tasks/verbal productions based tasks

Types of tasks to compare	Spatial reference	Age range	T value	Sig. (2-tailed)
symbolic representation tasks/verbal tasks	up-down	3-4	.530	.599
	up-down	4-5	.572	.570
	in front/behind	4-5	1.356	.183
	up-down	5-6	-1.000	.323
	in front-behind	5-6	1.775	.083
	left-right	5-6	.628	.533

One possible explanation for the fact that the hypothesis was not confirmed is the reduced number of participants in the research. The fact that spatial reference concepts are usually introduced, from a curricular point of view, through the three different means: object based, symbolic based and verbal based can also be an explanation for the fact that the second hypothesis of this research was not confirmed.

Conclusions

This establish the relation between motor, concrete object based development and abstract, symbolic, language development focusing on three different spatial axis: “up-down”, “in front-behind” and “left-right”. The three different types of tasks: concrete tasks, symbolic representations tasks and verbal tasks enable the researcher to establish a stage development in those six spatial reference concepts. This stage development can be used to design speech and language therapy and to design the curricular approach of language prerequisites.

The results confirm Franklin and Tversky (1990) studies, the first axis archived by the preschools tested during this study is head/foot axis followed by front/back axis and left/right axis.

A future perspective to expand this research and to demonstrate the fact that “in front-behind” axis is mastered even from 4-5 years old, children aged 3-4 can be assessed in order to establish that emergent/mastered “in front-behind” spatial abilities are already present at this age. Then, introducing other group of participants in the research, participants aged 6-7 years, may prove the fact that “in front-behind” axis is mastered at 4-5 years, the 6-7 years old children should obtain similar results with those with ages in the ranges 4-5 and 5-6.

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