Using "Yes-No" Game for teaching fundamentals of OTSM and Classical TRIZ

Part I: Spatial games.

For Parents, Teachers and all others who concern
with kids education improvement and thinking skills development.

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"Yes-No" Game (Spatial)

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ARBITRARY SYMBOLS

 - assignments

 - recommendations to adults

$\&$ - examples

1. Addressing the parents

Perhaps many people on the Earth have participated in the "Yes-No" game.

The core of the game reduces itself to unraveling some mystery. One person thinks of something while the other or others try to guess. Any object, phenomenon, work, etc. can be thought of. The answer can be found by asking questions. Asking questions is not that easy as it may seem at first glance. A question should be asked in such a form that the only answer can be "yes" or "no". This is where the game took its name from.

We have been using the "Yes-No" game for long. People of different ages easily understand the goal of this game: narrowing the research field by some features. The problems for the "Yes-No" game can be built on any material. When playing this game, it is necessary to guess some feature and then its specific meaning. Below is an example of the "Yes-No" game where the feature is the location of a thought-of picture and the feature value is "to the right or to the left" of a mid-object:

$\&$ *The "Yes-No" game with pictures of objects arranged in a linear row.*

Game rules: players have to ask questions which would reduce by half the number of objects in the row; to do this, it is necessary to find the mid-object.
Equipment: the pictures are displayed from left to right: car – candy – tomato – kettle – pencil – birch – flower.
Play action: guessing a picture (pencil).
Questions answered with "yes":
Is it to the right of the kettle? (the kettle is the mid-object)
Is it to the left of the birch? (the birch is the mid-object in the remaining part)
Is it a pencil?
Outcome: *The picture was guessed after asking three questions. The feature by which the search field was being narrowed is the object location in the linear row*

We remind that any real object has features of color, shape (3D or flat), size (height, length and width), amount, part, time change, material, location, etc. For example, while playing, you may think of the height of the world's highest mountain, the depth of the ocean's deepest point or the deepest cave, the height of the tallest or shortest man who ever lived on the Earth, dates of some events, etc.

2. The main kinds of spatial "Yes-No" games

The entire variety of problems on guessing an object can be grouped into several categories depending on the location of the object with regard to which the search field is to be narrowed.

The **spatial "Yes-No"** game is grouped into the following categories:

- **The linear "Yes-No" game.** Narrowing the search field in a one-dimensional space. Objects are arranged in a line, that is why the game is called the **"linear "Yes-No game with objects"**; objects may also be numbers, letters, pictures etc.; then we speak about the **linear numerical "Yes-No"** game.
- **The planar "Yes-No" game.** Narrowing the search field in a two-dimensional space. Objects are either on a vertical or on a horizontal plane.
- **The spatial "Yes-No" game.** Narrowing the search field in a 3D space. It may be a bookshelf, wardrobe, a box, a room and the like.

3. The linear «Yes-No» game

This work deals with teaching children to narrow a search field in space. The "Yes-No" game is better to start with linear features where objects are arranged in a horizontal, vertical or receding line.

3.1. The rules of the linear "Yes-No" game

The game is played according to specific rules:

In the linear "Yes-No" game, objects (numerals, numbers, pictures, toys) are arranged in a horizontal (vertical, receding) row.

- The leader presents the linear row and gives a task to find a thought-of object.
- The player has to ask search questions without enumerating the objects of this row.
- The leader accepts questions which narrow the search field (the narrowing mechanism is reducing by half the linear row).
- The leader is allowed to answer the questions with:
  - **"Yes"**
  - **"Now"**
  - **"There is no information on this"**
  - **"Both yes and no".** Answers of this kind actually point to the thought-of object.
  - **"It doesn't matter"**. This version of an answer may be used to control the problem-solving process. With this question, the leader can shorten the work by pointing to the futility of proceeding in this direction.

The outcome is the object, found after asking the minimum number of questions, and the analyzed game procedure.

3.2. The linear numerical "Yes-No" game

The most visual way of presenting the principle of the "Yes-No" game is the work with horizontally arranged numbers **– the linear numerical "Yes-No" game.**

Remember that the number is the notion of amount; the value used in counting. The numeral is a symbolic presentation of a number. Numerals are ten – from 0 to 9. Numbers are countless, they are made up of numerals.

Using the example of the numerical "Yes-No" game, it is easy to show the main principle of the game – revealing, limiting and consistently narrowing the field of search in a linear row.

Adults, let us play this game. We have thought of a number within the range from 0 to 1000. Guess the number! An unprepared person will be bewildered by this problem. With bad luck, it will be necessary to search through 999 variants. Using the search field narrowing principle, you will be able to solve this problem by asking few questions.

<div align="center">Try!</div>

& *The "Yes-No'" game "Guess a number from 0 to 1000"*

Game rules: enumerating the numbers is not allowed; accepted are questions which narrow the search field.
Play action: guessing the thought-of number by using the search field narrowing algorithm (the thought-of number is 201)
Questions answered with "yes":
- *Is it less than five hundred? (asking this question, we cut off half of the numbers at once)*
- *Is it less than 272 (each time it is necessary to find the mid-number in a numerical series and cut off half of the numbers)*
- *Is it more than 134?*
- *Is it less than 204?*
- *Is it more than 169?*
- *Is it more than 200?*
- *Is it less than 202?*
- *Is it 201?*

Outcome: The number was guessed after asking seven questions.

3.2.1. Developing while playing

In the traditional world didactics, different approaches to teaching ordinal counting to children are known. They are largely reduced to trainings which teach reproducing the sequence of number arrangement. In this case, the activity has a reproductive character, is weakly motivated and not always realized by children.

The numerical "Yes-No" game teaches children to narrow the field of search in a numerical series, allows quickly mastering the ordinal count, forms the ability to distinguish between a larger and smaller numbers and identify the mid-number of a numerical series, and acquaint children with intermediate numbers. This occurs against the background of a sustained interest of children to a given kind of activity and development of their cognitive abilities.

While playing "Yes-No" with preschoolers, you can solve the following problems:

- developing in a child of the ability to ask questions which narrow the field of search in a numerical series;
- quickly teaching, in a game form, serial counting, operations of sequential counting within units and tens; comparing quantitative indices;
- enriching the child's vocabulary with mathematical terms denoting the number place in a sequence;
- teaching a task-oriented search for needed information, developing independence, intellectual activity and persistence in attaining a goal;
- developing the ability to identify the names of features by which the search field is being narrowed; forming reflection skills.

It is desirable that several kids take part in the game. In this case, they will be spontaneously mastering the ability to listen to each other, to conduct a meaningful dialog, i.e. they will be acquiring communicative skills. An adult should encourage a joke and create a friendly atmosphere during the game.

3.2.2. Tranings

1) "Yes-No" games on a paper tape with a numerical series from 0 to 10.

Goal:

Teaching kids ordinal counting from 0 to 10. Introducing the notion of "before", "after", "between"; "preceding", "following", "mid", "end" numeral (number). Teaching kids to narrow a research field in a linear row.

$\&$ Goal: Guessing a numeral in a series from 0 to 10.

Game rule: players have to ask questions which would immediately reduce by half the numerical row.
Equipment: a paper tape used for visually narrowing the search field.

0	1	2	3	4	5	6	7	8	9	10

Play action: guessing a numeral by narrowing the search field in the numerical row (the thought-of numeral is 1).

Questions answered with "yes":
- *Is it five (identifying the mid-numeral)? – No.*
- *Are they numerals coming before five? – Yes (The paper tape is folded and the part with numerals which do not participate in the search is hidden. In the instant case, they are numerals 5 to 10).*
- *Is it two? – No.*
- *Does it come after 2? – No (the tape is folded so that only 0 and 1 can be seen).*
- *This numeral is formed of a stick (description of a numeral is encouraged).*
- *It is 1.*

Outcome: the numeral was found and the play action was discussed.

The games are first better to conduct by means of visual presentation of a numerical row; then without visual perception.

It is important that a kid draw the following conclusions in the course of the game:

- Enumeration of variants is ineffective. Questions should narrow the search field and cut off some areas.
- Asking questions by narrowing the search field is a faster way to getting an answer.

The criterion of the kid's successfulness may be the developed skill of guessing a number from 0 to10 without visual presentation on the tape.

2) "Yes-no" games on a paper tape with the numerical row from 0 to 100 by tens, without units.

Goal:

Teaching kids ordinal counting from 0 to 100 by tens. Introducing the notion of the number of a ten and the name of a ten ("the fifth ten" is the number of the ten –"fifty" is the name of the ten). Continuing to narrow the research field in a linear row.

& *Goal: guess a number from 0 to 100 (by tens without units)*

Goal: Assimilating by kids of a hundred by tens through visual presentation of a numerical series.
Conditions: enumerating the numbers is not allowed, accepted is only a question that narrows the field search.
Equipment: a numerical tape with tens without units

0	10	20	30	40	50	60	70	80	90	100

Play action: guessing a number using the search field narrowing algorithm (the thought-of number is 90).

7

Questions *answered with "yes":*
- *Does it come after 50? (the paper tape is folded so as to leave only the numbers which still participate in the search – from 60 to 100).*
- *It is more than 80? (only the numbers from 80 to 100 remain on the paper tape).*
- *Does it precede 100?*
- *Is it 90?*

Outcome*: the number was found and the playing action was discussed.*

The assignments either become more complicated or are repeated depending on the assimilation quality of the game with a numerical series from 0 to 100 by tens.

3) "Yes-No" games with a numerical series from 0 to 100 by tens without visual perception.

This and following games we play with kids without any visualization of numbers.

4) The game "Say where number 40 is located".

Possible answers are: number 40 is located between 30 and 50; after 30; before 50, etc.

5) The game "Find a thought-of number on a tape with a broken sequence of numbers.

Creating a problem situation: the sequence of tens is broken on a numerical tape. The question is how to find a thought-of ten.

Version 1.

Draw an empty ruler with the same number of cells and fill the cells with numbers in the right order. The subsequent search operation is known to children.

Version 2.

Search for a thought-of number without moving the numbers in the broken sequence. This is done by using the terms "to the left" – "to the right" from the mid-number.

"Yes-No" games with a preconditioned numerical series.

$\&$ **The "Yes-No" game with a numerical series from 20 to 80 by tens**

Goal: *Assimilation by children of a hundred by tens through visual presentation of a numerical series.*

Conditions: *it is not allowed to enumerate the numbers, accepted is only a question which narrows the search field.*

Equipment: *a numerical tape including tens without units from 20 to 80.*

20	30	40	50	60	70	80

Play action: *guessing the thought-of number using the search field narrowing algorithm (the thought-of number is 80)*

Questions *answered with "yes"*

- *Is it between 50 and 80? – "Both yes and no" (a kid has to understand that the thought-of number is one of these two numbers).*
- *Does the number consist of 8 and 0? - "Yes"*
- *It is 80! – "Yes"*

Outcome*: the number was found and the knowledge of the game rules was consolidated*

The kid's successfulness criterion is the developed skill to guess a ten from 0 to 100 without visual presentation on a tape.

6) "Yes-No" games with a numerical row from 0 to 20 (introduction of units).

Goal:

Teaching kids ordinal counting from 0 to 20. Reinforcing the understanding of the notions of "before", "after" "between"; a "previous", "following", "mid", "end" number. Continuing to teach narrowing the search field in a linear row.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

Games are conducted by analogy with the previous games with numbers, first using a paper tape, then without it.

The assignments either become more complicated or are repeated depending on the assimilation quality of the game with a numerical series from 0 to 20.

You may play next two kinds of games with kids:

6.1. "Yes-No" games with a numerical series from 0 to 100

The numbers on the tape must be depicted at equal distances from each other so that a kid could fold the tape and find a mid-number.

6.2. "Yes-No" games with a numerical series from 0 to 100 without visual perception.

For this game should be playing without any visual support.

As it shown bellow all previous games you could play with letters and any other symbols should be learned by kids according your educational programs and purposes.

3.3. The linear "Yes-No" game with objects

The linear "Yes-No" game with objects is played in the same way as with numbers, the only difference being that various pictures, toys, geometrical shapes, letters, etc. are used. Objects are searched for by the linear feature. This is the main peculiarity of this group of tranings.

> The linear "Yes-No" game with objects differs from the numerical game in that the location of the line is changed. It may be arranged horizontally, vertically or may be receding with respect to players.

3.3.1. Developing while playing

Another distinctive feature of this type of games is that the search field is narrowed not according to the ordinal counting notions but according to the space orientation notions. That is why the terms "left – right", "farther – nearer", "above - below", "|mid-object" are introduced.

While playing with preschoolers the linear "Yes-No" game with objects, you can fulfil the following pedagogical tasks:

- developing in a child the ability to ask questions which narrow the search field;
- quickly teaching, through game play, to orientate in a linear space;
- teaching a task-oriented search for necessary information, developing independence, intellectual activity and persistence in attaining a goal;
- developing the ability to identify the name of a feature by which the search field is being narrowed, forming reflection skills.

3.3.2. Trainings

1) **"Yes-No" games with objects.**

Groups of objects may be used, for example, toys or dishware, fruits or pieces of cosmetics arranged in a line.

& **The "Yes-No" game with toys arranged in a linear row** (the though-of object is the car).

This game is played with children aged 3 to 3.5.

Game rule: players have to ask questions which would immediately reduce the row by half and to perform the action "finding the mid-point – hiding a half".

Equipment: a 50x50 kerchief; 5 toys (car – pyramid - rattle – doll – ball) arranged from right to left at the kid's eye level at a distance equal to the length of his/her arms put out to the sides).

Play action: it is proposed to find a toy and read a rhyme about it. Younger children first look for the mid-object (the rattle). That is why the kid's palms should touch the edge objects of the row. Then the mid-object will be located before the kid's eyes. The kid asks:

Is it a rattle in the middle? – Yes

Do we have to read a rhyme about the rattle? – No.

Is this toy to the right of the rattle? – No (the rattle, doll and ball are covered with the kerchief not to dissipate children's attention).

Is it to the left of the rattle? – Yes.

Is it a car? – Yes. It is necessary to read a rhyme about it.

It is necessary to tell the kids that first they have to find the mid-point and cover a half. Then they will be able to guess the toy faster.

Outcome: the toy was found, the rule of finding a mid-object was consolidated

The assignments either become more complicated or are repeated depending on the assimilation   quality of the rule of narrowing a search field in a linear row.

2) **"Yes-No" games with horizontally arranged pictures of different classification groups.**

The number of pictures gradually increases to 11.

3) **"Yes-No" games with vertically arranged pictures of different classification groups**.

Goal:

Introducing the notion of "above - below" a mid-object.

4) **"Yes-no" games with pictures and toys of different classification groups arranged in a receding row relative to players**.

Goal:

Introducing the notion of "farther-nearer" relative to a mid-object.

5) **"Yes-No" games with pictures of one of classification groups.**

They may be pictures of animals, vegetables, plants or other groups of the same class.

Goal:

Developing the skill of narrowing a search field by different features – location, color, object shape, etc. The knowledge of the natural world, the ability of building a series according to an independently selected feature is consolidated.

6) **"Yes-No" games with geometrical shapes (3D or planar) of different size and color**.

Kids arrange by themselves the shapes in a linear series and search for a feature by which the search field can be narrowed (color, size or location).

These games may be used to reinforce the understanding of different size parameters: height, length, width. The material necessary for playing the games are sets of cardboard strips or sticks of different colors and sizes. In this way, the understanding of the color feature may be reinforced.

7) **"Yes-No" games with pictures of objects (each card includes numbers from 1 to 10 represented by points and by a numeral).**

Goal:

Teaching kids to compare quantitative indices with digital notation. (See Appendix 8).

8) **"Yes-No" games with pictures of times of the day, seasons, days of week.**

Pictures should be arranged in linear rows of different kinds (horizontal, vertical or receding relative to players).

These pictures can help reinforce the knowledge of the sequence of months in a year. They may be drawn together with kids by inventing a special designation for each month.

Reinforcing the knowledge of the sequence of days of week develops in kids the ability to enumerate them in any order. The days of week can be depicted in different colors. For example, Monday is red, Tuesday orange, Wednesday yellow, Thursday green, Friday sky-blue, Saturday dark blue, Sunday purple. The linear row can start from Wednesday (yellow card) and finish with Tuesday (orange card).

9) **"Yes-No" games with pictures of letters.**

Goal:

Guessing a thought-of letter by its location in a linear row.

10) **"Yes-No" games with changing the point of view of the linear row.**

Objects are arranged horizontally, the leader and the player are standing opposite each other. Questions are asked from the leader's point of view.

&*The "Yes-No" game with changing the point of view*

Goal: teaching kids to ask questions about the location of some kind of vehicles from the opposite point of view.

Game rules: two players stand opposite each other. There is a series of objects between them (for example, toy motor vehicles of different kinds). Trying to guess the thought-of object, the player asks questions from the viewpoint of the other person.

Equipment: pictures different kinds of vehicles arranged in a row.

Leader

Airplane	Train	Ship	Car	Helicopter	Rocket	Bicycle
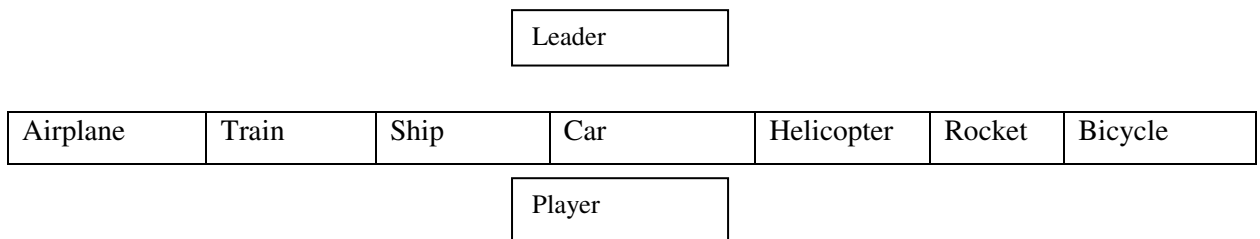
Player

Play action: guessing a picture by narrowing the field search (the thought-of picture is the helicopter)

Questions to be answered with "yes":

Is this kind of vehicle to the left of the car from your point of view? (for the player, it is the right side).
Is this kind of vehicle to the right of the rocket from your point of view? (for the player, it is the left side).
Is it the helicopter?

Outcome: the object was guessed and the rule was reviewed: it is necessary to ask question about the location of some object from the opposite point of view.

4. The planar "Yes-No" game

The preschool age is the period when notions related to the orientation in space are being formed. Starting from the age of three, children are able to assimilate information about object/space orientation. This allows faster adaptation to the surrounding world.

The planar "Yes-No" game is played using 2D space indices; therefore, the narrowing of the search field is performed by exploiting the notions of "right – left", "upper – lower", "farther – nearer" parts of a plane; center, corner, and side of a plane.

4.1. The rules of the planar "Yes-No" game

This kind of spatial "Yes-No" game can be played on a horizontal or vertical plane. A horizontal plane is usually a table; a blackboard serves as a vertical plane. The game objects may be both 3D objects and pictures of any contents.

The spatial game has some rules:

- The leader thinks of an object located in a planar space; it is necessary to find this ob-

ject.

- The player has to ask questions without enumerating the objects located on the plane.
- When searching for the object, it is necessary to use words denoting its location on the plane.
- The leader accepts questions which narrow the search field (the narrowing mechanism is cutting off part of the plane).
- The leader is allowed to answer questions with "Yes", "No", "Both yes and no", "It doesn't matter".

4.2. Developing while playing

Playing the spatial "Yes-No" game with preschoolers help to fulfill the following pedagogical tasks:

- developing the ability to narrow the object search field on a plane.
- teaching the ability to orientate in 2D (planar) space.
- teaching kids to find a point of reference in space (relative to themselves or to another object)
- developing the ability to characterize a spatial situation on a plane.
- enriching the vocabulary with prepositions, adverbs and other parts of speech reflecting the knowledge of the object/space surrounding. It is necessary to use the terms "right – left", "farther – nearer", "upper – lower" parts of a plane; center, corner, side of a plane.

4.3. Trainings

1) **The "Yes-No" game on a horizontal plane.**

   Goal:

   *Teaching kids to narrow the search field on a horizontal plane using the notions of "right - left", "far – near" parts a table; center, corner, side of a table.*

   $\&$ *The "Yes-No" game Goal: guess a geometrical shape on a table.*

   Game rules: players have to ask questions which would cut off part of the table plane.
   Equipment: a table with randomly arranged different geometrical shapes.

cone	**circle**	**sphere**
square	**cube** **cylinder**	
prism **ellipse**		**rectangle**
	triangle	
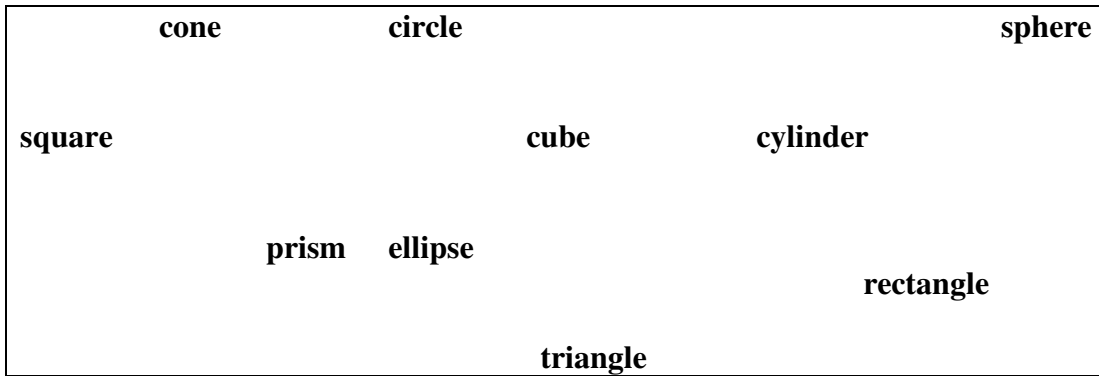
```
players
```

Play action: guessing a geometrical shape by narrowing the search field on the plane (the thought-of object is the sphere located in the right far corner)

Questions answered with "yes":
- *Is this geometrical shape located in the far part of the table?*
- *Is this geometrical shape located in the right far part of the table?*
- *Is this geometrical shape located in the right far corner?*
- *Is it the sphere?*
Outcome: the object was guessed and the principal rule of the game was reviewed.

The assignments either become more **complicated** or are repeated depending on the assimilation quality of the planar games.

2) **"Yes-No" games on a vertical plane (blackboard).**

Pictures of any classification group are arranged in any order.

Goal:

Narrowing the search field by using such orientation cues as a "right – left" part of the blackboard, the center of the blackboard, "above – below" the center of the blackboard, the corner and side of the blackboard.

3) **"Yes-No" games on a vertical plane with pictures of letters, numbers, names of fairytales or fairytale heroes, etc.**
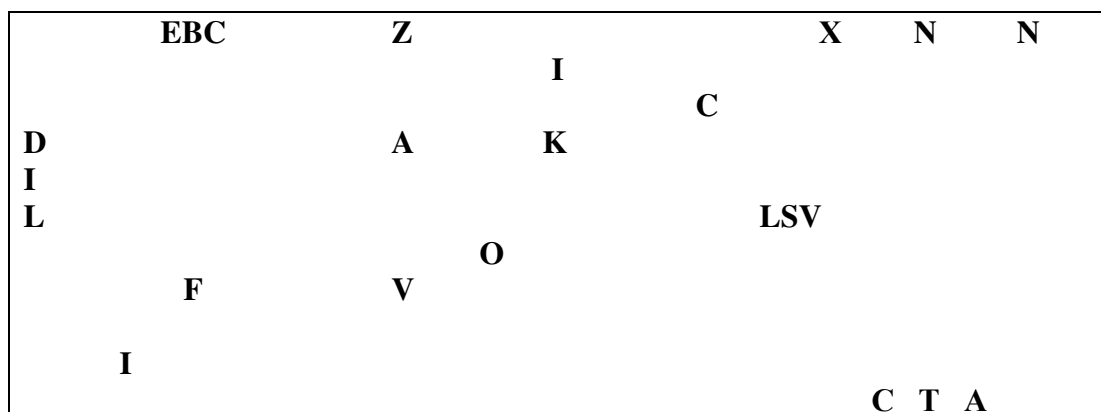
Pictures should be chosen according your pedagogical purposes and educational programs on learning various subjects.

$\&$ *The "Yes-No" game.*

Goal: guess a letter written on the blackboard

Game rules: players have to ask questions which would cut off part of the blackboard's vertical plane.
Equipment: a blackboard with randomly written letters.

```
      EBC           Z                          X    N    N
                          I
                                    C
D                 A           K
I
L                                        LSV
                        O
        F         V

    I
                                         C   T   A
```

Play action: guessing a letter by narrowing the field search (the thought-of letter is "I" located in the lower left portion of the blackboard).

Questions answered with "yes":
- *Is this letter in the left part of the blackboard?*
- *It this letter in the lower left part of the blackboard?*
- *It this letter closer to the left lower part of the blackboard?*
- *Is it the letter I?*

Outcome: the letter was guessed and the knowledge of alphabet was reinforced. The main rule of the game was identified.

5. "Yes-No" games with changing the viewpoint (the mirror and side versions).

The position of the players relative to the horizontal plane is changed:

- players are at a table opposite each other, that is, in a "mirror" position,

- players are at a table in a side position relative to each other.

The following rules are introduced: the players have to ask questions from the viewpoint of the leader. The following types of phrases should be used: "Is this figure in the right part of the table relative to you?", "Is this figure located in the right near part of the table relative to you?"

& *The "Yes-No" game. Goal: guess where on the table the portrait of a fairytale character is located.*

Game rule: players have to ask questions which would cut off part of the table by using the notions of "right – left", "farther – nearer" parts of the table, corner, side of the table. The player asks questions from the viewpoint of the leader.
Equipment: a table with randomly arranged portraits of fairytale characters.

Giant   **The Little Red Riding-hood**   **Puss in Boots**

Firebird   **Thumbelina**   **Seamaid**

player

Baba-Yaga

Scrag

Cinderella

leader

Play action: guessing the fairytale character by narrowing the search field (Puss in Boot is in the right far corner relative to the leader).

Question answered with "yes:
- *Is the portrait in the far part of the table relative to you? (for the player, it is the right part of the table)*
- *Is the portrait in the right far part of the table relative to you? (for the player, it is the right near part of the table)*
- *Is the portrait in the right far corner of the table relative to you? (for the player, it is the right near corner of the table)*
- *Is it Puss in Boots?*

Outcome: the fairytale character was guessed, the notions of "left – right", "far – near" parts of a table, corner, side of a table at a side position of players were consolidated.

6. "Yes – No" games with a geographical map.

An object on the global map or on the map of a country is thought of. Kids narrow the research field and get acquainted with the geographical object.

5. The spatial "Yes-No" game

The spatial "Yes-No" game employs 3D space indices; therefore, narrowing the search field proceeds though the notions of "right – left", "upper – lower", "front – back" parts of a room; center, corner and sides of a 3D space.

5.1. The rules of the spatial "Yes-No" game

This kind of spatial "Yes-No" game can be played:

- in a room – looking at 3D space from inside
- in a box (black box) – looking at 3D space from above.

The objects of the game may be all objects available in a room or box.

The game has special rules:

- When playing the spatial "Yes-No" game, objects are in a 3D space (room, box)

- The leader suggests guessing an object in a room (box) by narrowing the search field in a 3D space.

- Enumeration of objects is not allowed. Accepted are questions which narrow the search field in the room (box) space.

- The leader only has the right to give such answers as **"Yes", "No", "Both yes and no", "It doesn't matter".**

- The outcome is the object, found after asking the smallest number of questions, and the analyzed game procedure.

$\&$ *The "Yes-No" game "Guess an object in a room"*

Goal: teaching children to ask questions about the object location in a room
Game rules: *a player asks search field narrowing questions about spatial orientation*
Equipment: *a room and objects located in the room*
Play action: *guessing an object in a room by using the search field narrowing algorithm (the thought-of object is the flower on the window sill).*
Questions *answered with "yes":*
- *Is it in the front part of the room?*
- *Is it in the right front part of the room?*
- *Is it nearer to the right corner of the room?*
- *Is it connected with the window?*
- *Is it in the lower part of the window?*
- *Is it the flower on the window sill?*
Outcome: *The player guesses the object, the knowledge of the game rules is reinforced.*

At the initial stage, encircling gestures are used which point to the part of the room where search is performed.

5.1. Developing while playing

The spatial "Yes-No" game with preschoolers will help you fulfill the following pedagogical tasks:

- developing the ability to narrow the search field in a 3D space.

- teaching through game the ability to orient in a 3D space using different points of reference.

- enriching kids' vocabulary with such terms as "right – left", "upper – lower", "front – back" part of a room; "upper – lower", "nearer – farther", "right – left" corner; "right – left", "back – front" part of a room, "above – below" the eye level.
- developing in kids the ability to identify the names of features by which the search field is being narrowed.

5.2. Trainings

1) The "Yes-No" game "Find a toy".

Goal:

Finding a toy in a room by narrowing the search field in a 3D space. Using the orientation cues: "right – left", "upper – lower" parts of a room, "at the front – behind" a player; center, corner, part of a room.

& *Guess the location of a toy in a room*

Game rule: *all players stand in the center of a room, look in the same direction and ask questions cutting off part of the room.*
Equipment: *a doll hidden in a wardrobe standing in the room.*
Play action: *guessing, by narrowing the search field, where in the room the toy is hidden (the doll is in the left corner of the top shelf of the wardrobe standing in the right back corner of the room relative to the player).*

Questions *answered with "yes":*
- *Is this toy located behind you in the room?*
- *Is this toy behind you in the right corner?*
- *Is it hidden in the wardrobe? – After the approximate location of the toy has been guessed, the wardrobe is declared to be a "black box". Without opening it, the kid has to imagine its sides, inner corners and ask corresponding questions.*
- *Is this toy in the upper part of the wardrobe?*
- *Is it on the top shelf?*
- *Is it in the left corner of the top shelf?*
Outcome: *the wardrobe is opened and the doll is taken out, its location is uttered. The rules of object search in a 3D space are reinforced.*

The assignments either become more complicated or are repeated depending on the quality of game assimilation by kids.

2) The "Yes-No" game with changing the viewpoint in a 3D space

The positions of players are changed:

- the leader and the player are positioned opposite each other, i.e., they are in a 'mirror" position relative to each other.
- the leader and the player are in a side position relative to each other.

The players have to ask questions as if they see the room from the leader's position. Such phrases as "Is the the object in the right part of the room from your point of view?", "Is this object at your front?" should be used.

3) The "Black Box" game

The leader fixes some object inside a box and suggests guessing where this object is located by using questions which narrow the search field in a 3D space.

4) The "Robot" game

A kid is asked to play the role of a robot and move around a room. The Robot has to reach the farthest right part of the room and sit down on a chair. Players should "control" the robot by giving him tasks related to the orientation in space. They should give commands of the follows type: "Make five steps to the left!", "Turn about", etc. The obligatory condition of the game is that players must give as few instructions as possible to the robot.

6. The sample sequence of assimilating the notion of space by children aged 3 to 7.

Kinds of games	Arrangement of objects	Kid's age – 3 years	Kid's age 4 years	Kid's age - 5 years	Kid's age - 6 years
		Objects			
		Notions to be introduced			
Linear numerical "Yes-No" game	horizontal	-	numerals from 0 to 10	numbers from 0 to 100 by tens	number from 0 to 100 by units
		-	Middle, more-less	Middle, more-less	Middle, more-less
Linear "Yes-No" game with objects	horizontal	toys	pictures	Toys, pictures	Toys, pictures
		Left-right, middle	Between, outer-most	left-right, middle, between, outer-most at mirror position	right-left, middle, between, outer-most at mirror position
	vertical	toys	pictures	Toys, pictures	Toys, pictures
		above-below, middle	between, outer-most	slightly above, slightly below the middle	slightly above, slightly below the middle at mirror position
	receding	-	toys, pictures	toys, pictures	toys, pictures
		-	farther-nearer, middle	farther-nearer, middle	farther-nearer at mirror position
Planar "Yes-No" game	Horizontal	-	toys, pictures	toys, pictures, letters, numerals, fairytale heroes	toys, pictures, letters, numerals, fairytale heroes, geographical map
		-	Left, right part of surface, corner, center, farther-nearer parts of surface	Centers of right – left part, lower – upper part	At mirror and side position of players relative to objects
	Vertical arrangement of objects (games on a blackboard)	-	toys, pictures	toys, pictures, letters, numerals, names of fairy-tales, etc.	toys, pictures, letters, numerals, names of fairy-tales, etc.
		-	Right, left part of surface, corner, above-below	Centers, sides, corners of vertical surface	Centers, sides, corners of vertical surface
Spatial "Yes-No" game	View from above (box)	-	-	Box with toys or pictures fixed inside	Box with toys or pictures fixed inside
		-	-	Right – left, near – far, upper – lower parts of box	Right – left, near – far, upper – lower parts of box
	View from inside (room)	Any objects in a room	Any objects in a room	Any objects in a room	Any objects in a room
		At the front – behind, right - left	Above – below the eye level, right – left part of a room, front – rear, corner and side	Reference to objects inside a room (farther – nearer relative to a window, above - below a chair, to the left – to the right of a wardrobe)	Reference to objects inside a room in a mirror and side version.

7. Game exercises for children aged 3-7 (photos).

Comments of the authors:

Dear reader.
We are Sorry for this inconvenience.
This is a draft version of the book not for sale. It was created for European branch of the international Network "OTSM-TRIZ for Kids and Education"
Colored picture with comments will appear in the complete version of the book ready to sale.
Right now some of pictures are available in the key-note presentation of Tatiana Sidorchuk for the conference TRIZCON 2006. The presentation is posted in the English part of the JL-Project Web site:

www.jlproj.org

There on the site you can find some more educational materials free of charge. And last news about JL-Project activity and international Network OTSM-TRIZ for Kids and Education.

8. The description of a teaching aid and manufacturing methods

8.1.   Paper tape

The tape is made from paper. It may be of different sizes:

12 x 88 cm   - 11 cells – 8 x 12 cm ;

4 x 33 cm - 11 cells - 3 x 4 cm

0	1	2	3	4	5	6	7	8	9	10

Not to make several tapes, it is recommended to make a tape from semitransparent polyethylene in the form of pockets for inserting cards with numbers.

Not only numbers may be used as inserts, but also collections of pictures by classification groups such as "Dishware", "Furniture", "Toys", etc.; as well as letters, pictures of seasons, and the like.

8.2. **Cards for the "Yes-No" game with quantitative indices (the number of points corresponds to a numeral).**

1	2	3	4	5	6	7	8	9	10
•	••	•••	••	••	••	•	•	•••	••••
			••	•	••	•	••	•••	•
				••	••	••••	•••	•••	••••
						•	••		•

9. The video tape of game exercises with children

Video for this book and all others of this series will be posted on You-Tube and available for free of charge.

Videos are containing video records of real life classes with kids. Classes were done in Russian language. Eventually should appear Subtitles in English and in other languages. Search You-Tube: OTSM-TRIZ for Kids and Education.

10. Information of subsequent issues

10.1. The Second book of the series: Classifying "Yes-No" Games.

In the books you can find descriptions of trainings for developing skills in kids to narrowing the field of research by features of objects of natural and manmade world as well as by features of objects of musical, literary and art world.

This kind of games develops classification skills as well as skills to describe the same object within various levels of generalization. These skills are necessary to develop and improve problem solving and problem management skills.

10.2. The Third book of the series: Situational «Yes-No» Games.

In the book you can find trainings for developing skills to narrowing the field of research by features inherent in a certain "detective" situation (reality, time, place, characters, objects, etc.) given by the leader of the game and participants should investigate and explain this unusual situation.

This kind of games is helpful to develop skills of using fundamentals and base instruments of Classical TRIZ and OTSM for everyday private and professional life problem situations. We use this game for teaching adults to ARIZ and OTSM Contradiction technology in order to prepare them to more complex approaches and instruments of OTSM, like Problem flow networks approach and OTSM Fractal model of a solving non typical complex interdisciplinary problems.