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# Constructing a space: computational environment applied to a psychopedagogic evaluation process

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## Abstract

Works performed by different authors pointed out the possibility of understanding people's way of thinking through the use of a computer since you can follow their behaviour, and also see the final result of their representations on screen.

Psychopedagogic clinic needs this kind of tools – Kid Pix Deluxe® and Storybook Weaver Deluxe® - for allowing readings and recordings of situations or actions occurring during the evaluation process.

*Constructing a space* was developed based on the evaluation of a software and the need for technological resources of psychopedagogic clinic, offering means for the clinical diagnostic process of children from 7 to 11 years-old. Its aim is to provide the psychopedagogue with data about the child in process of knowledge construction in several dimensions: rational, desiderative and relational (Silva, 1998) or cognitive, emotional, pedagogic and social (Weiss, 1992). This software intends to create an environment where the dimensions aforementioned can be observed and recorded in an integrated way. Thus, it should be open enough for allowing the psychopedagogue to propose several activities.

This work is built upon a master degree dissertation\*\* and presents the software *Constructing a space* (developed in Imagine Logo), its development and substantiation, and a brief study with psychopedagogues with the aim of their evaluation.

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## Keywords

evaluation process; psychopedagogic diagnostic; psychopedagogic environment; LOGO microworlds, primary education

## The psychopedagogic clinic

Psychopedagogy was born from the necessity of a better understanding of the learning process and it became a specific area of study concerned to knowledge in different fields and, also, to create its own object of study (Bossa, 2000).

The psychopedagogic clinic corresponds to one of its fields of performance, which objectives are to diagnosis and to deal with the emergent symptoms in the learning process. The psychopedagogic diagnoses investigate and analyze which are the obstacles that prevent children from learning, learning with great difficulty and/or learning in a slow pace. It also clarifies a complaint of the children themselves, their family or the school. (Weiss apud Scoz, 1991).

Psychopedagogy in Brazil has been developing - for over thirty years - its own theoretical background. "It is a new area of knowledge, which brings in itself the origins and contradictions of a performance to interdisciplinary, needing much theoretical reflection and searches" (Bossa, op.cit, p.13).

The psychopedagogy is occupied of the human learning, what happened from a demand - the learning problem, placing in a territory little explored, situated beyond the limits of Psychology and the proper Pedagogy - and evolves due the existence of resources, to take care of this demand thus, consisting, in one practical. As it is worried about the learning problem, it must occupy initially of the learning process. Therefore we see that psychopedagogy studies the characteristics of human learning: how we learn, how this learning varies in time and is conditional for some factors, how the alterations in learning are produced, how to recognize them, to treat them and prevent them. This object of study, that is a person to be studied by another person, acquires specific characteristics depending on the clinical or preventive work (Bosssa, op.cit. P. 21).

The distinction between the clinical and the preventive work is basic. The former aims at searching for the obstacles and the causes for the already installed problem of learning; and the latter aims at studying the developing conditions of learning, pointing ways to develop a more efficient learning process. Considering the definition of Bossa (Idem, p.21) on the two fields of performance of psychopedagogy:

The clinical work is defined in the relation between a person with its personal history and its modality of learning, searching to understand the message of another person, implicit in not-learning. In this process, where investigator and object-person of study interact constantly, any alteration becomes an issue for study for Psychopedagogy. This means that, in this modality of work, the professional must understand what the person learns, how it learns and why, beyond perceiving the dimension of the relation between psychopedagogist and person in order to favor learning. In the preventive approach the institution, while physical and psychic space of the learning is object of study of Psychopedagogy, once that is evaluated the didactic and methodology processes and the institutional dynamics that intervene with the learning process.

In the clinical exercise, the psychopedagogue must recognize children's process of learning, their limits and their abilities - mainly the intrapersonal and the interpersonal ones. Therefore, its object of study is the other person, being essential for the psychopedagogic practice the knowledge and the possibility of differentiation of what is pertinent to one another. "This interrelation of persons, where one looks forward to know the other in what it is the obstacle to its learning, implies a very complex thematic" (Bosssa, op.cit. P. 23). Psychopedagogues have as their duties to identify the structure of the person, the children's structural transformations over time, the influences of children's environment in these transformations and the relationship of these transformations with learning. This knowledge demands from the psychopedagogue the better understanding of the learning process and their interrelations with other factors that may influence it, such as the emotional, social, pedagogical and organic ones. Knowing the beddings of Psychopedagogy implies reflection upon its theoretical origins and to understand how different areas of knowledge are transformed into a very particular and new theoretical framework.

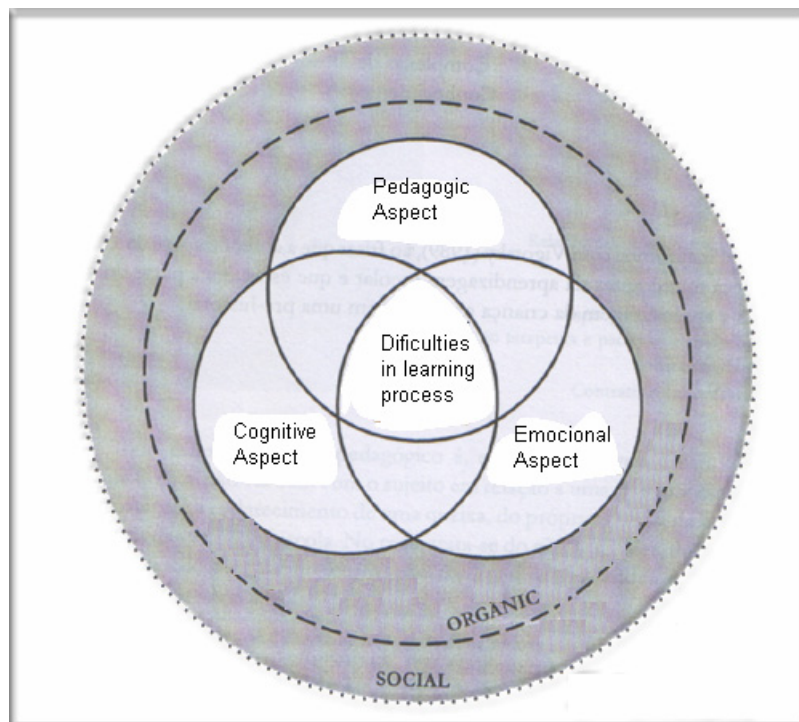
Psychology and Pedagogy are the core areas of psychopedagogy, but they are not enough to build up a solid base for this new field of human knowledge. For this reason, it was necessary to appeal to other areas, such as Philosophy, Neurology, Sociology, Psycholinguistics and Psychoanalysis, to reach a multifaceted understanding of the learning process.

The areas of study rose from the observation of different dimensions of the learning process which are organic, cognitive, emotional, social and pedagogic. According to Weiss (1992:22), “the interrelation of these aspects will help us build a gestaltic view of pluricasuality of the phenomenon, making possible a global approach of the subject and their multiple facets.”

The emotional dimension is connected to the affective development and its relationship with the knowledge construction of the children and their expressions via graphic and written productions. Psychoanalysis is the area which gives theoretical support to this dimension, dealing with the unconscious aspects involved in the learning process, allowing psychopedagogues to take into account the desirous face of children. The social dimension is related to the society’s own perspectives where family, the social group and the school are part of it. Social Psychology is the area responsible for providing theoretical base of this dimension. The cognitive dimension is connected to the cognitive structures of children applied to different situations. The Pedagogic dimension has to do with the content, methodology, classroom dynamic, educational techniques and evaluations children have to perform throughout their formal education at school. The Organic dimension deals with the physiobiological constitution of the learning children. The Linguistics is the area of study which pervases all the other dimensions previously mentioned.

However, none of the area mentioned came up to answer to specific questions about the human learning process. Though, all of them provide means to reflect critically upon the answers that emerge from questioning and it is also a valuable background for operating in the field of Psychopedagogy.

Figure [1] below, extracted from Weiss (*idem*, p.25) illustrates the relationship among the different areas that build up the theoretical background of Clinical Pedagogy; i.e, its delimitation.



*Figure 1 – Aspects related to the learning process.*

## The psychopedagogic diagnosis

The diagnosis is, per se, an investigation that follows fixed parameters defined by psychopedagogues who are in search of the causes of a complaint made by the children, their family and their school. The focus of the diagnosis is the obstacle within the learning process. A difficulty observed by the children, their school, their family and their social group is the symptom.

After acknowledging the obstacle in the children's learning process, a question arises: is it a diversion compared to what? This parameterization seems to be fundamental for the diagnosis process because it will define both the quality and importance of this diversion to formal development. After careful analysis, it is possible to come up with a plan to diagnose the problem.

To set in move the diagnosis process, the therapist needs to consider two main axes of analysis which should interact between themselves in a dialogic way: a) the horizontal axis – the a-historical perspective and b) the vertical axis – the historical perspective. In the horizontal axis, the therapist explores the present situation, looking for the existing causes as symptoms. In the vertical axis, the aim is to understand the general construction of the children a certain context.

According to Weiss (1992), the main objective of a psychopedagogic diagnosis is to identify the diversions and obstacles in the children's learning model<sup>1</sup> which are impeding them to develop themselves as socially expected. To understand a child's learning model, the psychopedagogue needs to gather data from the family, the school and the child under therapy, taking into account both a-historical and historical perspectives.

From the integration of the data collected arises the prognostic and material necessary for formulating the final hypothesis, which will be used during the diagnostic feedback interview.

## The computational environment in the psychopedagogic clinic

Is it possible to diagnose children through their interaction with the computer? How can this be done?

Woks performed by different authors pointed out the possibility of understanding people's way of thinking through the use of a computer since you can follow their behaviour, and also see the final result of their representations on screen. The learning process becomes visible to the psychopedagogue via representational schemas' observation.

Our own experience as psychopedagogue using technology (since 1992) and the literature review, allowed us to conclude that the use of Informational Technology makes possible for children deal with their own thoughts in a different way. This new way of dealing with thoughts and reasoning – that flows differently from the paper-and-pencil school routines – may bring a new dimension to the clinic psychopedagogic.

The Kid Pix Deluxe® and the Storybook Weaver Deluxe® are tools that offer multiple resources while they may be presented as blank pages from which it is possible to create. From objects – their own construction blocks - children create new things. In this construction process, children start to reveal important aspects of their learning processes, as it happens in metacognition, planning, error observation and error correction.

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<sup>1</sup> Learning Model means a dynamic group of structures that frame children's knowledge, their learning styles, their mobility, the cognitive performance, the acquired habits, their present motivations, their anxiety, and their conflicts and their defenses related to learning, their bonds with general knowledge and the object of formal knowledge, in particular, the meaning given to the formal education by children, their family and school " (Weiss, 2000, p.32).

Softwares like Kid Pix Deluxe® and Storybook Weaver Deluxe® are used in psychopedagogic clinic, during the diagnosis period, and are pointed by psychopedagogues (Oliveira, 1996; and Weiss, 2000) as one of the most used resources because of the resources they present.

However, from a psychopedagogic point of view, there is not a specific structured environment in these softwares aiming the diagnostic process with resources for registering complex and dynamic actions occurring during the process itself. The psychopedagogue should create a structure based on some available tools in the software and record /store the children's interaction process with themselves, using different means.

In the psychopedagogic diagnosis, we need to make use of different tools – in addition to the ones presented in Kid Pix Deluxe® and Storybook Weaver Deluxe® - to reach a more accurate diagnostic in a shorter period of time.

A structured computational environment that allows free expression will help children revealing specific aspects of their learning process, offering a valuable material for psychopedagogues. For us, a structure computational environment is a space ready to create specific situations where observations about children can be made. Both the topic and the logic structure follow a composition that lead children to exposing – via actions – how they articulate the rational, emotional and relational dimensions involved in their own learning process under specific circumstances.

Evaluating the softwares and the need of technological resources for pedagogic clinic, the software *Constructing a space* was developed with the goal of offering a resource for clinic diagnosis process of 7 to 11- years old children.

The objective was creating a propitious environment to evaluate the obstacles found in the children's learning process, focusing on both logic and projective activities which allow the construction of more consistent hypothesis that may be confirmed by applying different diagnostic resources, in a shorter period of time.

## Project to be developed

When developing a software for children, it is necessary to take into account two aspects: the psychopedagogic requirements and the available tools that may be used to engage the child in a specific task. The more intuitive the interface (i.e, designed to allow the children to concentrate on the efforts to accomplish the tasks), the more friendlier the software will be (Sampaio, 1996:72).

From the observation and analysis of software in use in the psychopedagogic diagnosis process, we present the functionalities that support the development of the software *Constructing a space*.

- Its tools allow the choice of a variety of scenarios for the computer screen, objects, characters and their appearance, size, literalities, besides the possibility to delete, replace and drag them.
- A graphic bank of scenarios, objects and characters that allow a higher number of possible combinations among themselves to be applied on the screen.
- A specific space for written expression relating it to images and sounds.
- Flexibility in the navigation; i.e, getting in and out at any time.
- Possibility of registering the files and the process of thinking.
- Multimedia possibilities of inserting sounds and images through the use of files already recorded or recording their owns.
- Iconic language to facilitate the interaction for users (children from 8-11)
- Easy interaction and intuitive use for adults and children.
- Pleasant and attractive for the age group (children from 8-11)

During the psychopedagogic diagnostic process, the functionalities listed above seem to be essential to a software. It is important to work with a software open enough to allow users to make their own choices, revealing the strategies, decisions taken, correct decisions and answers and mistakes made. So, it is possible to observe the mechanisms employed by users in their process of learning.

The software *Constructing a space* was developed based on the criteria previously listed. It was also necessary to add a tool for registering and observing children's process of learning. This tool has the function of recording, loading and executing files in which the children's actions and thoughts are recorded during the diagnostic session. It makes possible for both therapist and child to verify whenever needed, the representational system of the user of the software. A software equipped with all these features becomes an environment where children should act and make choices, projecting their desires and wishes; therefore, it offers psychopedagogues an unique material that will enable them giving a more accurate diagnostic.

In a psychopedagogic diagnostic process of children (7-11 years old), it is important to encourage children to project themselves and, as consequence, enable them to deal with their daily routines. For this reason, the topic adopted in *Constructing a space* is home and its semantic area.

The target group can be categorized in two levels: primary and secondary. The primary public is the psychopedagogue who will use the software for collecting data and analyse the data gathered after each session. The secondary target group is children from 7 to 11 years old who will be using the software. The delimitation of the secondary group was influenced by the fact that this age group is the one who most seek psychoepagogic evaluation due to different sorts of school problems.

## Graphic Project

The graphic project has an essential part in this software as the interface user-system is based on iconic knowledge. We also opted for colored icons which are organized in toolbars in the place of inscribed menu. The aim is make the use simple and intuitive. When there is any sort of written material, there are the options of hearing or visualizing it. The main idea is to focus on the task, avoiding that the child gets distracted by commands or any other kind of artificial operations which are exterior to the environment itself (Sampaio, 1996:73).

The gathered data also has an important part in this software, because all the activities proposed need to be done based on the data gathered and stored. It is from the combination and application of images in the computational environment that the logical, emotional and pedagogical relations can be established. Launches of projective mechanisms are dependent of the graphic universe – what it offers and the relationships that may be established from it. For this reason, we tried to create a bank of images which are part of children's universe, helping them to identify themselves, their families and friends. The graphics are logically grouped by their use in directories, making the identification and manipulation easier.

As the graphic data, the size and proportion of the images also matter because they are used to build up the graphic environment. All the images should be in an approximated scale but they should differ in proportion from one another. For each non-symmetric image, it was generated a correspondent mirror image.

The position of the images are in the same perspective as the background. Children are encouraged to look for a proportion relationship among the objects while placing them inside the rooms. They should also choose the appropriate side of the room and the correct perspective according to their own organizational plans.

The relationship among the distinct spatial representations is another point to be considered. The visualization of a ground plan of a house – for selecting a room –and the furniture – in perspective – help children to establish a series of complex spatial relations that can be

observed and analyzed during the diagnostic process. Due to the environment's presentation (in perspective), the images had to be adapted to different perspectives within a set limit ; i.e, not all the pictures can be placed on all the walls.

The software *Constructing a space* was conceived and developed in the platform IMAGE – a new Logo language program object-oriented. We selected this platform because it is the programming language mastered by the author of this article. Furthermore, this platform brings functionalities that may be inherited. It corresponds to the defined criteria for developing the software *Constructing a space*, as well.

## Platform of development: IMAGINE LOGO

“Imagine” is a new generation of Logo, with object-oriented structure merged into traditional Logo philosophy, with empowered animation, open hierarchy of graphic screens and panes, hierarchy of objects and behaviors, parallel independent processes, direct painting tools, extended direct manipulation interface, tools for publishing for the Web, rich Logo language and other characteristics.

Imagine Logo was developed by a group of professors of the University Comenius, Bratislava, Slovak Republic, translated for the Brazilian Portuguese version by Cnotinfor Brasil.

“When developing this educational environment we had in mind a learner who wants to access a very broad palette of activities, from painting and animating to Web authoring, doing traditional Logo, creating multimedia, using speech input and output, modelling, constructing domain-specific learning frameworks, communicating ideas, building presentations, developing projects and micro worlds for numeracy, literacy or science, working with data...Our goal has been to provide students, teachers and developers with a challenging general tool for learning.” KALAS, I; BLAHO, A.; Imagine... a new generation of Logo: Programmable pictures; Comenius University; Bratislava, Slovak Republic; Proceedings of the IFIP WCC 2000

### Turtle Geometry

The Main Window of Imagine Logo can enclose several Pages which are shown one by one. In each Page it is possible to find a amount of small graphic objects named Turtles<sup>2</sup>. In addition, each object Page may contain several Panel objects with a number of Turtle objects inserted in them.

In *Constructing a space*, when we develop the proceedings fro creating the recording function and the function for presenting all the moves done by children while using the program, turtle geometry is applied.

### Object-oriented, Class and Object

One of the main characteristics of all object-oriented system is the creation of classes which specify similar objects.

Imagine Logo environment consists of individual objects and instructions, that may be sent and performed by the objects, and classes. Each individual object – an Instance – is part of a class and each class specifies the behavior of similar objects; i.e., their own status and procedures. These procedures make possible that the objects react to instructions.

In *Constructing a space*, the classes used from Imagine Logo are: Button, Panel, Page, Text Box, Toolbar and Turtles. From the Button class, we created the Four Class. From the Turtle class, the Pict class.

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<sup>2</sup> The first version of the LOGO language appeared in 1968, as an enclosed part of a list processing. Then, the freestanding Turtle was designed: obeying commands such as walk and turn, a small robot walks on a piece of paper, leaving a pen-trace-like mark on the surface. For moving so slow, it was called Turtle. This icon is a representation of a mechanic turtle and it was idealized to bypass precision problems in the drawings made by children.

## Instance

In *Constructing a space*, it is possible to create Instances of basic classes of Imagine Logo and classes designed from super-classes, as previously shown in Figure 2.

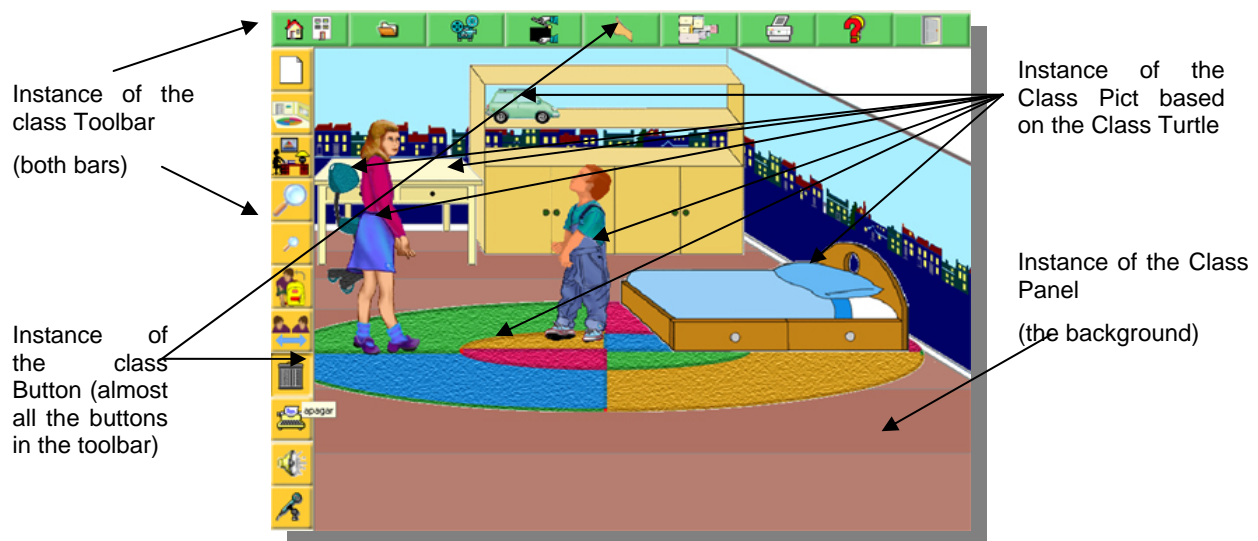


Figure 2

## Characteristics and Functions of Constructing a space

*Constructing a space* is a software for building and simulating the home atmosphere – suitable for being applied to diagnostic process of children from 7 to 11 years old.

The central Idea is to give enough freedom to children so that they externalize their actions – from a minimum body of rules. Through this process, we allow psychopedagogues to build up inferences about the children's model of learning.

### Brief description

At the beginning, the child is invited to simulate someone who is looking for a place to live. This character should choose a residence (a house or an apartment) for providing it with furniture and humanizing it. As soon as the choice is made, we give children four options of ground-plans: from 1 to 4 bedrooms. It is from the selection of the ground-plan that the children will choose which room they want to furnish first. They select the background – walls and floor, first –and, then, the objects, people, plants and animals that will be part of the environment. It is possible to furnish and humanize only one room or many rooms at a time. It is a free option in the software; i.e, it is not linked to any other predetermined task.

For this first version, it was not possible, due to lack of time, to create all the graphic structures for all the rooms of a house. So, we opted for enabling the bedrooms, since it is here that we find higher chances of a child develops projecting mechanisms. It was not possible to conclude the system for saving and opening LOG files.

### Desktop

The desktop presents a central area where the activities happen and it can be visualized in two different toolbars: a) the main toolbar (at the top of the screen) and b) the side toolbar. All the functions presented in *Constructing a space* are activated via these two toolbars.

### Toolbar: Main and Side

The *Main Bar* is enabled during the execution of the program, being hidden only when it executes the Help function. It comprises nine buttons which functions can be classified as selection, executable and filing.

The group of buttons as *selection tools* are those which grant access to selections of the ground-plans in the program, as shown in Figure 3, under numbers 1, 5 and 6.

The group named *executable tools* are responsible for carrying out the same defined action in all the modules of the program, as shown in Figure 3, under numbers 7,8 and 9.

The three-button group named filing tools – save, open and execute – are shown in Figure 3, under numbers 2,3 and 4.



Figure 3 – Main Bar

To set in motion the function of each button, just single-click on the button. If you single-click again, it is going back to its original status.

We will present all the tools presented in the Main Bar, their correspondent interface and the functions performed by them.

The tool *House or Apartment* may be set in motion, at any time, allowing the user to change the option previously made.

The tool *Open* opens the file with the actions recorded through the tool button open file. In accordance with the file chosen in the dialog box, the mode should be recognized (ground-plan or room interior) in Open function, letting it ready for execution.

The *Recorder* tool records in the file “executed actions” through a dialog box. In accordance with the file recorded, the mode for its execution should be recognized.

The “*Finalization*” tool indicates that a child confirms the end of the organization and humanization process in an environment and that they may move to another room. When children execute this function, the software will go back to the ground-plan previously selected by the child. Then, all the activities done in the environment will be recorded.

Ground-plan tool opens a window with four panels to be selected by the children with the number of rooms desirable. The children should click on the ground plan selected to set it in motion.

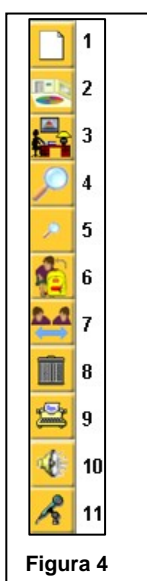


Figure 4

At the beginning of the activities with *Constructing a space*, when children choose between house or apartment, only the ground plans for the option selected is enabled.

The Print tool opens a dialog box for printing the screen area without the toolbars. At any time, children may print the ground plan selected.

The Help tool allows children to enter in the Help section. In this module, the text goes together with audio for a better understanding of the content.

The Exit tool closes the software and save the activity.

The Side bar (Figure 4) becomes activated only when the child selects a room in the chosen ground plan for furnishing and humanizing it. The buttons that comprise the side bar are: the selection, manipulation and utilities.

The selection tool (numbers 2, 3, 10 in Figure 4) has the function of selecting a background, objects, animals and characters and sounds that will be applied to the room in evidence in the desktop.

The manipulation tools (numbers 4, 5, 6, 7 in Figure 4) are used for re-arrange, resize, change the laterality and remove objects and/or characters. This group of tools has the

same operation mode; i.e, when the user single-click on them, they get activated. When we single-click on them again, they get inactive.

The utility tools (numbers 9, 11 in Figure 4) execute specific complementary functions to the program.

The Clean tool (numbers 1, 8 in Figure 4) deletes all the background, objects and/or characters.

The background opens a dialog box for the selection of the background for the room chosen. The environment may be visualized, one by one, when the user single-clicks on the name of the file. Selecting the background to an environment, this will appear on the center of the screen.

The room selected in ground plan will be present in perspective cut.

The tool Objects and Characters selects the objects and characters to be inserted in the room. When this tool is activated, a dialog box pops up presenting a list of directories organized into distinct categories: animals, people, toys and fun, adornment, electronics, and so on. Opening the directory of each category allows the user to visualize the files for selection.

When selecting the objects/characters in the dialog box, the indicator changes to points out the function of locating an object. After being applied to the screen, the object/character may be dragged within the limits of the central screen.

The Resize tool has the function of re-dimensioning objects/ characters inserted in the background area.

The Ordering tool allows the organization of objects/ characters on the desktop. The inserted objects and characters in the desktop go to the foreground in a click.

The Laterality tool has the function to alter the position of objects and characters inserted in the desktop.

The Delete tool removes objects and characters inserted in the desktop.

The Write tool enables a module for writing, opening a window with a dialog box in the desktop. Through this text box it is possible to write a text (without length limit), save it and open a text file in txt format.

The Sound tool has the function of selecting a file – wav, mp3 or midi – to be executed. The chosen file can be heard before it is set in motion.

The Recorder tool executes the recorder of Microsoft Windows, allowing users to record sounds in the wave format. These sounds may be executed via the same tool.

## Evaluation

Up to which point, does the software *Constructing a space* correspond to the evaluation needs of the psychopedagogue?

Once the environment was designed and built, it was evaluated by a group of psychopedagogues. The evaluation allowed us to find ways to optimize the software and to consider some suggestions for future application and implementation.

### Does the psychopedagogue recognise, in the environment, a tool for diagnostic evaluation?

During the first interview, in the software evaluation, we collected data about what makes a software appropriate for being applied to the diagnostic process. In the next stages of observation and post-observation interview, we matched these qualifications to the observations and comments of the participants while using the software.

From the analysis of the data that emerged from the answers to question posed above, we concluded that psychopedagogues acknowledge *Constructing a space* as a tool for observing

projective and cognitive aspects of children from 7-11 years old. In addition, psychopedagogues considered the software attractive and easily navigable.

### Does the software help the psychopedagogue to evaluate children's structures of thought (rational dimension)?

It is possible to conclude that the resources, related to cognitive aspects, presented in *Constructing a space* are noticed by psychopedagogues; however, it is not so clear as they perceive the resources related to the emotional aspects. The therapists highlighted that, from the use of such tools, children may interact with their own thoughts allowing therapists to observe their models of learning.

The rational dimension of the learning process is absorbed by the subjects as a second function of the software, which is integrated to the evaluation of children's desiderative dimension.

Some subjects presented certain doubts related to the correspondence between the level of the thinking frame and the tasks involving logic and infralogic operations, and topologic, projective and "Euclidian" relationships.

These understandings led us to formulate two hypotheses: a) the tools available in the software are not clearly presented functions for this kind of evaluation, demanding from therapists more observation and better understanding of the software and; b) psychopedagogues have little knowledge about the way children construct their space and the logic and infralogic structures that are part of it. According to Piaget (1993), we believe that the age group delimitation (7-11) is adequate. However, we cannot take conclusions about this topic because it would be necessary to carry out a deeper study of the subjects while interacting with the software.

The way buttons work would facilitate the diagnosis of children's reasoning modality, making it easier - or not - from the correspondence between the buttons and the cognitive functioning.

### Does the software facilitate the evaluation process of emotional aspects (desiderative dimension) connected to children's learning process?

The evaluation of the desiderative dimension, from the use of *Constructing a space* in a psychopedagogic diagnostic, is clearly detected for all the subjects.

We may conclude through the accounts of the evaluations done that *Constructing a space* is a software which helps in the process of emotional aspects involved in the learning process. In addition, the software is classified by the subjects as a projective software, being able of replacing formal tests that have the same purpose.

### Does the software facilitate the evaluation of the articulation among all the dimensions involved in the process of learning?

Analyzing the interviews (post-observation phase), the data signal that the subjects, from the evaluation group, perceive the application of the software as a resource for noticing the process as complex; i.e., in all its dimensions.

We highlight the use of the filing tools as one of the most important resource presented in this software. The subjects emphasized that from the use of these tools children may interact with their own thoughts and the therapist may observe the learning style applied. This process can be recorded by the software, what makes it unique.

### Evaluation of Tools and Suggestions for future modifications

Taking into account children's observations, we conclude that it would be necessary to implement some modifications in the design, interface and navigation of the software, such as:

- Delete, from the side toolbar, the *manipulation tool*. The idea is to make the actions performed by it in a direct mechanism of manipulation of the image on screen, becoming more flexible in relation to its on angulations and projection. The functions incorporated to

manipulation tools would be accessed by single-clicking on the mouse right button, opening a menu for selection of functions.

- Alter the images of the tool group Filing in a way to make them more intuitive.
- Make the colors used to discriminate the rooms in the ground-plans more vivid, the ground-plans clearer and the proportions more adequate.
- Create identification mechanisms for navigation in the rooms using the ground-plans so that children may visualize their own routes in the environment. This mechanism may present the objects and people from a top-bottom perspective.
- Modify the dialog Box to choose objects and characters, making it becomes iconic, categorizing the files using icons which go together with written material.
- Create mechanisms to Record the last actions automatically executed, avoiding missing files that contain the performed actions by children.

These modifications will make the software more efficient because the problems found would be repaired. Therefore, the tools become optimized and children's evaluation, more accurate.

The software *Constructing a space* was submitted to a first evaluation with psychopedagogues, presenting results that allowed us to conclude that, after the adjustments mentioned previously in this chapter, its application would be valid because its goals may be reached when used with children.

## Conclusions and Future works

*Constructing a space* was developed aiming at the observation of complex and dynamic processes and their registers. It is a computational resource which intends to clearly present, to the psychopegagogue, the way in which the rational, emotional and social dimensions interact among themselves while children perform a complex and dynamic activity.

From the software's assessment by psychopedagogues, we could confirm some of the hypotheses about the use of the software, for instance, the software is appropriate to what is proposed. However, we could also see that some modifications in the interface are necessary and improvements should be done in relation to the graphic data bank.

Due to lack of time, we could not test the software with children. Though, its application with children is essential for validating this computational resource. Therefore, we suggest, as future works, a deeper study with psychopedagogues and children from 8-11 years old while interacting with the software, exploring it in the course of a psicopedagogic diagnostic process.

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