

Improving the Awareness to Toddlers' Initial Emotional Experiences in Kindergarten with Virtual Reality

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Abstract

We used Virtual Reality (VR) technology to simulate a toddler's first few days' experiences in a daycare and improve the caregiver's understanding of their state of mind. The virtual worlds were developed in accordance with some well-known toddler's thinking modes, and emotional states. The aim of this study was to investigate whether the caregiver's awareness to the emotional experiences that the toddler undergoes in the first days in kindergarten improves through a VR simulation of a toddler's world. The participants in this study were 40 (female) caregivers who work with infants aged 6 months to 4 years old in private daycare. The findings indicate that experiencing a virtual world that reflects the real world of children improves, to some point, the caregiver's awareness to the emotional experiences that the toddler undergoes in her/his first days in a kindergarten or daycare.

Key words: Virtual Reality, toddler, day care, caregiver, kindergarten, emotional experience.

Introduction

The enrollment to a daycare for an infant aged 8 months to 2 years is a confusing experience. The infant's world expands. S/he must come to terms with a new environment and new people—the caregivers and other toddlers. The infant must adopt different behavioral patterns from those s/he is used to. His/her daily timetable changes and s/he must gradually learn to give up on previous habits. When the toddler enters a new environment—the kindergarten—s/he experiences a childhood crisis. S/he is steeped in anxiety, and struggles to understand or evaluate the new situation in which he finds himself. The toddler finds it hard to understand the new relationships with his social setting, struggles to formulate attitudes and aims, and shape appropriate behavior (Raviv & Katznelson, 1986).

The emotional competencies of the child are very different from those of an adult. These competencies affect the way the toddler cope with the new environment. Erickson (1950) describes eight stages in the emotional development of a child. The first stage is the development of trust and confidence. In this stage the child will express trust in his caregivers if his needs will be fulfilled, such as warmth, love, and nourishment. On the other hand, the child will express mistrust if those needs will not be provided. The level of trust depends on the maternal attitude that he will receive. The parents should represent for the child a deep belief that there is a meaning to what ever they are doing for him (Erickson 1950). While the parents leave the child with a caregiver he might have doubts that his needs will not be fulfilled. Therefore his trust diminishes and his adaptation to the new environment might be difficult.

The toddler's abilities to think and perceive are different from those of an adult, and they influence the way in which he will cope with adjusting to a new place. The toddler's world outlook is absolute. The infant mixes his "self" with the world, and only later does he distinguish between his private point of view and that of other individuals. The toddler believes that s/he is the center of everything that takes place, and that things always remain as s/he sees them (Piaget, 1967). Even when his thought progresses to the pre-operational stage (from 2 to 7 years), it is with difficulty that the toddler learns to see from someone else's viewpoint. His thought is concrete – things are as they seem from his direct and egocentric perception, and unsubstantial phenomena appear to him as tangible (dreams, thoughts) (Flavel, 1970).

Such patterns of perception make it difficult for the toddler to adjust to a new framework. He cannot understand why he must change his surroundings and move to a new place. He is focused on the things that he has found pleasure in and that have satisfied him so far, but now, with the move to a new framework, they are taken from him. He cannot relate to his parents' considerations that brought them to introduce this change into his life (Piaget 1967, Freiberg 1974).

The toddler's egocentricity leads to Magi-like thoughts. He believes that his wishes, his thoughts, and the words he emits from his mouth are the tools of his Magic like powers. He thinks that the actions he carries out have influence on other objects, and that he can change reality with a thought, word, or look. When the toddler is at the stage at which he believes that he is omnipotent, and that it is within his power to sway his influence over every object in his environment, his entrance into a new

framework shakes this belief: suddenly events are out of his control, he does not understand them, and he is not sure that his needs will be met; feelings of fear and anxiety are awoken in him.

The assumption at the basis of this study, therefore, is that the caregiver does not possess enough awareness of the influence that the separation from his parents has over his behavior at the beginning of the year in the kindergarten. By using three-dimensional Virtual Reality (VR) worlds that simulate emotional aspects unique to toddlers in their care, this study investigated whether it is possible to increase the caregiver's awareness to the toddler's emotional experiences in his first days at the kindergarten. To the best of our knowledge, this is the first time that VR technology has been used in training toddlers' caregivers, and in simulating the emotional experiences of toddlers.

Toddlers' VR Worlds

For this research, we have developed a virtual world that acted according to the rules of toddlers' emotional development, and simulated the toddler's world for the caregiver. Studies carried out in other fields have indicated that the use of simulations can help to improve comprehension in various areas (Postka 1995, Cass & Roblyer 1999).

For this study we designed 3D VR worlds in which we embedded cognitive elements from toddlers' experiences, based on Piaget's and Erikson's theories. The following is a description of the worlds with an ascription of the various images to the cognitive aspects they were based upon. These VR worlds can be accessed through the Internet with a free downloadable VR plugin (viscape viewer) at <http://faculty.biu.ac.il/~passig/vrprojects.html> (look for VR KINDERGARTEN).

1. Object Constancy

The caregiver enters a forest. Before her, she sees paths leading to further paths that lead to a house. After a few moments, different objects connected to the child's world start to fly past at speed. The objects swiftly and randomly approach and disappear. In the background, unclear sounds can be heard, interspersed with a number of clear words. From time to time, the user sees bodily parts approach him and then recede. The user moves, and sees everything from the height of a child. The participant has to reach the house. She is not given any instructions. She needs to experience it on her

own. If she finds herself unsuccessful, she must conclude that she needs to ask for assistance.

The appearing and disappearing objects and voices reflect the developmental element of object constancy, according to Piaget. Up until the age of 8 months, infants think that if a certain object disappears from sight then it no longer exists. Only when the infant is about one year old does s/he start to look for hidden objects, but even then s/he will look in the first place that the object was hidden. Only as the toddler reaches the age of two years old does s/he learn that objects that s/he cannot see still continue to exist (Flavel, 1970). As a result, the toddler feels a sense of instability, living as he does in a world in which objects and people appear and disappear, and it is not clear what is going on around him. He lives with a feeling that he lacks control over his environment (Freiberg, 1974). Searching for the house via the paths represents the way the infant experiences things and learns – by trial and error (Flavel, 1970).

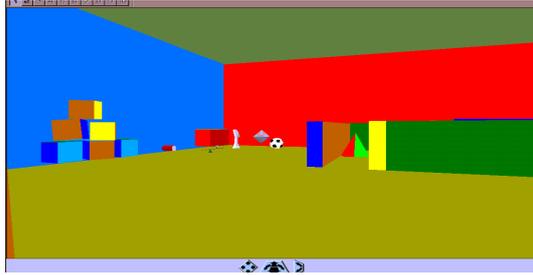
Figure 1: A picture from the virtual world – the house in the forest that the user must reach.



2. Trial and Error

Upon reaching the house, the participant enters a room. The room is a playroom in a kindergarten. Once more, the participant sees everything from the toddler's perspective. In the center of the room a maze appears. The participant must pass along all of the maze's paths until she reaches the exit. She must knock over the cones that she encounters along the way. Because of the change in perspective, each time the user touches a cone, it changes shape. This also relates to the element of spatial perspective (objects) – the child perceives the object differently from each angle. When the caregiver participant leaves the maze, she sees a door in front of her. She must touch the door, and move in to the next room. The attempt to find the way through the maze reflects the way the infant experiences things and learns – by trial and error (Flavel, 1970).

Figure 2: The maze in the virtual world's playroom as seen from outside



3. Spatial perspective – height & objects

The second room is designed like a playground. The participant can see a slide ahead of her. She is not given any instructions, and she must try to work out what to do alone, or ask for assistance. The participant must climb the ladder and slide down the slide. When she looks at the slide she can only see certain parts of the people and objects around her – she cannot see them in their entirety. After sliding down the slide, the participant will see big balls. She will struggle to catch them. The balls will roll away from her, until they disappear from her field of view, as if they no longer exist. After a number of attempts, a door will once more appear on the other side of the playground. The participant must touch the door and enter the next room. The participant caregiver's attempts at catching the elusive balls once more reflect the element of trial and error (Flavel, 1970). The rolling balls, escaping and disappearing from the user's field of vision, represent the developmental element of object constancy.

Figure 3: Part of the slide's ladder in the playground in the virtual world – view from below.



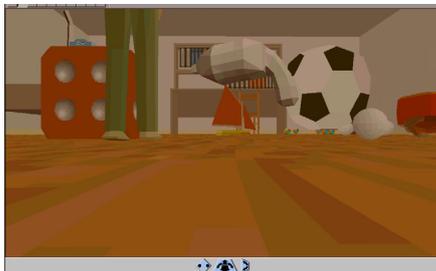
4. Imagination and Reality

In the third room, the participant can see a rug with toys on it, a vacuum cleaner and a drill. For the whole length of this room's experience, the sound of the drill can be heard. The caregiver looks around her and sees the drill in action, rotating, making an

exaggerated noise, and making enormous holes. When the drill ceases to work, the vacuum cleaner comes on. At this moment its dimensions enlarge and expand, it makes noise, and sucks up every object in its path.

This experience represents the toddler's inability to fully distinguish between imagination and reality. According to Piaget, the infant tends to attribute magic importance to his/her thoughts. The infant thinks s/he can change reality with a word or a look. He also attributes human characteristics to inanimate objects: the vacuum cleaner, for instance, can "eat" everything – objects and people (Piaget, 1967).

Figure 4: the drill in action in the virtual world's third room.



5. Egocentricity

While experiencing the virtual world, the participant wears a Head Mounted Display (HMD) and enters another world – the world of children. Throughout the experience, an effort is made to give the user the feeling that she is the center of this virtual world—everything happens around her. She is required to activate the virtual world, otherwise, nothing happens; there are no people there other than her; everything happens only to her and not to anyone else. The participant does not receive a description of what will happen to her during the experiment, but only a general explanation, and that in order to create a feeling of expectation, curiosity, and impatience to reach the next stage. This represents the infant's egocentricity. According to Piaget, the toddler feels as if everything that happens is centered around him, and that s/he is at the center of the world. S/he cannot see from another's point of view, and finds it hard to delay satisfaction (Piaget, 1967).

During the procedure we did not provide any instructions as to how act within the rooms. The user was asked to manage by herself or reach the conclusion that she needs to ask for assistance. This aimed at demonstrating the dependency feeling of a toddler to his caregiver (Erickson 1950).

Participants

Our sample included 40 caregivers. The term “caregiver” relates to baby-minders who work with infants aged 6 months to 4 years old in different private frameworks such as crèches, or kindergartens under the supervision of the Ministry of Education.

Table 1: The sample of participants

Age	20-28 = 30%	20-41 = 35%	42-58 = 35%	Total = 40
Education	15% did not finish high school	35% completed 12 years of K12 education	47.5% received 13-17 years of education	2.5% did not respond

Research Design

After the VR worlds had been built, and after the participants had consented to participate, the researchers scheduled personal meetings with each one of them at their convenience. The meetings usually took place in the afternoon hours, when the caregiver had finished work for the day. Two to four caregivers participated in each meeting, each of which lasted between 2-3 hours. The researchers brought the hardware and software needed to run the virtual worlds to the kindergartens in which the participants worked.

Pre-Experiment Questionnaire

Each participant received a short written explanation of what was about to happen in the meeting. Each caregiver was interviewed (questions 1-4 in table 2), and was asked about her opinions as to ways in which infants cope with their entrance into a new environment, and their reactions to it. Through the interview, the caregiver’s level of awareness as to the effect of the toddler’s separation from his parents on his behavior before intervention was also tested.

Table 2: Interview before experiencing the virtual worlds

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1. What situations, in your opinion, can cause a child to be irritable, and not calm?
 2. A child is not without his comfort blanket and dummy for a week at the beginning of the term. How would you react? Why?
 3. A child chooses to sleep all the time. What would you do? Why?
 4. About a month after the beginning of the year, a child still regularly bursts out crying. What should be done? Why?
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In addition the caregivers were asked to fill in a questionnaire (table 3) in which they were asked to react to a variety of behavioral situations, which might express various emotional states.

Table 3: Questionnaire before experiencing the virtual worlds

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5. A child is constantly crying and is not calm. How would you react?
 6. A child is attached to his comfort blanket, which he brought from home for a whole month. Should you react? What should you do? Why is he acting like that?
 7. A child chooses to sleep during the activity time. Should you react? What should you do?
 8. A child starts crying whenever you approach him. What should be done? Why is he like this?
 9. A child doesn't want to let go his bottle. What should be done in your opinion in the kindergarten and at home?
 10. A child is sitting aside watching the activity. S/he looks serious. Should you bother and react? If yeas, how?
 11. A child throws objects to all directions. What should you do? Why is he behaving like this?
 12. A child prefers to play alone and does not want to join other classmates. Should you react? If yes, how?
 13. A child follows one of the caregivers, and doesn't want to be without her presence. What should be done?
 14. A child hits and bites his classmates. Should you react and how?
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Virtual Experience

After completing the questionnaire, the researchers explained to the caregiver that she is about to enter a child's world. She must put on the Head Mounted Display (HMD), and adjust the lens. It is made clear to the caregiver that no explanations or instructions will be given during the experiment, and that if she wants to know what to do, she must ask for assistance (figure 5).



Figure 5: A participant wearing the Head Mounted Display and using the joystick whilst experiencing the virtual world.

Each experience lasted about ten minutes. Many of the caregivers struggled to get by in the virtual world using the joystick. Very few asked for help, even when they did not know what to do in each room in the virtual world. We had to remind them that they could ask for help. With the researchers' verbal help, the participants succeeded in finishing the experience. The caregiver's need to ask for external help during the experiment in order to get by in the virtual world gave her a real feeling of helplessness, frustration and the need for help in a new place.

Post-Experiment Questionnaire

After the experiment, the caregivers were interviewed. They were asked about their feelings during and following their experience. In addition, the caregiver was asked to respond to the following question: Following your experience in a simulated

emotional world of a toddler, what would be your attitude to a new child attending your kindergarten?

Since no appropriate questionnaires could be found in the literature, we prepared the questionnaires for this research. These questionnaires were compiled with the help of child and technology experts. Those experts deemed the questionnaires suitable for checking the aims of the research.

Results

We assumed that caregivers are not aware sufficiently to the difficulties a child goes through the separation from his parents in his first days at the kindergarten. We also assumed that caregivers are not aware to the effect that the toddler's emotional development has over the process of separation. This assumption was tested and confirmed in the post-experiment interview.

Each caregiver was asked seven questions that allowed her to attribute the child's behavior to his separation from his parents (questions 4, 6, 8, 11-14).

From the answers we received, the caregivers addressed the separation issue in only three out of the seven questions (questions 1, 4, 8).

1. 23 out of the 40 respondents (57.5%) related to the issue of separation once or twice in one of those three questions.
2. 17 respondents (42.5%) did not refer once to the issue of separation at all.

In the other four questions (questions 2, 3, 6, 11) just one of the respondents suggested that the issue of separation might be a possible reason for the child's behavior.

The questionnaire and interview that were carried out before the caregivers' experience in the virtual world confirmed the assumption that their awareness of the emotional experiences that the toddlers undergo during their first days in the kindergarten was indeed low.

Emotional awareness

The assumption regarding the caregiver's awareness to the emotional state of the child was tested with 10 questions (table 3), which examined the emotional situations in the kindergarten. The participants in this study were asked to note how would they react

in each situation. They were presented with the same situations before and after the VR experience.

Forty-seven statements were collected from their answers, which have been divided into 3 categories: cognitive, emotional (negative & positive), and treatment like (table 4).

Table 4: Statements by categories

CATEGORIES	STATEMENTS
Treatment like elements	To leave/enable him, let be attentive, check the diaper, check fatigue, check hunger/thirst, fix together, draw a line, stop, give a candy, reward, wash face, suggest a drink, give pacifier, check health, take object.
Emotional elements: Positive	To hug, kiss, caress, sitting with the child, carry, give attention, acustom, provide warmth and love, teach to be independent, the child will get closer, to calm, provide positive feedback.
Negative	To send away, hit back, to be angry, to cause to feel jealousy.
Cognitive elements	To play with, share, convince, explain, clarify reasons, discuss with parents, talk to child, to motivate, bring kids closer, assign a role, transfer an activity to a game. make laugh, help, story telling.

While analyzing the results we didn't find significant difference in the caregivers' answers before and after the VR experience. The differences before and after the experience weren't significant (table 5).

Table 5. Differences in cognitive, emotional and treatment elements before and after the VR experience (n=40)

	Emotional elements		Cognitive elements		Treatment elements	
	Average %	Deviation	Average %	Deviation	Average %	Deviation
Pre VR experience	21.3	9.4	47.8	13.6	30.8	12.8
Post VR experience	22.2	9.5	46.8	12.0	30.9	11.7

An additional way to test this assumption was through the direct question, which has been asked following the VR experience: what would be your attitude to a new child attending your kindergarten now that you have experienced the VR worlds?

The answers of the 40 participants indicate that:

25 of them (62.5%) reported some type of change in their attitude towards a new child attending kindergarten. This result was found to be significant $t=(8.0, 39)$, $p< 0.001$

12 out of these 25 (48%) pointed to changes that correspond to emotional aspects (3 of them related to just emotional aspects and 9 to both emotional and cognitive aspects).

This assumption was fortified by the direct question. Meaning that the VR experience improved the awareness of the caregivers to the toddlers' emotional experiences in the first days in kindergarten.

Discussion

The correlation between the caregiver's education and the personal maturity of the toddler is not new to the literature (Kontos 1992). Nor is it new to say that training has a positive influence on the caregiver's behavior, and the quality of her teaching (Henry 1996).

However, generally speaking, a large percentage of caregivers in day nurseries have received no pedagogic training. A small minority of them has received minimal training to work with infants, while those who have received training tend to undertake management, supervisory or training positions (Levin 1993). Furthermore, the worker turnover rate in care-giving institutions is higher than in other educational frameworks.

According to a recent report, the situation, at least in Israel, is dire (Yanay 1992). One can count many reasons for this gloomy situation. The most important reasons are the chronic shortage of manpower, unattractive salaries, and the expenses of in service training (Spodec, Saracho & Davis, 1991).

The purpose of this research was to test whether using advanced technologies such as Virtual Reality to train caregivers would make an impression on the caregiver, and influence her future behavior with toddlers. The research aimed to test whether a very small investment in time (10 minutes in the toddler's virtual world) would produce significant training results for the caregivers.

To the best of our knowledge, this is the first research project to report positive results for such a hypothesis. Many other studies have proved the effectiveness of Virtual Reality in other training situations, but our review of the literature did not reveal any use of VR with cognitive and emotional aspects related to toddlers.

The findings indicate that experiencing a virtual world, which simulates the real world of children, improves to some extent the caregiver's awareness to the emotional

experiences that the toddler undergoes in her/his first days in a kindergarten or daycare. A significant improvement was found according to the direct question in the interview. 62.5% of the caregivers pointed out some change. The reason to the improvement might be part of the Virtual Reality nature, which is based on simulation (Heim, 1993). Studies indicate that using simulation helped the participants understand other feelings of other people. Richstein (1985) found that students who experience simulation of a mild degree of hearing loss, understood better the way that a hearing impaired person feels. Maynes, McIntosh & Mappin (1997) reported that students who were trained as school's principals with video simulation became more identified with the character. On the other hand, perhaps the nature of the question—a direct one—created a kind of social desire, which can be the reason for the improvement.

Over all, the main research assumption was rejected after analyzing the questionnaire (see table 1). One reason might have been that the participants needed more time with the VR worlds. Another reason could have been that the participants needed a few days break to internalize and reflect on their experience.

Conclusion

The results of this research are by no means final, since without VR we would have had no means at all of getting the material across to the caregivers, apart from the conventional, lengthy, wearisome and expensive way – with words. This type of research opens a new path into uncharted territories—worlds that we could not easily and quickly touch and demonstrate. As opposed to other research projects using Virtual Reality, this research did not simulate situations or worlds familiar to us, but rather created abstract scenarios from a human brain, and tested the efficiency of another person's interaction with it. In particular, this research offers tools and hope for educators that they may be able to understand what is happening in the worlds of those children under their responsibility.

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