MEASURING EMPATHY TO SUPPORT LEARNING DESIGN AND NARRATIVE GAME: A PHENOMENOLOGICAL APPROACH

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Abstract

This work is the first step of a research aimed at the creation of instruments for empathy measurement in the learning - teaching process. In this context, the present article contributes to investigation towards the phenomenological approach to empathy concept (spatial theory of empathy[1]) and to the relationship between empathy and learning. The paper documents the choices made in the design stage of a narrative game aimed at measuring the competence of empathy.
Assessment of empathy is a necessary step in a wide investigation path that could be especially useful in the design of innovative and adaptive learning experiences with a view to an ATI approach

Keywords: narrative game, empathy, learning engagement, empathetic embodiment, phenomenological approach;

I. INTRODUCTION

The correlation between cognition and affect has a significant impact on student's involvement in learning experience. The empathic dimension is a particular instructional element that may improve learning interaction and can encourage and motivate students to achieve better results [2].

Empathy is an important instructional element that can increase students' interests and self-efficiency. According to Davis empathy is *the process of putting oneself in the place of another person, seeing matters from the other's perspective, perceiving the other's feelings and person.*[2].

Empathy is part of the epistemology of knowledge based on action and the feedback of the action, where the allocation of meanings (construction of knowledge) is determined by the ability to empathize - resonance with each other - through action (consensual) in the shared environment. This functional process is embodied, made available by neural mechanisms. In this light, the subject perceives the world and categorizes in relation to the possibility of acting in it and adapt to it.

The article presents a specific theoretical scenario which refers to the spatial theory of empathy proposed by Alain Berthoz [1]. The work goes on with the summary of perspectives on the relationship between empathy and learning, with a specific focus on learning-oriented interactive narrative resources (narrative games, visual novels) and adaptive instruction, and then documents the choices made in the design stage of a educational playful environment aimed at measuring the competence of empathy on the basis of the theory described above. Finally the work discusses the successive stages of the work and future prospects.

II. BACKGROUND

There is not an agreed and unique definition of empathy, consequently there are not absolute indicators to measure the empathy level.

The measurement of empathy and its development has had lengthy and very difficult story.

There are, however, two terms present in almost all definitions of empathy: affective and cognitive

Generally the term empathy is used to define an affective response congruent with that of another's emotional state, and cognitive empathy define the ability to understand intellectually the perspective of another person and so understand another's emotional state.

It is possible to distinguish different measurement techniques of empathy by focusing on aspects that they consider: cognitive [3], affective [4] and multidimensional [5].

In recent years has been increased the integration of these two traditional research. Davis developed an individual difference measure of empathy (Interpersonal Reactivity Index-IRI) based on such a multidimensional approach [5].

Instead of treating empathy as a single unipolar construct, the multidimensional IRI approach considers empathy as a set of connected constructs. The 28 item IRI is a self report measure consisting of four 7-item subscales (Fantasy-empathy,

Perspective taking, Empathic concern and Personal distress), each tapping some aspect of the global concept of empathy.

Empathy definition adopted in this study does not want to include numerous variations of empathy concept, but focuses on one of the fundamental mechanisms of the empathic process: the handling of spatial reference frames.

Alain Berthoz proposed a spatial theory of empathy, based on the ability we have to manipulate the point of view. According to Berthoz, "*Empathy is also important for social relation and to guess the opinions of others. Finally, it is essential to rational thinking, because it allows to examine the facts and arguments from different points of view. This mental operation assumes that you accomplish a sort of mental rotation on themselves, in relation to the environment, or an object environment, maintaining a main perspective environment in question*" [6]

"In relation to a modern conception of the philosophical tradition of phenomenology and a primary role of cognitive Embodiment" Berthoz showed "that there is a basic difference between sympathy and empathy. While sympathy is akin to an emotional contagion and does not require the subject to adopt the point of view of others, empathy requires a dynamic and complex manipulation of spatial reference systems". [7].

Based on the philosophical distinction between sympathy and empathy, made by Gérard Jorland in "*L'Empathie, histoire d'un concept*" [8], Berthoz states that neural mechanism underlying the handling of spatial reference systems is the central point of the difference between these two modes of intersubjective relationship [1]

Adopting this approach, empathy is a way that allows us to entering in relations with the other without attributing to ourselves "what the other is experiencing", rather entering the body of another and seeing the world from this perspective. The German philosophy, the first to adopt this version at the end of 19° century, used the term "Einfühlung", literally to "feel (fühlen) into (ein)" [9]

In *Einfühlung*, the prefix *ein* refers to a spatial process of mental simulation by which we project ourselves into the other (to feel *into*), i.e., imagine ourselves to be located (spatial aspect) in the other's body. On the other hand, the radical *fühlen* refers to a subjective sensory and/or emotional experience (*to feel* into). Hence, this grammatical structure suggests a reciprocal and dynamic interaction between simultaneously experiencing the other (I am feeling into the *other*) and oneself (*I am feeling* into the other)*[7]*.

According to a phenomenological approach, "empathy is a much more complex mechanism than sympathy. Therefore, empathy requires a "perspective change" and some form of "out of body experience" to separate ourselves mentally from our own body and travel into the other's body with our "second self" or mental "double," [10] or "doppelgänger" [11]

In Berthoz view, such approach represent a reversal than many research in neuroscientific field that "*addressed the question of the neural basis of sympathy and emotion via emotional contagion and resonance and do not address the complex dynamic mechanisms of empathy*". [7].

In neuroscience, the interest in relating to others was prompted by the discovery – and interpretation – of "mirror neurons" in the ventral premotor cortex (area F5) and inferior parietal lobule of the macaque brain which fire both when the macaque performs an action – such as grasping a peanut – and when it observes the same action being performed by another individual (e.g., the experimenter; [12, 13]. Empathy was re-theorized when studies using functional magnetic resonance imagery (fMRI) pointed out the existence of multiple putative mirror systems in humans revealing that specific areas in the human brain are activated by the processing of the own but also the other's emotion, intention, sensation or action. "This direct matching may underpin a direct form of action understanding by exploiting simulation, a specific mechanism by means of which the brain/body system models its interaction with the world" [14].

In the hypothesis developed at the Collège de France, four processes at the basis of empathic intersubjective relationships are identified

1. To construct a coherent perception of our body and its relationship to the environment
2. To resonate with the other's emotions and perceptions as we do in sympathy
3. To change our own perspective or viewpoint and mentally move our body and brain into the other's body and brain ("*Einfühlung*").
4. Most importantly, to be able to free *ourselves from these two egocentric and hetero-centric views* (our own and the other's) and adopt a true *allo-centric* perspective allowing us to free ourselves from the experience of the other's emotion, i.e., inhibit the emotional contagion[7].

Berthoz hypothesis is that these processes require the contribution, albeit not exclusive, of different brain mechanisms involved in spatial perception, in mental manipulation of the reference systems and in perspective changing. Empathy problem is not reducible to spatial information management and recruitment position of others in the space. The central problem is being at the same time themselves and the other. This cannot be reduced simply to the mirror neuron system, does not affect the ability to simulate the action, experience or the others emotion, but concerns the ability to change the point of view while remaining ourselves.

III. RELATED WORK

Narrative games technologies bear considerable potential for science education. Empathy and gaming sign the development of new forms of narrative learning, namely "storytelling game" or "visual novel". These are recognized in the scientific literature as a form of competitive storytelling in the context of gameplay. Narration is a "privileged instrument for developing cognitive skills and organizing knowledge, supporting process of meaning construction" [15]. As observed by Bruner [16], "*the narrative in all its forms is a dialectic between expectations and events*" (p. 15), and "*a call for problems, not a lesson on how to solve them*" (p. 20). In

the absence of narrative, learning environments can be unfocused and inconclusive. The use of narrative in learning processes can be exciting and stimulating curiosity and imagination, which are essential components of intrinsic motivation. The narrative experience can provide essential guidance for effective exploratory learning and the "affective scaffolding" for achieving high levels of motivation and engagement. Research in education pays much attention to the design of storytelling resources, enabling learners to interesting experience and engaging narratives. Storytelling game aims at the development of interactive fiction game sessions functional to the efficient transmission of narrative experience characterized by its capability to support high-level knowledge processes in continuous engaging thanks to a new form of competitive learning. Visual novel is carried out through a "quest", namely "call for adventure" on themes to be investigated: the user has the chance to perform different types of actions (e.g. talking, looking, interacting) in order to foster the achievement of a goal beforehand defined.

In academia, researchers argued that an interactive story can indeed be highly engaging to game players, leading to what Dow [17] referred to as the "*embodied narrative engagement*". Storytelling and gaming technology provide excellent chances to teach knowledge, skill and behaviors in compelling and engaging manner. Literature [18] focuses on narrative experience and recently studies analyze the potential storytelling game approaches to encourage students to learn and achieve specific learning objectives [19]. *Suspend Me* and *The TimeMage* [20]are two examples of storytelling game in the civil and emergency education. "The TimeMage" playing allows the participant to virtually experience solving problems during a hospital stay in person, which provides the participant with an opportunity to experience self efficacy.
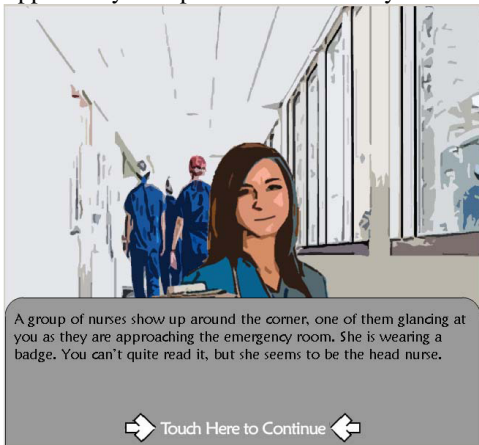

A group of nurses show up around the corner, one of them glancing at you as they are approaching the emergency room. She is wearing a badge. You can't quite read it, but she seems to be the head nurse.

→ Touch Here to Continue ←

Figure 1TimeMage (Yin et al., 2012)

In *Suspend Me*, players compete to control a story in which they create and maintain suspense by constantly creating danger and by saving the characters from this danger. The winner is the player who is able to resolve the problems, while also maintaining narrative tension .

In terms of research on storytelling game there is innovative work about the design of game mechanics that increase the dramatic dimension of game, creating narratively engagement in the story.

Interactive Storytelling concepts provide the chance to increase players excitement and immersion by using *dramaturgic concepts* (plot, situations, events, transformations), and *empathic characters* obtaining a more immersive learning experience and a higher state of locus *of control* and *sense of presence* [21] in the story. The strong effect of *empathy* in the narrative game may have important implications for learning. Psychologists describe this phenomenon as *narrative transportation*, where learners report feelings of being transported into a story and becoming involved with its characters.

In particular, the correlation between empathy (cognitive and affective) and narrative in educational contexts, like for instance "emergency" and "civil engagement", it has been acknowledged. Given the central role of empathy in education, it was hypothesized that empathetic characters could increase student perception of presence in narrative-centered learning environments. For example, *FearNot!*, is a narrative game developed for addressing bullying problems in school using an interactive virtual storytelling environment, in which empathy is at the center of the interaction between learners and characters [22].

Figure 2. FearNot! empathetic story game (Paiva et al, 2005)

In bullying situations there are two principal identifiable roles: the *bully* and the *victim*, and short dialogue takes place between the two, The learner takes the role of a friend that gives opinion and suggestions for future behavior.

Figure 3 - . FearNot!Interaction between victim and learner's character (Paiva et al, 2005

The dialogue established between the learner and the victim character is based on a set of patterns of response to bullying situations and each dialogue finishes with a decision that influences the character's behavior in future episodes [22].

Empathy is an educational element that is fundamental mainly with respect to those learning experiences having as goal both making the students learn some specific concepts and supporting the development/improvement of specific *taking abilities* [23].

There are known motivational benefits of empathy in the story game situation on the effectiveness of learning. The effect of empathetic characters on the "presence" and learning process in narrative game environments, suggest that designers of narrative-centered learning environments, that seek to increase the students' *sense of presence*, should consider introducing empathetic characters. Having characters that respond to student affect may give the student a greater sense of control over the environment by regulating how they feel. Thus, empathetic characters may be able to scaffold student experiences to support regulation of emotions that benefit learning. From our point of view, the perspective of empathetic characters is only one of the possible variables to consider in order to create narrative experiences able to support and improve the level of empathy student steeped in history. Instead of adopting an approach to predetermine a set of scripts to be used for empathetic character in a story, we need to identify a measure of individual empathy level and on this basis, try to dynamically adapt the narration with empathetic scaffolds, which may be new characters, or appropriate emotional prompts, new roles, or new "views" to be proposed to the student in order to increase his degree of empathy with the educational story. Our approach starts from the need to take a step forward compared to the models of adaptive learning, trying to understand how to assess empathy in order to intervene in the educational process by adapting the narrative game to the students characteristics. This approach is known as Aptitude-Treatment Interactions (ATI) [24] because it requires the identification of those that are the distinctive characteristics of a learner (or rather its attitudes) and use them to review the instructional design by selecting the most suitable strategies to facilitate the individual learning process.

We need to find a yardstick to measure what Gee [25] defines *empathetic embodiment*, functional to narrative transportation of students.

Empathetic embodiment is a process of being (narratively, interactively, perceptually) immersed within a context. A continuous measurement of student empathy level could allow to identify personal learning path to sustain individual empathy [26].

It is necessary to identify an empathy assessment methodology to direct "*empathetic exchanges*", a variety of factors which may serve to improve the learning experience by acting directly on the narrative structure.

IV. THE GAME-MEASURING EMPATHY IN EDUCATION

This work aims to measure the ability of learners to take the point of view of other subjects.

In this context, this paper intends to present the guidelines underlying the development of a narrative game designed with the purpose of measuring the ability to take the perspective of others[27, 28].

It is necessary to remember that the mechanisms under investigation represent an area partially explored, not only in learning but also, in a wider sense, in the field of neuroscience. Berthoz & Thirioux underline that "*neuropsychologists have already revealed different networks for body space, reaching space, near locomotor space as well as far environmental space, which was confirmed by modern fMRI studies (WEISS et al. 2000).Therefore, our hypothesis is that empathy involves different networks depending upon the distance at which the other is located. This aspect has been completely ignored until now*"[7].

We can establish further that studies that analyze this problem in the digital environment are still few. This appear more interesting, remembering that:

- many videogame take the first person perspective wiev as dominant perspective (FPC – First Person Camera), but at the same time allow to change perspective (TPC –Thirdh Person Camera); switching between different perspectives is considered effective among gamers.
- massive expansion of natural interfaces in videogames (based on devices such as, for example, Wiimote or Kinect) contributed to redefine space concept, making "sensitive" the space of the gamer.[29]

The hypothesis that this type of study is also valid in a virtual environment is evidenced experimentally by Berthoz: "*We designed a behavioral study in which participants interacted spontaneously with a life-sized virtual tightrope walker walking forward, backward and leaning to her left or right on a rope. Here, we report results showing that participants automatically embodied the avatar's leaning movements. Moreover, the form of the participants' motor behavior (i.e., automatic leaning movements to their right and left when the tightrope walker was leaning to her own right and left, respectively) revealed that participants, using mental imagery, located spontaneously themselves in the avatar body position, suggesting that they embodied the avatar's visuo-spatial perspective. in the avatar's body position to take its visuo-spatial perspective, suggesting that embodiment process is not necessarily exhibited by a physically mirroring body posture..*" [30]

On this basis, an edu-game aimed at measuring empathy is under development. The game is the digital edition of a classical Piagetian task: the three mountain problem."An experimental test is offered by Piaget: starting from a drawing that represents a person who is photographing three pyramids, we ask the child how the photograph will be seen.

'The photo will be a, b, c, d, or e?' (See Figure above).

Bearing in mind the position of the photographer, the choice should fall on the figure 'c'. This is the position of one who is capable of being in spatial situations other than those who look only centrally and a child, however, still immersed in an egocentric point of view, finds it difficult to choose a figure out of his narrow point of view. Exit from self, then, is to be able to see the reality (not only spatial, but also a mental, linguistic or otherwise) from several points of view" [31].
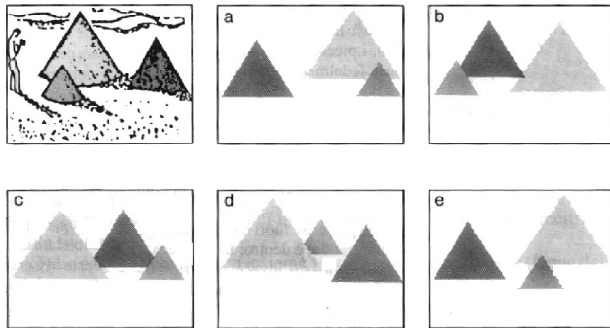

Figure 4 – The Piagetian Task (Trisciuzzi & Zappaterra, 2011)

The software developed so far requires the user to navigate in a three dimensional environment. Different 3D environments have been built and populated with different characters. For each environment, two global (allocentric) views are provided, from which it is possible to infer the position of the characters and some objects of reference, and the (egocentric) points of view of various characters. The software shows to users the global allocentric views, then shows the egocentric points of view of the characters and asks the children to connect the points of view to the characters which they belong.

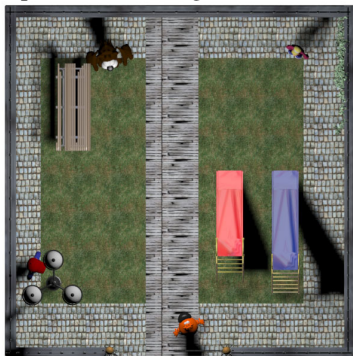The figures below show one of the environments developed from the global point of view (Fig 1, 2).

Figure 5 - Global scene

Figure 6 - Characters

Figure 7 - Global scene (another point of view)

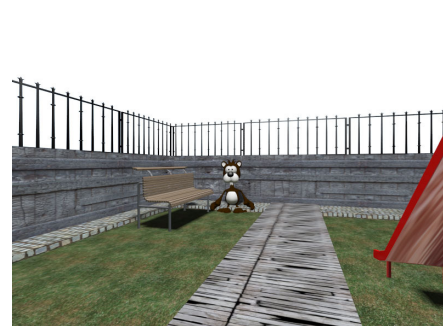Figures 8and 9show the point of view of some characters.

Figure 8Orange Bear Point of view

Figure 9- Red-Hat-Guy Point of view

In all environments there are objects distributed in order to represent a point of reference.

Currently, a first release of the game is in alpha-testing. The next version is going to include:

- the introduction of character animation, in order to verify the ability to locate the point of view of a character before and after movements;
- the introduction of objects to rotate, in order to verify the ability of mental rotation.

V.   FUTURE WORKS

As mentioned above, the objective of the pilot study is produce a tool that measures the ability of *perspective-taking*. The current phase of the project has led to the creation of a

narrative game still under alpha-testing. After the alpha-testing stage, the serious game will be tested whit students.

The research aims to explore a promising way to investigate the different sorts of inter-subjectivity in relation to learning process.The assessment of empathic ability is, in this direction, a necessary step in a broadest path of investigation that adopts a specific approach to the empathy concept and to the relationship between empathy and learning. This approach could be particularly useful in the design of embodied interfaces of digital objects for learning purposes, with particular reference to user interface design in the field of e-learning.

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