# Learning generalization in virtual environments: a revision of the theoretical principles from a cognitive perspective

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## Abstract

Virtual environments have proven useful (have shown their utility) for process of the optimization academic learning.  Equally, it is proved that in these virtual reality environments, the apprentice uses learned processes at physical reality.

This Generalization Learning Process is explained by the cognitive learning theories. The goal of this work is to review these theories, articulating them in an ordered and organised way.  Thus an overview of the learning processes in real and virtual environments is provided, and how these learning are widespread in one environment or another, and the theoretical reasons that support this fact.

As conclusion it set out that this learning transfer is due to the presence of common contextual elements in both environments. This phenomenon is possible thanks to the existence of a symbolic language.


Keywords: virtual learning environments, learning theories, learning generalization

## Introduction


New technological resources have brought a new dimension to the formative process by breaking the space-temporal barriers. One context mediated by the technological items which has meant, not

only, to consider the same concept of what is means to learn, but also the same process by which the learning are generated like interaction products among the participants. New demands make new learning approaches appear which add, a little more if this is possible, a complexity grade to the teaching-learning processes. Learning, as a social process, improves to the person, interrogates it, situates it in front of the people who surrounds him and about himself, at the same time that it lets the development and the learning of people and organizations. Communication is established, thus, the central act of human life (Cortese, 2004).

Beginning with this framework, we considerate the learning cannot be understood from a social and shared perspective, without analyzing the relation ways among the participants, in a situation of network collaboration, classroom or virtual. Understanding both processes is essential to understanding how knowledge in group processes or institutional networks is generated.

The next paper could be considered an academic essay about the learning theories from the Cognitive Psychology perspective, theories that can explain how people learn in virtual reality. This is an essay to the extent that it is to provide a general overview of proven psychologies theories, some proposals and even personal opinions. Behind this exposition, it is underneath the desire to understand how the physical reality and virtual reality are bound by learning process, apparently with common characteristics. In this sense, this paper also tries to encourage the reflection about the explanatory power of cognitive theories of learning in virtual reality, and encouraging a possible debate about the needed or not a paradigm change.

Firstly, it is necessary to establish a definition of what is Virtual Reality. In this sense, we have to define a common framework of understanding. Although there are several definitions of Virtual Reality, however, it is possible to conclude this concept refers a digital representation of a system which is able to stimulate the person to have the feeling of being in a representation system or in an original system.

Meanwhile, Virtual Worlds (VW) can be understood as the result of representing in Virtual Reality (VR) a complex virtual system. That is to say, a VW is a digital space which represents a real or imagined system. In this sense, the VW is a simulation. On the other hand, and

behind this perspective, the VW have a social character. It means the platforms where the VW are implemented, are mainly multiuser.

Following this conceptual line, you get the idea of Multiuser Virtual Environment (MVE) which is not another thing that, as Imperator tells (2009), spaces of high simulation level, interaction, creation and achievement.

In this way, this work field involve to establish a deal about three basic concepts: Virtual Reality, Virtual World and Multiuser Virtual Environments.

## Learning in Virtual Worlds

VW have been linked with learning from the beginning of their development.  In this sense, it may be recalled that Second Life (SL), one of the most widespread virtual world, it developed the VR platform Teen Grid. This VW is designed specifically for education, and it is mainly designers for teenagers. In the same sense, SL claims to have over 300 college institutions subscribed to its service. Therefore, Education and VW have a close relationship for some time.

Usually, studies in VW and Education show that generate learning in digital environments, It should appear at least three elements:

[1] Social Presence: that is to say, to perceive oneself and to be perceived in the social context inside the virtualized environment. In this sense, the presentiality in 3 dimensions surpasses the limitations which can sometimes experiment in distance learning.

[2] Cognitive presence: It can be understood as the need for knowledge building really occurring in the virtual environment.

[3] Interaction: whose action is necessary, but not enough to ensure genuine educational action.

We agree with García (2003) when he considers culture is primarily social mediation for incorporating significant action schemes for the reference group, so it is very important to takt into accounts the communication systems and the communication innovation, in the framework of a globalized and technological context.

Regarding the interaction emphasises the "affordance" idea which comes from Ecology (Gibson, 1979), and it has been applied in the last decade to technology in education (Kirschner, 2002). This term,

(that has not direct translation to Spanish), applied to technology in education, tries to explain the ability of a (technological or technological environment) device is able to promote the development of a previously learned behavior.

This concept is strongly related to some theories of Cognitive Psychology, as it will be seen below, explain the process of deployment of specific behaviors from the interaction that the person establishes with its environment.

To sum up, the studies reviewed show that VW are efficient learning tools, moreover, there seems to be an agreement that in the VW the teaching roles are similar to the roles experienced in physical reality.

**Psycho-cognitive learning theories**

Within the theoretical foundations that cognitive psychology offers to explain the learning process, there are some proposals that can be successfully applied to learning in VW. However, these same theoretical approaches do not close all the explanatory possibilities, pushing the proposal of new issues and questions of interest.

A wide range of theories that can be argued to explain learning in VW. Perhaps the most mentioned is constructivism (Wang and Burton, 2012), and together with constructivism, we will quote the schema theory (De Vega, 1984).

Constructivist theory analyzes the process of learning from a more social level. It tries to explain how people learn as a social individual. We understand that the learning process is by nature a communicative process (Strittmater and others, 1996), social interaction (Titone, 1986; Estebaranz, 1999) in which the message refers not only to theoretical and practical knowledge, but also feelings , attitudes, values,.., and nowadays it develops face to face and virtually, mediated by technological gadgets, which increasingly resemble the virtual world with the real world .

Meanwhile, Schema Theory offers a more personalized perspective, focusing on how the person internally manages its knowledge. In this sense, constructivism has a social perspective and Schema Theory a vision more individual.

1.1 Constructivism

Constructivism, whose origin can be placed on the theories of Jean Piaget (1896-1980) and George Kelly (1905-1967) along with the contributions of endless thinkers, researchers and authors (look up Raskin, 2002). It has marked several generations of educators and researchers of Education through the consequences of their proposals and the scope thereof. It maintains that learning is a constructing meaning processes , that makes sense based on the personal experience of the person who learn (Merriam, Caffarella and Baumgartner, 2007). The hue is in the extent that the context influences the learning process.

The potential of this theory to explain learning in virtual environments has been addressed in several investigations (Seitzinger, 2006; Hargis, 2008). In general, these studies conclude that constructivism is effective explaining the process of learning in virtual environments, as well as e-learning and distance learning.

In the light of the constructivist theory, knowledge acquired by the person is the result of social interaction. When the person talks to others, debates, listens to the opinions of others, assumes reviews and comments.., The person qualifies, refines and shapes that knowledge which is integrated into the knowledge body of the same person.

This general process, efficiently analyzed by constructivism, has been tempered by some theories derived from the constructivist perspective itself. Between these derived theories we can find the communal constructivism.

The communal constructivism indicates that people in a virtual environment, like virtual reality or the Internet, develop concepts, create information, provide procedures, express emotions and attitudes, etc.. These "artifacts" or knowledge items are dumped to society, so that the amount of knowledge of the same social group, is increasing gradually thanks to these contributions. Recent studies conclude that communal constructivism is an effective theory to understand the range of "affordance" featuring, for example, SL (Girvan and Savage, 2010).


1.2. Schema Theory

Schemes can be understood as specific ways of organizing experiences and knowledge people have been acquiring (Bartlett, 1932), in this knowledge organization supports the idea of system.  A

form of high-level thinking. As well, schemes would be formed in turn by smaller units, which may be nodes of information or even simpler sub-schemes.

Schemes are the result of symbolic abstraction that is able to generate the mind, when the person is exposed in its environment to similar events repeatedly.

One consequence of this knowledge organization based on simpler units product of symbolic abstraction, is the ability to upgrade and thus learn from new exposures to similar contextual events.

Inside this overview different specific approaches have been developed. Thus, we have Frames theory (Minsky, 1975), Scripts theory, or propositional perspective among others.

In the "Frames Theory ", these would be a type of schema that tries to describe objects categories. It is based on the idea that an abstract representation must contain the essential elements which give meaning to the reference frame experienced in reality. That is to say, that a certain reality is abstractly represented as a symbolic artifact that included elements (also symbolic) representing the essential parts which deterministically define the represented reality.

These elements or basic points that are abstracted as an integral part of the assembly represented can be understood as if they were slots of an electronic circuit.

Electronic circuits incorporate holes or slots which can be occupied by several mechanisms or can be prepared in order that they pass a given amount of current. Depending on which mechanism is incorporated or what amount of electrical current be let to pass, the electronic circuit will acquire a function or other, will serve for one thing or another.
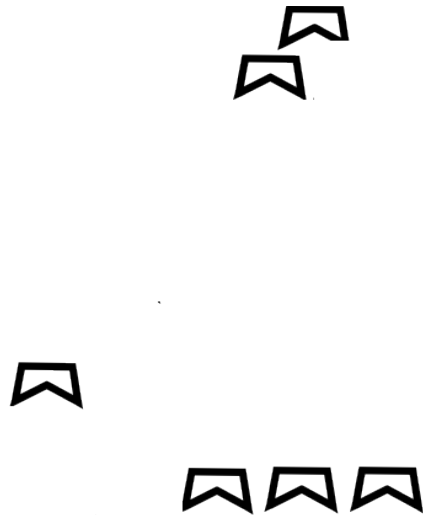
Figure 1. Isolated elements, without apparent representation

For example, the previous image (Fig. 1) shows some figures that seem staples . Only with those appearing is difficult to know if the set represents something or not. However, according as elements are added, that is, to be filling in the gaps or slots in units, it will foresee that the group forms a known geometric figure (Figure 2).
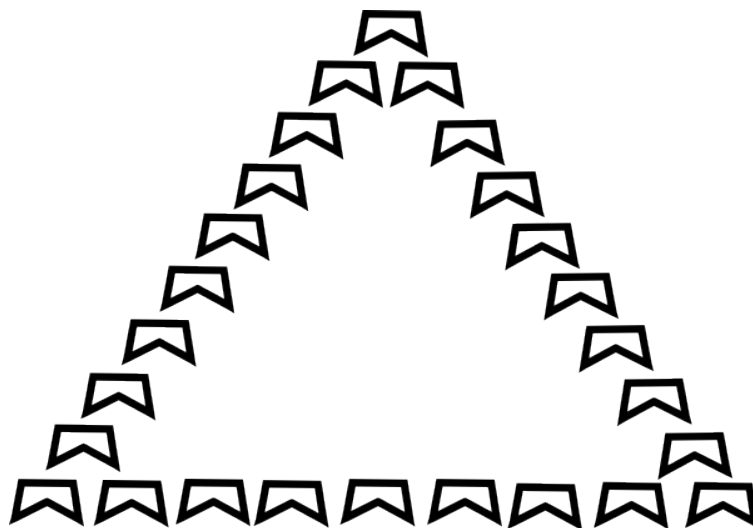


Figure 2. Triangle organization

The result of this simple example can be generalized to more complex situations, such as three-dimensional representations, or events everyday life.

To sum up, starting from the model frame-type schemas is possible to conclude that for a person to identify an environment as belonging to a category, it must include a set of key elements. These elements are generated from experience repeated exposure to similar events.

Therefore, to be effective in learning, virtual worlds should take into account which elements represent, so that the user of the virtual world could identify the represented environment, and be able to transfer the generated learning in the simulated environment to its physical counterpart (PR).

Moreover, scripts schemas or dashes can represent a routine of events. It is a way of organizing the knowledge about the steps to be followed to perform a complex action. One of the classic examples is the group of behaviors people have  when they are in a restaurant. Depending on the category of the restaurant, it could be appropriate or not to have some behaviors or others. For example, in prestigious and formal restaurants, it is suitable that the head waiter (maitre) assign the table, while in the popular restaurants the allocation is more flexible.

Finally, propositional theories, also known as Grammar Story (Mandler, 1967) are representations as narrative action. They can also be represented as links between events and nodes, interacting with concept maps.

After this review of the most experienced the theories in Learning Psychology, it should be noted that there are many more theoretical proposals and approaches for various reasons have not been addressed in these pages, one of them, perhaps the most obvious is the need to be brief for not unduly prolonging this communication. These reasons also notes that, from authors' perspective , some of the newest theories need more empirical path that ensures their real explanatory value of educational processes in virtual environments.

In spite of this, we do not want to miss the opportunity to present, albeit a testimonial, other learning theories that in greater or lesser extent, can be useful in understanding the process of learning generalization and translation between real and virtual environments:

- Theories about memory like Atkinson-shitfrin models (1968), or Baddely's model (Baddeley and Hitch, a974). These theories have had an important effect in instructive design which is a basic learning element in VW and physical environments.

- Transformative learning theory (Taylor, 2008) offers an alternative vision of appropriation process in learning, including emotive factor.

- Neuro-educative theories:  Based on brain studies, these theories link two separate for decades elements by Pedagogy researchers (unlike psychology, which has dedicated special attention to this theme) as the functional element of education against biological substrate that allows such functionality. Keep in mind that close to educational neuroscience or neuro-education such as connectionism, parallel distributed, and in general all approaches which use  the brain as a metaphor, have a similar origin processing within cognitive psychology (Rumelhart and McClelland, 1986). Although previously were have already referred to Minsky (*op. cit.)* it may be Seymour Papert (South Africa, 1928) the character within education has shown more these theoretical proposals.

- Connectivism as part of the social learning theories has its antecedents in Vigotsky and Bandura's theories, fitting therefore, in the general framework of cognitive psychology discussed throughout these pages.


## Conclusions

Depending on the explanatory power of the reviewed theories, it is possible to establish a summary, to conclude, of the learning and action process of the person within the interaction context.

First, it is necessary to highlight, though obvious, that people develop their activity (cognitive and behavioral) inside a specific environment. These environments change throughout the day, although, make up a relatively stable catalog for the most people.

Through repeated exposure to specific and stable environments, they become suitable for people through abstract, symbolic and distinctive elements, creating spaces experienced and stored in their memory. These two aspects are very well explained and predicted by  any version of constructivism.

When a person is exposed into a specific context or environment, the person tries to find items that tell which category the space where he belongs. This process is understandable from the frame model.

When a person identifies where he/she is, because it recognizes the place as belonging to a known category, the subject deploys the

behavior protocol which he has learned for that situation. The Scripts theory describes this process quite well.

Every event becomes an experience that feeds the process, and remains latched in the person (stored) in different formats. One possible form of storage is the narrative structure propositions.

This whole process of experimentation, identification and deployment is consistent with situational learning and the affordance idea (Figure 1).

Experience

Abstraction of elements

Knowledge Acquisition

New Event. Acquisition

Protocol Deployment

Proposiconal Storage

Experience

Situational Learning

Affordance

From this general process and partial explanations provided by each theory, some interesting questions about learning in virtual environments appears. Thus, it has been previously reported that the roles played by agents in virtual reality learning is similar to roles in learning in physical reality. Therefore, it is possible to assume that the process of deploying can happen in both situations, generating a result of independent learning of acquisition environment. Anyway, we may assume that learning in virtual reality is deployed in physical reality and vice versa, without significant impact. This would be an overcoming of the Virtual Vs Physical duality. However, this would not be an overcoming disjunctive of Body - Mind as could be understood from the perspective of *Embodied Cognition*.

If what we have exposed thus far is true, what can happen if a person learns contradictory "things" depending on the area (real - virtual) for the same context? As hypotheses can venture two answers:

1 It might be an effect of excessive differentiation or "over-differentiation", that is to say, one discrimination which include as differential factor the origin area.

2 Either, that an effect of "over-generalization" occurs so that the person to lose the references, so he does not know what to do in different contexts, simply because he does not know identify the context where he is.

Given these two possibilities, the most worrying in socialization terms is the second hypothesis. The verification of both hypotheses, with scientific studies, could clarify whether learning in VR-PR is interchangeable, more demanding in cognitive terms (over-differentiation effect) or a source of socialization problems (over-generalization effect).

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