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Resistance to change in scholarship: an experiment using an immersive and interactive 3D structure

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Abstract

The paper focuses on the process that generates resistance to change in the experiment of an immersive and interactive 3D structure by students during their course. Our case study enables us to complete the redefinition of resistance given by Piderit (2000). Four levels of resistance can be identified: emotional, physical, cognitive and intentional responses. We will show that these four dimensions are complex because they could take a positive or negative appearance for the change recipients (students: cyber-fear or cyber-utopia).

Keywords: Resistance to change, 3D Head Mounted Display, virtual image, levels of resistance, change recipients.

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Abstract

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Keywords: Resistance to change, 3D Head Mounted Display, virtual image, levels of resistance, change recipients.

1. Introduction

Change agents are people engaged in the conduct of change. The change recipients represent people who are responsible for implementation, adopting or adapting to the change (Ford, Ford and D'Amelio, 2008). Resistance to organization change is always seen (portrayed) as the product of irrationally and subjective objectives. For the author, it is time to extend the story of change by considering resistance in three ways:

- 1) Resistance as a self-serving and potentially self-fulfilling label given by change agents attempting to make sense of change recipients: it is an objective reality.
- 2) It is necessary to examine the ways in which change agents contribute to the occurrence of the reactions they label as resistance through their own actions and inactions. Change agents are active participants and contributors to change.
- 3) There are circumstances under which what agents call resistance can be positive contribution to change.

Both change agents and change recipients are engaged in sensemaking. If change agents go into a change expecting resistance, they are likely to find it (the Pygmalion effect and self-fulfilling prophecies). Resistance of change is an interactive phenomenon between change agents and change recipients. In theoretical studies, the change in scholarship has focused on the negative aspects of resistance. Piderit,

(2000) suggests that the definition of the resistance involve cognitive, emotional and intentional responses. Macri and al. (2002) noted that there are three levels of resistance in change scholarship.

In our study, we analyze the case of a resistance to change from a traditional course (an oral media-based course/ a media-based course in PowerPoint without taking notes/ and with note taking) to a media-based course in virtual imagery (3D, vision headset, total immersion). We analyze the change with the use by students of an immersive, interactive structure, giving the sensation of presence. Our experiment entails a 3D device in the setting of media-based, educational communication (Peraya, 1998; 2000) in scholarship.

We formed (Lombardo, 2007) 5 homogeneous groups of students (18 students per group in the second year of initial training, DUT of TC at the IUT of Université du Sud ¹, in the setting of our courses in the Psycho-sociology of Organizations), 90 students were be tested). The content of this course was the same in the five groups:

- 1) An oral, media-based course: the course was dictated, the students did not take notes.
- 2) A media-based course in PowerPoint alone but without taking notes. The images and the diagrams were the same as those that were used in the course in synthetic images.
- 3) A media-based course in PowerPoint, with note taking. The images and the diagrams were the same as those that were used in the course in synthetic images.
- 4) A media-based course in virtual imagery and synthetic images (3D, vision headset, total immersion).
- 5) A control group course, the pre-test and the post-test only.

We compared the five courses on:

- The cognitive and memorial aspects (long-term explicit memory)
- Identifying the different types of resistance to change

¹ DUT : Diplôme Universitaire Technologique, TC : Techniques de Commercialisation, IUT : Institut Universitaire Technologique.

We ventured two hypotheses:

H1: a course in virtual images makes it possible to memorize better compared with other types of media-based presentations (auditory, PowerPoint without notes, PowerPoint with notes);

H2: The resistance to change is a multidimensional process with five dimensions (cognitive, emotional, physical, relational and intentional). These dimensions could be positive or negative.

For our first hypothesis our initial hypothesis was calling upon an increasing number of sensory modes simultaneously makes it possible to increase performance of the long-term explicit memory of the information delivered by the didactic content (Paivio, double coding theory, 1991; Paivio and Caspo 1969). As far as our experiment is concerned, we have tested long term / explicit memory. In fact, that is the form of memory at work when memorizing a course, even if learning brings several forms of memory into play. The result of our study showed that students have not had better memory's performances in virtual image 3D course with HMD. It is the reason why we thought that these results could be explained by the resistance to change of students.

Our approach combined:

- a quantitative analysis based on hypothetical-deductive reasoning (first hypothesis) in order to analyze whether an immersive 3D structure in the framework of our courses on the Psycho-sociology of Organizations can have effects on memorization and to test the sensation of presence in the course presented by means of virtual images
- a qualitative analysis (second hypothesis) a) in order to understand how the students experienced the different communications situations across the four types of media-based presentation; and b) to study the different types of resistance to change and the ambivalence of this concept.

For our first hypothesis, the differences in results obtained by the courses were calculated by variance analysis (Anova). We used a test T. of the Student to test the sensation of presence in the virtual environment.

For our second hypothesis, we did 18 interviews of 18 students who lived the course in virtual images with HMD. The results of these qualitative interviews are exposed in this article and we deal with more particularly the second hypothesis on the resistance to change.

From this experiment, we will show that resistance is an essential element of change, and that it is not only positive or negative, but is a complex process, so resistance is not always the enemy of change.

In our study, we have identified four types of resistance to the 3D device:

- 1) Emotional resistance
- 2) Physical resistance
- 3) Cognitive resistance
- 4) Intentional resistance

We begin to show that resistance to change is a complex process in our case study, for that we will first expose the scholarship on this theme, so we will expose more particularly our case study and we will give our results of interviews in creating relationship between theory and our practice. We consider the teacher is the change agent in this sense that he imposes the change and we consider that students are change recipients in this sense they have to live the change. In conclusion, we will give the patterns of the "good teacher" that would aim to drive the change.

2. Resistance to change as a complex process

As Ford and al. (2008) point out, much of the research regard resistance to change in organizations as an irrational and dysfunctional reaction of change recipients. Ford and al. propose the rest of story by focusing on the role of change agents in the occurrence of resistance through their own actions and inactions and on the idea that resistance can be a positive resource for change (pp.362). Resistance is not the enemy of change. Change agents are the actors engaged in the conduct of the change, who

are responsible for identifying the need of change, creating a vision whereas the change recipients are the actors responsible for implementing, adopting and adapting to change (Kanter and al. 1992).

For Ford and al. (2008), in the resistance story "there is no consideration given to the possibility that resistance is an interpretation assigned by change agents to the behaviours and communications of change recipients, or that these interpretations are either self-serving or self-fulfilling (p. 362)". Change agents can contribute to resistant behaviours and communications through their own actions and inactions. Ford and al. present that resistance to change depends on the interactions and relationships between the change agents and recipients. They expand the resistance story in three ways:

- 1) The resistance is a self-serving and self-fulfilling label, given by change agents. Change agents make sense of change recipients' reactions to change initiatives.
- 2) Change agents analyze the occurrence of the very reactions they label as resistance through their own actions and inactions (breach of agreements and failure to restore trust, Ford and al., 2008, p. 365).
- 3) The resistance can be a positive contribution to change.

This contribution to change depends on the role of change agents and change recipients in sensemaking and on the quality of relationship between themselves. As noted by Ford and al. (2008) change is "a situation that interrupts normal patterns of organization and calls for participants to enact new patterns, involving an interplay of deliberate and emergent processes that can be highly ambiguous" (Mitzberg, Waters (1985)". We take change like "a coherent set of responses by the different parts of an organization to the different parts of its environment" (Macri, 2002). For us, the process of change is "an incremental rather than the result of "revolutions" or traumatic events" (Cyert and March, 1963, Kraatz and Zajac, 1996).

Change agents and change recipients engage in this situation and in sense-making process. Change agents try to determine "how will this get accomplished" and "change recipients try to determine what will happen to me" (Gioia and al, 1994). Role of change agents in the restoration of trust before and during the change involve

less resistance of change recipients. As noted by Kim and Rousseau (2006) change recipients acceptance depends on recipients' assessment on their individual benefits.

For Macri, Tagliaventi, Bertolotti (2002), the interactions of change agents and change recipients with the environment and patterns of organizational behaviour generate resistance to change. The resistances to change are interdependencies between the characteristics of the environment, the dispositions of individuals and the patterning of their actions within the social network.

In our case study, we will analyze change at level of individuals within organization. We will show that the perceptions of individuals play an important role in the process of change and in the creation of resistance,: "Individuals within a social network who claim to be open to new ideas and change can in fact act against change when they perceive that it would modify the extant relations"(Macri et al., 2001 p. 295). The perceptions of change agents and recipients must be analyzed because it generates positive or negative resistances. We take "perceptions" as noted by Piderit and Macri.

For Piderit, the studies of resistance to change have a dichotomized vision of change. Piderit propose a multidimensional view of responses to proposed organizational changes along all three dimensions: emotional, cognitive and intentional in a new view. For this author:

- 1) The emotional dimension of an attitude "refers to an individual's feeling in response to the attitude object" (p.786), Eagly and Chaiken (1988:272) define this dimension as the "feelings, moods, emotions, and sympathetic nervous-system activity that people have experienced in relation to attitude object and subsequently associate with it" and "The emotional dimension might range from strong positive emotions (such as excitement or happiness) to strong negative emotions (such as anger or fear)" (2000 p.787).
- 2) The cognitive dimension of an attitude "refers to an individual's beliefs about the attitude object" and "The cognitive dimension might range from strong positive beliefs (i.e. "this change is essential for the organization to succeed") to strong negative beliefs (i.e. "this change could ruin the company")" (2000, p. 787)

- 3) The intentional dimension of an attitude like “a plan or resolution to take some action” (Bagozzi, 1982)“The intentional dimension might range from positive intentions to support the change to negative intentions to oppose it”.

For our analysis, we retake these three definitions to identify the reactions of the change recipients to change. These three levels of analysis are mainly investigated separately from another in empirical studies (Piderit).

3. Case study: an immersive and interactive structure, giving the sensation of presence

We can describe the structure of our experiment as 1) an immersive, 2) interactive structure, 3) giving the sensation of presence.

3.1. A total immersive structure

Many authors have likened this term to a technical notion, which might act on the user’s senses. Cadoz (1994) asserts that immersion is “a technology, an interface technique between man and machine and does not involve the psychological state of the subject”. The physical immersion of a subject in a virtual environment is performed by sensory information (sight, hearing, etc) alone.

For Pimentel and Texeira (1993), immersion is “the state of a participant when one or more of his senses ... is isolated from the exterior world and he no longer registers any information that does not come from the computer”.

According to Seipel, a virtual environment is considered in total immersion when the totality of the user’s senses is called upon on the one hand, while on the other hand there is total immersion of each sense (even if this total immersion is seldom attained in practice).

According to Slater and Usoh (2001), in an immersive environment, the users have an egocentric view of the virtual world, that is, a view from the inside of the environment or of the phenomenon, as opposed to an exocentric view from the outside of the environment, where the user does not directly take part in the virtual world. For

systems of these types, immersive technologies are used: data gloves, CAVE or HMD headsets, etc. Technologies of this kind allow visual immersion of the user in a virtual environment.

Our structure was a total immersive structure because the students had a 360 degrees vision and an egocentric view of the virtual world.

3.2. An interactive structure

In virtual environments, the user's interactions are said to be subordinated to four tasks, according to Fuchs et al. (2001), as regards functional interaction. The user's four tasks are:

- 1) Observe the virtual world
- 2) Navigate in the virtual world
- 3) Act upon the virtual world
- 4) Communicate

Observing the virtual world is a stage that allows us to prepare ourselves for other actions and that is necessary for understanding the virtual world.

Navigating, acting and communicating presume an action on the user's part. The structure of our experiment can thus be considered as interactive in the sense that it allows the user to perform these four actions.

3.3. A structure giving the sensation of presence in a virtual environment

The feeling of being present in a virtual environment is sometimes combined with that of immersion, but it forms the psychological aspect, while the notion of immersion refers rather to the technological aspect. The notion of "presence" in a virtual world is "the psychological feeling of being there in the environment, of which immersion is the technological basis" (Slater and Usoh, 2001).

For our experiment, the students were equipped with:

- 1) A HMD (Head Mounted Display, that is, a Sony Glasstron LDI-D100B ruggedized vision headset (LCD screen, Resolution 800x600, non-stereoscopic, visual field 26° Horizontal, 19.6° vertical, headphones with stereophonic sound - see Figure 1).
- 2) A Tracker (movement detector) Intersense intertrax² (3 degrees of freedom, angular resolution: 0.02°, latency time 4 ms: internal refresh rate of 256Hz), mouse buttons as navigation tools.
- 3) Software used: Unreal 2004, 3D Studio max, Actor X, PowerPoint.

The students were in total immersion, in an interactive structure giving the sensation of presence.



Figure 1 Head Mounted Display

3.4. The personnel involved in the project: the change agents

Doctor Eric Malbos, physician and neuro-psychologist, who has elaborated a system conceived within a virtual environment in order to treat patients suffering from phobias by successive habituation. He conceived the storyboard of the course in virtual imagery, the animations and the course in virtual imagery.

A professor of Psycho-Sociology of organization who prepared a doctorate thesis (Lombardo, 2007) was the project leader.

A media engineering student from the University of Toulon and the South (Wallid), a specialist in synthetic images, has created, in the framework of a proficiency grant, the 3D images for the course in virtual imagery.

3.5. Experiment: report, the courses

- 1) Group 1: An oral, media-based course: the course was dictated, the students did not take notes.
- 2) Group 2: A media-based course in PowerPoint alone but without taking notes. The images and the diagrams were the same as those that were used in the course in synthetic images.
- 3) Group 3: A media-based course in PowerPoint, with note taking. The images and the diagrams were the same as those that were used in the course in synthetic images.
- 4) Group 4: A media-based course in virtual imagery and synthetic images (3D, vision headset, total immersion).
- 5) Group 5: A control group course, the pre-test and the post-test only.

An example of virtual environment: the students had to get into the university and traverse 23 classrooms (Figure 2)

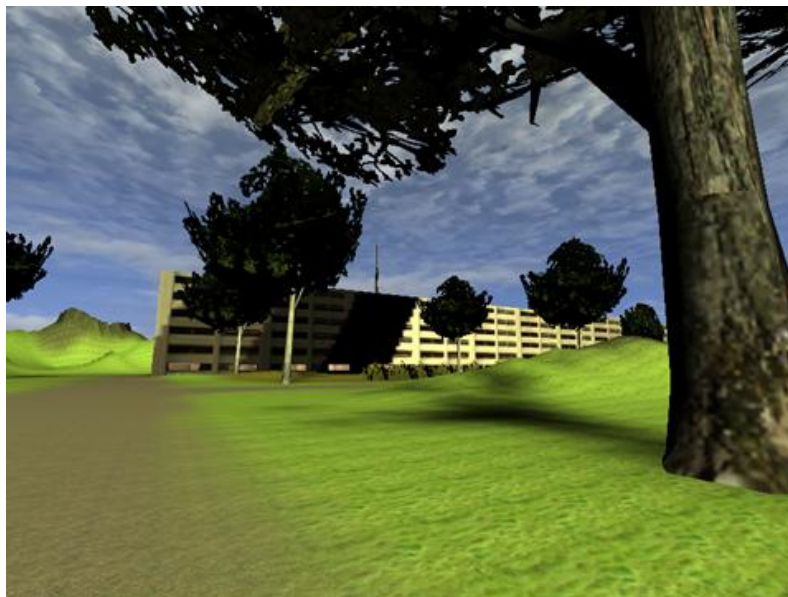


Figure 2 An example of the virtual environment seen by students

4. Methodology H1

A way of verifying hypothesis H1 was to construct a quasi-experimental system that allowed us to vary the different dimensions of the Independent Variable (IV) and to create teaching structures each one of which corresponded to a mode of the IV that we wanted to test, that is, the structure of the media-based presentation.

5. Data Processing H1

- The IV has several modes: course 1 auditory, course 2 PowerPoint without note taking, course 3 PowerPoint with note taking, course 4 by means of virtual images in immersive 3D.
- The differences in results obtained by the courses were calculated by variance analysis (Anova), and by a test T. of the Student.

6. Anova Results H1

- Group 3 (PowerPoint with note taking) is the one that had the clearest significant improvement in performance.
- By decreasing order of performance, group 2 came next (PowerPoint without note taking), then group 4 (virtual images), then group 1 (auditory) and last came group 5 (the control group).

7. Results of the test of presence H1

The results show that the students had a feeling of presence within the virtual environment of the course in immersive 3D.

8. Results of the qualitative treatment H2

The recurrent themes in the 4 groups (auditory, PowerPoint with note taking, without note taking, and by virtual images) were the following:

8.1. Theme 1: emotional

- 1) Positive emotional dimension: original universe/ environment; innovation/social network; funny.
- 2) Negative emotional dimension: unreal; "small lab rats".

8.2. Theme 2: physical

- 1) Positive physical dimension: sensation of presence in virtual environment
- 2) Negative physical dimension: discomfort/sick; headache

8.3. Theme 3: cognitive

- 1) Positive cognitive dimension: simulation as help in learning; simulation as help in understanding the reality; experiment as a source of motivation
- 2) Negative cognitive dimension: no human aspect: learning boundaries

8.4. Theme 4: intentional

- 1) Positive intentional dimension: emulation to take the course in virtual image
- 2) Negative intentional dimension: technical aspects of virtual device

9. Case based clarification of theoretical framework

9.1. Emotional dimension: The device (structure) in virtual images: an original and pleasant "universe" for change recipients (students).

In our case study, we can note that students (change recipients) resist changing with positive or negative responses. As Piderit (2000) point out responses to change are rarely consistently all negative or all positive. Our case study enables us to complete the redefinition of resistance given by Piderit (2000). We have identified four levels of resistance: emotional, physical, cognitive and intentional responses.

Positive Emotional dimension: original universe / environment

- The course in virtual image has emerged as "a universe" (student 5V), a world", "virtual world" (Student 2V), "and thus we entered directly into a virtual world. It was a world that we were not used to be next "(Student 3V)," then I walked into this world "(Student 3V). The characteristics of environment played a positive role (positive emotional dimension) in the perception of change recipients (students).

Positive Emotional / innovation / social network

- Many students noted the novelty of the device, particularly highlighting the fact that it was a first for them, the surprising aspect of the device appeared to them as positive: "It was a first" (Student 1V), "So there we were expecting something really innovative, why we were surprised because it's true that it changes us, it was innovative" (Student 3V). The innovative aspect of the device is also linked to the idea (and fantasy) of a future where education will go through the virtual "yes we realized that it might be the future of an educational standpoint, this would happen, and it is true that compared to whatever is happening to video games, the

virtual world, it seems to be a fairly logical way and future "(Student 3V). (The structure in virtual image as an Innovative changed the patterning of Students' actions in the social network)

Positive Emotional / funny

- The lighter side of the device is often linked to the playful aspect of the device: "First of all, the playfulness" (Student 3V) "I found it really interesting, the virtual world, to recreate a building, I thought it was really nice after I find that to learn the course, it's true that it's more fun yes, it is a fun side in the course "(Student 2V)," it is true that the 'playfulness that I really appreciated "(Student 3V)," and I took it as something fun "(Student 5V).

We noted as Macri and al. (2002) that the resistance to change is a complex mixture of context, attitudes and processes. The characteristics of environment played a positive role (positive emotional dimension) in the perception of change recipients (students).The structure in virtual image as an innovation changed the patterning of Students' actions in the social network.

Negative Emotional dimension: unreal - "small lab rats"

- Psychological immersion is not felt with the feeling of being truly present, but as a "game" that does not correspond to "real life" by some students, "The problem is that I have the virtual a bit of trouble. I too never felt like myself. ... It's not real. The atmosphere all this good is not real life, but it's well done, but after what I told you ... it's something else, it's a game for me"(Student 2V). This is consistent with the idea of being in a "universe" that has been identified by many students as we have seen.
- The course is seen as an experimental laboratory study, "I said, ah, my psychology teacher, she wants to reconsider my brain for his thesis!" (Student 2PSN).
- The course in virtual image caused an excitement and a kind of fantasy in that the students saw it as an imaginary being, a science fiction, "Because it was different. Because we were not in a lecture hall, 90, listening to someone speak is different. And I remember with one of my colleagues, I always see elsewhere, we said we will have a helmet, we will believe in "Back to the Future" in fact it was not like this story helmet, we had a good laugh about it" (Student 1PSN).

- Some students feel they were "small lab rats" and they thought it rather funny: "If once we amused ourselves by saying we were small laboratory rats, but it was fun, it was quite lived"(Student 3PAN)"As I told you, when we went to course, we said we will play small laboratory rats, but it was so good-it was not negative, that we knew very well that we was used (in quotes) for an experiment but it amused us all that ... So we did not have to say, no we will not go, we will be uses us, not at all "(Student 2PAN).

9.2. Physical dimensions: The real body to the test the technical and informational device in the virtual images

Positive Physical

- The physical immersion was felt by many students in the course virtual images, "I said through the headset and looking directly at the video we felt really soaked and directly, almost in the character was someone who was driving, which met after the questions, we were in the character, the main character, and it is true that I was fully integrated in this virtual world, I had returned"(Student 3V)"So at the sensation of moving your head, that's interesting" (Student 1V).

Negative Physical dimension: discomfort / Sick; headache

- Regarding the binding aspects of the device, they are of several types: first the physical discomfort caused by the device "for the first time, it is not too comfortable, me what I felt, I was not well, I remember, I was really sick "(Student 1V)
- The evil of heart (to feel sick) and headache (headache) were also often mentioned, but seem to appear to students as a problem of adaptation to the device "I think it gave a little bit of heart anyway ... it's true, then he must get used to "(Student 2V)
- Physical tiredness often goes through the eyes was also noted: "The eye fatigue. The sound is not annoying, but after a while I think it can be tiring" (Student 5V). The "eye tiredness" seems to cause disorientation. Another student talks about total loss of direction due to the HMD, "Headaches, disorientation and loss of all marks"

- The helmet was part of the technical (technical constraint) often noted, "It hurts a little to the forehead, I remember now, finally, after it is improving.
- We have the feeling of sustaining the course, "and also all that is helmet and all, it seems to be passive and we impose the fact that mode of education, of instruction, we are here and we suffered a bit with the helmet and the video "(Student 3V), the device appeared in some less interactive than a traditional course:" Not necessarily because there is an interaction, we "suffered" in quotes "(Student 5V).
- The contribution and the understanding of change depend on the role of change agents and change recipients in sensemaking.

9.3. Cognitive dimension

Positive cognitive dimension: simulation as help in learning; simulation as help in understanding the reality; source of motivation

- The simulation appears to be necessary in learning when describing situations that cannot be simulated in real life; it helps the understanding of a phenomenon (the student evokes a course in 3D simulation he followed during his training): "If in fact, there are a few staged it all, it's really done their course, ... I remember everything for art history, the representation, so we were told this, you have such a perspective, something like that, and then they showed us a 3D simulation that really gave it so we understand really well" (Student 2V)"I do not know there was an experience I do not know who it was, an experience, finally, we had imagined drawing in fact reflections of mirrors with all that, and in fact they showed us really the mechanism inside and all with different views and all, it's true that if the teacher wants to explain it like this, except to the table, it will be tedious. Here it is true that we understood better"(Student 2V).
- The simulation is therefore necessary to simulate case studies that in reality cannot be, "Here, they are real case studies so they can ... too much detail" (Student 2V).
- A memory aid students think the course in virtual imaging allow better remember: "By taking notes I think not after PowerPoint alone without writing, I would not think it is good, I think the virtual image it can still ... after I do not know what it is exactly but I think so, I would have said virtual imaging "(Student 3PAN).
- Having lived an experimental course was seen as a source of motivation, "Well first, it's true that experimentation me more motivated than normal, knowing that

it ' was an experiment, I went as a class, but it's true that I was more motivated, I was more careful when I filled out the questionnaire, when I experienced, I ' was really focused more than one way"(Student 3V).

- The fact that this is an experiment motivated students because they wanted to serve in some ways to profit, satisfy, to please him: "If we were still a bit more involved, because we knew it very well ... There was a desire (in quotes) to help you know since you did your research then we necessarily wanted to do the job, so we were a little more" (Student 3PAN). Therefore, they were more attentive, "Bluntly, we listened a little more because we always knew he had to have a small profit back. So it was perhaps a little more attentive" (Student 3PAN). In addition, they were more motivated, "Yes, because I know very well that there is experience" (Student 3PAN).
- Link exchange containers and change agent.

Negative cognitive dimension: no human aspect: learning boundaries

- The fact that there is no teacher appeared to be also a constraint for the relational aspect and human, "So, yes, that, that really bothered me, well first it's true that there is no teacher, no human aspect, and it found it a bit annoying "(student 3V
- Also the lack of teacher seems to lead to motivation "and also, it may be temporarily absent without the person noticing account as it is a computer, so there you can afford to meet without realizing it since it's a computer, while the human side, it's true that nothing can replace it, there one is necessarily more attentive and it is mainly used" (Student 3V). The teacher appears in the student as a person who will "boost" the student, and who will motivate, "So I really prefer education with a teacher, a real person, which can affect us, our behaviour that can motivate us, whereas with this virtual version, it's true that there, according to the behaviour we cannot do anything, you cannot motivate us, tell us more work, so it's really ... is a little cold as a means of instruction. So I really prefer a teacher" (Student 3V).
- The role of change agent (professor) is very important in breaching of agreements and Restoring trust of change recipients (students).

9.4. Intentional dimension

In the Intentional dimension, we show that change recipients (students) propose improvements for the virtual device.

Positive Intentional dimension

- There were indeed some emulation to take a course in virtual imaging and thus, eventually a disappointment to those who had not followed (tirage au sort): "I believed that I was, I know, in the dark, with glasses, we saw things, I imagined the big thing, and then good, we have not done" (Student 5A).
- Having had an experience seems to be a source of motivation, in that the whole course seems to tend towards that goal: "That is to say that my first year of psychology, we had not really done that, So the psycho we thought we learned things may not necessarily anything less, and there we saw each time was put in situations, we put in place what we learned, and then there was an end, that was your experience. So I may be more invested in the second year that the first year psychology"(Student 5A).

Negative Intentional dimension

- Some students were disappointed not to live the way in virtual image, "If in fact the beginning we were a little disappointed because we were told it would be us who would do the virtual image, we knew it too what it was, so we wanted to know what it was always, if you were a little disappointed about that, because ultimately, PowerPoint, taking notes ... this is a normal course"(Student 3PAN).

Technical improvements doubled the inclusion of an interactive character

- The improvement of the device appeared necessary for some students, particularly in the technical aspects: "It is true that we thought it was more an experiment again, it was fairly new and that especially needed to make many changes yet. It really is a prototype we will say"(Student 3V). The attenuation of the monotony could go through the distinction of classrooms: "Well, so I think if all the rooms were different, as I do not know ... It would be a plus, I'm not saying it would be the most part, but it would be more "(Student 5V).
- The notion of feedback they also appear to improve, including the inclusion of an interactive character: "If we were told by a character, it was like to talk to us, that

would be a plus"(Student 5V)"But I think that's enough fun around, it does not interfere with the text to be serious, but why not, because sometimes, instead of read, told by a character, it may be, it change is always the same, it would vary a little"

- Taking notes also appears as a possible improvement of the device "because it might have been-is not possible with this equipment to take two or three notes that were specific explanations, with definitions data that were not common, that are well adapted to the subject and that each analyst has done "(Student 4V).
- Remove the text and use the virtual image alone, appears also as an opportunity for improvement, "But to return to the information, it is true that both read, hear, move, it was perhaps much of things and if we had simply done as a video game, or simply virtual elements by removing the text, perhaps I should have more attention at the hearing, without rereading, etc.. So that, it might be to experiment"(Student 3V).

Depending on their personal experience (Macri)

- A student was afraid that the experiment be lived a little in the course as an "interrogation" as it entered the labour force and that the interview reactivated memories school not necessarily positive (this student was 10 years older than other students and followed the course in a continuing education course): "I'm a little tired, stressed out, I said to arrive before I was working too, it happened to me also to come under the afternoon, I boss morning, I was doing odd jobs, I was not declared when one is studying, but I was the one thing to interviewed, to take a course, but here I am finish my hands in my pockets, I thought I did not head"(Student 4PSN)"I know it's not a question, but if we had not done that, it's completely true that I swam, I would arrive on Mars"(Student 4PSN).
- Some students wondered how the experiment would take place, particularly in relation to the medical questionnaire, "Yes, they wondered what was going to be experimenting, following at the end of the course, because you a questionnaire had been spent telling us that it might cause minor problems, so they were wondering how it would happen"(Student 4PSN).

10. The limits of our study

We assume that the average score of students in the group virtual images could be explained:

- 1) The cognitive load theory: in fact, students were sometimes embarrassed by the HMD, they experienced headaches or heart, the hardware could cause mental or cognitive overload. Mayer (1993, 1997) or Schnotz, and Böckheler Grzondziel (1999) take into account in their models the notion of mental activity associated with multimedia learning, Sweller, Paas and Van Merriënboer (1998) defined the concept of cognitive load by placing it in the problems of multimedia learning. Cognitive load is defined by these authors as the mental workload that the execution of a task imposes on the cognitive system. Varies depending on the quantity and quality of information presented in a multimedia educational product, the cognitive load is assumed to depend on storage capacity and processing information in working memory learners. The theory of cognitive load may partly explain the poor performance of students in memory if the current 3D immersive virtual images;
- 2) the effect of habituation may be too long (we had planned to let students get used to the device for a quarter of an hour, but this time perhaps has not been sufficient, also another experiment might be to lead by allowing students to have time to get used the device much longer).

11. Conclusion: resistance to change like a complex process

In this paper, we wanted to show that the resistance to change is a complex process. First, we showed this complexity by the different dimensions that the resistance to change could take:

Like the scholarship shows, this resistance could take four dimensions:

- 1) The emotional resistance is an important factor in the driving of change because the virtual images could be symbolized like a cyber-fear or a cyber-utopia (the 3D device is in the same times synonymous of modernity like an innovational device and synonymous of an inhuman world where the students felt alone)

- 2) The physical resistance is to take in charge because the real body of the students are implicated in the process (the structure gave them headache for example)
- 3) The cognitive resistance is important too because the results of our study show that the virtual images did not permit to better memorize.
- 4) Intentional resistance shows that the course in virtual images procured a real emulation

These four dimensions are complex at the second degree because they could take a positive or negative appearance. For example, the emotional resistance is positive and negative in the same times because all the speech about the virtual image and a cyber-world created for the students an emulation to be in this sort of course, and in the same times they had have a deception of this course because it was not enough interactive.

The complexity of the resistance to change is also present in the role of change agents and the change recipients on resistance. The professor is in participant observation; it is a part of the experiment and participates in the resistance to change. As a teacher, he has authority and influences the beliefs of students. Simply saying that he would do an experiment influenced the students. They felt like little "lab-rats". Also, the environment influences on the beliefs of students and teacher. All the talk revolving around the virtual imagery were spooky (self-fulfilling prophecies and Pygmalion effect) prophecy positive (virtual image symbol of modernity and multiplicity of reality) or negative (the world where one feels alone, abandoned). These beliefs were transcribed in the interviews of students (verbatim).

Students who did the course in virtual imaging were enthusiastic to participate in this experience because the teacher has passed on his enthusiasm (theory, experiment never done before), a doctor was involved in the experiment (control of the health of students before the experiment) he was a figure of the "authority", relationship between change agents and change recipients were trust, professor prepared students to change in giving them sensemaking.

So, we think the role of perception of individuals in the process of change is a part very important in the process of change. After this study, we can ascertain some patterns of the "good" teacher who would like to drive the change.

Firstly the teacher who wants to drive the change has to consider the importance of the implementation of the change agents of change. Secondly, dynamism of the manager has a preponderant role in the good implementation of change and the management and participatory democracy (student were volunteers) has to take into account. Thirdly the teacher has to be iconic and charismatic. Fourthly the tool of change has to be analyzed: (the discourse around the technology was very important in our study): the change must be an extraordinary activity and not a routine activity. Fifthly the teacher must take into account the ambivalence of the resistance to change (not all negative / not all positive for example).

In conclusion, we can say students are not necessarily all of the players who resist change and there is a co-construction of meaning by the change agents and the change recipients. The resistance to change is a complex process and teacher has to take in account all the dimensions of this change (emotional, physical, cognitive and intentional resistance to change).

12.References

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