



**TECHNIUM**  
**SOCIAL SCIENCES JOURNAL**

**Vol. 19, 2021**

**A new decade  
for social changes**

[www.techniumscience.com](http://www.techniumscience.com)

ISSN 2668-7798



9 772668 779000

## **Towards a manipulation of memory by science?: a contextualized analysis of the films *Final Cut* and *Eternal Sunshine of the Spotless Mind***

**Carlos Alberto de Matos Trindade, Ph.D.**

Escola Superior Artística do Porto (ESAP), Porto, Portugal  
[carlos.trindade@esap.pt](mailto:carlos.trindade@esap.pt)

**Abstract.** In this article, after a general introduction about a brain prosthesis project - a substitute for the hippocampus -, started in 2003 by a team of neuroscientists from the University of Southern California, and experiments started between 2007 and 2009 by scientists of various nationalities, we present in more detail some of the main results of the latter, published in scientific articles, which allow us to predict some potential risks in the future, and pose ethical problems, for worthy intentions that scientists may have. Following this, we discuss films *Final Cut* (2004) by Omar Naïm and *Eternal Sunshine of the Spotless Mind* (2004), directed by Michel Gondry, which present multiple points of contact with the aforementioned scientific projects, anticipating some of the foreseeable dangers, and allow us to discuss the future possibility of a manipulation of memory (and of oblivion), through science. Although they are fiction films, much of what is shown in both is compatible (except for some aspects) with real neuroscience research projects that are currently underway.

**Keywords.** Chips, Scientific experiments, Memory manipulation, Oblivion, Emotion.

### **1. Introduction**

As Simone do Vale pointed out in 2005 (that is, in the year following the premiere of the films we are about to analyze), it's curious to verify

(...) that the first project of brain prosthesis being developed is, exactly, an electronic substitute for the hippocampus, the region of the brain whose function is to store memory and durable information. (Vale, 2005: 7)

The aforementioned prosthesis project, the only one of its kind still in progress, as far as we know, was initiated in 2003 by a team of neuroscientists from the University of Southern California, Los Angeles, headed by Theodore Berger, who developed an artificial hippocampus - a neural implant - with the aim of helping in the future people affected by dementias - Alzheimer's disease and others - by delaying the deterioration of the memory caused by them.

Starting from the conception of a working model of the hippocampus, based on the observation of the information processing patterns of the real, the team built a model on an electronic silicone chip, designed to serve as a kind of interface in the brain, replacing the

tissue deteriorated as a result of the loss of cells: the *chip* would couple to the hippocampus and communicate with the brain through two types of electrodes<sup>1</sup>, located on either side of the area affected by the neurodegeneration. One side of the *chip* records the electrical activity received from the rest of the brain, while the other has the function of sending the relevant electrical instructions to the brain.

Meanwhile, during the years 2007 to 2009 results of experiments carried out by teams of Israeli, American, Canadian and Brazilian researchers have been published, which allow us to foresee that something that until a few years ago still seemed to belong, and only, to the domain of fantasy and science fiction – as we have seen in films such as *Total Recall* (1990) and *Minority Report* (2002), directed respectively by Paul Verhoven and Steven Spielberg from the short stories *We Can Remember It for You Wholesale* (1966) and *Minority Report* (1956) by the American science fiction writer Philip K. Dick, an author in whom the theme of memory is recurrent; or Michael Gondry's *Eternal Sunshine of the Spotless Mind* (2004) – may become a reality in the not too distant future: *the manipulation of human memory*, and *oblivion*, by science.

Manipulation that will not be done through digital technology, as prophesied by the filmic fantasies cited, among others, but thanks to the remarkable progress achieved in recent years by biology and neurosciences in understanding the unfathomable mysteries of brain functioning. If, for now, as far as we know, all the experiments in laboratory to which we are going to refer were carried out with the brains of guinea-pig rats, they open anyway important perspectives also in relation to the human brain, for which applications derived from the acquired knowledge are already foreseen, and to be developed, especially in the treatment of its dysfunctions.

Before we go on to enunciate some of the data made public, and published, about the said researches, we can't fail to note, however, that if the scientists' discoveries have certainly meritorious intentions, they also potentially contain some dangers – if they are used for unethical purposes, which unfortunately would not be unprecedented –, demanding some caution and control. These discoveries open the way to the subsequent possibility, as you will easily notice, of implanting false memories.

## **2. Towards a manipulation of memory?**

In July 2007, in an article published in the *Journal of Pshychiatric Research*, a team of American and Canadian scientists announced that they used drug *propranolol* to block memories considered undesirable. The results were not yet conclusive at the time, but they expressed the hope that the research undertaken could lead to the discovery of new treatments for those patients with psychiatric problems, such as those caused by post-traumatic stress.<sup>2</sup>

Earlier, in May 2007, Israeli neuroscientists Itay Baruchi and Eshel Ben-Jacob, from Tel-Aviv University and University of California at San Diego (La Jolla), published an article in the journal *Physical Review E*, where they present the results of a pioneering experiment they carried out in cultured neural networks, of living neurons, *interfaced* with a computer. According to these authors, they proved the possibility of storing information in the activity of these cultured neural networks, as they found *memory patterns* in it, even after more than 40 hours had elapsed after inducing them, using local chemical stimulations, through the injection of microdroplets of inhibitory antagonist. The discovery, in addition to taking a step

---

<sup>1</sup> To view an image of the tiny chip designed by the team of neuroscientists at the University of Southern California, cf. Rita Carter, et al. (2009: 159).

<sup>2</sup> Cf. Ferraz (2008: 36-37).

forward in understanding the learning mechanisms in living organisms, opens up future perspectives for the development of neuronal networks, which allows us to think of a hypothetical technology to create *chips* built with integrated organic matter<sup>3</sup>.

In 2008, according to Maria Cristina Franco Ferraz,

[...] on the BBC Brazil website, dated March 27, 2008, a research was released (...) carried out by the University of California and recently published in the scientific journal «Proceedings of the National Academy of Sciences». According to this research, which has been vulgarized and synthesized in the journalistic website, the use of the inhaled anesthetic Sevoflurane, in reduced doses, would be able to block the formation of negative memories. At the end of the subject matter, we read that what is considered (even) more complicated is to manipulate old memories. The research projects are then advancing and gradually expanding their (provisional) limits. (Ferraz, 2008: 35-36)<sup>4</sup>

Already in 2009, a team of researchers from the University of California, at Santa Barbara, dedicated to studying the role of certain protein molecules in neural cells, such as MOV10 (inhibitor of the production of other proteins that strengthen synapses) – indeed, based on research by the Portuguese scientist Rosalina Fonseca –, has come to the conclusion that the degradation and production of these molecules plays a key role in the storage in neurons of so-called *long-term memory*. More important, they verified that this activity of producing and destroying proteins inside the nervous cells not only produced new memories (because, if the inhibiting molecules are degraded, the neuron produces proteins that strengthen the synapses) but, at the same time, it altered those already existing.<sup>5</sup>

Other specialists have dedicated themselves to studying the possibilities of what we may call *selective amnesia*. A team at the SUNY Downstate Medical Center in New York, led by neuroscientist Todd C. Sacktor, was able to develop a method that allows to remove memories from the brain long after they were stored there. The method consisted in blocking the action of a specific protein in the brain of Sprague-Dawley rats - by manipulating the enzyme PKMzeta, a kinase that ensures electrical signals between neurons -, in order to successfully erase memories that had been constituted a few months before<sup>6</sup>. Also Joe Tsien, at the Medical College of Georgia, has been manipulating CaMKII kinase, which is necessary for the learning process, with the same purpose.

In turn, a group of researchers from the Memory Center of the Pontifical Catholic University (PUC) of Rio Grande do Sul, Brazil, coordinated by Argentine neurophysiologist Martín Cammarota, carried out laboratory experiments that provided new contributions. Through the use of a drug inhibiting the action of the neurotransmitter dopamine in the hippocampus brain area, a specialized area essentially responsible for long-term memory formation, researchers were able to eliminate specific memories of the rats, before they reached their stable and “permanent” state.

The same group from PUC also made another important discovery: an area adjacent to the hippocampus, if activated 12 hours after an experiment, triggers the beginning of the

---

<sup>3</sup> On the pioneer experience, vd. Baruchi, I. & Ben-Jacob, E. (2007).

<sup>4</sup> For further information about the results of the survey mentioned by Maria Cristina Franco Ferraz, see Michael T. Alkire, et al. (2008). It is a scientific article with a technical jargon very “heavy”; that is why we opted to use in this article a short quote, second-hand information, which captures the essential of the results.

<sup>5</sup> About the research carried out by the team of researchers at the University of California, at Santa Barbara, see Schelp & Simões (2010: 116-117), and Banerjee, Sourav, Neveu, Pierre & Kosik, Kenneth S. (2009: 871-884).

<sup>6</sup> Cf. Schelp & Simões (2010: 125).

process that will culminate in the preservation of that memory. Although the experiment was carried out with laboratory rats – the results of which have been published in the journal *Science* –, the researchers admit the possibility that also in the human brain there is a time interval, of a few hours) until the perception of any fact is processed as a lasting mnesic trace (or “engram”). It would then be possible, during this time interval, to artificially modify the memory, either to strengthen it or to prevent it, which opens the door to some interesting perspectives from the clinical point of view<sup>7</sup>.

There remained, however, a dangerous ‘downside’ to take into account, in our view, and one that poses a challenge for scientists to solve: whether the discovery might lead to useful therapeutic applications, such as the creation of drugs to combat forgetfulness (and thus improve memory capacity) or narcotics use and dependence, or even “in the future, in theory, a rape victim may take a pill a few hours after the violence she suffered, in order to avoid the permanence of that traumatic memory.” (Schelp & Simões, 2010: 124), on the other hand, one can also incur the serious inconvenience of causing the absolute forgetfulness of everything that happened in the life of the medicated person for at least half a day, equally erasing memories that the person would wish, or would have every interest, to preserve.

### **3. *Final Cut* by Omar Naïm**

We start by mentioning some scientific experiments, and in development, that raise some ethical problems for us, and we will now proceed to an analysis of the films. Without being a masterpiece, the film *Final Cut* (2004) by American filmmaker Omar Naïm has an interesting script, in which the potential dangers of interfaces between computers and humans are focused, whereby in the not too distant future the technology will allow the placement of internal implants in the human brain. The question that arises is to what extent this step will not represent a technological violation of privacy, and yet another *abuse of the memory* that is announced, using an expression by Paul Ricoeur (2003: 67-111): the chips are a metaphor for the postmodern condition, but they also point to a potentially dangerous practice; there is always the risk of being misapplied, and the problem arises of who ‘controls’<sup>8</sup>.

In *Final Cut*, the company Eich Tech produces entirely organic implants (the ninth generation of a scientific discovery), the *Zoe chips*, which are placed in the brains of human embryos, and which are prepared to grow with the brain and nerve centers of the baby, recording the life of its possessor through his eyes and ears, until his death: all its experiences will thus be preserved. What the company announces is an old human aspiration: the dream of reaching “immortality”. According to Eich Tech, a *Zoe* image lasts forever, and thus becomes available to be enjoyed by loved ones, by future generations of the relatives of the one who possessed it, preserving the supposedly most important moments of his life.

Implanted in the brain and virtually impossible to detect, *Zoe chips* record the memory of a whole lifetime. But after the chip owner's death, his family can claim it from the company, and hand it over to Editors to edit it as a kind of ‘home movie’, to be shown at his funeral. They, in line with their clients' wishes, make all kinds of cuts and montages in a lifetime, shortening it and creating an edifying vision, in line with what the community wants, and people then actually attend a ‘Re-memory’ ceremony. So one point that the film clearly raises from the beginning regarding implants is that, from the moment they are extracted everything

---

<sup>7</sup> Cf. Schelp & Simões (2010, 124-125).

<sup>8</sup> The film *Johnny Mnemonic* (1995) directed by the American artist Robert Longo, which we will not discuss here, dealt with the issue of implanting chips in the human brain. In fact, the main character is an authentic human hard drive.

we have done and lived through will only last if our family so desires; ultimately, people will be able to see us in whatever way our family *wants* us to be seen, and that may be quite distinct from the way we would like to be seen, and remembered. On the limit, not even that, because there will be little left of us and of true experiences, and the *whole* that constitutes the unity and essence of a being will be the result of a choice in the hands of any 'Editor'.

The main character of the film is Alan W. Hakman (played by Robin Williams), a meticulous editor at Eich Tech, reserved and with a manifest difficulty in relating to other people. Alan is a different Editor from the others, who has a different editing method from his colleagues and accepts projects that they refuse. In fact, he does very questionable things, like omitting information from inconvenient memories, manipulating the images of their lives. We learned during the film that due to an incident that goes back to his childhood he has a mechanism of distance, which allowed him to specialize in enduring seeing what others can't, or aren't willing to. This mechanism then allows him to face with a certain coldness all the reprehensible acts that a person has done, and then, with a simple touch on the *delete*, those acts (unwanted or 'sensitive' files) disappear. As he says at one point, "my job is to help people remember what they want".

In conflict with himself for a long time due to his past, Alan seeks to forgive others because he believes that they need a redemption after death, even if it means changing what was their life. In an illustrative scene, his girlfriend Delila (played by Mira Sovino) commenting on his work tells him: "You're like a mortician, or a priest; or a taxidermist; all of them". For his part, Alan invokes for his procedure an ancient tradition of religious magic - a common practice, for example, in villages in England, Scotland and Wales (where it may have survived, some studies say, until the end of the 19th century) - in which was called the 'sin-eater' when someone died, usually a beggar, to through ritual means, involving food and drink, carry the burden of the deceased's sins.

Alan will be hired by the widow of C. Banister, an important lawyer at Eich Tech, after a colleague refuses the request. And soon in a first encounter of Alan with the widow, we became aware of his position: he is there so that her and her daughter help him choose the moments they want to preserve, in order to do 'justice' to her husband; a step that considers the basis for his work. And it's no accident that she tells Allan during this encounter that she trusts his professionalism, unlike that of other 'negligent' editors who have no respect for the dead.

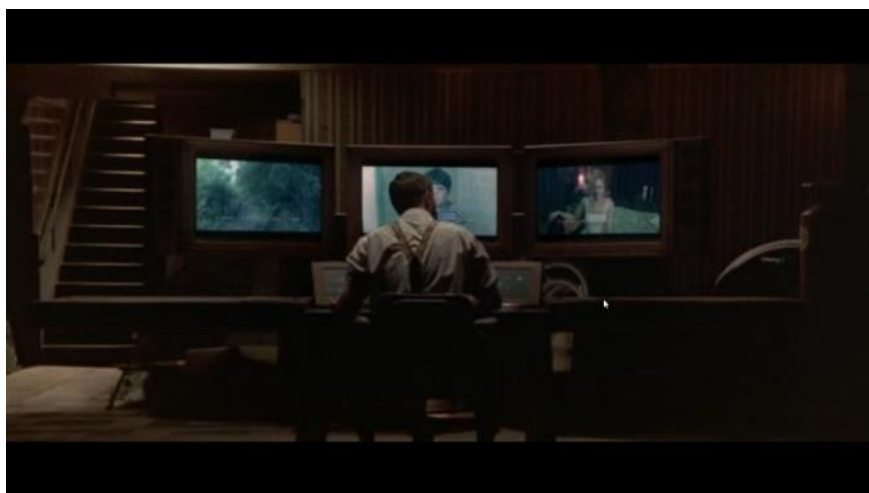


Figure 1. *Final Cut* (2004). Alan working on 'Guillotine'.

Source: <https://machinesaredigging.com/2012/06/28/movie-review-the-final-cut/>

In one of the key scenes of the film, we see Alan working with the sophisticated machine he and the other editors of the company use - "film editing table" type -, appropriately named "Guillotine" [figure 1], receiving (and putting in order) Bannister's experiences: in reality a *life file* archive, properly organized according to entries with titles as diverse as "childhood", "school", "sleep", "violence", "personal hygiene", "tragedies", "religion", "masturbation", "romantic life", "marriage", "temptations", among others. And it is by going through and opening these files, to edit the memories of the deceased, that Alan will find images of an obscure corner of his life: they prove that he raped his underage daughter Isabel. Alan is not a bad person, as you can see in the difficult conversation he will end up having with Isabel [figure 2]. Faced with the girl's reluctance to talk openly about her father, Alan carefully eludes the traumatic episode, but leaves her a message in the last dialogue before leaving:

Will you fix the things that Daddy can remember? (Isabel asks). To a certain extent I will (answers Alan). Can you make him forget that I drew a crayon in a contract with him? (Isabel asks). I will. He will forget; but make sure you don't. (answers Alan).



Figure 2. *Final Cut* (2004). Alan talking to Isabel.

Source: [www.sensacine.com/peliculas/pelicula-52423/fotos/detalle/?cmediafile=18394695](http://www.sensacine.com/peliculas/pelicula-52423/fotos/detalle/?cmediafile=18394695)

By a casual coincidence, when going through these files of another person's life Alan finds images - of a former Isabel's teacher, we learn during the conversation with the girl - that they reveal the crucial event of his own life [figure 3], the one that has been chasing him since childhood and has shaped his personality, originating the mechanism of detachment already mentioned by us. As Alan comes to discover, as he tries to unlock (his) secret and questions his identity, the child he came to know on a day far from his childhood, and thought he had killed, survived after all: what he thought he saw during his childhood incident when he was ten years old - the supposed death of the child, caused by a fall during a dangerous game in an abandoned shed, of which he blamed himself for having abandoned her on the spot without trying to help her, as he thought - was in reality an illusory perception, which often happens.

The definitive proof of his illusory perception is provided, with the help of two friendly editors, after discovering that he himself has an Eich Tech implant, commissioned by his parents without him ever having known. Through a dangerous experience, for being made 'in

life', he will visualize that desired remote memory - Alan needs to see, because that is how he records all things, used to being a *voyeur* of the lives of others - to reach the conclusion that he had after all confused in his memory the red ink spilled from a can, with a stain of blood on the ground next to his companion's body. This confusion reminds the viewer of something Alan had previously said to his girlfriend when, in another scene, he showed her on the Guillotine the functioning of the *Zoe chips*, with images of herself, half real, half dreamlike: "There are defective implants, they cannot differentiate between what the eyes and the mind see".



Figure 3. *Final Cut* (2004). Alan visualizes the desired remote memories.

Source: <http://www.sensacine.com/peliculas/pelicula-52423/fotos/detalle/?cmediafile=18857076>

However, Alan will be confronted by Fletcher, a former editor who went on to lead anti-implant groups Zoe - we see them demonstrating right at the beginning of the film [figure 4], at the entrance of a Re-Memory ceremony, displaying posters with phrases like 'live for the present' - and suspecting Bannister's life, he wants to take over the respective implant, and tells him during a meeting with him, explaining the reasons for his combat: "Implants distort memories, and therefore History, and I don't let the past be rewritten, in the name of nice re-memories". The shadow of G. Orwell's dark vision of a *Big Brother* runs through the whole film, along with the idea that we are 'walking cameras' in a progressively more voyeuristic society, since we are surrounded by cameras everywhere, wherever we go<sup>9</sup>.

---

<sup>9</sup> On Orwell's prophecy, and an assessment of the various facets of the direct impact of new information technologies, vd. Manuel Castells (2007: 404-408), who concludes: "Reports on the growing threat to privacy concern less the State as such than business organizations and private information networks or public bureaucratic apparatuses that follow their own logic instead of acting on behalf of the government". (*idem*: 405)



Figure 4. *Final Cut* (2004). Demonstration of Zoe anti-implant groups.

Source: <http://www.sensacine.com/peliculas/pelicula-52423/fotos/detalle/?cmediafile=18857064>

In the unexpected final outcome of the film, Fletcher will access Bannister's memories only through the implant of Alan - who recorded his work sessions, and with them the images he saw - murdered to that end, since the original was destroyed during an argument between Alan and his girlfriend. After all, the work of the one Fletcher had accused one day of "taking lives, and making lies out of them" was useful.

What interested Naïm the most, also the author of the script - as he states in an interview in the DVD edition ("Extras. Interviews") - was to explore the difference between how a person remembers certain moments, and how these actually occurred. The questions that arise are the following:

Does it really make a difference? Is it more important the event or our perception of the event? Everyone's life is perceived in the first person. All our lives are subjective. Ultimately, I know nothing about you and we don't know nothing except by yourself. We cannot experience the world except for yourself. So, does it matter that something has happened, or is it more important to think that it has happened? (*Final Cut*, 2004)

#### **4. *Eternal Sunshine of the Spotless Mind* by Michel Gondry**

Also the film *Eternal Sunshine of the Spotless Mind* (2004), directed by French filmmaker Michel Gondry (b. 1963, Versailles), raises the question of the manipulation of memory in the near future. However, the script (which many consider genius) is much more complex, creating a narrative at the very least labyrinthine: it earned Charlie Kaufman an Oscar, definitively establishing his enormous reputation as an original screenwriter. For his screenplay Kaufman will have looked for inspiration in some verses of the poem *Eloisa to Abelard* by Alexander Pope (1688-1744), which was written in 1716 - "How happy is the blameless vestal's lot! /The world forgetting, by the world forgot./Eternal sunshine of the spoteless mind!" (Ferraz, 2008: 44)<sup>10</sup> - from which the original title of the film is taken, but it

---

<sup>10</sup> The poem was based on a true, and dramatic, love affair between a 37-year-old theologian and his student, a 17-year-old girl, and it is an inescapable reference point in the theme of impossible and unhappy love. Abelard

will also have been based on the investigations of the American neuroscientist Karim Nader, and more specifically his *theory on the reconsolidation of memories*.

For his screenplay Kaufman will have looked for inspiration in some verses of the poem *Eloisa to Abelard* by Alexander Pope (1688-1744), which was written in 1716 - "How happy is the blameless vestal's lot! /The world forgetting, by the world forgot./Eternal sunshine of the spotless mind!" (Ferraz, 2008: 44)<sup>10</sup> - from which the original title of the film is taken, but it will also have been based on the investigations of the American neuroscientist Karim Nader, and more specifically his theory on the reconsolidation of memories.

In reality, no two evocations of the same experience are the same, and the term *reconsolidation* was applied by him to the inconsistency of so-called *long-term memories*, when these are played back through conscious thought. His theory, which called into question 100 years of conventional knowledge in this field, according to which we modify a memory every time we evoke it - that is, there are no faithful memories - was later confirmed by experiments carried out by the renowned American psychologist David L. Schacter, with volunteers whose brain activity was scrutinized through magnetic resonance imaging (MRI).

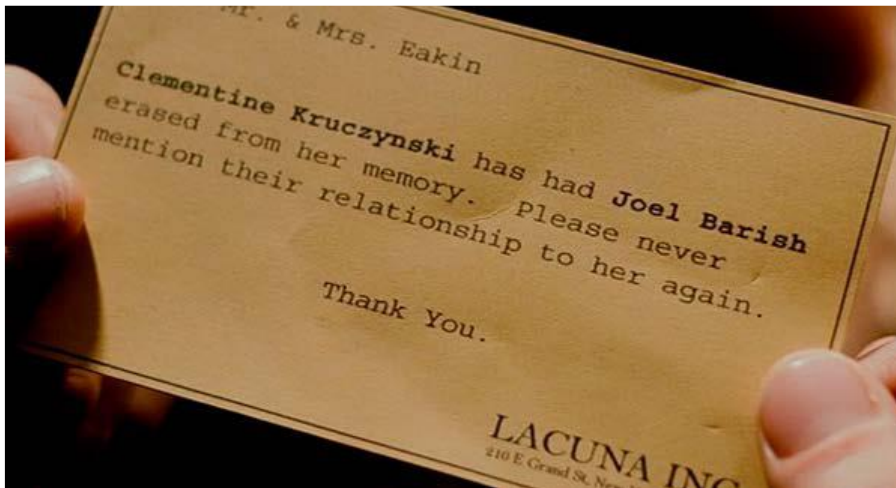


Figure 5. *Eternal Sunshine...* (2004). Joel Barish discovers the existence of Lacuna Inc.  
Source: <http://avante7.com.br/brilho-eterno-lacuna-inc-quemvoce-apagaria/>.

Joel Barish (played by Jim Carrey), discovers one day with surprise that his ex-girlfriend Clementine Kruczynski (Kate Winslett) resorted, in a radical way, to a specialized company [figure 5], Lacuna Inc., to erase from her memory all the memories of her unsuccessful relationship. He too, disappointed, after contacting the company to talk to the doctor in charge and inventor of the process, decides to do the same, that is, to erase Clementine from his memory. Lacuna Inc. advertises his ability to provide the alternative of 'moving forward'. Joel is instructed to separate all belongings that are connected to his relationship with Clementine. They are what serve for 'mind mapping': as presented, a kind of brain digitalization that is a direct reference to modern brain imaging techniques of the neurosciences [figure 6], which will facilitate the technical process used.

---

and Eloisa never stopped loving; he died in 1142 and she in 1162. In 1817 the mortal remains of the two lovers were transferred to the cemetery of P re Lachaise in Paris.



Figure 6. *Eternal Sunshine...* (2004). Joel Barish in Lacuna Inc., to erase memories.  
Source: <http://www.doyoulikemoviesaboutgladiators.com/the-20-best-movies-of-the-decade/>.

The film then focuses on the process to which Joe is subjected, made while asleep under the effect of drugs, which once started transports him into his memory, as his memories are progressively erased, starting with the most recent ones. However, in the middle of the process Joel discovers that he still loves Clementine (or Clem, as he called her) - this happens when he relives the initial moments of the couple's relationship, and they come to mind to be erased - and he doesn't want to continue the operation of obliteration, which in technical terms is a brain injury, as the doctor in charge explained to him. But how can you reverse the process if you are asleep?

The narrative structure becomes more confusing, mixing past, present and future, in a mental, inner journey; that of Joel, who resists the treatment and desperately tries to wake up; but it is too late, and runs away during the procedure. In this escape, he goes back more and more in time, and to prevent Clem's forgetfulness begins to put her in memories where she did not belong, where she was therefore not present, regions that digital mapping has not yet managed to reach - we have already said, the intervention of Lacuna Inc. begins with the most recent memories - taking refuge in the oldest memories until reaching the most hidden corners of his childhood, including some traumatic experiences; with the help of Clem, who accompanies him on this journey of rediscovery, to whom he says at a certain point: "hide me in a really buried place."

There is a clear allusion here to the phenomenon of so-called 'child amnesia', which refers to the impossibility of remembering any memories before the age of three and a half/four: this does not mean that before that age a child does not register any memory in his or her brain, although it is true that the limbic structures of the human brain only reach maturity between four and five years. And indeed, as Jean-Didier Vincent points out:

[It is] interesting to see to what extent the symptoms presented by the adult amnesiac make it resemble a small child: the memory that disappears seems to be that which does not yet exist in the small child: so-called episodic or declarative memory. (2007/2010: 311)

Several explanations have been proposed for the phenomenon, starting with a 'defect' in remembering memories, which despite having been effectively recorded by the brain would

be subject to degradation with the aging of that, no longer readable. But, according to Jacques Roubaud and Maurice Bernard, the most coherent theory until today, among those presented, would still be that of Freud's *souvenir-écran* (*souvenir-écran*), later developed by Jaques Lacan, which is obviously the one suggested in the film:

The first memories were hidden, buried by the mind in impenetrable regions without outside help. It is other, more recent memories that hide them from our vision of the past. (Bernard & Roubaud, 1997: 66)

The spectator is obliged to a certain effort of reconstruction, through *his* memory - in the same way, Joel's escape happens inside his head - to unravel the complex puzzle of the plot, because the narrative structure is not linear, but circular. Let's see: the characters get to know each other again, and fall in love again after having rescued themselves from the services of Lacuna Inc., and seem, even if vaguely, to recognize certain phrases. Also Mary Svevo, the company secretary, who without remembering had undergone the same treatment, falls in love again with the same man, the inventor doctor of the process, and the treatment should have served to erase him from memory. The circular structure is even more accentuated by the end of the film; but before we get there, it is still necessary to clarify Mary Svevo's significant role in its outcome.

It is she who, disturbed after discovering at a certain point that she was also submitted to treatment, returns to the doctor's office to collect the filed files of all patients treated by the company. It is one of the most curious aspects of the film, to verify that the same company that applies such a complex treatment process continues, nevertheless, to keep the traditional files in folders, papers and the others associated to the analog era (cassettes, etc.). It is these same files that will serve Svevo to unmask and denounce the company, by sending them by regular mail (another traditional way) to all the old patients, to have knowledge of the treatment to which they were submitted, and to be able to recover the memories that were eliminated from their memory. Joel and Clem will also receive the files that concern them, putting their relationship back in check, through the revelations they find there: what each of them said about the other.

In order not to deviate from the main theme, we have not wanted to address a question that is present in several moments of the film, and, it can be said, represents a 'tension' that runs through it: the relationship between the traditional analog and digital media or, more generally, the 'cultural exhaustion of the literate reference', as Maria Cristina Franco Ferraz calls it (2008: 31). One example of this, among others varied, is the following named by Ferraz:

[...] during the treatment, when Joel develops an unusual "resistance" to the process of deleting Clementine's memories, in a certain scene he penetrates an anguishing all white place, full of shelves with books whose covers and spines are also erased, in white. Besides the evident association, inscribed in our current language, between white and the obliteration of the memory, the process of forgetting seems to threaten both the character and the cultural memory traditionally consigned in books (Ferraz, 2008: 31).

The memory ends up triumphing over the forgetfulness in each of the protagonists, because of the fundamental role of emotion: each of our memories has an associated emotional core, and when we want to forget a complete relationship it is not only the pain that goes away. The writer Marcel Proust paid great attention to 'emotional memory', prone to

sudden reappearances revealing the existence of an unconscious memory, buried under our present: in Proust's case, relative not only to episodic memories but to entire regions of his mnemonic field. In referring to him, Jean Cambier quotes a passage from *A la recherche du temps perdu*, which easily takes us to certain scenes in the film:

The best part of our memory is outside us, in a rainy breeze, in the musty smell of a room or the smell of a first passion, wherever we find ourselves that which, no longer being useful, our intelligence has set aside (Cambier, 2001/2004: 48).



Figure 7. *Eternal...* (2004). Joel Barish and Clementine by the sea.

Source: [http://cinemateca.blogspot.com/2010\\_11\\_01\\_archive.html](http://cinemateca.blogspot.com/2010_11_01_archive.html)

In fact, we know today that the vast majority of our experiments leave no permanent 'mnestic traits' (engrams) in the brain. Only a few of them, admittedly the most emotionally striking - the effectiveness of the register is influenced by the quality of the experience - reach that state (always relative) in which certain memories have the possibility of maintaining their individuality, in a somewhat lasting way, through modifications in the connections between the neurons, enabling the future reconstruction of the initial experience as an autonomous reality<sup>11</sup>

One of the most interesting aspects of the film is that, as Maria Cristina Franco Ferraz rightly notes, in certain aspects it is close to the thesis developed by Henri Bergson:

As suggested in the film, by acting exclusively on the brain, the treatment carried out by Lacuna fails in depth. In certain aspects, therefore, the film meets what Bergson develops in *Matter and Memory*: memory is never totally erased for the simple reason

---

<sup>11</sup> The theme of the importance of emotions in memorization, and in the way the human being conducts his behavior in society, has deserved, it should be emphasized, great attention from the eminent Portuguese neurologist and neuroscientist António Damásio. See, for example, the following interview: (Damásio 2010, 119). On this same subject see also Jean-Yves & Marc Tadié (1999: 104-106 and 117-118).

If we go back in time, it is not by chance that in old times one could appeal - in certain circumstances in which it was necessary to keep alive the memory of occurrences considered relevant - to social practices rooted in tradition, meanwhile fallen into disuse, which aimed to accentuate the emotional nature of the experience, because it was believed to be mnemonic in its effectiveness. Portuguese experimental psychologist Nuno Gaspar (2011, XXXI) gives an imaginative example of this - in medieval times - in his PhD thesis.

that it's not where they look for it and track it. It does not concern a place, nor neuronal circuits, but to the thickness of time lived, the flow of duration, a certain relationship with temporality. In this sense, a brief final scene of the film in which new possibilities for Joel and Clem finally open up is significant (Ferraz, 2008: 38).

In fact, after resuming the full consciousness of the novel previously lived, of its degradation, and of the subsequent process of erasure, Joel and Clem at the end of the film seem somewhat resigned to the perspective of the impossibility of a new beginning. However, right after Clem leaves Joel's apartment, he opens the door after a brief hesitation and leaves for the corridor, where he asks Clem to wait. Nothing is said, everything is in suspense, but one senses that the uncontrollable and irrational force of love will prevail.

For our part, we will also evoke an advanced hypothesis in *Civilization and Its Discontents* (1930), one of Sigmund Freud's last works<sup>12</sup>:

Having overcome the error of thinking that our frequent forgetfulness amounts to the destruction of the trace left by memory and therefore to an act of annihilation, we now tend towards the opposite presumption – that, in mental life, nothing that has once taken shape can be lost, that everything is somehow preserved and can be retrieved under the right circumstances – for instance, through a sufficiently long regression (Freud, 1930/2004: 7).

## 5. Final Reflection

We should not delude ourselves; although it is a fiction film, much of what it shows us is compatible with real neuroscience research projects that are currently underway, as we have seen. In fact, all of its narrative structure striations intentionally, it seems to us, in an intelligent game between fiction and verisimilitude. Proof of this is that, even before its debut, it was possible to find in 2003 the 'official' website of the company (fictitious) Lacuna Inc., which presented and advertised in a very credible way the same services we see in *Eternal Sunshine of the Spotless Mind*, nothing less than a "painless and non-surgical process of erasing the memory".

## References

- [1] ALKIRE, M. T., et al. (2008). Neuroimaging analysis of an anesthetic gas that blocks human emotional memory. *PNAS (Proceedings of the National Academy of Sciences of the United States of America)*, 105 (5), February 5, 1722-1727.
- [2] BANERJEE, S., NEVEU, P., & KOSIK, K. S. (2009). A Coordinated Local Translational Control Point at the Synapse Involving Relief from Silencing and MOV10 Degradation. *Neuron*, 64, December 24, 871–884.
- [3] BARUCHI, I., BEN-JACOB, E., VOLMAN, V., RAICHMAN, N., & SHEIN, M. (2008). The emergence and properties of mutual synchronization in in vitro coupled cortical networks. *European Journal of Neuroscience*, vol. 28, 1825-1835.
- [4] BARUCHI, I. & BEN-JACOB, E. (2007), Towards neuro-memory chip: Imprinting multiple memories in cultured neuronal networks. *Physical Review E*, 75 (5), 050901 (1) – 050901 (4).

---

<sup>12</sup> On Freud's hypothesis, see also Sébastien Marot's analysis (2006: 43-53).

- [5] BERGER, T., et al. (2012). A Hippocampal Cognitive Prosthesis: Multi-Input, Multi-Output Nonlinear Modeling and VLSI Implementation. *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, 20 (2), March, 198-211.
- [6] BERGER, T. et al. (2005). Restoring Lost Cognitive Function. *IEEE Engineering in Medicine and Biology Magazine*, September/October, 30-44.
- [7] BERNARD, M. & ROUBAUD, J. (1997). *Quel avenir pour la memoire?*. Paris: Gallimard.
- [8] CAMBIER, J. (2004). *A Memória* (Sara Travassos, Trans.). Lisboa: Editorial Inquérito. (Original work published 2001)
- [9] CARTER, R., et al. (2009). *O Livro do Cérebro* (Anabela Delgado, Trans.). Porto: Dorling Kindersley / Civilização, Editores Lda.
- [10] CASTELLS, M. (2007). *A Era da Informação: Economia, Sociedade e Cultura*. Vol. II – *O Poder da Identidade*. Lisboa: Fundação Calouste Gulbenkian, 2nd edition.
- [11] DAMÁSIO, A. (2010). Não existe memória sem emoção. *Focus*, n. 547: 119.
- [12] FERRAZ, M. C. F. (2008). Cultura somática e tecnologias: Cérebro, genes e subjetividade. *Nada*, 12, 24-45.
- [13] FREUD, S. (2004). *Civilization and Its Discontents* (David McLintock, Trans.). London: Penguin Books, Great Ideas. (Original work published 1930)
- [14] GASPAR, N. (2011). *Memória operatória e afecto. Efeitos do estado emocional e da valência de palavras na evocação*. Lisboa: Fundação Calouste Gulbenkian / Fundação para a Ciência e a Tecnologia.
- [15] MAROT, S. (2006). *Suburbanismo y el arte de la memoria*. Barcelona: Editorial Gustavo Gili, SL.
- [16] RICOEUR, P. (2003). *La mémoire, l'histoire, l'oubli*. Paris: Editions du Seuil.
- [17] SCHELP, D. & SIMÕES, P. M. (2010). A conquista da Memória. *Focus*, 547, 114-127.
- [18] TADIÉ, J.-Y. & Marc (1999). *Le sens de la mémoire*. Paris: Editions Gallimard.
- [19] VALE, S. do (2005). *A morte como obra de arte*. Retrieved from <http://www.bocc.ubi.pt/pag/vale-simone-morte-obra-arte.pdf>. Accessed in: december 7, 2006.
- [20] VINCENT, J.-D. (2010). *Viagem Extraordinária ao Centro do Cérebro* (Isabel Veríssimo, Trans.). Alfragide: Texto Editores, Lda. (Original work published 2007).

### **Filmography**

- [1] *Final Cut. A última memória* (2004). Omar Naïm (Director). EUA. LNK Audiovisuais S.A. 2005. DVD.
- [2] *O Despertar da Mente* (2004). Michel Gondry (Director). EUA. Prísvideo – Edições Videográficas, S. A. 2010. DVD.