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Memory Matters in the Digital Age

In the movie *Eternal Sunshine of the Spotless Mind*, the company La-
cuna Inc. advertises its method for focused memory removal with the fol-
lowing slogan: "Why remember a destructive love affair if you can erase
it?"[1] When Joel Barish (Jim Carrey) incidentally finds out that his ex-
girlfriend Clementine Kruczynski (Kate Winslet) has undergone the
Lacuna procedure to wipe their bitterly ended relationship from her mem-
ory, he requests Dr. Howard Mierzwiak to perform the same procedure on
his brain. Joel is instructed to go home and collect any objects or memen-
tos that have any ties to Clementine ("photos, gifts, CDs you bought to-
gether, journal pages") and to bring them to the doctor's office. Upon his
return, Lacuna-technician Stan wires Joel's brain to a computerized head-
set; the doctor holds up each separate object (drawings from his diary, a
mug with Clementine's picture, etc.) and tells Joel to let each object trigger
spontaneous memories. Stan subsequently tags each object-related mem-
ory and punches it into a computer, apparently recording Joel's mental as-
sociations on a digital map of Clementine. That same night, Stan and his
assistant come to Joel's house, hook up their drug-induced sleeping client
to a machine that looks like a hairdryer but generates images similar to
those produced by functional magnetic resonance imaging (f MRI), and
start the erasure process. As the Lacuna Inc. website explains: "The proce-
dure works on a reverse timeline, which means it begins with the most re-
cent memories and goes backward in time. This approach is designed to

target the emotional core that every memory builds on. By eradicating the core, Dr. Mierzwiak is able to make the entire memory dissolve."[2] One by one, Joel's memories of Clementine are erased—a fairly automatic process that would have been finished by early morning if not for Joel's realization, halfway through the procedure, that he wants to keep the good memories of his love affair, so he actively starts to resist the erasure guys. Incapacitated by drugs, he embarks on a dreamlike, psychic journey with a remembered Clementine, creatively hiding her in unconscious, untargeted corners of his memory where she does not belong, in an attempt to escape the high-tech apparatus that is slowly stripping away Joel's recollection of his former girlfriend.

Michel Gondry's and Charlie Kaufman's fictional treatise of modern science's struggle to erase undesirable autobiographical memories raises important questions: First, what is the "matter" of personal memories? Memory is obviously embodied, but neurobiologists, cognitive philosophers, and cultural theorists hold different—even if complementary—views on what "substance" memories are made of. Scientific concepts of memory have evolved significantly in recent decades, and the movie actually reflects on some recent neurocognitive theories on memory formation and retrieval. Second, *Eternal Sunshine of the Spotless Mind* presents an ambiguous answer to the issue of where memory is located. On the one hand, personal memory is situated inside the brain—the deepest, most intimate physical space of the human body. On the other hand, personal memories seem to be located in the many objects Joel and Clementine (like most of us) create to serve as reminders of lived experiences. Most of these items are what, in the previous chapter, I dubbed "mediated memory objects," such as pictures, videos, recorded music, diaries, and so on; people have a vested interest in them because they come to serve as material triggers of personal memories. Mediated memory objects, however, are not simply prostheses of the mind, as the movie wants us to believe. Mediated memories, as I argue in this chapter, can be located neither strictly in the brain nor wholly outside in (material) culture but exist in both concurrently, for they are manifestations of a complex interaction between brain, material objects, and the cultural matrix from which they arise.

After exploring how mediated memories are concurrently embodied through the mind and brain, enabled by media technologies, and embedded in a cultural context, the question arises, what happens when memory

production enters the digital era? What makes the movie *Eternal Sunshine* interesting in this respect is the conversion of Joel's painful memories into digital brain scans. The technology deployed by Lacuna's technicians transcribes memories triggered by material objects onto a digital map that looks like a series of brain scans. Like ordinary computer files, the Clementine files can be erased and thus be made to disappear from the place in Joel's brain where they are stored. The proposed translations from experiences into memory objects, back into actual memories, and then into information files—files that can subsequently be stored or deleted—propel sophisticated perspectives on the (de)materialization and (dis)embodiment of memory. In contrast, the movie's depiction of memory objects in the digital age is rather simplistic: photographs, scrapbooks, and cassette tapes still seem to dominate Joel's and Clementine's mutual recollections in a period when digital pictures, weblogs, compact disks and MP3 files are rapidly replacing their analog precursors. In light of recent revisionist theory on memory formation, the question arises how digital technologies may accommodate the "matter" of both mind and media. Even if memory in the digital age is just as embodied and mediated through artifacts as before, the very notions of embodiment and materiality need upgrading, in order to account for memory's morphing nature. Upon entering the digital era, the question of where mediated memories are located or produced—how they are embodied, enabled, and embedded—becomes even more poignant.

Embodied Memory: "Personal Memory Is in the Brain"

Ever since memory entered scientific discussions, it has been caught in the brain-mind dichotomy and appropriated by scholars from various disciplines. Whereas philosophers tend to confine acts of memory to the mind, (neuro) scientists concentrate on the brain as the locus of memory's origin. Until the early twentieth century, the location of memory was generally consigned to the mind, and the stuff that memories were thought to be made of—an indefinable, immaterial set of thoughts and mental productivity—was considered the province of philosophers. From John Sutton's rather impressive historiography of how philosophers from Augustine to Descartes and from Hume to Bergson have conceptualized memory, it transpires that former spatial concepts of thinking about memory have gradually given way

to connectionist concepts.[3] Metaphors such as the library and the archive were commonly used to explain the retention of information or the preservation of experience in an enclosed space, from where it can be retrieved on command.[4] When trying to remember something, the mind, triggered by a material object or image, searches through the stacks from which stored and unchanged information can be retrieved and reread. Research paradigms based on these metaphors assumed memories to be static data from someone's past, and this assumption still often exists in popular representations of memory.

In his important work *Matter and Memory* (1896), the French philosopher Henri Bergson already refuted a one-to-one correspondence between physical stimuli and mental images to account for human consciousness, instead proposing a recursive relationship between material triggers and the images formed by our minds.[5] Bergson's view that memory is not exclusively a cognitive process but also an action-oriented response of a living subject to stimuli in his or her external environment prohibits the idea of a pure memory preceding its materialization in a mental image. According to Bergson, "to picture is not to remember," meaning that the present summons action whereas the past is essentially powerless; recollection images are never re-livings of past experiences, but they are actions of the contemporary brain through which past sensations are evoked and filtered. In chapter 3 of *Matter and Memory*, Bergson discusses the relationship between pure memory, memory image, and perception. In order to analyze memory, he states, we have to follow the movement of memory at work. In that movement, the present dictates memories of the past: memory always has one foot in the present and another one in the future. The brain does not store memories but re-creates the past each time it is invoked: "The bodily memory, made up of the sum of the sensori-motor systems organized by habit is a quasi-instantaneous memory to which the true memory of the past serves as a base."[6] In other words, rather than accepting the existence of a reservoir of pure memory from which the subject derives its remembrances, Bergson theorizes that the image invoked is a construction of the present subject. The brain is less a reservoir than a telephone system: its function is to (dis)connect the body, to put the body to action or make it move.

This shift toward a connectionist model of understanding the matter that memory is made of definitely transpires from recent research by sci-

entists studying its neurological and genetic workings; they point at the brain as the nucleus of all our mental activity and consciousness.[7] Genes, neurons, and living cells all constitute the bodily apparatus needed to carry out mental functions, for instance cognitive tasks such as factual recall, or affective tasks such as emotions or feelings. In spite of putting the center for memory activity in the brain, scientists assert there is no such thing as a single location for memory. Even though some parts of the brain are specialized in specific memory tasks—such as the hippocampus for retaining short- and long-term memory, the amygdala for emotional learning—there is no single vector between one brain system and one type of memory. Autobiographical memory is usually associated with emotional matters that are in turn sheltered by the two amygdalae, yet this does not mean they are solely confined to this part of the brain. Instead, the establishment of memories depends on the working of the entire brain network, consisting in turn of several memory systems, including semantic and episodic memory, declarative or procedural memory.[8] The hunt for the location of memory, undertaken by scientists of various disciplines, has come up with a staggering distributed answer to that question, in fact defying the very possibility of pinning down one type of memory to a single place in the brain. Facilitated by neurological circuits, the brain sets the mind to work, stimulating a perception or a mode of thinking—a mental image, a feeling—that in turn affects our bodily state. The brain is thus the generator of reflexes, responses, drives, emotions and, ultimately, feelings; memory involves both (the perception of) a certain body state and a certain mind state.

In more recent philosophies of mind, connectionist metaphors tend to conceive of memory as a distributed agency that leaves traces of an ongoing process. Of all connectionist metaphors that philosophers and neuroscientists have introduced over the years, the networked computer is probably the most prominent one, but it is not necessarily the best one.[9] Perhaps the symphony orchestra is a more appropriate metaphor than the computer when it comes to explaining the function of memory and how the brain's matter is responsible for the personal memories it produces.[10] Like a performance of Mahler's Seventh Symphony by an orchestra requires a brass section, a string section, and a percussion section, memory is a function of the *brain* that manifests itself through the mind and directs our consciousness or conscious acts, such as self-reflection or autobiographical reminiscence; it is a consortium of concerted efforts resulting in

a momentary performance. Each member of the orchestra plays his or her part, following the prescribed score as well as the conductor's instructions—their individual performances contributing to the overall sense of harmony. The composer's notational score may be adjusted under the influence of some single parts or as a result of the audience's interpretation or appreciation. Even the hardware of musical instruments may be tweaked to accommodate the performance; material changes in musical instruments inevitably result in subtle performative changes. And, as every music aficionado knows, a symphony's performance changes over time, as each performer tends to interpret the score as well as previous performances through a contemporary ear.

The extended symphony metaphor may also account for why memories change each time they are "performed" by the brain. From recent neuroscientific research, we learn that the brain stores emotional memories very differently from unemotional ones. Negative emotional memories are retained in much more detail than positive emotional memories. In the case of traumatic memories, they tend to be captured by two separate parts of the brain: the hippocampus, the normal seat of (cognitive) memory; and the amygdala, one of the brain's emotional centers. Hippocampal damage can affect one's capability to form long-term memories, but someone suffering from this condition may still be able to recall vague pleasant memories if the amygdala is left intact. Memories effectively are rewritten each time they are activated; instead of recalling a memory that has been stored some time ago, the brain is forging it all over again in a new associative context. Every memory, therefore, is a new memory because it is shaped (or reconsolidated) by the changes that have happened to our brain since the memory last occurred to us. Neuroscientists' findings are corroborated by clinical psychologists whose research demonstrates that memories of personal experience are never direct and unalterable copies of past experiences but are partially reconstructed; self and memory work in tandem to allow us the ability to use our own past as a present resource.[11]

In more than one respect, the movie *Eternal Sunshine* appears in sync with current neuroscientific research, as it demonstrates a nuanced understanding of how the brain forms memories. Scientist Steven Johnson states in his review of the film that whereas older movies like *Memento* still reflect the idea of memory as a kind of information retrieval system, the "emphasis on feeling over data processing puts *Eternal Sunshine* squarely

in the mainstream of the brain sciences today."[12] In *Memento*, the main character, Leonard, suffers from complete amnesia after a major trauma; he fervently tries to reconstruct his past by taking snapshots, which he instantly annotates with words—sometimes tattooed on his body—in a desperate attempt to counter the constant loss of information about his own identity and past experiences from his brain.[13] Lost information or memories seem to be fixed in the past and are fixated in the annotated photographs Leonard keeps producing. In contrast, *Eternal Sunshine* reflects a more complex model of memory and how it is stored in different centers of the brain. Joel's memories partly consist of information that can be erased, yet their emotional core persists. Moreover, his memories are not fixed but morph into new ones. When Joel realizes he needs to stop the erasure procedure, he consciously manipulates the process by taking Clementine to memory spaces where she does not belong—kidnapping her away from the probing scanner, ushering her into scenes from his childhood that he remembers as being humiliating, painful, or very happy. These intense emotional memories are not so much reexperienced as they are rewritten through his recollection. Without the slightest science babble, the movie's assumptions on autobiographical memory are broadly compatible with the reconsolidation theory.[14]

If memory is made of molecular and cellular substance, and it is transported through the wired systems of its neurological and sensory apparatus, what, then, is the matter of the mental images produced by the mind that we conjure up when reminiscing? The most basic answer coming from a neurobiologist would be that each mindset derived from the brain is made of the same substances: cells, tissues, organs. Due to the mediation of the brain, the mind and its images are grounded in the body proper. The more sophisticated answer, however, includes a refined description of how the mind and consciousness are functions of the brain. Autobiographical memory involves most parts of that well-woven apparatus and comes in various shapes: the recall of facts (where was I born? What is my age?) is as much part of personal remembrance than is the invocation of a familiar mood or event (Do you remember the day your brother was born? How sad I felt when she died!) or the conscious reflection on an earlier stage in life (Have I really changed since the age of 18?). In some instances, memory is an affective feeling that accompanies our seeing a picture or a mental picture we have formed in our minds. To the

extent that emotions inform our memories, the stuff of memory may be partly derived from the external object itself (a scenic landscape or a picture thereof) and partly from the construction the brain makes of it (the auditory, visual, tactile, or olfactory perceptions in our minds). Neuroscientist Antonio Damasio calls the latter an "emotionally competent object," referring to the event or object (e.g., seeing a painting, a landscape; hearing a song) that is at the origin of a brain map and elicits a certain feeling: "this picture makes me feel happy" or "this music makes me sad." Invoking a scene or scenery through one's memory may not change the actual object (the painting, the photograph, the record), but it certainly changes the internalized "map" of the initial trigger.[15] Recall and permanent re-arrangement of our personal experiences, according to Damasio, play a role in the unfolding of desire. The very desire to re-create an original emotion may be the motivation for changing the brain map: "There is a rich interplay between the object of desire and a wealth of personal memories pertinent to the object—past occasions of desire, past aspirations, and past pleasures, real or imagined."[16]

As neuroscientific research indicates, memory and imagination are not the distant cousins they once seemed: both derive from the same cellular and neurological processes and are intricately intertwined in the matter memories are made of. Memory can be creative in reconstructing the past, just as imagination can be reconstructive in memorizing the present—think only of the many visual tricks people play to perform the cognitive task of factual recall. The function of personal memory, even if restricted to studying its "mindware," is not simply about re-creating an accurate picture of one's past, but it is about creating a mental map of one's past through the lens of the present. The contents of memory are configurations of body states represented in somatosensing maps. Living cells producing this mindware are all but indifferent to the processes they condition, and thus, we could conclude, memory is only the trick the mind plays on the brain. As humans, we even tinker with these processes, for instance by inserting chemical substances (drugs) that alter the body's emotional state. Or, as in the science fiction of *Eternal Sunshine*, technicians artificially remove unpleasant memories by deactivating those neurological circuits responsible for undesirable responses conditioned in brain maps. The erasure of the mental image of an experience in Joel's brain activates a desire to thwart the procedure, which in turn causes the

neurological circuits in his brain as well as the circuits in the technician's laptop to go haywire.

Assuming the intrinsic mutability and morphing quality of personal memories laid out by neuroscientists and tested in experimental clinical settings, I now shift the searchlight of this inquiry to a different aspect of memory's matter. In Damasio's as well as most other neuroscientific theories, the nature and materiality of the external object or memory trigger is typically taken for granted.[17] It is obviously not the tangible object they are interested in—the painting, the photograph, the landscape that triggers an emotion or memory—but the contents it represents. Neuroscientists argue the actual pictures become part of the mental maps the brain creates in response to the object, so the materiality of the item does not really matter. But is memory indeed indifferent to the shape and matter of external stimuli and piqued solely by its contents, particularly when it comes to mediated personal memory objects? Is the material artifact that invokes memory irrelevant to mental processes, or does its (changing) materiality have reciprocal effects on the mindware that perceives it? In order to understand personal memory as a complex of physical-mental, material-technological, and sociocultural forces, we may need to understand its distributed matter beyond its embodied nature.

Enabled Memory: "Personal Memory Is in the Mediated Object"

Consider for a moment this all too familiar hypothetical question: What objects would you try to rescue from your house if it were on fire? When confronted with this unwanted yet potential situation, many people rate their shoeboxes filled with pictures, diaries, and similar mediated memory objects over, or on par with, valuable jewelry and identity papers.[18] Whereas the latter two are expendable, the first is considered unique and irreplaceable: memory objects apparently carry an intense material preciousness, although their nominal economic value is negligible. The loss of these items is often equated to the loss of identity, of personal history inscribed in treasured shoebox contents. If you pose the burning house question, asking people whether a mere copy of their original mediated memory objects would suffice, there is a fair chance the answers would be largely negative.

Many of us appreciate these items for more than contents only: we treasure the fading colors on yellowed paper, the fumes of tobacco attached to old diaries, the irritating scratches on self-compiled tapes. Apparently, physical appearances—including smell, looks, taste, and feel—render mediated memory objects somehow precious.

Some cultural theorists have located the matter of memory precisely—and often exclusively—in the tangibility of mediated objects. Walter Benjamin, writing on reproducible memorabilia like personal photographs, called them the "modern relics of nostalgia," the meaning of which lies hidden in the layers of time affecting their appearance.[19] Some contemporary scholars argue that memory materializes primarily through the technology used to produce mediated objects. Media theorist Belinda Barnet, for instance, prefers technology as the main focus for memory research when she writes: "There is no lived memory, no originary, internal experience stored somewhere that corresponds to a certain event in our lives. Memory is entirely reconstructed by the machine of memory, by the process of writing; it retreats into a prosthetic experience, and this experience in turn retreats as we try to locate it. But the important point is this: our perception, and our perception of the past, is merely an experience of the technical substrate."[20] Whereas both Benjamin and Barnet acknowledge that memories actually change over time—one in terms of the object getting older, taking on a sheen of authenticity and invoking nostalgia, the other in terms of technology defining and replacing the very experience of memory—they are adamant in restricting their focus on memory to its material and technical strata only. Barnet argues the primacy of technologies in our production and reproduction of memories. Quite a few mediated memory objects require the original technological apparatus upon later recall because that equipment is indispensable for viewing their contents. Think, for instance, about the projector and roll-down screen needed to show your old slides, an 8-track recorder for playing these antique tapes, or, to stay closer to the present, the hardware and software to read the large floppy disks on which you diligently continued writing your diary after buying your first word processor.

Clearly, the inscription and invocation of personal memory is often contingent on technologies and objects, but unlike Barnet, I locate memory not in the matter of items per se but rather in the items' agency, the way they interact with the mind. Paradoxically, the real value of mediated

objects and their enabling technologies is often thought to lie in their supposedly static meaning, despite their obvious physical decay, and in their supposed fixity as triggers, despite our constant intervention in their materiality. Memory objects serve as representations of a past or former self, and their robust materiality seems to guarantee a stable anchor of memory retrieval—an index to lived experience. But the hypothesis that mediated memory objects remain constant each time we use them as triggers is equally fallacious as the outdated theory that memories remain unaffected upon retrieval—a theory meticulously refuted by neuroscientists. After all, photo chemicals and ink on paper tend to fade, and home videos lose quality as a result of frequent replay (and even if left unused, their quality deteriorates). In fact, it is exactly this material transformation—its decay or decomposing—that becomes part of a mutating memory: the growing imperfect state of these items connotes continuity between past and present. Their materiality alters as time passes, but could it be the very combination of material aging and supposed representational inertia that accounts for their growing emotional value?

Besides a sort of natural physical decay, there is a decisive human factor in the modification of (external) memory objects. Like human brains tend to select, reconfigure, and reorder memories upon recall, people also consciously manipulate their memory deposits over time: they destroy pictures, burn their diaries, or simply change the order of pictures in their photo books. Memory deposits are prone to revision as their owners continue to dictate their reinterpretation: a grown-up woman ashamed of her teenage scribbles revises details in her diary; a bitter man erases videos of his ex-wife; a grandmother takes apart her carefully composed photo album to divide its pictures among her numerous grandchildren.

The double paradox of a stable yet changing external object triggering a stable yet retouched mental image appears all too persistent in our cultural imagination. In *Eternal Sunshine,* Joel's and Clementine's desire to destroy their reminders testifies to the human inclination to constantly revise our past. An endearing scene in Dr. Mierzwiak's waiting room, showing tearful clients holding their bags filled with treasured items to be destroyed, signals the intrinsic modifiability of objects as they are constantly prone to manipulation and reinterpretation. People have always used material objects not just to store memories but also to alter them, annihilate them, or reassign meaning to them. Mediated memory objects never stay

put for once and for all: on the contrary, the deposits themselves are *agents* in an ongoing process of memory (re)construction, motivated by desire. Memory allows for both preservation and erasure, and media objects can be manipulated to facilitate and substantiate (new) versions of past experience.

The parallel between neuroscientific theories of memory formation and cultural conjectures of memory is far from coincidental; I dare to argue the two processes intersect. For neuroscientists, the mediation of memory happens in the brain where various interacting neurosensory apparatuses account for their inherent mutability. Cognitive philosophers add to this theory that memories are mediated not only by the intricate brain-mind orchestration but also by the interaction between the brain with physical, external objects it encounters, including the technologies that help make them manifest. Australian philosopher John Sutton, for instance, defines the locus of memory in the hermeneutics of mind and matter; the biggest challenge in analyzing the cognitive life of memory objects is "to acknowledge the diversity of feedback relations between objects and embodied brain."[21] This view is corroborated by Andy Clark, who argues that memory and its enabling technologies are mutually constitutive; he proposes a cognitive science that includes "body and brains" as well as "props and aids (pens, papers, PCs) in which our biological brains learn, mature, and operate."[22] Both Sutton and Clark regard a mutual shaping of the brain/mind and object/technology the inescapable consequence of new neuroscientific insights, and they advocate a concerted interdisciplinary research effort to face the challenge of new paradigms created by these findings.

Indeed, I agree with both philosophers' view that memory is not simply triggered by objects but happens through these objects; brain, mind, technology, and materiality are inextricably intertwined in producing and revising a coherent picture of one's past. However, this double-edged concept can still not fully account for the matter of memory. Memories, in my view, are not only embodied by the brain/mind and enabled by the object/technology, but they are also mediated by the sociocultural practices and forms through which they manifest themselves. Although practices and forms are commonly squarely located in the realm of culture, they cannot be studied separately from the other two conceptual pairs. But before we take that layer further apart into its cultural components, let us first look at how media technologies and objects "matter" as instruments for inscribing personal memory and identity.

Embedded Memory: Personal Memory as Part of Culture

Mediated memories are material triggers for future recall—produced through media technologies, whether pencil or camera. At the same time and by the same means, however, they are instruments and objects of inscription and communication: devices by which humans seek to establish their own identities in the face of their immediate and larger surroundings. Every historical time frame, as Michel Foucault states, is marked by its idiosyncratic regime of "technologies of truth and self," technologies that "permit individuals to effect by their own means or with the help of others a certain number of operations on their own bodies and souls, thoughts, conduct, and way of being, so as to transform themselves in order to attain a certain state of happiness, purity, wisdom, perfection, or immortality."[23] Instead of attaching technologies of self to the brain, Foucault argues they are always in and of themselves *cultural.* In Stoic culture, for instance, students wrote letters to friends disclosing and examining their conscientious self in order to establish and test their individual independence with regard to the external world. Contemporary variants of former epistolary practices, such as e-mails or weblogs, also help construct a sense of self in connection to an outside world. People (and, one could argue, especially young people) wield media technologies to save lived experiences for future recall and at the same time shape their identities in ritualized processes. We take pictures on vacation for later remembrance but also to convince our friends at home of our relaxed and happy sojourning state; we may want to capture our Thanksgiving dinners on video to document some happy family moments, but a home video concurrently serves to reinforce our notion of belonging to a family. Technologies of self are thus in and of themselves social and cultural tools; they are means of reflection and self-representation as well as of communication.

Foucault's concept may erroneously suggest that media technologies can be regarded apart from their habitual and quotidian use. Naturally, our inclination to take photographs or to write a diary is as much induced by the availability of technologies as by our knowledge of how to use them. As members of a society in a particular historical time frame, individuals deploy a set of practices in common response to their shared social environment and material conditions.[24] Taking pictures, shooting a home

movie, or taping recorded music are practices shaped by an internalized cultural logic, unquestioned by one's social surroundings, and performed through seemingly automatic skills. Mediated memory objects provide clues to their social and cultural *function*, thus divulging how people use technologies to produce their own material and representational deposits; these deposits, in turn, betray sociocultural practices.[25] Concretely, a photograph concurrently shows an image and relays information about the habit of taking pictures; a home movie may also reveal something about familial power structures by looking at how various relatives and siblings (often males) take charge of the camera. Some anthropologists even argue that sociocultural practices have their own cognitive properties, which in turn affect (the memory of) individuals.[26]

Besides signifying sociocultural practices, memory objects come in shapes that are often mediated by individual invention in response to cultural convention. Letters or family photographs do not arise out of the blue: we write letters because it is an accepted cultural form. Family albums may literally predispose the kind of photographs we take of our children. Looking at a 1868 photograph of our great-grandfather, we may be touched or puzzled by the stern look of a posing figure eyeing the camera. It is important to acknowledge this memory object to be the result of a historical practice and form: the late-nineteenth-century habit to have a young adult's picture taken by a professional photographer, resulting in a studio portrait. Cultural frameworks are never stable moulds into which we pour our raw experiences to come out as polished products; they are frames through which we structure our thinking and against which we invent new forms of expression.

The significance of sociocultural practice and forms for memory formation poignantly surfaces in *Eternal Sunshine of the Spotless Mind*. For instance, Joel is asked to bring pictures, CDs he bought with Clementine, or tapes they made for each other into Dr. Mierzwiak's office in order to destroy them, because confrontations with these items after his memory's erasure might compromise the procedure's success. Many viewers undoubtedly understand Joel's embarrassment when the technician holds up a mug with Clementine's picture—a commodified form of nostalgia—and empathize with his agony upon seeing him tear up pages filled with sketches and words. When relationships fail, as Joel and Clementine's did, the pain derived from dividing music collections often appears to be inversely

proportional to the pleasure of building up communal preferences. More often than not, the collection and consumption of recorded music is a matter of sharing, and the resulting objects are residues of an intensely social process. Compiling tapes with mutually liked music can be an important part of building up a relationship, just as sharing recorded music with others may be a ticket into peer-group culture. Technologies of self are concomitantly technologies of sharing: they help form bonds across private boundaries, tapping into a communal or collective culture that in turn reshapes personal memory and identity.

At this point, adherents of social-economic theory may downplay the relevance of cultural aspects, arguing that memory objects are nothing but products of a commercially induced technology push, promoting new generations of media technologies, forms, and practices for the do-it-yourself memorabilia market (think of the kitsch mug personalized with a picture of your loved one). Following this line of thought would put research squarely into the realm of economics. However, as some sociologists have claimed, the cultural meaning of mediated memory objects and technologies is complex *because* of their inherent linking of private life to public culture. Roger Silverstone, Eric Hirsch, and David Morley, for instance, consider the use of media technologies to be grounded in the very creation of home and "home-ness."[27] A family unit (or household, to use a more economic term) makes a decision about which technologies or media objects enter its private sphere. Studying how these items are appropriated, objectified, and incorporated in the home, the British sociologists try to understand how interrelationships of technology and culture define notions of self and family vis-à-vis society at large.[28] Commercial forces should not be underestimated, but neither should they be singled out as determinant factors in the construction of memory objects.

To summarize my argument so far, scholars from various disciplines have refuted the truism that memories are images of lived experiences stored in the brain that can be recalled without affecting their content. The cliché of (mediated) objects as immutable deposits triggering fixed memories from a mental reservoir is as outdated as the idea of enduring single memories being stored in particular sections of the brain. Scientists and philosophers agree material environments influence the structure and contents of the mind; objects and technology *inform* memory instead of transmitting it. Memory is not exclusively located inside the brain, and

hence limited to the interior body, and it cannot be "disembodied," because external bodies and technologies are part of the same mutual affect. To this doubled-edged concept of brain/mind and object/technology I have added a third layer of sociocultural practices/forms that, in my view, complements the other two. Mediated memories perform acts of remembrance and communication at the crossroads of body, matter, and culture.

The Digitization of Personal Memory

Up to this point, I have deliberately focused on cultural memory in the context of analog media technologies. Now that we are entering a digital age, the questions arise: How does digitization change the stuff that memory is made of? Will it modify the "nature" of our brain maps? Does it affect the epistemological or ontological status of digitized media objects? Or will it alter the cultural practices and forms through which we shape our remembrance of things past? Questions like these suggest a deceptive primacy of technology as the impetus for change. History has taught us time and again that a transition from one technological regime to another implies more than the replacement of tools or machineries; it involves a fundamental epistemic overhaul, revising our instruments of living along with our ways of understanding life. Digitization, rather than being a replacement of analog by digital instruments, encompasses everything from redesigning our scientific paradigms probing the mind to readjusting our habitual use of media technologies, and from redefining our notion of memory all the way to substantially revising our concepts of self and society. Obviously, the digital evolution has not changed the "matter" of memory—the mindware enabling conceptions of who we were, are, and want to be—but it certainly affects the way scientists understand the brain performing various functions of memory. And ultimately, I argue, it may change the brain itself, for digitization may impact the brain's constitution just like chemical and genetic evolutions did before.

For one thing, digitization is definitely changing the way neurobiologists envisage and conceptualize memory functions. Activities of the living brain are increasingly visualized with the help of digitized imaging technologies, such as fMRI or positron-emission tomography (PET).[29] An fMRI scanner typically registers specific changes in brain activity: while

the person performs a cognitive task, the machine measures the metabolic changes that are linked up with neural activity. In this way, emotions such as fear, aggression, or sexual urge—emotions essential to survival—can be shown to emerge through the paleocortex, the middle brain, whereas the "higher" cognitive and behavioral functions, including reason, are regulated in the neocortex, the outer brain layer.

But what do these scans exactly figure? Do they visualize the matter of memory? Not really. What these machines do is to measure increases in blood flows through the brain; if the brain is more active, it needs more blood and oxygen, resulting in more intensive blood circulation. This activity shows up as red and yellow blots on the screen; representations of the brain at work can subsequently be translated into knowledge about mental processes—that is, by those properly trained in reading them. Medical imaging involves a series of translations in which the body, technology, and expert scientists each play a constitutive role; the beautiful graphics of fMRI, like many techniques heretofore developed in medical diagnostics, imply much more precision, interpretative clarity, and transparency than there actually is.[30] Although the development of fMRI is still in its infancy, the apparatus could theoretically be employed to trace memories as physiological activities in the brain; "trace" is the word here, not "locate," because what neuroscientists actually capture in these images are the changes in neural activity resulting from a specific cognitive, emotive, or conscious task encoded in colored signals. However, most fMRI studies use univariate processing—highlighting only one variable in the brain—a method that shortchanges the distributed nature of neurodynamics. The apparatus tends to confine activity to a specific location in the brain, thus favoring the legitimacy of linking complex mental functions to particular brain regions.

If powerful imaging technologies sway professionals to design research questions supportive of simplified paradigms, it is easy to see how nonexperts are persuaded by the machine's potential to appear like a transparent diagnostic apparatus, linking diseases to exact locations in the brain. Ever since the emergence of X-ray technology, photography has been the dominant model for all kinds of medical imaging—what you see is what you get. It is an increasingly popular tenet—especially in court circles—that complex phenomena like schizophrenia, drug addiction, criminality, or for that matter, "traumatic" personal memories, can show up on digital

scans as pieces of irrefutable evidence.[31] In popular discourse, like magazines and in medical television series, these images often come to stand as visual proof of a certain diagnosis, be it brain damage or mental abnormality.[32] The movie *Eternal Sunshine* is a case in point: in this Hollywood fantasy, new digital tools diagnose "ailments" such as traumatic memories of botched relationships. As said before, the film attests to the latest neuroscientific findings on memory formation; it also plays up to the popular expectation that personal memories show up in precise spots on the fMRI scans ("the Clementine files"). Indeed, even if few researchers seriously believe that brain functions are compartmentalized, the alleged potential of fMRI machines to visualize "disease" or concrete memories reflects a strong desire for visual transparency and technological prowess, but is still far from being a reality.

The diagnostic promise of fMRI, however, is not the real science fiction in *Eternal Sunshine*; the same technologies that help diagnose mental processes are actually projected to also help doctors intervene in the brain and thus remedy ailments. Michel Gondry's extrapolation of techno-experts erasing the Clementine files from the brain in a sort of backward intervention through the computer may seem a projection on par with H. G. Wells's time machine. And yet, the image of Joel's head wired and plugged into the computer—an automatic software pilot deleting memories from his brain—does not look as alien as it should. Why is that? A couple of explanations may be plausible. First, we have come so used to technologies depicting our interior body and making it visible on the screen and translating it into digital code that we begin to understand corporeal processes as disembodied information.[33] Second, we are rapidly becoming accustomed to treatments of bodily defects via computers. Computer-assisted surgery (particularly neurosurgery) is no longer a fictional trope; it is a fast-developing branch of medicine. Actual bodies are treated from outside the physiological realm, as surgical interventions mediated through computers and steered by human hands and brains. And third, already successful experiments with chemical interventions in the blockage of traumatic memories in human brains make "informational" interventions appear far more feasible. However far-fetched it may appear, manipulation of the mind as a result of computer processing is theoretically feasible. In fact, brain modification by means of information processing does occur, albeit more subtly and attenuated than this movie would have us believe.

In many respects, digital imaging technologies turn the brain into a seemingly disembodied, informational entity, and yet it is an illusion to think that memory could be severed from the body, because biology and technology—body and media—have merged beyond distinction. Philosopher of science Eugene Thacker illuminates this process by introducing the concept of "biomedia," defined as the continuous transformation of bodies through the practices of encoding, recoding, and decoding bio-information.[34] Bodies, as Thacker contends, are "both material and immaterial, both biological and informatic."[35] When digitizing the body, the biological is rearticulated as informatic in order to be enhanced or re-designed. Both body and machine are considered platforms through which activities are mediated, yet the materiality of that platform profoundly *matters*: information is embodied as much as flesh is computed. In the long run, the computations carried out by computers will inevitably retool our mindware if only because certain interventions in the body's physiology can not be designed or executed without digital machinery.[36] Of course, it is still a long stretch to prove how this theory applies to memory research in neuroscience, but it is inevitable that digital technologies will impact not only our knowledge of how the brain works but its actual workings.

What we witness in the movie *Eternal Sunshine* is an almost allegorical illustration of Thacker's biomedia, spelled out in a step-by-step encoding, recoding, and decoding sequence. First, Joel's memories of Clementine are translated into digital data—information visualized in fMRI scans. Subsequently, the Clementine files are uploaded into a laptop and "recoded" to be deleted; and finally, Joel's brain is rewired to accept the cleansed "data" into his memory. Joel's resistance of the erasure guys affirms Thacker's contention that informational processes never leave the body untouched and vice versa; the mindware of the brain is not simply retooled by the hardware and software of the computer, but data and flesh are mutually implied in the spiraling process of transformation. The movie delicately—even if awkwardly, in an accelerated compression of time—suggests the inseparability of brain and informatics in its fictional depiction of "digitized memory."

The subtle message behind this movie that computers are both diagnostic imaging tools and instruments of intervention should not be mistaken. Functional MRI scans never take the mind outside the body, just as ultrasounds do not sever a fetus from the maternal womb, and yet they

definitely *affect* the body.[37] If we accept the premise that memory is not located either inside the body or outside it in culture but is an embodied experience in which mind, computer, and object form the distributed agency, then the idea of intervention in the brain's function by means of information technology becomes much more realistic. In the long run, not one component in the chain lacing mind, machine, and memory will be left untouched. In fact, brain modification by means of information processing does occur, albeit more slowly and weakly than this movie makes us believe. Technologies of memory are in and of themselves *technologies of affect*.

Digital Memory Objects and Media Technologies

Similar to the myth of disembodiment, digitization often promotes the erroneous presumption of dematerialization. In the first decade of a new millennium, our "technologies of self" are being rapidly replaced by digital instruments, and we are still in the midst of finding out how to adapt to the cultural forms and practices that inevitably come along with this retooling of memory artifacts. What does it mean for personal cultural memory when our tools and objects for producing memories become digital (a term often equated with "immaterial")? What are the consequences of "digitized" objects for our habits of inscribing, storing, and re-creating personal memories? Obviously, digitization carries substantial epistemological and ontological implications, not only with regard to our memory objects and the technologies we use to create them but also with regard to our very *concepts* of memory and experience. Let me briefly elaborate on several of these implications.

In *Eternal Sunshine*, analog mediated memory objects—cassette tapes, framed and laminated pictures, handwritten diary pages—serve as imprints for lost moments; they are the reified items through which we come to know and hold the past, and which need to be destroyed in order to get rid of unwanted memories. The absence of modern digital memory objects (such as digital photographs, weblogs or MP3s) in this movie is rather conspicuous in the face of the fancied digital erasure procedure wielded by the doctor and his technicians.[38] As said before, the supposed fixity of mediated objects has always been illusionary because the very corrosion of analog objects is partial to the "memory sensation." Digital objects, such as photographs, are

considered by many to be immaterial because digits are invisible and they can be endlessly manipulated until a final format (printed photograph, music CD) "materializes." However, to understand the digital as immaterial is as erroneous as the idea of analogue mediated objects being static reminders of past experience. Layers of code are definitely material, even if this materiality is different from the analog objects that we are used to and that are still very much part of our personal cultural memory.

Indeed, digital technologies necessitate an adjustment of epistemological horizons: we can no longer assume—if we ever could—a digital photo to accurately represent reality as caught by the camera eye. In many ways, computer memory perfectly suits the morphing nature of human memory over time. Computers are bound to obliterate even the illusion of fixity: a collection of digital data is capable of being reworked to yield endless potentialities of a past. An intermediate layer of coding enables infinite reshaping of pictorial representations of the past before they become manifest in the present.[39] Perhaps not coincidentally, the reconsolidation theory recently adhered by neuroscientists finds its technological and material counterpart in digital media technologies that boost our ability to re-design one's past on the conditions of one's present. The ease of digital manipulation, compared to analog photography, may not just facilitate the airbrushing of images to be stored in our repositories but may also actually augment the role desire has always played in the mental articulation of images, as pointed out by neuroscientists. Personal memories, at the moment of inscription, are prone to wishful thinking, just as memories upon retrieval are vulnerable to reconsolidation. Imagination and memory, in the age of digital technologies, may become even closer relatives.

In addition, the digital condition likely affects the ontological status of memory objects. Memory objects were never immutable items but were always constitutive agents in the act of memory. What changes with the advent of digital cameras, webcams, and blogs in our personal lives is that computerized tools infuse our memory at various stages of the process, and their digital nature (again) probes the boundaries between what constitutes memory and object. The coded layer of digital data is an additional type of materiality, one that is endlessly pliable and can easily be "remediated" into different physical formats. But this new type of materiality is equally vulnerable to decay—a degenerative process that is part and parcel of human memory. The world's computers are brimming over with personal

treasures of every genre (music, pictures, texts), but no one guarantees the preservation of electronic materials for generations to come. Machines and software formats may become obsolete, hard drives are anything but robust, and digital files may start to degrade or become indecipherable. Ironically, problems of preservation and access to personal memories, as a result of their digital condition, could become even more complex than before. Even digital memories can fade—their fate determined by their *in silico* conception—as the durability of hard drives, compact disks, and memory sticks has yet to be proven.[40] Memory does matter, perhaps even more so in the digital age.

The Digitization of Culture

Not only does the digital transform brain-imaging techniques and memory objects, but there is also an iterative relationship with the sociocultural practices that inform their use. Whereas in the analog age, photos, cassette tapes, or slides were primarily intended to be shared or stored in the private sphere—a slide show with the neighbors, a forgotten shoebox in Grandpa's attic—the emergence of digital networked tools may reform our habits of presentation and preservation. By nature of their creation, many digital memory items are becoming networked objects, constructed in the commonality of the World Wide Web in constant interaction with other people, even anonymous audiences. Technologies of self are—even more so than before—technologies of sharing. However, the moment of sharing, as a result of the networked condition, may arise much earlier in the memory process; for instance, a photo or diary entry may be sent through the Internet only seconds after it has been made, and it can be distributed among a potentially worldwide audience by a click on the mouse. When it comes to weblogs or MP3 file exchanges, it becomes difficult to describe new sociocultural practices in terms of the old: diary writing or compiling cassette tapes for a friend are succinctly different activities than weblogging or downloading music. Interestingly, people deploy several technologies concurrently when amassing their personal collections; each mediated artifact, whether a cassette tape or MP3 file, not only represents the contents favored at one time in life but also makes a statement about one's preferred mode of recollecting.

Digital cultural forms do not simply replace old forms of analog

culture; weblogs only partly overlap with the conventional use of paper diaries, laminated pictures are still printed despite the rise of digital photography, and MP3 files are not exactly replacing our tangible music collections. New practices gradually transform the way we collect, read, look at, or listen to our cherished personal items. The word "gradually" is important to emphasize here, because the ongoing digitization of memory tools and objects all but annihilates analog forms and practices. On the contrary, various theorists emphasize the dynamics of remediation: the way in which new technologies tend to absorb and revamp older forms or genres without completely replacing the old.[41] Photography "remediated" painting, but never took its place, even though both cultural practices repeatedly had to adjust their ontological and epistemological claims in the face of new technologies. Diaries and photo albums are currently undergoing a metamorphosis, although it is hard to predict which status and function familiar paper forms will adopt in conjunction with lifelogs and various kinds of web-based pictorial repositories. In fact, it is likely that analog and digital forms and practices will always coexist, albeit in varying configurations. New hybrid forms and fused practices are likely to inform the larger cultural tendencies that propel their use.

Can we conclude from the above that digitization is, ultimately, a cultural process that is slowly changing the way we remember our selves? The problem with this thesis, as stated earlier, is its deceptive primacy of technology as the cause for change. The matter, nature, and function of memory never changes as a result of technology; rather, the concomitant transition of mind, technology, practices, and forms gradually impinge on our very acts of memory. The first chapter explained how mediated memories manifest themselves along two axes: a horizontal axis expressing relational identities and a vertical axis articulating time. Being active producers and collectors of mediated memories, we carve out our personal niches in the vast sea of culture surrounding us, thus creating a continuum between past and present. In this chapter, I have argued to add a third (diagonal) axis to this model, configuring how memories are mediated through functions of body and mind, technology and materiality, and practices and forms (see Figure 2). Tied in with the horizontal relational axis, it emphasizes how acts and objects of memory are concurrently embodied in individual brains and minds, enabled by instruments and embedded in cultural dynamics. And offset against a vector of time, the model builds in a reflection on transformation.

Projection Future Creation

Self

Private

Individual

Embedded

Mediated Memories

(enabling technologies)

Others

Public

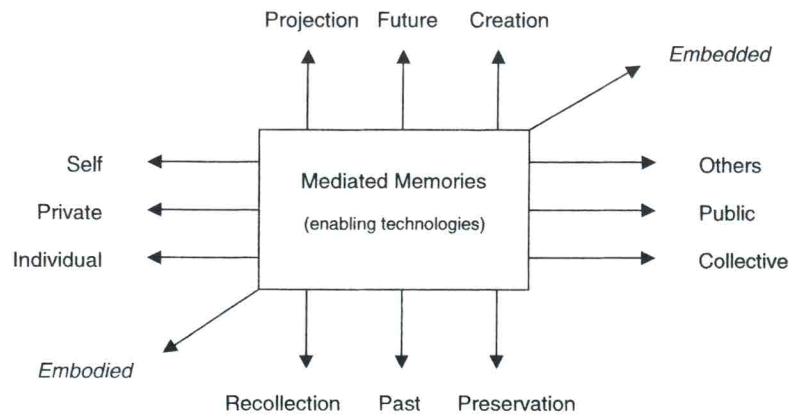Collective

Embodied

Recollection Past Preservation

FIGURE 2

Moments of media transition are so interesting because they are periods in which social practices and cultural forms are unsettled and renegotiated—a negotiation that concerns the materiality and embodiment of media technologies as well as the meanings arising from their use. It is at the nexus of mind, technology, and perceptual and semiotic habits that mediated memories are shaped. An insidious process, digitization—conceived as concurrently a technological and sociocultural transformation—is likely to affect our very concepts of memory and remembering.

First of all, the digitization of media may affect physiological and mental functions of memory, as much as mind mechanisms inform our development and use of digital, networked media technologies. Multimedia computers increasingly encompass a divergent variety of personal memory objects and concurrently connect us to a vast network of instantly available visual, auditory, and textual resources. Search engines and digital cut-and-paste techniques allow easy access to, and use of, numerous productions of others—known or unknown, private or public expressions that may or may not invite reciprocity. Memory, as a result, may become less a process of recalling than a topological skill, the ability to locate and identify pieces of culture that identify the place of self in relation to others. The old-fashioned model of the computer as a model for the brain as a means for storage and retrieval may be up for renewal; the computer supports the inherent inclination of memory to store *and* revise, to download *and*

upload, to recollect *and* project or invent. Of course, memory was always a creative act that involved communication as much as reflection, and yet it remains challenging to analyze and identify concrete instances of how mental processes are implicated in a larger pattern of transformation.

Another profound change in the transformation from analog to digital lies in the emergence of multimedial, multimodal technologies, objects, forms, and practices. If we look at our analog mediated memory objects, they commonly fit single categories of media and perceptual modes. For instance, a diary used to be a paper object that favored writing (despite the occasional drawing or illustration); a photo album contains laminated pictures (although occasionally annotated by handwritten comments); and a compiled cassette tape caters to our auditory dimensions of memory. In the digital era, it becomes easier to tie in a single memory object with multiple modes and media. The weblog is no longer strictly a piece of (hand)writing, as the incorporation of music and picture files expands the possibilities of computer-mediated reflection. Digital cameras carry standard options of adding verbal tags and allow the shooting of moving images, and the MP3 player appears to smooth the revival of audiobooks. The multimedial and multimodal potential of digitization is not merely an interesting side effect of technology but may ultimately redefine the sensory ways in which we catch and store memories. Visual, auditory, and verbal memory objects are not confined by the sensory mode inscribed in their enabling media; instead, mediated memories may become an intrinsically multimodal reservoir for creative inventions. Hence, diary writing may no longer be "a matter of script"—an utterance contained by its material and technological parameters—but could yield innovative ways of expressing the multimodal self.

Finally, science imaging and technological imagineering are inseparable from the forces of cultural imagination. While we are reinventing the tools for remembering, fantasies of digitized memories enter our popular culture. Technologies of self are intimately interwoven with cultural products: home movies, for instance, surface in Hollywood blockbusters, family albums become online multimedia productions, and tape collections inspire grand-scale schemes of music swapping. Future memory objects and acts of memory may be produced digitally, but they will be inevitably shaped by desires and concepts previously developed in the era of chemical, magnetic, and mechanical reproduction. *Eternal Sunshine of the Spotless Mind*, released

at a moment in history when personal memory finds itself caught between analog and digital materiality, helps us reinvent the meaning and function of personal memory: What do we expect and want from our new tools? How do we envision the role of memory in our lives and how would we like to change it? The invention of every new technology—whether photography, video, or the Internet—revises our methods of personal remembrance, and each of these same tools influences the way we imagine and inscribe our selves in relation to the culture at large. In fact, this may answer the question *why* memories matter: humans have a vested interest in surviving, and therefore they invest in creating and preserving imprints of themselves—their thoughts, appearances, voices, feelings, and ideas. They may want these images to be truthful or ideal, realistic or endearing, but most of all, they want to *be* remembered.

The proposed model is intended as an analytical tool; it serves as a model for understanding complexity, reminding us of the intricate multifaceted, interdisciplinary, and dynamic nature of memory. Mediated memories, in their conceptual and material dimensions, are always in transition; they are infused with technology and yet always also embodied and enculturated. The remainder of this book puts the analytical power of this model to a test. In each of the next four chapters, concrete mediated memories (diaries, sound recordings, photographs, and videos) form the lens through which to examine a specific aggregate of minds, objects, technologies, forms, and practices at this transitional stage between analog and digital. Acknowledging the changing epistemological and ontological status of mediated memories, I explore how digital culture is revamping our very concepts of memory and experience, of individuality and collectivity, unsettling the boundaries between private and public culture in the process. Digital technologies, which are part of a culture whose cognitive and epistemic paradigms are under construction, are as much reflections as they are agents of change. Personal cultural memory is coming out of the shoebox and becoming part of a global digital culture—a wireless world that appears dense with invisible threads connecting mind, matter, and imagination.

8. For an illuminating introduction to neuroscientific and genetic "machines" of memory, see Rusiko Bourtchouladze, *Memories Are Made of This: How Memory Works in Humans and Animals* (New York, Columbia University Press, 2002).

9. The metaphor of "hardware" to describe the matter of memory may be as tricky as the book retrieval metaphor. It presumes that the brain is a fixed set of neurons and genes that remains unaltered when "software" is run on its electronically wired system. Yet the living cells a brain is composed of are constantly changing due to external and internal stimuli. Brain and mind work in tandem to produce mental images, moods, and feelings, and they mutually inform their altered states. Rather than deploying the term "hardware," I resort to the metaphor of "mindware," a concept introduced by Andy Clark, in *Mindware: An Introduction to the Philosophy of Cognitive Science* (Oxford: Oxford University Press, 2001), to counter the potential misconception anchored in the computer metaphor.

10. The metaphor of the orchestra describing the mind's functions comes from Antonio Damasio, who coins the image in his book *The Feeling of What Happens: Body and Emotion in the Making of Consciousness* (Orlando, FL: Harcourt, 1999), 216. However, whereas Damasio restricts the use of this metaphor to the neuroscientific aspects of the mind, I expand its meaning to include objects external to the body as well as cultural aspects that affect the mind's memory functions.

11. For psychological studies on autobiographical memory and reminiscence, see, for instance, Susan Bluck and Linda J. Levine, "Reminiscence as Autobiographical Memory: A Catalyst for Reminiscence Theory Development," *Aging and Society* 18 (1998): 185–208. See also Linda J. Levine, "Reconstructing Memories for Emotions," *Journal of Experimental Psychology* 126 (1997): 176–77.

12. Steven Johnson, "The Science of *Eternal Sunshine*: You Can't Erase Your Boyfriend from Your Brain, but the Movie Gets the Rest of It Right,"*Slate*, March 22, 2004, available at: http://www.slate.com/id/2097502/ (accessed April 18, 2006).

13. Christopher Nolan, *Memento*, directed by Christopher Nolan (Los Angeles: Newmarket Films, 2000). The film is based on Christopher Nolan's brother Jonathan Nolan's short story *Memento Mori*.

14. See also Steven Johnson, *Mind Wide Open: Your Brain and the Neuroscience of Everyday Life* (New York: Scribner, 2004); Edwin Hutchins, *Cognition in the Wild* (Cambridge, MA: MIT Press, 1996).

15. Damasio, *Looking for Spinoza*, 88–98.

16. Experiments in which subjects were asked to invoke a particularly strong emotional episode from their personal memory confirmed Damasio's theory; certain invoked feelings corresponded to certain changes of neuroactivity spotted in specific regions of the brain. For a description of the experiment, see Damasio, *Looking for Spinoza*, 95–101. The mapping of body states significantly altered during the process of feeling, evidenced by the electrical monitors of positron-emission tomography (PET) scans registering the seismic activity of emotion in all experimental subjects before the actual experience of feeling (sadness, joy) had begun.

17. Strictly speaking, the destruction of physical objects patients bring into Lacuna's office should be redundant, because the internal, mental pictures from which the unpleasant memories derive no longer constitute the link between the brain and the feeling or emotion proper.

18. Don Slater, quoted by Deborah Chambers in *Representing the Family* (London: Sage, 2001), refers to the results of a market research survey in which 39 percent of respondents claimed their family photos to be their most treasured possessions (82).

19. Walter Benjamin, *One-Way Street and Other Writings* (London: Verso, 1979). On Benjamin's writings on memory objects, see also Esther Leslie, "Souvenirs and Forgetting: Walter Benjamin's Memory-Work," in *Material Memories*, ed. Marius Kwint, Christopher Breward, and Jeremy Aynsley (Oxford: Berg, 1999), 107–23.

20. Belinda Barnet, "The Erasure of Technology in Cultural Critique," *Fibreculture* 1 (2003), http://journal.fibreculture.org/ (accessed December 23, 2006).

21. John Sutton, "Porous Memory and the Cognitive Life of Things," in *Prefiguring Cyberculture: An Intellectual History*, ed. Darren Tofts, Annemarie Jonson, and Alessio Cavallara (Cambridge, MA: MIT Press, 2002), 130–41, 138.

22. Clark, *Mindware*, 141.

23. L. H. Martin, *Technologies of the Self: A Seminar with Michel Foucault* (London: Tavistock, 1988), 16.

24. My notion of sociocultural practices finds a middle ground between what sociologist Pierre Bourdieu, in *Outline of a Theory of Practice* (Cambridge: Cambridge University Press, 1977), refers to as "habitus" and what philosopher Michel de Certeau, in *The Practice of Everyday Life* (Berkeley: University of California Press, 1984), rearticulates as "the practice of everyday life." Bourdieu's "habitus" is associated with the internalized, practical knowledge by which people operate in stable, social structures and situations; De Certeau uses the term "practice" to emphasize the dynamics of people evolving in social structures, changing them and adapting to new ones. When I use the term "sociocultural practices," I am referring to both static structures and dynamic changes. However, I am much more specific in my denotation of the word "practice," referring to a set of practical, technical, social, and cultural skills needed to operate the "technologies of self" Foucault identifies. These sociocultural practices are grounded both in materiality and technology (in this case media technologies) as well as in the knowledge of their practical use (e.g., social norms and discourses).

25. Hartmut Winkler, a German media scholar, presents a theory of cultural continuity by explaining the translation of certain cultural practices into "deposits" (defined by technology and its use) that turn back into practices. Through constant reinterpretation and reshaping of practices and objects, the continuity of culture is secured, even if constantly morphing. See "Discourses, Schemata, Technology, Monuments: Outline for a Theory of Cultural continuity," *Configurations*, 10 (2002): 91–109.

26. Anthropologist Edwin Hutchins, in *Cognition in the Wild* (Cambridge, MA: MIT Press, 1996), argues in contrast to the standard view that culture affects the cognition of individuals, that cultural activity systems have cognitive properties of their own that are different from the cognitive properties of the individuals who participate in them.

27. Roger Silverstone, Eric Hirsch, and David Morley, "Information and Communication Technologies and the Moral Economy of the Household," in *Consuming Technologies: Media and Information in Domestic Spaces*, ed. Roger Silverstone and Eric Hirsch (London: Routledge, 1992), 14–31.

28. Notions of self and family, as I argue Chapter 6, are constructed and reflected through media technologies. Media technologies, as Silverstone, Hirsch, and Morley argue in "Information and Communication Technologies," are never fixed instruments, just as media objects are never immutable items. Video cameras may be appropriated differently by various members of a household, and it is not uncommon that each member of a household composes his or her own individual photo album in addition to the family album kept by a parent.

29. Positron-emission tomography (PET) is a scanning technology that with the help of radioactive isotopes allows one to study the brain functions in vivo; functional magnetic resonance imaging (fMRI) makes it possible to record static images of activity in the brain that subsequently can be turned into a moving film.

30. With the digitization of medical diagnostics came a stronger articulation of images as transparent indicators of ailments, even though it has been abundantly argued that (medical) imaging has rendered the body opaque rather than transparent. For an elaboration of this argument, see José van Dijck, *The Transparent Body: A Cultural Analysis of Medical Imaging* (Seattle: University of Washington Press, 2005), chapter 1.

31. For an insightful analysis of how brain images like those from PET scans have served in courts and popular culture as "objective" evidence of mental illness and abnormality, see Joseph Dumit, "Objective Brains, Prejudicial Images," *Science in Context* 12, no. 1 (1999): 173–201. See also Brent Garland, ed., *Neuroscience and the Law: Brain, Mind, and the Scales of Justice* (New York: Dana Press, 2004).

32. Neurologists' and neuroscientists' infatuation with fMRI as a way to determine pathological and criminal behavior is also touted as the new "phrenology" of medicine; see William R. Uttal, *The New Phrenology* (Cambridge, MA: MIT Press, 2003).

33. Many science fiction movies, from *The Matrix* to *The Thirteenth Floor*, prophesy the future of human bodies to be one where uploading the mind into the computer helps transcend the flesh, ushering into a kind of wired universe where the mind-machine survives autonomously. The merger of brain and computer implicitly hails the triumph of informatics over flesh, of software and hardware over "wetware." N. Katherine Hayles, in *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature and Informatics* (Chicago: University of

Chicago Press, 1999), rightly criticizes theorists such as Hans Moravec and Ray Kurzweil whose affection for "disembodied minds" and "virtual brains" seems to dispose of the body as a locus for mental activity. "Posthumanists," as Hayles calls them, are blind to the materiality of informatics and indifferent to the embodiment of digital media. The idea of human memory being digitized and transposed to a locus outside the brain is an immensely popular trope in the twenty-first century, informing both visionary science projects and science fiction movies like *Brain Destroyer* and *Fantastic Voyage II: Destination Brain.*

34. Eugene Thacker, "What is Biomedia?" *Configurations* 11 (2003): 47–79.

35. Ibid., 76–77.

36. Genomics is a case in point: the computations of genetic sequences are carried out by computers, and thus digital information becomes an impetus for redressing our knowledge of genetic defects. For a detailed explanation of how genomics and information interact, see José van Dijck, *ImagEnation: Popular Images of Genetics* (New York: New York University Press, 1998), chapter 6.

37. For an extensive analysis of how ultrasound imaging not just works to reconfigure our conceptualization of the fetus, but also affects pregnancy and the development of the fetus, see Van Dijck, "Ultrasound and the Visible Fetus," in *The Transparent Body,* 100–117.

38. There is a hilarious scene in *Eternal Sunshine* where Dr. Mierzwiak asks Joel to unleash his painful memories of Clementine by talking about her into the microphone of an old-fashioned cassette recorder. Later in the movie, Joel and Clementine are confronted with their embarrassing monologues when the magnetic tapes with their voices are returned to them through a disgruntled, revengeful secretary after she has discovered the "erased" love affair with her boss, Dr. Mierzwiak.

39. Gregory Ulmer, for instance, treats (digital) memory as a reservoir for creative invention and intervention—new media technologies allowing the reordering and reshaping of digital imprints of the past, whether pictures, sounds, or texts. See Gregory Ulmer, *Heuretics: The Logic of Invention* (Baltimore, MD: Johns Hopkins University Press, 1994).

40. A concise and insightful article in the *New York Times* provides an overview of the many problems involved in storing, preserving, and retrieving digital memory files for the next generation. See Katie Hafner, "Even Digital Memories Can Fade," *New York Times,* November 10, 2004 (online edition, www.nytimes.com).

41. See Jay Bolter and Richard Grusin, *Remediation: Understanding New Media* (Cambridge, MA: MIT Press, 1999).

CHAPTER 3

1. Susan Herring, an American sociologist from Indiana University specializing in computer-mediated communication, in a 2005 presentation, quotes the number

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