

Impressive. Memory, Matter and Mind

Herbert Hrachovec

Think of a film. What sort of thing is it? It comes in reels or, more recently, in a great variety of digital formats. Numerous materials have gone into the product, specific activities were called for: the hiring of a director, scriptwriters and actors; the determination of locations; technical support was provided, a plot was enacted, recorded and put onto an appropriate medium; raw takes were cut and reassembled. This is only half of the story, though. What about the movie's impact on an audience? It is perceived as belonging to a certain genre, as entertaining or frightening and, generally, as a work of fiction (or documentary, or else), following the rules of narrativity and aesthetic conventions. These stories differ significantly – and yet, we have no difficulty in applying either of them, or some suitable combination, to the underlying phenomenon. Multiple layers of descriptions are, in this case, taken for granted. The situation is quite different when it comes to human memory.

Living organisms show a capacity to retain and redeploy information concerning their environment. How they are capable to do so is a fascinating topic of scientific investigation. There are, on the other hand, countless instances of individual memories constituting the mental set-up of humans, their personal identity and their ethical profile. Both viewpoints are, again, distinctively different. But here it seems that they are more incompatible than e.g. the lightning of a certain scenery and some conclusion a moviegoer might draw from it. The urge to construct a dualism is much stronger in the first case. And this, in turn, triggers a predictable monistic rejoinder, according to which the intricacies of social constructs like film cannot be taken as a guide in treating so-called natural phenomena.

This paper will set out a dualistic pattern, exemplified by (1) a neurobiological account of memory and (2) a short segment of the work of an Austrian avantgarde film-maker. This segment is chosen to simultaneously show a possible proximity as well as the presumable incompatibility of neurological and artistic approaches. The inevitable question of how those points of view relate to each other is taken up in the final section.

Memory Matters

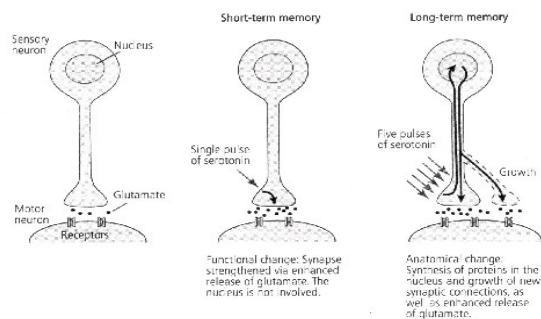
Microbiology has advanced so far as to be able to investigate the details of neuronal interaction down to the level of single cells. Eric R. Kandel has received the Nobel prize for his work on the formation of short and long term memory in the marine snails *Aplysia*. He was able to isolate the pathways connecting stimuli originating from the tail of this animal to a synaptic relay between sensory and motor neurons, which triggers a gill withdrawal reflex.¹ The next step was to look closer at the biochemistry of the synaptic setup. It turned out that a shock to the tail of *Aplysia*

¹ The following account is taken from Eric R. Kandel's autobiography *In Search of Memory. The Emergence of a New Science of the Mind*. New York 2006. For a handbook introduction see Craig H. Bailey and Eric R. Kandel: *Synaptic and Cellular Basis of Learning*. In: Gary G. Berntson, John T. Cacioppo: *Handbook of Neuroscience for the Behavioral Sciences*, Volume 1. pp.528ff. A generally accessible account is given by R. Douglas Fields *Making Memories Stick*. Scientific American 2005 (2). pp. 58ff

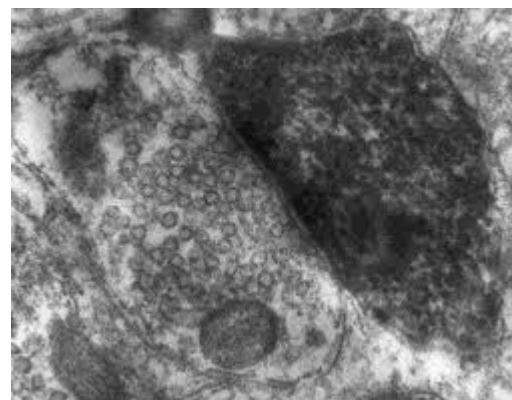
releases a chemical messenger (serotonin) which binds to receptors on the sensory neuron. A chemical substance (cyclic APM) is thereby produced, which in turn (via a protein called kinase A) enhances the release of glutamate (a neurotransmitter) into the synaptic cleft separating the sensory from the motor neuron. The synapse is strengthened, which leads to a marked change in behavior of *Aplysia*, e.g. enhanced reactions to an outside stimulus. This is a very superficial sketch of the neuro-physiological foundation of what can be called „short term memory“. i.e. in this case a passing mode of information storage in a comparatively primitive organism.

It might be argued that such imprints are hardly different from sunburns caused by solar radiation. Such burns, like neuronal activation, result from environmental conditions, carrying information about certain of its states. Commonsense talk of memory, on the other hand, is usually referring to a more complicated set of capacities of an organism. Sunburns are transient traces and it has been shown that actual excitation of sense receptors is similarly short-lived. Another type of pre-conditioned and/or conscious behavior is called for in order to understand how memory can persist over a longer period of time. Eric R. Kandel has, again, been instrumental in clarifying the neuro-physiological mechanism responsible for „long term memory“. Surprisingly, it hinges on an anatomical change on part of the sensory neurons. While a single stimulus strengthens the synapse involved, repeated stimulation triggers a further chemical process within the cell. It is directed towards the genetic information residing in the cell's nucleus and results, ultimately, in the growth of additional synapses. Long term facilitation of biological senso-motor linkage is, as it turns out, supported by structural changes in the cell's architecture.

Kandel's results have, among other things, been made possible by advanced microscopic technologies. A sequence of chemical processes could thereby *be shown* to lead to cell development which could, in turn, be linked to functions of elementary memory. It has become standard procedure in public presentations, textbooks and journal publications to offer vividly schematic, multicolor graphs on order to show the essentials of bio-chemical interactions. One point is lost in these images, namely the materialistic thrust characteristic of neuro-physiological research. It is, of course, helpful to be offered an easily surveyable sketch of the functional dependencies between the various processes underlying memory formation. Yet, an important fact is bracketed by this approach, namely the evidence offered by electronic micrographs that actually *present* (not *re-present*) the biological states. If it were only for the textbook illustrations we could just as well deal with artificial designs (not to mention science fiction). It has, however, to be conceded that those micrographs look considerably less tidy than their idealizations.



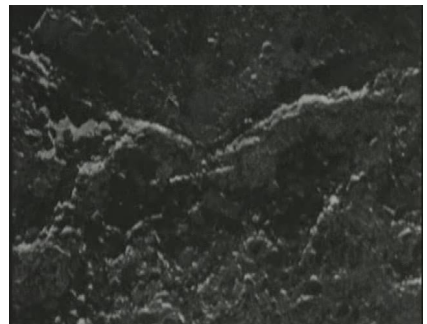
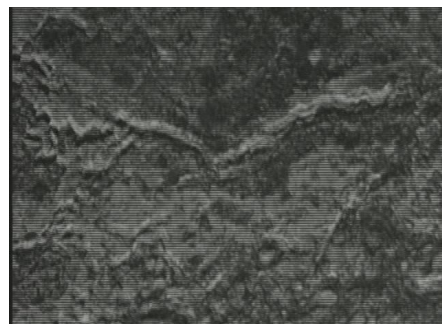
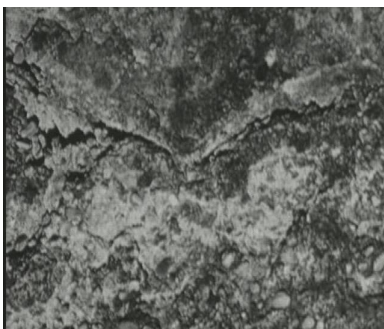
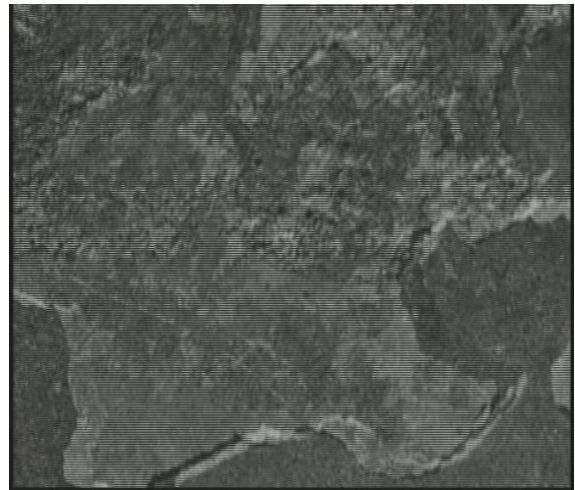
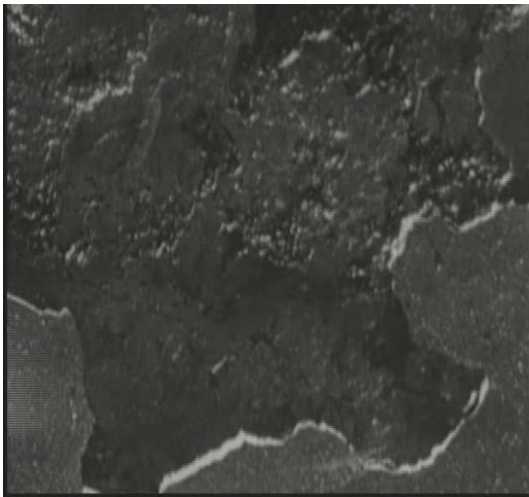
18-4 Changes underlying short- and long-term memory in a single sensory and motor neuron.



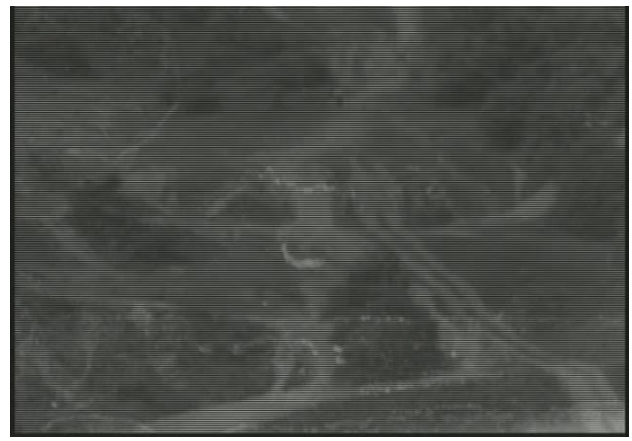
There is one important lesson to be drawn from pictures made by microscope and enhanced with superimposed inscriptions, pointing to an image's relevant features. Neurophysiological research does not proceed by simply rendering the material foundation of life in increasingly greater detail. Those textbook sketches are *unavoidable* since they depict theoretical constructs *guiding* empirical investigations. Looking at a coarse, gray, pointillist surface we do not spontaneously see a synapse, not to mention the chemical reactions leading to the formation of additional synapses. It is true: we have to be able to verify theoretical claims with reference to such visualizations. But we need *concepts* to visually distinguish the salient features. The matter of memory, explored by scientists like Eric R. Kandel, does only reveal its workings under the prompting of an extremely sophisticated array of cognitive and social presuppositions. We are talking about chemical compounds from within a certain understanding of storage and memory. The approach has proved to be extremely successful. But it should be mentioned that this undertaking does not by itself have any bearing on different attitudes to pictures.

Minding Memory

I have introduced some recent results in neurophysiology before remarking on the methodological status of depictions only made possible by sophisticated technical means. Now, consider another set of pictures which look quite similar: gray contours of nondescript blobs devoid of any obvious meaning. Their sheer physicality puts them firmly on the side of matter, subsisting as a mindless given, like traces of sedimentation or molecular aggregations in a Petri dish.



The images switch from positive to negative, a slow change of pattern can be detected. No visible clue enables the viewer to relate this sequence of images to any known natural process. They could be taken from a mudslide or a melting pot. They seem, if anything, just stuff; pure matter. Some filaments appear, delineating a network structure that superimposes itself onto the irregular patches.



I have been withholding information regarding the provenance of the photo-clips. Just as the previous micrographs needed a caption to be properly deciphered, the second set of pictures has to be contextualized. Here is the relevant snapshot:



The stills have been taken from a film by the Austrian experimental filmmaker Kurt Kren. The title indicates that it has been produced in 1961 and furthermore it holds the key to the content of its visual representations. We are shown shots from (decaying) walls, alternatively switched to positive and negative mode. The appearance of a biological process is entirely superficial. And we are, secondly, presented with a hybrid image: a system of pathways superimposed upon the mural patterns. Cinematic procedures have resulted in a photographic double-take which can be read as a testimony to two material states encountered by an errant camera. The scenario lacks the intricacy of the previous example. It seems glued to a haphazard depiction of motives devoid of importance, dull instances of chance actions. Alas, there is more to the film than is apparent from its mere imagery.

A wall versus a path: the title of the film establishes a semantic opposition. Walls close in, they stop movement; whereas paths are made for movement. The pictorial patterns *per se* do not express

these distinctions. These visual impressions could be given any number of treatments. But they *support* one very particular *interpretation*. The beholder may view those stimuli in a semiological vein. She may observe that block-shaped patterns are reminders of obstacles and that they are contrasted by the network of routes etched into the ground by humans crossing the terrain. She may, furthermore, come to think about the hybridization of those motives. Taken in isolation those clips instantiate the dichotomy of stop and go. Dichotomies, however, are just one way to deal with competing states or ideas. The positive/negative modes of the first series of pictures can, in fact, be regarded an echo of this methodological observation. The law of the excluded middle is materialized by juxtaposing two images related to each other by a particular logico-ontological bond: each photo presents *precisely* that state of affairs that the opposite photo constitutively *fails* to present. Given any feature of one of the two, the corresponding one voids its existence.

This is, however, *not necessarily* the relationship between a wall and a path. A wall can be constructed to run parallel to the way; or it is a low barrier designed to be stepped over; or it is made of smoke and can easily be traversed. As those examples demonstrate the meaning of negation („this is *not*“) is not confined to contradictory exclusion. There is a variety of uses of the term and a great number of *differences* that can be established by means of negations less powerful than the global binary operator.. „Speed bumps are a kind of wall not stopping, but slowing down traffic.“ Kurt Kren's film exhibits both kinds of negation, the exclusionary as well as the differential variety. Given the understanding of some of the formal characteristics of negation it can be seen as a playful attempt to visualize those features.

Let me add one more layer of meaning, from a professional philosophical point of view. The preceding considerations have been implicitly been guided by scholarly work entirely unconnected to Kurt Kren's film or his ingredients. In an exegetical paper on Ludwig Wittgenstein's early philosophy² I have argued that his elementary sentences in the *Tractatus* are a compound of two different kinds of meaning. Their *pictorial* sense derives from an isomorphism with real states of affairs, while their *veracity* has – according to Wittgenstein – to be located in their bipolarity, e.g. their being either true or false. Wittgenstein calls this their „Richtungssinn“, („directional sense“). Kurt Kren's distinctive shapes, combined with their positive/negative alternation, strike me as surprisingly felicitous „embodiments“ of Wittgenstein's theoretical construct. And there is more.

According to the logical atomism of the *Tractatus* elementary propositions are to be strictly separated from each other. Every proposition is one of its kind, representing one basic fact. Taking up a term used by the later Wittgenstein one may talk of a „picture radical“ underlying such propositions. Those radicals exhibit one particular structure *regardless* of the directional sense (the truth value) the picture is given in actual employment. Bivalent building blocks of logically simple expressions are then – in Wittgenstein's early view -- concatenated by truth-functional operators to create a linguistic pattern describing the world. Time and varying degrees of truth-ascription are absent from this account. It is, in short, quite similar to an array of static photo clips. Wittgenstein, returning to this issue in the thirties of the previous century, became aware of the shortcomings of this account. He found that a neatly cut (description of) the world built from immutable primitive elements was more of a dogma than a philosophically tenable position. This led him, among other things, to reassess his views on negation, allowing differences within a given spectrum, rather than insisting on a binary partition of the space of meaning. I will not elaborate on this, but only hint at the fact that the appearance of paths in addition to snapshots of walls in Kurt Kren's film is a clear visual parallel to this development.

2 Herbert Hrachovec *Bilder, zweiwertige Logik und negative Tatsachen in Wittgensteins 'Tractatus'*. Zeitschrift für philosophische Forschung, 32 (4). pp. 526ff

Mediation

Proceeding from roughly similar looking images two markedly different stories have been told. The first was the sketch of the scientific research leading to the discovery of the neurophysiological preconditions of memory formation. The second one made an entirely different use of underlying depictions. Rather than take them as evidence by means of which theories can be tested, this story started with visual cues, proceeding to develop them into a semantic web and to ultimately utilize them as suggestive prompts within a philosophical argument. It has been pointed out at the beginning that, faced with everyday phenomena like movies, a kind of perspectival permissiveness is widespread. We do not worry too much whether we can strictly relate technical data on the supporting medium to high-level cineastic attitudes. The juxtaposition of diverging stories presented above is meant to prepare the field for the consideration of two quite distinct socio-cognitive strategies with regard to many phenomena, including memory.

Relativism, post-modern multiplicity or simply tolerance are one option, as indicated. Yet, there is another influential attitude, deeply entrenched in our culture. Wittgenstein's *Tractarian* logic is, in fact, a prominent example of a „rigorous scientific“ approach that only allows *one* access to truth via a closely regimented language and a binary procedure of deciding scientific claims. Forms of expression that do not conform to those requirements are considered inadmissible from the outset. Wittgenstein's spectacular transcendentalism refers a set of non-conforming means of expression into the realm of „Sinnlosigkeit“ (lack of meaning), distinguishing them from „Unsinn“ (nonsense), but this is quite an idiosyncratic position. It is more common to promote scientific materialism and reject attempts to diversify the field of scholarship by including „soft“ disciplines like history, social anthropology or hermeneutics as inquiries into truth. The treatment given to (on the face of it) similar images in the preceding section can serve to highlight the dilemma. From a scientific point of view Eric R. Kandel does serious, well-grounded research, whereas the interpretation I have been imposing upon Kurt Kren's film are aesthetic criticism (at best) and more likely just flights of phantasy for hard-nosed scientists. A humanities scholar, in reply, will point out that this amounts to a dictatorial gesture, ruling out numerous possible options of dealing with the human predicament.

Those different cultures, as a matter of fact, coexist, albeit in constant conflict. Scientific rigor and pluralism hold on to their respective intuitions. The question then becomes: what about this coexistence itself? What should we make of a situation offering such conflicting features? This is the point made by our initial observations regarding movies. How should we treat the indisputable fact that the material substitute of forms of human life obeys its own, physical law *and* that those forms, in turn, are quite distinct from their bodily implementation (storage media versus movie genres). The weight of the problem, obviously, far exceeds the scope of the present contribution which will be confined to just one suggestion on how to approach this thorny issue. I take a hint from a book Antonio Damasio has written on Spinoza.³ Damasio is a neurophysiologist trying to cope with the limitations of an exclusively „materialistic“ outlook. In Spinoza he finds a daring theoretical construct, a sort of synthesis between „body“ and „mind“. E.R. Kandel's autobiography, from which I took my cues in presenting his work, runs the two aspects together. It not only contains an account of his scientific discoveries, but also memories of his childhood, his collaborators, his personal development. One question is not raised: How can the expressions of proteins in some particular cell relate to memories of the Viennese 18th district before the second

3 Antonio Damasio *Looking for Spinoza*. London 2003

world war?

This is a philosopher's concern. Damasio presents Spinoza's solution: „What is Spinoza's insight then? That mind and body are parallel and mutually correlated processes, mimicking each other at every crossroad, as two faces of the same thing. That deep inside these parallel phenomena there is a mechanism for representing body events in the mind.“⁴ Monism and pluralism are both put aside in favor of another type of view. Take film reels and film genres. Is there a way to conceptualize their interdependence? Addressing the body-mind problem Spinoza's proposal is to consider both as parallel and mutually correlated processes. There is an underlying given (a continuum of „films“ and „humans“) and at least two different implementations of its potential which are held together by the very action of positing this given. It is because we regard films as something simultaneously material and cognitive that we can establish the necessary cross-connections. Easy, initial correlations could be established between photographic material and color films or between photographic procedures and animation. The general idea is that it must be possible to relate a multiplicity of appearances back to a common ground, *given* one wants to avoid ending up with numerous partly equivocal uses of a term.

Spinoza is explicitly stating that, as far as body and mind are concerned, they are two aspects of a common „thing“. „quod scilicet Mens, at Corpus una, eademque res sit, quae jam sub Cogitationis, jam sub Extensionis attributo concipitur.“⁵ This is not the place to go into exegetical details concerning this surprising doctrine. I shall restrict myself to offering two lines of thought intended to show the attractiveness of this type of proposal. The first will be taken from the later Wittgenstein, the second one will refer back to the stories presented at the beginning of this article. Wittgenstein has introduced a standard psychological test design into his philosophical discussion of „seeing as ...“, i.e. aspect dependence of visual impressions. His famous „duck-rabbit“ exhibits a structure that can be put to good use in approaching Spinoza's two-aspects doctrine. There is just one underlying drawing, but two conflicting ways to look at them. Both claims are equally valid: (1) depictions of ducks and rabbits are generally distinct and (2) these depictions are (in this case) demonstrably rooted in a single substrate. We can identify the precise pictorial traces that can both be seen as a duck and as a rabbit. One may even pick only part of the drawing and obtain similar results: this very segment represents a duck's beak or a rabbit's ears.

This hint does, of course, not do justice to Spinoza's intricate demonstrations linking *res extensa* and *res cogitans*, nor does it in any way specify how one might go about relating (e.g.) *genetic change* in the establishment of long term memory's *content*. But it can show the attractiveness of a Spinozistic approach which is neither simply monistic, nor does it split the ontological realm into dualistically opposed parts. It rather endeavors to combine intuitions about the ultimate homogeneity of the world with intuitions pertaining to incommensurable ways of dealing with a common substrate. Wittgenstein's paradigm, likewise, shows a way to uphold a singularity while refusing to abandon multiplicity built upon it. To see *something* as one thing or another is not the most elementary starting point, which is, presumably, to *simply* see something. „Seeing as ...“ introduces points of view and those, in turn, give rise to an ominous question. *What* are those different views about? How can some unit be posited as underlying the constitutive duplicity?

The question seems easy with respect to Wittgenstein and very difficult regarding Spinoza. One and the same glass window can be taken as part of a wall or as an opening. A piano can be used as a musical instrument or for book storage. Cases like this can be sorted out comparatively easy. The

4 Damasio loc.cit. p.217

5 Baruch Spinoza *Ethica*. Pars Tertia, Propositio II, Scholium.

mind-body divide, on the other hand, seems to pose an much more complicated problem. Here we are faced with two qualities that have been defined as being constitutively different. There is no obvious neutral point of reference for physical stuff and ideas to converge upon. Whereas one can easily switch between the two ways to talk about a window it is difficult to see a *tertium* in the case of Cartesian dualism. Spinoza's answer cannot be explored here, but I will offer a first approach to justify the sort of thing he is doing. To do so I return to the stories presented in the first two sections of this paper.

Someone looks at a micrograph. What is this an image of? Let us assume that one answer is that this shows the development of an additional synapse between a sensory and a motor neuron. And let us further assume that someone else claims that this shows the formation of an instance of long term memory. The first response is an example of straight „materialistic“ talk, the second one makes reference to memory, which term has strong connotations to a state/capacity of a mind, i.e. a non-material phenomenon on the face of it. Once the situation is laid out like this the question immediately becomes: How can those two different descriptions relate to each other? Can we reduce phenomena of the mind to physical givens? This is the well-trodden path of debates about monism, dualism, reductionism, epiphenomenalism and so on. But, in the light of Kandel's story, consider the initial step that effectively triggered this set of options. A certain situation prompted a particular intake by a recipient. It is this intake which gets processed in various forms along the way, leading to points of view dramatically diverging and producing seemingly irreconcilable post-process results, e.g. reference to chemical compounds and to states of the mind. What should we say about their relationship? What *can* be said? The answer is: *the routes leading to different outcomes are all open to inspection*; it is possible to draw the course they are taking.

Two sets of genetic information can be identical in lab conditions. But they may be part of the physical setup of monozygotic twins. So they develop in different ways. Kandel's research, in fact, tells us that some of their genetic information will change due to environmental circumstances. The lives of two different persons develop, even though they share an extraordinary amount of common traits. And the obvious way to deal with this puzzle is to trace the respective life-lines, in other words to tell a story about an initial state and the emergence of differences. Such stories are necessarily told in hindsight. There is no way that, just given an ad hoc situation, the possible divergences can be foreseen. The initial state *as* initial state is already marked within a narrative. It is possible to bracket the narrative, but then the present problem disappears. It is only by *figuring in stories* that a given unit of information (of physical parameters of sense impressions) can be unfolded into various „branches“. The question of how those branches relate to each other, then, comes to this: What do the narrative accounts tell us about those associations. The strength of dual-aspect theory of certain phenomena depends on the conviction carried by the pertinent stories.

I started out observing that an easygoing relativism governs everyday talk about, for example, the world of film, whereas an almost obsessive dualism can be observed in a number of domains, some of them embattled in philosophy. The mind-body dichotomy is a traditional case in point. On closer inspection the weight of claims to have discovered the neurophysiological foundations of long term memory depends on how successful the accounts of bio-genetics and (ultimately) psychology can be interwoven. A similar result holds for Kurt Kren's film. His snapshot of patches of decaying walls are not *per se* visual comments of certain of Wittgenstein's ideas. They can be put forward as such insofar as a coherent cognitive relation is established in an argument. Mind-body dualism is quite a superficial pattern, and so is reductionism. What we should look out for are rich descriptions of investigative approaches and conceptual design.