MEMORY, SLEEP AND IMAGINATION

>FR

(Excerpts from radio programs ***Sur les épaules de Darwin*** (On the shoulders of Darwin) – ***A la recherche des mystères de la mémoire*** (In search of the mysteries of memory - Programs 1 and 2 by **Jean-Claude Ameisen** on October 18 and October 25, 2014 on France Inter.)

Table

Preliminary note

*I have not reproduced here the entire content of the two radio programs by **Jean-Claude Ameisen** from which I extracted this text and which explains and develops abundantly what are place cells and grid cells. It is up to the reader to inquire about it, as his responsibility for thinking requires, whether as a citizen or even more simply as a member of a human group, as it has been among men since dawn the times.*
My responsibility here comes down to highlighting some of the tracks that came to my mind and which we could take advantage of in terms of research or even new surrealist practices.

These two radio programs aimed to make French audiences aware of the importance and the interest – if only from the point of view of minimal humanism – of the work of the 2014 Nobel Prize winners in physiology and medicine, which moreover, they followed on from previous work of the same importance, which was also the subject of a Nobel Prize.

*Having read by chance in parallel the book **Mauvaises Pensée et autres** (Bad thoughts and others) by **Paul Valéry**, it occurred to me to compare the quotes by Valéry that best applied to the context with Jean Claude Ameisen's text.*

*In what follows, Jean-Claude Ameisen's text is in **brown** and my comments are in **black**.*

Horses of memory

In the depths of our brain, there is a small area that has the shape of a small sea horse: the hippocampus. And it is indispensable to the memorization, to the inscription within us of memories that will become durable. In the hippocampus our recent memories begin to register and will gradually be transformed into long lasting memories.

During our sleep nerve cells networks reactivate in the hippocampus, reviving within us some of the experiences that we have lived in the waking state. And during our sleep, when it seems to us that we are absent from ourselves, our recent memories are gradually transformed into long lasting memories. And this transformation is partly realized in the form of a real journey, like a boat in us, which would break its links, leave the bank, and drift.

A journey, a gradual migration, night after night, within us, for several weeks, of some of the traces of our lived experiences that were initially inscribed in our hippocampus and that will move towards areas located on the surface of our brain, in our cerebral cortex. This slow drift during which we recompose, reorganize, recreate without feeling it, without knowing it, the meaning of what we have lived in the waking state, occurs in the darkness of the night, when consciousness seems to leave us and to only wake up briefly, intermittently in the form of the hallucinations of our dreams.

Notes :

Our clearest ideas are daughters of an obscure work.
Paul Valéry - Bad thoughts and others - NRF Gallimard 1942. Page 171.

The temporal localization of dreams which was formerly clearly attributed to periods of paradoxical sleep no longer seems so clear. It seems that dreams can also occur during the phases of slow sleep. Most authors now prefer not to go too far and say that the phases of paradoxical sleep are characteristic of the dreams ***that one remembers***.

Mosaic of memories

During our sleep, the activity waves traveling through our hippocampus synchronize with the waves traveling over the surface of our brain, our cerebral cortex, allowing the network of cells on the surface of the brain to resonate with part of the transformations which happened in the hippocampal cell networks and which will gradually be integrated on the surface of the brain.

And so, during our sleep, our memories become durable by being inscribed within us in the form of a moving mosaic, made of scattered traces that gradually move away from one another. When they later reappear in our consciousness, in the light of the day, when we remember, these traces will re-associate, re-emerge together, giving us the illusion that our memory has retained the unique imprint, of what we have experienced.

What is extraordinary is that, most often, we do not perceive anything of this re-composition phenomenon, of this re-binding of scattered pieces into a whole, into a set. And these re-creation phenomena are even richer due to the fact that we are not aware of them.

One of the consequences of mosaic nature of our memories is our ability to draw pieces of different memories and to reassemble them, recombining them in a new way; and hence, from our past experiences, we can bring to existence imaginary scenarios. We can create.

Notes :

Consciousness reigns but does not govern.

Paul Valéry - Bad thoughts and others - NRF Gallimard 1942. - Page 56

Everything is composed, combines, substitutes, compensates, mingles and unravels, and that is the spirit.

Paul Valéry - Bad thoughts and others - NRF Gallimard 1942. - Page 23

Thickness of the new

The hippocampus, this area within our brain that is essential to our learning capacities, is renewed throughout our existence. Among all the areas of our brain it is probably the only one that continues to be renewed after childhood throughout our adult life.

A study published by researchers from Sweden and the United States in **Nature Medicine** had first highlighted it 16 years ago in 1998. But the existence of this renewal, of this permanent rejuvenation had been debated and doubted. And it was only confirmed for the first time one year ago, by a much more complete and much more accurate study published in June 2013 in the journal **Cell**.

The researchers showed that throughout our adult life occurs a renewal of about more than one third of the total number of nerve cells that make up the hippocampus in a particular area of the hippocampus

called toothed gyrus. Every day on average, throughout our existence, about 700 nerve cells are born in the toothed gyrus and replace nerve cells that die in equivalent numbers. Each year, nearly 2% of the nerve cells in this hippocampus area are replaced by new cells; about 250,000 cells per year.

This plasticity, this renewal, this constant rejuvenation of a portion of our brain plays an essential role in our ability to learn, in our ability to inscribe new memories within ourselves and to continually adapt to a changing world. To learn is to become different. And as we learn throughout our lives, our brain also becomes different.

Studies in mice indicate that the more stimulated they are, the more their environment stimulates their attention, their memory and their anticipatory ability, and the more important the birth of new cells to their hippocampus is. When elderly mice are placed in a more stimulating environment than the usual environment of a laboratory animal facility, when their environment is made richer, for example by expanding the space they can explore, by increasing the number of mice that they may encounter, by introducing objects that attract their attention and which are often changed, then the hippocampus of these old mice rejuvenates, increases in volume compared to that of mice of the same age, although genetically identical, who live in a less stimulating environment.

And in those elderly mice who live in a stimulating environment, learning and memory skills increase and become similar to those of younger mice. And so, the richness and complexity of the environment has an important effect on the functioning modalities, on the reconstruction and rejuvenation of the brain.

And if what happens in mice also applies to ourselves, then learning, discovering, exploring, opening ourselves to the world, constantly expanding the scope of our encounters with others is not just creating a greater number of memories in us, but it also probably modifies the way our memories articulate with one another in our memory, that means to modify the memories of the experiences we have experienced, the way we confront these memories with the world around us and the way we adapt to new environments.

Notes :

The phenomenon does not seem to be restricted to the hippocampus. I remember a TV program about Boris Cyrulnik and his work on resilience, showing a spectacular catch-up in terms of brain volume resulting from the rehabilitation of affectively and perceptively abused children in the Romanian institutions created by the Ceaucescu dictatorship. From a surreal point of view, does a vast and rich memory (resulting from a rich and intense life and diversified experiences) relate to the extent of the movement or of the results of poetic activity?

Routes and places

During our journeys, some nerve cells in the hippocampus and in a neighboring region are activated drawing in us in real time maps of the configurations of the environment that surrounds us. And when we mentally, consciously or unconsciously, in the waking state or during our sleep, re-live the paths we have taken, these same cells reactivate by redrawing the maps of the places we have passed through. We then travel without moving through dynamic mental maps that follow one another as we move in thought.

"How do we know where we are, how can we store this information in such a way that we can immediately find that place again when we find ourselves on the same path?"

Thus began the communique of the royal academy of Sweden which presented the Nobel Prize for Physiology and Medicine awarded twelve days ago, October 6, 2014 to **John O Keefe** and **May-Britt Moser** and her husband **Edward Moser**.

In 1971, as he developed his research at Macgill University in Montreal, while recording the activities of individual nerve cells in the hippocampus in rats that were freely moving in a room, John O Keefe discovered that some nerve cells were active when the animal was located in a particular place in the room.

He showed that the activity of these cells, which he called locus cells, did not simply reflect what the animal saw but that they actually constructed a map of the room. He concluded that the hippocampus creates many maps of the environment, each map being made up of all the cells that are active in a given environment. And so the memory of a given environment can be stored into memory in the form of a particular combination of locus cells activities in the hippocampus.

Reticulated space

More than 30 years later [...] May-Britt and Edward Moser discovered another essential component of the brain navigation system. While they were recording the activity of hippocampal cells in rats moving freely in a room just as O Keefe did, they identified surprising activities in another family of nerve cells in a neighboring brain area close by the hippocampus, the ento-rhinal cortex. They named these cells, grid cells, and showed that these grid cells constitute a system of coordinates which makes it possible to navigate through space.

Unlike a locus cells in the hippocampus that activates at a specific location, activation of a grid cell in the ento-rhinal cortex breaks down the surrounding space into a regular grid that forms a triangle or a hexagon, and the grid cells together divide the surrounding space into a regular hexagonal grid that resembles the wax alveoli networks built by bees. This breakdown is created by the brain, it does not pre-exist in the external environment, it continues to occur even when the animal traverses a room in complete darkness.

And May-Britt and Edward Moser discovered that this hexagonal geometrical structuring that completely paves the whole of a flat surface without leaving any empty space, is created by the brain, inside the brain by the activity of the grid cells.

The edges of places

And so the discoveries of John O'Keefe and May-Britt and Edward Moser revealed two essential and complementary components of the learning and memorizing of space. A memory of the exact places where we once found ourselves, a form of autobiographical memory: this the precise place where we were and we remember the journey we made; And a memory of the topography of the environment in which we made our journey, that is inscribed on a grid plan, in a grid of hexagons, as a system of coordinates which makes it possible to deduce the distances and the borders all around the place where we are. A memory of the map of places and a precise memory of our journey through these places.

The power of returning

Studies in mice that are on a route, indicate that each time they take a short break or stop to eat, the film of the journey they have just made, the succession of the different locus cells activations is displayed back again and again several times in an accelerated way in their hippocampus, the route they used to reach that place and the route back. The route they used to reach the place, is the film of the paths they have used to get where they are. And the way back is the film of the path that they would have to take if they had to go back, to return to their starting point, that is, if they had to escape...

Later, while they are asleep, the film of these successions of maps that begin to move towards their lasting memory, will be repeated a greater number of times, while being slowly stored in the mice long-term memory, partly migrating into different areas of the brain cortex.

Notes:

It thus appears that the continuation of nocturnal dreams in diurnal reveries and reciprocally, as presented by Breton in **Les Vases Communicants**, is now an objective finding (and no longer the sole personal introspection of André Breton) and is scientifically established – in this case in mice. Thus what is now proven is the reality of processes that are in no way confined to the human, poetic or artistic domain, but rather a mode of functioning of the brain that is at least common to mammals.

It is also asserted above that sleep and day dreams play a role in long-term memorization activities, or at a minimum take place in parallel with long-term memorization activities. I do not remember that the memorizing function of dream or sleep was ever mentioned by Freud.

From a surrealist point of view, a question that seems to arise according to me is quite simply: what can we say about it ? In our experiences and / or our dreams, have we been able to identify this function of dreams in terms of the perpetuation of memory?

In a more general way, it seems to me that the surrealist movement has almost always concentrated on the content of dreams (on “what”) rather than on the process of dreams itself (on “how”) while Breton in Les Vases Communicants is focusing more on “how”, reaching as we have seen, conclusions that are objectively valid.

Enthused by the machine learning experiments achieved by formal neural networks, I did not inquire too much into the precise circumstances of this type of learning and more specifically regarding the number of repetitions required for machine learning to take place.When I further learned that several thousands of repetitions were necessary, it suddenly seemed to me that artificial neural networks were considerably less effective than natural biological networks. Yet the "very many times" mentioned above slightly relativizes the differences.

Compressing and pruning living experience

The time component, the duration of the completed journey is compressed, accelerated. A journey of several seconds is redeployed mentally in the much shorter time of a tenth of a second. And the maps of the places traveled, which represent whole sections of the immensity of the outside world, are reduced space re-compositions, pruned by numerous details, a succession of tiny maps in the microcosms, the tiny inner worlds of the hippocampus and of the ento-rhinal cortex.

Notes:

This would provide the basis for a surrealist game, of the situationist dérive type for example, where each player would write down the details that struck him during the course of the dérive, would then repeat the same exercise days later. And the results, the visions obtained by the different players would then be compared.

An important remark here may be : how this compression – condensation according to Freud's terminology – is done ? How is the pruning done, on which basis, according to what sort of principles ? A possible way to do it would be for instance to select some on the original frames of the internal neural film and remove the others.

Every man knows a lot of things that he does not know he knows. To know all that we know? This simple research exhausts philosophy.

Paul Valéry - Bad thoughts and others - NRF Gallimard 1942. Page 141

We seek, we guess by broad lines, but there are no lines in nature, no extensions assured. It is a text that one must be resigned to deciphering only word for word. The rest is philosophy, that is, a search for what has already been found. This method has proved its worth: no positive knowledge is due to it.

Paul Valéry - Bad thoughts and others - NRF Gallimard 1942. Page 151.

Mixed maps

How many of these maps can be stored in memory? A map is a series of contours and of ranges of color on a neutral background. In the hippocampus, contours and color ranges are constituted by the networks of locus cells that have been activated in real time along the course. And the neutral background on which the maps stands out are cells that have been called silent cells. Whenever during the sleep or in the waking state these living maps are deployed again, whenever the film of the course is re-projected into the hippocampus, it shall be in the form of a reactivation of the same locus cell networks, on the same neutral background of the silent cells.
In the hippocampus, a new succession of maps does not definitively covers the preceding ones, does not erase them, does not make them invisible. Different maps coexist appearing and disappearing in an alternate way.

How many different maps of the places traveled can be drawn and co-exist alternately inside the hippocampus?
A response was provided by results published in 2011. The study involved mice. It indicated that in the hippocampus, the identity of a cell that participates in the elaboration of a map, may it be a locus cell or a silent cell, is not definitively fixed once and for all. A cell that has become a locus cell in a given environment can become a silent cell in another environment.
Thus, the same cell can be part of the color ranges and of the contours of several different maps and also of the neutral background of several other maps. And this very large number of possible combinations enables the inscription and the persistence in the memory of a very large number of maps of different places.

May-Britt and Edward Moser later discovered that the grid cells and the locus cells of the hippocampus communicate with each other, allowing the animal to determine its position in its environment, making it possible to memorize this position and this environment, and to navigate through space. Together with other ento-rhinal cortical cells that respond to the direction of the head and to the boundaries of the environment, to the walls of the room, the grid cells form a circuit with the locus cells of the hippocampus and this circuit constitutes a positioning system, an internal GPS in the brain.

Memory of Time

Not only the events we have experienced become a part of our memory, but also the order in which the events we have lived took place, the duration of these events and the length of the time intervals that separate the events. And without a structuring of our memories in a temporal dimension, our inner maps of places where we have been would be only the pieces of an unorganized, unassembled puzzle.

But which cells in our hippocampus activate at regular intervals, beating our inner time and allowing us to inscribe this temporal dimension in our memories? A set of recent studies suggests that time cells are a part of the locus cells. Some of these cells are activated depending on where we are, others are activated at certain times, regardless of where we are. And so, most of the locus cells inscribe in us, either the memory of space, or the memory of time. The same set of nerve cells in our hippocampus build the spatial and temporal organization of the events we experience.

The tempo of our experiences, the temporal resolution of our memories can be of the order of a few seconds, a few minutes, a few hours, a few days, or a few weeks. Does this temporal resolution vary as the spatial resolution does along the hippocampus, from back to front? The precise memories of the short time intervals in the later regions, and the more general recollections of the long time intervals in the anterior regions? We do not know yet. But these studies suggest that the term locus cell that John O Keefe gave them when he discovered them more than 40 years ago is probably too restrictive.

Our memories are woven of relationships between space and time, actions, intentions, emotions, events, learning. And the cells that compose the hippocampus and the neighboring areas probably build up this complex weaving, by writing into what we call a memory, different components of the experiences we live.

Notes :

For personal physiological reasons, I am not a great dreamer and when I happen to remember my dreams, they never have any poetic interest, nor even most often any kind of erotic interest or connotation (alas).
However, I observed many times and long before the phenomena described above were established or even widely evoked from a scientific point of view, that towards the end of my holidays, a few days before the moment to go back to work, I started to dream of my job tasks and of the various questions and problems that I was going to find when back.

While Freud claims that there is no time in the unconscious, my personal experience would be rather inverse. While I rarely consciously think about returning to work before the final end of my holidays and mostly only the very evening before, my unconscious - in this case my dreams - takes care much more cautiously than I, and by watching much better than my conscious mind, reminds me of the problems I am going to face in the days to come and prepares me to confront them.

In the same way, each one of us has observed that, in many cases, there is no need to use the alarm of an alarm clock in order to wake up on time, even though it is an unusual hour. Our unconscious manages very well in most cases and awakens us at the required moment before the alarm clock rings. It seems to me - quite contrary to classical opinion - that the unconscious has a notion of the hour of an astonishing precision (for an unconscious). It is probable that some well-conducted hypnosis experiments would confirm this fact.

I have always been struck too by the fact that nobody is surprised that we usually wake up in the morning with the "right" memories, the memories that are likely to be useful in the daytime part of our day ahead. How, while we were able to wander in the most unlikely places during our sleep, do we happen to fall almost instantly back upon our feet at the moment of awakening? This return to reality has always seemed to me to have been mysteriously but very effectively silently prepared by our unconscious.

The man who wakes up from artificial sleep recovers where he was. The first idea is the last one left. If the dead woke up, they would wake up dying. Keep on

dying.

Paul Valéry - Bad thoughts and others - NRF Gallimard 1942. Page 49

In general, the transitions towards sleep and out of sleep towards our awaken state do not seem to me to have been sufficiently studied or documented within the surrealist movement.

It must be said too that the meaning of the word "time" is quite fuzzy. It covers both aspects related to events - aspects related to events themselves and aspects related to the sequencing of events - and aspects related to durations.
When Einstein's Relativity tell us about the contraction of time, it only aims at durations. The local sequence of events can not be modified, otherwise the laws of physics would not be preserved locally for two different observers. Yet, the fact that nature is intelligible constitutes, I believe, one of the bases of Einstein's reasoning.

So, perhaps, Freud simply wanted to say that in the unconscious, there were no durations. It has been seen that in the processes which take place in the hippocampus, durations are indeed considerably contracted. However, are they annihilated? Do we have in the surrealist movement collections of dreams about waiting, not even to mention dreams including quantifiable durations, dream perceptions of long or short periods in which we waited ?

On the other hand - but in the present case, is it related to ? - we know very well that our dreams are certainly not without surprises.

Migrations

It was during the 1990s that Eric Kandel, who had studied the mechanisms of emergence of long term memory in a mollusk, the sea hare, began to take an interest in the hippocampus and in memories of the journeys traveled by mice . He discovered that, like other forms of memory, the inscription of the memories of the paths in the long term memory implies a transformation of the connections between the nerve cells of the hippocampus and the migration of traces of memories from the depths of the hippocampus into the regions of the brain cortex .And in 2000 Eric Kandel received the Nobel Prize for Physiology and Medicine for his discoveries on the mechanisms that allow transient registration in our brains of our short-term memory and our long term sustainable memory enrollment.

Imagination and memory

But memory does not only tells us about yesterday, it also tells us about tomorrow. Our memory allows us to imagine possible futures. And it is difficult to separate memory from imagination. Complete lesions of the hippocampus that destroy the ability to acquire new conscious memories also alter the imagination.

Notes :

Ameisen's expression above is perhaps a little erroneous in the sense that, as he shows a little later, it is not memory as such that allows us to imagine possible futures, but another type of cerebral activity which is associated with it, and which, embroidering on memories, produces variants that do not correspond to real past events from events captured by memory.

From a surrealist point of view it would be interesting to identify what we have learned, what we know about the relationship between memory and imagination.

To what extent does memory play a role in automatic writing and if so, which role? Is immediate memory the most active or, on the contrary, does our writing more often bears the mark of our older memories?

Past and its future

To project ourselves in the future is always to appeal to the past. There is no crystal ball that would allow us to read the future, even the most rational, even the most scientific prediction can only be based on an extrapolation from what we have learned and understood from the past.

Notes :

Is the view expressed above of general validity? Or do we have examples of predictions or anticipations that would not seem to have their origin or their explanation in the past?

Are not you the future of all the memories that are in you? The future of a past.
Paul Valéry - Bad thoughts and others - NRF Gallimard 1942. - Page 170.

To what extent would we be able to see (in the sense of a clairvoyant) events or situations that it would be difficult for us to express on the basis of experiences or knowledge from our past. Could we, for example, imagine the absolute opposite of experiences of déjà vu (or of already-felt), something that would be, on the contrary, of the order of the never seen (or the never felt)?

I think... Is this different from this ancient practice which consisted (and still consists) in consulting the "spirits"? Wait before a table, a deck of cards, an idol, or a dormant pythia, or before what one calls "oneself" ...

Paul Valéry - Bad thoughts and others - NRF Gallimard 1942. Page 24

One of the capacities - or rather one of the requirements of poetry - is it not precisely to express the never-seen, the never felt?

Matta's project in his *psychological morphologies*, namely capturing perceptions before they become forms, was it not of this type ? Has this project been continued in the surrealist movement, if so, where and by whom, and if not why?

Hazards of imagination

In 2011, a study by G. Dragoi G, and S. Tonegawa of the MIT Department of Brain and Cognitive Science in Boston is published in Nature. S. Tonegawa after receiving in 1987 the Nobel Prize for Physiology and Medicine for his work in immunology engaged in neuroscience research to explore the mysteries of memory.

Notes :

It may be noted that **Gerald Edelman**, who was awarded a Nobel Prize for Physiology and Medicine as well for works that also related to immunity, has also engaged in works in "cognitive sciences".
This convergence with the evolution of S. Tonegawa is probably not entirely a coincidence: on the one hand the neurons and the cells used in the immunity come from a common line in the course of the differentiations which happen duringn embryo-genesis, but additionally the immunity systemis a cognitive system as the brain is (see, for example, the little book by Francisco Varela "Knowing Cognitive Sciences"). It is a cognitive system that operates on the basis of such vertiginous variability that it allows the organism to "mark" possible invaders, including those that do not yet exist!

It seems to me in no way inappropriate to speak in this case of imagination (cellular imagination, or even chemical imagination perhaps, but imagination all the same). Hence the comment I made ten years ago that we survive only because our immune system is surrealist enough.

Predicting the unknown

The study involved mice and revealed a strange relationship between memory and the anticipation of the future. Mice perform a route along an artificial trail that has particular topographic components.

When the mice arrive at the end of the first part of the route where the researchers placed food, they stop, eat, sleep, or fall asleep. And during their siesta, or during their sleep, the succession of journeys they have just traveled is projected as a film repeatedly in their hippocampus, while beginning to register in their lasting memory.

But this study also identified another surprising and hitherto unknown phenomenon. When the first part of the track traveled ends with a gate that prevents the mice from seeing the rest of the course, during their rest or during their sleep a series of apparently random variations on these paths occurs . A succession of new, changing, open paths appears in their hippocampus.

As if during the rest and during sleep an anticipation of the possible topography of the invisible sequence of the journey was invented, an exploration of an imaginary still unknown geography. As if, during rest and sleep, the memorization of the future course in the unknown part of the track was being prepared, a repertoire of possible pre-adaptions to a still unknown topography, but which could share some common characteristics with places that have just been traveled and are in the process of being memorized.

Notes :

The results of the aforementioned study seem to me to be directly concerned with surrealism in the sense that one may see here at work (in mice) one of the mechanisms of the work of the imagination.

Here we are dealing with seemingly random variations around a set of recent memories - and further on in the results of studies, old memories are also mentioned

How does the brain work to produce random or seemingly random variations? Is the brain a kind of random generator (as **Mallarmé** thought of it in his text Igitur) or is it a "pseudo-random", that is to say, a determined and deterministic biological mechanism that allows producing a diversity of such magnitude and richness that it seems to us to be random?

From a surrealist point of view, does the internal chance illustrated by the dramatic experience of Mallarmé during the night of Igitur and its resulting expression in Le Coup de Dé play a preponderant role in textual or visual automatism, or else is something else agitated in there?

(See also the definition of the poetic image by Reverdy)

If chance plays a role, preponderant or not, how could we hope to increase and expand our capacities of enunciation (as poetic responsibility absolutely requires) by studying and implementing (or conversely) different types of chance ?

In the mathematical theories (and practices) of probabilities, we always begin by constructing the set of all possible events. It is generally observed that when this space of all possible events is erroneously constructed (which is rather frequent) the calculations about probabilities attached to it, although apparently logically correct, are in fact false.

From another point of view, and even more radically, there is no set of all possible events (which would lead into considering the set of all sets, something known in mathematics to lead to logical contradictions) . In other words, in mathematics, chance is always relative to a given context. This raises the question of the diversity of contexts types where chance comes into play - and of their categorization. This diversity is partly reflected and in my opinion incompletely in mathematics in the diversity of the laws of classical probabilities.

It can also be observed that in the experiments described above, the imagination of the mice apparently relates essentially to the premises and is thus limited to the context of localization. One might have imagined that the memories of other experiences without immediate relation to the place are also summoned. But perhaps this is the case too and maybe wider effects are concealed by the experimental protocol.

From a surrealist point of view, we know very well that the chance of gambling is not the objective chance mentioned by Breton, and that the chance of the situationist derive is of a yet different nature. But do we have any ideas on the number and diversity of the types of chance that we have been able to identify so far within the movement?

Do we have ideas about the surrealist (experimental and poetic) use that we could make of a more extensive and systematic knowledge of the different contexts and situations of chance, of which there is every reason to believe that an important part could remain unknown to us?

Would it not be judicious to resume research on chance or what resembles it in the diurnal and nocturnal life and in the spontaneous activity of the mind?

Imaginary training

And when the researchers placed mice in front of the door separating the two parts of the trail, who had not taken any particular route during the day but found food there, then fed or fell asleep, these mice during their rest or during their sleep also have reactivated maps of probably old paths and built up variations on these maps. And some of these variations happened to coincide with the topography of the hidden portion of the runway.

The mere presence of the door at the end of a track that they had not traveled induced a mental exploration of the possible routes to come. The anticipation of a future move in a still unknown environment induced a recapitulation of the memories of past journeys and a series of random variations on these memories that allowed a virtual exploration of the field of possibilities. And so these probably unconscious variations created during rest and sleep on the theme of recent memory, and probably also on the theme of older memories, are probably one of the forms of learning that prepares us for an unpredictable future.

"See in the future" was the title of the commentary accompanying this publication

Notes :

Most of the thoughts we follow, opinion projects, etc., could be drawn lots.

Paul Valéry - Bad thoughts and others - NRF Gallimard 1942. - Page 156.

Assuming that thinkers are of any use, they could be considered as machines capable of carrying out the greatest number of ideal combinations, either in the form of a "definition" or of reconciliations which practice does not give.

Paul Valéry - Bad thoughts and others - NRF Gallimard 1942. Page 14

But after all, reality is just a special case.

Paul Valéry - Bad thoughts and others - NRF Gallimard 1942. Page 168.

It must be admitted here that the mice had previously learned what a door looked like - which is not specified - for I do not think that the notion of door is necessarily part of the ordinary experience of mice. Though...

It may also be difficult to admit that it was possible to verify that "some of these variations happened to coincide with the hidden topography of the runway." But it must be taken into account that it is very likely that the diversity of pathways proposed to the mice by the experimenters has been rather weak and it is therefore not unlikely that over the fifteen variants finally identified by the researchers and selected by the mice one of them could have ben adequate.

These remarks being made, as "nothing makes sense in biology unless in the light of evolution", the imagination, whatever the level at which it is implemented, certainly appeared by chance, but it has not been selected or its characteristics significantly refined and amplified without it constituting a considerable evolutionary advantage (even if neither surrealists nor whoever has the slightest idea of where the imagination can lead us).
I may add that the same probably applies to curiosity and play, and although I have not yet cited love (which the reductionists call sexuality, but of which gardening birds have built a somewhat wider vision) It seems to me that Surrealism could constitute the flower of the movement of the living as regards imagination, or at least the most acute consciousness of the adventure and risks into which life wanders and through the use of imagination, ventures.

Let's leave those whom the distressing persistence of some incongruous remorse of religious thought lead to believe that imagination and the human thought constitute an absolute rupture - of which we know only too well from whence it was derived - a rupture that would radically separate us from the rest of the living. Let's leave them in the strange blindness by which they fail to see the marvelous continuity which is here revealed by some recent studies between the movements of the minds of the mice and those of the minds of men. For my part, I shall not get out of it, I did not come into the world, I am of the world, like mice that constantly furtive and venture and dream but do not believe in God.

Variations

And two years later in spring 2013 G. Dragoi and S. Tonegawa published their explorations of this anticipation of the future in mice. The study G. Dragoi and S. Tonegawa has been published in the proceedings of the US Academy of Sciences. It indicates that in mice placed in front of the closed door of a track that they have never seen before, during their sleep while in their hippocampus variations of activation of the locus cells are happening on the theme of old paths, altogether, these variations lead to the emergence of **about fifteen future journeys that mice have never yet used..**

Memory does not only speak of yesterday, it also speaks of tomorrow. It is difficult to separate memory from imagination, intuition, anticipation, and among all the maps of the world that live within us, some are imprints of the past and others prefigure future futures. There is within us a knowledge of the world of which we are most often unconscious and which emerges during our periods of calm and during the night, in the heart of those periods of sleep where we seem to withdraw from the world. An inscription already in our memory of what we have not yet lived and that we may never live.

Writing fiction [...] is like remembering of what has never happened, it is like remembering what has not yet happened, what may happen one day, a testimony of this marvelous power of the living, and of our brain to draw from the imprint of the past a prefiguration of the future, always unknown, this extraordinary ability to prepare ourselves for the unpredictable by appealing to variation, to drift, to recombination from what remains in us of what we have experienced.

Notes :

Intelligence... It is to be lucky in the game of associations and à-propos memories

Paul Valéry - Bad thoughts and others - NRF Gallimard 1942. Page 153

The work of anticipation

In May 2013, when the study of G. Dragoi and S. Tonegawa was published, another study was published in **Nature** by two researchers from the Department of Neuroscience at John Hopkins University in Baltimore, Pfeiffer and David Foster.

They had analyzed the activity of locus cells in the hippocampus of mice, not during their sleep, but during the moments before they began to go in agiven direction either to fetch food or to return to their shelter.

The mice are resting for a while and then they will leave and while they are resting they travel in their hippocampus the route that they will follow even when the route they are going to choose is new and they do not know it. And so before engaging in a particular journey, this path is prefigured in their brain before they start to use it.

To what extent to remember and imagine are one and the same thing, [...] at to what extent are they different things? To travel mentally through our past by imagining what could have happened instead of what happened, may as well, as we draw from our memories by recombining them, modify our memories and our memory can then make us relive not what we have already experienced, but for the first time, what without realizing it, we have gradually been persuaded to have lived.

Notes :

Forecasting is a dream from which the event draws us.

Paul Valéry - Bad thoughts and others - NRF, Gallimard 1942. - Page 98

But the real plays with our anticipations: perhaps is it simply that which

always puts them in default.
Paul Valéry - Bad thoughts and others - NRF, Gallimard 1942. Page 150

Experienced dimensions

There are still other questions that have been asked about the locus cells. The hippocampal locus cells and grid cells and head direction cells and border cells in the ento-rhinal cortex were primarily studied in rodents, rats and mice that appear to move and imagine space in two dimensions, but what about animals moving in three dimensions?

It is the case of bats that fly through space and whose echoes of ultrasonic vocalizations reveal the contours of the world through which they fly. A study published in Science in Spring 2013 addressed this issue. It was carried out by two researchers from the Department of Neurobiology at the Weizsmann Institute in Israel.

They studied the activity of the cells of the hippocampus of bats from Egypt while flying freely in a large room in the dark looking for food. This bat lives in Africa in the Middle East, Pakistan and India. She lives at night and feeds on fruits.

The study indicates that the field in which a given cell is activated is the equivalent of a sphere, a volume of space the width, length and height of which are equal. And because this is true for all locus cells, the hippocampus inscribes the path of the bat into a succession of small spheres.

What about the cells of bats ento-rhinal cortex, how do they tile the three-dimensional space, in which the bat flies, we do not know yet.

The ancestors of the bats and the ancestors of the primates separated some sixty million years ago, before the separation of ancestors from rodents and ancestors of primates. Non-human primates leap into trees from branch to branch and because of our size and bipedalism, we move through a three-dimensional space. Do our locus cells take into account a three dimensional space and do they partly inscribe within us three-dimensional memories of our journeys? We do not know.

Notes :

Would it not be possible, from a surrealist point of view, to give an answer to the question: do we dream in three dimensions or not, and if so, to what extent?
One might think, for example, of flight dreams, which do not usually correspond to real flight experiences.

Semantic memory and episodic memory

But there are many learning mechanisms that do not use the hippocampus, which do not depend on the hippocampus. There is in us a form of conscious memory which we call the declarative or explicit memory and which corresponds to all the memories we can not only summon in ourselves but also describe to others.

And this conscious, declarative memory also has two components: on the one hand, a general, impersonal memory, called the *semantic memory*, which is composed of our memories of facts, symbols, our knowledge of the world, the name of the country where we live, the name of is its main town; and

on the other hand a set of memories that give us our personal experiences, the situation, the context, what we were doing, where we were at the time when such an event occurred. This form of memory is called the *episodic memory*, the memory of the experienced episodes, or the autobiographical memory. It connects facts between them and connects them to us. It connects events to what we have experienced, to the experience we have had, by enclosing them in a narrative in which we are present and which gives them their meaning.

Notes :

The past feeds on chance. Any Incident draws a memory

Paul Valéry - Bad thoughts and others - NRF, Gallimard 1942. - Page 170

What does not resemble anything does not exist

Paul Valéry - Bad thoughts and others - NRF, Gallimard 1942. - Page 169

Procedural memory

But in addition to our conscious memory, there is a form of unconscious memory that we call the implicit, the *procedural memory*. The one that allows us to describe, to swim, to ride a bicycle, to speak our language or a second language learned in adulthood. We have recorded in ourselves the memories of these learning, but what we have learned, we implement it automatically, unconsciously, without thinking, and we perform all these performances better, when we perform them as automatisms .

We have learned, we remember, but this is not an explicit, declarative memory. We can not precisely describe what we have learned or how we have learned it. And the complete lesions of the hippocampus, do not hinder this type of learning. A person who has suffered a complete injury to the hippocampus will be able to learn to ride a bicycle, but she will just not be able to say that she learned that or simply to tell what she learned.

But how do these forms of learning that do not depend on the hippocampus work? How does this form of memory fit in? Ten days ago, October 17, 2014, a response was given by a study published in **Science...**

Notes :

In the productions of the surrealist movement as a whole, are there observations concerning these different types of memory, the way in which they appear in the movement of the mind and how they merge into the nocturnal and diurnal personal experience?

For example, the procedural memory (the memory of action, gestures and sequences of gestures) is probably strongly used in the **Butoh** dance, the poetic character of which is undeniable. Would it not be interesting to study what roles are played by the gestures, the sequences of gestures, the memories of gestures in dreams and poetry?

How do we express, or how can we not express these gestural and physical aspects in our experiments and our surrealist activities?

While surrealism has largely dwelt on the desiring body, on the body enjoying, are there examples of surrealist interest for the moving body or evidences of the role of body movement in works or poetry Surrealist (I know at least one example, and it is the poetry of Claude Cauet which in its breathing and its rhythm always seemed to me inseparable from the march).

The vast majority of our perceptions and thoughts have no consequences. Those that matter are distinguished and drawn from the whole either by our bodies, or by our fellow men. Our own role is very modest.

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