

How the Victorians Saw Things

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The age of Victoria underwent profound changes, not the least of which concerned the ways of seeing, to use the title of John Berger's seminal book published in 1972. This is evidenced in concrete terms by the fascination with optical instruments (from the stereoscope to the photographic camera) and, indirectly, by the uncertain relationship between vision, representation and interpretation highlighted by Kate Flint:

The Victorians were fascinated with the act of seeing, with the question of the reliability – or otherwise – of the human eye, and with the problems of interpreting what they saw. Those problems extended from the observation of the natural world and the urban environment, to the more specialist interpretation demanded by actual works of art. (1-2).

In the space of three eventful generations, the Victorians witnessed and contributed to profound transformations affecting industry, culture, art and science. Such upheavals required a permanent adaptation of the gaze to understand a changing world, especially as the interaction between these different sectors of activity was frequent and the disciplinary compartmentalisation was less impervious in the nineteenth century than it is today.

To better understand and then account for the ways the Victorians engaged with “reality” in a coherent manner requires the researcher to share nineteenth century observers’ mental framework, to look at his subjects

from their own perspective, adopting the scope, and limitations, of their vision. Renate Brosch convincingly argued that, “as ways of seeing inform modes of depicting and representing, the latter inadvertently disclose subject positions and power relations corresponding to them” (8). Here, we will take the “subject position” in its most literal sense, and wonder what that position was with reference to the observed object in various periods of the nineteenth century. This will raise the question of the point of view adopted, which itself is conditioned by the place where one stands in relation to one’s material: above, beside or inside.

Nancy Anderson and Michael Dietrich have convincingly argued that images shape the way we see things and engage with the outside world because “the visual image is a teaching tool that has worked to convey information or train the eye and the mind in the ways of seeing, researching, organizing, and acting in the world” (6). Following their lead, I am interested in the way images as representations – in the sense Stuart Hall understood this term – are conceived, produced, interpreted, circulated, and recycled. The scholarly field of Victorian visualities has yielded numerous and important contributions in the last forty years. The production, interpretation and circulation of images have especially been studied in great detail by Jonathan Crary, Kate Flint, Renate Brosch and other eminent academics. The point of view used in the conception of images has received less attention, yet it seems to be of paramount importance to study what pictures do to us as spectators, not in terms of affect or understanding, but quite pragmatically, where they position the beholder in relation to the represented object. From what distance and from what angle would the object have to be seen to match the illusionistic representation? In art, this is called perspective, and since the Renaissance, linear perspective has been used in the Western world to provide the illusion of depth on a two-dimensional surface. However, the hegemony of the front-view linear perspective started to crumble in the nineteenth century. Things did not necessarily have to be seen at eye level, from a distance. Objects could now be seen from above, or in close-up, or from inside. These new perspectives affected as much as they were the result of, changing relations between the human subject and the outside world. By borrowing the words of Georges Didi-Huberman, I propose that the point of view be “thought both as an object and as a method, as a syntagma and as a paradigm, as a characteristic of works of art and as an issue of knowledge that claims to say something about it” (10). The point of view conditions the collective illusion of seeing together (sharing the viewpoint), thus to embrace with a common

look an object seen from a certain angle and which becomes significant because it testifies to the rallying of twin spirits.

W.J.T. Mitchell pointed out that etymologically the word “idea” comes from the Greek verb “to see” and is therefore “bound up with the notion of imagery” (5). In fact, one can only represent what is already in one’s mind and what one wishes to make physically present, precisely because of its absence. What is seen through our eyes or in our minds has previously been envisaged, and vision is satisfied in the matching of perception and anticipation. The objects then seem in their right place and can be made sense of, as they appear to belong in a “natural order”. However, we tend to ignore the fact that our “horizon of expectation” is culturally constructed, and that social conditioning acts powerfully in determining what we see and how we see it. In 1986, W.J.T. Mitchell postulated that theories about pictures cannot be separated from larger semiotic theories because images are signs and their history is therefore constituent of the history of knowledge, of science and of power structures. This point was later taken up by Gordon Fyfe and John Law, who argued that invisible and culturally construed and absorbed images condition the ways we perceive the world around us, because “a depiction is never just an illustration. It is the *material representation*, the apparently *stabilised product of a process of work*” (1).

To represent is thus to put forward a singular way of imagining the world, through the material production of an image. This image will necessarily depend on a particular point of view that the researcher must strive to share for the need of analysis, while preserving the necessary scientific distance.

The appearance of the represented object gives us information on the position, distant or close, frontal or lateral, at eye level, from a high or a low angle, or from within, which the author has adopted vis-à-vis his or her material. The work of adopting the point of view of an artist who is distant in space and time allows us to absorb his verbal and visual rhetoric, which necessarily reveals his or her perspective, in the double sense of the word. Any perspective, even the one that claims objectivity, is necessarily subjective, and subjectivities are exciting because they are the ones that best inform us about the spirit of an epoch. To grasp the angle in which the object of a poem, of a painting, or of an essay is envisaged allows the scholar in return to deduce the relation that the observer or the author develops with his or her subject.

This article postulates that a viewpoint is culturally constructed, that it is the fruit of the practices, habits, technical and optical innovations of an epoch that normalize it and eventually impose it as a common vision for a time. Jessica Evans and Stuart Hall, drawing on seminal research by Norman Bryson and Richard Rorty, have described the “reflectionist attitude, in which the image is considered to act as a transparent ‘relay’ to a singular originary presence which is imagined to lie behind it” (12), an attitude that implicates a singular position in space. This article will argue that in the nineteenth century three federating points of view, implying three different postures vis-à-vis the observed and represented objects – the surplombing, lateral, and inner standing points - succeeded each other without completely cancelling the previous one(s).

1. Distant view

The “view from afar” can be vertical (bird’s eye view) or horizontal (panoramic). In both cases, the illusion of ocular distance enables the beholder to take a mental distance from the object represented, that is to operate a “distanciation” which helps to view a larger picture than what is possible in the ordinary experience of reality.

The distant overview was a privilege that up until the invention of the balloon was reserved to celestial and divine beings, and to a handful of mountain-climbers. The yearning for exhaustivity, for the control of all existing things and phenomena, had animated the European encyclopedists. In 1784, the Montgolfier brothers made the eighteenth-century dream of an all-encompassing vision come true. In return, this vision, once experienced, allowed the acceptance and development of more elaborate maps, first geographical (as early as 1801), then thematic, as well as “cartographic thought”, manifest through the censuses (the first one also took place in 1801). The same yearning to see all is also explicit in Jeremy Bentham’s panopticon, which he devised between 1788 and 1793 with the help of his brother Samuel and the architect Willey Reveley in order to watch and control prisoners¹. It also permeated literature in the form of the omniscient narrator, or the neutral voice of the editor of scientific treatises that seems to come from an ectoplasm flying over the world. In all these examples, the extensive scope of vision meant power. The overview created a situation of domination in which the thing or

the person observed was submitted to the observer's gaze without the possibility to gaze back.

Henry Mayhew, the well-known author of *London Labour and the London Poor* (1851), had an immersive experience of the capital's working class and underclass, which necessitated an internal focalisation while he was assembling his material, but from which he departed when he produced his report. Indeed, the subtitle of the volume, as well as the first sentence in the preface make it clear that the author's ambition was to offer "a cyclopædia of the industry, the want, and the vice of the great Metropolis" (1 : iii). The eighteenth-century ideal of exhaustive grasp on reality is contained in the word "cyclopedia", as is the visual means through which this control is to be effected – evoking as it does the giant one-eyed cyclopes of ancient mythologies. However, the journalist yearned to see things from above not only theoretically, but physically as well, and he had this exhilarating experience when he flew in a balloon for the first time in 1852. He related his feelings in an article for the *Illustrated London News* which stresses how for him the vision of the mind and that of the body were similarly trained to various and intertwined points of view, and why the bird's eye view held the promise of total understanding and absolute power.

I had seen the world of London below the surface, as it were, and I had *a craving to contemplate it far above it* – to behold the immense mass of vice and avarice and cunning, of noble aspirations and humble heroism, blent into *one black spot*; to take, as it were, an angel's view of that huge city [...] *to look down upon* the strange, incongruous clump of palaces and workhouses, of factory chimneys and church steeples, of banks and prisons, of docks and hospitals, of parks and squares, of courts and alleys – *to look down upon these as the birds* of the air look down upon them, and see the whole dwindle into a heap of rubbish on the green sward, a human ant-hill. [...] *To see, to think, and to feel* thus was [...] that led me to peril my bones in the car of a balloon. ('In the clouds' 224)

By describing the accumulation of human misery as one black spot, Mayhew anticipated the cartographer's conventional practice of representing density by dark patches of various sizes. It was first used by John Snow during the cholera epidemic of 1854. Increasingly sophisticated maps were produced in the nineteenth-century, and they brought about as well as they testified to, a generalisation of the overview stance. They permitted a new visual literacy that encouraged an imaginary, decentered vision and created

links between two visual points of view – the terrestrial and mundane level of the pedestrian, and the mental and schematic overview. As Sara Thornton explained « the panoptic aerial view of the mapmaker [...] renders the city legible and comprehensible » (305). It gives to the viewer scopic control of his or her surroundings, and reifies the contemplated object. Such mastery through the power of vision was also applied to panoramic front views.

The distant “front-view” informs the popular panorama shows of the Victorian stage as well as the collection of objects placed side by side in a museum or an art gallery, in order to perceive their common features. These assemblages deliver a message of power and order, as the six million visitors of the Great Exhibition of 1851 could see. The gathering of specimens of all sorts constituted a sort of repository of information which the visitors consumed visually, and memorised as data. This internalised organisation of things could then be instrumental for a fuller comprehension of the real world, especially through the process of analogy. The spectacular expansion of the British Museum and the Royal Academy of Arts throughout the century and their increasing attendance gave the frontal view a new meaning: hindsight allowed one to embrace with one’s eyes an immense amount of works and objects presented in series, at the same time as the context in which they appeared. The two modes of distant vision, be it overhanging or frontal, allow the eye to embrace a vast “visual field”, and the mind to organize the world, to re-present it. The democratisation of this all-embracing gaze yielded a unified response in the ordering of things through what the historian Tony Bennett calls the exhibitionary complex:

The exhibitionary complex was [...] a response to the *problem of order* [...]. As such, its constituent institutions *reversed the orientations* of the disciplinary apparatuses in *seeking to render the forces and principles of order visible* to the populace – transformed, here, into a people, a citizenry – rather than vice versa. They sought *not to map the social body* in order to know the populace by rendering it visible to power. Instead, through the provision of object lessons in power – the *power to command and arrange things* and bodies for public display – they sought to allow the people en masse rather than individually, to know rather than be known, to become the subjects rather than the objects of knowledge. Yet, ideally, they sought also to allow the people to know and thence to regulate themselves; to become, *in seeing themselves from the side* of power, both the subjects and the objects of knowledge. (“The Exhibitionary Complex” 76)

The panoramic vision therefore exercised a similar regulation function to that of the distant overview. Close vision allowed to observe in detail how the elements come together, and it also served the purpose of organisation and regulation. Jonathan Crary identified the first shift as manifest in the years 1820-1830².

2. *Close encounters*

Close vision gives a different access to the previously invisible. It was made possible by optical instruments such as the magnifying glass or the microscope which enabled an examination from above of the minute details of any specimen. Close lateral vision was also encouraged by the laboratory practice of cross-section and the use of transparent test tubes which allow scientists to see the constituent parts of any element and to deduce its internal structure.

This close lateral vision was commonly used in the natural sciences, especially geology (thanks to the geological models of Thomas Sopwith), mineralogy, and biology. The lateral vision of a core sample allowed early Victorian geologists to deduce general laws from a fragment and to draw geological plans (sometimes erroneous). It is this static representation that brought to light the invisible layering of strata in the earth, and which then acquired a power to rationalise analogically many different situations of stratification. It legitimized stratification as a meta-scheme for structuring the visible and invisible world. Figures abounded in the nineteenth century that presented, in the form of a stratified structure, the most diverse things, including animals and humans, and they contributed to naturalizing the concept. They tended to rely on cross-sections to visually represent invisible hierarchical organisations. The geological paradigm offered an alternative to the previous aeronautic overview, without superseding it totally. It made the concept of evolutionism visible and previsible by schematising genealogical and archeological layers of things, animals or people vertically, with the oldest, most primitive, most humble form at the bottom, and the most accomplished contemporary specimen on top. As Tony Bennett summarized, around the mid-nineteenth century, “the organisation of the gaze [...] is archeological: seeing is a matter of seeing how, in the succession of ideas which typological arrangements make visible, the inheritance of the past continues to exist *as a layer* within the

make-up of each step in evolutionary development” (*Pasts* 271). These visualities became so widely understood that they soon permeated non-scientific illustrations and served to naturalise a discourse about Western – and more specifically British – bourgeois male supremacy. Stratification as an ordering method became naturalized because it provided a convenient rationale usable in many different fields, including sociology, anthropology, and psychology, which legitimated one another’s methodology. For instance, in a letter of 1896 to one his friends, Sigmund Freud wrote: “I am working on the assumption that our psychological mechanism has come into being by a *process of stratification*: the material present in the form of memory traces being subjected from time to time to a *rearrangement*” (207). To Freud as to the vast majority of his contemporaries, the geological principle of stratification appeared so natural that it was taken for granted. The aims and origins of such an organisation when it was recycled and used in other domains than geology or archeology were rarely questioned. This geological vision, prone to imagine underlying strata of previous states of things, or previous lives, also imagined deeper meanings in art and literature. In that view, the surface became deceptive as the scholar needed to dig for the invisible, metaphorical significations of the work, or its “typological symbolism” to borrow Geoge Landow’s expression.

According to Foucault, the nineteenth century constituted a new order of knowledge (together with a new way of seeing), passing from one type of knowledge deployed on the surface of representative space, to another, which, on the contrary, is hollowed inwards, according to a dimension no longer horizontal but vertical:

The space of Western knowledge is now about to topple: the taxinomia, whose great, universal expanse extended in correlation with the possibility of a mathesis, and which constituted the down-beat of knowledge – at once its primary possibility and the end of its perfection – is now about to order itself in accordance with *an obscure verticality*: a verticality that is to define the law of resemblances, prescribe all adjacencies and discontinuities, provide the foundation labour, life, language for perceptible arrangements, and displace all the great horizontal deployments of the taxinomia towards the somewhat accessory region of consequences. (*The Order of Things* 273-274).

What Foucault is describing is a shift from the horizontal, cartographic perspective to the vertical, geologic one. Technological advances, of course, played a vital role, displacing the point of view to where was no

longer just a matter of everyday, ordinary, real-life experience based on the external appearance of things. By the mid-nineteenth century, at least by imagination, the bird's-eye view allowed by the invention of the dirigible balloon, the infinitely close perception to which the microscope gave access, not to mention the "through" vision permitted by the democratization of glass, became accessible to the vast majority of Victorians. In addition, the profusion of the iconographic material, made possible by the multiplication of publishing houses and the improvement of the processes of reproduction of images, allowed an education of the gaze. Looking at the city plans on the new maps that the Ordnance Survey had been constantly promoting, one could imagine gliding in the air, like an aeronaut flying over the landscape. The transparency of the test tubes and the side-cut illustrations made it possible to imagine stratifications invisible to the naked eye but nevertheless real, and to project oneself in the role of a geologist physicist, and to discover invisible strata beneath the surface of things. As Foucault explains,

Thus, European culture is inventing for itself a depth in which what matters is no longer identities, distinctive characters, permanent tables with all their possible paths and routes, but *great hidden forces* developed on the basis of their primitive and inaccessible nucleus, origin, causality, and history. From now on things will be represented only from the depths of this density withdrawn into itself, perhaps blurred and darkened by its obscurity, but bound tightly to themselves, assembled or divided, inescapably grouped by the vigour that is hidden down below, in those depths. (*The Order of Things* 273-274)

In this excerpt, Foucault suggests the second shift affecting the point of view, the one from beside to inside "the depths" of the matter, and concerned with assemblage, division, and "vigour", that is energy. This new concern was the principle which guided late-Victorian mental blueprints and served to organise one's knowledge and locate oneself in an increasingly complex world, and it took into account movement and change. As Jonathan Crary has convincingly demonstrated, the observing subject is "both the historical product and the site of certain practices, techniques, institutions, and procedures of subjectification" (*Techniques* 5). The inward move of the standpoint of the observer corresponds to the development of new subjectivities, attentive to the inner mechanics of structures. The late Victorian period was increasingly democratic (and led to the passing of the Reform Act of 1884) and its population was

better educated. This educational boom was perceptible in elementary education with the Forster Act of 1870, but it had affected adult education since the 1850s with the rapid growth of Mechanics' Institutes throughout the country. This newly gained and better-informed power to take part in the apparatus of the state, even at a minor level, developed simultaneously with the inward shift in point of view, and with a greater acceptance of technical rather than artistic models to visualise natural or man-made objects.

3. *The inner mechanics*

The industrial and technical schematics offering views in bevelled or broken sections gave access to the operation of the machines, the movements of their cogs, the circulation of their fluids and propelled, so to speak, the observer into the shoes of an engineer³. This is suggested by Foucault when he mentions a new attention to the connectedness of things:

Visible forms, their connections, the blank spaces that isolate them and surround their outlines – all these will now be presented to our gaze only in an already composed state, already articulated in that nether darkness that is fomenting them with time. (*The Order of Things* 273-274)

The “broken down” view in a “through” perspective, representing the object in its three dimensionalities, shows the relationships between the various constituent parts of the object, it allows to grasp the complexity of a system. This functional approach to representation is the common practice of industrial designers. There was in the second half of the nineteenth century a veritable campaign of drawing literacy that supported industrial design, because it “materially assists the understanding of machinery, not only by illustrations, but by *teaching the mind to separate the parts of a whole and to note their relation*” (*Spectator* 29, 1856, 1080). This more schematic representation is also more dynamic and reflects the modernity of its approach with an emphasis on circulation, movement and exchanges. Moving away from the external appearance of things, or even from their internal composition, it provides an understanding of how things work, highlighting points of contact, intersections, and

flows. Visually it inspired the plans of the great works undertaken in the capitals, in Paris by Baron Georges Haussman and in London by Joseph Bazalgette, two visionaries who, according to Sara Thornton, not only changed the appearance of their respective cities but also gave them a new meaning, and thus served as models for novelists such as Charles Dickens. The schematic vision immediately makes comprehensible the coexistence and interdependence between the visible surface, with its river, rail, street and pavement networks, and the invisible below, with its sewer system and subway tunnels. This pattern, which attaches itself to active networks, serves as a paradigm, it models thought, and contributes to a new, more organic/mechanic interpretation of the living world, of history, and to the evolutionary thinking that is taken in the “vision of the flow”. It also served a Liberal discourse at a time when social mobility became increasingly possible and desirable. The interconnectedness of fields of knowledge was made possible by their apparently similar inner structure as Edward Tylor, who is credited for the invention of cultural anthropology, wrote in 1871: “culture, or civilization, taken in its broad, ethnographic sense, is that complex whole which includes knowledge, belief, art, morals, law, custom, and any other capabilities acquired by man as a member of society” (Tylor I:1). This complex whole is a conceptual construct that uses the visual paradigm of the assembly diagram, which itself is an abstract representation. It no longer bears any resemblance to the object it schematises but instead makes intelligible the networks and assemblage within a physical or immaterial object. What we need to bear in mind is that the arrangement of knowledge is culturally constructed, and that it mirrors the a priori of a certain socio-cultural group. By seeking to observe the movement of ideas from one discipline to another, we carry our stance from one object to another, using the same perspective, the same understanding process. This point of view becomes for a time predominant and enables interpersonal exchanges, which contribute to the hegemony of this specific stance. “By the mid-nineteenth century, the chief source of variability had shifted inward, to the multiple subjective viewpoints that shattered a single object into a kaleidoscope of images” write Lorraine Daston and Peter Galison in *Objectivity*, their stimulating book on the history of a scientific ideal (113). The inward shift noted by these authors affected the Victorians globally, changing their gazes with their stance vis-à-vis the object of their observations.

Conclusion

The three different points of view which I have summarized as those of the aeronaut, the geologist and the engineer manifested themselves in various fields of human experience: Gillian Beer identified them in the scientific thought of Charles Darwin, Michel de Certeau noticed them in the historical narrative⁴ and in popular culture⁵, Sara Thornton traced them in literary works. Paradoxically, by striving to attain a mythical scientific objectivity that would bring them closer to the Truth, rid of the trappings that appeared henceforth to be subjective prejudices, new points of view, themselves in solidarity with new subjectivities, were trapped. During the “long” nineteenth century, the point of view underwent changes that testify to different ways in which people thought of the world, and engaged with it. In *Les Mots et les choses*, Michel Foucault defined these necessary preconceptions with the concept of epistemes, which designates the consensual bulk of a priori necessary for the constitution of a certain knowledge, which, in setting their guidelines, anticipate the explanation of what they form.

Modifying the “historical a priori” leads to a replacement or adjustment of assumptions and methods of previous research, and produces a new “structural invariant” of knowledge. In *Les Mots et les choses*, Foucault identified this shift in the nineteenth century as the transition from horizontality to verticality. It seems to me that he was describing a vision of the mind that I relate to the visual experience of the gaze, affected as both are by the change in point of view. In 1977, Foucault included a second paradigm shift, which was accompanied by a new change in perspective, no longer outside (looking at objects horizontally or vertically) but inside, concerned with the mechanics of producing thought. The scientific theories developed during the nineteenth century, and in particular evolutionism, played an important role in displacing the point of view because, by renouncing to place man at the centre of the universe, science led the human being to adapt his point of view, and the artist to try to conceive things from new angles. As Gillian Beer summed up,

Darwin drew upon the *imaginative orderings* and the narrative formulations of his contemporaries. One particular current intellectual ideal of nineteenth-century European culture intensified the impact of scientific theory as well as affecting its terms; the ideal of *synthesis*, a *panoptic scope* which sought similarities between

remote disciplines [...] and which analysed such similarities *morphologically*, as in general systems study today. Another such ideal was that of *relations*, implicit in *organicism*, which in prose allowed the rapid *transformation* of one kind of reference into another – economics into art history into race-theory, say – the kind of organization which made for energy and obscurity in Carlyle and Ruskin [...] Carlyle, indeed, wrote that Ruskin ‘twisted [...] geology into morality, theology, Egyptian mythology [and] political economy’. (41)

When Gillian Beer describes two Victorian ideals, one of panoptic synthesis, the other of organic relationships, she describes two ways of looking at the order of the world that I have described above in parts 1 and 2. These visions of the mind are, it seems to me, conditioned by the point of view adopted, “flying over” in the first case, immersed in the heart of matter in the second. Between these two points of view, the “plane” vision and the “bevelled” or “shattered” vision, a transition was made by the “vertical” vision, which could be the one Beer had in mind when she referred to geology, and which Foucault identified as the one interested in internal morphology. This intermediary point of view ignores the surface of things, and rather digs deep for underlying strata. It seems to me that these three points of view shaped the discoveries of the nineteenth century.

These three perspectives, were basically successive in order of mainstreamness, but each new one also had to coexist with the previous one or two, so that by the end of the century we find illustrations of these three ways of looking at the world, which also depend on three patterns in the sense that Michael Arbib and Mary Hesse understand this term – ie. projections of the mind⁶. We are all the heirs of the past, eighteenth- and nineteenth-century ways of seeing still inform our understanding of the world, and this is why the analysis of any “text” can be static, and focus on displaying its location in History (of art, literature, ideas), or unmask its underlying meanings (using a structuralist approach). Finally, it can be dynamic and study its (de)formation within a network in perpetual motion. With their shifts in points of view, the Victorians adapted their understanding and experience of the world from the metaphysical to the empirical and the conceptual. As natural sciences and technology evolved tremendously throughout the nineteenth century, so did ways of knowing, and of describing and transcribing this knowledge. Overall, the inward shift followed at the same time as it generated the ways in which human subjects looked at themselves, as images of God (since God created Man

in his own image) overhanging infinite panoramas, as children of Nature at ground level intent on discovering the geological secrets of their universal mother, or as cogs located in a gigantic mechanism of many networks. This position conditions three vantage points, above, beside, or inside the object of study that are still the ones that we use today.



- 1 This has been studied by Michel Foucault in *Discipline and Punish* (1975).
- 2 «The camera obscura model of vision... collapsed in the early nineteenth century – in the 1820s and 1830s – when it was displaced by radically different notions of what an observer was and of what constituted vision»; Jonathan Crary, «Modernizing Vision», Hal Foster (ed.), *Vision and Visuality*, Dia Art Foundation, n° 2, Seattle: Bay Press, 1988, 29-44, 30. In *Techniques of the Observer*, Crary develops this idea and shows how this new subjective vision contributed to the advent of Modernism.
- 3 The shattered illustration was invented during the Renaissance and Leonardo da Vinci used it frequently. It proliferated in Victorian periodicals, illustrating the power of non-verbal thought as Eugene Ferguson has brilliantly demonstrated. Eugene Ferguson, *Engineering and the mind's eye*, Cambridge, Mass. & London: MIT Press, 1992.
- 4 Michel de Certeau, *L'Écriture de l'histoire*, Paris : Gallimard, 2002.
- 5 Michel de Certeau, *L'Invention du quotidien*, tome 1: « Arts de faire » [1984], Paris : Gallimard, 1990.
- 6 Arbib & Hesse, « A mental model can be seen as consisting of a network of entities called schemas», 2.



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