‘Meyerson a chemist turned philosopher’,

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Meyerson a chemist turned philosopher

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Meyerson is known as a philosopher who displayed an impressive erudition both in history of science and philosophy, some one who spent his lifetime in reading and writing. His readers can testify (and sometimes complain) that his philosophical claims were based on and tested against a wide range of historical episodes taken from a variety of sciences.
Moreover it is clear that he had an intellectualist approach to science, as he was more concerned with theories than with scientific practices.
Therefore it does not really matter that he was trained as a laboratory chemist and that he had practised industrial chemistry in his early career. These aspects are biographical details hardly mentioned as mere anecdotes. For instance Christian de Rabaudy presented Meyerson as « a chemist by training and a philosopher by destination ». [1]The standard story goes that after a failed attempt in dyestuff industry he left the dirty factories for his beloved study where he dedicated himself to his philosophical inclinations. And philosophers would be tempted to say : O happy failure, O necessary misadventure, which gained for us so great a philosopher! It thus seems that the main impact of chemistry on Meyerson's philosophy was to bring him to a dead-end from where to start a new life. Meyerson himself acknowledged that chemistry was a « point of departure » meaning both that it was a starting point and that he had to part company with chemistry.
Futhermore historians of science familiar with the chemical philosophy that prevailed in the period when Meyerson practised chemistry could easily explain why he parted company with chemistry. Nineteenth century chemistry was by and large a model of positivism : a practice-oriented science, with no cognitive ambitions and no ontological asssumptions. Chemistry embodied all the deviations that Meyerson fought. It was so to say an anti-model science.

[1] De Rabaudy, Christian, E. Meyerson, identité et réalité, Paris, PUF, 1976, p. 12

I would like to question the standard view that chemistry did not really matter or did act as an anti-model in Meyerson's philosophy. I will argue that not only chemistry provided a kind of entrance hall in the history and philosophy of science, as Meyerson himself often acknowledged, but it also shaped his philosophy.

I) Meyerson early steps in chemistry.

To begin with let me pay attention to this « minor » episode of Meyerson's biography in order to revise the standard view.

The entry « Meyerson » in the *DSB* gives few details about Meyerson's failure as a chemist *« Interested in chemistry he followed the usual practice of spending time at several universities distinguished for resear laboratories : Göttingen, Heidelberg, Berlin. He also worked in Paul Schutzenberger's laboratory at the Collège de France after his arrival in Paris in 1882. His short career as an industrial chemist was blighted by his failure to develop a process for the synthetic manufacture of indigo based on a wrong reaction obtained by Baeyer.»* [2]

DATES	PLACES	ACTIVITIES	PUBLICATIONS
1879-80	Bunsen's laboratory (Heidelberg)	Intensive practice of inorganic analysis	
1882	Schutzenberger's laboratory (Paris, Collège de France)		
January 1884	At home in Lublin		Jean Rey et la loi de conservation de la matière
1884-86	Collineau Anilin Dye Company (Argenteuil)	April 1, 1884 : 3 year appointement Sept 17, 1885 : Letter of resignation January 1886 : 5 year appointment as chief-chemist double salary) July 10, 86 : Letter of resignation « for personal reasons »	
January 10 1888	?	Meyerson's patent on tetramethyl indigo	Theodore Turquet de Mayenne et la découverte de l'hydrogène
1889	Havas Agency Paris		
1890-92	Havas Agency	Project of construction of a chemical plant for the production of sulfuric ether in St Petersburg	Paracelse et la découverte de l'hydrogène La coupellation chez les anciens Juifs

With the help of the archives and a bit of history of chemistry we can get a more precise view of this early career: 5 major remarks

[2] Paul, Harry, 19 ??, *Supplement of the Dictionary of Scientific Biography*, p. 422

1) After a good training in top laboratories Meyerson started a career in mainstream chemistry (dyes synthesis). His patent on indigo synthesis and the related manuscripts detailing the routes of synthesis, and production cost of the purified raw material testify for his professionalism.

2) His brief professional career in chemistry (about 4 years) does not mean that he no longer practiced chemistry. There is evidence that he pursued chemical ventures after he was employed by Havas Agency in 1889 (project of a factory in St Petersburg in 1890).

3) There is no evidence that his process of indigo synthesis derived from Baeyer. In 1880 Baeyer synthesized indigo from cinnamic acid but despise 1 million of investments and 152 patents by the Badische the process was never commercialized. In 1882 Baeyer suggested synthesis from ortho-nitro-toluene which proved too expensive. New departure in 1890 and the result only in 1897.

4) In view of Baeyer's own difficulties with indigo synthesis, Meyerson's alleged failure has to be qualified. His patent was serious enough to be considered by German, Swiss and English factories.

5) he was an active chemist when he started writing and publishing in the history of chemistry

II) Lessons from the history of chemistry

II.1 Kopp's influence and the question of precursors

A German chemist Herman Kopp, his supervisor in Heidelberg, awakened Meyerson's interest in history and philosophy.[3] He presented his *Geschichte der Chemie* (1843) as "the most complete, the most penetrating and really the best organized and clearest exposition of a science". [4]

Kopp's history of chemistry gave a balanced view of prelavoisieran chemistry, emphasizing its consistence and the continuity with modern chemistry. In the German tradition of history of chemistry the concept of precursor came to prevail in response to French chauvinistic claims that Lavoisier was the sole founder of chemistry. It comes to no surprise that

[3] See Metzger (1929) in La méthode philosophique en histoire des sciences, Paris Fayard, 1987, p. 99 « C'est en effet en méditant sur l'œuvre historique admirable du professeur Hermann Kopp, qu'il avait eu le bonheur d'avoir comme maître de chimie à l'université d'Heidelberg, qu'il se fixa le programme philosophique qu'il a employé toute sa vie à remplir. […] M. Meyerson se plaît à reconnaître [Kopp] comme son inspirateur".

[4] Emile Meyerson, « Evolution de la pensée allemande dans le domaine de la philosophie des sciences », Conférence du 23 avril 1911 unpublished, manuscript in Meyerson archives/203.

Meyerson's first publications discussed the notion of precursor through various examples: Jean Rey, an obscure French seventeenth-century physician, later recognized as Lavoisier's precursor because of his account of the increasing weight in metals during calcinations; Turquet de Mayenne alleged precursor of the invention of hydrogen and David Hume's precursors. Meyerson did not support the German consensus about the role of precursors. He firmly concluded that Jean Rey did not anticipate Lavoisier's view on the role of air in combustion and calcination and could not be viewed as a precursor. On this occasion, he pointed out that Rey relied on a principle of conversation of matter thus suggesting that his science was embedded in metaphysics. This early case study was his first encounter with conservation principles that he would later considered as a priori metaphysical assumptions and the necessary roots of scientific endeavours.

II.2 Historiographical lessons from Stahl's phlogiston theory

Later on in the appendix of *De l'explication dans les sciences*, Meyerson developed Kopp's views on Stahl's phlogiston theory. This episode determined his historiographical attitude, which in many respects exemplifies the historiographical style that came to prevail in the 1980s science studies..

-1) a symmetric account of controversies. Meyerson finely described the reactions of staunch phlogistonists such as Scheele, Priestley, Kirwan and Macquer. Rather than considering the loosers as blind and stupid minds, he emphasized the consistence of their attitudes. In *Le cheminement de la pensée* Meyerson drew general conclusions from such episodes :

> « Never has mankind in its ensemble be slightly more stupid than it is nowadays. The vanity of living beings prevent them from seing the good reasons and the audacy of ancient theories." [5]

2) He did not neglect social aspects of scientific controversies as he insisted on Lavoisier's fortune and power position in the French society.

3) Furthermore he showed a remarkable reflexivity as he confessed that his historiographical line was inspired by his epistemological inquiry about the power of explanatory theories. "We are led to speak continually of the birth and death of these theories and to examine how reason behaves in these scientific revolutions. "[6]

4) scientific revolutions? The phlogistonist chemists' resistance testifies for the resilience of explanatory theories. Innovations cost a huge amount of painstaking efforts and inevitably raise controversies, because explanatory theories have an inner strength, which acts as a major

[5] Meyerson, (1931) §360, p. 569-571.
[6] Meyerson, (1921) p. 599

obstacle to scientific change. Does it mean that Meyerson denied the existence of scientific revolutions as suggested by Metzger and Biagioli? [7] Indeed Meyerson claimed that science will ever rest on the same intangible a priori. The often-quoted last sentence of *Explanation in the sciences* - "Everyone always and in all circumstances has reasoned and still reasons in an essentially invariable way" – supports this claim. However his account of resistances to Lavoisier' s revolution in the same volume suggests that sciences do change while the human intellect operates along the same line. Far from denying scientific revolutions, Meyerson dramatized them; he presented them as improbable events because of his insistence on their costs.

II.3 Epistemological Lessons from Stahl's theory

- a) Theory-laden experiments: Phlogistonist chemists could neglect the experimental evidence of the increased weight of calcinated metals as it contradicted their powerful theoretical interpretation of combustions and calcinations as a release of phlogiston. "The savants diverted their attention". They necessarily have to neglect certain experimental data. Meyerson concluded from this episode that because of the inner power of explanatory theory, experimental evidence is seldom able to refute a reigning paradigm and bring about a revolution. Lavoisier's overthrow of Stahl's theory is not the result of a crucial experiment. Never an experiment can overthrow a theory. On this point Meyerson is in full agreement with Duhem. Rather, Meyerson argues, Lavoisier's experiment emerged from an alternative theoretical background. [8]

b) Phlogiston theory exemplifies another important – albeit largely unnoticed – argument. There is more than one single way for rationalizing the sense data. In his quest for identity and conservation, the human intellect can chose among various possibilities and does not always elect the most rational one. In this respect Lavoisier's assumption that only mass is conserved was less rational than Stahl's assumption of the conservation of combustibility. Stahl relied on the conservation of qualities while lavoisier only admitted the cosnervation of quantities.« la théorie qualitative de Stahl était supérieure à celle, purement quantitative de

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[7] Metzger (1987) p. 98, 105 ; Biagioli 1988

[8] « On peut même supposer que, dans des cas de ce genre, la suite des phénomènes mentaux, chez l'auteur de la découverte matérielle et de la théorie, a été l'inverse de celle que l'on suppose généralement, Ce n'est pas la découverte qui, dans son esprit a précédé la conception théorique ; c'est parce que des faits, connus avant lui, lui avaient inspiré une théorie qu'il a eu l'idée de tenter l'expérience, laquelle n'a donc fait que confirmer des suppositions qu'il avait formées au sujet du lien intérieur entre les phénomènes ». Mais ces faits même, précisément, avaient été jusqu'à lui entièrement négligés ». (Meyerson, 1931, p. 228)

Lavoisier. »[9] This remark suggests that scientific advances do not necessarily mean a progress of rationality.

Ccl: lessons from the history of chemistry

- no precursor
- no science without conservation principles
- no change without controversy
- theory laden experiments
- No equivalence between science and rationality

III. Lessons from modern chemistry

So far we argued that past chemistry shaped Meyerson's philosophy. But what about the chemistry of his time ? Did he forget about it, did he reject the chemistry he was taught while focusing on early modern chemistry ?

III.1 Is Chemistry an ontology-free science ?

There were good reasons for Meyerson to reject the espistemological attitude of contemporary chemists ? Nineteenth century chemists especially those involved in synthetic organic chemistry like Meyerson, made extensive use of atomic theories and structural formulas while refraining from all ontological assumptions about the existence of atoms. For instance August von Kekulé who conjectured the hexagonal structure of benzene, the basis of most artificial organic compounds manufactured by the end of the nineteenth century, denied the existence of atoms. More precisely, he rejected the ontological issue out of chemistry, as belonging to metaphysics.

[9] Meyerson (1931) §322 p. 515-516. Noter ici une légère contradiction avec ce qui fut dit précédemment car il attribue la victoire de Lavoisier à l'expérience alors que p. 227-28 il admettait que expérience seule ne pouvait trancher. Obscurité de sa formule « substrat numérique » qui lui évite de se poser le problème pourquoi le quantitatif était devenu plus important que la somme des propriétés qualitatives et pourquoi le poids plus important que le volume.

Meyerson could not take chemists' scepticism about atoms seriously. He strongly reacted by raising doubts about the authenticity of their ontological non-commitment.

> "He (Kekulé) sometimes expressed reserves but as one can feel it was just to pay lip service, as a formality. In his heart, he strongly believed in the existence of atoms, of their molecules and of their bonds, as he manipulated them rough and ready exactly as if they were objects of common sense. "[10]

Meyerson was shocked by what he considered as a mark of duplicity from his mentors while he was an apprentice chemist in Germany. On the eve of his life he even confessed that this feeling was the driving force that led him into philosophy of science:

> "Concerning the reality of chemical atom, the faith of laboratory chemists was as robust twenty, thirty or even forty years ago (i.e. when I was young and entered the domain) as it could possibly be. To speak plainly, my astonishment in front of the patent discrepancy between the researcher's intimate conviction and the philosophical conviction that he claimed to have adopted only to pay lip service (i.e. without any influence on his work in action) was the starting point of the reflections which lead me to search for a new epistemology."[11]

This confession suggests that chemical atomism played a leading role in the emergence of Meyerson's central thesis that there is no science without ontology. Therefore Meyerson eagerly cared to keep up with recent advances in chemical theories as is visible from his correspondence with the French André Job and Georges Urbain. He remained curious about chemistry trying to figure out what ontology they carried. Chemists rely on two different notions of element: elements taken in their "atomic state" and elements taken in their molecular state. "Only the former is veritable since it is the only one susceptible to enter into combinations. Yet we can never see it since as soon as it is isolated, it becomes the latter."[12] For Meyerson, the reality of atoms and elements as well is an intellectual construction. Atoms are real although they are not – and perhaps will never be observable – as Jean Perrin's demonstration of molecular reality suggested. [13]

III.2 Chemistry: a niche of irrationals

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[10] E Meyerson, Conférence du 23 avril 1911 sur « Evolution de la pensée allemande dans le domaine de la philosophie des sciences » p. 22. (archives A 408/11)

[11] E Meyerson, lettre à Bertoud de 1925 (A 408/11)

[12] (Meyerson, 1931, p. 883). This distinction inspired a critical comment on Lavoisier's notion of elements: "les elements lavoisiens aussi présentent quelque chose d'aussi hypothétique que le phlogistique car ce qui entre en composition c'est l'élément atomique alors que ce que nous isolons c'est l'élément moléculaire". (Essais, 1936, p. 122-23).

[13] (Meyerson, 1908, p. 410-424)

-For Meyerson the reduction of chemical atoms to physical atoms does not dissolve irrationality. The electrical units (electrons, ions, protons) are as "occult" and as obscure as the billiard balls of classical mechanics. And he firmly concluded that: "Scientists or philosophers, we all know that reality is inaccessible. We all know that whatever we can do we will never eliminate irrational from the image than we shape of it."[14] In *Le cheminement de la pensée,* Meyerson resolutely discards a possible reduction of chemistry to physics and identifies the irrational proper to chemistry as being quality. [15] The existence of irreducible qualities, of material properties that cannot be reduced to geometrical figures is one of the irrationals brought about by chemistry.

- The second one is the existence of multiple chemical elements. As stated in *ES* chapter 6, material diversity is the equivalent in space of Carnot's principle in time, a radical obstacle to the intellect's effort to identity. "The true element, that which has to remain undecomposable, undestructible, uncreatable, is by definition an irrational, something that reason is condemned to acknowledge as an eternally recalcitrant given."[16]

Finally the very existence of chemistry as an independent science proves that rational hopes of total reduction of diversity are chimerical. One could bet that Meyerson would welcome the explanation of Mendeleev's periodic system in terms of electronic structure as a triumph of identity over diversity and of physcial realism over chemical agnosticism. His comments in *De l'explication dans les sciences* chapter 8 however suggest a quite different interpretation. Meyerson described two trends competing within chemistry: experimental evidence tends to impose an increasing diversity of chemical elements while our a priori tendency to identity denies or at least attempts to reduce the individuality of chemical elements. Meyerson further developed this view of chemistry as torn between two competing tendencies in his book dedicated to Einstein's relativity theory in 1925. While describing relativity theory as a victory of identity over the irrational notion of force imposed by Newton's physics, and emphasizing that recent science has identified electricity and light, electricity and matter, Meyerson nevertheless minimized the triumph of identity by recalling the ongoing fight between reduction and diversity in chemistry. He devoted several pages to chemistry in order to emphasize the « two tendencies of science » (§197). Chemistry instantiates the continuous battle between the « desire not to overindulge in generalization and to stick as closely as

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[14] André Job Séance du 19 décembre 1912 *Société française de philosophie* « Le progrès des théories chimiques » par André Job année 13, N°2, février 1913, pp. 47-62 . In *Le cheminement de la pensée* Meyerson resolutely discards a possible re duction of chemistry to physics and identifies the irrational proper to chemistry as being quality.§313.p. 501 cf §314 p. 503
[15] Meyerson (1931) §313.p. 501 cf §314 p. 503
[16] Meyerson, 1921, pp. 170-171

possible to the observed facts and « there is no science without reasoning and no reasoning without generalization. Both tendencies are legitimate (against Bacon and Comte) and physicists look naïve .[17] Chemistry thus illustrates Meyerson's major point that rational hopes of total reduction of diversity are chimerical. [18]

III.3- illusion of identification

More directly however chemistry challenges our will for identification. In *Le Cheminement de la pensée* chemistry is used to cast doubts on the validity of our use of the sign "=" to equal causes and effects or antecedents and consequents. The mind's will to assume the permanence through chemical changes, or the conservation of elements in chemical reactions led chemists to equal the inputs and outputs of chemical reactions. For Meyerson, chemical equations usually considered as the landmark of Lavoisier's positive chemistry involve an absurdity. When chemists write the equation Na + Cl = Na Cl they mean the quantity of matter is conserved. However taken literally this formula is a nonsense: How can we assume that the addition of a soft metal like sodium and a greenish gas like chlorine equates a colourless salt?[19] In writing chemical equations chemists behave exactly like primitive people, like the totemic Bororos described by the anthropologist Lucien Lévy-Bruhl. Bororos were said to violate the non-contradiction principle when they declare that "Bororos are araras", i.e. parrots. Similarly chemists cannot formally equate the ingredients and the products of a chemical reaction: the sign" =" expresses our intellect's chimerical and absurd expectation that if we could have a complete knowledge of the world, antecedents and consequents would be recognized as identical. Therefore the Dutch chemist van' t Hoff was perfectly right when

[17] English edition §204 pp. 185-186 The two tendencies within chemistry
« Thus chemistry was shaped by a constant battle –which is at the same time a collaboration – between these two conceptions : the one tending to affirm the diversity of substances, for which the diversity is essential and ultimate, and the other assuming that this diversity is only apparent and conceals a fundamental unity ». The former is likely to inspire theorists and the latter the experimentalists. Mendeleev « we still remember clearly the time when laboratory chemists (including the most illustrious, such as Bunsen) never tired heaping sarcasm on this 'chimera'. Going back a bit further, we can see an analogous situation before Lavoisier : mechanistic explanation denied the existence of qualities. « Those who work more closely with things, however, and observe the strong correlation between matter and some of its properties , necessarily come to the conclusion that those properties are something substantial, that they must persist through time ….In the quite conspicious attitude of the physicist of that time toward the chemist's findings there is, to be sure, something of the true scientists's scorn for what he considered only an imperfect science…However there is also the fact of a strong rational conviction, which does not intend to let itself be shaken by evidence to the contrary, however warranted, because it *knows* that in the end these discrepancies will necessarily be explained ». Today traces of the same conflict. « For although the chemist fully accepts the oneness of matter…he nevertheless knows that in the everyday practice of his science he must continue to reckon with the distinct elements of the chemistry of Lavoisier, endowed with many determinate properties, only a small number of which could really be deduced from the place the element occupies in the periodic table, let alone from the hypothetical structure of the atom. » Not convinced that it will ever be possible. At any rate he sees here a program, one to which he is certainly willing to devote all his efforts, but whose full realization at the moment seems to him very remote. » And he is annoyed to see that the physicist believe the problem has been solved as if the behaviour of chemical bodies in their extremely complex relationships could actually be read from Mendeleev's periodic table.

[18] Meyerson (1925) §204-218.

[19] Meyerson 1931 p. 84-85. On p. 414 Meyerson clearly distinguished between numerical equality which is reversible and chemical equation which appeared as irreversible. Hence van't Hoff decision to change the symbol equals for an arrow..

he replaced the sign equals by a simple arrow, which just conveys the view that the union of sodium and chlorine "gives" sodium chloride. [20]

III.4 Lessons from chemical practices

The lessons taken from chemistry so far mainly engaged matter theories. But Meyerson drew no less important lessons from chemical practices. Thanks to his professional experience in industrial chemistry, Meyerson was well aware that structural formulas were meant at predicting new compounds and that the slightest differences between two compounds could make an enormous difference in their behaviours. Rather than identity and permanence what matters for action is the non-identical, the non-permanent, and the unpredicted. Meyerson pointed out a contradiction between prediction (which requires attention to changes and individual differences)- and explanation (desperately seeking permanence and identity). Once again sodium chloride helps make the point. "When I see a soft metal and a yellowish gas giving birth to colourless crystals, as in the reaction of chlorine upon sodium, how can I assume that what remains is more important than what has changed?" [21]Because chemistry has a hybrid identity as science and technology, it clearly points to the limits of the relevance of our intellect's tendency to identification. Thus chemistry is the science that Meyerson invariably mentioned to convey a polarity between two opposite faces of reason: on the one hand, reason urging for the eternal identity of Parmenides' s sphere and on the other hand, reason facing permanent challenges, always at risk.[22]

Furthermore, from his laboratory practice Meyerson drew philosophical assumptions, which led him to seriously consider relativism. As he commented on the views of the logician B. Bosanquet who claimed that reasoning takes place within a close system and that causal connections are always relative to a framework, Meyerson added that scientific statements are also informed by tacit and largely unconscious rules. He referred to his former supervisor, Robert Bunsen who was a skilled laboratory chemist (« vieux routier de laboratoire »). "He gave the impression that he saw 'from the inside' as people used to say around him, that he

[20] (Meyerson, 1931, p. 276-78

[21] Meyerson, 1931, p. 527)

[22] *The Relativistic Deduction* §197-204.. Meyerson he presented chemistry as a science that « was shaped by a constant battle –which is at the same time a collaboration – between these two conceptions : the one tending to affirm the diversity of substances, for which the diversity is essential and ultimate, and the other assuming that this diversity is only apparent and conceals a fundamental unity ». Meyerson, 1925, §204 pp. 185-186.

guessed thanks to a superior instinct the essence of the real." [23] He was guided by rules and methods only transmitted through practice, which allowed him to instantly find explanations and remedies for anomalies. Although Meyerson himself rejected all predominance of practical knowledge over theoretical knowledge[24], his emphasis on what Polanyi later called "tacit knowledge", is presumably one of the aspects that Thomas Kuhn retained from Meyerson. [25]

Conclusion : Meyerson's training in chemistry helped shape at least 3 major philosophical claims :

- No science without ontology positivism is a superficial and rhetoric position
- the inner contradiction of human intellect with a polarity between identity and diversity, unity and multiplicity.
- All scientific statements are embedded in a broader and largely non verbal framework

IV) A Chemical model of Philosophy

IV.1) Chemical analysis as a philosophical method

In his review of *Identity and Reality* at the Académie des sciences morales et politiques on January 23 1909 Bergson said (my translation):

« We could thus summarize Meyerson's perspective by stating that the leading principles of knowledge are neither a priori nor just a posteriori, that experience is neither just in accord nor just in contradiction with our mind's requirements, that the philosopher's task is to perform a **dosage** of these various elements, instead of deleting some of them in favour of the others, and that it is the analysis of scientific matter theories that allow a precise **dosage.** »[26]

Bergson is the only one who cleverly pointed out the chemical roots of Meyerson's method. Just as a chemist trained in a German laboratory routinely determined the nature and

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[23] Meyerson, 1931, p. 494.

[24] Meyerson disagreed with Croce's praise of « the clinical eye » prevailing over sicentific methods of diagnosis. And he added : « En invoquant l'intuition de l'homme pratique ou la tardition de laboratoire, au détriment des connaissances qui prennent leur source dans un savoir théorique, on tend à faire prévaloir la routine, ennemie de toute innovation » (Meyerson, 1931, p. 486).

[25] Kuhn acknowledged the influence of Meyerson in the preface to *The Structure of Scientific Revolutions*, 3rd ed., Chicago: University of Chicago Press, 1996, p. *vii-viii.*

[26] Bergson Review of *Identity and Reality* at the Académie des sciences morales et politiques on January 23 1909, *Mélanges*, Paris PUF 1972, pp. 786-788 (my translation):

proportions of the chemical elements of all sorts of compounds, Meyerson set out to to determine the nature and proportions of the ingredients of human knowledge. His entire philosophy is an attempt to sort out a priori from a posteriori ingredients and to precisely determine their respective proportions.

And from his earlier book until his latest papers (posthumously published in 1934), Meyerson never varied in his methodological choice. To me, it comes as no surprise that when he decided to make explicit the method that he « instinctively applied in the beginning », he entitled his *Discours de la méthode* « De l'analyse des produits de la pensée ». [27]Both terms « analysis » and « products » clearly point to the chemical roots of his intellectual practice. Just as chemists are aware that chemical reactions are obscure and black-boxed phenomena and that they have no direct access to them, Meyerson claimed that there is no direct access to intellectal mechanisms through introspection or through what scientists have to tell about themselves. Since observation is hopeless, experimental analysis is a good alternative. Just as a professional chemist should test a large variety of samples, Meyerson systematically applied his analytic skills to all sorts of products of human intellect. He did not content himself with close a analysis of physics or of chemistry. He did not content hismself with examining past theories. He wanted to test his philosophical hypothesis against all sorts of thought products, ranging from ancient and early modern doctrine to the most recent scientific advances, and including mathematics and logic as well as common sense and « primitive thought ».

IV.2 Ways of thinking and dyeing technologies ?

So deep is the unconsicous chemical imprinting on Meyerson's philosophy that it is tempting to speculate about the vocabulary he chose to describe successful ways of reasoning. They consist in a « secret » operation by which the « mind manages to make the identical penetrate within the diverse ». [28] For the penetration to be successful, the strategy of the human intellect is what epistemologists call abstraction. To artificially select and isolate a locality among the sense data that is sufficiently purified to become permeable to human reason. « It is important to discover, among the confuse and disturbing mass of the real, one region that can be sufficiently isolated so that its behavior can be determined. »[29] In other words this intellectual operation which conditions the discovery of general laws, requires that the external world has

[27] Meyerson, *Revue philosophique*, 118, N°9-10, septembre oct 1934, in Essais, Paris, Vrin, 1936, pp. 106-151.
[28] Ibid p. 109
[29] Meyerson, 1931 p. 246

offers a special structure that he calls «fibres ». This strange term borrowed from Arthur Balfour refers a set of coherent phenomena that can be isolated from the dense and messy fabric of the external world so that our intellect can grip on it. [30]It presupposes a partial coherence or rationality of the outside world. There is no obvious reason why Meyerson so much liked the metaphor of the fibre but it presumably resonated with his what he knew about dyeing technologies. The search for scientific laws is similar with the chemical operation of dyeing, in order to force the matter of the dyestuff to penetrate within the fiber the dyer has to prepare the fibre and to use intermediates named mordants.

Conclusion

However I will resist the temptation to push the chemical metaphor that far. By no means chemistry should be seen as a key of interpretation that would account for all aspects of his works. The purpose of this purpose was more modest. I just tried to shed a new light on meyerson's works.

Historians of philosophy tend to describe Meyerson's works as a reaction against the positivistic tradition illustrated by Comte, Mach, Hemholtz, Duhem, Milhaud. Indeed it is convenient especially for pedagogical purpose to distinguish between a positivist tradition and anti or neo positivist tradition. However such philosophical classifications not only overlook the complexity and nuances of his philosophical works but more importantly they ignore that philosophies of science are rooted in scientific practices. In the present case most interpreters overlooked the German chemical roots of Meyerson's philosophy.

[30] Meyerson (1921) chapter 4, p. 136-137, chapter 16 p. 738-747.