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against those workers and peasants who managed to obtain an education because of the Revolution.

## Machian Epistemology and its Part in František Kupka's Painterly Cognition of Reality<sup>1</sup>

JOHN G. HATCH

**ABSTRACT** A consensus has emerged amongst art historians that portrays the work the Czech painter, František Kupka (1871-1957), as fluctuating between differing styles and never resolving itself into one straightforward and single-minded direction beyond abstraction. Visually this is true, but for Kupka the visual was secondary in that it plays a subsidiary role to the process involved in the creation of the work itself. A failure to properly understand this process has resulted in an inaccurate reading of Kupka's art, essentially missing the point that his paintings embody in their imagery the cognitive process involved in their creation. Significantly, as I argue, the major contributing factor in terms of Kupka's development toward this position was the scientific philosophy of the Austrian physicist Ernst Mach.

THE CZECH PAINTER František Kupka has been largely ignored in the annals of the history of modern art despite the fact that he exhibited the first abstract painting in 1912 at the Salon d'Automne in Paris. In part, this oversight is due to Kupka himself: he did not actively promote his work and published little, while his only major theoretical text, *La Création dans les Arts Plastiques*, written between 1907 and 1914, never found a publisher in France and, consequently, only appeared in 1923 in a Czech translation. These factors have been compounded by the inability of scholars to deal with the apparent eclecticism of Kupka's paintings; Kupka's visual production does not follow the same consistent and coherent evolution toward abstraction as found in the work of Wassily Kandinsky and Piet Mondrian. Furthermore, Kupka's work cannot be categorized comfortably under any of the rubrics of the time, particularly Cubism which Kupka found rather uninteresting. Granted, Kupka's visual output does, on the whole, appear to fluctuate between differing styles and never resolves itself into one straightforward and single-minded direction beyond abstraction, but what a number of scholars have failed to understand is

<sup>1</sup> For their help and support at various stages of my research, I want to thank Dawn Ades, Peter Vergo, Linda Dalrymple Henderson, J. Gerard Curtis, James Housefield, James Hatch, Karen Hatch, and the lads (Patrick and Robbie). My interest in this topic originated with the doctoral thesis I completed at the University of Essex in 1995; I presented a version of this article at the 1999 annual conference of the British Association for Slavonic and Eastern European Studies and would like to thank those who attended the session I participated in. Lastly, I must thank the Social Science and Humanities Research Council of Canada and the National Gallery of Canada for their financial assistance.

that for Kupka the visual was secondary. This is not to say that the visual was unimportant, rather it plays a subsidiary role to that of the process involved in the creation of the work. A failure to properly understand this process has resulted in an incomplete reading of Kupka's art, essentially missing the point that Kupka's paintings embody in their imagery the cognitive process involved in their creation. In other words, the meaning of Kupka's works is embedded, in a sense, in the process itself, a process which is duplicated in terms of how the work functions vis-à-vis the viewer. Why the cognitive process involved in the creation of a work of art was so important for Kupka is because it embodies an important epistemological and ontological position: in other words, it addresses the fundamental issue of our relationship to reality, a relationship which for Kupka defines the essence of our being. Significantly, the major contributing factor in terms of Kupka's development towards this interpretation of art rested with his understanding of the sciences and particularly the scientific philosophy of the Austrian physicist Ernst Mach.

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Between 1894 and 1904 Kupka faced a crisis which resulted in a feverish immersion into scientific thought in search for a solution.<sup>2</sup> It is impossible to retrace exactly the various steps Kupka undertook to resolve this crisis, but one thing appears certain, the nature of the resolution was epistemological. This is suggested by the fact that Kupka painted relatively few works between 1894 and 1904, and that he began writing *La Création dans les Arts Plastiques* in 1907, a text which represents a thorough review of artistic methodology.<sup>3</sup>

The role science might have played in an epistemological crisis seems enigmatic to say the least, yet there is little doubt that it supplied some sort of answer, since *La Création dans les Arts Plastiques* opens with the following statement: 'The results of modern science have an obvious influence on contemporary artists; many of them become, consciously or unconsciously, pupils of the most recent thinkers.'<sup>4</sup> Two key issues dealt with in *La Création dans les Arts Plastiques* suggest which recent thinker Kupka had in mind: the relationship between our subjective perceptions and objective reality and the role of sensations in this relationship. Both of these are corner stones of Mach's scientific philosophy.

Ernst Mach was an Austrian physicist and philosopher of science who studied mathematics at the University of Vienna and had a distinguished

teaching career in Graz, Prague and Vienna.<sup>5</sup> He is known to the general public chiefly through the term 'Mach Speed,' the ratio of the velocity of a moving object to the speed of sound. He is also important in having argued for the relativity of space and time in his *Science of Mechanics* (1883), a principle which would be crucial for Albert Einstein's Theory of Relativity. What Mach is not remembered for is his staunch denial of the existence of the atom, just at the time when the atomic model was about to gain general acceptance in the scientific community. The reason for Mach's rejection of the atom lay with his work in the philosophy of science and particularly his *Contributions to the Analysis of Sensations* (first published in 1886), a text which redefined scientific inquiry solely in terms of the analysis of sensory data. Mach was also an important popularizer of science as his *Popular Scientific Lectures* bear witness.

In order to understand the relationship that exists between Kupka and Mach it is important to highlight one particular aspect of the crisis Kupka faced in 1904: the relationship between art and nature. In his numerous polemics against the mimetic tradition in painting, two problems are highlighted by Kupka which became the focus of the solution he began to outline by 1907. Firstly, nature is in a constant state of change which introduces the problem of how to translate this feature in a static medium like painting.<sup>6</sup> Secondly, it is impossible to create an objective image of nature for the simple reason that one's temperament or subjectivity excludes it.<sup>7</sup> For Kupka, we are inevitably a part of nature and it is impossible to take the position of a disinterested observer in recording it, let alone observing it. The latter suggested the direction Kupka would take in solving his crisis.

Kupka felt that in art the traditional subject/object dualism had resulted in either an attempt at pure imitation, thus denying the inner self of the artist, or pure subjective or imaginative creations, which deny natural reality.<sup>8</sup> Either direction was unacceptable for Kupka since he felt that maintaining any division between the subjective and the objective was contrary to human nature.<sup>9</sup> The key to resolving this whole issue lay in a reconciliation between the external world and the self, a reconciliation which could best be achieved through an understanding of our sense perceptions, the one element that links the self to

<sup>2</sup> L. Vachtova, *Frank Kupka*, London, 1968, p. 18.

<sup>3</sup> F. Kupka, *La Création dans les Arts Plastiques*, Paris, 1989.

<sup>4</sup> *Ibid.*, p. 43.

<sup>5</sup> J.T. Blackmore, *Ernst Mach: His Work, Life, and Influence*, Berkeley, Los Angeles and London, 1972; J.T. Blackmore (ed.), *Ernst Mach - A Deeper Look: Documents and New Perspectives*, Dordrecht, 1992.

<sup>6</sup> F. Kupka, 'Quelques Idées de François Kupka sur la Peinture,' in *Frank Kupka*, Cologne, 1981, p. 6.

<sup>7</sup> Kupka, *La Creation*, p. 78.

<sup>8</sup> *Ibid.*, pp. 44-45.

<sup>9</sup> *Ibid.*, pp. 203-204.

nature.<sup>10</sup> Thus, sensation came to represent a fundamental component of Kupka's artistic theory.

The inherent unity between the self and nature was the reason for Mach's belief that all scientific inquiry should be based solely on our sense perceptions. His theory of sensations was directed toward breaking down the subject/object dualism which lay at the basis of contemporary scientific inquiry. He saw this dualism as a definite hindrance to our understanding of physical reality, the blame for which he lay at the feet of Platonic idealism which, according to Mach, 'has had an unfortunate influence on our ideas about the universe.'<sup>11</sup> The end result was that 'the universe...became completely separated from us, and was removed an infinite distance away.'<sup>12</sup> This duality ran contrary to the fact that 'the human being, with his thoughts and his impulses, is himself merely a piece of nature, which is added to the single fact.'<sup>13</sup> Consequently, Mach wished to re-establish our inherent unity with nature, a unity which could be achieved through an analysis of sensation.<sup>14</sup> He felt that this could be accomplished for the simple reason that the whole of reality, including ourselves, is essentially made up of complexes of sensations: we as individuals function in terms of sensations and external reality itself produces sensations.<sup>15</sup> As Mach wrote:

perceptions, presentations, volitions, and emotions, in short the whole inner and outer world, are put together, in combinations of varying evanescence and permanence, out of a small number of homogeneous elements. Usually, these elements are called sensations.<sup>16</sup>

Like Kupka, then, Mach clearly believed that a unity between the objective world and our subjective selves could be achieved through sensation. In the same way as Kupka could note that 'the observation of the surrounding world is one of the necessities of becoming conscious of the self,'<sup>17</sup> Mach would write, '[...] not only are we ourselves a fragment of nature, but it is the presence of these very properties [sensations] in our environment that determines our

<sup>10</sup> Ibid., pp. 60 and 101.

<sup>11</sup> E. Mach, *The Analysis of Sensations and the Relation of the Physical to the Psychological*, 5th ed., Chicago and London, 1914, pp. 11-12.

<sup>12</sup> Ibid., pp. 11-12.

<sup>13</sup> Ibid., p. 334.

<sup>14</sup> Ibid., pp. 310-311.

<sup>15</sup> Ibid., p. 29.

<sup>16</sup> Ibid., p. 22.

<sup>17</sup> V. Spate, *Orphism: The Evolution of Non-Figurative Painting in Paris 1910-1914*, Oxford, 1979, p. 87.

existence and our thought.'<sup>18</sup>

It is clear that any theory of sensation must, of necessity, be linked to an understanding of how knowledge is acquired: in other words, how does one organize and interpret one's sense perceptions. Mach stresses the unity of intuition, physical experiences and conceptual idealization as part of this process.<sup>19</sup> In historical terms, Mach sees the Egyptians as reflecting a type of intuitive knowledge demonstrated in their art:

On the old Egyptian monuments we see objects represented which do not reproduce a single visual impression, but are composed of various impressions. The heads and the legs of the figures appear in profile, the head-dress and the breast are seen from the front, and so on. We have here, so to speak, a mean view of the objects, in forming which the sculptor has retained what he deemed essential, and neglected what he thought indifferent. We have living exemplifications of the processes put into stone on the walls of these old temples, in the drawings of our children, and we also observe a faithful analogue of them in the formation of ideas in our own minds.<sup>20</sup>

For Mach, this intuitive or instinctual grasping of external reality is founded on a simple, common sense approach to the real world. This process begins with the simple act of naming a 'thing': the Egyptian pictogram is one such example, while the designation of things through words (what Mach calls 'symbols of speech') is another. The act of naming already represents, for Mach, a level of abstraction where the name embodies the important or relevant features of the object named and dispenses with what is deemed to be unessential. In mathematics, Mach sees this process expressed in the simple act of numeration, while in geometry it is the condensing of natural objects into basic geometric forms. In all of these examples it is clear that sacrifices are made, as Mach noted with regard to language:

Language, the instrument of this communication, is itself an economical contrivance. Experiences are analyzed, or broken up, into simpler and more

<sup>18</sup> Mach, *Analysis of Sensations*, pp. 351-352.

<sup>19</sup> Ibid., p. 194. I should point out that my account of Mach's epistemology is condensed from the numerous discussions on the subject found in Mach's published work. His theory is mentioned, to varying degrees, in all of his work. The most complete accounts are found in *The Science of Mechanics*, 7<sup>th</sup> ed., LaSalle, Ill., 1912, pp. 577-595; 'On the Economical Nature of Physical Inquiry' in *Popular Scientific Lectures*, 3<sup>rd</sup> ed., LaSalle, Ill., 1898, pp. 186-213; and, *Analysis of Sensations*, pp. 319-328. It must be emphasized that Mach was one of the first to examine at length the evolution of scientific knowledge.

<sup>20</sup> Mach, *Popular Scientific Lectures*, p. 201.

familiar experiences, and then symbolized at some sacrifice of precision.<sup>21</sup>

But, as Mach stressed, the condensing of reality into simpler forms is a necessary step toward the development of knowledge. What is intuitive of this initial process lies in the identification or recognition of which facts are important and which are not in furthering our understanding of reality.

Once the basic characteristics of objects have been identified and labelled/named, the next step revolves around establishing the relationships that exist between things. This also occurs first in the intuitive phase of the acquisition of knowledge. The understanding of the relationship between things expresses itself in the simplistic form of cause and effect; of the direct relationship of one object to another. A mathematical example of this lies in the simple act of counting, the establishment of the relationships between numerals, such as  $5+7=12$ , or in the case of a child's acquisition of language, the establishing of a relationship between the words 'bus' and 'stop,' for example. This causal understanding of external reality still represents for Mach a type of 'primitive or intuitive abstracting.'

This initial abstracting of relationship does not, on its own, help us understand reality. Cause and effect isolates particular situations and helps one understand the direct relationship between two elements, but once re-inserted into the real world it is invalidated. What it does do is simplify reality, make it more manageable. The value of abstraction on the level of cause and effect lies in how well we build upon it. It is built upon through experience, by gradually incorporating more elements into the equation bringing the abstract model closer and closer to reality in terms of embodying its complexities. To return to the mathematical analogy cited earlier, once one has established the relationship between numerals one can dispense with the numbers by formulating these relationships in terms of algebraic equations, saving us the trouble of repeating the manual counting process each time. It should be added, though, that the abstract description does become inherently more complex, that mathematical description has to move from describing a simple causal relationship in favour of a functional relationship. In other words, the formulation moves from A which is related to B, to A which is determined by the elements C, D, E, is related to B which is determined by the elements F, G, H. It is an odd dichotomy of Mach's epistemology in that our conceptual grasp of reality becomes greater the further we abstract it. However, it should be pointed out that this process of abstracting might be one of simplification but cannot be one of oversimplification.

Gradually, over time, our knowledge or understanding of reality is widened and further refined. Abstraction builds upon abstraction where finally our understanding of reality can be summed-up in the physical sciences by an

<sup>21</sup> Mach, *The Science of Mechanics*, p. 578.

equation. Yet it must always be remembered that that equation is a short-hand formulation of accumulated experience and that the reading of that equation should, thus, trigger a whole series of associations, in other words, the equation embodies its history. The veracity of the equation lies in being able to trace its philology since, for Mach, it is essentially a summation and condensation of *sense* experience. Significantly, all of Mach's books on physics, whether *The Science of Mechanics*, *The Theory of Heat*, etc., retrace extensively the history of the development of these areas in science. Contemporary knowledge is the summation and distillation of historical knowledge. This whole process is what Mach described as the 'Economy of Thought,' a theory so important to Mach that it is expounded upon, in varying degrees, in all his writings.

Kupka follows the same line of reasoning as Mach, adopting an historical approach as well. Like Mach, Kupka realized that knowledge or understanding is first based on instinct which is then refined over time through the use of our intellect: 'The growth of the essence of knowledge in man is based on the progressive predominance of intellect over instinct.'<sup>22</sup> This process is characterized by Kupka as a gradual abstract grasping of reality. An example of this process is provided by Kupka in his recounting of the development of the Greek column. He notes in *La Création dans les Arts Plastiques* that the idea of the column is first derived by the Egyptians and Mesopotamians from the structure of trees, translated into rough terms as a supporting member for their structures. The Greeks appropriated this idea and, in turn, further refined it, eventually resulting in a schematized abstract formulation of the idea of equilibrium embodying the rules of rhythm and proportion.<sup>23</sup>

It should be added that like Mach, Kupka also saw instinctual knowledge as reflected in a simple cause and effect relationship, and that as this knowledge is further refined it formulates itself in terms of a more complex functional relationship. As he observed: 'To our benefit, we have replaced the Cartesian principle of observation pure and simple by more useful theories, based on relationships, or rather comparisons.'<sup>24</sup>

Kupka's basic understanding of Mach's epistemology and theory of sensations lays the foundations, in *La Création dans les Arts Plastiques*, for Kupka's more general account of how sensations and their organization function in the arts. In general terms, the artist must first struggle with the numerous impressions his senses receive; he must struggle to disentangle these, make sense out of them, elaborate them and introduce a certain logic to these sense impressions. Then must follow the struggle toward abstracting these sensations and giving them material form, i.e., produce a work of art.

<sup>22</sup> Kupka, *La Création*, p. 46.

<sup>23</sup> *Ibid.*, pp. 67-69.

<sup>24</sup> *Ibid.*, p. 129.

The final form resulting from the process Kupka inherited from Mach is obviously different, Kupka's paintings are not mathematical equations written with a brush. Yet the painted forms found in Kupka's canvases, nevertheless, function in the same manner as Mach's equations. The painted image represents a synthesis of the multitude of sensations one receives over time. The canvas expresses the results of this process. It essentially represents the equation I spoke of earlier with reference to Mach, where the abstracted image on canvas should embody within itself its own history, where it acts as a trigger; where sensations are encapsulated, given economic form, in order that they can trigger a similar series of sensory responses from the individual who approaches and seeks to interpret these abstractions. Thus, the success of the image lies in its ability to set-off a parallel response in the viewer. To put it another way, the painting must, like Mach's equation, embody its own history, its own evolution; it must reveal the process involved in its creation.

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The importance of the creative process for Kupka cannot be stressed enough. The painted image is but one step in an intricate and complex process. A failure to understand that process results in a misunderstanding of how the 'image' functions. But the 'image' plays a somewhat subsidiary role in this process since it is the creative process itself (or '*cuisine mentale*' ['mental cookery'] as Kupka put it) which is important.<sup>25</sup> This is underscored by the fact that Kupka could easily envisage the abandonment of painting in favour of a more direct means of communication.<sup>26</sup> For Kupka, creativity is the process of understanding, of how we acquire and organize knowledge. The creative act lies in identifying what is essential and inessential in terms of our perceptions of nature, the abstract structuring of these perceptions and, finally, their formulation on canvas by means of what Kupka termed 'a kind of pictorial geometry of thought.'<sup>27</sup> It is exactly this mental process which binds us to nature in the sense that it parallels nature's own creative process.<sup>28</sup> The painted image must reflect this through an economic organization of its forms and the perfect integration of the language with its context, all parameters derived from nature. The importance of creation and how it should parallel nature is spelled out almost literally by Kupka, whose images starting around 1910 deal predominantly with themes of creation in nature: the creation of the earth, the creation of the solar system, the creation of life in plants, the creation of matter

<sup>25</sup> Ibid., p. 239.

<sup>26</sup> Ibid., pp. 229-230.

<sup>27</sup> Kupka, 'The Inevitable Division,' in Vachtova, *Frank Kupka*, p. 286.

<sup>28</sup> Spate, *Orphism*, p. 87.

on a molecular level, the life-giving energy of the sun or a woman's reproductive capacity.<sup>29</sup>

That we can to a certain extent recognize the source of Kupka's imagery begs an important question as to the nature of Kupka's abstraction. It should be clear by now that abstraction for Kupka does not mean non-figurative or non-objective in the common sense of the term. Abstraction refers to a process of simplification and codification which is still firmly rooted in reality. In Kupka's mind, an abstract image can only function if it can be retraced to its source, i.e. nature. Otherwise, it is merely a tautology which does not contribute to the advancement of knowledge or understanding. This is essentially the point made by Mach, where the success of any economic form of expression lies in how closely it describes the phenomena it was derived from. As Mach stated, 'economy of thought' substitutes 'indirect description [for] direct description, which...restricts itself absolutely to the abstract apprehension of facts.'<sup>30</sup> Like Mach, Kupka's abstraction is not a move away from natural reality but rather a closer and fairer description of that reality. The peculiarities of the language used, i.e., abstraction, are simply due to the manner in which that reality has been comprehended and not a desire to move away from it.

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Creation represented for Kupka a form of inquiry or investigation, with nature as its model and subject. Painting was the particular language Kupka adopted to communicate the results of this process: 'We always return to the following [point]: the plastic arts can be considered as a form of writing, a discourse whose articulation depends on how it is primarily received.'<sup>31</sup> We must now turn to the visual evidence and see how closely it fulfills the demands Kupka placed upon it. Fortunately, as the proceeding discussion will show, many of the theoretical problems Kupka was dealing with were being worked-out both on canvas and in writing. Consequently, we will witness an important dialogue occurring between the art and theory, with one sequence of his paintings tracing explicitly the various steps of the thought process Kupka wanted his works to encapsulate.

By 1904 Kupka began to devote more fully his attention to painting. Although he had begun to outline the new direction his art would take by this time, it did not result immediately in an abandonment of the figurative. It did,

<sup>29</sup> J. Andel, 'A Wanderer between Chaos and Order,' in J. Andel & D. Kosinski (eds.), *Painting the Universe, František Kupka, Pioneer of Abstraction*, Bonn, 1997, pp. 85-95.

<sup>30</sup> Mach, *Popular Scientific Lectures*, p. 248.

<sup>31</sup> Kupka, *La Création*, p. 240.

however, engender an abatement of the symbolic in Kupka's work. But if the figurative was maintained, it nevertheless underwent a crucial transformation. As of c.1907, figures in Kupka's paintings no longer exist as physical entities but rather as component parts of the painted image as a whole. At times the figure becomes integrated almost to the point of ornamentation. This was certainly intentional since on one study for *Girl with a Ball* (1908-09: the Museum of Modern Art, New York) Kupka inscribed: 'there is here but//the dissection//of surfaces//the concept//of// atmospheric//co-penetration....'<sup>32</sup> The reasoning behind this merging of figure and space emanated from Kupka's belief in the intrinsic unity between nature and the self or, as Kupka put it, the 'conscious solidarity [of] our individual self...with the immense universe.'<sup>33</sup> This was a theme which was already present in earlier symbolic works such as *Ballads -- Joys* (1901-02: National Gallery, Prague), but the meaning lacked clarity due to the rather obscure symbolism. In *Water -- Bather* (1906-09: Musée National d'Art Moderne, Paris) the theme is represented in a more explicit and simple way, where the bather is literally immersed in nature.

The merging of figure and space is the focus of a series of three studies entitled *Woman Gathering Flowers* (1909: Musée National d'Art Moderne, Paris), which culminate in the 1910-11 work *Planes by Colour* (ill. 1). Significantly, this work represents one of the first examples of a visible scientific influence on Kupka's painting. As Linda Dalrymple Henderson has shown, *Planes by Colour* incorporates X-ray imagery in the depiction of the nose of the female figure, where Kupka depicts it as a shadowed image closely parroting the rather unique image of the nose found in X-rays.<sup>34</sup> But, according to Henderson, this copying of a scientific image proved unsatisfactory for Kupka because it was too literal. Nevertheless, it appears to have drawn Kupka's attention to electromagnetic theory, an interest which Henderson believes would be reflected only in later works.<sup>35</sup>

Henderson's discovery of the use of X-ray imagery is a crucial element linking Kupka's work to science, but another is suggested by the most distinctive feature of *Planes by Colour*: the use of coloured planes. In *La Création dans les Arts Plastiques* Kupka noted that coloured planes can generate a sensation of vibration ('modulation').<sup>36</sup>

Moving from lights to darks, each colour scale produces a composite impression, where distinct vibrations are juxtaposed. It is a game of cymbals,

<sup>32</sup> František Kupka 1871-1957: *A Retrospective*, New York, 1975, p. 116.

<sup>33</sup> Spate, *Orphism*, p. 105.

<sup>34</sup> L.D. Henderson, 'Kupka, les Rayons X et le Monde des Ondes Electromagnetiques,' in *František Kupka 1871-1957, ou l'Invention d'une Abstraction*, Paris, 1989, p. 51.

<sup>35</sup> *Ibid.*, pp. 53-54.

<sup>36</sup> Kupka, *La Création*, p. 177.

where the metallic discs, arranged according to scale, each vibrate and generate a specific sound. Here, as always and everywhere, nature teaches us admirably.<sup>37</sup>

Vibration or waves represented, for Kupka, one of the fundamental manifestations of energy in nature: 'The radiation of the vital energy found in nature [...] malways manifests itself in terms of relationships between different vibrations.'<sup>38</sup> This belief is expressed in a number of Kupka's early works. For example, such symbolic works as *The Wave* (1902: National Gallery, Prague) and *Water -- Bather* which deal primarily with the notion of spiritual rebirth through a communion with nature, also demonstrate a fascination with the vibration or movement of water. In fact, this interest might complement the symbolic meaning of these works. As both these images focus on women, Kupka may be drawing a parallel between the popular notion of a woman's biological functions determined by lunar cycles and the gravitational influence of the moon on tides. Such an interpretation seems reasonable given Kupka's belief that we are inextricably a part of nature.

The theme of vibration or wave-like phenomena is an important component of *Piano Keys -- Lake* (1909: ill. 2). The top part of this work presents a lake scene, while the bottom shows a pair of hands playing some melody on the keys of a piano. Where the two merge an abstract vertical colour pattern results. Here it is clear that Kupka is drawing a parallel between sound waves and the waves produced on the surface of water. That such a parallel should be drawn is intimated by the title of the work. The colour pattern itself represents a painterly expression of this shared characteristic, where its form adheres to the parameters of the medium, while also introducing colour as another wave-like manifestation.

The fact that an abstract vertical motif is used in *Planes by Colour* clearly suggests that some sort of wave-like phenomenon is at the basis of this image. It has been suggested that this work is derived partly from Jules-Etienne Marey's nineteenth century photographic motion studies, since the figure in *Planes by Colour* is depicted in movement: where the left arm swings inward toward the body and the head appears to turn clockwise.<sup>39</sup> But Kupka may have simply interpreted bodily motion as generating another form of vibration, namely that of the displacement of air caused by the movements of the figure. This could be an example of what Kupka termed 'atmospheric co-penetration,' of the integration of figure and space or, as he stated in *La Création dans les*

<sup>37</sup> *Ibid.*, p. 179.

<sup>38</sup> *Ibid.*, p. 141.

<sup>39</sup> M. Rowell, 'Kupka: the Metaphysics of Abstraction,' *František Kupka 1871-1957: A Retrospective*, pp. 49-67.

*Arts Plastiques*, an illustration of the fact that 'form is inseparable from its setting.'<sup>40</sup> The colour planes may also embody the Theosophic spiritualist belief that our bodies emit spiritual auras. This is certainly a possibility although in C.W. Leadbeater's *Man Visible and Invisible* (1902) these auras project in a different fashion from Kupka's vertical colour planes. This should not preclude, though, a connection between aural emanation and Kupka's coloured planes, since Kupka may have thought it more reasonable to assume that auras propagate in waves. Thus the vertical colour planes in *Planes by Colour* can be interpreted as expressing both the co-penetration of figure and space and the emanation of one's spiritual aura, as well as incorporating possibly the different wave-like phenomena expressed in *Piano Keys -- Lake*.

The synthesis of the different wave-like phenomena expressed in *Planes by Colour* may yet include another complementary element. This is suggested by Kupka's literal use of an X-ray image. He may have used this image simply because it could be recognized easily and, thus, prompt further inquiry as to the reasons for its inclusion. Anyone familiar with X-rays would immediately recognize the connection between X-rays and the coloured vertical planes: the inference being that these planes are referring to Fraunhofer lines. Kupka was certainly aware of Fraunhofer lines or what is also known as the chemical spectrum. In speaking of colour vibrations and the visible spectrum in *La Création dans les Arts Plastiques*, Kupka also noted:

Black bodies...absorb everything. For the physicist or the photographic plate it represents an absence of light, and for our retina, it gives the impression of contrasting with luminosity where colours radiate in terms of more or less rapid vibrations.<sup>41</sup>

In mentioning black bodies (which absorb all radiation and, thus, when hot emit radiation of all wavelengths), photographic plates and physicists together, Kupka is referring obliquely to the invisible spectrum, i.e., the chemical spectrum, where the colours are invisible because they are beyond the range of the visible spectrum. Not surprisingly, the reason for this inclusion on Kupka's part is that Fraunhofer lines, which when recorded appear as vertical coloured lines, indicate the presence of certain chemical elements based on the wavelength of radiation emitted.

What source he may have drawn upon to learn about this phenomenon is impossible to establish exactly. Obviously, whatever texts he read on X-rays would have discussed the chemical spectrum. Scientific sources are the most logical point of departure. Mach is one possibility as he mentions the chemical

<sup>40</sup> Kupka, *La Création*, p. 182.

<sup>41</sup> *Ibid.*, p. 137.

spectrum in his discussion on colour in the *Analysis of Sensations*.<sup>42</sup> Another source might have been Henri Poincaré, one of the few scientists referred to by name in *La Création dans les Arts Plastiques*.<sup>43</sup> But the spectrum was also discussed in non-scientific journals. One finds, for example, in the *Mercure de France*, the following description written in 1911:

Everyone knows that white light decomposed by the prism forms a spectrum which, for our eye, extends from red to violet; but beyond this the spectrum continues by invisible rays which are revealed by their action on the photographic plate.<sup>44</sup>

Obviously, another potential source are mystical writings. As was the case with X-rays, the chemical or invisible spectrum was felt by spiritualists to confirm a number their beliefs.<sup>45</sup> There are a number of other potential sources: in fact, they are so numerous that it is difficult to imagine Kupka not having known of Fraunhofer lines.

The inclusion by Kupka of the chemical spectrum in *Planes by Colour* suggests further refinements in terms of how the image should be read. It was mentioned earlier that the motion of the figure in *Planes by Colour* generated a wave pattern in terms of the displacement of air. Kupka may have been a bit more specific: the motion of the figure may have been causing a displacement in the 'ether'. The ether was postulated as the medium through which such phenomena as electromagnetism, light, radiation, etc., were propagated. It was believed by scientists, though never proven, that such a medium had to exist since these manifestations could not occur in empty space. This notion of the existence of an ether was popular particularly in the nineteenth century but persisted well into the twentieth century. For example, the author of the passage discussing the chemical spectrum from the *Mercure de France* cited above, added that the invisible rays revealed by spectral analysis manifest themselves in terms of 'waves in the ether.' Theosophy adopted the concept of the ether as well and used it in much the same manner as science, defining it as the carrier of spiritual energy; it served as an important link between spiritual reality and the material world.

The ether was a popular concept amongst artists. Within Kupka's own circle we find artists and writers as diverse as Guillaume Apollinaire, Henri Barzun and Robert Delaunay, all referring to it in one form or another. That Kupka himself was aware of the concept of the ether is revealed in *La Création*

<sup>42</sup> Mach, *Analysis of Sensations*, pp. 103-104.

<sup>43</sup> Kupka, *La Création*, p. 160.

<sup>44</sup> Spate, *Orphism*, p. 23.

<sup>45</sup> L.D. Henderson, 'X-Rays and the Quest for Invisible Reality in the Art of Kupka, Duchamp and the Cubists,' *Art Journal*, 47, 1988, 4, p. 335.

*dans les Arts Plastiques*, where we find him speaking of 'waves which propagate themselves through the atmosphere -- or the 'ether'.<sup>46</sup> His use of it certainly makes perfect sense within the context of the different wave-like phenomena *Planes by Colour* encapsulates. In fact, the inclusion of the ether ties neatly together the various elements presented in *Planes by Colour*, since it is the medium which carries the vibrations of colour, sound, radiation, and spiritual auras.

The work Kupka had done leading to and including *Planes by Colour* represents basically a visual equivalent of the initial phase of the theoretical approach Kupka had derived from Mach. It embodies Kupka's attempt to identify and define in painterly terms a fundamental component of natural reality; in this case, the manifestation of natural energy in terms of waves. To a large extent the paintings discussed above represent an experimental ground, as Kupka remarked to Arthur Roessler: '[o]ne has to work on a problem for years in order to produce a sketch, a viable study.'<sup>47</sup> What one expects to find next is a move on Kupka's part toward an abstract formulation of his belief that all energy in nature expresses itself in terms of waves. Kupka does not disappoint us.

The abstract formulation of wave motion is announced early in *Piano Keys -- Lake* with the vertical pattern found at the point where the lake and piano converge. The gradual abandonment of the figurative begins in earnest with *Madame Kupka among Verticals* (1910-11: Museum of Modern Art, New York), where only Madame Kupka's face is discernible amongst a multitude of coloured verticals. Finally, the figurative is eradicated totally in *Arrangement on Verticals* (1911-12: Musée National d'Art Moderne, Paris). This last painting undertakes even further steps in the refinement of the abstract representation of wave motion. A key element in the process of abstract conceptualization for Kupka was that the image had to replicate the sensation of the object(s) from which it was derived. This is what Kupka appears to be doing in *Arrangement on Verticals*. The 'arrangement' or composition of the verticals in this work mimics the basic up and down motion of a wave. This sensory component of the abstract image in Kupka differs somewhat from Mach's formulation. Although Mach's abstraction is based on information supplied exclusively by the senses, it does not attempt to replicate those sensations. His abstraction can certainly suggest the sensation(s) which generated it, but never as directly as Kupka's images. Kupka, however, had the benefit of a medium which acts upon the senses and to his credit took full advantage of it, whereas Mach's background in mathematics equipped him with

<sup>46</sup> Kupka, *La Création*, p. 255.

<sup>47</sup> M. Mladek, 'Central European Influences,' in *František Kupka 1871-1957: A Retrospective*, p. 32.

a language that was never intended to function in sensory terms: granted, we 'read' an equation but its primary purpose is to stimulate a mental rather than physical response. Kupka's images are meant to do both in a complementary fashion.

*Arrangement on Verticals* not only re-formulates the abstraction of wave motion in sensory terms but also initiates a process of simplification and clarification which culminates in *Vertical Planes I* (1912: ill. 3). Against a simple blue background, Kupka presents in *Vertical Planes I* an arrangement of seven planes whose composition recalls motion photographs of a bouncing ball. Various descriptions and comments on this work suggest that it has succeeded in transmitting the sensation of movement it is meant to encapsulate. Margit Rowell has linked *Vertical Planes I* to Marey's motion studies, while Virginia Spate sees it as representing 'waves in space.'<sup>48</sup> As we have seen, these interpretations are all essentially correct, although they fail to identify the crucial process reflected in the genealogy of this work.

Beginning with *The Wave* in 1901 we have a visual working-out of the process Kupka described in his writings, that of the move from an instinctual understanding of reality to an abstract conceptualization. *Vertical Planes I* represents in its purest painterly form the expression of wave motion found in nature. There is no longer any references to specific wave-like phenomena, rather *Vertical Planes I* synthesizes into one basic form and sensation, light waves, electromagnetic waves, spiritual auras, sound waves, waves on the surface of water, and possibly even brain waves, since Kupka maintained also that electrical impulses conduct information to our brain.<sup>49</sup> It should come as no surprise then to find Kupka referring specifically to those planes as 'planes of force' in a study for *Vertical Planes I*, thus, representing the basic abstracted form of the energy which permeates nature.<sup>50</sup>

The series of works which conclude with *Vertical Planes I* provide a unique glimpse of the process of abstract conceptualization at work in Kupka's paintings. It is unique for the simple reason that it is an experimental phase, which occurred at the time Kupka was outlining his theoretical approach to painting. Once the experimentation was over, his future works would dispense with such an overt enactment of what was meant to be an internal process. This is not to say that later abstract works would not refer back to earlier compositions, rather that the visual traces of their history would never be as explicitly laid out as that of *Vertical Planes I*.

Kupka continued to experiment with different pictorial forms in order to better capture the idea of nature expressing itself in terms of waves: just like

<sup>48</sup> Spate, *Orphism*, pp. 138-139; Rowell, pp. 49-67.

<sup>49</sup> Kupka, *La Création*, pp. 84 and 86.

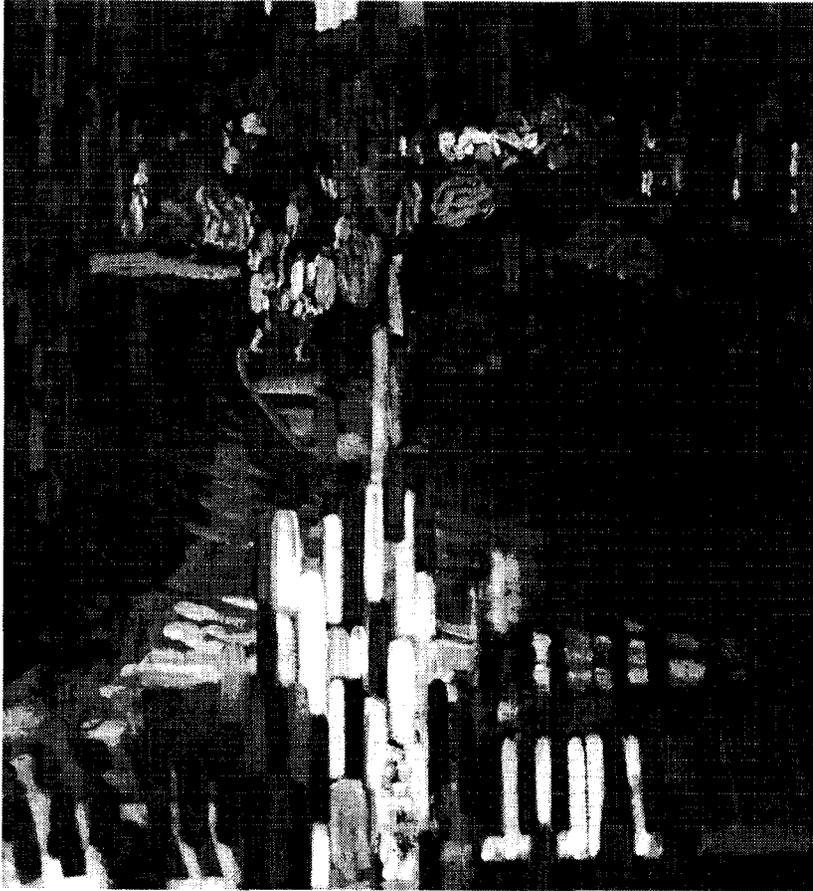
<sup>50</sup> *František Kupka 1871-1957: A Retrospective*, ill. 96.

Mach's 'equation,' Kupka's 'images' are simply a summation and condensation of current knowledge and, thus, never an end point. Thus *Vertical Planes I* spawned *Vertical Planes II* (whereabouts unknown) and *Vertical Planes III* (1912-13: National Gallery, Prague), while such works as *Compliment* (1912, 1919-1922: Musée National d'Art Moderne, Paris), *Strokes, Planes, Space III* (1913-1926: Musée National d'Art Moderne, Paris) and *Moving Blues* (c.1925-27: Private Collection, Paris) will each pursue in their own manner the theme encapsulated in *Vertical Planes I*.

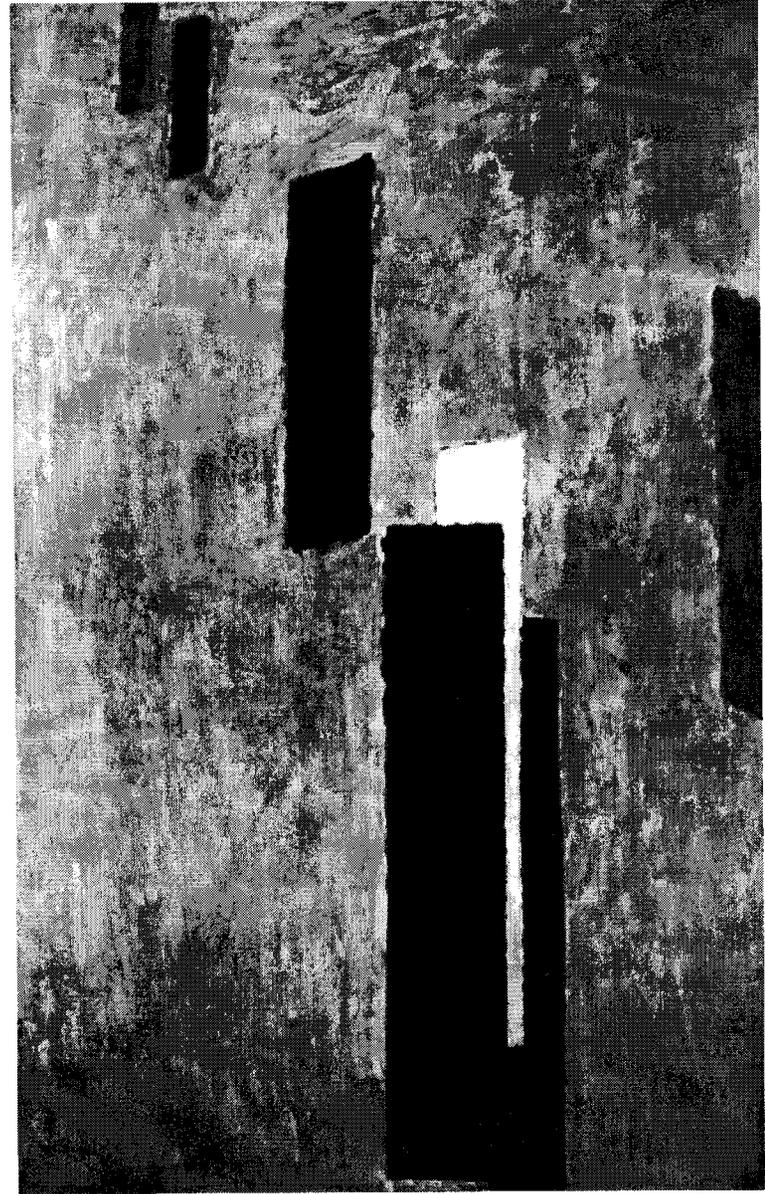
Kupka did not limit himself to examining exclusively one form or aspect of nature. While pursuing the series of works which resulted in *Vertical Planes I*, his attention was drawn to astronomy. This interest engendered a new direction for Kupka, one which began essentially with *The First Step* (1909: Museum of Modern Art, New York) and culminated in *Amorpha, Fugue in Two Colours* (1912: National Gallery, Prague). Stylistically, *Vertical Planes I* and *Amorpha* would be markedly different, but the process involved in their creation would be the same.



1. František Kupka, *Planes by Colour*, 1910-11, oil on canvas, 110.0 x 100.0 cm) Musée National d'Art Moderne, Paris.



2. František Kupka, *Piano Keys -- Lake*, 1909, oil on canvas, (79.0 x 72.0 cm)  
National Gallery, Prague.



3. František Kupka, *Vertical Planes I*, 1912, oil on canvas, (150.0 x 94.0 cm)  
Musée d'Art Moderne, Paris.