

The Implicit Influence of Mondrian's Philosophy on Sustainable Product Design

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Abstract: Mondrian's abstract painting has completely subverted the paradigm of traditional realistic painting in terms of creative concept, formal language and color application. Based on Kandinsky's "internal demand principle," he put forward a very original proposition that painting should reflect the internal order of the universe. The influence of this idea has far overflowed the field of painting and penetrated into many categories such as architecture, furniture design, visual communication and product design. Based on Mondrian's abstract painting theory and tacit knowledge theory, this paper examines its influence on modern design around the dimensions of creative concept, composition form, color organization and structural order, and combines typical cases to explain how the artistic concept is implemented as a specific design scheme. The results show that Mondrian's inspiration for sustainable product design does not lie in the direct misappropriation of red, yellow, blue squares or black grids, but more in the designers' absorption and re-creation of the principles of simplification, sense of order, modularization, structural clarity and lasting aesthetic value. His abstract philosophy reveals many possibilities of design creation, and also highlights the importance of interdisciplinary transformation of non-rigid thinking and tacit knowledge in contemporary design. Therefore, it is of both theoretical and practical significance to explore the impact of this implicit context on sustainable product design.

Keywords: Mondrian; Abstract Painting Philosophy; Tacit Knowledge; Sustainable Design; Modernism; Product Design

1. The Transformation of Abstract Painting Concepts in the Design Field

1.1 The Establishment of Abstract Painting Concepts Tacit Knowledge

Michael Polanyi put forward the concept of "tacit knowledge" in his book "personal knowledge." This type of knowledge is very special, and its essence lies in an understanding, that is, 'tacit thinking', which enables people to understand and reorganize knowledge, so as to achieve a rational grasp. For example, when we use thing A to observe thing B, it is actually a simultaneous perception of both; the more we focus on B, the more ambiguous our consciousness of A is, and vice versa. This structure is the embodiment of Polanyi's distinction between focus awareness and auxiliary awareness. Tacit knowledge is concerned with some of the most fundamental human cognitive skills, such as recognizing faces or appreciating Mondrian's paintings, but its essence is difficult to exhaust with clear language. It is neither mysticism nor unspeakable mystery, but a treasure waiting to be explored [1].

In Polanyi's opinion, tacit knowledge is the foundation of all knowledge, so the implicit thinking in creative design should not be regarded as limited to the professional field of individuals. At the beginning of the 20th century, the abstract painting concept advocated by Piet Mondrian was extremely subversive, and his works presented an orderly rational structure and profound spiritual tension. In the 'New Plasticism' movement, Mondrian emphasized the use of vertical and horizontal lines, primary colors, and non-color relations to express a universal order - a concept that, together with Fauvism, has made important contributions to the formation of modern design language [2,3]. Figure 1 presents *Red, Yellow, Blue Composition*, a hallmark of Mondrian's mature abstract expression. The work establishes visual harmony through limited color palettes, linear divisions, and asymmetrical balance, demonstrating a highly rationalized visual organization. This piece not

only exemplifies Mondrian's artistic language but also provides visual evidence for analyzing the principles of "simplification", "order", and "modularization" in sustainable product design. Black lines form a stable structural framework, while red, yellow, and blue blocks achieve dynamic equilibrium through variations in area and placement. Such compositional techniques inspire designers to eliminate superfluous decorations and emphasize structural relationships and functional logic in product design.

These philosophical thoughts of Mondrian do not enter the field of design directly with rigid formulas, but slowly penetrate through the observation, understanding, experience accumulation and creative interpretation of designers. To put it bluntly, the designer is not simply imitating Mondrian's works, but internalizing his innovative courage to break through stereotypes, his ability to refine the essence of form, and his pursuit of visual balance into a set of design methods. Exploring the transformation process of this tacit knowledge will help us see how Mondrian's abstract painting philosophy has promoted the development of sustainable design. It also shows how artistic ideas are integrated into modern design practices through the experience, intuition and creative decisions of individual designers [4].

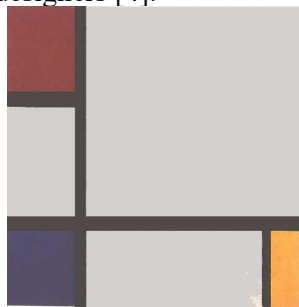


Figure 1. Mondrian's "Red, Yellow, and Blue Composition"

1.2 The Transformation of Abstract Painting Concepts as Tacit Knowledge

According to Polanyi's theory, tacit knowledge and cognitive subject are inseparable; in order to fully express abstract thinking, individuals must have the ability to understand, recombine and recreate [1]. Western classical architectural design can be said to be the product of tacit knowledge transformed from classical painting and the law of proportion, but its form is often bound by the established order, so creativity

and uniqueness are relatively limited. The private residences and nurseries in Venice presented in Figure 2 and Figure 3 all emphasize the sense of proportion, symmetry and order, and the facade shows a clear geometric structure, although the functional differences are not clear from the appearance. This precisely shows that although traditional architecture values order and proportion, it has not been able to reach the height of Mondrian's highly abstract and formal revolutionary creation. Put these two buildings together with the abstract paintings of Figure 1, the contrast is very clear: classical architecture conveys rationality through the proportional scrutiny of the facade, the rhythm of the colonnade and the order of the space, while Mondrian further purifies this rationality into a very pure relationship between lines, planes and colors. It can be seen that Mondrian's philosophy is not a simple abandonment of the traditional order, but a more thorough formal refinement on the basis of general rationality. This advancement has brought a key inspiration to modern design: to create a new visual order by reducing decoration, strengthening the integrity of the structure, and building modular associations [5,6].

In order to internalize the concept of abstract painting into tacit knowledge in the field of design and ensure the original appearance of the work, designers cannot lack design creativity. Cross regards creative cognition of design as the core issue of design cognition, and believes that designers often adopt the strategy of scheme focusing when dealing with unclearly defined problems, and use abductive reasoning and non-verbal graphical means to promote design-through these ways, tacit knowledge is transformed and integrated into design practice [4]. Creative thinking is not trapped by existing experience in solving problems, and can flexibly call different methods or paths; solving problems is the essence of sustainable design, and creative thinking has become an important cornerstone of Mondrian's abstract painting philosophy affecting sustainable design. It is in this context that rational abstraction can function as tacit knowledge.

Creative imagination comes from the disintegration and reorganization of memory representation and the integration of new experience. However, the sharing of

information within the same field sometimes binds the boundaries of imagination; therefore, after clarifying the design concept, it is necessary to carry out creative imagination beyond the conventional communication mode. The materialization of imagination refers to the transformation of the image in the heart into a physical object, which is reflected in the design activities as the concrete landing of the design concept. Taking The style movement as an example, his architectural practice is to transform the plane segmentation, asymmetric balance and proportional law in the new plasticism painting into the architectural language - such as the Schroeder house designed by Rietveld, and the vertical and horizontal lines, primary color blocks and dynamic balance in the Mondrian painting. The concept of space is directly applied to the elevation division, color configuration and internal layout of the building [6]. All in all, Mondrian's abstract painting philosophy as the transformation of tacit knowledge in the field of sustainable design, in fact, requires designers to learn and integrate similar tacit knowledge from other disciplines, with the help of creative thinking, imagination process and concept of physical presentation, to drive design innovation.

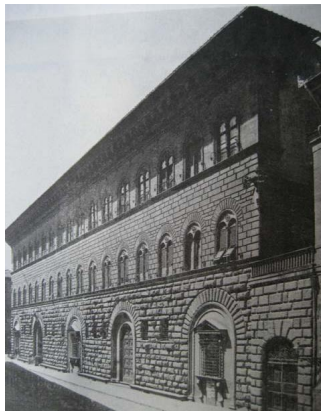


Figure 2. The Private Mansion in Venice



Figure 3. Infant Care Facility2. Analysis of the Impact on the Concept of Sustainable Design Creation

2.1 Similarities and Differences between Mondrian's Abstract Painting Philosophy and His Sustainable Design Concepts

The principles and language of sustainable design are clearly influenced by Mondrian's abstract painting. It should be noted that the use of Mondrian colors can be combined with sustainable materials and design principles to create a more eco-friendly space. Designers will have more opportunities to combine Mondrian's ideas with modern technology, sustainable principles and multiculturalism to create a more unique, modern and personalized indoor environment [7]. In view of this theory, it is of great theoretical and practical significance to explore how Mondrian's abstract painting philosophy guides sustainable design practice in the field of contemporary design.

Mondrian's rational abstract painting is mainly used as a carrier of personal spiritual expression. It aims to explore pure spiritual expression and show a new cosmic order. Its concept has profoundly influenced the art and design fields of later generations. He used a new painting language combining rectangular structure with red, yellow and blue colors to explore the inherent laws of art and establish a new order system [5]. It is worth noting that Mondrian's pursuit of simplification and structural clarity has formed a potential echo relationship between his art and the inherent demands of contemporary sustainable design in aesthetic logic.

The design process covers many aspects, including material selection, manufacturing process, production process and user feedback, and is restricted by factors such as equipment configuration, processing capacity and material properties. The human-centered design concept is mainly reflected in the general use requirements: for example, modernist architectural design focuses on functional practicality, while product design emphasizes ease of use, durability, maintainability and environmental responsibility. Sustainable design advocates new ways of using and living, challenging the traditional way of defining, designing and producing functional objects [8]. This makes it different from artistic creation in essence-art serves more personal spiritual expression, while design faces the specific problems of the real world. On the other hand,

the two have commonality in the pursuit of innovation: sustainable design is committed to responding to contemporary challenges through systematic changes, while Mondrian's rational abstract art builds a new visual system by subverting traditional aesthetics and concrete expression order. This spirit of "challenging the existing framework and creating new possibilities" is the common path for the two to promote change in their respective fields.

2.2 Manifestations of Originality in Sustainable Product Design

The concept of abstract painting brings tacit knowledge into the field of design, and its greatest significance may be to enhance the originality of design works. This originality can be understood from two aspects: one is the originality of the work itself, and the other is the innovation at the theoretical level.

The key to the originality in design is to capture the innovative spirit of the connection between abstract painting concept and design philosophy, and then transform it into a cognitive way and working method that can be used in design practice. When the creative logic of abstract painting is truly integrated into the design of its own language system, it may give birth to new works. This originality in product design is often not only in the change of color or surface pattern, but also in the organization of the structure, the cooperation between components, and even the update of the interaction between users and products [9,10]. The application of linear components, the combination of planar components and the exploration of open space relations in modern furniture design can be regarded as a structural embodiment of the transformation of abstract painting language into product design field [9]. Such structured processing can not only bring rich visual levels, but also reflect a modular and detachable design thinking. For sustainable product design, clearly defined components, reasonable structural configuration, and extremely simplified styling are conducive to product maintenance, replacement, and life extension.

Again, theoretical innovation. The originality of theory marks a leap in artistic creativity. Modernist design is not only in the shape of new objects, more importantly, it puts forward a new concept of life and space concept. The style movement transformed the concepts of

proportionality, new order and asymmetric balance contained in the painting into a complete theoretical framework for space design and product design, thus promoting the development of early European modernist architecture and furniture design [3, 6]. This leap from practice to theory shows that the deep influence of Mondrian philosophy on design is not on the surface form level, but on its thinking about the fundamental propositions of order, structure and lifestyle innovation.

3. The Manifestation of Mondrian's Underlying Philosophy in Design Practice

3.1 Spatial Design Case: Ronchamp Chapel in France

Mondrian's exploration of form simplification and abstract order provides a reference for similar directions in modern architecture. Each designer has its own emphasis on understanding and application. The Ronchamp Chapel designed by French architect Le Corbusier cannot be simply regarded as a direct copy of Mondrian's formal language. It is more like a typical case of the evolution of abstract form in modern architecture [11]. The material used in this building is relatively simple, which combines industrial construction technology with traditional technology; the changes of color and light and shadow make the space more spiritual and expressive, and also reflect the exploration of modern architecture in abstract form and spatial experience.

Figure 4 and Figure 5 show the architectural form and spatial characteristics of Ronchamp Chapel. Different from the horizontal and vertical linear pattern in Mondrian's paintings, the walls and roofs of this church show a distinct surface shape and sculpture, and do not directly copy Mondrian's formal vocabulary. However, from the perspective of abstract design, the two have a consistent pursuit in the refinement of the form, the strict control of the spatial order and the reorganization of the visual relationship. The irregularly arranged doors and windows on the facade of the building form a strong contrast with the heavy walls; the light penetrates into the interior through holes of different sizes, creating a rhythmic feeling of space. This interaction between 'entity' and 'emptiness', 'light' and 'wall' echoes the structural abstract logic between lines, planes and colors in Mondrian's

paintings.

From the perspective of sustainable design, the heavy wall of Ronchamp Chapel helps to maintain a relatively stable indoor environment, while the layout of the window subtly uses natural light to improve the quality of the space. Therefore, this complex not only shows the appearance of the cathedral, but also shows how to transform abstract artistic concepts into specific environmental characteristics through materials, structures, lighting and spatial layout. The significance of this case is to remind us that Mondrian's inspiration to the design community should not be narrowed down to 'using straight lines and three primary colors', but should be understood as a collective exploration of modern design in abstract order, form purification and spatial relations.



Figure 4. Sculptural Form and Volume of Ronchamp Chapel by Le Corbusier



Figure 5. Void-Solid Relationship and Rhythmic Light of Ronchamp Chapel by Le Corbusier

3.2 Product Design Case: Ritterwald's Furniture Design

At the product design level, Mondrian's creative ideas have been more directly projected, and Rietveld's furniture works are one of the most convincing examples. Grit Thomas Rietveld is a famous Dutch designer and one of the key figures in the style movement. His design was a subversive breakthrough at the time. His masterpiece 'Red and Blue Chair' (1917-1918) is regarded as a milestone in the history of modern furniture,

marking an important turning point in the design of furniture structure and space.



Figure 6. Red and Blue Chair

Figure 6 shows the final maturity of the red and blue chair. After 1920, inspired by the interior design style of van Doesburg and the three primary colors theory in Mondrian's abstract painting, Rietveld began to reinterpret the spatial composition of the chair with color: red seat, blue backrest, yellow cross-section end and black components. Together, they build a clear visual hierarchy, turning the furniture from a simple practical object into an artistic combination full of room for interpretation. Its linear skeleton echoes the black grid in Mondrian's painting, and the level of color corresponds to the red, yellow and blue blocks in the picture. It can be said that the red and blue chair transforms the two-dimensional abstract composition shown in Figure 1 into a three-dimensional product structure, which is a model of applying the Mondrian concept to product design. From the perspective of sustainable design, this chair is composed of relatively independent woody components, with clear structural relationship and obvious modular characteristics. Although its comfort has not yet reached the contemporary ergonomic standards, the separate components, clear structure and simplified shape adopted by it provide important enlightenment for the development of modular furniture and long-term design.

After 1923, Rietveld's grasp of the principles of Mondrian's abstract painting became more proficient, paying more attention to spatial composition, and consciously incorporating primary colors into it. In the same year, he designed the 'Berlin Chair', which was more restrained than the 'Red and Blue Chair'. While following the composition principles of Mondrian, he also showed the characteristics of abstract sculpture. With the same design concept, he also created a small side table with

vertical intersecting panels, which embodies the ingenious integration of abstract art and functional design. In 1934, Rietveld introduced the 'Z-shaped chair', which pushed the abstraction of the form to the extreme. As shown in Figure 7, the Z-shaped chair abandoned the traditional independent chair legs and assumed the functions of support, seat surface and backrest simultaneously with a continuously folded panel structure. Compared with the 'Red and Blue Chair', this work not only further reduces the number of components, but also highlights the efficiency of material utilization and structural innovation, which fully proves that the influence of Mondrian's concept is far more than color and surface decoration, but directly points to the basic logic of product structure.



Figure 7. Z-shaped Chair

This Z-shaped chair achieves a complete functional form with the help of a minimalist geometric plane [9]. From the perspective of sustainable design, its performance in material simplification, structural optimization and lasting aesthetic value just responds to several core demands of sustainable product design. Rietveld draws nutrients from Mondrian's abstract paintings, but is not framed by a certain art genre. The work always has a distinct pragmatic background and preserves its own language. In his view, the design should be based on personality as the core; at the 1982 'Stylism: Utopia Scene' exhibition, his works received attention because of this unique value. The two examples of red and blue chairs and Z-shaped chairs show that Rietveld did not mechanically copy Mondrian's painting composition scheme, but took the abstract painting principle as tacit knowledge to achieve the balance between materiality and spirituality. He positioned his design goal as "commercial products that enhance people's life experience and benefit the public", which coincides with

the focus of contemporary sustainable design on user needs, resource utilization and social value. Therefore, Rietveld's furniture can be defined in this paper as 'a key example of product design level'; the Mondrian theory discussed above, the comparison with classical architecture and the case of Ronchamp Chapel constitute the 'theoretical basis', 'historical reference' and 'spatial transformation', respectively-which together build a complete logical chain from artistic concept to sustainable product design.

4. Summary

Based on Mondrian's abstract painting philosophy, this paper examines how it influences modern design through the transformation of tacit knowledge, and further combs the internal relationship between it and sustainable product design. Mondrian's unique abstract painting concept is an important cornerstone of sustainable design. His revolutionary art not only enriches the conceptual system of design, but also enables the design language to break away from the shackles of tradition and fundamentally change the old design practice. Through the study of the origin, development and basic characteristics of this concept, combined with the analysis of typical cases in various design fields, this paper finally draws two key judgments:

- (1) There is a fundamental fit between the creative concept of Mondrian's abstract painting and the basic requirements of design creation. With the help of creative thinking, imaginative visual expression and the ability to put imagination into concrete forms, designers transform these ideas into innovative design schemes and internalize them into their own tacit knowledge. This essential fit and the transformation mechanism of tacit knowledge constitute the basis for Mondrian's lasting influence on the design field, which is precisely the focus of this study.
- (2) The absorption and transformation of the concept of sustainable design in Mondrian's abstract painting art provide a new inspiration for contemporary Chinese design. Designers can integrate art, engineering, materials, environmental factors and social needs into one furnace by 'breaking the stereotype of traditional experience' and 'crossing the boundaries of disciplines', and then develop a

more original design methodology.

It should be noted that the influence of Mondrian's philosophy on sustainable product design does not mean that all relevant cases are directly derived from him, nor can all the achievements of modernist design be simply attributed to him. A more accurate expression should be that Mondrian has conveyed an abstract, orderly and structured way of thinking for modern design. This design concept has evolved through multiple paths such as the Art Nouveau movement, modern architecture and furniture design, and finally condensed into a series of features such as simplifying structure, reducing redundancy, strengthening functional logic, and extending aesthetic durability in product design.

In contemporary design practice, Mondrian's philosophy still continues to exert influence in many fields such as visual communication, packaging design, fashion design and even interior design. For example, recent studies on Mondrian's color theory, packaging visual language and its application in fashion show that his abstract composition technique and three primary color system still have practical significance that cannot be ignored. However, what the designer should do is not simply copy the surface elements such as red, yellow, blue squares or black grids, but should deeply grasp the sense of order, balance, simplicity and innovation spirit contained in the core of his works.

The era is changing, blindly and mechanically relying on old experience, it is difficult to achieve breakthrough progress. By using a flexible and non-rigid way of thinking, the tacit knowledge from various disciplines is introduced into the design domain. This path

has effectively promoted the overall improvement of existing product design, sustainable design and Chinese original design capabilities.

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