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Review Article

Body Painting Type Analysis Based on Biomimicry Camouflage

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Abstract: The purpose of this study is to establish a method and find a possible way of applying biomimicry camouflage in body painting. This study seeks a direction for the future of the beauty and art industry through biomimicry. For this study, we analyzed the works by classifying camouflage body painting into passive and active camouflage sections based on the application of biomimicry to the artificial camouflage system. In terms of detailed types, passive camouflage was classified into general resemblance and special resemblance, and active camouflage into adventitious resemblance and variable protective resemblance, and expression characteristics and type were derived. Passive camouflage is the work of the pictorial expressive technique using aqueous and oily body painting products. The general resemblance was expressed as a body painting of crypsis and camouflage strategies. The special resemblance is a mimicry in which the human body camouflages the whole figure of living organisms or inanimate objects. Active camouflage is a work that uses a special body painting product with the object and airbrush techniques. The adventitious resemblance was camouflaged with the object technique, the most primitive camouflage method. The variable protective resemblance was expressed in abstract motifs with a variety of colors and optical illusions using special body painting products. As a result of the research, body painting in the field of applied arts can best express camouflage, and the development of new materials and techniques through biomimicry can expand the scope of expression in body painting.

Keywords: Biomimicry Camouflage, Body Painting, Beauty Industry, Art Industry

1. Introduction

Zoologist, Hugh Bamford Cott (July 06, 1900–April 18, 1987) insisted that camouflage is both art and science. As such, camouflage, a form of art and science, was developed in various ways by the natural environment as a means of false decoration in order to reveal neither identity nor body. Camouflage has also been used for a long time in the animal kingdom, as well as by humankind, to assist with hunting activities, as well as to assist in survival. However, modern camouflage is considered at a much more scientific level. Therefore, in this paper, the expression, characteristics and types of camouflage body painting were derived based on the application and implementation of biomimicry to an artificial camouflage system. The purpose of this study is to find a method and examine the possibility of applying biomimicry camouflage in body painting. The study classified biomimicry camouflage-based body painting works into passive and active camouflage. The detailed types refer to the classification by British evolutionary biologist, Edward Bagnall Poulton, who first classified and organized the different types of camouflage. Thus, the works were classified into general resemblance for passive camouflage, special resemblance, adventitious resemblance for active camouflage, and variable protective resemblance. Preceding papers for this are Eun-Young Park (2018), “Analysis of Biomimicry Behavioral Level-based Art Makeup Design” [1] and Eun-Young Park (2018), “Analysis of Biomimicry Organism Level-based Art Makeup Design” [2] While the preceding paper focused on the biomimicry level 3 level base of the organism level and the behavioral level, this paper focuses on the biomimicry camouflage base.

Biomimicry has infinite potential to provide humanity with

natural and smart technology. Therefore, biomimicry-based research in the beauty and art industries will enable us to expand the scope of eco-efficiency and various artistic activities by combining biological discovery and engineering development with artistic inspiration.

2. Theoretical Background

2.1. Camouflage

The word camouflage came into existence and was coined in France in 1917 during World War I. It comes from the verb "camoufler," which means make up and disguise. Before the war, it was a word used in theater, and during the war, it was used instead of the terms "cryptic coloration" or "protective coloration." [3]

Camouflage is a survival skill that animals use to deceive other animals and to hide and has been extensively researched. Animals camouflage themselves in a wide variety of ways using patterns, textures, or shapes that are suited to their environment [4]. The majority of camouflage methods aim for crypsis, often through a general resemblance to the background, high contrast disruptive coloration, eliminating shadow, and countershading.

2.1.1. Passive (Static) Camouflage

Many animals and plants, especially insects, can look like inert objects such as bits of wood or stones. Because of their colored wings, many moths can conceal themselves when placed against a suitable background such as the bark of a tree. The peppered moth in industrial areas of England has been held as a classic example of natural selection, as birds usually eat peppered moths that were visible only when they were sitting on unsuitably colored barks. In this instance, the moth was originally light with a small black speckling, but pollution produced in the early industrial revolution blackened the trees. Thus, an initially rare, dark form of the moth was less easily seen and eaten. Later, with the reduced pollution and clearing of the woods, the barks were lighter and better lit, and thus, the lighter-colored form predominated again. Similarly, many nesting birds are difficult to see; ground-nesting birds have camouflaged eggs and chicks. Many insects, especially grasshoppers, have bright hind wings that disappear when the insect stops flying, settles, and folds its wings, thus getting camouflaged. This sudden change makes it difficult to spot the insect.

Another basic component of passive camouflage, well known to technology, is countershading: a process in which those parts of the body that are normally well illuminated are darkly - colored and those that are normally shaded are lightly - colored. This is seen in both terrestrial and aquatic animals; the corollary is the larva of the privet hawk moth which is dark on the underside and light on the upper side and habitually hangs inverted beneath its twig. This effect visually flattens the shape of the animal, making it difficult to judge its size and how far away it is [5].

2.1.2. Active Camouflage

Active camouflage or adaptive camouflage is used among several groups of animals, including reptiles on land, and cephalopod molluscs and flatfish in the sea. Animals achieve active camouflage both by changing color and by counter-illumination, with the use of bioluminescence [6]. Animals that perform rapid adaptive camouflage with physiological color change use visual perception to identify their environment and display appropriate camouflage patterns. How animals perceive their environment is not entirely clear, however, the consensus is that the majority of perceived information is visual and processed in the brain. Visual perception has been extensively studied in cuttlefish, which are known for their rapid adaptation capabilities [4].

Active camouflage is the type that adapts, often rapidly, to the surrounding of an object such as an animal or military vehicle. In theory, active camouflage could provide perfect concealment from visual detection [7]. Also, it provides concealment not just by making an object generally similar to its surroundings, but by making it effectively invisible with "illusory transparency" through accurate mimicry, and by changing the appearance of the object as changes occur in the background [8].

2.1.3. Translucent Camouflage

Whole animals or parts of animals can be translucent and, therefore, nearly invisible. To achieve translucence, reflection of incident light must be kept to a minimum, and light must be neither scattered nor absorbed as it passes through the body. Scattering is caused by variations in refractive index. Animal tissue normally has many variations in refractive index. The most important factors are the distribution and size of the components. Refractive index is comparatively less important, and the shape of the components is the least important. Many organisms living in the deep ocean, where there is little or no ambient light to be reflected or by which camouflage color can be seen, produce their own light. The organisms that do this photophores can be mounted on mechanisms that rotate them so that they face the body and are effectively obscured, and, thus, can be modulated and switched on and off [5].

2.1.4. Reflecting Camouflage

The most difficult view of camouflage is that from directly underneath when the fish obscures light from above. Many clupeids, such as the threadfin shag Dorosoma pretense, are thin and come to a sharp point at the belly. This allows light from above to be reflected vertically downwards over its entire outline. Another form of reflecting camouflage is provided by the cuticles of some scarab beetles. The cuticle is made of structures that look like liquid crystals, mainly nematic and cholesteric. Thus, of the incident light on the cuticle, the right circularly polarized component can be reflected, and the left circularly polarized light can penetrate the helicoidally structured cuticle. However, at a certain depth, there is a layer of nematic structure that acts as a half-wave plate, reversing the sense of polarization of the light, which is then reflected when it reaches the next layer of

helicoidal structure, has its sense of polarization reversed again by the nematic layer, and continues back out through the helicoidal cuticle with very little loss. The refractive index of the cuticle increases by the addition of uric acid. Thus, the cuticle is an almost perfect reflector, making the beetle appear the same shade of green as its surroundings. This system will work only when the color and light intensity are the same in all directions [5].

2.1.5. Motion Camouflage

Motion camouflage is camouflage that provides a degree of concealment for a moving object, given that motion makes objects easy to detect however well their coloration matches their background or breaks up their outlines [9]. This is a stealth shadowing technique used by, for instance, the dragonfly approaching its prey on the wing. The dragonfly follows a path in which it always lies on a time connecting itself with a fixed point. Then the only visual cue to the dragonfly's approach is its looming. Thus, the observer of the object sees no movement away from the direction of the fixed point. The fixed point could be a part of the background against which the dragonfly is camouflaged or the initial position of the dragonfly, in which case the dragonfly appears not to have moved from its starting point [5].

2.2. Body Painting

Body painting can be defined as the application of paint to the human body. Paint is formed by pigments, which act as coloring substances, and a binding medium which gives cohesion to the mixture and helps it adhere to the surface of the object where the paint is applied. This surface, in turn, acts as a support to the painting. In body painting, the support is the body skin and sometimes its hair too, especially when the head is covered with paint [10]. Unlike tattoos and other forms of permanent body art, body painting is temporary, painted onto the human skin, and lasts for one day, or at most, a couple of weeks. In the twentieth century, the development of various products led to the manufacture of various colors and textures. In particular, the development of aqueous paints led to the growth of body painting techniques.

Body painting is an art form of the moment, a bridge between most human tribal traditions and contemporary art. It is becoming a field of unique art in its own right based on the human body. Body art is also a sub-category of performance art, in which artists use or abuse their own body to make their particular statements.

3. Examples of Biomimicry Camouflage

In Chapter 3, implementing passive and active artificial camouflage systems using camouflage methods grounded in theory is considered. Artificial camouflage not only learns from natural camouflage but may also contribute to research into natural camouflage. But research on artificial camouflage systems is still in its early stage, as the biological mechanisms of animal camouflage are not yet fully understood.

3.1. Passive Camouflage

Protective color is a typical protective function and survival strategy that utilizes camouflage and crypsis, where organisms change body color and pattern according to their surroundings. The pattern applied by the protective color is called camouflage and its dictionary definition is to paint or cover military soldiers, equipment and installations to blend in with surroundings. It also means the natural color and shape of an animal that blends in with its surroundings.

Figures 1 and 2 show a camouflage pattern designed to be invisible to the enemy, as a typical application of passive camouflage. It is still applied to military uniforms and military equipment around the world to function as camouflage. The pattern chosen for this camouflage combat dress was called "frog-skin" (See Figure 1) and was derived from experiments carried out by the US Army's Corps of Engineers in 1940. The winning design was chosen from one created by Norvell Gillespie, a horticulturist and the gardening editor of Better Homes and Gardens. His inspiration came from the natural patterning on amphibians, consisting of abstract rounded shapes [11]. However, many countries currently use "digital patterns" with excellent camouflage effects (see Figure 2). Also, many modern camouflage textiles address the question of visibility, not just visible light but also near-infrared, for concealment from night vision devices.

Figure 1. *Frog-skin military camouflage.*

Figure 2. *Digital military camouflage.*

Members of different tribes living in Africa, Australia, Papua New Guinea, and North America frequently painted

their brown naked body surfaces with white or bright yellow/grey/beige stripes. The patterns (e.g., stripy, spotty, wavy and checkered) of these paintings are extremely diverse and are used as body decoration. This can be for the purposes of emotional expression or as marks to signify personal identity and/ or group affiliation. The stripes of these body paintings are similar to the stripes occurring on the pelage of zebras and okapis. Cultural reasons may determine their designs, but it has been suggested that they could also serve a function in heat regulation or as camouflage. Where the majority of people using body painting presently live, blood-sucking horseflies are abundant, and they frequently attack the naked brown surface area of the human body with the risk of transmitting the pathogens of dangerous diseases. However, horseflies are deterred by the black and white stripes of zebras. On this basis, experiments were conducted in Hungary, and three different plastic human models were used: homogeneous dark brown, dark brown with white stripes and homogeneous light beige. The light beige model (Figure 3) was used as a control and was intended to model people with fair skin, whereas the dark brown models (Figure 4) were intended to model people with darker skin such as members of the indigenous tribal communities of Africa, Australia and North America. The white stripes (Figure 5) produced using common oil paint on one of the two brown models mimicked the stripes of African and Australian tribal body paintings [12].

The study shows that body painting provides protection against insects. A brown plastic model of a human attracted ten times as many horseflies as a dark model painted with white stripes. The researchers also found that the beige-colored plastic figure used as a control model attracted twice as many bloodsuckers as the striped model. Thus, this study offers experimental evidence that striped body paintings confer protection against biting horseflies by making the body less visually attractive to them.

Figure 3. *Beige.*

Figure 4. *Brown.*

Figure 5. *White-striped brown.*

An Australian company, Shark Attack Mitigation Systems, has developed a line of anti-shark wetsuits that will repel sharks or camouflage a swimmer, based on scientific studies of sharks' sense of sight. Sharks are believed to be color-blind, and the new wetsuits are designed with that in mind, according to Shaun Collin, a researcher with the University of Western Australia's Oceans Institute, as told to Agence France-Presse (AFP) [13].

The new wetsuits use a specific combination of colors and patterns, providing two strategies for protection:

(Figure 6) The "Elude" design allows the wearer to effectively blend with background colors in the water making it very difficult for a predatory shark to detect the person or to focus.

(Figure 7) The second "Diverter" design makes the user appear highly visible while using disruptive color patterns totally unlike any normal prey. The Warning Surfer design integrates with a patterned surfboard design to render a full visual from below when the surfer is paddling or stationary [14].

Figure 6. *Cryptic diver.*

Figure 7. *Warning surfer.*

3.2. Active Camouflage

Cephalopods employ their chromomorphic skins for rapid and versatile active camouflage and signaling effects. This is achieved using dense networks of pigmented, muscle-driven chromatophore cells which are stimulated by the brain to actuate and affect local skin coloring. This allows cephalopods to adopt numerous dynamic and complex skin patterns, most commonly used to blend into the environment or to communicate with other animals [15]. Researchers have created a man-made system that mimics this form of camouflage. The team developed flexible sheets of light sensors, containing a temperature-sensitive dye, that can automatically sense and adapt to the color of their surroundings (See Figure 8).

The color-changing elements act like chromatophores, the tiny pigment-containing and light-reflecting organs in cephalopods. The reflective background is like leucophores (white chromatophores found in some cephalopod species); the motors act like the muscles that control the chromatophores; and the light sensor acts like structures that contain opsins, which are light-sensitive receptors involved in vision. The researchers tested their camouflage material, showing that it was able to adapt to changing patterns of light in its surroundings within 1 to 2 seconds, according to the scientists [16].

Systems such as this could lead to adaptive camouflage technology that could be tuned to its environment, and integrated into electronics for a variety of applications, from military to industrial uses, according to the researchers.

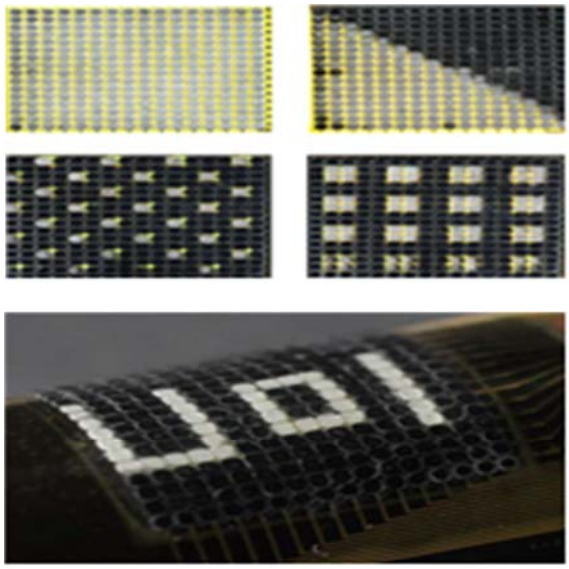

Figure 8. *Image of a device in operation while bent, while showing the text pattern "U o I" (for University of Illinois).*

The Tachi Laboratory at the University of Tokyo has developed numerous applications as regards Retroreflective Projection Technology (RPT). One of them involves a system for active camouflage in which a camera and projector are set up in front of the eye of an observer, as shown in Figures 9 [8]. This is a transparent cloak (see Figure 10) using optical illusions so that wearers become transparent and disappear. It takes a video of the surrounding images and puts them on clothing through projection mapping. It acts as a camouflage effect that instantly assimilates the wearer to the environment, making it difficult to distinguish the person.

In other examples, Canadian and German military researchers are developing a chameleon-like armored vehicle capable of altering its appearance to conceal itself from the enemy. The British defense research agency, QinetiQ, is working on an active camouflage system called "rugged smart skins." NASA has commissioned studies of this invisibility technology, called "adaptive camouflage."

All of these developments typically include a network of electronic flat panel display units, each containing a camera, configured into a flexible array. Light direction, color, intensity, and other information is required to produce the image on the displays [8].

The camouflage technique, which is assimilated into the environment using digital and high-tech materials, also appears in the 2009 "Digital Skins" (See Figure 11) published by Nancy Tilbury. Body modifications, such as that carried out by chameleons, occurs by projecting light and images onto specially made material. Also, the boundary of the body and the surrounding environment is blurred, allowing for the selection of concealment and revealing. This is a future textile example. So, through projection mapping, IP triggers, and facial recognition, people could overlay themselves with glowing designs, customized only for their

bodies [17].

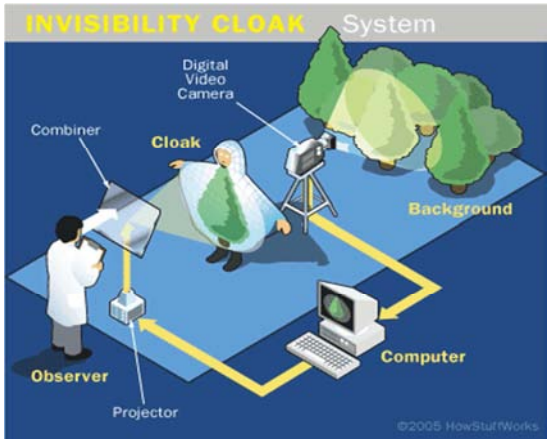

Figure 9. *RPT System for active camouflage.*

Figure 10. *RPT with projection on a retroreflective cloak (2003).*

Figure 11. *Nacny Tilbury, Digital Skins, 2009 (Braddock & Harris, 2012, p. 141).*

Biomimicry camouflage is not only visual; heat, sound, magnetism and even smell can be used to target weapons and maybe intentionally conceal them. Recently, camouflage has been developed with high optical illusion techniques in various fields due to the development of new printing and digital technologies.

4. Body Painting Type Based on Biomimicry Camouflage

Camouflage has had an extraordinary impact on the art and design industries over the last hundred years. Born out of the war in an age of machines it takes its inspiration from the natural world. By its very nature, camouflage has always attracted visual and creative talents, especially during the two World Wars [11]. Since the beginning of camouflage, which mimicked the protective color of living things during World War I, it has had a lot of influence on popular culture, especially in the contemporary arts.

Therefore, this study classifies and analyzes camouflage body painting into passive and active camouflage based on case studies of biomimicry camouflage application.

4.1. Passive Camouflage

4.1.1. General Resemblance

Protective resemblance is used by prey to avoid being hunted. It includes special protective resemblance, now called mimesis, where the whole animal looks like some other object, for example when a caterpillar resembles a twig or a bird dropping. Generally, in protective resemblance, now called crypsis, the animal's texture blends with the background [3]. Most cases of camouflage fall into this category, and the tree bark mimicry of many moths is typical.

Uroplatus sikorae (see Figure 12) has coloration developed as camouflage, mostly grayish brown to black or greenish brown with various markings meant to resemble tree bark down to the lichens and moss found on the bark. Additionally, it has flaps of skin running the length of its body, head, and limbs, known as the dermal flaps, which it can lay against the tree during the day, scattering shadows, and making its outline practically invisible [18]. The caterpillars of the peppered moth (*Biston betularia*) not only mimic the form but also the color of a twig (see Figure 13). Recent research indicates that the caterpillars can sense the twig's color with their skin and match their body color to the background to protect themselves from predators [19].

Figures 14 and 15 show examples of applying camouflage strategies to body painting to change the color and pattern of the body, to make them similar to the surroundings, to protect themselves from predators. Figure 14 shows the technique of body painting to disguise the human body as part of the bark. Figure 15 shows the human body as a part of nature by realistically expressing the moss-covered stone on the human body by using the stipple technique.

Figure 12. *Uroplatus sikorae.*

Figure 13. *Biston betularia (Peppered Moth).*

Figure 14. *Body painting by Johannes Stoetter.*

Figure 15. *Body painting by Johannes Stoetter.*

4.1.2. Special Resemblance

Special resemblance means that an organism takes the shape of an object. Mimicry of leaves, twigs, sticks, and stones falls into this category. The most amazing mimetic organisms are the *Kallima inachus* or South African living stones *(Lithops*), which seem to overturn the animal/plant/mineral classification system. *Kallima inachus* is an animal tissue that pretends to be a plant, and *Lithops* is a plant that pretends to be a mineral [3].

The butterfly wings of *K. inachus* (see Figure 16) are shaped like a leaf when in the closed position. When the wings are closed, only the cryptic underside markings are visible, which consists of irregular patterns and striations in many shades of biscuit, buff, brown, yellow, and black. The veins are darkened and resemble the veins of a leaf. The resemblance to a dried leaf, a masquerade, is extremely realistic and gives the genus its common names, the oakleaf or dead leaf [20]. *Lithops* (commonly called "flowering stones" or "living stones") are true mimicry plants (see Figure 17): their shape, size, and color causes them to resemble small stones in their natural surroundings. The plants blend in among the stones as a means of protection [21].

One of the most famous body painters today, Johannes Stötter, created this tropical frog by painting on five people. Bringing his artwork to life with each brushstroke, and creating detailed effects with his hands, he fuses the seen and unseen into one (Figure 18). This artist creates incredible optical illusions using nothing but humans and body paint. The five models were fully camouflaged in the form of frogs, with the forelimbs, hind legs, and torso of the frog. Figure 19 is a special resemblance to a typical passive camouflage disguised by the human body as an inanimate object. Using the human body as a form of art material, it expresses camouflage body painting with color and texture such as the surrounding stone.

Figure 16. *Kallima inachus.*

Figure 17. *Lithops.*

Figure 18. *Body painting by Johannes Stoetter.*

Figure 19. *Mozambique project by Veruschka, 1972.*

4.2. Active Camouflage

4.2.1. Adventitious Resemblance

Adventitious resemblance or self-decoration camouflage is a method of camouflage in which animals or soldiers select materials, sometimes living, from the environment and attach these to themselves for concealment. For adventitious protection, an animal uses materials such as twigs, sand, or pieces of shell to conceal its outline, for example when a caddis fly larva builds a decorated case, or when a decorator crab decorates its back with seaweed, sponges, and stones [3].

Decorator crabs of many species camouflage themselves with pieces of seaweed, shells, small stones, and living organisms such as hydrozoa, sponges, and sea anemones to evade predators (see Figure 20). They pick up these pieces and stick them to their shells as semi-permanent camouflage, keeping them until the next molt. Their shells are covered with curved hairs to hold the decorations. *Reduvius personatus* or the masked hunter (see Figure 21) is an insect belonging to the assassin bug (Reduviidae) family. The name derives from the fact that its nymphs camouflage themselves with dust or small flakes of wood [22].

This category refers to the use of objects, the most primitive camouflage method of selecting materials from the surrounding environment and attaching them for crypsis. Figure 22 shows the body painted by an airbrush and decorated with grass and twigs. The human body is accommodated in nature and disguised as a natural sculpture. It expresses the beauty of the human body in harmony with nature. In Figure 23, the body is first painted brown, and then camouflaged with secondary soil, moss, and stone. Nature's color and texture are expressed as it is—the human body has become part of nature.

Figure 20. *Hyastenus elatus.*

Figure 21. *Reduvius personatus.*

Figure 22. *Body painting.*

Figure 23. *Body painting.*

4.2.2. Variable Protective Resemblance

In variable protective resemblance, an animal such as a chameleon, flatfish, squid or octopus changes its skin pattern and color using special chromatophore cells to resemble whatever background it is currently resting on [3]. Cuttlefish are well known for their unmatched camouflaging abilities which are possibly due to light scattering leucophores, pigmented chromatophore organs, and structurally reflecting iridophores all located in their skin. These specialized characteristics give them the ability to not only change their color, but also change the texture and appearance of their skin and all of this is done despite them being color-blind [23].

Research is currently underway to mimic creatures like the cuttlefish and octopus to develop skins that can chemically react to shifts in light, as well as have the ability to actively change their surface texture. The giant Australian cuttlefish (*Sepia apama*) in Figures 24 and 25 alters the relative size of its pigment-bearing chromatophores and warps its muscular skin to switch between camouflage mode (see Figure 24) and communication mode (see Figure 25) in under a second [24].

Figure 26 shows an optical illusion where the abstract motif and the marbling effect of body painting are combined with a two-dimensional background. It is expressed as if the chameleon and octopus are assimilated with the surrounding color so that their size and appearance are not revealed. Figure 27 shows a body painting done with the action painting technique. Action painting is also called gesture abstraction and is a painting style that naturally dribbles, bounces, or stains rather than being applied carefully. The product used for body painting is a special paint that emits UV light and reacts to black light. This is a direct and orderly neon color effect with the intense color and dynamic sense of UV. The UV light and black light expression techniques are scientific body painting techniques that combine body painting paint and light. UV light paints appear opaque in normal lighting but show more vivid colors in UV light (blacklight). In particular, this expression technique has a sharpness of color depending on the number of watts of the UV light and is more effective when using the UV light alone than other condensing. UV body painting can prominently represent the colorful and visual elements of light emission. Therefore, it stimulates liveliness and visual perception to show active camouflage.

If the intrinsic feature of the ecosystem is life, then the camouflage body painting done on the human body would be the same as art creating life. As such, the human body's ecosystem camouflage shown in the examples of body painting demonstrates that the human body is a formative object by revealing and hiding the visible and the invisible. Therefore, body painting, a field of applied art, is one of the areas that best expresses camouflage.

Figure 24. *Sepia apama (camouflage mode).*

Figure 25. *Sepia apama (communication mode).*

Figure 26. *Colors of devotion 2, Bella Volen, 2017.*

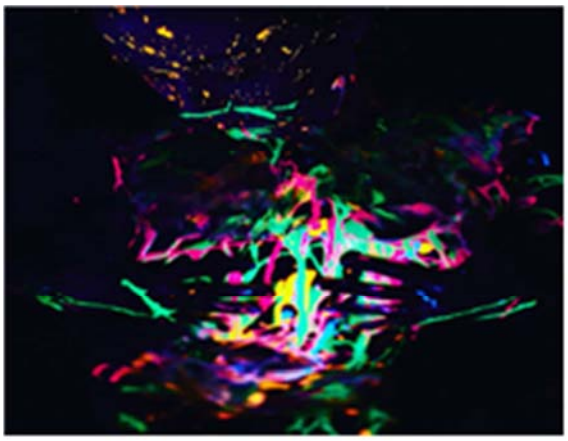

Figure 27. *UV body painting.*

5. Conclusions

Camouflage body painting is classified into passive and active camouflage based on the biomimicry application of the artificial camouflage system. Passive camouflage uses aqueous and oily body painting products and is expressed in a pictorial expressive technique that is a way of shaping the subject with realistic expression. Active camouflage is expressed as an object technique to form or shape using materials and an airbrush technique to spray paint by air pressure. The products were classified into works of abstract motifs using special products such as UV body paints and airbrush paints. The conclusion is as follows.

As regards passive camouflage, first, general resemblance expressed in body painting is done through crypsis and camouflage strategies, the protective coloration that changes the body's color and pattern to protect itself, similar to its surroundings. Second, special resemblance is a mimicry that looks exactly like the living organisms, and the human body perfectly camouflages the whole figure of living organisms or inanimate objects.

In active camouflage, first, adventitious resemblance is the most primitive method of camouflage using an object. After body painting on the human body, it was disguised as an object of nature and became a natural sculpture. Second, variable protective resemblance means that the living organisms are assimilated with the surrounding color and do not reveal their size or appearance. Using abstract motifs and special body painting products, marbling effects and action paintings are expressed in varied colors and optical illusions.

This study sought a direction for the future of the beauty and art industries through biomimicry. Therefore, based on the above conclusions, biomimicry-based camouflage body painting can demonstrate the most direct way in which humans relate to ecosystems. Thus, body painting in the applied arts field can best express camouflage, and the development of new materials and techniques through biomimicry can expand the scope of expression in the field of body painting.

References

[1] Eun-Young Park. Analysis of Biomimicry Behavioral Level-based Art Makeup Design. Journal of The Korean Society of Beauty and Arts. Vol. 19, No. 1, 2018.

[2] Eun-Young Park. Analysis of Biomimicry Organism Level-based Art Makeup Design. Journal of The Korean Society of Beauty and Arts. Vol. 19, No. 3, 2018.

[3] Peter Forbes, Dazzled and Deceived: Mimicry and Camouflage. Yale, New Haven and London, 2012, pp. 50-71.

[4] Yang Li and Nikolaus Correll. From Natural to Artificial Camouflage: Components and Systems. Department of Computer Science. University of Colorado Boulder, USA, 2018.

[5] Yoseph Bar-Cohen. Biomimetics: Biologically Inspired Technologies. II ECCOMAS THEMATIC CONFERENCE ON SMART STRUCTURES AND MATERIALS. C. A. Mota Soares et al. (Eds.). Lisbon, Portugal, 2005, pp. 18-21.

[6] https://en.wikipedia.org/wiki/Active_camouflage.

[7] Akash Ravindran and Akshay Premkumar. Camouflage Technology. International Journal of Emerging Technology in Computer Science & Electronics (IJETCSE). Vol. 3, No. 1, 2014.

[8] Kent, McKee and David Tack. Active Camouflage for Infantry Headwear Applications. Defence Research and Development. Canada, Toronto, 2007.

[9] https://en.wikipedia.org/wiki.

[10] Danca Fiore. Body Painting in Tierra del Fuego. The Power of Images in the Uttermost Part of the World. Degree of Doctor of Philosophy, University College London, 2001.

[11] Tim Newark and Jonathan Miller. Camouflage. Published by Thames and Hudson Ltd. 2009, pp. 8, 129.

[12] Gábor Horváth, Ádám Pereszlényi, Susanne Åkesson and György Kriska. Striped Bodypainting Protects Against Horseflies. Royal Society Open Science. Vol. 6, No. 1, 2019.

[13] https://www.livescience.com/38350-anti-shark-wetsuits-inspired-by-nature.html.

[14] https://themermaidsociety.com.au/science-help-decrease-shark-attacks.

[15] Aaron Fishman, Jonathan Rossiter and Martin Homer. Hiding the Squid: Patterns in Artificial Cephalopod Skin. Journal of the Royal Society Interface. Vol. 6, No. 108, 2015.

[16] Cunjiang Yu, Yuhang Li, Xun Zhang, Xian Huang, Viktor Malyarchuk, Shuodao Wang, Yan Shi, Li Gao, Yewang Su, Yihui Zhang, Hangxun Xu, Roger Hanlon, Yonggang Huang and John Rogers. Adaptive Optoelectronic Camouflage Systems with Designs Inspired by Cephalopod Skins. Proceedings of the National Academy of Sciences of the United States of America. Vol. 111, No. 36, 2014.

[17] Yeonjae Yoo. The Expressive Characteristics and Internal Meanings of Biomimicry Applied to Contemporary Fashion. Graduate School, Kyungpook University. 2018, p. 990.

[18] Eric Pianka and Laurie Vitt. Lizards: Windows to the Evolution of Diversity. Berkeley: University of California Press. 2006, p. 247.

[19] Eacock, A., Rowland, H. R., van't Hof, A. E., Yung, C., Edmonds, N., Saccheri, I. J. Caterpillars of the Peppered Moth Perceive Color Through Their Skin to Match Their Body Color to the Background. Retrieved 2 August 2019.

[20] Hugh Cott, Adaptive Coloration in Animals. Oxford University Press. 1940, pp. 318-320.

[21] http://www.lithops.info.

[22] https://en.wikipedia.org.

[23] Lydia Mäthger, Chuan-Chin Chiao, Alexandra Barbosa and Roger Hanlon. Color Matching on Natural Substrates in Cuttlefish, Sepia officinalis. Journal of Comparative Physiology. Vol. 194, No. 3, 2008.

[24] Innes Cuthill, William Allen, Kevin Arbuckle, Barbara Caspers, Cuthill et al., The Biology of color. Science. Vol. 357, No. 6350, 2017.