Abstract—Abbott H. Thayer (1849–1921), a prominent U.S. painter, was one of the first to describe in detail the function of protective coloration in nature. In military history, he frequently is credited with the first military applications of countershading and disruptive patterning, so that he was known among friends as 'the father of camouflage'. This essay is a brief review of Thayer's lifelong involvement in the study of both natural and military camouflage.

I. INTRODUCTION

In the last quarter of the nineteenth century, Abbott H. Thayer was an important U.S. painter whose portraits and landscapes were frequently praised (Fig. 1) [2]. In addition, he was an exceptional teacher, and among his most prominent students were Rockwell Kent, Louis Agassiz Fuertes and the sons of William James, Alexander and William, Jr. [3].

It is less widely acknowledged that Thayer was both an artist and a scientist. In biology, he most often is remembered as one of the first to describe in detail the function of protective coloration in nature. In military history, many credit him with the first military applications of disruptive patterns or 'dazzle camouflage', so that he was known among friends as 'the father of camouflage'.

This essay is a brief review of the lifelong involvement of Thayer in the study of visual concealment in natural and military camouflage.

II. CHRONOLOGY

Born in Boston in 1849, Abbott Handerson Thayer was a descendant of the seventeenth-century settlers of Brain-tree, Massachusetts. The son of a country doctor, Thayer spent most of his formative years in rural New Hampshire near Keene, at the foot of Mount Monadnock, a region to which he later would return.

When people see the camouflaged uniforms for jungle warfare, or elaborate concealments of installations, few realize that the technique for all this was 'pioneered' by a New England artist in the woods of Dublin, New Hampshire.

Nancy Douglas Bowditch [1]
Thayer moved to Brooklyn in 1867, where he studied painting at the Brooklyn Art School and the National Academy of Design. In 1875, having married KateBloede, he moved to Paris with his wife, where he was a student for 4 years in the atelier of Jean-Leon Gérôme at the Ecole des Beaux-Arts. Thereafter, the Thayers returned to New York, where he established his own studio, served as president of the Society of American Artists and worked with a handful of students.

Two of the Thayers' children died in the early 1880s. This may have been one of the causes for the subsequent illness of Mrs. Thayer, who underwent mental and physical deterioration and died in a hospital in 1891. Thayer was shattered by his wife's illness, although he was somehow productive throughout. After her death, he married their loyal and capable friend, Emmeline Buckingham Beach, and returned to southwestern New Hampshire to live [5].

For the remainder of his life, although he actively painted and taught, Thayer was largely preoccupied with the study of protective coloration, of which the most notable consequence was the publication of an ambitious and controversial volume on Concealing Coloration in the Animal Kingdom, first published in 1909 [6].

Thayer died in New Hampshire in 1921. He was profoundly depressed at the time, apparently because of the lack of acceptance of his abundant ideas regarding protective coloration and military camouflage [7].

III. COUNTERSHADING

Abbott Thayer's interest in protective coloration in nature may have begun in 1892, at which time he realized that there is a functional reason for the white undersides of animals [8]. As an artist, Thayer had long been aware of the fact that two-dimensional renderings are made to look three-dimensional by the technique of shading, in which highlights are painted at the top of a figure, because of the overhead light of the sun. In a large number of animals, a system of inverted shading occurs, in which the white-bellied body looks less round and less solid because the effects of the sunlight have been canceled out or counteracted (Fig. 2) [9].

Today this is commonly known as Thayer's Law or the principle of countershading. In the words of Hugh B. Cott, a British zoologist, "in countershading we have a system of coloration the exact opposite of that upon which an artist depends when painting a picture. The artist, by skilful use of light and shade, creates upon a flat surface the illusory appearance of solidity: Nature, on the other hand, by the precise use of countershading, creates upon a rounded surface the illusory appearance of flatness. The one makes something unreal recognizable: the other makes something real unrecognizable" (Fig. 3) [10].

Among zoologists, the principle of countershading was not controversial, and, in fact, as Thayer eventually found, his discovery had been anticipated in 1886 by a British entomologist, Edward B. Poulton, with whom he established a friendship [13]. But certain corollaries of countershading were highly controversial, as was the combative and arrogant tone of virtually all of Thayer's proposals [14].

It was a contention of Thayer that the coloration of all animals has evolved in such a way as to contribute to their low visibility. He did not agree with the common belief that some animal coloration is designed to be seen quickly and easily to assist in the process of finding a mate, fooling quarry or intimidating a predator. Whenever a species is seen readily, said Thayer, it is because it is being observed 'out of context' (outside of its customary environment) or, within
Blending is largely dependent upon a relationship of extreme similarity (between the figure and its ground), while disruption is based on the opposite tack, that of an excess of contrast (within the bounds of the figure itself). Both have been used widely throughout military history, and abundant examples also can be found in the colors and patterns of natural forms [18].

V. MIMICRY AND BACKGROUND PICTURING

In mimicry, a subcategory of blending, there is a deceptive resemblance between two kinds of unrelated organisms. Some animals, for example, have an almost unbelievable similarity to dead leaves, twigs or tree bark (Fig. 4) [19]. Thayer was skeptical of some types of mimicry. He was especially dubious of those kinds of mimicry in which it had been claimed that “harmless butterflies or other insects had through natural selection acquired similar patterning and coloring to those of bad tasting butterflies for their protection” [20]. In order to challenge that theory, he traveled to the West Indies in 1903, where he systematically tasted both harmless and...
distasteful species of butterflies. According to his daughter Gladys, who witnessed this highly unusual feast, Thayer “could find no difference in the flavor” [21].

On the other hand, Thayer also held the view that all occurrences of natural disruption are examples of a type of mimicry in which the shapes on an animal’s coat are an epitomized emblem of its customary surroundings—“a generalization or distillation of the features of those physical settings in which the animal commonly was found, a surface that would be absorbed into a greater variety of specific backdrops” [22]. He referred to this extraordinary concept as “background picturing” (Fig. 5).

VI. MILITARY COUNTERSHADING

Throughout Thayer’s adult life, one of his closest associates was the U.S. painter George de Forest Brush. It was with Brush’s help that Thayer first became involved in military camouflage. In 1898, during the Spanish-American War, Thayer and Brush were invited to present to the U.S. Department of the Navy their recommendations for the application of protective coloration to ship camouflage.

“Because of the lack of model and test facilities, however, nothing came of the idea” [23].

According to U.S. Navy records, Brush again submitted plans for ship camouflage in 1908, but, “through his attorneys, imposed such stringent conditions as to secrecy that the Bureau dropped the matter. When these conditions were later modified, the monetary consideration demanded was so high that in August 1911, the matter was definitely abandoned” [24].

In 1912, Thayer’s concern with ocean visibility was renewed when the Titanic crashed into an iceberg. Regarding that disaster, Thayer published an article in the United States Hydrographic Bulletin in which he explained it was wrong to assume that white objects in the sea (such as icebergs) are more visible at night than dark objects. Rather, Thayer insisted, “it is precisely when they are purest white that they are at night invisible” [25]. Thus, when World War I began, he argued that all Allied warships should be adorned in brilliant white, and that such vessels should purposely “wait for the dark parts of the day to do their fighting in” [26].

In the early stages of World War I (prior to official U.S. involvement), Thayer and Gerome Brush, the painter’s son, again approached the U.S. Navy with ship camouflage proposals. Their efforts were largely successful this time. Thayer and the younger Brush officially were granted a patent for the application of countershading to ship camouflage, after which Brush was assigned to the supervision of the painting of merchant ships all along the eastern seaboard. He worked at Norfolk, Virginia, Boston Harbor, New York Harbor, and many other places. He trained men to do the painting according to Mr. Thayer’s theory [of counter-shading]. The color scheme for the ships was taken from the general coloring of a seagull, worked in two shades of gray and pure white, the underpart of everything being painted white [27].

VII. DAZZLE CAMOUFLAGE

Thayer frequently is credited with the first military applications of “ruptive” (his term) or disruptive coloration, which became commonly known as ‘dazzle camouflage’ (Fig. 6) [28].

Fig. 7. Burnell Poole, A Distorted Target for U-Boats, oil painting, 1924. (Photo: U. S. Department of the Navy) In American accounts of the development of military camouflage, Thayer often is credited with the use of disruptive patterns in ship camouflage. Such ‘dazzle painting’ was intended to confuse German submarine torpedo gunners in their critical estimates of the speed, direction and anticipated location of ships.
By one account, Thayer was looking at models of ships in 1915 when he noticed that a partly painted model appeared to be headed in the wrong direction. His further experimentation led to a system of course- and type-deception painting which used misleading painted-patterns to falsify real perspective and natural lines of construction. Such strong contrasting deception patterns, when carefully designed by good artists, could make a ship appear to be headed on any course desired, regardless of the ship's actual course [29].

There is, however, considerable doubt about who first suggested that Allied ships, artillery and even field service uniforms should be ‘dazzle painted’. For example, Sir John Graham Kerr, a highly respected British statesman and zoologist, stated that he had come up with a plan of “parti-coloring” in 1895 as he was observing a convoy of ships painted in uniform battlefield gray. “The effect of the grey coloration” (which was intended to reduce the ship’s visibility), recalled Kerr, was obviously interfered with by differences in light and shade, which detracted from the obliterative effect not merely of the ship as a whole but still more so in the case of those details which on one hand betray the character of the ship and on the other hand, through their perspective, play an important part in showing how the ship is heading [30].

Thereafter, it was Kerr’s advice “that war camouflage, so far as camouflage by means of paint is concerned, must, to secure full effectiveness, be in accord with those principles, (1) counter-shading and (2) ‘dazzle’, to which is due the effective- ness of camouflage in the larger animals” [31].

In addition, there is the autobiography of Norman Wilkinson, a British marine painter who was the authorized strategist of more than 3000 dazzled ship designs (no two were identical) for England, and, after his loan to the U.S., more than a thousand additional ships (Fig. 7) [32]. In 1917, according to Wilkinson, he was returning from a trip in a cold carriage, when I suddenly got the idea that since it was impossible to paint a ship so that she could not be seen by a submarine, the extreme opposite was the answer—in other words, to paint her, not for low visibility, but in such a way as to break up her form and thus confuse a submarine officer as to the course on which she was heading [33].

Finally, we know that disruptive designs were employed by the French infantry as early as 1914 [34]. On a cold winter evening in that year, Pablo Picasso and three of his friends (his mistress, Eve, Gertrude Stein and Alice B. Toklas) were strolling and talking on the Boulevard Raspail in Paris. Suddenly, they were surprised to be passed on the street by a convoy of camouflaged cannons, the barrels of which had been painted with multicolored zigzags. Picasso was spell-bound. “C’est nous qui avons fait ça”, he said. We originated this! This is cubism [35]. The crazy-quilt shapes on the camouflaged guns may have reminded Picasso of the diamond designs on a harlequin’s suit, a recurrent motif in his paintings. Later, he jokingly said to a friend (the poet Jean Cocteau) that the French army should issue harlequin costumes to the infantry, since the zigzags would make them confusing to see [36].

VIII. EPILLOGUE

A distant relative of Abbott Thayer was Nathaniel Thayer of Boston, who in 1865 financed a zoological expedition to the jungles of Brazil, an adventure that was undertaken by Louis Agassiz, his wife and six assistants, among them a young medical student named William James, a person who later was prominent in the life of Abbott Thayer [37]. Thayer was the painting teacher of two of William James's sons, Alexander and William, Jr. When William James died in 1910, some of his clothing was given to “Uncle Abbott”, including a favorite duck-hunting jacket, a brown Norfolk [38].

Five years later, Thayer was scheduled to meet with a group of British staff officers in London, a meeting that had been arranged by John Singer Sargent, at Thayer’s imploring, persistent request. Thayer had traveled to London “to plead for changes in the British field service uniform which should make it less conspicuous” [39]. He intended to advise the British that khaki-colored uniforms, although they readily blended with sand, were insufficient camouflage. A monochrome shape is too easy to see. Thayer intended to demonstrate a new kind of field service uniform, one in which a soldier’s shape would be disrupted by an irregular patchwork of blatantly contrasting fragments—like the camouflaged cannons that passed on the street, like the diamond designs on the harlequin’s clothes [40].

But Thayer was not in attendance. In anticipation of the meeting, he had grown horribly anxious. He had simply slipped away and boarded a ship to return to New York. At his London hotel, he had left a note for Sargent and a suitcase of the props he had made to demonstrate the uniform. Inside were a number of drawings and an old brown Norfolk jacket with scraps of irregular fabric attached. It was William James’s hunting jacket [41].

REFERENCES AND NOTES

3. Regarding Thayer’s teaching, see Rockwell Kent, It’s Me, O Lord (New York: Dodd, Mead, 1955); Barry Faulkner, Sketches From An Artist’s Life (Dublin, NH: William L. Bauhan, 1973); and White [2].
13. Poulton and Thayer [9].
31. Kerr [30].
34. See Kahn [18].
36. Penrose [35].

**Announcement**

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