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The Evolution of Camouflage

Although conflict forces humans to fight, flee, or hide. The development of camouflage into a calculated and engineered method of concealment reveals how modern militaries have transformed the instinct to hide into an effective survival implementation. How was the latter developed into a genuine and modern method of disguise? How effective is it? Who led this research? Why are their findings still pertinent today? What pattern works best, and should that pattern be uniform? Camouflage, the blending of the physical appearance into the surroundings, is a steadfast pastime of human culture. The many patterns adopted by militaries allow for an interesting glance into artificial attempts to evolve camouflage.

Life has used camouflage for millenia. In fact, “Camouflage is one of the most widespread forms of anti-predator defence and prevents prey individuals from being detected or correctly recognized by would-be predators.” (6) Animals have evolved to adapt to their environment through several ways and humanity has analyzed them all along the way. Humans have used disguise and trickery most often in combatance with itself. Evidence of such use goes back to the 12th century B.C. where the Greeks, in the Trojan War, crafted a large wooden horse outside the walls of Troy. Inside this horse, they housed a raiding party. After the Greek ships sailed out to sea, a few Greeks “who remained behind posing as deserters, told the Trojans the animal was an offering to the Goddess Athena.” (7) After taking the horse inside the city walls and letting their guard down, the Greeks inside successfully took control of the city. Another example was during the Peninsular Campaign of the American Civil War. Confederate Major

General John B. Magruder faced General McClellan's Army of the Potomac in 1862. (7) Not only did Magruder send southern deserters to tell the Union army that ""… at least 50,000 entrenched Rebels barred" their way," but he used camouflage to further deceive his opponent. The Major General built "quaker guns" that were sticking out of an elaborate set of earthworks. These contraptions were "peeled logs painted black and bored out to look like the real thing." (7) This tactic succeeded in delaying McClellan and aiding in the defence of Richmond.

The word 'camouflage' is French-Parisian in origin and had several meanings, mostly slang, in the theatrical business signifying "make-up." This was, in turn, derived from the Italian word *camaffare*, meaning, to disguise. (3) The word became popular during the First World War from July 1914 to November 1918. The war revolutionized combat through several inventions. The machine gun, military aircraft, poison gases, landmines, flamethrowers, tanks, submarines, and torpedoes all rose to prominence during the conflict. Furthermore, firearms and artillery had become incredibly accurate, making sniper nests and artillery batteries extremely effective in their static positions. The tradition of issuing bright, flamboyant, Napoleonic uniforms to accurately identify troops had already been questioned years prior. For example, In 1800, a British officer, Colonel Hamilton Smith, (1) initiated tests to see which colours fooled trained marksmen the best. He found that grey worked best out of the three. During the war the traditional practice began to do more harm than good in the monochrome colors of trench warfare, particularly in the early-war French uniforms, they wore striking red pantaloons with bright "gris de fer bleuté ("iron blue-gray")" (9) coats. These vivid uniforms were able to be seen from great distances, attracting small-arms fire and swift artillery bombardments. The Germans and British, in contrast, issued their soldiers dull grey and khaki uniforms. Eventually, the French began to replace their uniforms in "25 November 1914" (9) with "bleu horizon

("horizon-blue.")" (9) The uniform is "deceiving though, as in actuality the range of colors varied from an ashen light blue to a medium blue-gray." These shades melded well with the chalky mud of the Champagne and Artois on the Western Front.

The First World War was known as the "'Cambrian explosion' for military camouflage. Canvas nettings, aircraft camouflage, and dazzle coloration for ships were all invented during this war." (1) Despite the switch towards a more muted color of uniforms, "Only a handful of units, mainly snipers, started to use handmade camouflage dress." (1) The first soldiers regular troops "to receive officially issued camouflage clothing were the Italians in 1929 [8]. Designated as M1929 *telo mimetico.*" (1) This pattern was made up of deep browns and dull greens against a muted yellow background. These colors blended in best in the woodlands of Europe and the Italian peninsula. The canvas nettings served to not just deceive ground troops, but pilots in their planes as well. Aerial photography was an extremely effective invention of the war. Pilots, from their lofty vantage point, took perpendicular photos of enemy artillery batteries, headquarters, supply dumps, and infantry movements. By gathering this information, a bombardment could be directed towards a guaranteed target with terrifying precision. A member of the American Expeditionary Force (A.E.F) during WW1, regarding his work to create camouflage netting, mentioned that "A commanding officer made the comment to Lieutenant Conrow, that "actually no section of the Army Engineer School was of greater importance than the camouflage section and that it promised to become the largest and possibly the most important section of the A.E.F."" (3)

As camouflage has been a staple of human history throughout the ages, there have been many pioneers and researchers who have discovered and analyzed the methods used by both humans and animals in evasion from visual recognition. Abbott H. Thaye, the first military

applicator of “disruptive patterns,” discovered this through researching rats and the pigments of their species. Thayer was a prominent American painter and teacher of the 1900s. Most of his work could be classified as portrait and landscape paintings. However, “It is less widely recognized that Thayer was both an artist and a scientist.” (4) In fact, he is even revered as “the father of camouflage” (4) through his work in biology. Regarding his biological research, Thayer is best remembered as one of the first to offer a detailed account of how protective coloration works in the natural world. Born in Boston in 1849, Abbott Handerson Thayer grew up to be an avid hunter, trapper, and outdoorsman. Although Thayer kept up his career as an artist, he still found time to study protective coloration. This study culminated in the bold publication of “*Concealing Coloration in the Animal Kingdom*, first published in 1909.” (4) As an artist, Thayer understood that two-dimensional objects could appear as three-dimensional by use of shading. A light source such as the sun highlights the top of the object while the shadow contrasts the bottom, creating the look of a non-flat surface. “Thayer's Law or the principle of countershading” (4) is the characteristic of animals in the common use of inverted shading. To prevent themselves from looking round and solid amidst a contrasting background, many animals have evolved lighter colored bellies with darker backs. These characteristics invert and counteract the effect that highlights and shadows have on these animals. Hugh B. Cott, a British zoologist said: “Nature, on the other hand (contrasting the artistic use of shading), by the precise use of countershading, creates upon a rounded surface the illusionary appearance of flatness.” (4) This flatness allows the animal to more readily disappear into a landscape. To a potential threat, “An object (prey) is easy to see to the extent that the object and its back-ground are observably different in one or more ways.” (4)

Abbott Thayer was one of the first people to claim that two kinds of camouflage exist: “blending, in which the figure so closely resembles the background that one cannot tell them apart readily,” (4) and disruption, in which the object’s shape is fragmented by strong arbitrary patterns of color which destroy the object’s “continuity of surface.” (4) The camouflage netting mentioned before not only protects the object from being seen by planes above, but also observers below. The fragmentation of light on the object through the netting disrupts the object from being perceived. The most famous use of this during World War One is in the ‘dazzle camouflage’ painted on naval ships. In 1898, during the Spanish-American War, Thayer along with his colleague and confidant George Brush presented the idea of protective coloration in ship camouflage to the U.S. Department of the Navy. They attempted to enact these designs multiple times due to monetary constraints before their success in the First World War. Thayer’s application is credited as one of the first military implementations of ‘dazzle camouflage’

During tests of model ships in 1915, Thayer concluded that “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.” (4) This effect would hinder the Central Powers’ navy in firing successful salvos, understanding the course and speed of their target, and maneuvering themselves to take an advantageous position. Sir John Graham Kerr, “a highly respected British statesman and zoologist,” (4) advised that, to obtain the most effective brand of camouflage, both “(1) counter-shading and (2) 'dazzle', to which is due the effectiveness of camouflage in the larger animals” should be combined. Thereby, a pattern of contrasting colors with the use of lighter colors where shadows are most common and darker colors where highlights are common should be the goals of an effective variant of camouflage.

Most modern studies assess how well camouflage can conceal stationary objects. However, animals inevitably move, as do militaries. Camouflage patterns made for static behavior restrict movement. Camouflage decreases predation through aiding its user in evasion, therefore, natural selection furthers evolutionary adaptations to the same patterns. Evasion or a successful hunt can't be achieved only through static-purposed camouflage, predation depends on detection, identification, and capture. Therefore, the camouflage needs to be effective also in movement amongst its background. The prey's camouflage can conceal itself in three major ways: "It can blend with the background (background matching, BM), break up its shape (disruptive camouflage) or mimic irrelevant objects (masquerade)." (5) Both Thayer and Cott said that "differential blending and high disruptive contrast" (5) are vital in a capable camouflage pattern. These arbitrary colors stand out and break up the continuity of blended shapes and colors. Some studies, analyzing centrally placed markings and markings placed on the edge, contradict each other in finding characteristics of greatest value in a pattern. In one of my sources, *Camouflage, detection and identification of moving targets*, an experiment is presented to find the truth behind these previous studies. "We, therefore, created seven camouflage patterns based on the strategies of BM and disruption, and compared them with a no pattern control." (5) This are tested through willing volunteers that were "naive, had normal or corrected-to-normal vision, and gave informed consent in accordance with the Declaration of Helsinki." (5)
Each sample pattern had different levels of BM and disruption besides for the control pattern. The background during the experiments was static with a target hidden somewhere in it. The subjects would be given a mouse and a monitor, then they clicked the target as quickly as they could. In the second and third experiments, the target was moving. The third's target was elliptical, rotating, and showed similarities to 'distractor patterns' spread throughout the

background. Subjects not only had to ‘catch’ the target, but also use keystrokes to identify it amongst a list of other patterns identified by separate keystrokes. The results of the experiment concluded that Thayer and Cott were correct in their claim of BM and disruption working together to create the most effective pattern of camouflage while those characteristics didn’t work as well apart from each other.

Modern camouflage is much more effective and versatile than historical patterns and colorations. My favorites include Alpenflage, Flecktarn, Tiger Stripe, Strichtarn. Strichtarn is East German, its rain-like streaks are incredibly unique. Alpenflage, a swiss pattern, is bright orange, red, dark green, black, white and brown. This imitation of lichen and the hue of dusk or dawn are very visually distinct. Many of these patterns are used today as fashion statements. The community surrounding the wearing of vintage camouflage is incredibly extensive. NATO camouflages such as the famous British DPM (1966) or the German Flecktarnmuster (1990) offer plenty of spotted background matching shapes. The colors are a spectrum of both vibrant and dull greens and browns that fit in well in temperate European forests. The pattern most revered and recognized today is the American M81 Woodland (1981) with its 4 colors: green, black, brown, and beige. This uniform was mass-produced and saw American use in Iraq, Grenada, El Salvador, Panama, Kuwait, Somalia, Bosnia and Herzegovina, Haiti, Afghanistan and many more places. As the pattern has been mostly retired, surplus uniforms have been used globally ever since. When many people think of camouflage, M81 Woodland is the pattern they imagine. In contrast, after 2001 when the marines adopted it,“pixelated camouflage was rapidly adopted globally.” (1) However, modern camouflage such as MARPAT, OCP, and Multicam have strayed away from pixels and have been tested rigorously. They are much more effective than previous iterations. However, there is not one single pattern that fits everywhere. Each

environment and military call for their own unique and effective patterns. American camouflage has been influenced by the large amount of time spent engaging in conflicts in the middle east as it is more beige than it used to be. Furthermore, M81 Woodland was heavily influenced by conflicts in South America with a tropical environment. Despite this, the most versatile camouflage pattern is most likely Multicam for its versatility. Made by Crye Precision, it can disguise the wearer relatively well in “forests, deserts, mountains, and urban environments.” (10)

Disguise, being such a common trait among animals and humans alike, has evolved to be a vital attribute of survival. Leading researchers like Abbott Thayer and Hugh Cott show us how integrated coloration and background masking is in nature and conflict. Over time, this attribute has become a sophisticated practice capable of concealing entire armies from being detected, identified, or defeated. The questions that guided its development—how to create a pattern, which patterns work best, and whether a single design can ever suit a single every enviroment—remain relevant because the challenges of staying undetected have only grown more complex. The wide range of camouflage patterns today offers a revealing look into how humans, like other animals, imitate and adapt to their environment.

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