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Shapes and Colors Identification Used in Malvinas Camo and Sage Green Camo on the Field Service Uniforms (PDL) of the Indonesian National Army (TNI)

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ABSTRACT

Introduced during the 80th anniversary of the Indonesian National Armed Forces (TNI) on October 5th, 2025, the Sage Green camo pattern introduced as an update to the long-standing Malvinas pattern used since 1983. This study identifies the differences in pattern, shape, and color between these two camo designs. Data were collected through fabric sample observation and digital tracing, then analyzed using a comparative-descriptive method to determine their distinct visual characteristics. Observations indicate that Malvinas camo features a larger rapport size with 157 patterns. In contrary, Sage Green camo utilizes a smaller rapport with a higher density of 271 patterns. This disparity suggests that the Malvinas camo is optimized for silhouette disruption at long distances, while the dense Sage Green camo intended for better texture blending at closer range. The study concludes that the distinct geometric and color properties of these camos resulted in specialized tactical functions. These findings provide a foundational framework for developing future camo designs optimized to manipulate human visual perception.

***Keywords**: Camouflage, Sage Green, Malvinas, Rapport, Visual perception.*

INTRODUCTION

Camouflage is an effort that involves a combination of colors, clothing materials, or lighting techniques that help users blend in with the background of a place they are in, either by disguising the user as another object or making the user difficult to recognize at a glance (Amy Miles, 2020).

Camouflage operates by obscuring the visual signature of an object, and reducing its form into 'visual noise' that avoiding recognition, particularly from a distance. Within military doctrine, this framework usually defined as Camouflage, Concealment, and Deception (CCD) (Tudor, 2019).

As the name suggests, CCD is divided into three parts. Camouflage is an effort to create a visual effect so that objects 'blend in' with their surroundings. Concealment is an effort to ensure that military activities such as troop movements, weapons, logistics, and even financial flows are not detected by enemy forces. Meanwhile, deception is a tactic to "fool" the enemy in various ways; starting from creating decoys or fake weapons that resemble the real ones, especially large defense equipment such as ships and fighter planes (Milic et al., 2024), diverting the enemy's attention, to spreading false intelligence information to the enemy. All three are part of operation security (OPSEC), which ensures the safety and security of all team members and the success of their mission (Tudor, 2019).

Extending this concept, (Matthews & Matthews, 2024) argued that concealment is a fundamental manifestation of biomimicry that integrated into military strategy and technology. In biological context, this involves organisms resembling environmental objects or signals to gain an evolutionary advantage, whether for protection, reproduction, or predation. The advantages could be gained by manipulating visual, accoustic, tactile, chemical, or even electrical signals—featuring a multi-sensoric experience.

In this study, the focus is narrowed to the visual and tactile syntax of printed textile patterns, analayzing how the geometric repetition of Malvinas and Sage Green camouflage patterns aligns with these biological principles of concealment.

In tactical concealment, there is a principle that must always be considered in order to create effective concealment that is not easily detected by the enemy. This principle is called The 7S's of Camouflage, which includes silhouette, shine, shadow, shape, spacing, sound, and speed (Stipwarn, 2019). Of the seven principles of camouflage, two of them, namely silhouette and shape, are the main focus of this study. These two principles are the focus of the study to see how the pattern and color of these two camouflage motifs can affect human visual perception.

One part of camouflage is the camouflage pattern on military uniforms. Since its first appearance in the late 1800s, camouflage patterns have undergone many developments and are used by various military forces around the world. To date, there have been more than 350 military camouflage patterns created worldwide (Subrata, 2005).

Going back to the days when modern camouflage was first discovered by humans, the term camo or camouflage itself comes from the French word camoufle, which means to play practical jokes. Meanwhile, according to the Webster New World Dictionary, which also refers to a French term, camufleur, it means "to disguise" or "an attempt to deceive." In its journey in the world of military affairs, uniforms with graphic camouflage patterns became commonly known as camo or cammies (Subrata, 2005).

According to historical records, the first users of various forms of camouflage were tribes in the interior regions of Africa and America. They used it to deceive their opponents during tribal warfare, as well as when hunting so that they would be difficult to spot by their prey. Their camouflage efforts involved smearing their entire bodies with natural colors obtained from plants in their surroundings (Subrata, 2005). This was not only a means of camouflage, but also a way to appear powerful and brave in the face of death. This impression was found to boost morale and provide moral support for success in tribal warfare or hunting.

It was only when the world entered the early 20th century, when the arms industry and the era of modern warfare began to develop, that the benefits and importance of artificial camouflage techniques were truly realized. The first things they tried to conceal were not soldiers, but rather military vehicles such as tanks, ships, and aircraft. The goal was clear: to deceive and confuse the enemy's vision by making the outlines and original shapes of military equipment less distinct.

One of the earliest versions of camouflage painting on vehicles was the famous "Dazzle" pattern applied to British merchant ships. This concept was first discovered by Norman Wilkinson, a British Navy officer, who sought to reduce the number of British merchant ships lost to German submarine torpedoes (Imperial War Museums, n.d.).

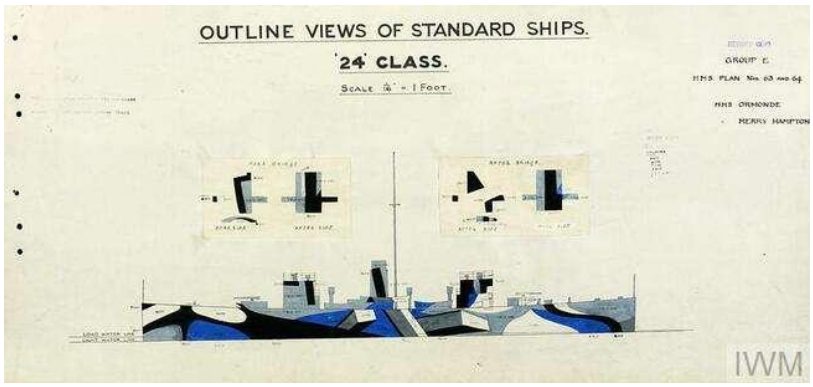

Figure 1: "Dazzle" motif design on a British merchant ship. (source: Imperial War Museum website, Art. IWM DAZ 45)

Norman believed that an object as large as a ship could not be completely hidden, so instead he used shapes, lines, and colors to obscure the outline, original shape, and the direction of the ship as the design shown on Figure 1. His efforts were successful, as German submarine commanders found it difficult to determine the shape, size, direction, range, and direction of the ship.

Charles Darwin and Abbott Thayer later published a book entitled "Concealing Coloration in the Animal Kingdom: an Exposition of Laws of Disguise Through Color and Pattern". Broadly speaking, this book, published in 1919, presented the results of their studies on camouflage resulting from animal behavior. The results of their studies included the identification of various types of camouflage shapes and patterns, including disruptive patterns. It did not take long for this book to become a kind of "mandatory reference" for researching and designing military camouflage patterns in greater depth at that time (Subrata, 2005).

The rapid development of military camouflage patterns continued to evolve with the times—and, of course, with the major wars that the world experienced during that period. Starting from World War I and II, the Cold War, the Vietnam War, and others. Various new camouflage motifs also emerged, depending on the environment in which they would be used. There are camouflage patterns specifically used in tropical and subtropical forests, deserts, areas with intense snowstorms, and even urban camouflage patterns specifically used for urban warfare.

In Indonesia itself, the use of new camouflage patterns began in the mid-1940s. There were two types of camouflage patterns that first appeared in Indonesia. One of them was the Denison Smock from the British Armed Forces, which at that time served as the representative of the Allies in Indonesia. Another camouflage pattern was the American Spot Pattern M-1942, which was borrowed by the Dutch Marines to return to Indonesia after the arrival of the British (Subrata, 2005).

These two types of camouflage patterns became the foundation for the development of military uniform camouflage patterns used by Indonesian armed forces units, with patterns that were similar to the two original patterns and slightly modified.

In its development in the early years after independence until the early 1980s, there were 10 types of camouflage patterns used by various Indonesian military units or branches. On the positive side, each unit/branch had its own idealism and was able to display its own characteristics that were not possessed by other units/branches.

However, because of this, it was difficult for the units/branches to unite among themselves. In addition, sometimes the camouflage patterns used were not suitable for the operational scenario or environment in which they were used. Furthermore, operational costs increased due to the procurement of uniforms with various patterns (Subrata, 2005).

To address this issue, on October 5, 1983, during the Indonesian Armed Forces' anniversary, the Minister of Defense and Chief of Staff, General L.B. Moerdani, discontinued the use of the ten different camouflage patterns and replaced them with a single camouflage pattern for all Indonesian Armed Forces units. Today, we know this pattern as the Malvinas camouflage pattern. For more than four decades, the Malvinas camouflage pattern has been the sole identity used by TNI soldiers in various fields of operation. However, with the development of military technology such as remote sensing and changes in Indonesia's distinctive tropical vegetation, the need for a more adaptive camouflage pattern became inevitable.

On October 5, 2025, just as the TNI celebrated its 80th anniversary, the Sage Green camouflage pattern was introduced. The combination of digital camouflage and a new color palette makes the Sage Green camouflage pattern claim to have superior concealment capabilities compared to the Malvinas camouflage pattern (Elvan Widyatama, 2025). However, this claim raises a fundamental question in the study of defense product design. To date, there has been no academic study that openly explores this claim.

The urgency of this research lies in the change in the design of the patterns and colors used in both camouflage motifs, from the original organic lines to geometric pixelated digital camo patterns. Understanding the differences in characteristics between the two is very important, because even the slightest error can cause the camouflage motif to fail to work properly.

LITERATURE REVIEW

Table 1: Research Gap Table

No.	Authors	Research Object	Research Findings	Gap
1	(Prasetyo, 2020)	Evaluation of military camouflage patterns in Southeast Asian countries using the Camouflage Similarity Index (CSI)	Of the 14 background photos tested against camouflage patterns from 10 different countries, most had similar levels of concealment power	- The samples tested were camouflage patterns from 10 Southeast Asian countries, not specifically Indonesia alone - The Indonesian camouflage pattern included in the test was only Malvinas, Sage Green wasn't included
2	(Prasetyo, 2019)	Evaluation of 8 different types of Chinese military camouflage patterns using the Camouflage Similarity Index (CSI) method.	Statistically, the 8 types of camouflage patterns have concealment levels that are not significantly different.	All camouflage patterns tested were taken from Google, so there is a possibility that the test results have color characteristics that differ from the original colors on the fabric material.
3	(Talas et al., 2017)	Researching the similarities in design principles between animal camouflage patterns and military stripe patterns by analyzing textures and colors using computers. In addition, observing evolutionary analysis (both biological and cultural) in	The results of the convergence findings show that military camouflage patterns not only have a concealment function, but also an identification friend or foe (IFF) function at close range, which works similarly to animal camouflage patterns.	Some of the fabric samples used in this study are old (some were made in the 1930s), so there is the potential for color inaccuracy because the fabric samples have aged and faded.

		patterns commonly found in nature and human design.		

Research gaps were found in several previous studies discussing the topic of military camouflage motifs, particularly those related to the Camouflage Similarity Index (CSI). Although some of this literature developed and utilized mathematical formulas to measure the similarity between the camouflage motifs involved and the background images, the majority of the research conducted often treated the camouflage motif images as static images only, without dissecting the camouflage motifs down to the level of the image patterns contained within them and how those image patterns were duplicated and repeated.

Based on initial identification of fabric samples, the hypothesis in this study is that differences in the number of image patterns contained in a single cycle group (rapport), the characteristics of the lines in the image patterns, and the colors used in each of the Malvinas and Sage Green camouflage motifs create different functions, especially in relation to effectiveness at certain viewing distances. Advanced digital computational analysis is indeed required to prove this, but the proof will be better and more in-depth if it is preceded by a strong foundation of understanding of the elements that form the camouflage motif itself, such as the morphology (characteristics of the shape) of the image pattern and the colors used.

METHODOLOGY

The data collection method used in this study was sample object observation. Observation comes from the Latin word “observare,” which means to see and pay attention (Ni’matuzahroh & Prasetyaningrum, 2018). Observation can be defined as the systematic observation of human activities involving all the senses, such as hearing, sight, taste, touch, and smell, to produce facts (Hasanah, 2017).

In research, observation is carried out by accurately observing human activities, then recording, documenting, and/or documenting all activities that occur. Observation must be carried out naturally (naturalistically), where the observer must be immersed in realistic and natural situations that are occurring at the moment (Kerlinger, 2003 in Ni’matuzahroh & Prasetyaningrum, 2018).

Observations in this study were conducted by observing new fabric samples featuring Malvinas and Sage Green camouflage patterns that had not yet been sewn into clothing sets. The reason for using new fabric samples was to facilitate observation of the rapport, or the collection of patterns that are grouped together in a cycle.

First, the colors on the fabric were identified by type and number using the PANTONE® TCX (Textile Color Edition Extended Range) color index. After that, the researchers traced the image patterns that were grouped together in one cycle (rapport), and how the duplicated rapport could be connected to one another (tiling) to produce a repetitive pattern that filled the entire space in the fabric sample. The rapport found is then photographed from various angles and digitally traced using vector image processing software.

The collected data was then analyzed using comparative-descriptive analysis methods. The comparative method is a method that compares two variables (Hasyim, 2007 in Huri, 2015). On the other hand, the descriptive method is a method used to solve actual problems by collecting, compiling, classifying, analyzing, and interpreting data (Ahmadi and Narbuko, 2002 in Huri, 2015). This comparative-descriptive method was used to find the differences in visual characteristics between the Malvinas and Sage Green camouflage patterns based on the colors used, shapes, and line characteristics in the patterns found in each camouflage pattern.

DISCUSSION

The new fabric sample featuring the Malvinas and Sage Green camouflage patterns measures 300 cm x 150 cm. As a first step, the colors on the fabric will be identified by type and number using the PANTONE® TCX (Textile Color Edition Extended Range) color index, which is part of the PANTONE® color ecosystem, namely PANTONE® Fashion,

Home + Interior Systems (PANTONE® FHI). The PANTONE® FHI color ecosystem is a reference standard and 'communication tool' specifically designed for the needs of fashion, textile, and interior designers (Budianto, 2025). The 'communication tool' were designed in order to achieve equal differences in correspond to equal geometrical distances (Kuehni, 2001). Using proven industrial standard helps research team easier to extract the research data if they need to reuse it or continue a further research.

The identification of color types and numbers was carried out in two ways; scanning the fabric samples with the help of a PANTONE® CapSure spectrocolorimeter, and manual matching between colors in fabric samples and color chips in the physical PANTONE® TCX catalog book. After that, the patterns summarized in one cycle group (rapport) will be traced in terms of their shape and connection, photographed, and then digitally traced using vector image processing software.

To ensure objective data acquisition, the color identification process utilized a tool named spectrocolorimeter, moving beyond device-dependant imaging systems. While standard imaging systems do not perceive colors as humans do, spectral analysis provides device-independent reflectance data that is designed to imitate how human vision works (Rout et al., 2022). Using specialized test instruments--such as PANTONE® CapSure spectrocolorimeter--helps researcher to achieve high measurement accuracy (Raluca, 2016).

This approach provides robust and calibrated readings, which are essential for measuring actual color effects in complex surfaces such as military camouflage fabrics. By adopting the spectrophotometric protocols suggested by Rout et al. (2022), this study minimizes the risk of gamut compression often occurred in standard digital photography, by ensuring the quality and integrity of the color data.

Regarding the principles of perceptual organization, the meaning of a stimulus doesn't lie in it's isolated parts, but rather in their compositional relationships (Dondis, 1973). In this study, color identification using the Pantone TCX standard spectrum is merely the first step; the effectiveness of the Malvinas and Sage Green camouflage motifs is determined by how these visual units are combined to form a 'visual statement' capable of deceiving the observer's perception.

Following Rudolf Arnheim's ideas—as cited by Dondis in his book, this study explores strategies for unifying individual visual elements—such as color, texture, and pattern proportions—into a cohesive whole. The disruption of this compositional coherence that ultimately hinders the viewer's ability to achieve visual unification, resulting in the subject failing to be perceived in its entire shape.

This intentional failure in visual literacy is operationally achieved through disruptive coloration. Disruptive coloration is a set of markings that creates the appearance of false edges and boundaries and hinders the detection or recognition of an object, or part of the object's true outline and shape by create false edge and boundaries (Stevens & Merilaita, 2011). By doing that, the camouflage pattern doesn't just hide, but also sabotaged the 'visual statement' actively (Dondis, 1973) by providing the observer's brain with conflicting structural imation and prvent the forming of a coherent

Figures 2, 3, 4, and 5: Color scanning process using a PANTONE® CapSure spectrocolorimeter and manual matching using PANTONE® TCX color chips. (source: Personal documentation)

As shown on Figure 2-5 which documented the color identification process, the results of color matching on fabric samples with Malvinas and Sage Green camouflage patterns using the PANTONE® CapSure spectrocolorimeter and the PANTONE® TCX physical catalog are as follows:

Table 2: Malvinas Camouflage Pattern Color Scan & Match Results

No	Fabric Sample Color	Scanned Color by PANTONE® CapSure	Matching with PANTONE® TCX Catalog Color Chip	Crosscheck Results
1	Dark Green	19-6050 TCX Eden	19-6050 TCX Eden	19-6050 TCX Eden
2	Dark Brown	19-1018 TCX Ganache	19-1018 TCX Ganache	19-1018 TCX Ganache
3	Cream	- 16-1109 TCX Greige - 17-1310 TCX Timber Wolf	16-1109 TCX Greige	16-1109 TCX Greige

4	Black	19-4008 TCX Meteorite	19-4008 TCX Meteorite	19-4008 TCX Meteorite

Table 3: Sage Green Camouflage Pattern Color Scan & Match Results

No	Fabric Sample Color	Scanned Color by PANTONE® CapSure	Matching with PANTONE® TCX Catalog Color Chip	Crosscheck Results
1	Moss Green	- 18-0317 TCX Bronze Green - 18-0322 TCX Cypress	18-0230 TCX Garden Green	18-0230 TCX Garden Green
2	Olive Green	19-0515 TCX Olive Night	19-0515 TCX Olive Night	19-0515 TCX Olive Night
3	Cream	17-0620 TCX Aloe	15-0318 TCX Sage Green	15-0318 TCX Sage Green
4	Brown	18-0622 TCX Olive Drab	17-1028 TCX Antique Bronze	17-1028 TCX Antique Bronze

When scanning colors on fabric samples using a spectrocolorimeter, or when transferring from a spectrocolorimeter to a physical catalog chip, there are certain color areas that produce two or more different colors. This is normal, considering that each color is scanned at several different points, resulting in different color outputs.

These differences are usually not too significant, generally only differing by two or three color blocks between one another. This phenomenon of difference is then addressed by looking at which color output is more prevalent than the others, and then double-checked with the color chips available in the physical PANTONE® TCX catalog.

Armed with the colors scanned using a PANTONE® CapSure spectrocolorimeter and a physical PANTONE® TCX catalog, the author then traced and rearranged the patterns summarized in a single cycle group (rapport), in this case the Malvinas and Sage Green camouflage motifs. The rearrangement of this pattern cycle was done by photographing the details of each camouflage motif, then traced the whole pattern using Affinity Designer v2.6.5 software.

Figure 6: Results of digital tracing of one cycle of the pattern (rapport) on the Malvinas camouflage pattern, with colors adjusted based on fabric sample color checks. (source: Personal document)

In terms of form, the basic idea behind the creation of the Malvinas camouflage pattern was adapted from the Disruptive Pattern Material (DPM) camouflage pattern used on the British Battle Dress Uniform (BDU). The shape and color of the Disruptive Pattern Material (DPM) was gradually developed further by the Indonesian National Armed Forces, resulting in a new camouflage pattern that became known as Malvinas. The name Malvinas was taken from one of the wars that occurred shortly before this camouflage pattern was released on the TNI's anniversary on October 5, 1983, namely the Falklands War that took place in 1982 between Argentina and the United Kingdom. This war took place in the Falkland Islands, or in Spanish, these islands are often referred to as Islas Malvinas (Rezky, 2023).

Measurements taken from fabric samples show that a 72 cm x 81 cm area is required to produce one repeat of the Malvinas camouflage pattern. As shown by Figure 6, this repeat consists of 157 different patterns in 4 PANTONE® TCX colors, which means that each pattern has an average area of 37.14 cm2. Upon closer inspection, the image patterns in the Malvinas rapport use organic shapes, with the overall image patterns in the rapport utilizing lines that are full of curves and rounded turns. The Malvinas rapport is arranged horizontally from top to bottom. The PANTONE® TCX colors used in this camouflage motif tend to be dark colors, such as 19-6050 TCX Eden, 19-1018 TCX Ganache, and 19-4008 TCX Meteorite.

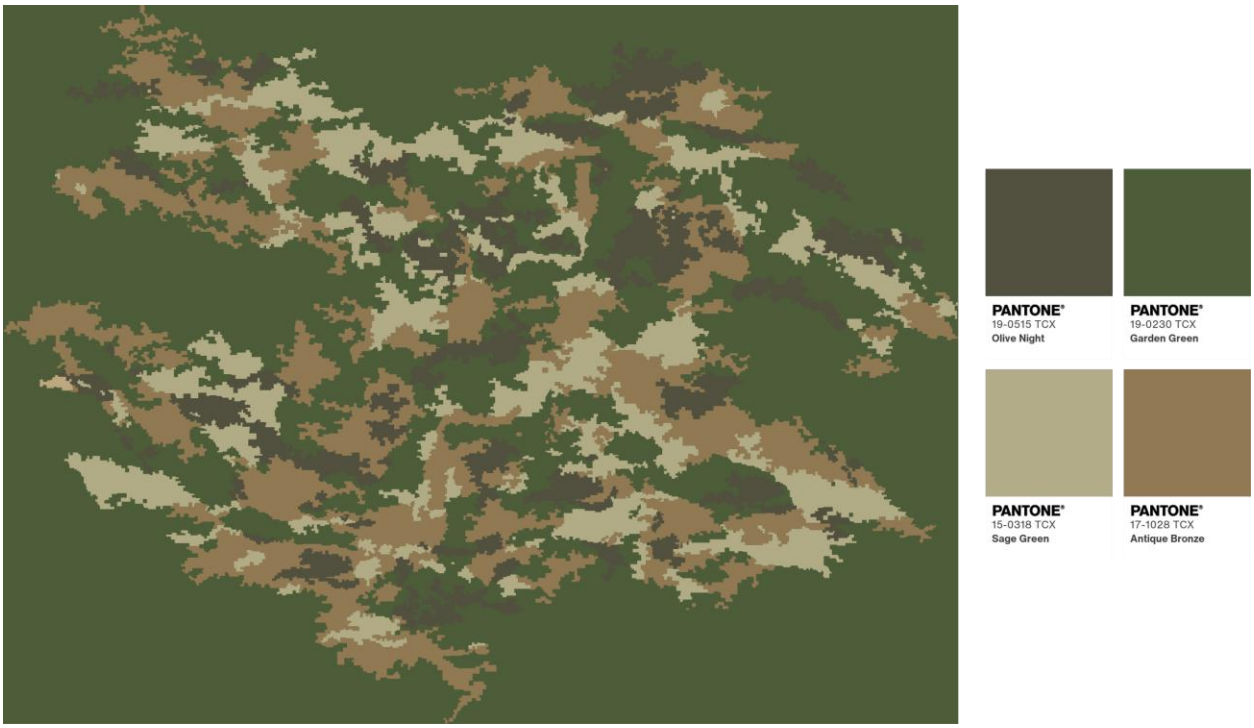

Figure 7: Results of digital tracing of one cycle of the pattern (rapport) on the Sage Green camouflage pattern, with colors adjusted based on fabric sample color checks. (source: Personal document)

The Sage Green camouflage pattern is the latest camouflage pattern originally owned by the Army Strategic Reserve Command (Kostrad), which is part of the Main Combat Command under the Indonesian Army. Its pixelated image style refers to a similar camouflage pattern design that was released earlier in other parts of the world, namely CADPAT (Canadian Disruptive Pattern) from Canada, which was developed in 1997 and entered service in 2002 (King, 2014). A similar pixelated camouflage design to the Sage Green camouflage pattern was previously used by the TNI on the Battle Dress Uniform (BDU) of the Raider Infantry Battalion (Yonif Raider) and Kopaska Special Forces (Rezky, 2025) which shown on Figure 8 and 9.

The difference is that the pixelated camouflage motif on the Yonif Raider's BDU is not entirely new, but rather a pixelated version of the British Disruptive Pattern Material (DPM) camouflage motif. Meanwhile, the pixelated camouflage motif used by the Kopaska Special Forces —later known as Skull of Frog—only resembles the Sage Green camouflage motif in terms of color. Additionally, in the center of the camouflage pattern is an image of a frog skull holding a trident, in line with the name Skull of Frog it bears (Rezky, 2025).

Figures 8 and 9: Pixelated camouflage patterns used by the Raider Infantry Battalion (left) and Skull of Frog used by the Kopaska Special Forces (right). (source: Zhen Rezky/Frownland Archive).

Unlike the Malvinas camouflage pattern, measurements taken from fabric samples show that a 56.5 cm x 42.5 cm area is required to produce one repeat of the Sage Green camouflage pattern. Although smaller than the Malvinas camouflage pattern repeat, the Sage Green camouflage pattern repeat consists of more images.

As the rapport previously shown on Figure 7, there are 271 different image patterns in 4 PANTONE® TCX colors. Which means that on average, each image pattern has an area of only 8.86 cm2. Due to the use of a pixelated style, the images in the Sage Green rapport appear very geometric, with the overall image in the rapport utilizing right angles and sharp turns, as well as 45°-60° slanted lines at several points. The Sage Green camouflage motif rapport is arranged lengthwise from left to right. The combination of PANTONE® TCX colors used in this camouflage motif tends to show a one-tone color scheme, such as 15-0318 TCX Sage Green, 17-1028 TCX Antique Bronze, and 19-0230 TCX Garden Green.

There is one unique feature found in the Sage Green camouflage pattern, that is the Indonesian map that lies ‘hidden’ between the patterns collected in one rapport. Upon closer inspection, two Indonesian maps are found in the same rapport. The two maps are arranged back to back, facing up and down. The Indonesian map in the camouflage pattern is composed of the intersections between the image patterns and the edges of the image patterns themselves. The maps are marked with red blocking as shown on Figure 10.

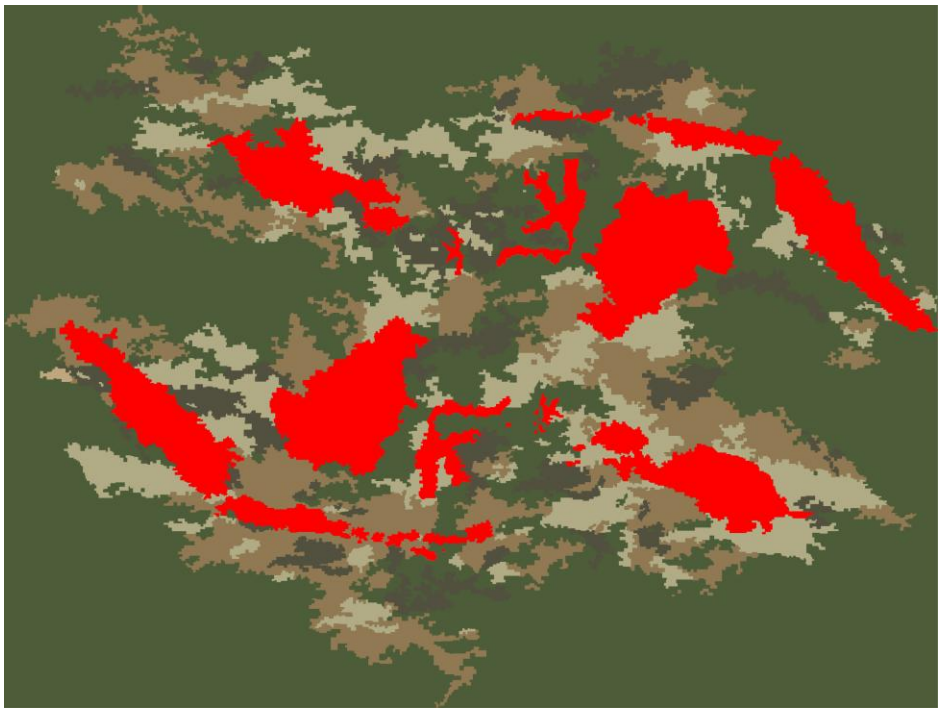

Figure 10: A couple of 'hidden' maps of Indonesia between one Sage Green camouflage pattern rapport. The maps of Indonesia in question are marked with red blocking. (source: Personal document)

CONCLUSION AND RECOMMENDATION

Observations of the samples shown that there are differences in the characteristics of the image patterns and colors of the two camouflage motifs. The Malvinas camouflage motif has an organic line pattern, a large average image pattern size, and a tendency to use dark colors. The combination of large image patterns and organic lines in the Malvinas camouflage motif has great potential to disrupt the silhouette of the human body from a distance.

On the other hand, the Sage Green camouflage motif has a geometric image pattern with the use of many right angles. In addition, the average size of the image pattern in the Sage Green camouflage motif is relatively small, but there are many and they are more densely packed. The color selection also tends to form a rapport with a one-tone color scheme. The combination of geometric patterns with many right angles and small pattern sizes gives the Sage Green camouflage pattern the potential to blend well with the surrounding environment when observed from a close distance. However, this needs to be further proven, because the Sage Green camouflage motif has geometric image patterns, while the elements in the forest environment are dominated by asymmetrical shapes and organic lines.

This initial identification can be used as a basis for conducting further quantitative research with the help of digital image analysis to prove the potential, strengths, and weaknesses of each camouflage motif when used in various backgrounds, distances, and lighting conditions.

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