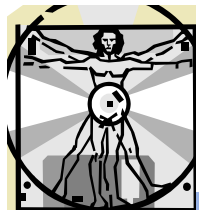


# Camouflage & Stealth

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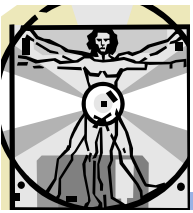
Can you hear/see/smell me now?



# Overview

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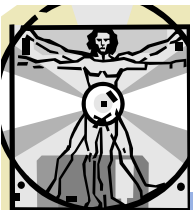
- The Word
- The Act
- S&P and Camo
- Fundamentals
- Nature, Human Uses
- Uniforms
- Non-Visual
- Stealth
- Adaptive
- Defeating Camouflage
- Upcoming



# Origins of the Word

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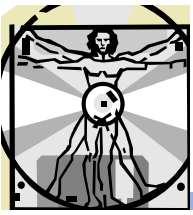
- Camouflet (Fr, 16th c.)
  - ❖ From *chault mouflet*, the old smoke-in-the-nose prank
  - ❖ Then, a small explosive charge to collapse tunnels
- Camoufler (Fr, 19th c.)
  - ❖ To dress up or disguise (theater; deception)
- Camouflage (Eng. 1917)
  - ❖ “The act of hiding anything from your enemy is termed ‘camouflage’ .”



# Origins of Camouflage

- Certainly did not begin with/by humans!
- Concept is not new, even for humans
  - ❖ Sun Tzu in *The Art of War*, 550 BC
    - *“All warfare is based on deception. When able to attack, we must seem unable; when using our forces, we must seem inactive; when we are near, we must make the enemy believe that we are far away; when we are far away, we must make him believe we are near. Hold out the bait; entice the enemy. Feign disorder and crush him.”*
  - ❖ Greeks in the Trojan Horse
  - ❖ Shakespeare references (e.g., *Macbeth*)

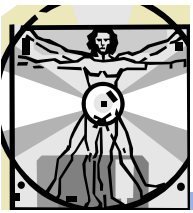




# S&P and Camouflage

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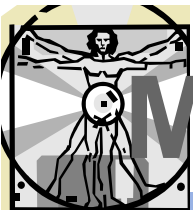
- 19th century study of optics, perceptual psychology, color theory
  - ❖ Helmholtz, Goethe, Cheveul
  - ❖ Monet, Renoir, Seurat
  - ❖ Gestalt Psychology
    - Grouping, forms, foreground/background
    - “How is it that we see something?”
    - “How, then, can we prevent people from seeing things?”
  - ❖ Abbott H. Thayer: *Concealing Coloration in the Animal Kingdom* (1909)



# Fundamentals

---

- Basic approaches to (visual) camouflage:
  1. High similarity camouflage
    - Blend with the background
  2. High difference camouflage (disruptive patterns)
    - Destroy object continuity
    - Erratic surface and edge cues
  3. Mimicry
    - Look like something else

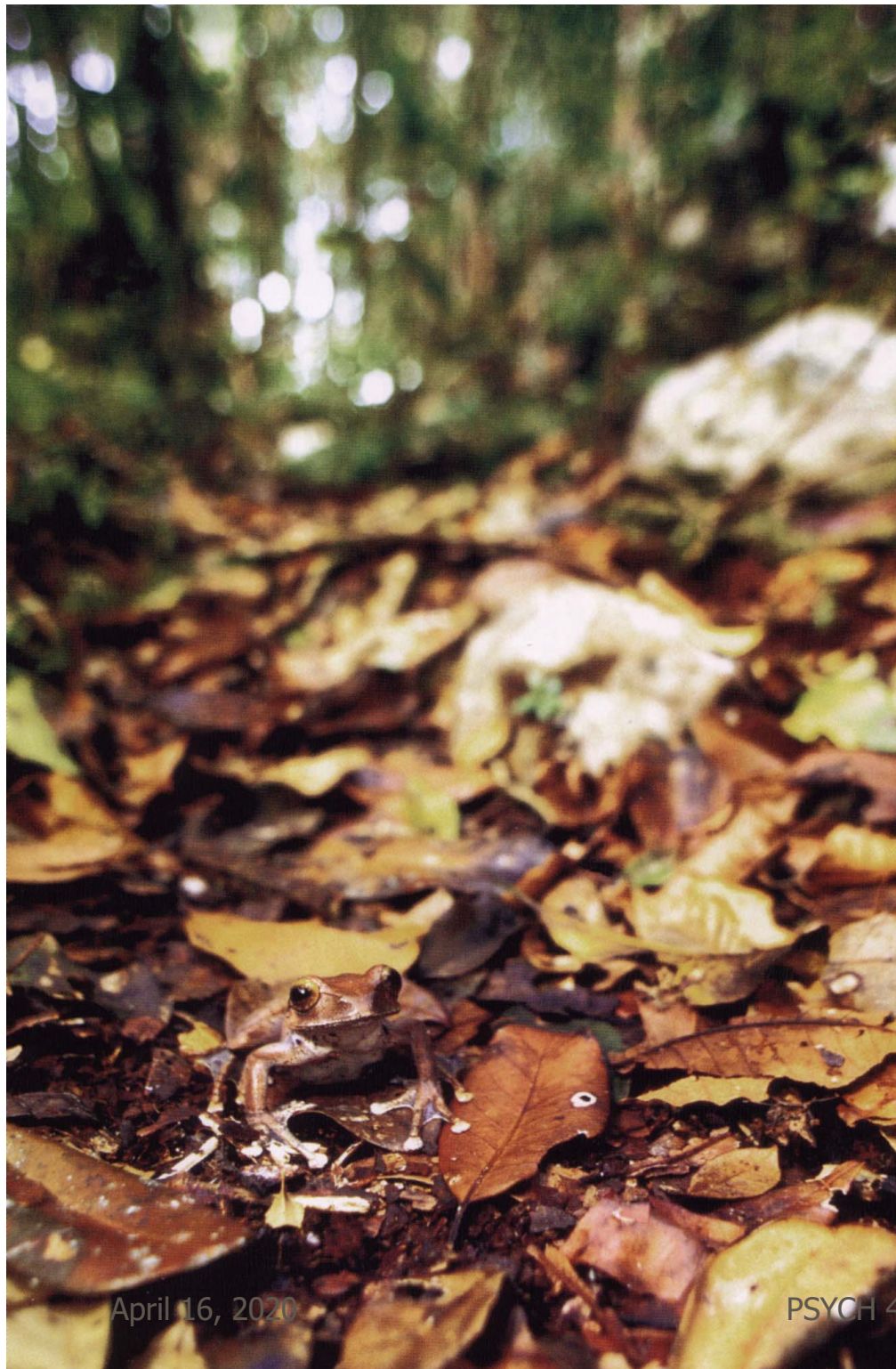


# Mimicry: Natural, and by Humans

---

- Plenty of examples of blending, foreground-background, disruptive patterns, and mimicry
- Mimicry
  - ❖ Look like background (essentially like other camo)
  - ❖ Look like something else that is similar
  - ❖ Look like something else entirely

# Frog in Leaves



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# Leaf Mimic



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# Leaf Frog



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# Ant and Bug



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# Hoverfly and Yellow Jacket



Will the real yellow jacket wasp please stand up... The hoverfly (*Spilomyia longicornis*) on the left mimics the toxic eastern yellow jacket wasp (*Vespa maculifrons*) on the right in colouration, form, and behaviour as a way to deter predators. © Robert Sisson, © 2004 National Geographic

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# Eye Spots



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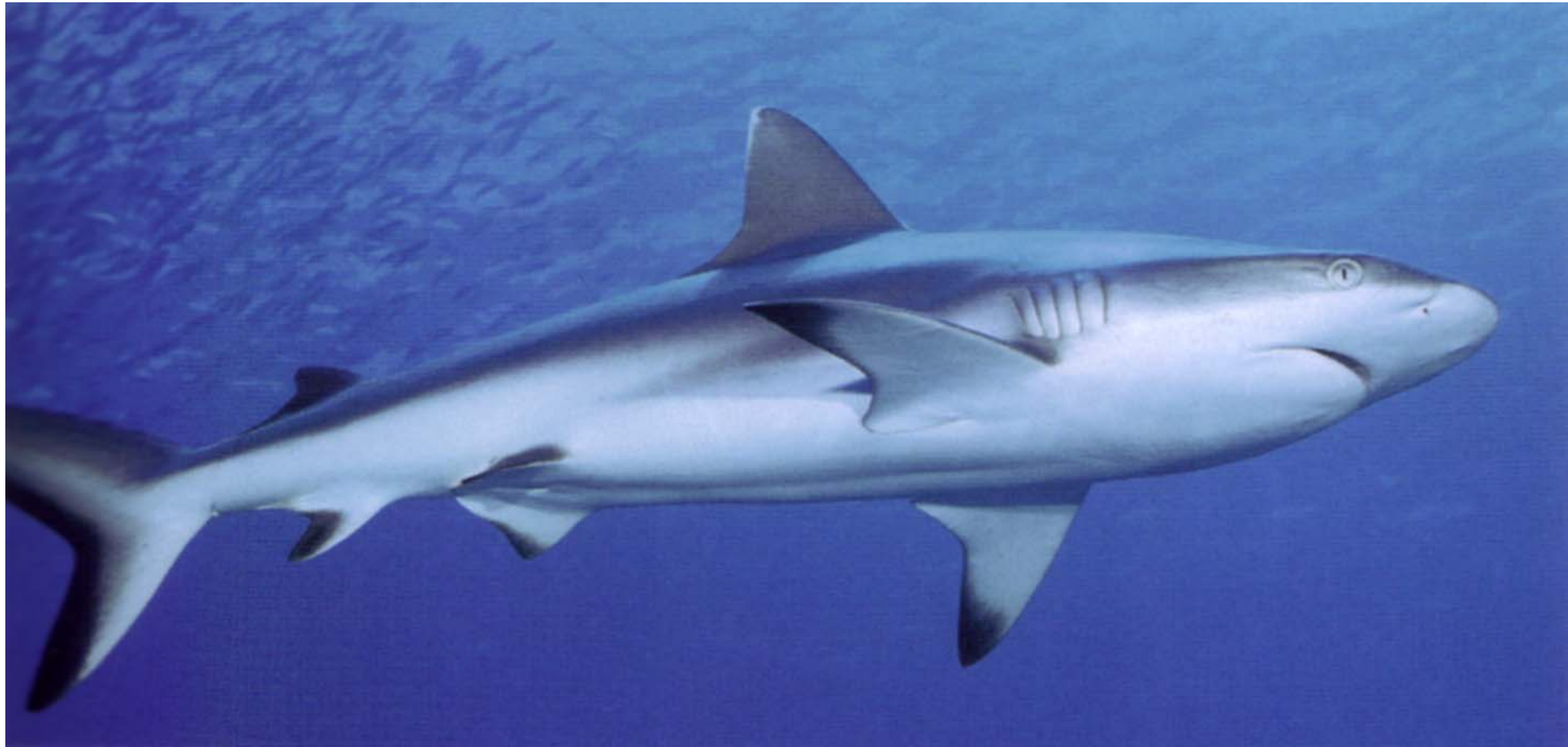
# Plant Mimicry



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# Countershading



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# Countershading Applied



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# Disruptive Patterns



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# Disruptive Patterns



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# Disruptive Patterns

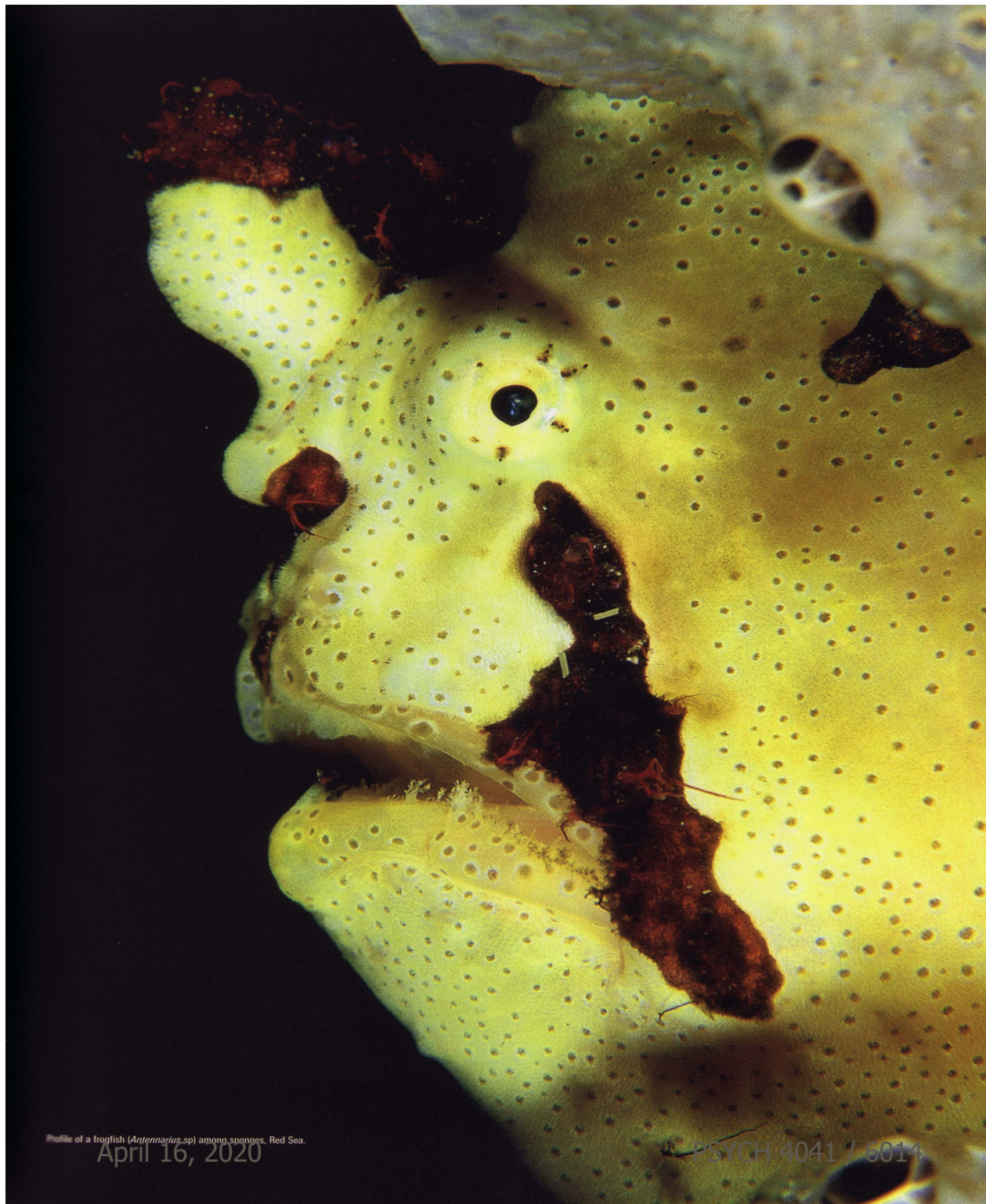


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# Disruptive Patterns

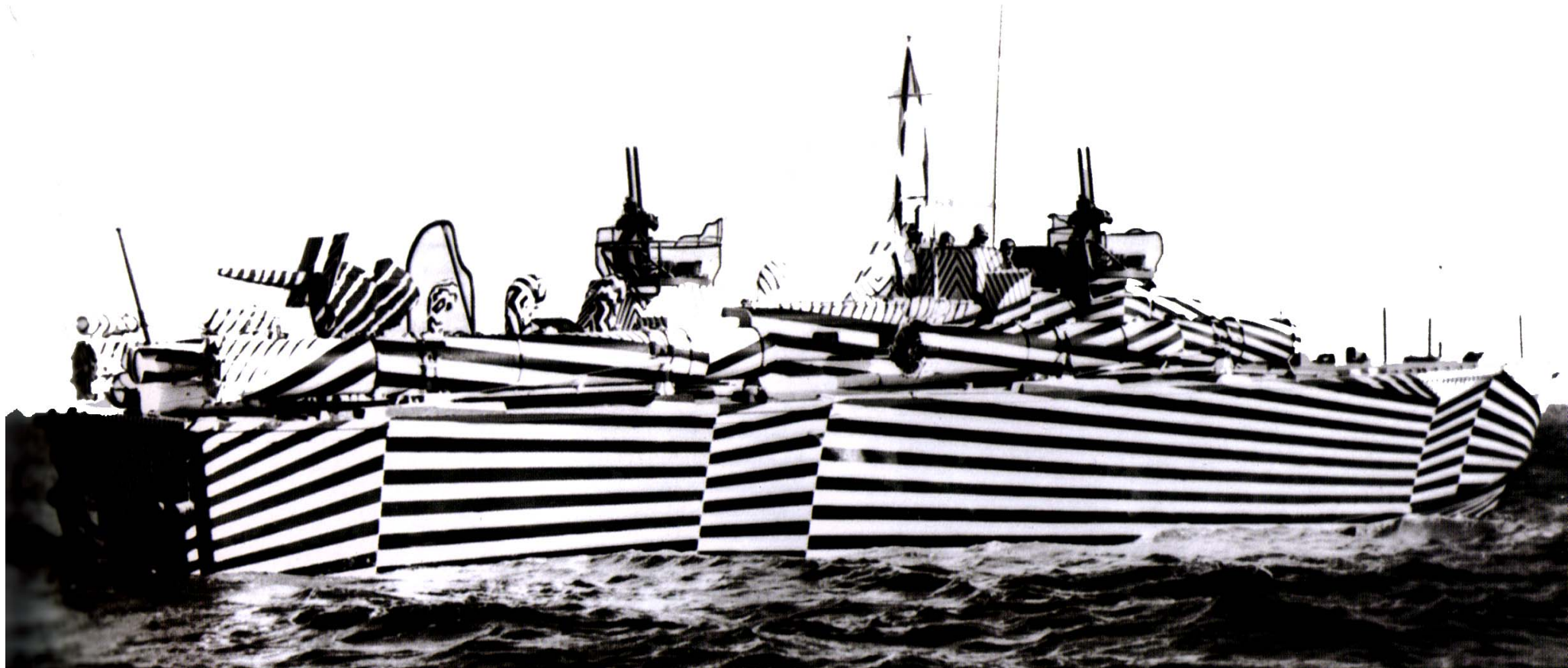


Profile of a frogfish (*Antennarius* sp.) among sponges, Red Sea.  
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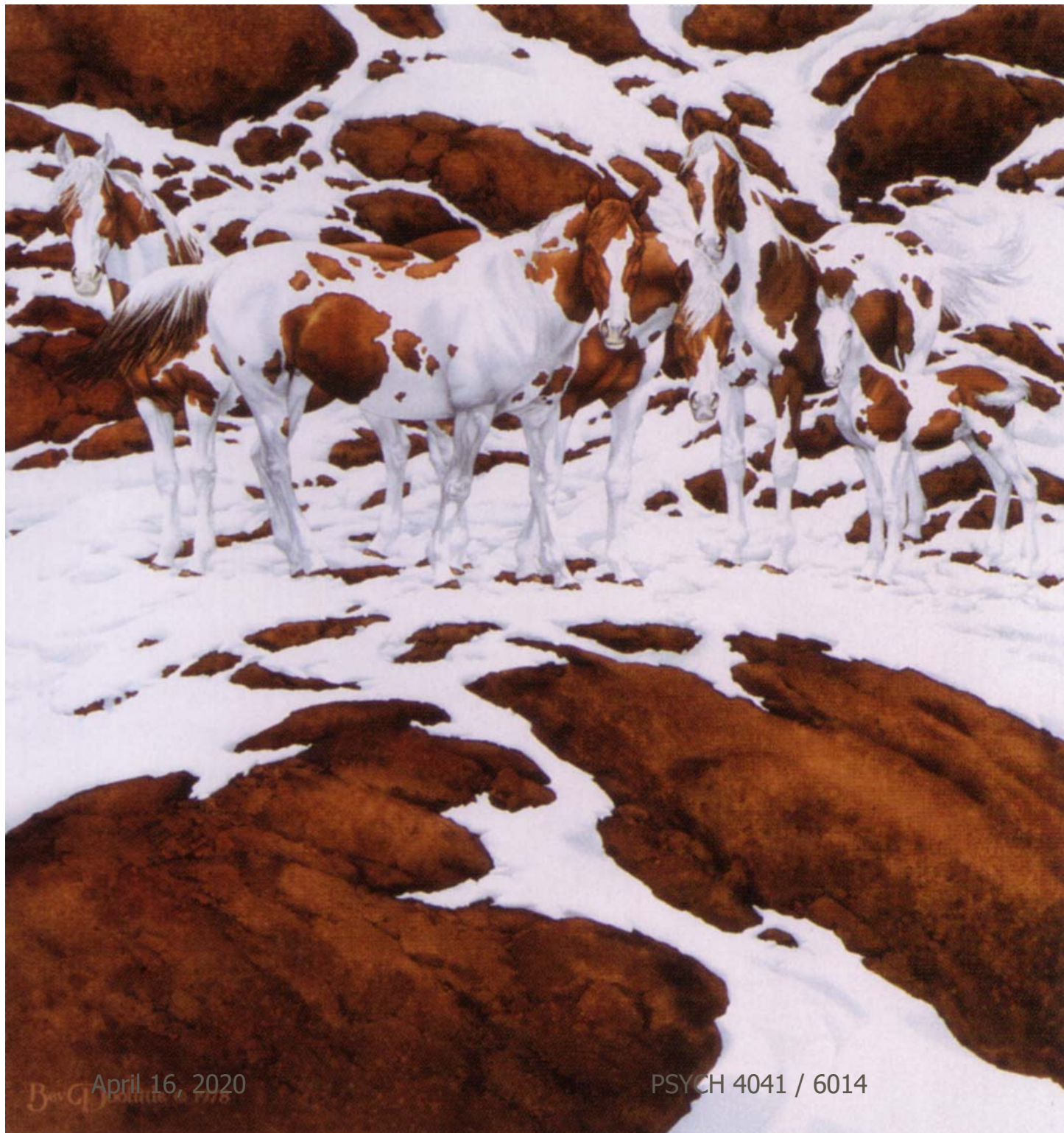
# Dazzle Ship



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# Mud in Nature



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# Mud



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# Mud



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# Ghillie Suits



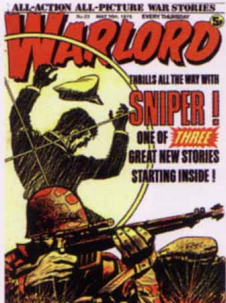
Sniper rifle with leaf stencils, US Marine Corps, Bosnia-Herzegovina, 1998. © Nicolas Peucelle



Many snipers customise their camouflage uniforms – this USMC sharpshooter has reversed his 'woodland' jacket. © Nicolas Peucelle



Toy the sniper, 12" action figure. Courtesy Dragon Models Ltd



Warlord #33, 10 May 1975. Hardy Blechman collection



sniper in ghillie suit during SFOR exercises in Bosnia-Herzegovina, 1998. © Nicolas Peucelle



Dutch sniper in ghillie suit, SFOR, 1998. Such suits may be made of as many as 1,000 fabric strips attached to a net base. © Nicolas Peucelle



Polish sniper in ghillie suit during SFOR exercises in Bosnia-Herzegovina, 1998. © Nicolas Peucelle



# Uniforms



A German mercenary, circa 1350, in dress typical of the Hundred Years War.  
© Neil Davenport



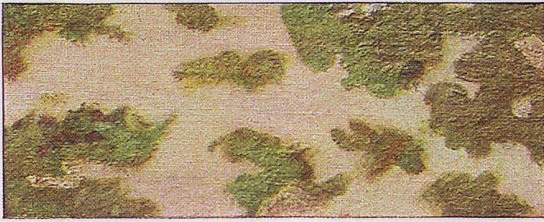
A pikeman of the English Civil War (1642–49) stands at the order of pike  
(The Sealed Knot re-enactment group). © Neil Davenport



Royal Artillery soldiers of the 1770s with light battalion guns and musketry  
(Shrapnel's Battery re-enactment group). © Neil Davenport



# Studying Colors for Uniforms



Secteur de Champagne.



Secteur de l'Aisne (bois).



Secteur du Santerre, au printemps.



Secteur de Lorraine.



Secteur des Flandres.



Secteur de l'Oise.



Secteur des Vosges.



Chemin des Dames.



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Secteur de Verdun.



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Secteur de l'Argonne.



# WW II





# Vietnam



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# Modern



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# Brazilian



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# Modern



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# Modern (SEALs)



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# Norwegian

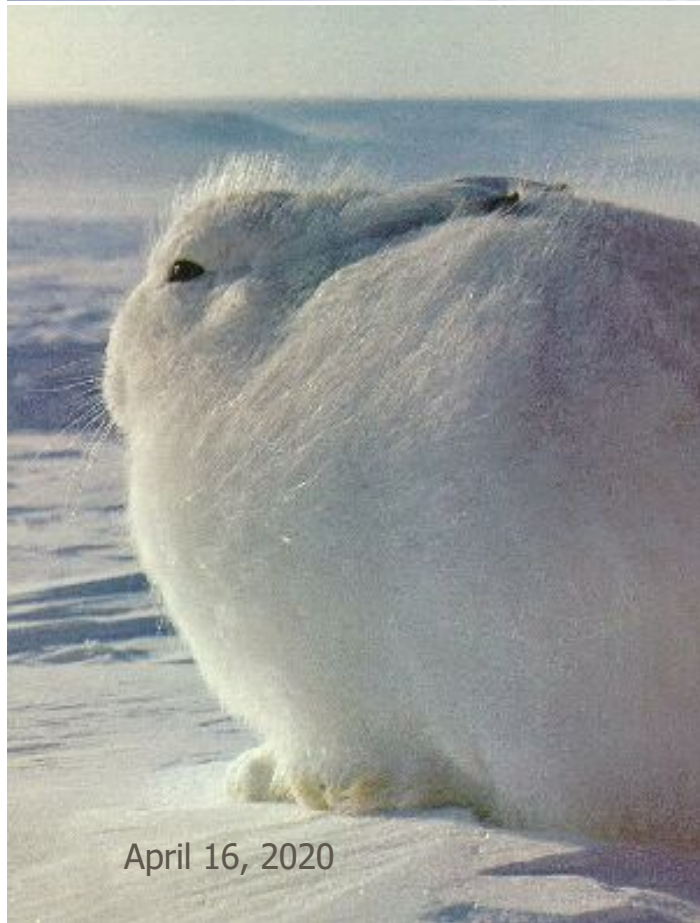


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# Arctic



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# Snow



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# Sniper



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# Digital Patterns



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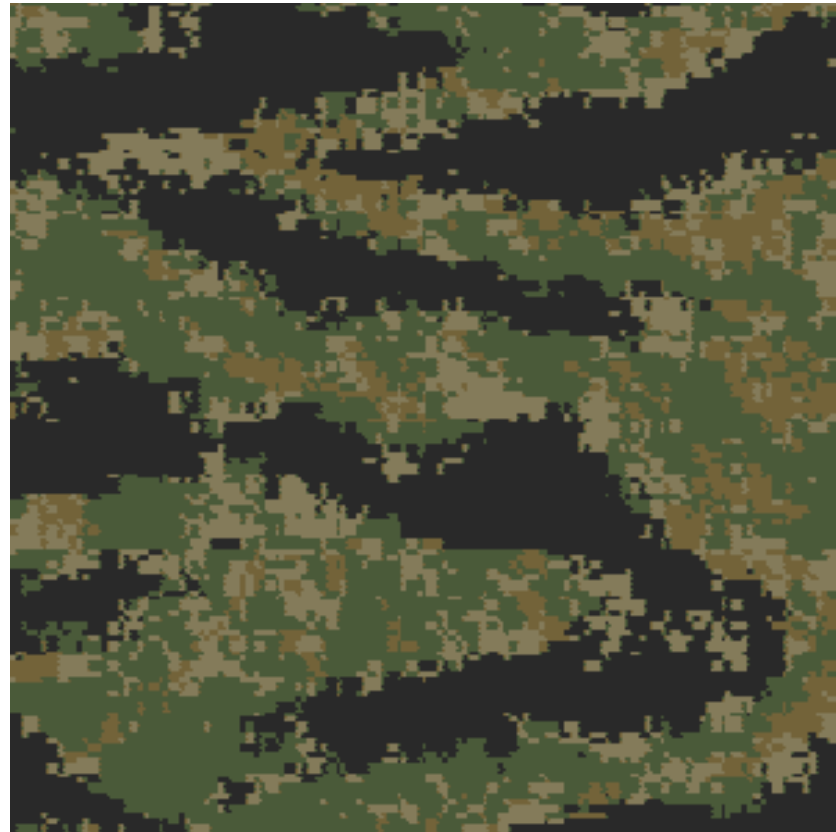
# Digital



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# Digital



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# Air Force



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# Adapting



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# Adapting



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# Hunting



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# Hunting Concealment?



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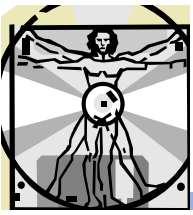
# Modern Hunting Camouflage



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# Non-Visual Camouflage

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- Sound
- Smell
  - ❖ (see hunting camo)
- Chemical
- Thermal
- Radiation
- Taste
- Etc.

# Carrion Flowers



© W.P. Armstrong 2004



© W.P. Armstrong 2002

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# Carrion Flowers

*Rafflesia micropylora*  
Rafflesiaceae  
C. H. Lamoureux

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# Stealth



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# More Stealth



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The sub-aqua environment is inhabited by an abundance of camouflaged creatures. Here an octopus (*Octopus cyanea*) exhibits a procrustic habit as it contorts its body to mimic the shape of a Seychellois reef.

Alexander Mustard

# Dynamic and Adapting

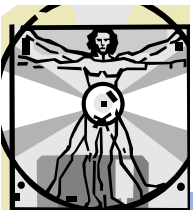
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# Cuttlefish

➤ See movies



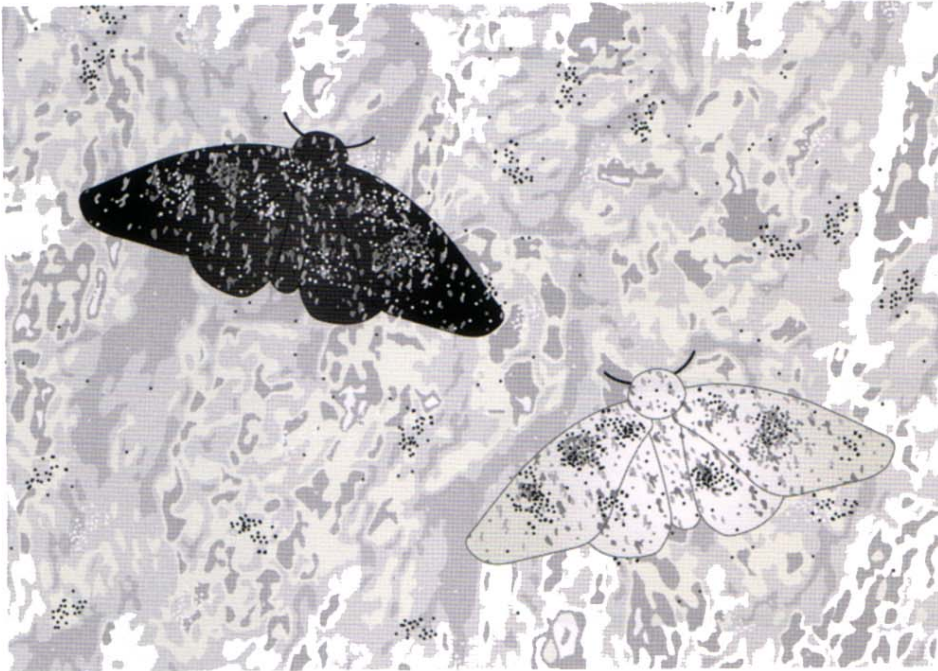
# Defeating Camouflage

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- Better sensors
  - ❖ Color vision
  - ❖ Tri, or polychromatic color vision
  - ❖ Edge detectors
  - ❖ Increased sensitivity
- “Top-down” effects
  - ❖ Learning, training, practice, expectancies, strategies
- Etc.



# Evolution of Camouflage



Pre-Industrial Revolution



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Post-Industrial Revolution

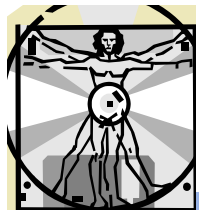
# More Evolution



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# Upcoming

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- Wrap-up
- Final Exam