Elements of Interpretation

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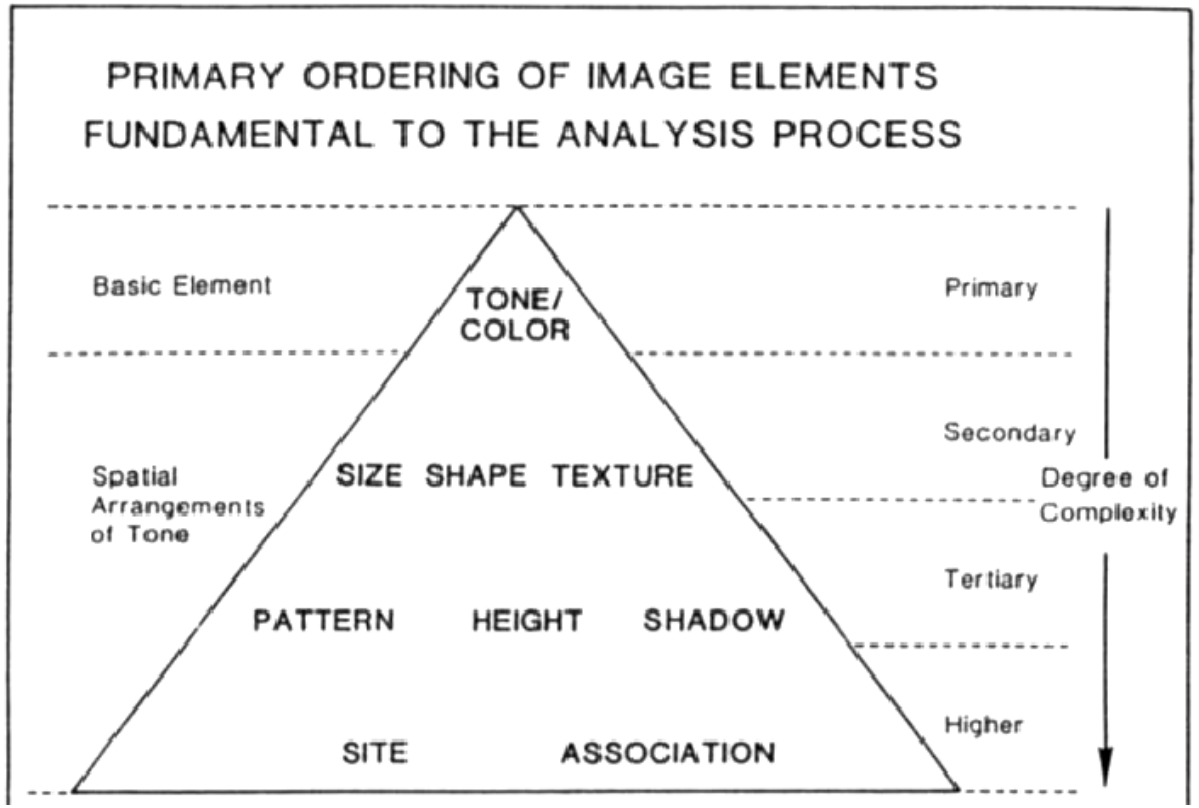
Basics of Image Interpretation

- "The act of examining photographic images for the purpose of identifying objects and judging their significance." (Colwell, 1997)
- Uses:
  - Military
  - Land use management
  - Urban planning
  - Historians
  - Wildlife research
  - Etc.
- Human ability still supersedes computer ability in many dimensions of interpretation

Colwell, R.N. (1997). History and place of photographic interpretation, *Manual of photographic interpretation, Second Edition* (W.R. Philipson, editor-in-chief). American Society for Photogrammetry and Remote Sensing, Bethesda, Maryland, pp. 3-47.

Elements of Image Interpretation

- Tone/Color
- Size
- Shape
- Texture
- Pattern
- Shadow
- Site
- Association



Element – Tone/Color

- Tone: the lightness or darkness of a region (e.g. light grey vs dark grey)
- Color: the hue, value, and chroma of a region (e.g. green vs brown)

- Human vs. Computer Ability
  - Human: poor
  - Computer: excellent

Element – Size

- Size: the dimensions of an object or image component
  - Relative
  - Absolute

- Function of scale

Element – Shape

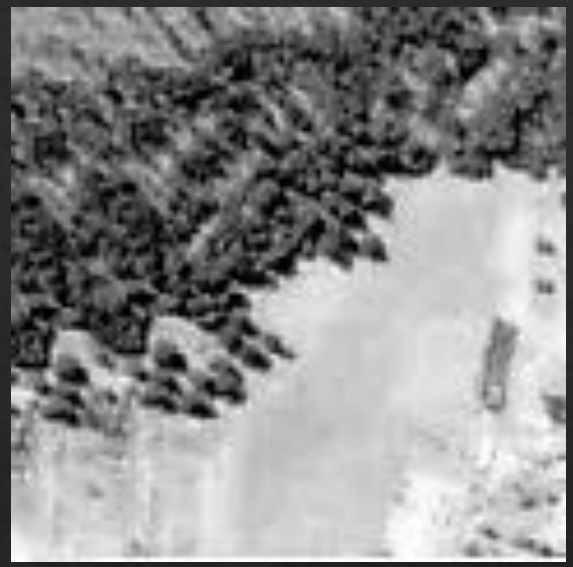
- Shape: an object's geometric form, structure, or outline
- Manmade shapes:
  - Straight edges
  - 90 degree angles
  - Regularity
- Natural shapes:
  - Diffuse edges
  - irregular

Element – Texture

- Texture: the arrangement and repetition of variation in tone/color (i.e. apparent “roughness” or “smoothness” of a region)

- Rough textures
  - “Mottled” appearance
  - Abrupt change in grey/color level

- Smooth textures
  - Uniform appearance
  - Few or gradual changes in grey/color level



Element – Pattern

- Pattern: the recurring arrangement of discernable objects within a region
  - Systematic/regular
  - Random
  - Linear
  - Circular
  - Etc.

- Scale independent

Element - Shadow

- Shadow: solar illumination from an angle outside the zenith, which projecting the object's outline onto ground nearby
- Can reveal the vertical shape of an object
- Careful of distortions!
- Can cause problems for other objects

Element – Site

- Site: the characteristics of an object's location in relation to physical features (e.g. elevation, slope, adjacency to water etc.) or cultural features (e.g. transportation, utilities etc.)
  - How an object is situated in relation to terrain features or human features

- Useful when combined with additional knowledge:
  - A certain crop type grows only on shady hillsides
  - A hydroelectric plant should be in close proximity to a large river
  - An observatory will be located on a hilltop or open plain

Element – Association

- Association: the combination of recognizable features or objects in proximity to the target of interest
- Related phenomena give clues about the use or characteristics of an area/object
  - E.g. combination of playing fields, parking lots, and clusters of moderately sized buildings together within a residential area typically indicates the presence of a school
- Especially useful for interpreting anthropogenic settings (human-made)
- Human vs Computer ability
  - Human: excellent
  - Computer: poor

Practice

Application for Waterfowl Identification

- Tone/Color: Different species have unique markings and coloration which can be used to tell them apart
- Size: ducks < geese < cranes
- Shape: Cranes tend to be elongated whereas ducks are compact and round, and geese are somewhere in the middle
- Shadow: Can reveal long neck (not duck) or long spindly legs (crane)
- Association: waterfowl tend to cluster together, often in species-specific groups

Lab Exercise

- Learning Objectives:
  - Describe how the fundamental elements of interpretation contribute to the identification of image contents
  - Develop the basic skills required to successfully interpret remotely sensed images of waterfowl
  - Contribute to citizen science efforts by producing a set of accurately labelled aerial waterfowl images on the Zooniverse online platform

- Approximate time needed: 1 - 2 hours

Software and Data Info

- Software: Zooniverse (no download needed!)
  - Web-based training data platform accessible at: https://www.zooniverse.org/projects/rowan-aspire/drones-for-ducks
- Data:
  - Drone imagery taken from Bosque del Apache and Maxwell National Wildlife Refuges from November 6th, 2018 to November 27th, 2018
  - Platform: DJI Mavic (BdA); Sensefly EBEE+ (Maxwell)
  - Sensor: Hasselblad L1D-20c (BdA); Sensefly S.O.D.A (Maxwell)
  - Ground Sampling Distance (cm/px): 0.94 (BdA); 1.1 (Maxwell)