Cognitive Error and Visual Intelligence in Dermatologic Diagnoses

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July 27, 2019

Overview

• Definitions
• Quick mini test
• Principles of visual recognition
• Introduction to "visual intelligence"
  • Another mini test
  • "COBRA"
    • Who, what, when, where
• Reducing diagnostic error

Deliberate practice

• Necessary to develop expertise
• Takes "5 hours/day x 6 years" (popularized in Malcolm Gladwell’s Outliers)

What is deliberate practice in dermatology/dermatopathology?
What is deliberate practice in dermatology/dermatopathology?

• On a practical level: pattern recognition
  ▪ Seeing patients
  ▪ Reading slides
• Going further:
  ▪ Continuing education
    - Reading journals/journal clubs
    - Attending meetings
  ▪ Honing visual skills
  ▪ Deliberate review of what we don’t know – ideally with instant feedback
    - Dermatopathology consensus conferences

Pattern Recognition

• Key to dermatopathology (and dermatology)
• Keen observation is important
  ▪ We can train the brain
    - With greater experience (through seeing slides/patients, atlases/books, lectures, etc...)
    - Using lists of clues and differentials
    - Through visual exercises (evaluating art, puzzles, comparing 2 or more entities, etc...)
• The brain can be tricked

Optical illusions

• We can be tricked by visual information

Dr. Beau Lotto (neuroscientist):

“The brain has evolved to see the world it is useful to see.”

Cognitive error

• Optical illusions are concrete examples of how the brain can trick us
• Cognitive error – sometimes due to a cognitive illusion (bias) that cannot be seen as easily

A few more definitions...

• Cognition
  = ability of the brain to attend, identify, and to act
  = thoughts, mood, inclinations, decisions, actions
  encompasses alertness, concentration, perceptual speed, learning, memory, problem solving, creativity, mental endurance

• Metacognition = thinking about cognition

From Ch 1 of Mozart’s Brain and the Fighter Pilot: Unleashing Your Brain’s Potential
by Richard Restak, MD
Scenario
Please consider Linda, a 31-year-old woman, single and bright. When she was a student, both in high school and college, she was deeply concerned with discrimination and social justice, and also participated in anti-nuclear protests.

Which is more probable about Linda’s occupation today? (a) Linda is a bank teller; (b) Linda is a bank teller and active in the environmental movement.

Our brains make mistakes
Visual perception : Optical illusions
Cognitive perception (cognition) : Cognitive illusions (error)

Diagnostic error

• Overall, in medicine, 10-15%!
• 75% of errors are cognitive errors (flawed thinking)
  § 1. Faulty processing
  § 2. Incomplete information
  § 3. Knowledge gap
  § 4. Incorrect verification

Diagnostic error

• Overall, in medicine, 10-15%!
• Pathology and radiology, ~5%!
• 75% of errors are cognitive errors (flawed thinking)
  § 1. Faulty processing
  § 2. Knowledge gap
  § 3. Incomplete information
  § 4. Incorrect verification

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“[A] high level of expertise does not immunize individuals against inherent limitations of human attention and perception. Researchers should seek better understanding of these limits, so that medical and other man-made search tasks could be designed in ways that reduce the consequences of these limitations.”

Inattentional blindness

- What we are focused on filters the world around us aggressively (faulty processing)

System 1 (fast, "gut")
System 2 (slow, "logical, rational")
Both systems can result in error
The 2 can complement each other

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Principles of visual recognition

Gestalt
- Definition: overall assessment – the whole that may be more than the individual parts
- Important elements of gestalt
  - Figure-ground separation
    - Part vs whole
    - Proximity and similarity
    - Color
Gestalt diagnosis – 200 msec!
• Based on System 1 (fast) processing
• Cognitive short cuts are used – heuristics
  ▪ Primary lesion (e.g. macule)
  ▪ Shape
  ▪ Location
  ▪ Distribution
  ▪ Pattern
  ▪ Color

Principles of visual recognition
Gestalt
• Definition: overall assessment – the whole that may be ore than the individual parts
Important elements of gestalt
  ▪ Figure-ground separation
  ▪ Our own experience
  ▪ Part vs whole
  ▪ Proximity and similarity
  ▪ Color

FIGURE 5. The simple shape of a cross housed in the square (A) is more easily recognized than the more complex shapes (B), which are also present in the square in (A).
Perception -- ambiguity


Gestalt: the same image can be interpreted in more than one way

How do we decide?

Our own experience

Part vs. whole

Proximity/similarity

Color

Babysitter: "plaque psoriasis"

Me: "You are right! How did you know that?"

Babysitter: "From seeing a coworker who has it and commercials"

Our own experience

Proximity/similarity

Pitfall: "melanoma in situ"

Grouping incorrectly can lead to cognitive error

Bilateral cheeks

Present x years, unchanging

Pseudomelanocytic nests

"Lichen planus pigmentosus"

Grouping incorrectly can lead to cognitive error

That we can still read words with jumbled letters and when vowels are missing

Herman AE, Visual Intelligence

The Stroop effect

- Name the color
The Stroop effect

• Reading (System 1, fast processing) interferes with the less familiar task of describing the word (e.g. naming its color; System 2, slow processing)

The Stroop effect in dermatology and dermatopathology

• “It just doesn’t look like that”
• “That’s what it looks like to me”
• “Sometimes it’s just gestalt”

“Reading” the skin (System 1, fast processing) may interfere with describing the skin (System 2, slow processing)

More color theory

• Remember as many as you can

Color theory

• Brown and Lenneberg, 1954
  ▪ Names aid recognition and memory
  ▪ The more names (diagnoses) we know, the better
Availability heuristic

- Common things are common
- Recognizing the uncommon takes more effort

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“Visual intelligence”

- Being aware of perceptual filters helps us know what we might miss
  - Own/close experience
  - Geographic history, affinity, location
  - Education
  - Likes/dislikes
  - Mood
  - Information from others

Reducing cognitive error: “COBRA”

- Concentrate on the camouflaged
  - Look again
  - Look all the way and back
  - Reposition patient or slide
  - Reposition yourself
- One thing at a time
  - Who, what, when, where?
- Take a Break
- Realign your expectations
- Ask someone else to look with you

Who, what, when, where of dermatology and dermatopathology

- Who?
  - patient
- What?
  - configuration, architecture
  - morphology
  - color (cell type)
  - secondary changes
  - benign vs malignant
- Where?
  - distribution (body, side)
- When?
  - close up, detail, etc.
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Reducing diagnostic error

- Visual training
- Using both System 1 and System 2 processing
  - COBRA
- Check your "fast" diagnosis (gestalt) by going "slow"
- Reducing cognitive load
  - Algorithms
  - Protocols
  - Practice guidelines
  - Checklists
- Getting feedback/asking others

Reducing cognitive error: Visual training

Reducing cognitive error

- Check your “fast” diagnosis (gestalt) by going “slow”
  - Deliberately ask, "What doesn’t fit? What else can it be? What is the trap?"
  - Verbalize a differential diagnosis
  - Check for pertinent positive and negative evidence for your initial diagnosis

Get feedback/ask others

- Grand rounds
- Consensus conference
Reducing diagnostic error

- Visual training
- Using both System 1 and System 2 processing
  - COBRA
  - Check your “fast” diagnosis (gestalt) by going “slow”
- Decreasing cognitive load
  - Algorithms
  - Protocols
  - Practice guidelines
  - Checklists
- Getting feedback/asking others