Workshop Notes

- Croskerry & Nimmo (2011):
  “‘How doctors think, reason and make clinical decisions is arguably their most critical skill.’"


- Montgomery (2006):
  “No matter how solid the science or how precise the technology that physicians use, clinical medicine remains an interpretive practice. Medicine’s success relies on the physicians’ capacity for clinical judgment.”

- Elstein AS. (2009) (Full references are listed below in next section.)
  “It would be good if physicians were as well acquainted with the relevant principles of cognitive psychology as they are with comparable principles in pathophysiology.”(Croskerry & Nimmo, p. 156.)

  important readings on the topic of thinking about thinking (metacognition).

- Croskerry & Nimmo (2011):
  “Diagnostic errors are frequent and underappreciated. Although the true overall prevalence is unknown, it is estimated to be in the order of 10–15%. ...it is somewhat surprising that [how doctors think, reason and make clinical decisions] is not explicitly addressed in most medical undergraduate curricula.”
• Bakwin (1945):
  “The mistaken practices and attitudes that have been listed are not isolated phenomena. They are part and parcel of the practice of medicine today, resting on assumptions that permeate daily routines.”

• Croskerry (Acad Med, 2009) model of diagnostic thinking processes that span the intuitive to analytic. Figure 1, p. 1024:

• Drage (2009) Case of eruption post-antibiotic therapy.

• Croskerry (2013) Case of anxiety, depression and intermittent dyspnea.
Croskerry & Nimmo (2011) Table 1/page 156:

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Type 1</th>
<th>Type 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reasoning style</td>
<td>Intuitive</td>
<td>Analytical</td>
</tr>
<tr>
<td></td>
<td>Heuristic</td>
<td>Normative</td>
</tr>
<tr>
<td></td>
<td>Associative</td>
<td>Deductive</td>
</tr>
<tr>
<td></td>
<td>Concrete</td>
<td>Abstract</td>
</tr>
<tr>
<td>Awareness</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Verbal behaviour</td>
<td>None to minimal</td>
<td>Yes</td>
</tr>
<tr>
<td>Prototypical</td>
<td>Yes</td>
<td>No, based on sets</td>
</tr>
<tr>
<td>Action</td>
<td>Reflective, skilled</td>
<td>Deliberate, rule-based</td>
</tr>
<tr>
<td>Automaticity</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Speed</td>
<td>Fast</td>
<td>Slow</td>
</tr>
<tr>
<td>Channels</td>
<td>Multiple, parallel</td>
<td>Single, linear</td>
</tr>
<tr>
<td>Propensities</td>
<td>Causal</td>
<td>Statistical</td>
</tr>
<tr>
<td>Effort</td>
<td>Minimal</td>
<td>Considerable</td>
</tr>
<tr>
<td>Cost</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Vulnerability to bias</td>
<td>Yes</td>
<td>Less so</td>
</tr>
<tr>
<td>Reliability</td>
<td>Low, variable</td>
<td>High, consistent</td>
</tr>
<tr>
<td>Errors</td>
<td>Common</td>
<td>Few</td>
</tr>
<tr>
<td>Affective valence</td>
<td>Often</td>
<td>Rarely</td>
</tr>
<tr>
<td>Predictive power</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Hard-wired</td>
<td>May be</td>
<td>No</td>
</tr>
<tr>
<td>Scientific rigour</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Context</td>
<td>Specific</td>
<td>General</td>
</tr>
<tr>
<td>Context importance</td>
<td>High</td>
<td>Low</td>
</tr>
</tbody>
</table>

Adapted from Dawson, Cryptency, and Evans.

Factors that influence System 1/Intuitive thinking:

**bias**: (Croskerry & Nimmo, 2001) gender, race, ethnicity, obesity, psychiatric illness, age, socioeconomic status, sexual orientation, substance abuse disorders, chronic and complex illness)

- Croskerry, Singhal, Mamede (2013):
  “Numerous studies have shown that diagnostic failure depends upon a variety of factors. Psychological factors are fundamental in influencing the cognitive performance of the decision maker. In this first of two papers, we discuss the basics of reasoning and the Dual Process Theory (DPT) of decision making. The general properties of the DPT model, as it applies to diagnostic reasoning, are reviewed. A variety of cognitive and affective biases are known to compromise the decision-making process. They mostly appear to originate in the fast intuitive processes of Type 1 that dominate (or drive) decision making. Type 1 processes work well most of the time but they may open the door for biases. Removing or at least mitigating these biases would appear to be an important goal.”
• Croskerry & Nimmo (2011) identifies de-biasing strategies for reducing diagnostic error as well as improving intuitive performance.

<table>
<thead>
<tr>
<th>High-risk situation</th>
<th>Potential biases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Was this patient handed off to me from a previous shift?</td>
<td>Diagnosis momentum, framing</td>
</tr>
<tr>
<td>2. Was the diagnosis suggested to me by the patient, nurse or another physician?</td>
<td>Premature closure, framing bias</td>
</tr>
<tr>
<td>3. Did I just accept the first diagnosis that came to mind?</td>
<td>Anchoring, availability, search satisfying, premature closure</td>
</tr>
<tr>
<td>4. Did I consider other organ systems besides the obvious one?</td>
<td>Anchoring, search satisfying, premature closure</td>
</tr>
<tr>
<td>5. Is this a patient I don’t like, or like too much, for some reason?</td>
<td>Affective bias</td>
</tr>
<tr>
<td>6. Have I been interrupted or distracted while evaluating this patient?</td>
<td>All biases</td>
</tr>
<tr>
<td>7. Am I feeling fatigued right now?</td>
<td>All biases</td>
</tr>
<tr>
<td>8. Did I sleep poorly last night?</td>
<td>All biases</td>
</tr>
<tr>
<td>9. Am I cognitively overloaded or overextended right now?</td>
<td>All biases</td>
</tr>
<tr>
<td>10. Am I stereotyping this patient?</td>
<td>Representative bias, affective bias, anchoring, fundamental attribution error, psych out error</td>
</tr>
<tr>
<td>11. Have I effectively ruled out must-not-miss diagnoses?</td>
<td>Overconfidence, anchoring, confirmation bias</td>
</tr>
</tbody>
</table>

Adapted from Graber. General checklist for AHRO project. A description of specific biases can be found in Croskerry.

• Croskerry P, Singhal G, Mamede S. (2013):
• “Mindfulness means paying attention in a particular way; (On purpose, in the present moment, and nonjudgmentally.”

Jon Kabat-Zinn

context: Montgomery (2006):
“Diagnosis and treatment choice...are not simply matters of logic or a patient preference exercised in the moment but a more contextual consideration intertwined with history, identity, culture, and the meaning of an individual’s life.”
Montgomery, p. 49
(Croskerry (2009):
“One of the major constraints on decision-making is context...”

emotion: McConnell & Eva (2012):
“The authors found articles that show that emotion influences various cognitive processes that are involved in the acquisition and transfer of knowledge and skills. More specifically, emotion influences how individuals identify and perceive information, how they interpret it, and how they act on the information available in learning and practice situations.

• Croskerry (2005):
  • “Physicians and caregivers are just as vulnerable to mood alterations as anyone else, yet the impact of affective state on decision making has gained little attention to date.
  • The full range of affective disorders would be expected, as would various emotional dysregulatory influences that might uniquely affect a caregiving role.
  • These various influences may be collectively referred to as affective dispositions to respond (ADRs).”

heuristics. Wikipedia:
“...any approach to problem solving, learning, or discovery that employs a practical methodology not guaranteed to be optimal or perfect, but sufficient for the immediate goals.
...mental shortcuts that ease the cognitive load of making a decision. [a rule of thumb, an educated guess, an intuitive judgment, common sense...]”

• Samuels (2010):
“Physicians use heuristics or shortcuts in their decision making to help them sort through complex clinical information and formulate diagnoses efficiently.”
• Table from Redelmeier (2005):

<table>
<thead>
<tr>
<th>Circumstance and Pitfall</th>
<th>Classic Definition</th>
<th>Corrective Strategies</th>
<th>Clinical Maxims</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability heuristic</td>
<td>Judging by ease of recalling past cases</td>
<td>Verify with legitimate statistics</td>
<td>Pay attention to base rates: “If you hear hoof beats, think about horses not zebras.”</td>
</tr>
<tr>
<td>Anchoring heuristic</td>
<td>Relying on initial impressions</td>
<td>Reconsider in light of new data or second opinion</td>
<td>Think beyond the most favored: “If the patient dies unexpectedly, what would it be from?”</td>
</tr>
<tr>
<td>Framing effects</td>
<td>Being swayed by subtle wording</td>
<td>Examine case from alternative perspectives</td>
<td>Deliberately consider from another angle: “Let’s play devil’s advocate…”</td>
</tr>
<tr>
<td>Blind obedience</td>
<td>Showing undue deference to authority or technology</td>
<td>Reconsider when authority is more remote</td>
<td>Tactfully reconfirm human work (in case of human authority); assess test accuracy (in case of technology)</td>
</tr>
<tr>
<td>Premature closure</td>
<td>Exposing narrow-minded belief in single idea</td>
<td>Return to case when refreshed (if clinical pace allows)</td>
<td>Give consideration to extremes: “What’s the diagnosis that I don’t want to miss?”</td>
</tr>
</tbody>
</table>

• Schiff & Bates (2010):

<table>
<thead>
<tr>
<th>Role for Electronic Documentation</th>
<th>Goals and Features of Redesigned Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Providing access to information</td>
<td>Ensure ease, speed, and selectivity of information searches; aid cognition through aggregation, trending, contextual relevance, and minimizing of superfluous data.</td>
</tr>
<tr>
<td>Recording and sharing assessments</td>
<td>Provide a space for recording thoughtful, succinct assessments, differential diagnoses, contingencies, and unanswered questions; facilitate sharing and review of assessments by both patient and other clinicians.</td>
</tr>
<tr>
<td>Maintaining dynamic patient history</td>
<td>Carry forward information for recall, avoiding repetitive patient querying and recording while minimizing copying and pasting.</td>
</tr>
<tr>
<td>Maintaining problem lists</td>
<td>Ensure that problem lists are integrated into workflow to allow for continuous updating.</td>
</tr>
<tr>
<td>Tracking medications</td>
<td>Record medications patient is actually taking, patient responses to medications, and adverse effects to avert misdiagnoses and ensure timely recognition of medication problems.</td>
</tr>
<tr>
<td>Tracking tests</td>
<td>Integrate management of diagnostic test results into note workflow to facilitate review, assessment, and responsive action as well as documentation of these steps.</td>
</tr>
<tr>
<td>Ensuring coordination and continuity</td>
<td>Aggregate and integrate data from all care episodes and fragmented encounters to permit thoughtful synthesis.</td>
</tr>
<tr>
<td>Enabling follow-up</td>
<td>Facilitate patient education about potential red-flag symptoms; track follow-up.</td>
</tr>
<tr>
<td>Providing feedback</td>
<td>Automatically provide feedback to clinicians upstream, facilitating learning from outcomes of diagnostic decisions.</td>
</tr>
<tr>
<td>Providing prompts</td>
<td>Provide checklists to minimize reliance on memory and directed questioning to aid in diagnostic thoroughness and problem solving.</td>
</tr>
<tr>
<td>Providing placeholder for resumption of work</td>
<td>Delineate clearly in the record where clinician should resume work after interruption, preventing lapses in data collection and thought process.</td>
</tr>
<tr>
<td>Calculating Bayesian probabilities</td>
<td>Embed calculator into notes to reduce errors and minimize biases in subjective estimation of diagnostic probabilities.</td>
</tr>
<tr>
<td>Providing access to information sources</td>
<td>Provide instant access to knowledge resources through context-specific “infobuttons” triggered by keywords in notes that link user to relevant textbooks and guidelines.</td>
</tr>
<tr>
<td>Offering second opinion or consultation</td>
<td>Integrate immediate online or telephone access to consultants to answer questions related to referral triage, testing strategies, or definitive diagnostic assessments.</td>
</tr>
<tr>
<td>Increasing efficiency</td>
<td>More thoughtful design, workflow integration, and distribution of documentation burden could speed up charting, freeing time for communication and cognition.</td>
</tr>
</tbody>
</table>
• John Murtagh (2011/General Practice 5th edition) and his template for diagnostic thinking: **a key strategy**

  What is the most probable diagnosis?

  What serious disorders must not be missed?

  What conditions are often missed (pitfalls)?

  What else can look like this (mimics)?

  Is this patient trying to tell me something else?

• Cases discussed

• Summation: Croskerry (2013):

  “Becoming alert to the influence of bias requires maintaining keen vigilance and mindfulness of one’s own thinking. When a bias is identified by a decision maker, a deliberate decoupling from the intuitive mode is required so that corrective “mindware” can be engaged from the analytic mode.”

• Graber, Kissam, Payne, Meyer (2012):

  “In conclusion, there is a surprisingly wide range of possible approaches to reducing the cognitive contributions to diagnostic error. Not all the suggestions have been tested, and of those that have, the evaluations typically involved trainees in artificial settings, making it difficult to extrapolate the results to actual practice.”

• “Mindfulness means paying attention in a particular way; On purpose, in the present moment, and nonjudgmentally.”

  Jon Kabat-Zinn

• The Critical Thinking Community: [http://www.criticalthinking.org/](http://www.criticalthinking.org/)

• Murtagh, redux.
Thinking about Thinking


Describes problems in clinical reasoning some 70 years ago.


“Overall, the role of cognition in improving safety has not received enough attention... [Health Information Technology]... should focus not just on traditional causes of harm—like hospital-acquired infections—but in less well defined and inherently more complex safety issues such as diagnostic errors, the management of patients with multimorbidity and evaluation of patients who may be decompensating.”


Paper describes strategies by which “…clinical teachers can promote the development of diagnostic reasoning while simultaneously diagnosing both the patient’s disorder and the learner’s abilities." In same vein also see a most useful paper about clinical teaching:


A very thoughtful paper filled with wisdom and insight about clinical teaching.


Though our focus here is on reducing diagnostic error, effective learning is a parallel goal as we seek to teach others and ourselves. A most useful review of what is known about effective learning.


This paper from the UK reminds us that, “The most challenging aspect of triage, which GPs confront on a regular basis, is diagnosing rare but serious disease.”
The following papers of Pat Croskerry, MD, PhD are part of his extraordinary contributions to our current understanding of thinking about thinking (metacognition). Their richness comes in part from his earlier career as an experimental psychologist and now as Professor of Emergency Medicine at Dalhousie University, Halifax, Nova Scotia, Canada:


A synopsis of work from a researcher who was an earlier, seminal thinker about medical problem solving and its challenges.


A handy tabular summary of “cognitive biases and failed heuristics [that are] addressed by diagnostic checklists.”


“We identified a wide range of possible approaches to reduce cognitive errors in diagnosis. Not all the suggestions have been tested, and of those that have, the evaluations typically involved trainees in artificial settings, making it difficult to extrapolate the results to actual practice.” The paper cogently reminds us that it is one thing to recognize bias, another to identify and implement strategies that help debiasing.


A best seller with stories that highlight the rewards and stress that flow from diagnoses well made and those missed.


Daniel Kahneman is Professor of Psychology and Public Affairs Emeritus at the Woodrow Wilson School, the Eugene Higgins Professor of Psychology Emeritus at Princeton University, and a fellow of the Center for Rationality at the Hebrew University in Jerusalem. He was awarded the Nobel Prize in Economic Sciences in 2002.


“The authors found articles that show that emotion influences various cognitive processes that are involved in the acquisition and transfer of knowledge and skills. More specifically, emotion influences how individuals identify and perceive information, how they interpret it, and how they act on the information available in learning and practice situations.”
Dr. Meagher is an emergency room physician and teacher with over 40 years of experience. The book is an honest and engaging synthesis of that experience. See also his regular essays on the web that are well worth reading.


A scholarly, well-written examination about clinical judgment by an author who is an emeritus Professor of Medical Education-Medical Humanities and Bioethics.


“Fildes’ timeless painting The Doctor reminds contemporary doctors of the crucial importance of the relationship between a patient and the doctor and the value of a patient-centered approach.”


“Residents can easily recall diagnostic errors, analyze the errors for cognitive bias, and richly describe their context. The use of reflective writing and narrative discussion is an educational strategy to teach recognition, analysis, and cognitive-bias-avoidance strategies for diagnostic error in residency education.”


This is a report written by by Members of the European Association for Quality in General Practice/Family Medicine. “This paper describes the management of uncertainty as an essential skill which should be included in educational programmes for both trainee and established GPs.” (Also see Buntinx above.)


A useful monograph devoted to the exploration of metacognition. Written for medical educators at all levels to assist them in the effective teaching of this important domain.

Donald Redelmeir, an internist-researcher/Professor of Medicine/Senior Researcher in Toronto, has for many years brought intriguing insights into many topics others would not have examined. In this important paper, he speaks knowingly about heuristics and concludes, “Rather than trying to completely eliminate cognitive shortcuts (which often serve clinicians well), becoming aware of common errors might lead to sustained improvement in patient care.”


“A longitudinal curriculum in diagnostic error and cognitive bias improved internal medicine residents’ knowledge and recognition of cognitive biases as measured by a novel assessment tool. Further study is needed to refine learner assessment tools and examine optimal strategies to teach clinical reasoning and cognitive bias avoidance strategies.”


“There are numerous ways in which EHRs can diminish diagnostic errors...”


“The current educational model in which clinical reasoning expertise is developed passively has produced disappointing results. We propose that explicit instruction in the clinical reasoning process should begin at the earliest stages of medical school as a foundational ‘basic science’ and be strongly emphasized throughout the undergraduate curriculum. Building upon this basic foundation, this tripartite agenda for improving diagnostic performance can be adopted by clinicians at all levels of experience.”


An engaging paper which applies the discussion of heuristics from Redelmeier (see above) to cases within Neurology.
Case Literature

Case 1.


Case 2.

Case 3.

Case 4.

Case 5.

Case 6.

Case 7.

Case 8.

Case 9.

Case 10.
Case 11.

“Case 12” Ball/bat/lilly pads

Other cases shown:
Cases: First Thoughts

1. 35 year-old man with abdominal pain: ________________________
2. 43 year-old woman with persistent cough:_____________________
3. 58 year-old man with bilateral leg erythema:___________________
4. 23 year-old woman with multiple complaints:__________________
5. 28 year-old woman with severe headache:_____________________
6. 56 year-old woman with severe fatigue:_______________________
7. 23 year-old man with arm pain & erythema:____________________
8. 10 year-old boy and his past history:_________________________
9. 21 year-old man with fever and rash:_________________________
10. 65 year-old man with headache and diplopia:________________
11. 50 year-old man with chest pain:____________________________
12. Two problems:
    a. Ball and bat_________________________________________
    b. Lilly pads__________________________________________
Cases Redux:

1. 35 year-old man with abdominal pain: ________________________

2. 43 year-old woman with persistent cough:_____________________

3. 58 year-old man with bilateral leg erythema:__________________

4. 23 year-old woman with multiple complaints:__________________

5. 28 year-old woman with severe headache:____________________

6. 56 year-old woman with severe fatigue:_______________________

7. 23 year-old man with arm pain & erythema:____________________

8. 10 year-old boy and his past history:________________________

9. 21 year-old man with fever and rash:________________________

10. 65 year-old man with headache and diplopia:________________

11. 50 year-old man with chest pain:___________________________

12. Two problems:
    a. Ball and bat_________________________________________
    b. Lilly pads___________________________________________