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# Assessing Diagnostic Skills: Psychometric and Systemic Issues

Mark Wiggins

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## Outline

- The Problem with Diagnosis
- The Basis of Diagnosis
- The Opportunities for Diagnosis

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- The Problem with Diagnosis
- The Basis of Diagnosis
- The Opportunities for Diagnosis

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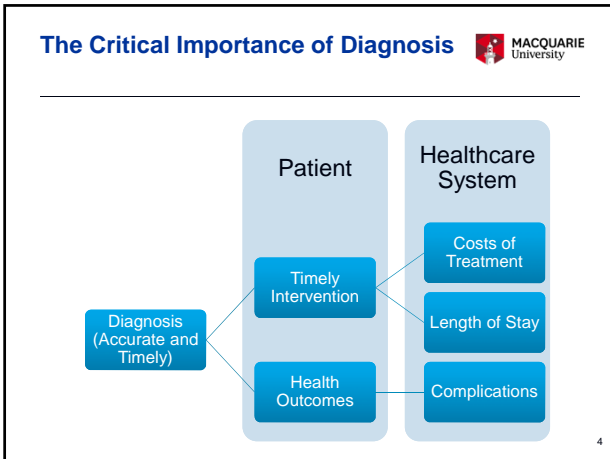
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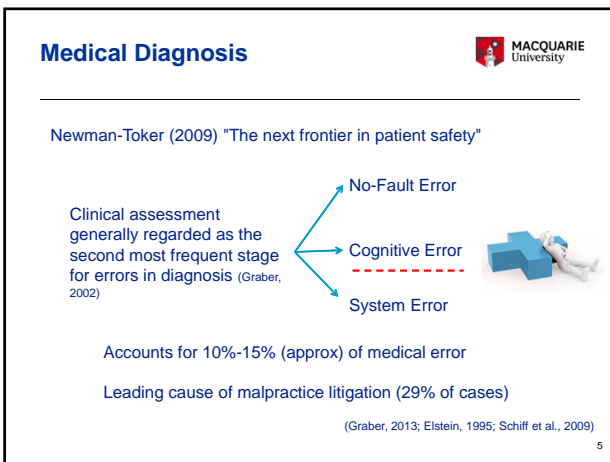
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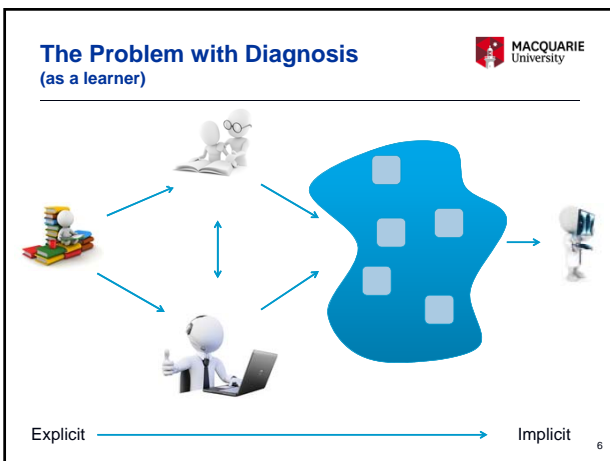
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**The Problem with Diagnosis**  
(as a competent practitioner)



◆ + □ + ▭ = Condition X

 ◆ + □ + ▭ = Condition Y

"It looked just like..."

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**The Problem with Diagnosis**  
(as an 'expert')



 ◆ + □ ( ) = Condition X

"Oh, that's....."

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**Factors in Diagnostic Competence**



Does the system give you the 'right' information?  
Is the information providing in the 'right' form?  
Is the information provided at the 'right' time?  
Is the information pr the 'right' seque  
(for you)

How often have you seen condition?  
How often have you seen this condition in different forms?  
How much recent experience have you had?

Are you fatigued?  
Is there a time-constraint?  
Are there distractions?  
Are you anxious?  
Are you pre-occupied?  
Are you in a positive mood?

Diagnost Capacity

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- The Problem with Diagnosis
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### Diagnostic Capacity at the Core

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Perception    Decision    Response

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### Diagnostic Capacity

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Perception    Decision    Response

The capacity to label and draw implications from a select pattern of stimuli.

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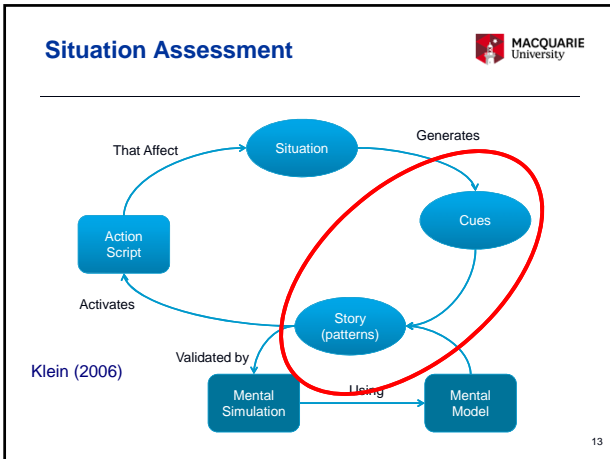
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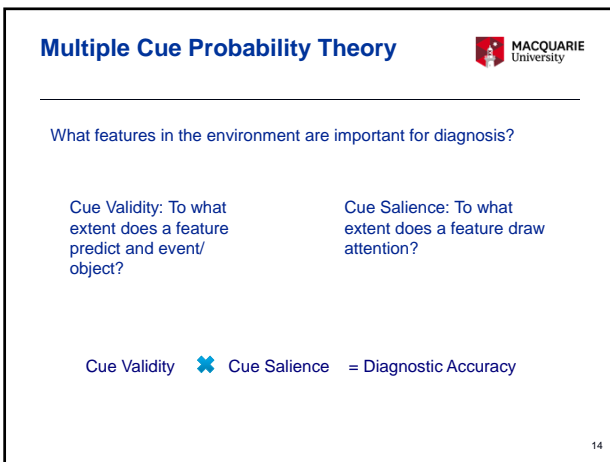
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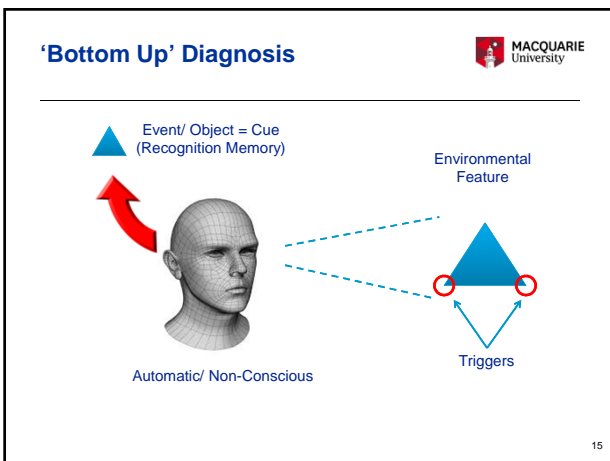
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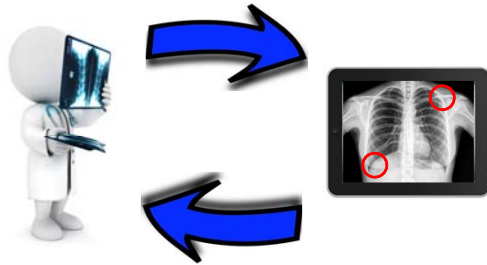
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### Ideally.....



Capture the performance of experts and model this behaviour in training and system design



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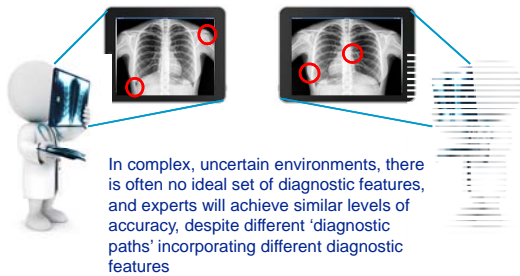
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### The Reality



In complex, uncertain environments, there is often no ideal set of diagnostic features, and experts will achieve similar levels of accuracy, despite different 'diagnostic paths' incorporating different diagnostic features

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### The Problem with Cues



Errors of Commission (Miscue)  
(James, 2013)

Wrong Feature – Event/Object  
(Signature Cue)



- Failure to respond
- Unnecessary response
- Incorrect response

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### Approaches to Diagnosis

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The diagram illustrates two diagnostic approaches. On the left, a 3D figure of a person stands next to a computer monitor. A large blue arrow points from the monitor to a chest X-ray image with two red circles highlighting abnormalities. From the X-ray, a downward arrow labeled 'Top Down' and 'Expectancy' points to the word 'Diagnosis'. From the bottom right, an upward arrow labeled 'Bottom Up' and 'Features (Symptomatology)' also points to 'Diagnosis'. A 3D figure of a person is shown sitting at a desk with a computer monitor and keyboard.

(Sacket et al., 1996) 19

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### Cue Utilisation

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Auton et al., 2013, Wiggins, 2014; McCormack, Wiggins, et al., 2014

Experts differ from non-experts in their acquisition of cue-based information from an array

The figure shows two 3D surface plots. The left plot is labeled 'Non-Expert' and shows a relatively flat surface with many small peaks. The right plot is labeled 'Expert' and shows a surface with a few very prominent, sharp peaks, indicating a more focused acquisition of cue-based information.

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### What we Know About Cues?

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1. Experts are reliant on cues (Abernethy, 1990, Mann et al., 2007)
2. People use different cues (Shanteau, 1989, 1992)
3. Patterns of cues can be misinterpreted (Crosskerry, 2009)
4. Cues can limited (restrict) information acquisition (Glockner & Betsch, 2008)
5. Different cue use can lead to similar levels of accuracy (Gigerenzer, 1995)
6. Individual differences in cue acquisition (Wiggins et al., 2014)
7. Cues are context-specific (Lany et al., 2007)
8. Cues can be triggered in memory (Morrison et al., 2013)
9. Cues can be very precise (Loveday et al., 2013)
10. The successful use of cues increases their use (Newell et al., 2004)
11. Cues can be prioritised (Patrick & James, 2004)

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### Self Assessed Diagnostic Skills (or... the problem of base rates)

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How would you rate your diagnostic skills?

Below Average      Average      Above Average

1. How do you know that you made a correct diagnosis?  
2. How does your overall performance compare to others?  
3. Can you remember correct from incorrect diagnoses?

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### The Role of Feedback

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Task Performance

Novice      Competent      Expert

- Association
- Revise
- Refine
- Reject
- Maintenance
- Adaptation

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### Diagnostic Skills and Feedback

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Process      Outcome

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- The Problem with Diagnosis
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Assessing Diagnostic Performance

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Trigger Tools

- Unscheduled hospitalisation within 2 weeks
- Discrepant pharmacy and laboratory reports

(Singh et al. 2011)

Reporting Tools

- Patients
- Clinicians

(Newman-Toker et al. 2012)

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Characteristics of Skilled Diagnosis

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Identify and Extract Features

Associate Features and Events in Memory (Cues)

Apply Feature-Event Associations from Memory

Prioritize Feature-Event Associations in Context

Skilled Diagnosis

(Wiggins, 2014)

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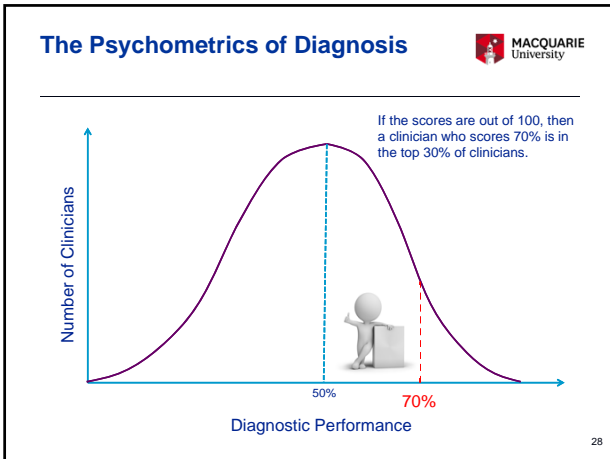
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- ### Psychometric Dependencies
- Does the 'assessment tool' actually measure clinical diagnostic skills?
  - Does the 'assessment tool' need to account for different specialties?
  - Is the 'assessment tool' sensitive to differences in skill acquisition?
  - Is the response to the 'assessment tool' consistent for a given clinician?
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- The slide features a list of four questions regarding psychometric dependencies. Below the list is a 3D illustration of a white figure sitting on a blue chair, working on a laptop with a blue folder next to it.

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- ### Opportunities
- Benchmark individual performance
  - Identify areas of development
  - Target interventions to individuals and specific skills
  - Test the impact of new diagnostic tools
  - Identify skill degradation
  - Evaluate prospective new appointments
  - Incentive towards improvements at the system level
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- The slide lists seven opportunities for improvement. At the bottom, there are two 3D illustrations: one showing a white figure running towards a bar chart with four red bars of increasing height, and another showing a white figure and a red figure in a crouching position, possibly representing a race or competition.

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### System Dependencies



- Needs a whole of 'system' approach
- Outcomes need to be generative, rather than punitive (just culture)
- Opportunities for improvement (development)
- Confidence in the data security



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### An Example (that might surprise you)



The screenshot shows a software interface for a 'Failure Identification Task (Stage 1)'. On the left, there is a complex flowchart with various nodes and connecting lines. On the right, there is a form titled 'Information Acquisition Task' with several input fields and a 'Next' button. The form includes sections for 'Location of Paper Cues', 'Type of Signal', 'Preparation Process', 'Class of Event', 'Relevant Weather Conditions', 'Accessibility', and 'Location of Paper Substances'. Below the form, there is a small diagram of a power line tower with a red arrow pointing to a specific component.

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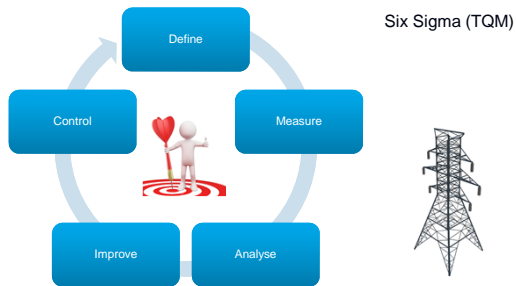
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### Proactive Assessment



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