

Cognition in Action

Cognition and clinical application

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Cognition in Clinical Populations



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- Patients differ cognitively, behaviourally, physiologically, and perhaps biochemically from healthy individuals.
- Understanding symptoms and role played by cognitive factors crucial for treatment.
- Theorists (e.g., Beck & Dozois, 2011) assume clinical anxiety and depression depend on cognitive biases.



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Cognitive biases

- Attentional bias (AB)
- Interpretive bias (IB)
- Explicit and Implicit memory bias (MB)
- Key question: do cognitive biases play role in triggering disorder, or does disorder enhance the cognitive bias?
- Various tasks used to assess AB.....



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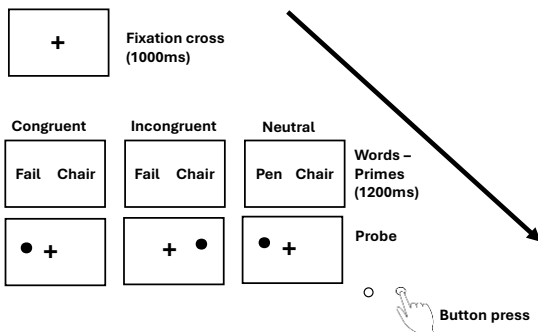
Dot-probe task

- Allocation of attention assessed by recording speed of detecting and responding to dot that replaces stimulus.
- Detection latencies shorter in attended areas
- AB shown through detection latencies being shorter when dot replaces negative stimulus.



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Dot-probe task



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Emotional Stroop

- Traditional Stroop task (Stroop, 1935): assessing competition between colour word and colour of ink.

Green	VS	Green
Black		Black
Red		Red
Purple		Purple
Orange		Orange
Blue		Blue

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Emotional Stroop

- Emotional Stroop task, same as traditional in naming colour of the ink.

However, words will either be negative or neutral.

SAD	SKY
HATE	TABLE
DEPRESSED	CAR
CRYING	PEN
ANXIOUS	FOOD

People with anxiety take longer to name colour of negative words compared to neutral words.
Showing an attentional bias effect

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Evaluation

- Dot-probe and Emotional Stroop only provide RT data
- Difficult to know if anxiety/depression affects attentional engagement or disengagement (Clarke et al., 2013).
- Eye-tracking can help

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Evaluation

- Armstrong and Olatunji (2012):
 - Meta-analysis on studies measuring eye movements during visual search task
- Anxious Ps = increase vigilance for threat + found it harder to disengage from threat compared to controls.
- But less evidence in depressed Ps – instead, they take longer to engage and spent less time looking at positive stimuli.



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Memory biases

- Role in maintaining negative mood?
- Can occur via automatic process:
 - Implicit** memory bias
 - Superior performance for negative/threat than neutral or positive information on memory tests **not** involving conscious recollection.
- Or process the individual is aware:
 - Explicit** memory bias
 - Tendency to retrieve negative/unpleasant rather than positive or neutral information on memory tests involving conscious recollection.

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Research evidence

- Williams et al. (1997):
 - Explicit memory bias found in depressed patients compared to anxious patients
 - Whereas opposite was case for implicit bias.
- However, Mitte (2008) did not find evidence of anxiety associated with implicit bias
 - Goes directly against work of Williams et al.

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Possible explanation?

- Type of test - Anxiety associated with memory biases in **recall** but **not recognition**
- Extensive retrieval processes required for recall = more scope for involvement of emotion.
- Depression (more than anxiety) associated with inward focus and disengagement from environment.
- Depression (more than anxiety) associated with negative past events (Eysenck et al., 2006).



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Cognitive Bias Modification

Key Question

- Do cognitive biases make individuals more vulnerable to anxiety/depression?
- Or does anxiety/depression lead to development of cognitive biases?
- Can address this through cognitive bias modification



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Cognitive Bias Modification

- Experimental paradigm that uses training to induce maladaptive or adaptive cognitive biases.
- E.g., altered version of dot-probe where dot always appears where neutral stimulus was presented.
- Patients learn to avoid allocating attention to threatening stimuli.
- Good success rates and training to reduce one type of CB often leads to reduction in another type of CB.



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Cognitive Bias Modification

•Evaluation:

- + Is focused, so easy to understand underlying mechanisms
- + Enhanced understanding of relationship between bias and emotional states.

(MacLeod & Clarke, 2013)

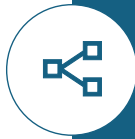
- Little generalisation/transfer from lab to real life
- Assessment of changes in anxiety/depression involves self-report measures
- Patients often report being unclear on reasons behind cognitive bias modification

(MacLeod & Mathews, 2012)

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RIF in Generalised Social phobia disorder: Amir et al. (2001)

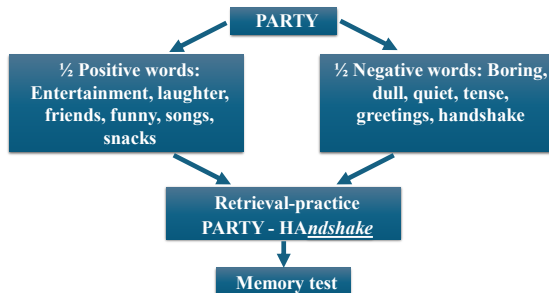
- Intrusive memories of negative social interactions.
- Constant retrieval of negative social info prevents socially phobic individuals from forgetting socially negative memories.
- Negative social info highly integrated in memory.
- All negative social situations bound together.
- Difficult to forget negative info because retrieval of one retrieves others.



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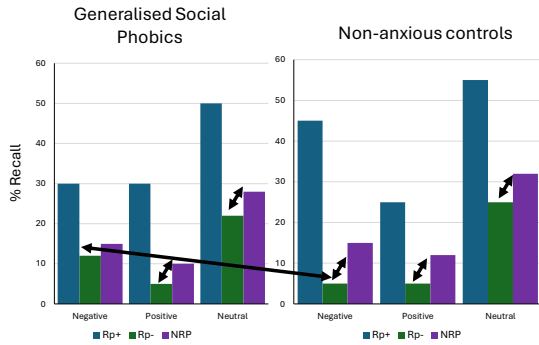
Amir et al. (2001)

- Two groups: Generalised social phobics and non-anxious controls
- Given 4 neutral and 4 social categories of words – in social category, words were divided into positive and negative.



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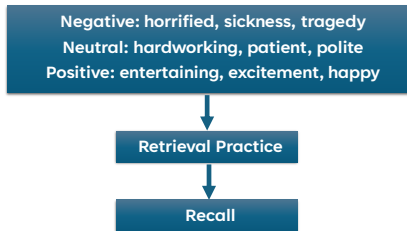
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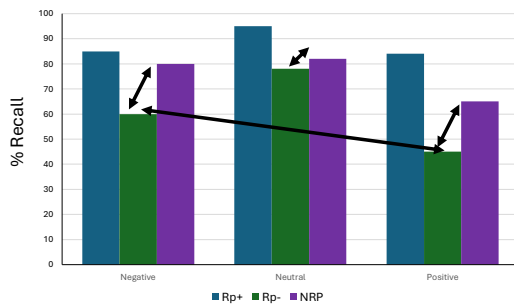
Cognition in clinical application

- Unconscious forgetting in emotional memory:
- **Barnier et al. (2004)**



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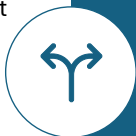
Barnier et al. (2004)



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Decision making in Clinical settings

- Humans = generally inconsistent
- In lab, asked to detect:
 - Sound of varying volume
 - Light of varying intensity
 - Object recognition
 - Signal = pre-determined and researcher controls number of trials
- In real-world = vast variation



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Detailed Example

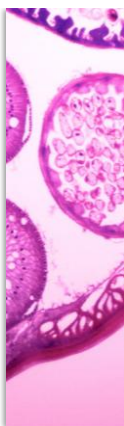
- **Medical Diagnosis:**
- Application: Detect disease (present/absent)
- Considerations:
 - Strength of signal
 - Sensitivity of decision maker
 - Salience of disease
 - Number of other 'related' symptoms
 - Experience of decision maker



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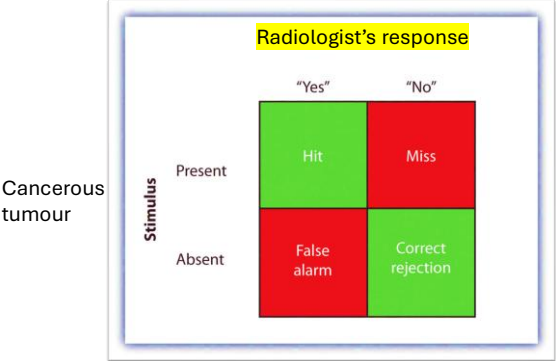
Medical diagnosis

- Detecting cancerous tumour vs. benign cyst.
- Implications:
 - Not detecting cancerous tumour
 - Inaccurately detect benign cyst as cancerous tumour.
- High stakes & time pressure, generates stress for decision-maker.



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Medical Diagnosis: SDT Matrix



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SDT: Medical Diagnosis

- Aim: improve radiologists' sensitivity
- Use checklist listing features to be considered
- Assess confidence
- Less experienced radiologists = greater sensitivity using checklist compared to not.



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SDT: Medical Diagnosis:
(Parasuraman, 1985)

- For every 100 patients with cancer, checklist increased detection in ~ 13 additional patients
- For patients without cancer, it decreased unnecessary need for biopsies in ~12 patients
- Other factors influencing decision:
 - Timepoint when patient is examined
 - Initial screening (high beta, low probability)
 - Referral (lower beta, higher probability)



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SDT: Medical Diagnosis

- What about payoffs (value/cost) in medical decisions?
 - How can consequence of Hit, FA, CR, and misses be quantified with human lives?
- Uncomfortable to think about but has key influence on detection rate.
- Instead of considering all outcomes individually, criterion limit can be set.
- Swets (1998): FA rate is $\sim .10$ in medical contexts.



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SDT: Medical Diagnosis

- However, differences in criterion setting between different countries
- E.g., in US, probability of signal given “yes” response is 20-30%, in England it is $\sim 50\%$.
- Why?



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Scenario

A 22-year-old athlete collapses after a run.

If you were a clinician, what would be your first thoughts?

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Concept and Impact of Cognitive Biases

Role of Cognitive Biases

Cognitive biases: mental shortcuts that speed decisions but may reduce accuracy under pressure.

Amplifying Factors in Clinics

Fatigue, cognitive overload, emotional stress increase bias impact during clinical decisions.

Consequences of Bias

Biases can cause diagnostic delays, treatment errors, reduced trust, and flawed team reasoning.

Mitigation and Awareness

Recognising biases fosters reflective reasoning, safer collaboration, and evidence-based decisions.



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Influences on Decision making

•Simulation Heuristic

- Judgment based on ease a plausible scenario can be constructed
- Like availability heuristic
 - But ease of imagination instead of direct retrieval from memory



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Interactive task – the undoing problem

- Two different travellers heading to airport
- Catching different flights leaving at same time
- Meet outside hotel and share a taxi
- Get caught in traffic jam on the way
- Arrive at the airport 30 minutes late
- Both expect to have missed their flight

However:

Traveller A is told their plane left on time and traveller B is told their plane was delayed but left 5 minutes ago.



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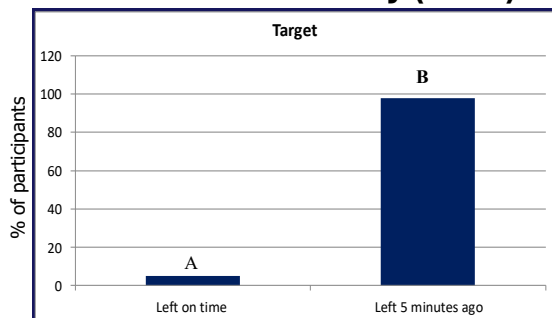
•Who do you think would be most annoyed/upset?

•Traveller A or B?



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Judgments of “Upset” Kahneman and Tversky (1979)



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Interactive task: the united nations query

•Estimate the % of countries in the United Nations that are from the continent of Africa

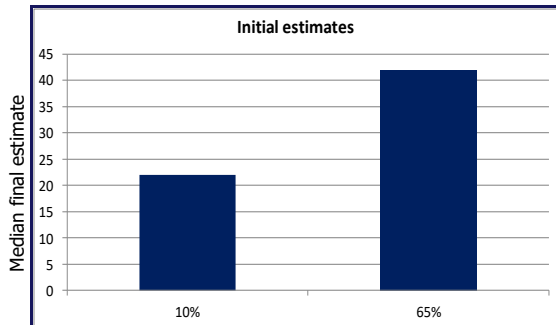
- Some people say 10%
 - What do you say?
- Some people say 65%
 - What do you say?



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African countries in UN

Kahneman and Tversky (1974)



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Anchoring and (Insufficient) Adjustment Heuristic

When we make estimates, we are influenced by initial value state

(Epley & Gilovich, 2006; Tversky & Kahneman, 1974)



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Anchoring and Adjustment Heuristic

- Final estimates influenced by initial estimates

- Estimates begin with initial values
- Initial value serves as anchor

➢ Common sales technique

- Estimates can be influenced by meaningless or unrelated figures



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Bounded rationality

- Herb Simon (1960, 1978)
 - We make rational decisions within limits of human information processing
 - ❖ E.g. STM capacity, incomplete knowledge, uncertainty
- Definition of situation likely incomplete
- Impossible to generate all alternatives
- Impossible to predict consequences of each



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SDT: Vigilance

Mackworth (1948/1950):

- Experienced vs. trainee radar operators.
 - “Clock Test”: Detect double-jump of pointer.
 - Decline in efficiency after 30 mins.
 - “Breakdown of Vigilance”
 - “Vigilance Decrement”



[Psy Tool Kit Example](#)

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Time based decision making

- Let's try a quick task:
 - Close your eyes and count to 20 in your head
 - When you get to 20 open your eyes and put your hand up.
 - How good are we at estimating time intervals?



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Core Types of Cognitive Biases

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Anchoring, Confirmation, and Availability Biases

BIAS TYPE	DEFINITION	TYPICAL CLINICAL TRIGGER	EXAMPLE SCENARIO
Anchoring	Fixating on initial information	Referral notes, first symptom reported	Assuming confusion = UTI in older patient
Confirmation Bias	Seeking evidence supporting prior belief	Strong initial hypothesis	Young adult chest pain labelled musculoskeletal
Availability Bias	Judging likelihood based on memory	Recent or dramatic cases	Panic about meningitis after recent case

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Additional Clinical Bias Patterns

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Premature Closure and Attribution Biases

Premature Closure Risks

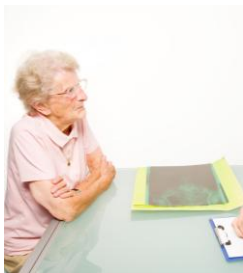
When diagnoses accepted without full verification, risking missed serious conditions.

Attribution Bias Impact

Leads to stereotyping and misinterpretation, especially affecting marginalised patients' care quality.

Mitigation Strategies

Using checklists, reflective questioning, and encouraging second opinions reduces bias and improves patient safety.



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Strategies to Reduce Bias in Clinical Judgement

Analytical vs Intuitive Reasoning

Clinicians shift from fast intuitive thinking to deliberate analytical reasoning to reduce errors.

Alternative Diagnoses Generation

Generating multiple plausible diagnoses prevents premature closure and challenges cognitive biases.

Seeking Disconfirming Evidence

Actively looking for signs that contradict initial hypothesis improves diagnostic accuracy.

Use of Structured Tools and Reflection

Tools like checklists and reflection prompts foster consistency and metacognitive oversight.



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Applying Bias Recognition to Clinical Cases

Interactive Group Task:
Using the Case Scenarios and Cognitive Biases Worksheet, consider what cognitive biases may be present and how they may have affected the clinical decisions made

You can find more cognitive biases here: [Cognitive Biases](#)

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Bias in Clinical cases responses

Anchoring Bias in Elderly Confusion

Past medical history anchors clinical thinking, causing overlooked medication-induced delirium/metabolic issues

Availability Bias in Child Assessment

Recent or emotional cases distort risk perception, affecting diagnosis like meningitis in mildly symptomatic children.

Confirmation Bias in Chest Pain

Prematurely concluding musculoskeletal causes can miss early cardiac conditions in young patients.

Attribution Bias in Vulnerable Patients

Symptoms in homeless or substance-using patients may be dismissed, risking missed serious diagnoses.



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