Cognitive Psychology

PSYC230

Lecture # 20

Next week

Tuesday: Review for test
Course evaluations

Thursday: Test #2

So far this term, we've discussed attention, memory, knowledge, language, and points in between.

So what …?

*What can you **do** with it?*

Applied Cognitive Psychology

Application of knowledge and methods about human **cognitive** capabilities and limitations to the design of tools, procedures, and systems in everyday life.

Human Factors
Engineering Psychology
Cognitive Ergonomics

My experiences in
Applied Cognitive Psychology

Began at the Veterans' Hospital in Albuquerque, New Mexico

Research Associate investigating recovery of function after stroke

Diagnostic testing & development of rehabilitation training programmes

Aviation & Aerospace Psychology

One of the earliest and most significant significant application area for Applied Cognitive

"The Biology Barrier"

Fatigue – demanding task, sustained flight times, jet lag
Vibration – Tracking and reaction time performance
Acceleration – "G" forces & G-LOC
Workload – information overload & time stress
Situation awareness – spatial disorientation & finding the picture

Increased display and control complexity led to significant problems with mental workload & situation awareness

USAF F-16

USCG HH-65
Search & Rescue

Simplified cockpit displays

electro-optical displays capable of multiple functions depending on pilot tasks – minimise mental workload and maximise situation awareness

Ground-based system complexity at air traffic control centres

Workload, situation awareness, & stress

Perception, temporal distortion, & channelised attention

Displays, symbology, communications, & problem solving

Vigilance, distraction, habituation, & fatigue

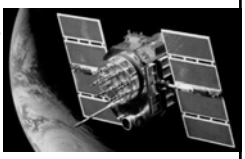
ARTCC – enroute control

TRACON – terminal approach

Global Positioning System

Largest constellation of SVs ever attempted

Military and civilian users worldwide



High contact rate & precision orbits in 3 planes

Master Control, 3 ground antennas, 5 monitor stations

Significant crew workload & situation awareness issues

Crew composition & training issues

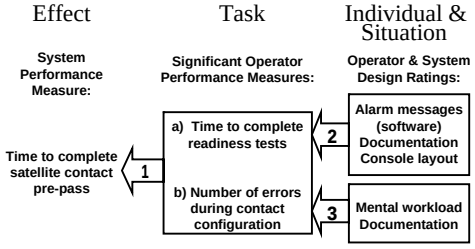
Critical Incident (SITE) Analysis

Critical Incident perspective based on technique used in aircraft accident investigations.

A SITE/CI analysis can use observation, self-reports, or archival sources to identify tasks that posed a problem, what was supposed to happen, what actually happened, the preceding and following events, and how the subject was feeling immediately before the problem.

Situation	Individual	Task	Effect
Controls Displays Software Habitability Anthropometry Manning levels Documentation System modes Shift length Hours of rest etc.	Age Gender Fatigue Workload Skill level Experience Sit. Awareness etc.	Reaction time Completion time Accuracy Sequence Reliability Repetitions Force applied etc.	System output System accuracy User satisfaction Cost effectiveness

Using SITE as an epidemiological analysis structure



1. System performance was significantly predicted by the two tasks; R2 = .36, F(2,27)=9.12, p<.001

2. Performance on task A was significantly predicted by three HF design ratings; R2 = .48, **F**(3,12)=5.60, **p**<.01

3. Performance on task B was significantly predicted by two HF design ratings; R2 = .68, **F**(2,13)=16.66, **p**<.001

Driver attention & decision making

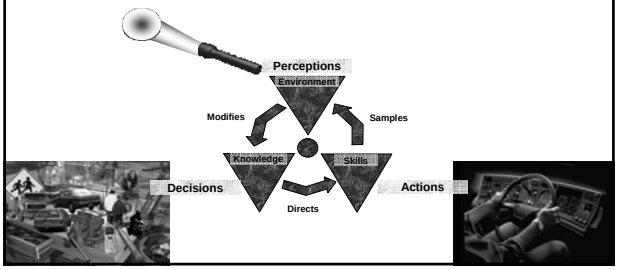
With practice, driving becomes proceduralised

Most drivers are driving without awareness, most of the time

Driving without awareness (inattention) causes more crashes and injuries than speed, alcohol, fatigue, or failure to wear seatbelts

The task of driving

"Driving is a skill-based, rule-governed, expressive activity involving balancing capability and task difficulty to avoid loss of control and ongoing real time negotiation with co-present transient others to avoid intersecting trajectories while maintaining and enhancing your self-image" *Stephen Stradling 2005*



Why Drivers Crash

85-90% of crashes are attributed to human error

Why does human error occur?

Mistakes: due to inexperience, unskilled actions, incorrect decisions, intentional, conscious acts, but *wrong (closed-loop)*

Learner drivers – small proportion of population, & they get better with practise

Action slips: capture & activation errors, well-practised actions, proceduralised/automatic acts (*open-loop)*

Inattention – taking driving for granted (DWA) failure to drive to the conditions fatigue, cell phones, etc

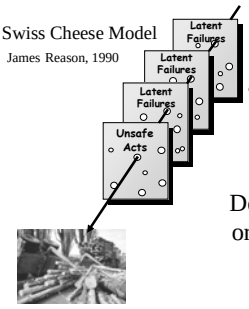
Violations: intentional errors, shortcuts, workarounds, breaking the rules (*closed-loop)*

Underestimating crash risk, overestimating driving skill, rules don't apply, bad rules

Why Drivers Crash

Latent Failures – *Failures of Design*

The Swiss Cheese Model
James Reason, 1990



Latent failures set the stage for unsafe acts (active failures); appropriate safeguards are missing

Designs that fail to prevent, or contribute to, user errors

Why do drivers speed?

Inadvertent speeding

Much of our driving behaviour is governed implicitly *esp. lane keeping & speed maintenance*

Most drivers are driving without awareness, most of the time

Speed Management

Historically, the most common approach to managing drivers' speeds is via road signs

Drivers may notice as few as 1 in 10 road signs and have very poor memory for road signs they've just passed (6% recall - 9% recognition)

road warnings are often not noticed because the situation is not perceived as hazardous

The 3 Es: Education, Enforcement, & Engineering

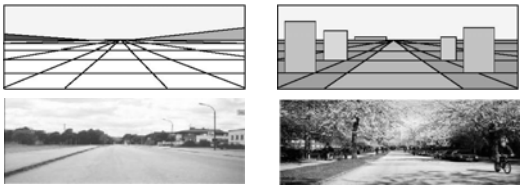
Other engineering approaches rely on forcing functions to eliminate incorrect behaviour

Speed management techniques *(AKA Traffic Calming)*

Self-explaining roads -- Self-enforcing roads

Using psychological principles to affect
the **"look & feel"** of a road

Choosing road widths, delineation, and road furniture
designed to ***afford*** a desired speed and lane position



Affordances: perceptual properties that function
as "built-in" instructions, processed *without awareness*

Two local examples

Requires conscious effort to keep speed down to 50 km/h

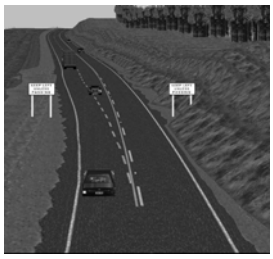
distraction & fatigue result in a speed well above limit

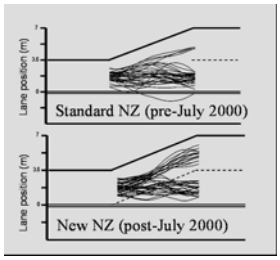
Requires little or no effort to keep speed at or below 50 km/h

lane widths, markings, angle parking, & visual complexity produce low speeds

Self-explaining roads aren't just for speed management

Addition of a continuity line ***affords***
staying left at overtaking lanes

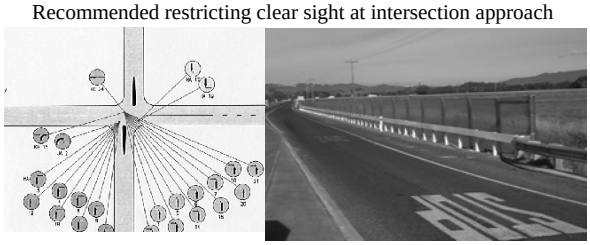




Lane delineation is used by the implicit (automatic)
driving script to maintain lane position

Tahuna Paeroa Intersection at SH27

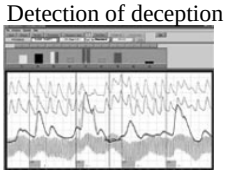
Asymmetric pattern of crashes (eastbound)
Anticipatory decision-making by eastbound drivers
Recommended restricting clear sight at intersection approach



23.4% reduction in the 80th percentile speed. 10.95 km/h reduction in 85% percentile speeds (from 49.95 to 39 km/h).
Elimination of all approach speeds over 57 km/h

Forensic Psychology

Detection of deception



Jury decision-making

Eyewitness identification

Interview techniques
& offender profiling

Eyewitness Testimony

Accuracy of testimony influenced by events during:

Acquisition – time spent witnessing the event, emotional tone of the event

Retention – delay between event & recall, talking with other witnesses

Retrieval – style of questioning, misleading questions

Acquisition factors

Stress effects – Yerkes-Dodson law, inverted U-shaped function
poor recall of events with too little or too much stress

Violence effects – violent events can produce time dilation and retroactive interference for 2 minutes prior

Weapon focus – attention dedicated to weapon and little else is encoded

Eyewitness Testimony

Retention factors

Recency effects – more time between event and retrieval the poorer the accuracy (and greater susceptibility to misleading suggestions)

Plausibility effects – the more unusual the event (departs from schema or script) the more memorable it will be, but details (especially implausible ones) are forgotten
Recollection of what probably happened

Source monitoring effects – did you see it or just hear about it?
Confusion with post-event discussions, identifications, etc.

Eyewitness Testimony

Retrieval factors

Constructive processes – effects of subsequent information, misleading questions & suggestions

Young children's memories are no less accurate than adults, but they may recall fewer details, better at remembering events than identities, young children are more susceptible to leading questions and suggestions, more questions = more errors
Very young are poor at source monitoring

Elderly are also more suggestible (poor at source monitoring), less complete, and less accurate

Architects, artists, & salespeople most easily misled
college students least suggestible

Jury Decision-making

Two historical models

Rational-Mathematical model
Jurors use mental calculations weighing the strength of each piece of information and compare it to a criterion for guilt

Story model
Jurors organise and interpret trial evidence to fit narrative or story schema and then try to find best fit of story to verdict categories provided

Research favours the Story model
Evidence presented witness by witness or chronologically (event-based). Chronological sequence more likely to produce verdicts consistent with the story schema

Advertising Psychology

We are exposed to as many as 3,500 ads per day

Brand loyalty can be established in children as early as age two

Advertisers rely heavily on psychological principles to design their campaigns

Some of the most effective ads work without you being aware of having seen them

Consumer Processing Model (CPM)

Based on human information processing model, consumer behaviour is seen as systematic, & reasoned

8 stages:

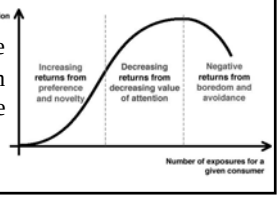
Exposure to information ⇨ Selective attention ⇨ Comprehension ⇨ Agreement ⇨
⇨ Retention in memory ⇨ Retrieval ⇨ Decision making ⇨ Action (purchase)

Techniques to Enhance Memorability

Jingles
Slogans
Taglines
Logos (symbols)
Story schemas
Repetition

Nike: establishing a symbol

Repetition increases memorability, but can also cause "wear out" habituation & boredom with ad negative reaction to ad due to over-saturation ultimately negative attitude towards brand



Advertisers are also aware of decision-making biases

Framing effects

The alternative is to make the consumer feel good, no agreement required

Hedonic Emotional Model (HEM)

Transformational ads associate the product with affective characteristics, & increase emotional involvement with the product

Implicit Advertisements

Product placement
Sponsorship arrangements
Subliminal advertisements

don't rely on explicit processing of message or recall of brand

Consumer product design

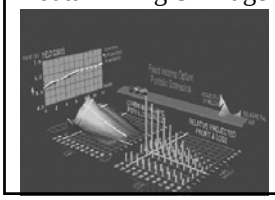
issues of:

user interface design
operability & usability
mental models & instruction-free designs
error tolerance & error reduction
accessibility for disabled users
aesthetics & generative design

Information representation

issues of:

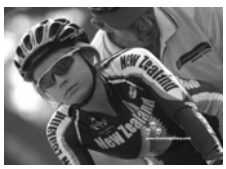
decision support systems
mental models & representation
avatars, telepresence & teleperformance
distributed & parallel problem solving
data mining & imagery

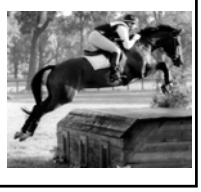


Sports Psychology

issues of:

perception & attention
expertise & automaticity
proceduralisation of motor performance
representation of domain knowledge
decision making (athletes & judges)





So,
What is Cognitive Psychology?

Ans: