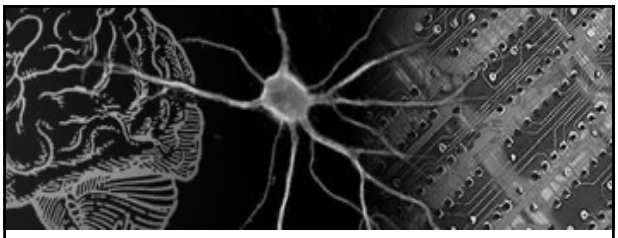

Welcome to PSYC305

Applied Cognition & Neuroscience

Mātai hinengaro whaipainga me te roro tāiao

Introductions

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Introductions

What is AC&N?

An overview of current theory in sensation, perception, attention, memory, decision-making, psychophysiology and neuropsychology and their application to current issues in aviation & aerospace, road transport, forensic psychology, product design, & information technologies

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Introductions

History of AC&N

John Flach, *The human capacity for work: A (biased) historical perspective*

Four Eras of Applied Psychology

Phase 1 – Scientific management

Phase 2 – Elimination of Human Error

Phase 3 – Information Overload

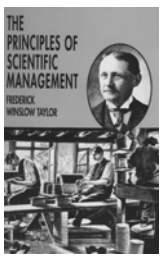
Phase 4 – Visualisation

Phase 1 **Scientific management** (Taylorism)

Fredrick Winslow Taylor -- **Scientific management** ***Principles*** published in 1909

Designed tools and processes to fit the worker

In 1881 studied coal shoveling, observed and timed workers at Bethleham Steel Works
Designed shovels for every task – reduced the number of people required to shovel from 500 to 140 (at 60% more pay)



Four fundamental principles:

1. Development of a science for each element of work
2. Scientific selection, training, and development of workers
3. "Spirit of hearty cooperation" between workers and management to ensure work would be carried out according to scientific principles
4. Division of work in equal shares between workers and management (hierarchical organisation structure, work incentives, task specialisation)

Hugo Münsterberg

Student of Wilhelm Wundt. 1st Chair of Psychology Laboratory at Harvard. Elected President of APA in 1898. Published in areas of forensic psychology, educational psychology, psychology of art, media psychology, clinical psychology, social values, & industrial accident investigation

Psychology and Industrial Efficiency (1913)
Three main sections: *the best possible man for the job*, *the best possible work*, & *the best possible effect*. The best possible man for the job dealt with personnel selection. The best possible work discussed factors affecting worker efficiency (e.g., monotony, attention & fatigue). The best possible effect discussed sales, marketing, and advertising

Münsterberg criticized scientific management for failing to take the psychological characteristics of the worker adequately into account. Scientific industrial psychology had to take the mental structure of the worker as seriously as it took the mechanics of work. Only in this way would *'mental dissatisfaction in the work, mental depression and discouragement...be replaced in our social community by overflowing joy and perfect inner harmony'*

Died suddenly while lecturing in 1916

Frank & Lillian Gilbreth

1912 -- implemented the employee suggestion box, rest periods, process charts, & ways to employ physically handicapped workers

Conducted "motion studies" (as opposed to "time studies")

"*Therblig*" – a motion step in a worker's task

Bricklaying – studied motion economy and raised standard output from 1000 to 2700 bricks per day

Surgical procedure is their best-known legacy, nurse handing instruments reduces time, increases efficiency, and had net result of improving surgical success

(Applied motion analysis to household tasks -- advocated "cheaper by the dozen" philosophy and had a family of 12 (subject of a book by Lillian and 2 Hollywood movies)

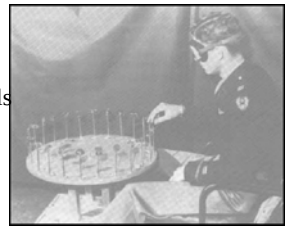
Phase 2 **Elimination of Human Error**

During WWII several significant centres & laboratories of Applied Psychology established

Applied Psychology Unit of Cambridge University:
studies of equipment design led by Sir Fredrick Bartlett
Armstrong Aeromedical Research Laboratory:
at Wright Field OH (now Wright-Patterson AFB)
led by Dr Paul M Fitts (LtCol).
The Psychological Corporation in NYC:
control & display design (later Dunlap &Assoc.).
Johns Hopkins University in Baltimore:
Navy contracts to study combat information centers

Studied equipment design problems leading to human errors (e.g. high rate of gear-up landings)

Many crashes were due to "blind activation" errors, confusion of flap & gear controls



Researchers conducted experiments on shape coding of aircraft controls

Led to standardisation of the shape and location of controls

3 types of control systems (tools)
manual, mechanical, & automated

Level I: Manual – human powered, human controlled
Level II: Mechanical – machine powered, human controlled
Level III: Automated – machine powered & controlled, human monitored

The role of the human operator has changed

use → control → monitor

What are the consequences of this change?

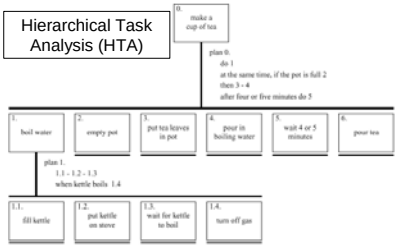
With manual tools, a mistake can injure the operator, result in loss of time, material, or damage the tool

Mechanical tools are more powerful, errors are magnified and more destructive

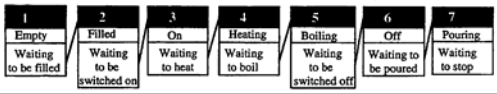
With automated tools, the cost of one operator error can be disastrous...

Error analyses & task analyses

Hierarchical Task Analysis (HTA)



State Space Diagram (SSD)



Fitt's Law: Movement time is a log function of distance for a constant target size

$$MT = a + b\log_2(2D/W)$$

MT = movement time
a + b = constants (from observation)
D = distance moved
W = width of target

Schmidt's Law: Movement speed for movements without visual feedback

$$W = a + b(D/MT)$$

1. Warrick's principle: the expectation that the pointer on the display will move in the same direction as that side of the control which is nearest to it. This principle applies only when the control is located to the side of the display.

2. Scale-side principle (for vertical displays): the expectation that the pointer will move in the same direction as the side of the control knob which is on the same side as the scale markings on the display. This principle operates when the control is at the top, bottom, or side of a vertical display.

3. Clockwise-for-increase principle: people will turn a rotary control clockwise to increase the value on the display no matter where the control is located relative to the display.

Phase 3 **Information Overload**

The design of systems began to exceed human attention & working memory capacity limits

Research into cognitive workload leads to simplification and integration of controls & displays

Phase 4 **Visualisation**

A shift in focus to understanding and representation

The kinds of mental representations we have can be influenced by the technology we use (situation awareness)
Those representations in turn affect the technology we build
"visualisation theories" are representations (theories) of how representation and technology interact

Bell Laboratories & Xerox PARC did a lot of early research on computer interface design. Move away from laboratory tasks and development of standards to field studies and domains of user knowledge.

Phenomenon-centered research

Phase 4 **Visualisation**

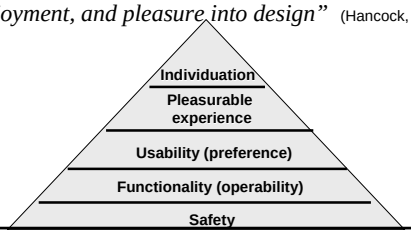
Norman's 7 principles for turning difficult tasks into simple ones

1. Use both knowledge in the world & knowledge in the head.
2. Simplify the structure of tasks.
3. Make things visible.
4. Get the mappings right.
5. Exploit the power of constraints.
6. Design for error.
7. When all else fails, standardise!

A fifth phase? -- Hedonomics

Switch from a focus on preventing error & unpleasant experiences to promoting pleasure

"To fulfill the needs of the user, we need to incorporate an explicit recognition of motivation, quality of life, enjoyment, and pleasure into design" (Hancock, 2005)



Two hedonomic principles:

Aesthetic longevity – aesthetic preference is a balance between novelty and typicality. Use of a classic form that can be updated over time (phone faceplates).

Seamless interaction – tool transparency. Promotes zone of optimal function (flow experience), enabling user to focus on the task not the tool

Jordan's four types of product-related pleasures (practical, emotional and aesthetic benefits associated with products)

Physio-pleasure Psycho-pleasure Socio-pleasure Ideo-pleasure

Physio-pleasure: sensory characteristics of the product; shape of the cellphone, texture of the pen or toothbrush, smell of the new car

Psycho-pleasure: emotional reactions, excitement of a video game, satisfaction from creating an artwork with photoshop

Socio-pleasure: social identity & status associated with the product; sports car, latest model cellphone, or name-brand clothing

Ideo-pleasure: values exemplified by the product; vegetarian shoes, hybrid automobile, t-shirt with social message

Future Challenges

Changing social interactions

Avatars: a representation of yourself that you can "send" anywhere to interact with others

Avatars can do things that we can't

Avatars can be who we aren't

What are the effects of cognitive tools on our lives?

Tools change what we can do

Cognitive tools change the way we think

Cognitive tools make us smart, they can also make us dumb

Technology is not neutral – it is always a two-edged sword
Every new technology has consequences that cannot be foreseen

What will be the cognitive consequences of a virtual world?

Welcome to PSYC305

Structure of the course

Outline available on-line @ Moodle

Recommended prerequisites: 2nd year papers in Cognitive, Perception & Physiological Psych

Assessment:

Test 1	30%
Test 1	30%
Laboratory journal	40%
Laboratory report 1	10%
Laboratory report 2	15%
Laboratory report 3	15%