Cognition & Design

PSYC305
Applied Cognition & Neuroscience

Ergonomics & Consumer Products

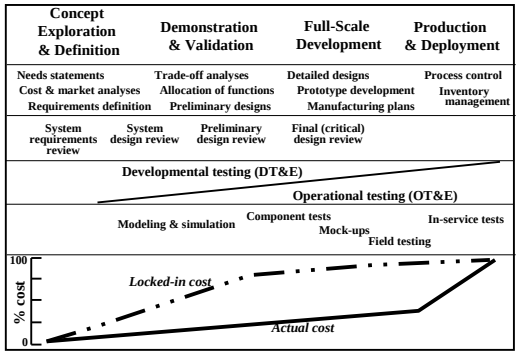
Product design process
- Product development phases
- Product requirements

The needs products are designed to fill
- Labour saving devices
- Ergonomic designs
- Error resistance & error tolerance
- Hedonomics & generative design

The role of advertising
- Consumer processing model (CPM)
- Hedonic emotional model (HEM)

The Product Development Process

4 distinct phases



Product Design
Idea generation

The initial product idea can come from either of two distinct paths

Technology "Push": identify promising new technology; validate a market opportunity, identify product features & requirements

Market "Pull": identify market needs; develop product requirements, identify technology solutions

Product Design
5 common idea sources

Surveying potential customers

Surveying suppliers, distributors, and salespersons

Analyzing warranty claims, customer complaints, and other failures

Bench marking: Comparing a product or process against the best-in-class product.

Reverse engineering: Carefully dismantling a competitor's product in order to improve one's own product.

Product Design
Identifying product requirements

Kano's 3 types of requirements
(Noriaki Kano 1984)

Normal Requirements are what we get by just asking customers what they want.

Expected Requirements are so basic the customer may fail to mention them – they only notice when they are absent. For example, if coffee is served hot, customers barely notice it. If it's cold or too hot, dissatisfaction occurs. Expected requirements must be fulfilled.

Exciting Requirements are difficult to identify because they are beyond the customer's expectations. For example, if full meals were served on a flight from Auckland to Wellington, that would be exciting. If not, customers would hardly complain.

Product Design
Identifying product requirements

Requirements identification is the most important stage but also the most difficult for engineering psychology

What does a cognitive psychology requirement look like?

The product must be user friendly

How do you design "user friendliness"?
How do you test to see if you succeeded?

Product Design
Identifying product requirements

Characteristic-based requirements

The product will comply with ISO safety standards for adult use

The product will comply with ISO safety standards for child use

Function-based requirements

The product will allow an average user to perform 10 error-free transactions within 10 mins

The design of consumer products came out of a tradition of "building a better mousetrap"
A product that filled an existing need by performing a difficult task more effectively or efficiently
A labour saving device

Some subsequent consumer products created new activities to fill the time saved (rather than making existing tasks easier)

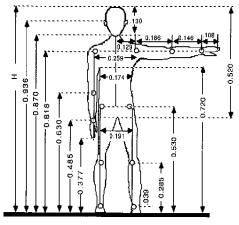
More features were added to make the consumer products more attractive to buyers

Design was task-centred or product-centred

Product design was based on an engineering solution

Consideration of the user of the product didn't arrive until the 1950's -- ensuring that the product sizes "fit" the consumers

Anthropometry
"physical fit"
5 to 95 = 95% of the population



Measurement (inches)	Males 95th	Males 50th	Males 5th	Females 95th	Females 50th	Females 5th
1- Forward Grip Reach	33.3	30.9	28.5	30.1	28.0	25.8
1a- Bust to Grip Reach	21.9	20.9	19.8	18.3	18	17.5
2- Elbow Height	46.9	43.5	40.2	43.1	40.2	37.2
3- Hip Height	39.2	36.0	32.9	35.5	32.8	29.9
4- Fingertip Height	28.5	26.0	23.4	27.4	24.8	22.2
5- Shoulder Height	61.0	56.7	52.4	56.1	52.2	48.2
6- Eye Height	71.9	67.3	62.8	64.2	60.0	55.9
7- Stature	79.5	69.1	64.6	68.1	64.0	59.8
8- Vertical Grip Reach	87.0	81.9	75.8	80.5	75.8	71.1

Many anthropometric standards were based on samples of military personnel not always representative of civilian consumers

Ergonomic designs

Design standards for "knobs and dials" were originally developed for military systems then adopted for use in consumer products

The use of anthropometry and ergonomics was introduced to minimise users' unpleasant experiences with the products (frustration, errors, pain)

More features can mean increased difficulty for some users (and sometimes safety issues)

Physical "fit" isn't enough to prevent problems

Designing for Error Resistance

The HAZOP approach
identifying & preventing hazards

Hazard – an event or situation that could result in injury to product users

Operability – a design configuration that allows the user to operate & control the product without error or injury

Models of Human Error

James Reason's three-level model of human error

Increasing frequency

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

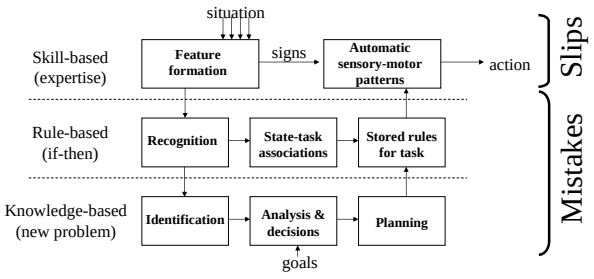
Mistakes: incorrect decisions, unskilled actions, intentional, conscious acts, *(closed-loop)*

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

Increasing severity

The SRK Model

Jens Rasmussen



Rule-based Mistakes

Example: It is usually correct to turn the wheels in the direction you want to go (unless you are skidding on ice)

Formulated as IF-THEN rules
But, the situation may be incorrectly classified (mode errors) or there may be exceptions or qualifications that are overlooked

Rule-based mistakes tend to be done with much confidence "*Strong but wrong*"

Knowledge-based Mistakes

Failure to understand the situation or consider alternatives (biases in decision making)

Representativeness & availability, anchoring & adjustment, confirmation bias, loss aversion, framing effects, & cognitive fixation

Many inadvertent rule "violations" are really decision or knowledge mistakes

Less confidence in knowledge-based errors

Preventing Human Error

To meet operability requirements you have to identify possible hazards & error modes

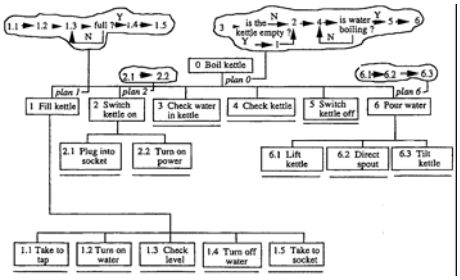
Task and error analyses

Hierarchical Task Analysis (HTA),
State Space Diagrams (SSD),
Task Analysis for Error Identification (TAFEI)
& Transition Matrices

Hierarchical Task Analysis (HTA)

(AKA functional flow analysis)

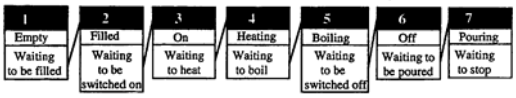
Typically three levels: functions, tasks, & resources required



Example: electric jug

State Space Diagram (SSD)

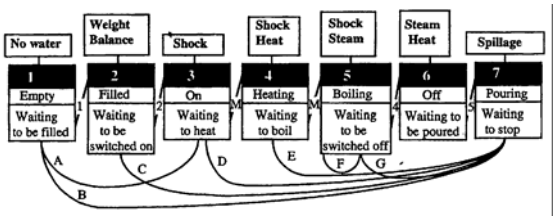
Alternative to HTA, shows the state of the operator and the equipment during each stage of operation



Example: electric jug

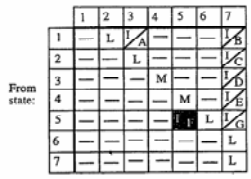
Task Analysis For Error Identification (TAFEI)

Builds on SSD, indicates possible hazards and error modes at each stage of operation



Example: electric jug

Transition Matrix



Examines all possible transitions from one state or task to another to identify possible errors and hazards

In the transition matrix each cell has been categorised as legal (L), illegal (I) or impossible (--). It is worth pointing out that transitions 3 to 4 and 4 to 5 are performed by the kettle and therefore have been labelled M (for machine). The illegal transitions (or errors) have been identified as:

A. Switching on an empty kettle.
B. Attempting to pour water from an empty kettle.
C. Pouring out cold water.
D. Pouring water before it is hot.
E. Pouring water before it has boiled.
F. Not switching off a boiling kettle (noted as a recursive transition).
G. Pouring water before the kettle has been switched off.

Example: electric jug

Designing for Error Resistance

Some product designs introduced ***Forcing functions*** to try to eliminate incorrect actions

Appliances that shut off when opened
- Washing machines
- Microwaves
- "deadman" switches

Products with audible alarms
- car ignition alarms
- refrigerator doors

Forcing functions are a "*hard technology*" makes the user adapt to the way the tool works

Forcing functions can increase safety, but they are relatively inflexible and unpopular

Error Tolerance

the ability of a system or component to continue normal operation despite the presence of erroneous inputs

Error-Tolerant Systems: *There is one positive aspect of errors - the opportunity to correct them. This gives the operator a sense of control. The operator must be given a chance to explore the functionality of the system. In an error-tolerant system one can recover by undoing action - there is a back-up option*

Error tolerant designs include "Undo" functions & informative error messages

Reflective & Experiential Cognition

Don Norman describes two ways of interacting with consumer products

Reflective cognition – requires you to explicitly consider the details of accomplishing the task
thinking about typing when writing an essay
Often occurs in the early stages of product use or skill acquisition
can be enjoyable for some tasks but can intrude on others

Experiential cognition – accomplishing the task automatically without explicit consideration
watching TV without thinking about how to change channels
Natural mapping & affordances enable a "flow experience"
don't require reflection, analysis or problem solving to use

Experiential Cognition

Factors that aid Flow:
Clear goals
Skills that match challenges
(sense of accomplishment)
Feedback and Reward
Sense of control

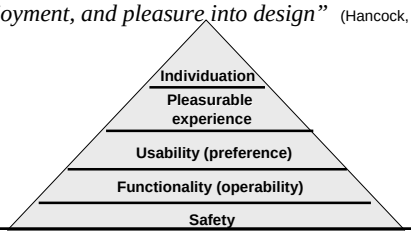
Outcome of Flow:
Loss of sense of time
Loss of sense of self
Loss of sense of space
Focused attention

A new type of product requirement

Hedonomics

Switch from a focus on preventing pain & 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

Designing for pleasure should be an explicit goal
(subordinate to safety, functionality, & usability)

Hedonomic design must still be empirically grounded

Need a "measure of pleasure"

Jordan's "pleasurability" ratings

Do aesthetic considerations determine product choice?

Generative Design Process
includes the affective, emotional character of product

EMOTIONAL

What are the different types of meaning users attach to their phones, i.e., status symbol, to be connected, security, etc.?
What inadequacies, frustration, inconveniences do people associate with their phones?
How is the phone perceived in terms of time management and productivity?
What element of fun, if any, is associated with cellular phone use?

USE

Other than the primary user who else uses the phone?
What other products is the phone used in conjunction with?
What is the process each person went through to learn their phone after it was purchased?
How does each person manage and store their phone numbers?
How do people take notes when using their phone?
How do people use their phone in relation to a pager and a two way pager?
Where do people typically use their phone, and in what way does this impact how the phone is used?
When people carry their phone with them, where do they carry it and where do they want to carry it?
What influences them to carry it the way they carry it?
What are the culture and gender specific uses of the phone? How do the international markets differ?
What are the culture and gender specific inhibitions associated with phones?
Along with battery charging what other different types of maintenance do people do, such as cleaning, etc.?
What are the different ways people use their phones, i.e., outgoing vs. incoming calls, voice mail, etc.?

Generative Design Process
focuses on user interactions with product
(& may include target users in design process)

A father and son collaborating on creating an ideal product using a velcro toolkit

The Role of Advertising

Walter Dill Scott
student of Wilhelm Wundt

1903 *The Theory of Advertising*
1908 *The Psychology of Advertising*

"advertising has as its one function the influencing of human minds... As it is the human mind that advertising is dealing with, its only scientific basis is psychology... Everyone is subject to the influence of suggestion; and suggestion, not reason, is the primary determinant of human action."

John B Watson
"Psychology as the Behaviorist Views It"
Baby Albert Experiments

Resigned from John Hopkins University in 1920 after an affair with Rosalie Raynor
(his research assistant on the Baby Albert experiments)

Took up a position at J. Walter Thompson advertising agency working for Stanley B. Resor

Stanley B. Resor, Head of J. Walter Thompson Agency believed in "laws" of human behavior & scientific investigation:

"*Whenever one of us goes to the theater or picks a necktie, we are responding to definite laws. For every type of decision – for every sale in retail stores – basic laws govern the actions of people in great masses*" (Resor 1921)

To understand consumers better, Watson spent the summer as a clerk at Macy's department store

Concluded that different brands of a product were indistinguishable to consumers; their buying decisions must be based on the product's image instead of on the product itself

Watson originated or popularised many advertising methods still in use today

Celebrity endorsements: Watson got the Queen of Romania and the Queen of Spain to do testimonial ads for Ponds Cold Cream. Sales increased dramatically.

Watson originated or popularised many advertising methods still in use today

Infomercials – creating a "need": Watson conducted a half-hour educational radio broadcast explaining how stimulation of the salivary glands is beneficial to healthy teeth. Although the brand name was never mentioned in the program itself, the sponsor was Pebeco toothpaste, "*specially formulated to stimulate the salivary glands*" .

But wait, there's more! If listeners requested the additional information that was offered, they received a free sample of Pebeco toothpaste with its new and improved flavor (hitherto known for its foul taste)

Used behavioural principles to develop a campaign for Lucky Strike cigarettes
"Reach for a Lucky instead of a sweet"
"LS/MFT"

Watson was a success.
In 1924, Watson became president of J. Walter Thompson Agency.
Moved to William Esty Agency until retiring in 1945

Estimates of the number of ads we are exposed to each day range from 500 - 3,500 ads

30% of local TV news broadcast time is devoted to advertising

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

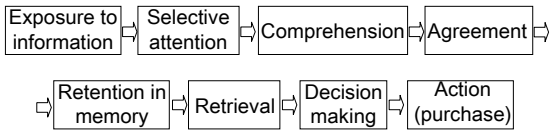
Advertisers still rely heavily on Psychological Principles to design their campaigns

Explicit Advertisements -- CPM
Implicit Advertisements – HEM

Consumer Processing Model (CPM)

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

8 stages:



Stages 1 & 2: Exposure to Information & Selective Attention

Get the consumer's attention
and put the message in working memory

What attracts our attention?

- Personally Relevant Stimuli
- Pleasant Stimuli
  - Humor
  - Music
  - Attractive models/celebrities
- Surprising stimuli
  - Novelty
  - Unexpectedness
- Easy to process stimuli
  - Prominent stimuli
  - Concrete/specific stimuli
  - Contrasting stimuli

Initial processing of advertisements begins prior to conscious understanding.

Ads produce an emotional responses before conscious reflection 'kicks in' (implicit effect)

Novelty and motion in images grab our attention automatically

Humorous & unusual images also grab our attention automatically

24 - 42% of all television ads contain some form of humor.
Consumers rate humorous ad campaigns very positively.

Celebrities are frequently used to add visual attractiveness to advertisements

Source Attractiveness – "*What is beautiful is good*" stereotype

Halo Effect – assume persons of high status on one dimension excel on others as well

Celebrities are successful endorsers because they embody specific status, social class, gender, age, & personality types

Particularly effective for products that have high social risk

Once you've got their attention what do you do with it?

Stage 3: Comprehension & Understanding -- create meaning out of signs and symbols

Signs: Derive their meaning from other items in the ad context

Symbols (logo): associated with a brand name
Symbol and referent have no prior intrinsic relationship

created with simple association, simile, metaphor, or allegory

Simile

Uses comparative terms (*like* or *as)* to associate items from different classes of experience

Metaphor

Create a picture in consumers' minds and tap into meaning shared both by the advertiser and consumer

Allegory

A story underneath a story
(something other than what is literally represented

Often used in advertising of potentially offensive products

Stage 4: Agreement

Convince consumers of something
consumers' agreement depends on whether the message is credible & appealing

Informational ads communicate the product's best features & positive outcomes of purchasing beauty, health, safety, wealth, status, etc…

Stages 5 & 6: Retention & Retrieval

Techniques to Enhance Memorability

Jingles
Slogans
Taglines
Logos (symbols)
Story schemas
Repetition

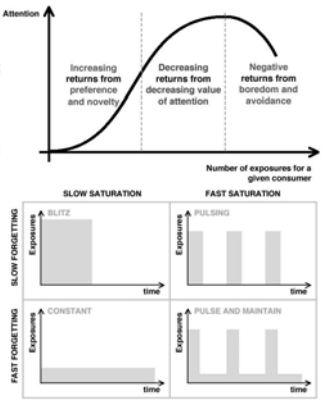
The Truth effect
Belief in an ad claim due simply to prior exposure

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

Mahajan & Muller's formula for advertising frequency

$$\frac{dA}{dt} = f(u(t))(1 - A) - b \times A$$

A	Aided recall (indirect awareness)
$f(\ )$	S-shaped function
$u(t)$	Media plan (as a function of time)
b	Forgetting rate



Timing of advertising campaigns' can be based on conspicuity and memorability of the ads

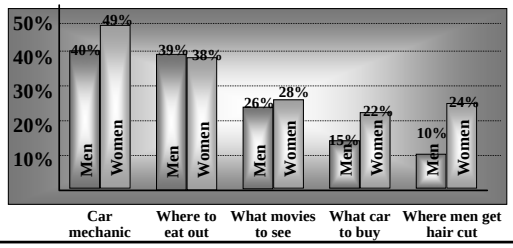
Advertisements are targeted at specific consumers

most often women & kids

Women make 82% of all consumer purchases

Women purchase 60% of all new cars

Even in "joint decisions", women do the deciding



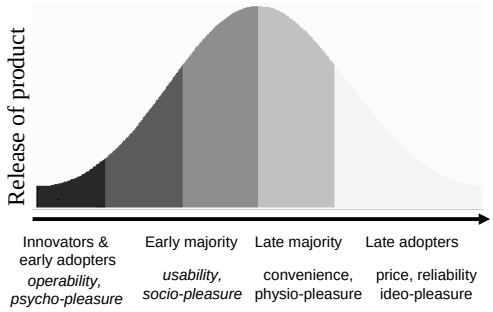
The Asch Effect:
the effect of a reference group on individual decision-making (groups whose values & standards influence a person's behavior)

2 requirements:

The product must be one that others can see & identify.

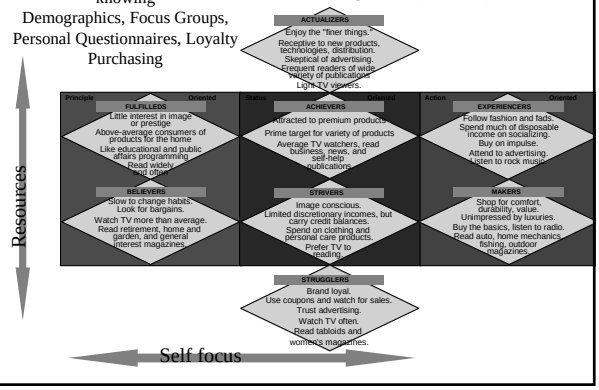
The purchased item must be conspicuous; stand out as unusual, a brand or product that not everyone owns.

Different segments of the user population value different aspects (at different times)



Advertisers know a lot about us – just about everything worth knowing
Demographics, Focus Groups, Personal Questionnaires, Loyalty Purchasing

Values & Lifestyles categories (VALS)



Hedonic Emotional Model (HEM)

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

Affective association works implicitly
(via classical conditioning)

requires lower levels of cognitive resources and conscious involvement
(effective for those lacking ability to process complex messages -- kids)

relies on associations between product cues and feelings produced by stimuli such as exciting visuals, celebrities, music, color, sexy images
outcome is attitude toward the product or brand

The effectiveness of explicit advertisements is typically measured by explicit recall & recognition tests

Affective (HEM) ads aren't particularly memorable but they work for some types of product

Emotional responses – Glavanic skin response (GSR) vs verbal ratings

Promotional Claim/Offer	*GSR Score**	*GSR Ranking†*	*Verbal Ranking‡*	*Market Results*
1-cent sale	.300	1	4	1
Special saving	.284	2	3	2
Sampler	.248	3	1	3
Macramé	.231	4	2	4

Implicit Advertisements

Product placement
Sponsorship arrangements
Subliminal advertisements

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

Implicit Advertisements such as product placement get many of the benefits (affective association, source attractiveness, celebrity endorsement, etc.) without the potential downside of "wear out"

Product Placement

simply getting the product / brand in the public eye
no explicit message

ET -- Reeses Pieces & Pizza Hut
Seinfeld & *Friends* have lots of product placements

Extremely popular even though
traditional measures of success (recall tests)
show weak or mixed results

Research shows a negative correlation between awareness of product placement and positive brand affect
(if it is too obvious there is a "Boomerang Effect")

Product Placement

Corporations have moved from demanding royalties when their products appeared to
now paying the shows to include their products

The False Familiarity Effect
Product or person judged as "famous" 24 hrs after exposure without recall of when or where exposure occurred

The (Mere) Exposure Effect
Familiarity leads to liking an object

Product Placement Hall Of Fame:
the Reeses Pieces in *E.T* (sales shot up by 65% after these candies appeared in the movie)
Budget Rent-a-Truck in *Home Alone*
Red Stripe Beer in *The Firm* (within a month of the film's release, sales of Red Stripe in the U.S. rose by 50%)
the "Junior Mints Episode" of "Seinfeld"
Pizza Hut Pizza and Nuprin pain relievers in *Wayne's World*
the "Reebok scene" in *Jerry Maguire*
Ray Ban glasses in *Risky Business* and *Men in Black*

Visa card, Avis car rentals, BMW cars and motorcycles, Smirnoff vodka, Heineken beer, Omega watches, Ericsson cell phones and L'Oreal makeup in *Tomorrow Never Dies*
Chanel perfume in *Anastasia* (the first time product placement appeared in an animated picture)
Hasbro action toys in *Small Soldiers*

Implicit advertising can be very effective for low involvement purchase decisions

Low involvement purchase decisions are low-cost & low risk,
little or no information search or explicit consideration of alternatives (except price).
The products usually don't involve any personal consequences and are often immediately consumed.
Examples: can of soda, candy bar or a bar of soap.

Consumers aren't always consistent with their preferences due to a range of situational factors
Situational factors are especially prevalent in low-involvement consumer behavior

Explicit advertising is best for high involvement purchase decisions

High involvement purchase decisions can be expensive, have serious personal consequences, and/or reflect one's social image.

They typically involve extensive information search, explicit consideration of several product attributes and brands, and discussion with others.
Example: purchase of an automobile or stereo system.