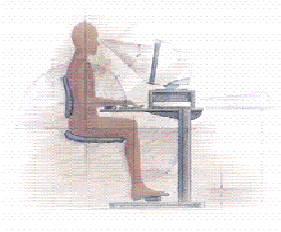
CMPE 233: Human Factors

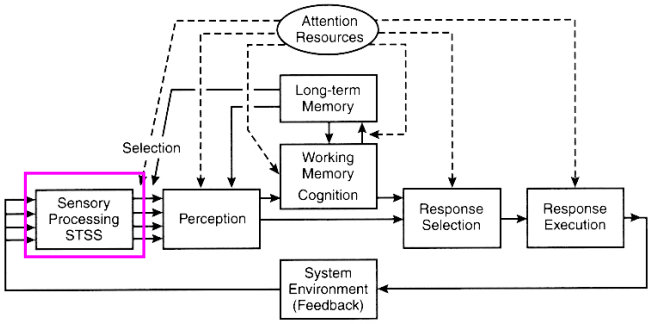


Biological basis of psychology and sensation. Human Information Processing, Visual System

Why is it important?

- Return from Salyut (1971)
  - 3 Soviet cosmonauts died returning from the Soviet space station Salyut in the Soyuz 11 command module
  - Physiological effects of rapid decompression
    - brain is oxygen-starved
    - pockets of air in sinuses explode shattering the facial bones
    - cells in body expand, arms and legs balloon
    - roughly 45 s until unconsciousness
- Why did the accident happen?
  - Failure to perform proper functional analysis
  - Elimination of back-up systems
  - Design did not take into account the constraints of the environment and human limitations

A Model of Human Information Processing



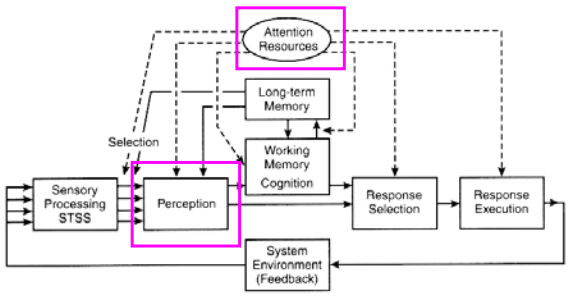
Sensory Processing

- For human factors, the primary emphasis is on the visual, auditory, and proprioceptive senses of the body, although some olfactory displays do exist (e.g., additives to natural gas that allow us to detect leaks)
- Proprioception
  - Perception of body states e.g., need to urinate, stomach ache
  - also includes kinesthetic sense → limb position
  - can refer to knowledge of your body's orientation in space – the direction of gravity
- Characteristics of the senses apply important constraints on human performance

Short Term Sensory Store (STSS)

- Each sense has a mechanism for prolonging the representation of the physical stimulus for a short period
- Characteristics of the STSS
  - pre-attentive: information is stored whether you attend it or not
  - veridical: does not change or process the stimulus appreciably
  - decays rapidly (iconic memory for vision = 200-300 ms; echoic memory for sound = 2-8 s)

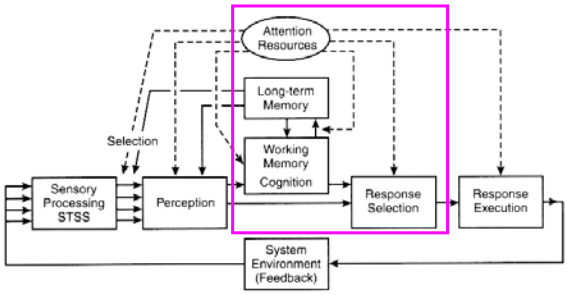
Perceptual Encoding and Attention



Perceptual Encoding and Attention

- Perceptual Encoding: incoming sensory information is interpreted in the context of previous experience (information in long-term memory)
- Top-down and bottom-up processing
  - Top-down: contribution of previous experience
  - Bottom-up: contribution of incoming data
- Perceptual encoding is limited by attention
- Attention
  - selection of information for further processing "attentional searchlight"
  - pool of resources - limitation to the number of stimuli or tasks one can attend
  - attention limits also apply to decision making and response execution stages

Decision making

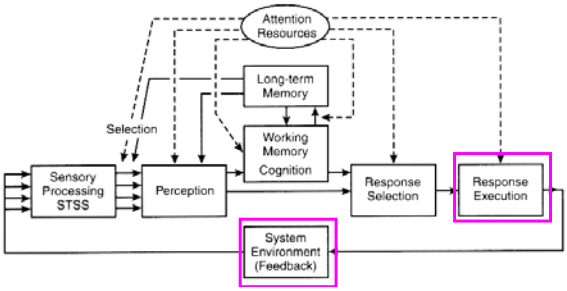


Decision Making

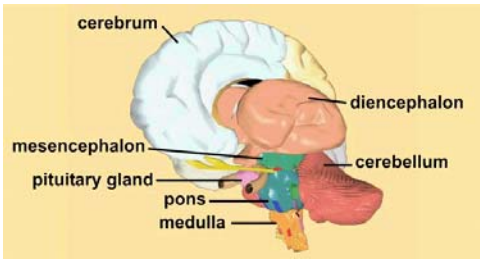
- Once a stimulus is perceived, we must decide what response to make
- Automatic vs. controlled decisions
  - automatic: quick
    - no attention needed
    - learned reflexes
    - long-term memory procedure executes automatically in response to the stimulus
  - controlled: slow
    - attention required, typically conscious of thoughts
    - interaction with *working* and *long-term memory* systems
    - may involve rehearsal (to store new information)
    - weighing of costs and benefits

Response Execution and Feedback

- Once the decision has been reached to execute a particular response the complex motor movements of the response must be executed
- Typically, we monitor the consequences of our actions, producing *closed-loop feedback*
- Model is circular rather than linear



The Brain

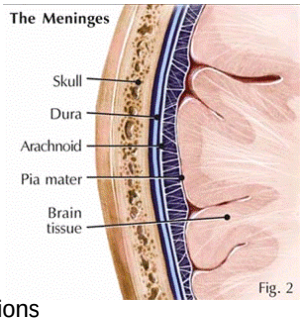


- 6 major regions
- Cerebrum
  - Largest part
  - Controls higher mental functions
  - Divided into left and right cerebral hemispheres
  - Surface layer of gray matter (neural/cerebral cortex)
- Cerebellum
  - Second largest part of brain
  - Coordinates repetitive body movements
  - 2 hemispheres
  - Covered w/ cerebellar cortex

The Brain

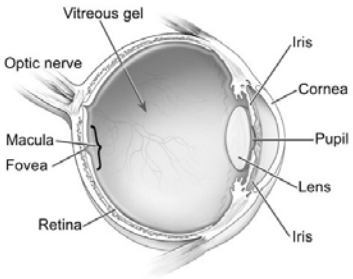
- Diencephalon
  - Links cerebrum with brain stem (mesencephalon, pons & medulla)
  - R & L Thalamus: relays and processes sensory information,
  - Hypothalamus: hormone production, emotion, autonomic function
  - Pituitary Gland: interfaces nervous and endocrine systems
- Mesencephalon/midbrain
  - Processes sight, sound, and associated reflexes
  - Maintains consciousness
- Pons
  - Is involved in both somatic and visceral motor control
- Medulla Oblongata
  - Connects brain to spinal cord
  - Regulates autonomic functions: heart rate, blood pressure, and digestion

Brain Protection and Support



- Physical protection:
  - bones of the cranium
  - cranial meninges
  - cerebrospinal fluid
- Biochemical isolation:
  - blood–brain barrier
  - Isolates CNS neural tissue from general circulation
  - Formed by network of tight junctions
- Cranial Meninges - 3 layers:
  - dura, arachnoid, pia mater
  - Protects the brain from cranial trauma

The Eye

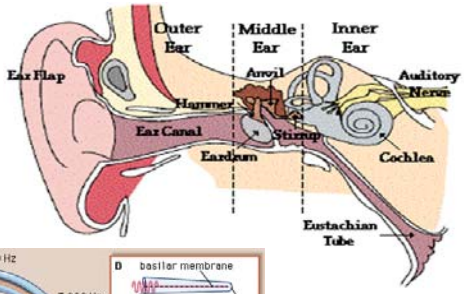


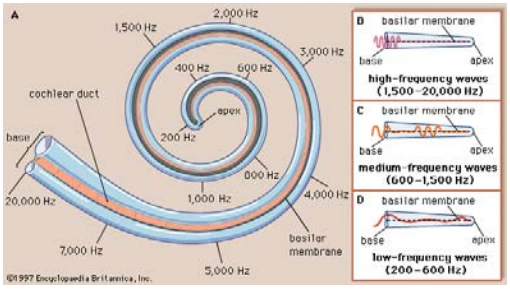
- *cornea*: transparent covering; protects the eye, bends light to provide focus
- light enters the eye through the *pupil*, a small adjustable opening
  - size of the pupil adjusted by *iris*, a circular colored muscle
- *lens*: transparent structure behind the pupil that changes shape to focus an image on the back of the eye

The Retina

- *retina: light-sensitive* inner surface of the eye
  - *rods*: retinal cells/receptors that detect black, white, and gray; necessary for peripheral and twilight vision
  - *cones*: retinal cells that detect colors and fine detail; function in daylight and well-lit conditions
  - *fovea*: central part of the retina with the highest density of cones and the highest resolution (contains virtually no rods)
- rods and cones connected to *ganglion cells*
  - ganglion cells' axons create the *optic nerve* (a bundle of nerve fibers that carry messages from the retina to the thalamus)
  - no rods or cones at spot where optic nerve leaves eye (blind spot)

The Ear



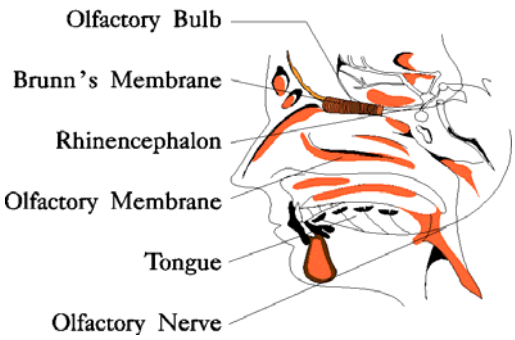


Structure of the Ear

- sound waves enter the ear and strike the *eardrum* (*tympanic membrane*)
- ear drum vibrations move the three tiny bones in the ear (*hammer, anvil, stirrup)*
  - bones amplify sound and transmit it to the *basilar membrane*, which is inside the cochlea
- basilar membrane lined with tiny projections called hair cells
  - hair cells : hearing :: rods and cones : vision
  - vibration in bones causes basilar membrane to vibrate
  - vibration in basilar membrane causes hair cells to fire, triggering neural impulses to brain

The Chemical Senses: Taste & Smell

- rely on sensing the presence of certain chemicals



Smell

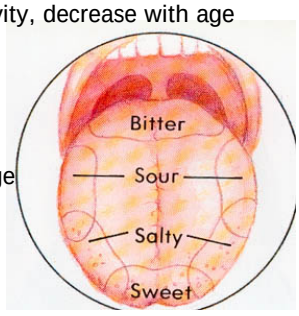
- Molecules of certain substance sensed by about 5 million receptor fibers on the roof of each nasal cavity
- Different receptors for different smells (about 1000)
- Like colors, we detect smell by the combination of receptors that fire → around 10K smells detectable by humans
- some people are 20x more sensitive to smell than others (Rabin & Cain, 1986)
- most people think they are good at detecting smells, but are surprisingly poor at it (de Wijk et al., 1995)
- Cain (1979): people correctly identify only about half of 80 common smells
- women better than men (Cain, 1982)
- young adults better than children (up to 14) or middle-aged adults (40-50) (Cain & Gent, 1991; de Wijk & Cain, 1994; Murphy, 1986)

Smell and Memory

- Herz et al., 2004
  - Participants placed in a scented room, played a computer game that was rigged so they would always lose (frustration) while exposed to either same smell/different smell/no smell
  - Results: same smell group gave up task earlier than other two groups
- Smells can also evoke pleasant memories
- Why are smell and memory so closely linked?
  - *evolutionary explanation*: smell used by most mammals to detect food (good or bad) and poison
  - *biological explanation*: two major neural tracks that deliver olfactory information – thalamus to hippocampus (memory) and limbic system (emotion)

Taste

- *Taste buds*: microscopic structures on the bumps on the tongue surface, at the back of the throat, and inside the cheeks
  - taste buds die and are replaced every 10 days (McLaughlin & Margolskee, 1994)
  - number of taste buds and sensitivity, decrease with age (Cowart, 1981)
- Taste and smell closely related
  - aspartame (NutraSweet) tastes sweeter when smelling vanilla (Sakai et al., 2001)
  - both types of information converge on same region of frontal lobe critical for perception of flavor (Schul et al., 1996)



Somasthetic Senses

- Senses that have to do with perceiving the body and its position in space
  - specifically touch, kinesthetic sense, vestibular sense, pain sense
- Touch (skin = largest organ)
  - millions of sensory receptors; combinations of receptor activation lead to different types of touch
  - sensory cortex divided by body part; more cortex = more sensitivity (Weinstein, 1968) → most sensitive hand, least sensitive back.
  - brain tuned to be more sensitive to unexpected stimulation
  - women more sensitive to touch than men (Weinstein, 1968)

Somasthetic Senses

- *kinesthetic sense*: the sense that registers the movement and position of the limbs → 2 types of specialized cells
  1. in tendons (connect muscles to bones); triggered by tension
  2. in muscles themselves; triggered by length of muscle
- *vestibular sense*: the sense that provides information about the body's orientation relative to gravity
  - relies on *semicircular canals* in the inner ear
  - filled with fluid and cilia (tiny hairs); detect balance by sensing fluid's movement

Pain

- A product of bottom-up and top-down processing.
- bottom-up: damage to a portion of the body sends signals to the sensory cortex (parietal lobe), indicating a problem
- top-down: brain anticipates pain, body feels expected pain
  - Armel & Ramachandran (2003): slightly bent unseen fingers of participants while simultaneously severely bending finger on fake rubber hand
  - participants "felt" severe twist; reported more pain, increased perspiration
- Despite how it feels, pain is a *good* thing for us.
  - alerts us to something wrong, signals us to change behavior
  - people born without ability to feel pain usually die by early adulthood

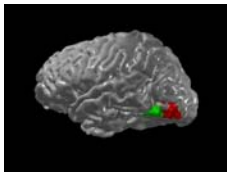
Gate-Control Theory of Pain

- Theory that the spinal cord contains a neurological "gate" that either blocks pain signals or allows them to continue to the brain (Melzack & Wall, 1965)
  - 2 types of nerve fibers in spinal cord: short and long
  - short nerve fibers: conduct pain signals, open the gate
  - long nerve fibers: conduct most other sensory information, close the gate
  - one way to treat pain may be to activate long nerve fibers via massage, electric stimulation, or acupuncture (Wall, 2000) → e.g. rubbing the injured area

Controlling Pain

- pain at the intersection of mind and body
  - can be controlled by physical or psychological interventions?
- painkiller operates on physical level (bottom-up)
  - but, placebos activate some of the same brain structures as painkillers (and work to alleviate pain!) (Petrovic et al., 2002; Wager et al., 2004)
- Lamaze classes: relaxation (deep breathing, muscle relaxation), counterstimulation (gentle massage), and distraction (focusing on something else)
- Surgery patients whose rooms face trees require less pain medication and recover more quickly than those whose rooms face brick walls. (Ulrich, 1984)

Synesthesia

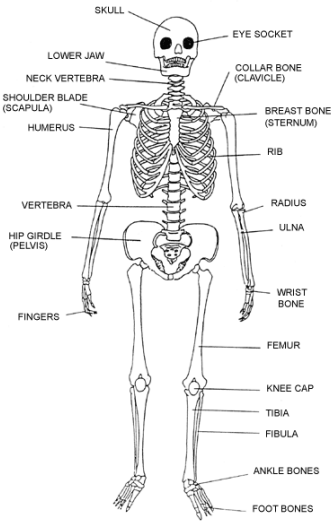


- comes from the Greek *syn* ("union") + *aisthises* ("of the senses")
- phenomenon in which stimulation of one sensory pathway leads to automatic experiences in a second sensory pathway
  - up to 1 in 23 people experience synesthesia
- lots of forms; almost any two senses can be linked via synesthesia
- Why does synesthesia happen?
  - increased communication between specialized parts of the brain that are physically close to one another?
  - e.g. letter/number recognition (green) and color processing (red)

Synesthesia

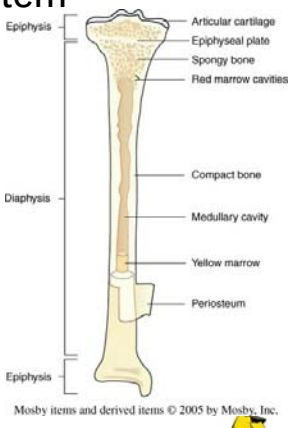
- *grapheme → color synesthesia*
  - letters and/or numbers associated with specific colors
  - associations vary from person to person, but there are some common pairings (e.g. A and red, O and white/black, S and yellow) (Day, 2005)
- *music → color synesthesia*
  - specific tones or songs associated with specific colors
  - again lots of variation, but still some common trends (e.g. higher pitches = brighter colors) (Ward et al., 2006)
- *lexical → gustatory synesthesia*
  - individual words and sounds associated with experience of specific tastes (e.g. /k/ paired with taste of eggs)
  - very rare form of synesthesia, not yet well understood
- How do we know that synesthesia is real?
  - *test-retest reliability: 90% for synesthetes vs. 30-40% for non*

Human Skeleton



Skeletal System

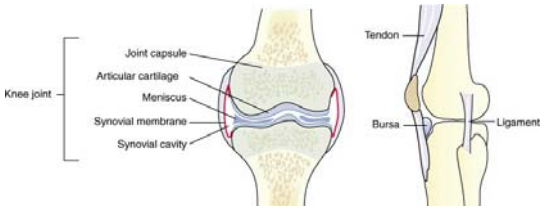
- Provides a framework for the body, protects the soft body parts such as the brain, stores calcium, and produces blood cells
- Provides movement, posture, joint stability, and heat production
- 206 bones, 600+ muscles



Bone Structure

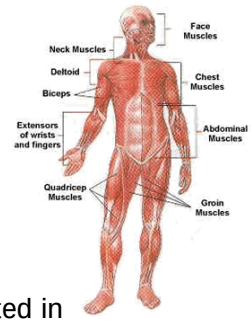
- periosteum: outermost layer of the bone, made up of fibrous tissue
- compact: dense, hard layers of bone tissue that lie underneath the periosteum
- Cancellous/spongy: looks like a sponge and is encased in the layers of compact bone
- endosteum: membranous lining of the hollow cavity of the bone
- diaphysis: shaft of the long bones
- epiphysis: ends of the long bone
- bone marrow: material found in the cavities
  - red marrow: thick, blood-like material (location of blood cell formation)
  - yellow marrow: soft, fatty material

Joints

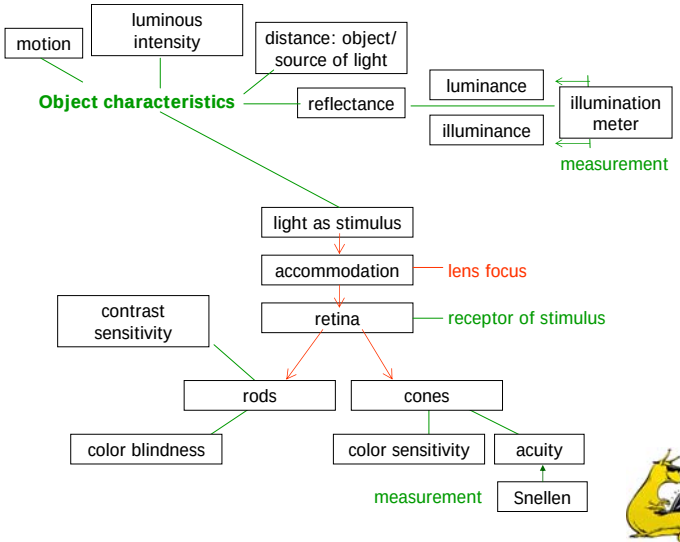


- hold bones together and make movement possible
  - ligament: flexible, tough band of fibrous connective tissue that attaches one bone to another at a joint
  - tendon: band of fibrous connective tissue that attaches muscle to bone
  - bursa: small, fluid-filled sac that allows easy movement of one part of a joint over another
  - meniscus: crescent-shaped cartilage found in the knee
  - intervertebral disk: cartilaginous disk found between each vertebra in the spine
  - synovia: fluid in joint cavities

Muscular System



- Skeletal muscles (striated): attached to bones by tendons and make body movement possible.
  - produce action by pulling and by working in pairs.
  - A.k.a voluntary muscles → we have control over these muscles.
- Smooth muscles (unstriated): located in internal organs such as the walls of blood vessels and the digestive tract.
  - A.k.a. involuntary muscles → respond to impulses from the autonomic nerves
- Cardiac muscle: forms the wall of the heart.
  - Its involuntary contraction produces the heartbeat.



Light as Stimulus

100,000 Sunny Day

35,000 Cloudy Day

10,000 Atrium

1,000 Exhibition Hall

500 Office Evening restaurant

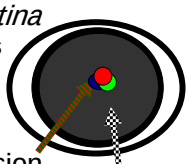
100 Cinema Planetarium

- Luminous intensity is measured in candalas (cd), or lumens, 1 cd = 12.57 lumens.
- Illuminance is the amount of light shining on an object, measured in foot-candles (fc): intensity/d^2; d=distance in ft
- Luminance is the amount of light reflected from an object, measured in foot-lamberts (fL)
- Reflectance is determined by the surface and color properties of an object; how much light is absorbed or thrown back at the viewer. It's a ratio of
  - The measured reflectance of the target surface,
  - The measured reflectance of a *standard* Kodak neutral test card = 0.9

  Reflectance = 0.9 x L_{target} / $L_{standard}$

Vision: the eyes

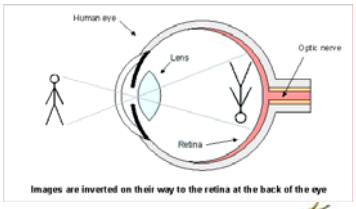
- Lens focuses light to the *retina*
  - Light passes through the lens
  - Focused on the retina
  - Rod cells (periphery)
  - Cone cells (fovea)



- Central 1-2° gives *foveal* vision
- Remaining 180° gives *peripheral* vision
- Cone cells
  - Detect color and hi-res images
  - X-ganglia (wires from the cell to the brain) provide early pattern detection.
- Rod cells
  - Good for low levels of luminance
  - Y-ganglia permit early movement detection
  - Sense shades of grey but can't detect colors.

Inversion of Images

- image projected upside down on retina, once it passes through lens
  - receptor cells in retina convert light into neural impulses, which are organized by brain into meaningful structures
- vision is constructed by brain, rather than merely received
  - retinal cells extremely sensitive and specialized
  - *feature detector neurons*: nerve cells in the visual cortex that respond to very specific features of a stimulus, such as shape, angle, or movement

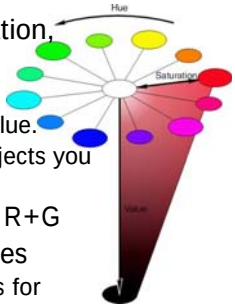


Visual Information Processing

- serial vs. parallel processing
  - *serial processing*: processing of information step-by-step in a specific order (e.g. computers, conscious problem solving)
  - *parallel processing*: processing several aspects of information simultaneously (e.g. vision, many other brain activities)
- brain simultaneously perceives color, depth, movement, and form (Livingstone & Hubel, 1988)
  - integrates information "on-the-fly" and allows for almost instantaneous recognition of objects

Color vision

- Cone cells detect color (hue, saturation, value) through photo-pigments.
  - mainly reds (64%); few blues (4%).
  - Center of retina (high acuity) has no blue.
  - Means disappearance of small blue objects you fixate on.
- Brightness is determined mainly by R+G
- Shapes are detected by finding edges
  - combine brightness & color differences for sharpness
  - harder to deal w/ blue edges & blue shapes
- Color is a product of our brains' transduction of light waves.
  - We can discriminate 7 million+ colors



Color vision

- Different wavelengths of light focused at different distances behind eye's lens
  - need for constant refocusing → fatigue
  - be careful about color combinations
- More saturated colors = more focusing
  - don't use saturated colors in UIs unless you really need something to stand out (warning)
  - pastel colors are cleaner
- Objects do not "possess" color (in a sense, the tomato isn't red, it's everything but red…)
  - Wavelengths of red light are reflected from the tomato
  - "The [light] rays are not coloured." (Newton, 1704)

How we see the world

Visual disability

- Normal: 20/20: the ability to read letters of a certain size (the norm for one's age) from the eye chart placed 20' away
- 20/40 = You need twice the size to read at 20'
- Registered blind = 20/200
- At least 1.5M blind and visually impaired Americans use computers
- Only 10% blind people read Braille
- The most common AT: screen magnifier/reader

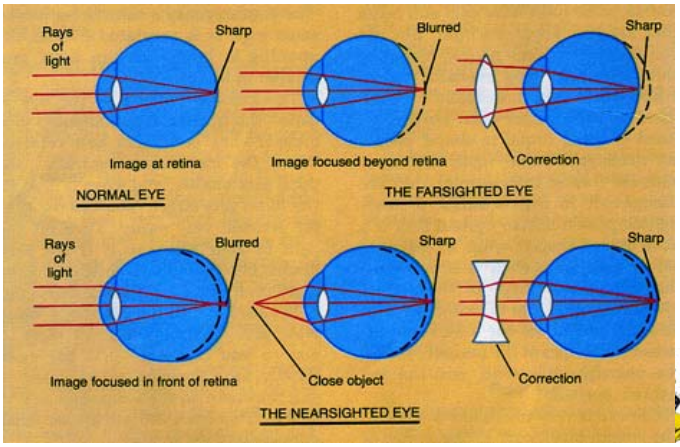
Myopia (short-sighted)

Hypermetropia (far-sighted)

Cataracts

Glaucoma

Nearsightedness & Farsightedness



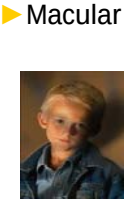
Visual disability

Color Blindness

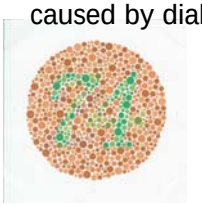
- *8-10% male and 0.5% female populations experience some form of color deficiency*
- Protanope
  - 1% males, “red-weakness”
- Deuteranope
  - 5% males, “green-weakness”
- Tritanope
  - blue/yellow deficit

Ageing-related

- Macular Degeneration



- Retinopathy (mostly caused by diabetes)



Visual Disability

Normal vision

Protanope

Simulated using Vischek
(http://www.vischeck.com/vischeck/vischeckURL.php)

Deuteranope

Tritanope

Designing with color

- Before designing with colors, ask:
  - Does color add something that cannot be provided by black and white?
  - Is the chosen color appropriate for the text or object?
  - Does the color provide cues to improve understanding or memory?
  - Are there any visual problems that may make the information less legible (dyslexia, color blindness, aging)?

- On-screen color varies widely from device to device for two reasons
  - Device calibration (gamma setting, 1.8 for PC, 2.2 for Mac)
  - Inability to display certain color (color replacement)

Designing with color

- http://websitetips.com/colortools/sitepro/
- Use contrast for structure & hierarchy
- Color palettes
  - Monochromatic
  - Complementary
  - Analogous

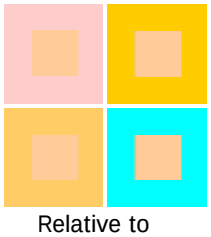
Designing with color

White on Red | White on Green | White on Black | Red on Yellow — Good

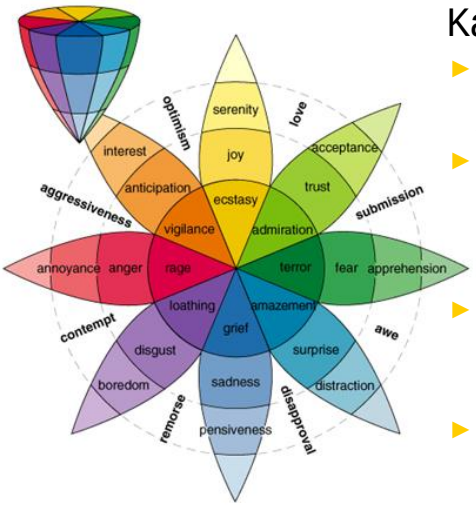
White on Blue | Yellow on Black — Better

Red on White | Black on White
Black on Yellow | Green on White — Best

Blue on Yellow or Orange | Red or Orange on Green
Green on Red or Orange | Yellow or Orange on Blue — Bad



Relative to surrounding



Kansei's colors

- Invented by Nagamachi in Japan in 1970
- KANSEI study seeks the structure of emotions, which exists beneath human behaviors
- Used a lot in customer product (first used in the US by Mazda)
- Not just colors

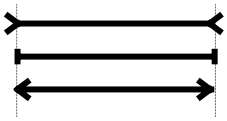
Color Meanings: Culturally Specific

Color	Western European	Japanese	Chinese	Arabic
Red	Danger Aristocracy (France)	Anger, danger	Joy, festive occasions	
Yellow	Caution, cowardice	Grave, nobility Childish, gaiety	Honor Royalty	Happiness Prosperity
Green	Safe Sour Criminality (France)	Future Youth, energy		Fertility, strength
Blue	Masculinity Sweet Calm Authority	Villainy		Virtue, faith, truth
White	Purity Virtue	Death, mourning	Death, mourning	
Black	Death Evil			

http://www.princetonol.com/groups/iad/lessons/middle/color2.htm

Sensation and Perception

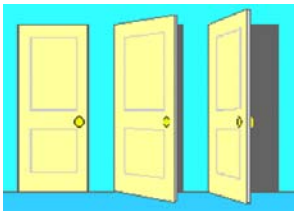
Muller-Lyer Illusion



- Sensation = sensing our environment through touch, taste, sight, sound, and smell
- Perception = the way we interpret these sensations and therefore make sense of everything around us

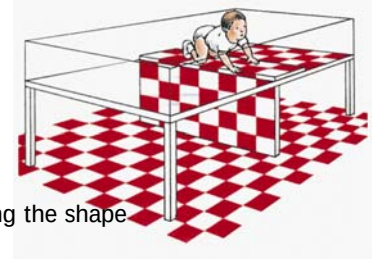
Perception: "knowing"

- Gestalt psychology
  - Perceptions are formed by grouping of stimuli based on prior knowledge
- Object constancy
  - When landing, you just "know" that the houses are real (size)
  - You just 'know' that the door maintains its shape



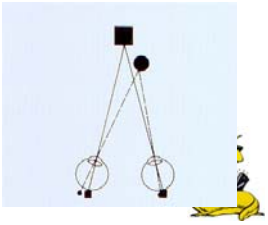
Depth Perception

- the ability to see objects in 3D, even though the images that strike the retina are in 2D
  - Allow us to judge distance
- depth perception is at least partly innate
  - Visual cliff studies (Gibson & Walk, 1960)
  - Also in newborn animals
- ability to perceive depth is due to:
  - binocular cues
  - monocular cues
- Actual depth
  - strain of muscles controlling the shape of the lenses codes depth



Binocular cues/Stereoscopic vision

- cues to depth perception that arise from the use of both eyes working together
- 2 eyes have slightly different views of the world because they are in slightly different places
  - need to cross eyes slightly to focus object on fovea of both eyes
  - doing so leads other objects to appear on different spots in the 2 retinas (*retinal disparity*: the difference between the images striking the retinas)
  - more disparity = closer object; less disparity = further object



Monocular cues

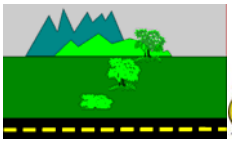
- *relative size*: closer object appears larger
- *relative clarity*: hazy objects are perceived as being further away than clear objects (light scatters in the atmosphere)
- *texture gradient*: objects far away seem smoother and more closely packed
- *relative height*: objects higher in field of vision appear farther away



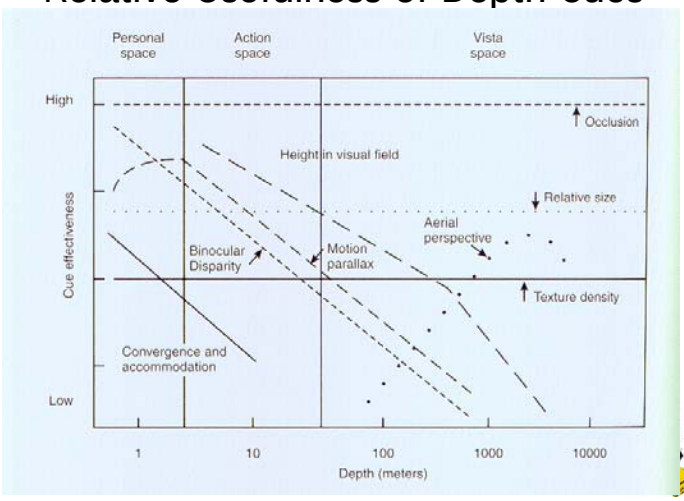
Monocular cues

- *interposition*: objects that block the view of another are perceived as being closer
- *relative motion (motion parallax)*: as we move, stationary objects seem to move backward → objects further away move at slower pace than closer objects.
- *linear perspective*: parallel lines appear to converge with distance
- *light and shadow*: nearby objects reflect more light to our eyes (dimmer objects seem further away)





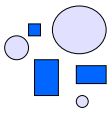

Relative Usefulness of Depth Cues



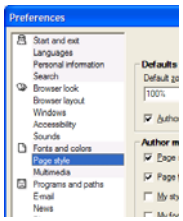
Gestalt Psychology – Law of Perceptual Organization

1) Proximity (grouping)

2) Similarity (color/shape)

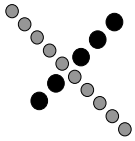


3) Closure

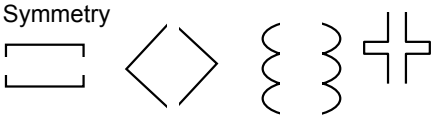
Gestalt Psychology – Law of Perceptual Organization

4) Continuity




6) Figure-ground

5) Symmetry




Perceptual Organization

- Preattentive processing
  - objects and groups of objects are segregated
  - figure-ground relationships established
  - course level of detail (global)
  - automatic: requires no attentional resources
- Focal (Attentive) processing
  - certain objects selected for further processing
  - requires attentional resources (working memory)
  - fine level of detail (local)

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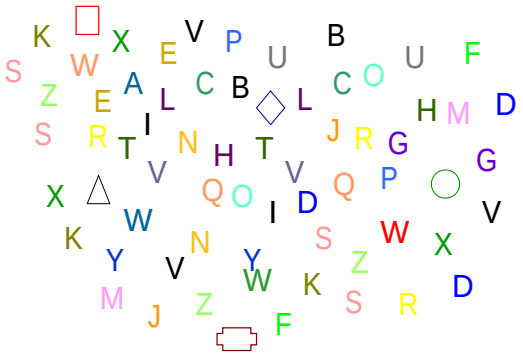
Visual Search

- Serial search: sequential scanning of stimuli needed to detect target (attentive processes)
  - search time increases as # of display elements increases (positive time-numerosity slope)
- Parallel search: target "pops-out" of multi-element display without scanning (pre-attentive processes)
  - search time is constant as # of display elements increases (zero time-numerosity slope)
- Expectancy Effect: search where we *expect* targets to occur, e.g., football quarterbacks, radiologists
- Availability Effect: search where it is easiest and most obvious (can overcome expectancy)
  - inexperienced drivers may not check mirrors because they are not obvious

Helping Visual Search

- Saliency: some types of stimuli tend to draw our attention → processed preattentively
  - motion or flickering
  - bright, colorful (high contrast)
  - large size (global)
- Ranked speed
  1. Shapes
  2. Size
  3. Color
  4. Alpha characters → %, >, <, ?
  5. Characters → vary by character (A is faster)

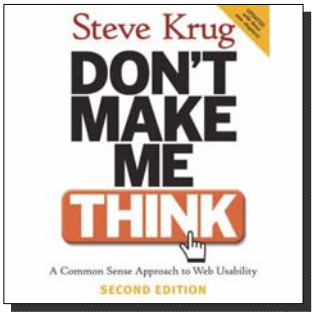
Find the Red Letter; Find the 'A', Find the triangle



Don't Make Me Think

Don't Make Me Think
By Steven Krug
A Common Sense Approach to Web Usability

- Guiding Principles
  - First Law of Web Usability
  - How we *really* use the web
  - Omitting needless words
- Best Practices
  - Street Signs and Bread Crumbs
  - Usability vs. Design
- Applications
  - Usability testing
  - Accessibility, CSS, etc.



Krug's First Law of Web Usability:
"Don't make me think!"

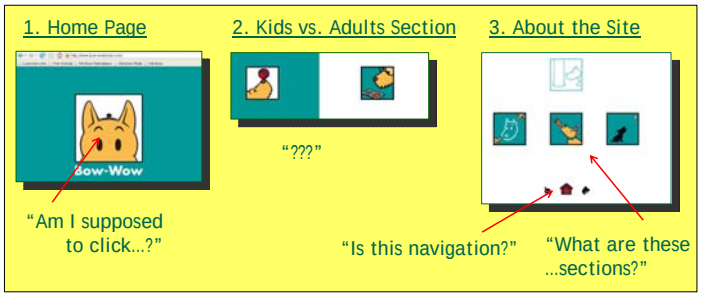
- Pages should be obvious, self evident, self explanatory
- "Oh, it's a _____! Duh!"

Krug's First Law of Web Usability:
"Don't make me think!"

VS.

Krug's First Law of Web Usability:

"Don't make me think!"

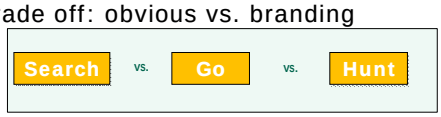


- Not-so-obvious or self evident
- Every thought has question marks. Not sure where to go
- Not sure what site is even about

Krug's First Law of Web Usability:

Things that make us think

- Unfamiliar Terminology
  - Marketing induced
  - Company Specific
  - Ex: Search
  - Trade off: obvious vs. branding

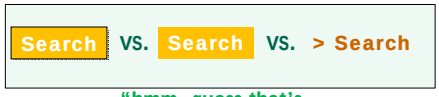


"Click!" "hmm..Click!" "Is that Search?"

Krug's First Law of Web Usability:

Things that make us think

- Links / Buttons That Aren't Obviously Clickable
  - User should NEVER have to devote ms of thought



"Click!" "hmm..guess that's a button" "Is that a button?"

- The Point: Eliminate Question Marks
  - Every question mark adds to user's cognitive workload
  - Distracts user from task at hand
  - People don't *like* to puzzle over how to do things
  - Not making things obvious can erode confidence in the site and its publishers

Krug's First Law of Web Usability:

Example: Bookstores

Quick Search

VS.
Amazon.com

"What's 'Quick Search'? Is that the same as 'Search'?"
"Hmm..do I have to click on that drop down menu? All I want is that book by Al Gore..."
Clicks on drop down menu
"Well...I guess he would be the 'Author'. Though I'm not actually sure if he wrote it himself..."
Chooses "Author"
Types "Al Gore" -> Clicks Search

Types "Al Gore" -> Clicks Search

Krug's First Law of Web Usability:

Self - Evidence

- Every site should convey to users:
  - Where am I?
  - Where should I begin?
  - Where did they put ___?
  - What are the most important things on this page?
  - Why did they call it *that*?
  - Blah blah blah
  - Yata yata yata
  - Etc etc.
- Most Importantly
  - Apply the basic principle of ELIMINATING QUESTION MARKS!

Krug's First Law of Web Usability:

Discussion

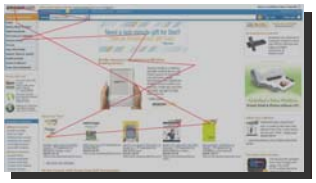
- Self – Evidence vs. Self – Explanatory ?
  - If you can't make a page self-evident, at least make it self-explanatory
- Is the average user really that "challenged"?
  - Humans are very good at adapting, no?
- http://www.bow-wowbooks.com/
  - Is their site really that bad? What can they do?
- When is usability more important?
- When is branding / innovation / identity more important?
  - Do you stick to bad layout, logo, slogan if those define your product?

How We Really Use The Web

- Users pore over each page
- Read all of our text
- Figure out how things are organized before they make a decision

What we design for
vs.
The reality

- Users *glance* at each page
- Scan *some* of the text
- Click first link that catches their interest



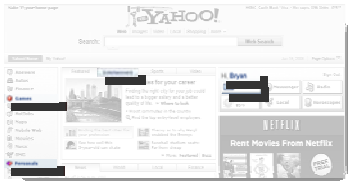
3 Facts of Life

#1 - We don't *read* web pages. We *scan* them

- We're usually in a hurry
  - Use web to save time
- We know we don't *need* to read everything
  - Just the task at hand
  - Everything else is irrelevant
- We're good at it
  - We scan newspapers, magazines, books for parts we're interested in

3 Facts of Life

What we build



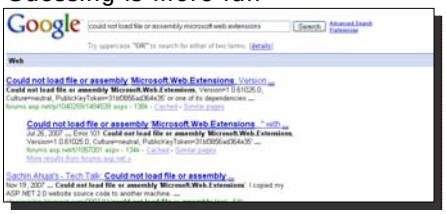
What user sees

- Words or phrases to match
  a) The task at hand
  b) Our personal interests
  c) Trigger words (ex: "Free", "Sale", our own name)

3 Facts of Life

#2 – We don't make optimal choices. We **Satisfice**.

- Satisficing
  - Not choosing the *best* option
  - Choosing the first *reasonable* option
- Why?
  - We're in a hurry
  - Not much penalty for guessing wrong (excp: 56k…)
  - Weighing options doesn't improve chances
  - Guessing is more fun



3 Facts of Life

#3 – We don't figure out how things work. We muddle through

- *Most* people don't read instructions
- Instead we muddle through to figure out how something works
- We manage to get things done that way!
- Example: How people use the internet

- Other Examples
  - Videogames
  - Cell Phones
  - Windows Vista

- Why does this happen?
  - Apathy
  - We find something that works and stick to it

What do you do?

Q: My audience is acting like I design *billboards*. What do I do?

A: Design great *billboards*…

Billboard Design 101

5 Important Things You Can Do:

1. Create a clear visual hierarchy on each page
2. Take advantage of conventions
3. Break pages up into clearly defined areas
4. Make it obvious what's clickable
5. Minimize noise

1. Clear Visual Hierarchy

Most important headings are…

- Larger
- Bolder
- Distinctive color
- Set off by white space
- Near top of page

Very Important

A little less important

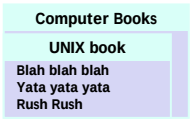
Nowhere near as important

Related Logically → Related Visually

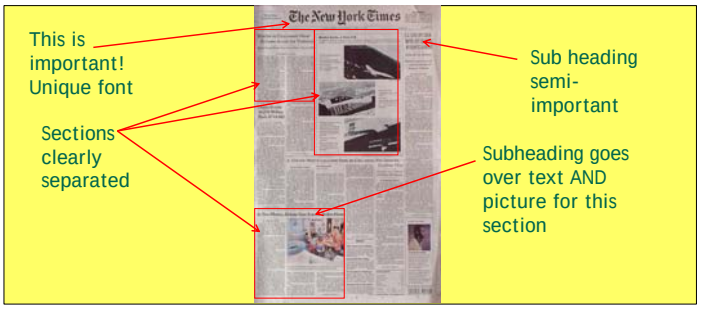
- Group together under a heading
- Similar visual style
- Clearly defined area

Sections are nested

- Ex: Books



Clear Visual Hierarchy



"This is all natural to me!"

Clear Visual Hierarchy

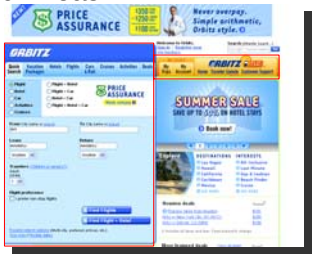
- Visual Parsing
  - FACT: The only time we're aware of this is when we can't do it
  - Flawed visual cues make us think, or even miss-understand
  - Good hierarchies *pre-process* the page for us (how the author intended it to be parsed)
- Lexicographic Parsing
  - Ex: "Bill put the cat on the table for a minute because it was a little wobbly."
  - Ex: "Q: Would you rather the crocodile attack you or the alligator?"

Conventions

- Conventions as commonality
  - Ex: Knowing *how* to read one newspaper helps us learn to read ALL newspapers
  - Every publishing medium develops conventions
  - Web conventions exist and are still being developed
  - They're useful because they work
  - Designers are often reluctant to take advantage
- Innovation
  - When should you innovate?
  - When should you just go with convention?

Clearly Defined Areas

- Identifying…
  - *This* is where I can _____. And *This* is where the _____ are! And if I need to _____, this is where I do *that*!
  - Should be able to do this within seconds
  - Establish which areas to focus on and which areas can safely be ignored
  - FACT: Users decide quickly which sections they want to explore and often NEVER visit the other sections



Designing Pages For Scanning, Not Reading

Make it obvious what's clickable

Q: How many links are on this page?

- FACT: Users are constantly looking for the next thing to CLICK
- Even while they're still reading!
- Identifying links should be mindless
- Links have conventions too
  - What are they?

Designing Pages For Scanning, Not Reading

Minimize Noise

- Busy-ness
  - Everything on a page clamoring for attention
  - Lots of shouting!
- Background noise
  - Tiny bits of visual noise wear us down
  - Need to "turn the volume down" on other noises