

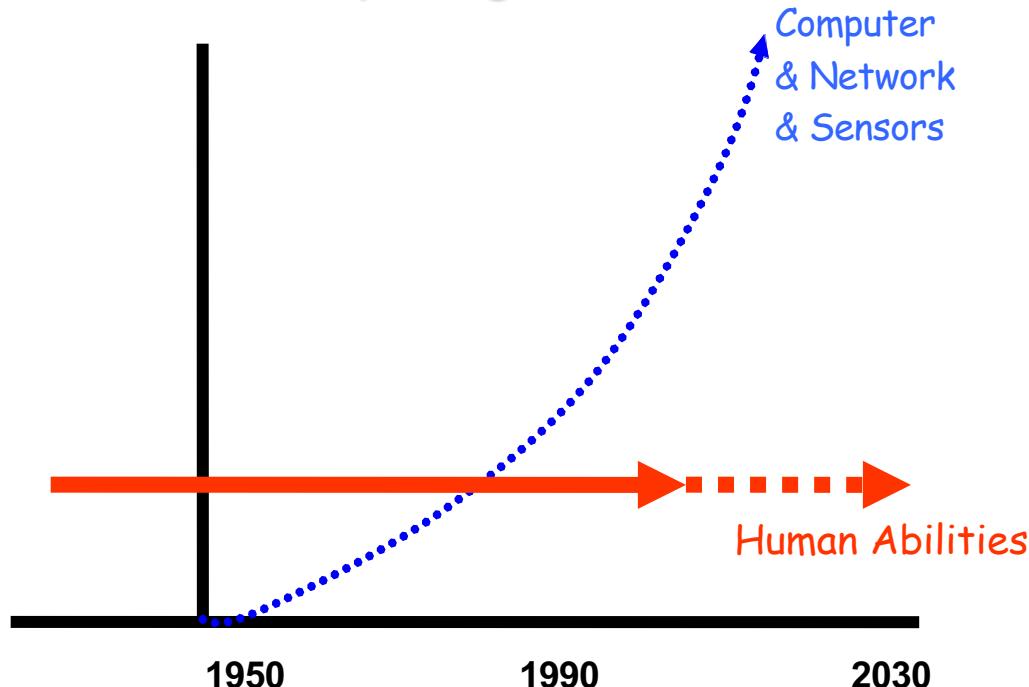
Human Abilities

- It's easier to understand the machine side (as complicated as computers) than to come to grips with the far more complex and variable of human side.
 - Age, Gender, Cultural background, level of expertise
- **Chap 1 Human Factors:** Ergonomics, Perception and Cognition
- **Chap 2 Human Information Processing Model**



• Chap 1 Human Factors

Human *vs* Computing devices



Humans are limited in their capacity to process information

• Chap 1 Human Factors

Human *vs* **Computing devices**

Complex interaction among

- Complex human @ society
- Complex computer & network
- Complex things around us @ sensors

▪Expect computer & network can be used

- more productively / efficiently
- in easier way / natural way / in wider area

- **Chap 1 Human Factors**

- 1.1 Ergonomics**

- fitting to the physical body**

- 1.2 Perception**

- sensing the world**

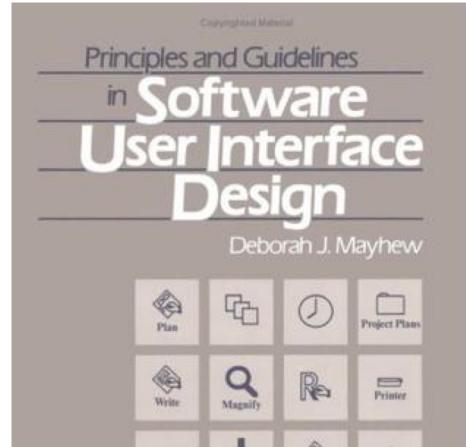
- 1.3 Cognition**

- attention to the world**

1.1 Ergonomics

- Interacting with us physically are reasonably straightforward
- Computer relevant ergonomics:

Mayhew (1991): Principles and Guidelines in Software User Interface Design. Chapter 12, input and output devices, p379-433



1.1 Ergonomics: fitting to the physical body

The International Ergonomics Association definition:

Ergonomics (or human factors) is the scientific discipline concerned with **the understanding of interactions** among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance.

In essence it is the study of designing systems that fit **the human body and its cognitive abilities**.

1.1 Ergonomics: fitting to the physical body

- Related terms:

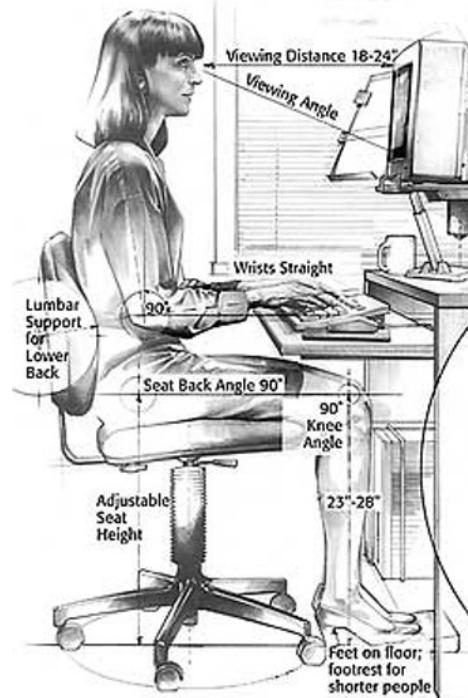
Human Factors

Human Factors Engineering

Human Engineering

Engineering Psychology

Q: Your desktop Screen Size?



1.1 Ergonomics: fitting to the physical body

- Targets:
 - ✓ To make sure that **the task is structured** to fit the person performing it.
 - ✓ To deal with making **the performance of task** more pleasant and efficient.
 - ✓ To enable the design of **the working environment and the workplace** to conform to the needs of people, their capabilities and how they prefer to perform.

1.1 Ergonomics: fitting to the physical body

- Research area:
 - Traditionally, used to design equipment, tools, etc. for use when user is constrained in posture.
 - The comparative study of size and proportions of the human body.
 - More recently, being applied to design of computers that are *wearable* or *portable*.

1.1 Ergonomics: fitting to the physical body



- Ergonomic research on **size** of mobile devices



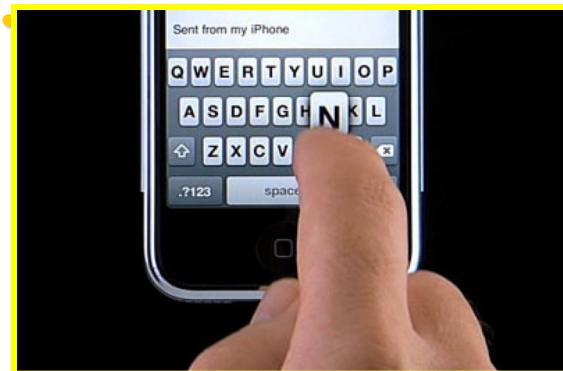
1.1 Ergonomics: fitting to the physical body



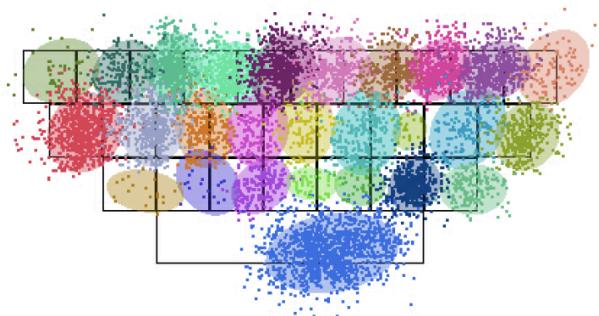
The size of touch target?

- Ergonomic research on **size** of mobile devices

- **Pocket or handbag?**
- **One hand operation?**
- **Battery life?**
- **Visibility?**
- **Icon size and arrangement?**



1.1 Ergonomics: fitting to the physical body



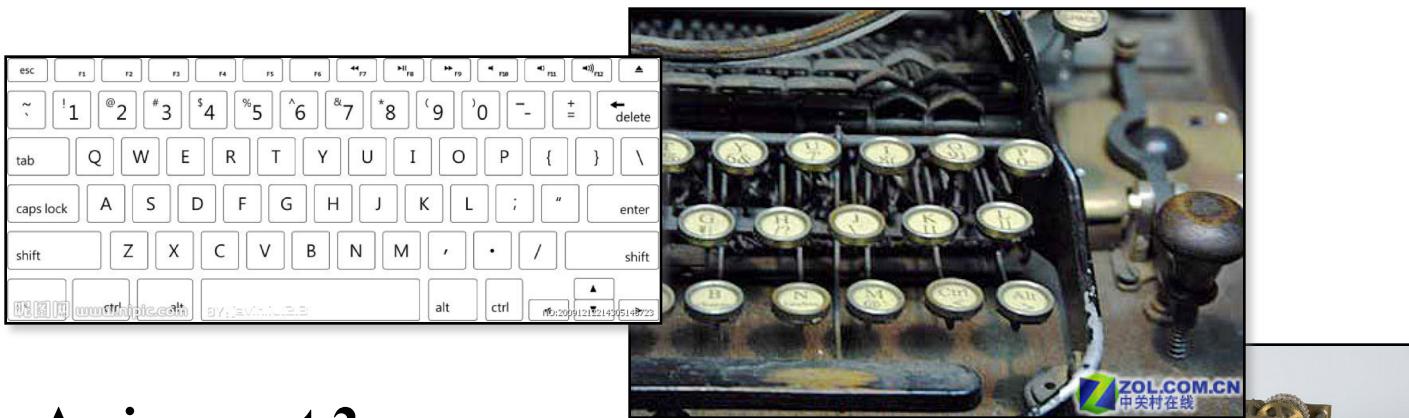
Average Error Rate for individual key is above 50%

Fat finger problem



1.1 Ergonomics: fitting to the physical body

- Keyboard Design as a case study



The image consists of two photographs. The left photograph shows a standard QWERTY keyboard layout with various keys labeled including esc, f1-f12, tab, caps lock, shift, and function keys. The right photograph is a close-up of an antique typewriter's keyboard, showing individual keys with letters like A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z, along with symbols like !, @, #, \$, %, ^, &, *, (,), -, +, =, and delete.

Assignment 2:

1. Why “QWERTY”?
2. faster/more comfortable solutions?
3. Why we still use QWERTY keyboard today?

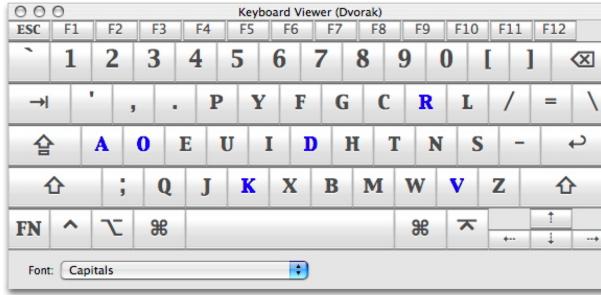


1.1 Ergonomics: fitting to the physical body

- Keyboard



Fixed Split Keyboards maintain the standard key-spacing and size while introducing an opening angle and some vertical angling of the keys.



DVORAK is faster

The **DataHand** is largely in a class of its own, being a hybrid somewhere between a standard and cording keyboard



1.2 Perception: sensing the world

Sensors:structure and physics

Physical: *vision, sound, touch*

Chemical: *smell, taste, pain*

- Related terms:

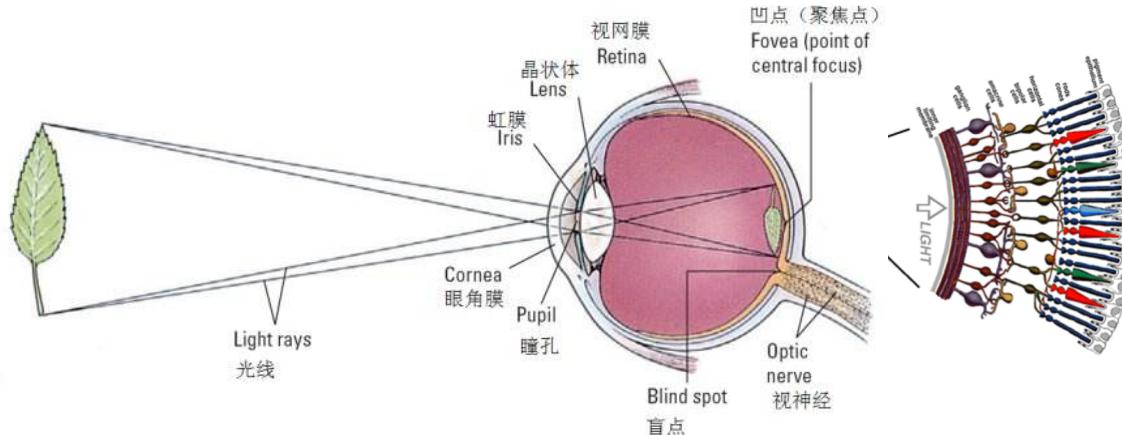
Human Factors

Physiology

1.2 Perception: sensing the world

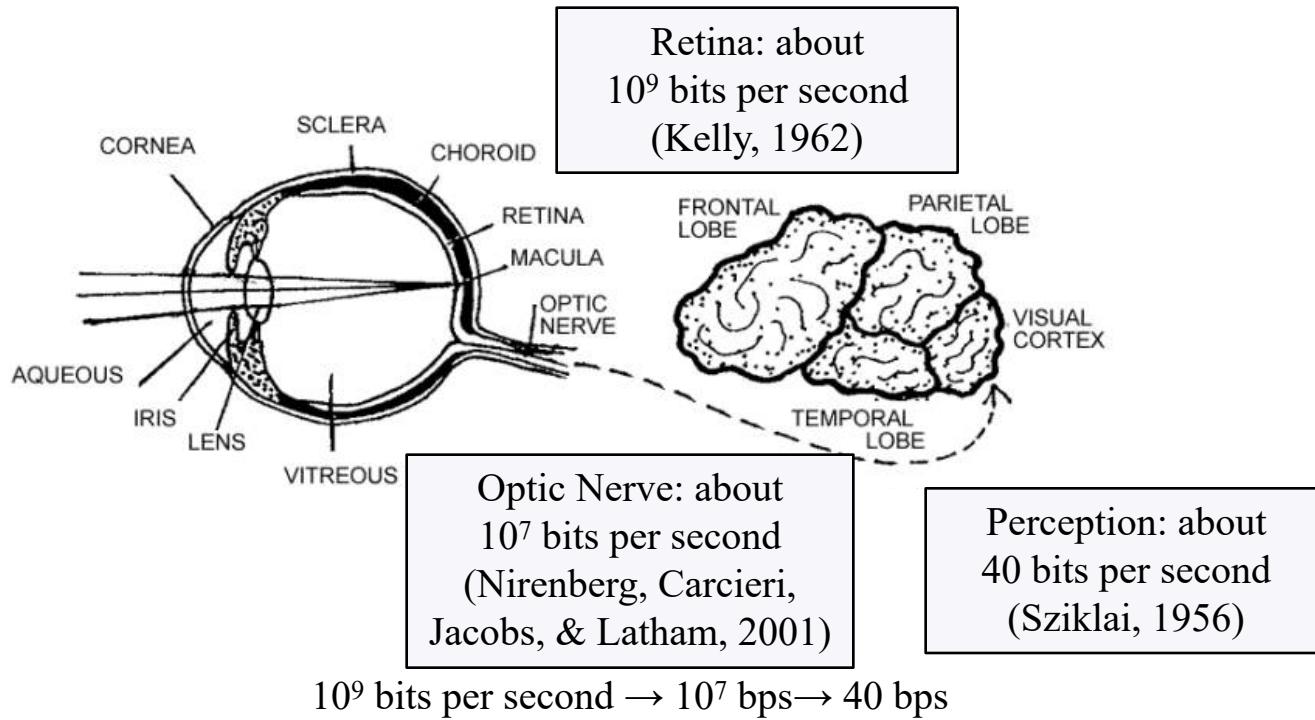
Sensors:structure and physics

Physical: *vision*



1.2 Perception: sensing the world

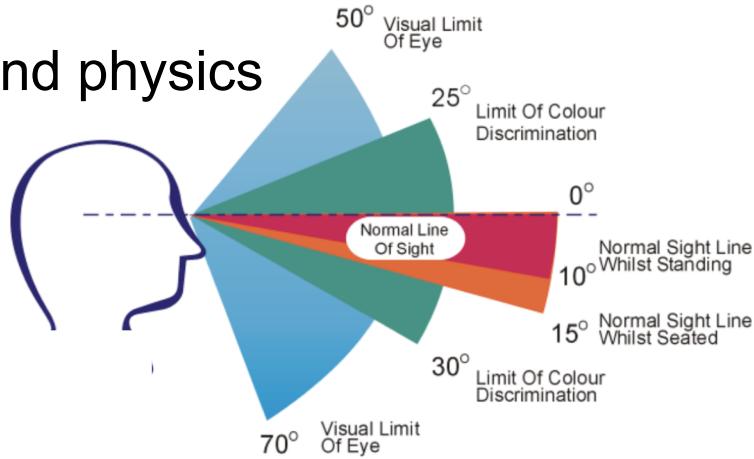
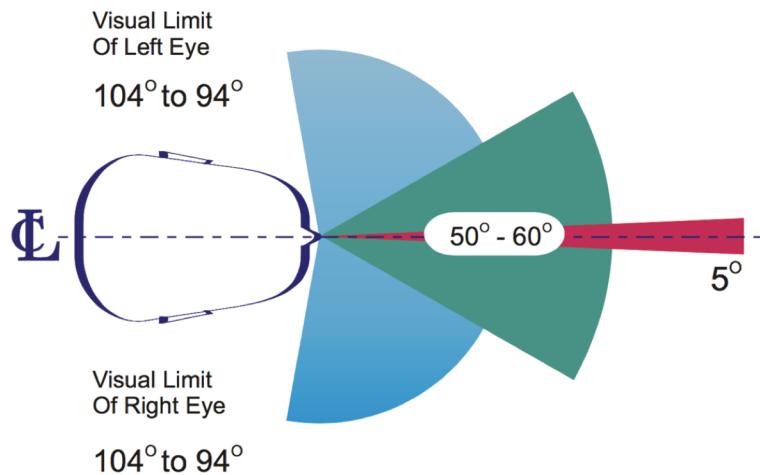
Information Flow in Human Visual System



1.2 Perception: sensing the world

Sensors:structure and physics

Physical: vision



1.2 Perception: sensing the world

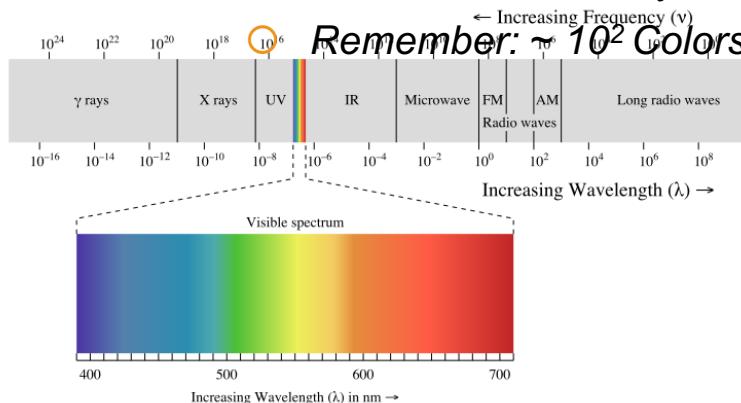
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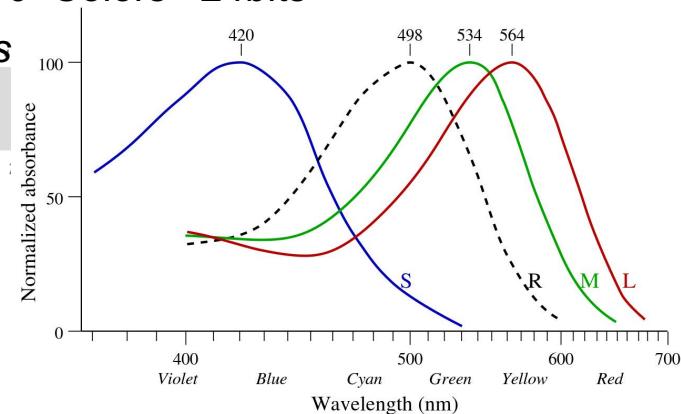
Chemical: *smell, taste, pain*

- Cones and colors

- Frequency resolution / color discrimination
- Discrimination ability: $\sim 10^7$ Colors 24bits



Remember: $\sim 10^2$ Colors



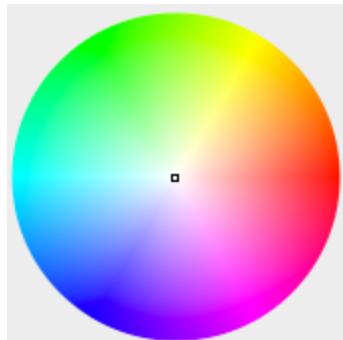
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blue	slate	sky	navy
indigo	cobalt	teal	ocean
peacock	azure	cerulean	lapis
spruce	stone	aegean	berry
denim	admiral	sapphire	arctic

white	pearl	alabaster	snow
ivory	cream	egg shell	cotton
clifford	salt	lace	coconut
linen	bone	dairy	powder
frost	porcelain	parchment	silk
tan	beige	macaroni	hazewood
granola	oat	egg nog	foam
sugar cookie	sud	spice	latte
oyster	biscotti	parmesan	bacon
sundae	buttermilk	sand dollar	sheerbread
yellow	caraway	gold	daifuku
flame	butter	lemon	mistral
coral	metallic	duveline	me
blush	banana	strawberry	dash
honey	blonde	pineapple	tucson
orange	terpine	mustard	color
lime	green	sign	ice
lemon	catalogue	spicet	blue
honeydew	coast	squash	water
strawberry	sunburst	sunbeam	can
red	cherry	rose	jam
marlet	garnet	crimson	cobly
scarlet	wine	brick	apple
malibogy	blood	angria	berry
currant	blush	candy	lipstick
pink	rose	fuchsia	punch
blush	watermelon	damson	rose
salmon	cool	peach	strawberry
lemonade	lemonade	taffy	babyskin
honeydew	crepe	grapefruit	lemon
purple	mauve	violet	blueberry
lavender	plum	maurita	lite
grape	purple	angria	eggplant
jam	te	maulfer	maulfer
rum	cochab	malibury	wine
blue	slate	sky	grey
indigo	cobalt	teal	ocean
peacock	aurora	cerulean	liquid
spruce	stone	aegean	berry
denim	admiral	sapphire	arctic
green	chartreuse	lime	sage
lime	fern	olive	green
pear	lime	lime	lime
pickle	pondster	must	moover
gray	shadow	poplate	iron
pester	lead	olive	smoke
date	anchor	abs	popone
done	fig	flame	charcoal
pebble	lead	cone	lead
brown	coffee	mocha	peanut
cash	hickory	wood	pecan
walnut	camell	grahambread	ryup
chocolate	tootla	umber	tawny
braunette	cinnamon	peny	cedar
black	ebony	crow	charcoal
midnight	ink	raven	oil
pease	oxix	pith	soot
able	jet black	coal	metal

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Apple II 1977



Apple II Plus 1979

tan	beige	macaroon	hazel wood
granola	oat	egg nog	fawn
sugar cookie	sand	sepia	latte
oyster	biscotti	parmesan	hazelnut
sandcastle	buttermilk	sand dollar	shortbread
yellow	canary	gold	daffodil
flaxen	butter	lemon	mustard
corn	medallion	dandelion	fire
bumblebee	banana	buttercup	dijon
honey	blonde	pineapple	tuscan sun

Among 2000+ beige

white	pearl	alabaster	snow
ivory	cream	egg shell	cotton
clifford	salt	lace	coconut
linen	bone	dairy	powder
foist	porcelain	parchment	silk
tan	beige	macaroon	hazel wood
granola	oat	egg nog	fawn
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honey	blonde	pineapple	tuscan sun
orange	tangerine	mandarin	elder
crème	green	lime	ice
lavender	catalogue	spicet	blue
honeydew	coconut	squash	water
strawberry	sunbeam	sunstone	can
red	cherry	rose	jam
marlet	garnet	crimson	cobly
scarlet	wine	brick	apple
malachite	blood	angria	berry
carrot	blush	candy	lipstick
pink	rose	fuchsia	punch
blush	watermelon	damson	rose
adobe	coal	peach	strawberry
raspwood	lemonade	taffy	bulldog
hollyhock	crepe	peacock	horseradish
purple	mauve	violet	boysenberry
lavender	plum	magenta	lite
grape	periwinkle	angria	eggplant
jam	teal	maulfer	mauve
rum	ochre	whaleberry	wine
blue	slate	sky	navy
indigo	cobalt	teal	ocean
peacock	aurora	serulean	lique
space	stone	argus	berry
denim	adored	aphelia	acetic
green	chartreuse	lime	sage
lime	fern	olive	celery
pear	lime	lime	lime
peacock	periwinkle	must	moose
pickle	pinata	lime	crocodile
grey	shadow	purple	iron
pester	lead	olive	smoke
date	anchor	ah	popone
done	fog	blue	charcoal
pebble	lead	blue	toad
brown	coffee	mocha	peanut
carob	hickory	wood	pecan
walnut	caramel	grapehead	syrup
chocolate	tootie	umber	tawny
bouquet	cinnamon	peony	odor
black	ebony	crow	charcoal
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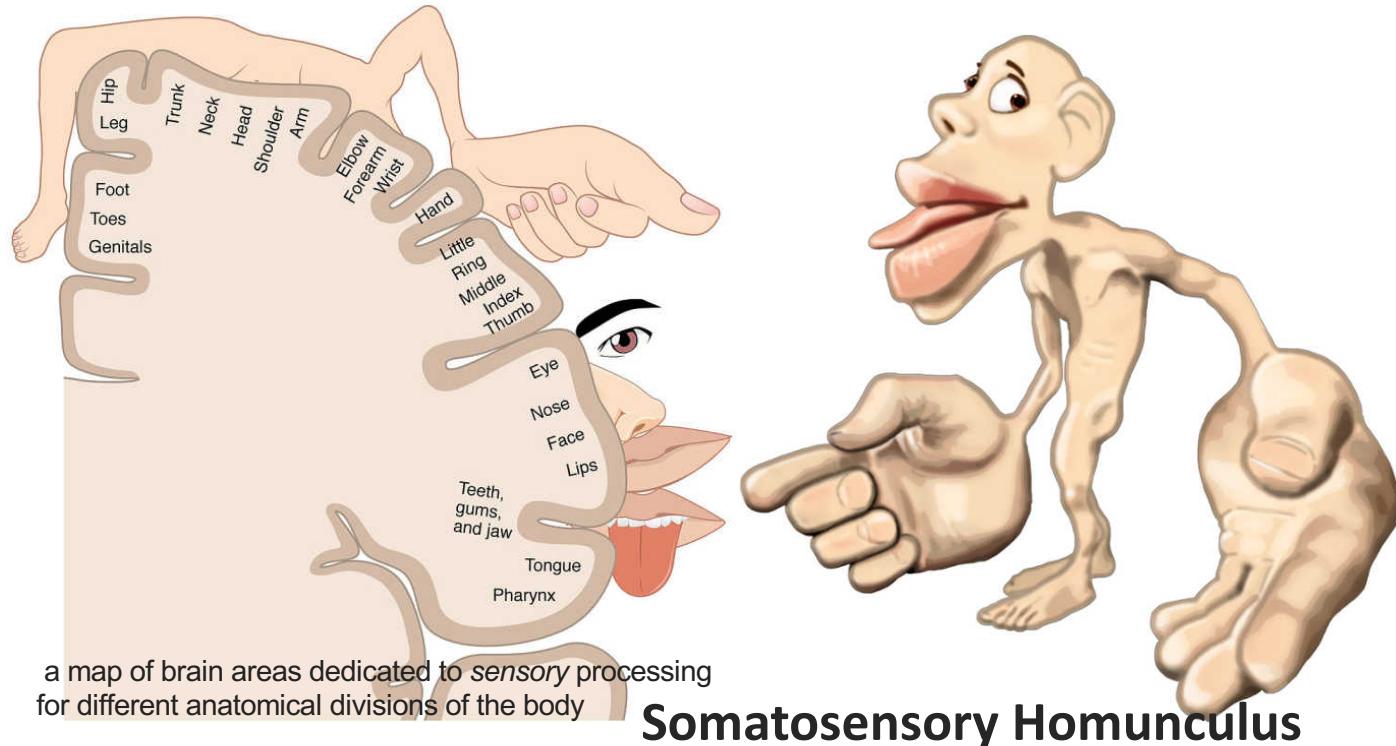
Chemical: *smell, taste, pain*

- Visual Perception
 - Searching for Patterns
 - The Third Dimension
 - Stereopsis – Monocular cues



1.2 Perception: sensing the world

Sensors:structure and physics



1.3 Cognition: attention to the world

Cognitive Conscious and Cognitive Unconscious

The mental abilities (cognitive engineering: cognetics): We must master an ergonomics of the mind if we want to design interfaces that are likely to work well.

Attention, Learning, Remembering and forgetting

- Related terms:

Human Factors

Psychology

1.3 Cognition: attention to the world

1) Properties of the Cognitive Conscious and Cognitive Unconscious

Properties	Conscious	Unconscious
Engaged by	Novelty Emergencies Danger	Repetition Expected Events Safety
Used in	New Circumstances	Routine situations
Can handle	Decisions	Nonbranching tasks
Accepts	Logical propositions	Logic or inconsistencies
Operates	Sequentially	Simultaneously
Controls	Volition	Habits
Capacity	Tiny	Huge
Persists for	Tenths of seconds	Decades (lifelong)

1.3 Cognition: attention to the world

2) Locus / focus of Attention

You see and hear much more than whatever is the locus of your attention.

- Formation of habits

Done by not giving it a glancing thought

Consistency and Safety

1.3 Cognition: attention to the world

(a) phones, remote controls

1	2	3
4	5	6
7	8	9
0		

Consistency and Safety

Assignment 2 (optional):

4. The numeric keyboards on your mobile phone app UIs for phone and calculator are different. Can you try to explain the reason? Why the developers don't design same keyboards for these apps?

(b) calculators, computer keypads

7	8	9
4	5	6
1	2	3
0		

1.3 Cognition: attention to the world

Locus / focus of Attention

- Formation of habits
- Singularity of the locus of attention

An essential fact about your locus of attention is that there is but one of them.

Oneness, as opposed to a great many independent activities going on at once.

Exploitation of the single locus of attention

- How long should a computer take to start-up (get ready for the user)?

Less than 10 seconds (context switch)

(Time delay is masked) It's *Canon Cat*

- an innovative, small, task-dedicated computer released in 1987
- did not make use of either a mouse, icons, or graphics
- one of the earliest "information appliances" but its demise was likely due to poor marketing



- Why Android phones do not work smoothly as iPhones ?

- RAM?
 - 1G vs 4G
- UI rendering !
 - realtime priority vs main thread

