

THE BRAIN AND TECHNOLOGY

Brain science in interface design

LESSON 5. THOUGHT

[Brian Whitworth](#), BA (Psych), BSc (Maths), MA (Psych), PhD (IS), Major (Retd.)

With illustrations by Jasmin Whitworth

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THOUGHT

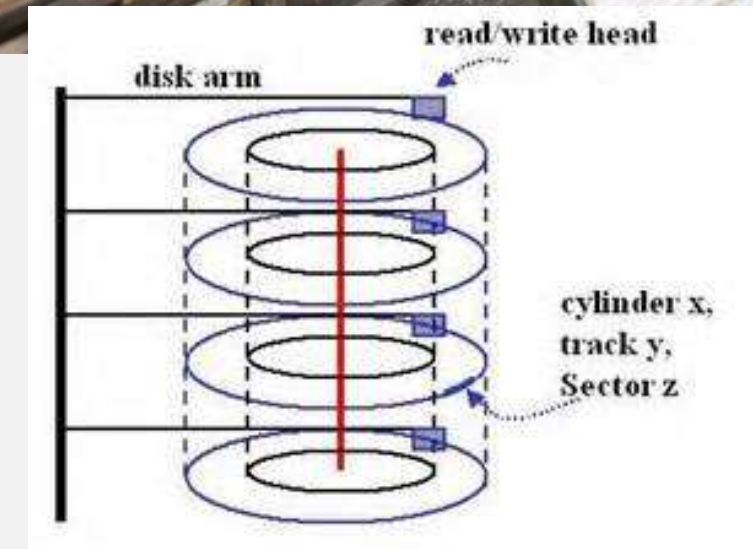


Can the brain run out of space?

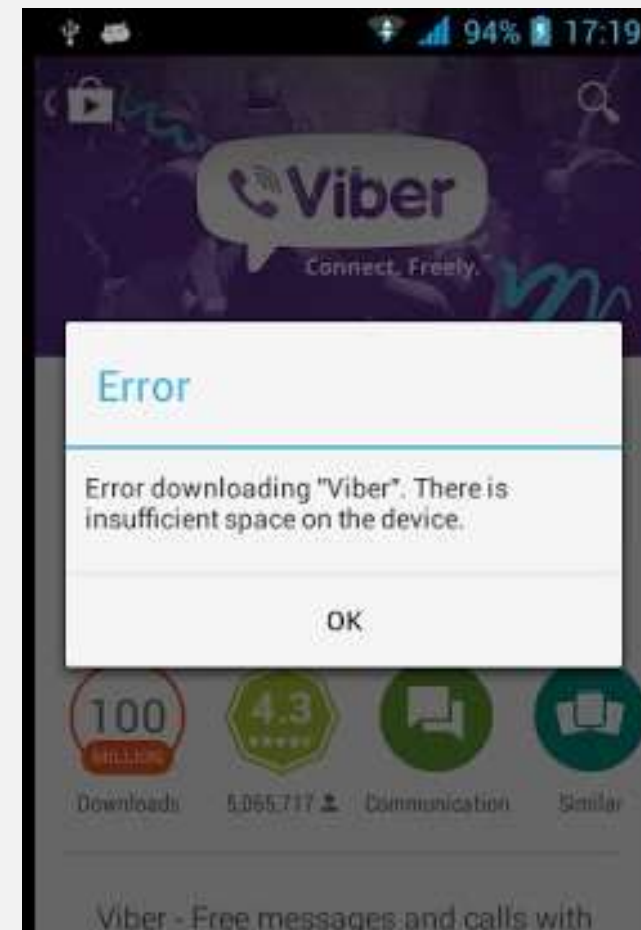
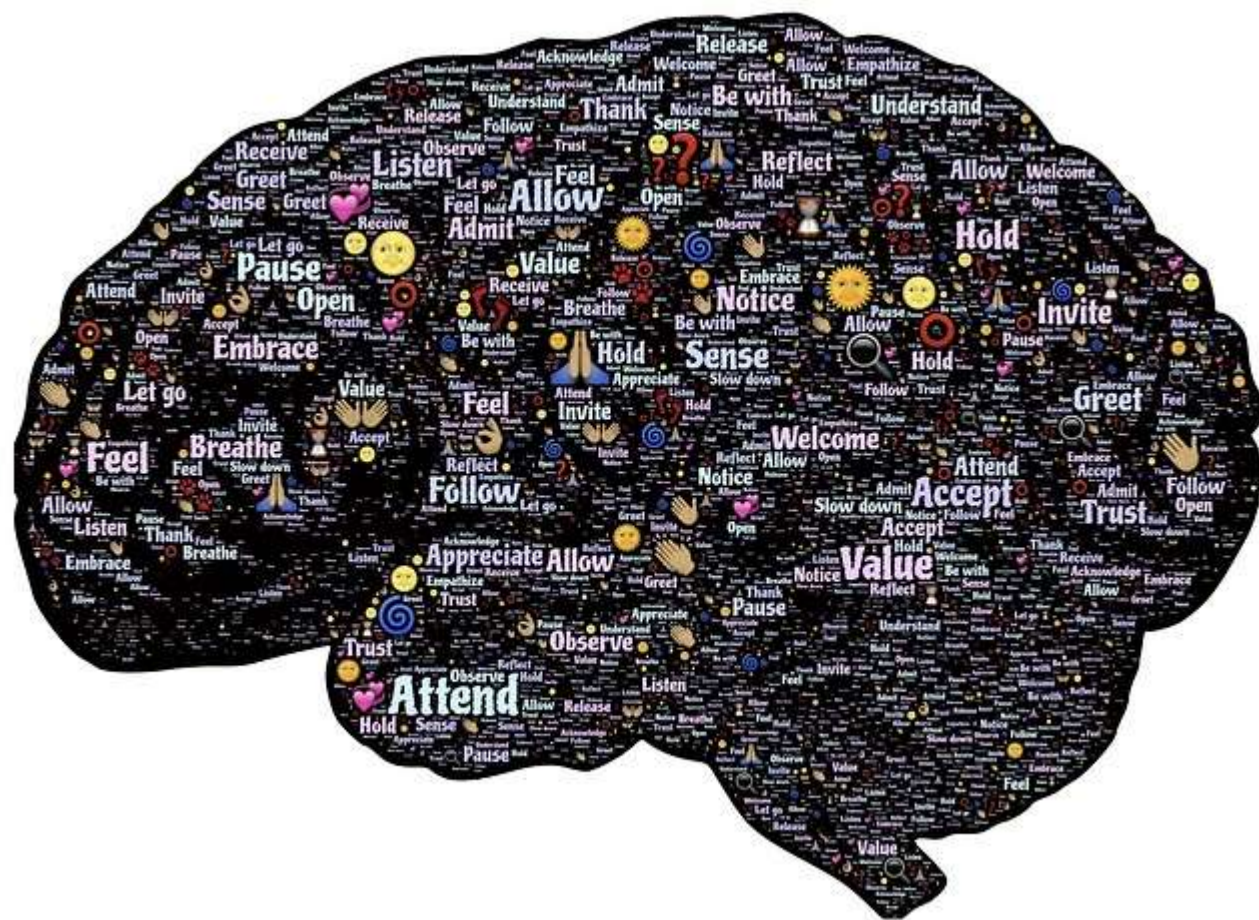
PART 1. ACCESS BY LOCATION

Computers:

- Store data in specific locations like a big physical filing cabinet
- Damaging the location loses the data.
- Call this **access by location**.
- **Data** *is accessed* by a key field **index** value:
 - “Hello, can you tell me what my insurance policy covers?”
 - “Certainly, Sir, what is your *account number*?”
- More indexes allow better **access**:
 - “Hello, what does my insurance policy cover?”
 - “*Certainly, Sir, what is your phone number?*”
- Indexes must be unique, so you don’t get:
 - *Certainly, Sir, what is your first name?*”



Computers store data like a filing cabinet



How does the brain solve this problem?

THE ENGRAM

Karl Lashley tried to find out where a rat brain stored a memory engram.

- He taught 100 rats how to run a maze:
- Then surgically removed a different cortical area in each.
- Which ones still ran the maze?

The results:

- Destroying **any** 10% of the cortex gave no effect.
- After that, performance degraded *proportionally*.

After **33 years** of ablation studies, he concluded:

**Brain memories have no special brain locations.
There was no engram!**

We cant upload or download brain memories as in the movie [Johnny Mnemonic](#), because the brain doesn't store data like a computer does!



ACCESS BY CONNECTIONS

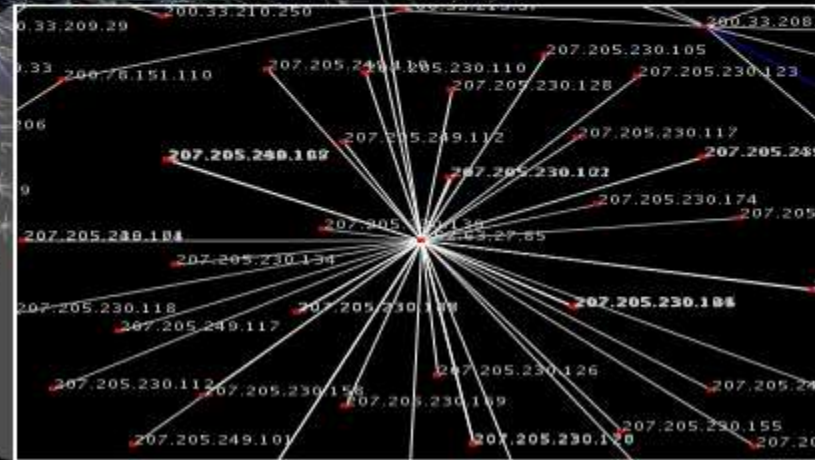
How long can the brain store a life video at 20Mb/sec movie?

- There are about 86 billion neurons in the average brain:
 - About 8 billion bytes or 8,000 Mb or ~ 8 minutes
 - But each neuron connects to up to ten thousand others.
 - Over 10^{14} connections can hold a lifetime of memories.
- There are 1,000 to a million neurons per memory:
 - One memory needs many neurons.
 - One neuron is used in many memories.
 - **One neuron doesn't store one bit.**
 - Stimulating one neuron can give a memory flashback, but it isn't stored there.
 - Memory depends on **connections** that must be **refreshed**.
 - **We lose connections—not locations—as we age.**



The brain doesn't store data like a computer does.

**86 billion neurons with up to 10,000 connections is a hundred trillion links
– more bits than in all the computers on Earth.**



WHAT IS MEMORY?

If you asked a friend these questions:

- What did you have for dinner last night?
- When did you last eat fish?
- Whom do you know living in Northcote Rd.?
- Do you know John Davis?
- Who has a red-haired wife?
- Do you know any autistic children?
- The answer to these and a hundred other questions could be **one** memory of dinner last night.

One memory
could answer
all these
searches.



The brain focus is **memory access**:

- Unlimited **access by data content values**
- Like a data file indexed by every data field in it!
- Like a database where every data value is a unique file
- This incredible flexibility requires **access by connections**.

Some people have eidetic memory

- Perfect visual recall
- See [The Boy Who Can't Forget](#)

TRAIN YOUR BRAIN BY REFRESHING CONNECTIONS.

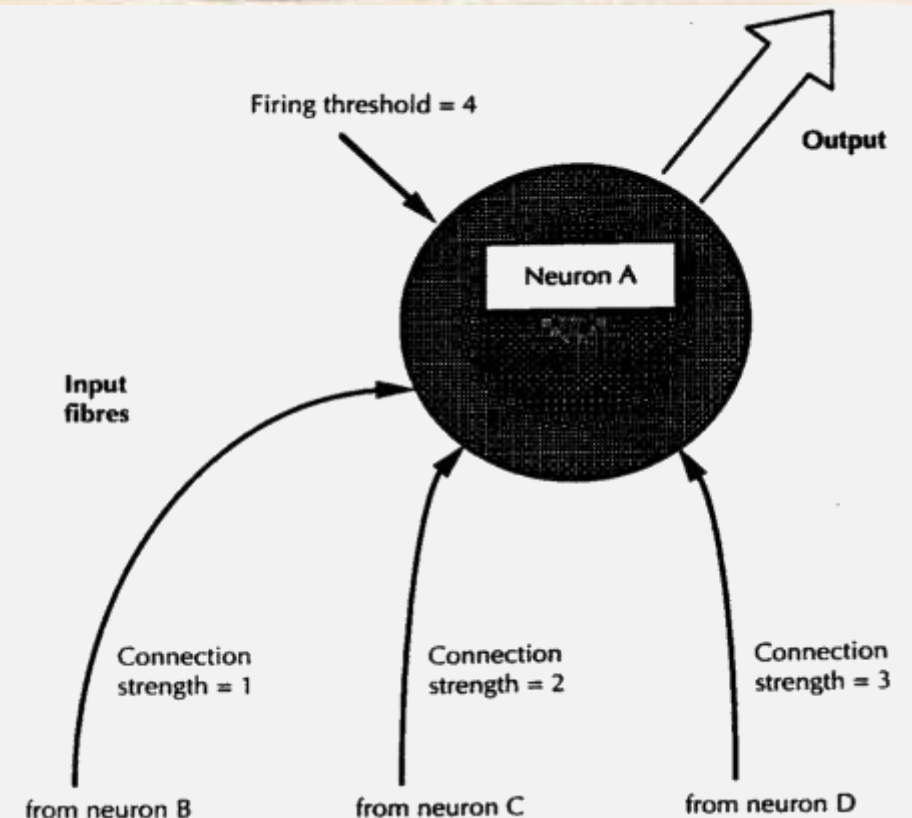
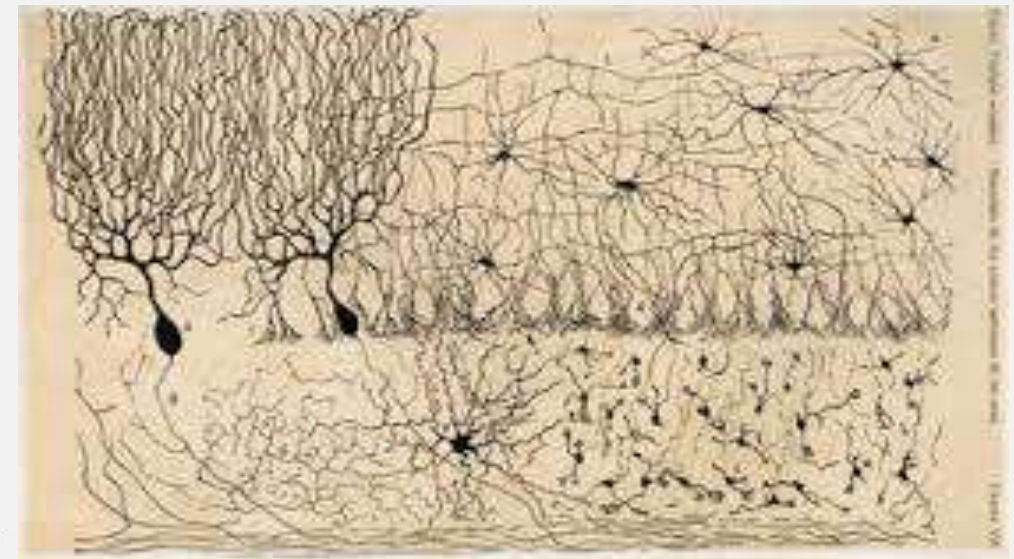
Recall effect depends on **connection strength**, which depends on **use**.



HOW NEURONS CONNECT

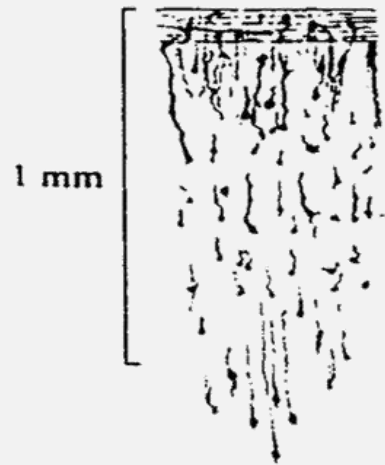
A neuron is a binary mechanism that either fires or does not based on the **input threshold**.

- Does the input meet the **threshold**?
 - B and C firing don't make A fire.
 - B and D firing make A fire.
 - C and D firing make A fire.
- Input effect depends on **connection strength**.
- **Connection strength** depends on use
 - As in **neural networks**
- Some neurons can **inhibit** others:
 - If neuron E fires, then A doesn't.



MASSIVE INTERCONNECTION

Growth of Cells in Striate Cortex



27-week Foetus



Newborn



6 months



24 months

From
Gregory:
1998, p105

“The mass of processes, structures and interactions possible within this (maze) beggars both description and mathematization. The fascination is almost akin to terror...” (Rose, 1976)

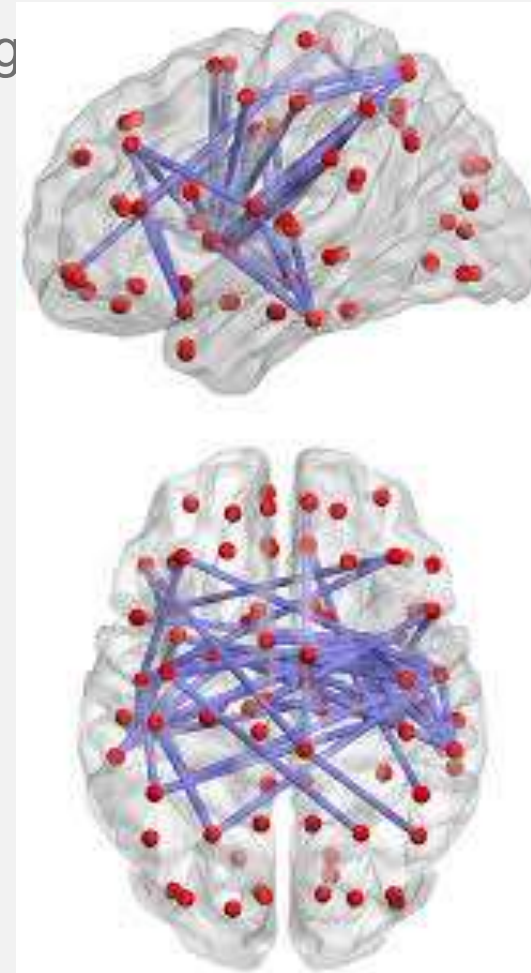
NEURAL NETS

Neural nets alter connections based on success or failure:

- **Virtually unlimited capacity** - no “disk full” message
- **Flexible** - access by any memory property
- **Learn** by modifying the connection strength
- **Memories fade** if not used.

Disadvantages

- **Strength varies** with attention or emotions.
- **Imperfect** recall as connections overlap
- **Modifiable** – the act of recall alters the memory.
 - Recovered memory syndrome in trials
- **Must be refreshed** – use it or lose it
- **Unreliable** – can forget simple things
- In old age, we run out of **activity** not **space**.



Biological neural
nets

HYPERTEXT

HTML (Hypertext Markup Language) works like human memory.

- **Hypertext** links any document word to any document, document part or file - **anything can connect to anything else.**
- Its introduction by Tim Berners-Lee was rejected by ACM Hypertext conference 91 in San Antonio because it was **too simple** by people **who** didn't understand **how the brain works.**

Interactions count—e.g., if you have children:

- One child is the work of one child = 1
- Two children are the work of two plus **their interaction** = 3
- Three children are three plus **three interactions** = 6
- Four children are four plus **six interactions** = 10

How people recall

- “I can't find my wallet.” When did you last use it? Where? Why?
- I know the word begins with “T” (anchoring).
- Smell associations bring back memories (intuition).



People “search” their brains by finding and following links.

PART 2. LANGUAGE

Karl von Frisch discovered how bees tell other bees where the honey is.

- Their **dance** direction was relative to the hive axis's angle to the sun.
- Distance was dance type (round or waggle) and speed.

Language is an agreed way of converting signals to meaning.

- **Sender and receiver must process the same way.**
 - There are three races in the world, **men, women and children**, and none of them speak the same language.
- Text with no emotional context, like tone of voice or facial expression, is easily misinterpreted.
- Sarcasm and humor can fail in email and texting, but emoticons help.
- **Autocorrect** gets it wrong unless **monitored**.
- *People sitting alone at night lose social context.*



BODY LANGUAGE

People in conversations **synchronize** behaviors:

- Sit the same way (**postural congruence**)
- Use hands the same way (**gestural congruence**)
- Talk the same way (**language congruence**)
- To signal **rapport**: they think, act and feel the same way.

People read your site's or app's body language:

- **Is this me? Does it act like me?**
 - **Cautious:** Nothing sudden or strange
 - **Active:** Lots happening
 - **Hip:** Up with the latest

Identify your target audience and show **congruence**.

- Business web sites need business colors (blue, grey ...)
- Web sites for the young need to **look young**.



What is she thinking?

SYMBOLS

Symbol: An information signal that evokes a meaning

- **Meaning:** A neural-based conscious experience
 - Brain is both an information **sink** and a **source**.
- **Percept:** Meaning based on sensory data—e.g., red
- **Concept:** Meaning abstracted from sense data—e.g., flat
- **Idea:** A meaning used by the intellect
- **Word:** A symbol with a common community meaning
- **Language:** Arbitrary **signal-meaning links**
 - **Words** for table vary between languages.
 - Mensa, mesa, ... all mean the same thing.
 - **Instinctive** biology sounds based do not change.
 - **Speech** involves **both** learned and instinctive sounds that cross language barriers
 - Texting and email need **soundicons**!



Primitive symbol



Sophisticated symbol

LANGUAGE LEVELS

Physical level: Physical signal received

- **Spoken:** Phonemes are the basic sounds of words
 - Altered by the sounds around them (**context effect**)
 - Recognize foreigners by their speech
 - Native speaker is familiar, a foreigner is exotic
 - Some cultures have special sounds
 - English “th”, German umlaut, Chinese tonal vowels
 - Whistle languages, whistle to dogs, bird language
- **Written:** Pictographic, symbolic, alphabetic
 - **Sound** is not defined by **spelling**.
 - Characters said differently in Mandarin & Cantonese

- Bough
- Rough
- Cough
- Through
- Dough

Information level: Computers can handle spelling and syntax

- **Spelling:** How letters/symbols form into words
- **Syntax:** How words form clauses and sentences



Silbo is a whistled language used by inhabitants of La Gomera in the Canary Islands to communicate across the deep ravines and gullies on the island.

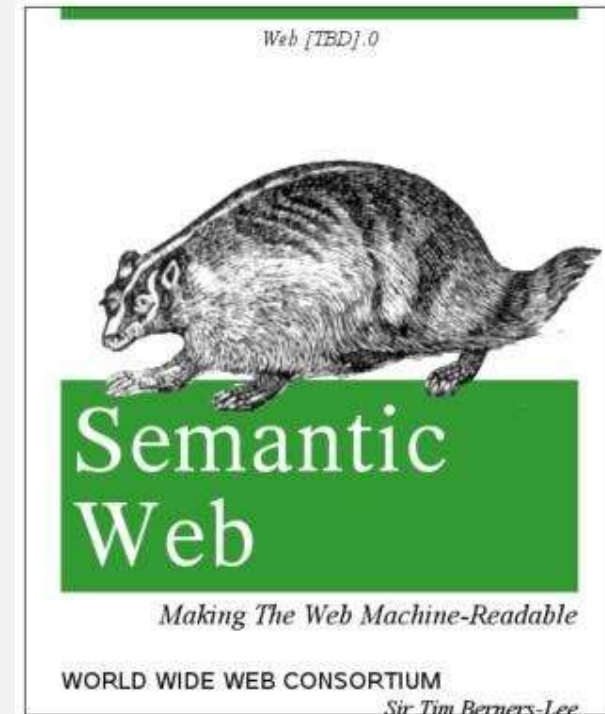
THE SEMANTIC WEB

Human brain processes information to create meaning.

- Semantic Web in 2001 promised as much as its brother the World Wide Web
 - Computers struggle with meaning:
 - “Beer o’clock” is 5 p.m.? Need to know the social context
 - Pre-order? How can you order before you order?
 - Semantic web is impossible by information analysis alone because meaning only arises when information reaches conscious people
 - Consciousness is the source and sink of information
 - Al-Khalil & McFadden: Consciousness from quantum entanglement.
 - Software can check syntax but not semantics.
 - The semantic web requires people!

We need semantic interfaces – technology that mediates meaning.

- **Human-world interfaces:** From Google to wearable senses—e.g., a vest for the deaf to feel sounds, or the blind to ‘hear’ vision.
- **Human-Human interfaces:** From Facebook to brain-brain links



Neil Harbisson,
a color blind artist,
has the world's first
“eyeborg”,
an electronic eye
that converts colors
to sounds he can
hear



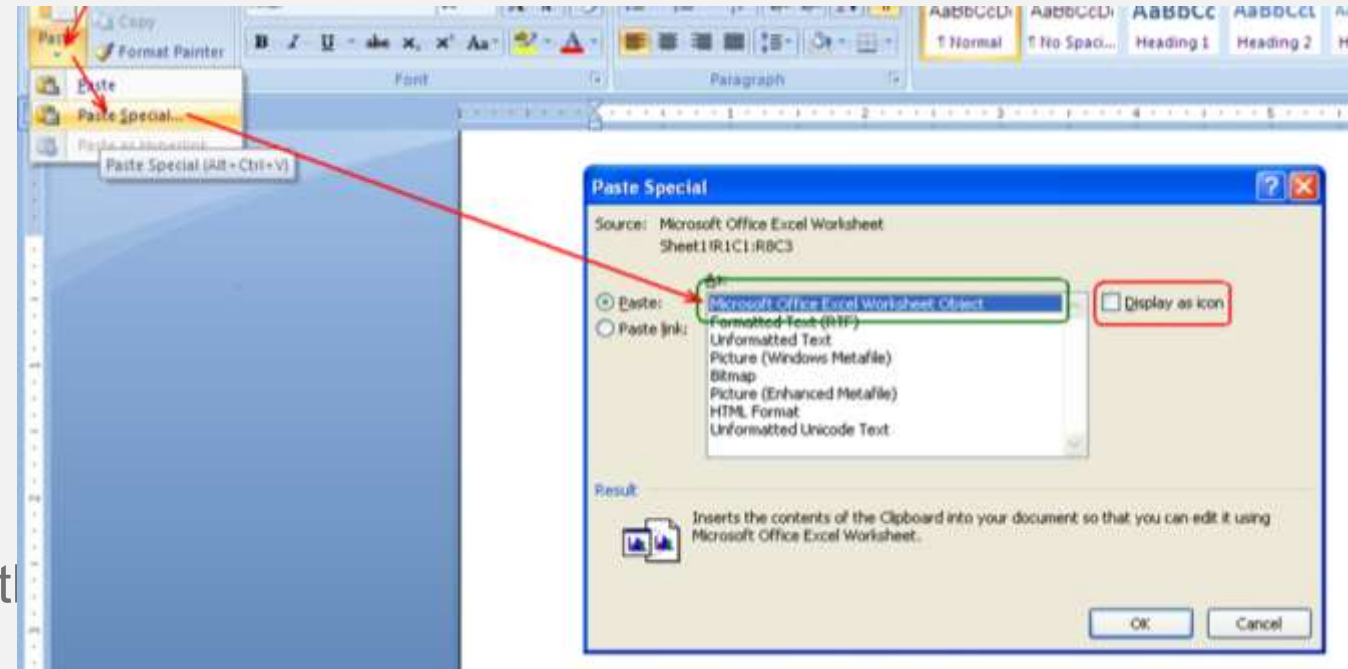
TRANSLATION

Computers **translate** at the **information** level.

- **Clip and Paste** between graphics, sound, video, text translates between computer languages.
 - Paste text as a picture and you can't edit the words.
 - Paste pdf into Word and get hard breaks.
 - Paste unformatted text and lose information!

People translate at the **semantic** level.

- Information-level translation is not reliable.
- **Google translate** is better than nothing.
- See: [Why Machines Alone Cannot Solve the World's Translation Problem](#)



A restaurant based on a computer translation

LANGUAGE IS RICH

Productivity: Noam Chomsky showed there are more **possible sentences** than atoms in the universe, language can't be learned one sentence at a time.

- How do three-year-olds say sentences never said before?
 - “Yes, *owls are not turtles*” (3-year-old's reply to that owls are nocturnal)
 - “*Salad is ruining my life.*” A comment on dinner
 - “*My poop is coming. It's packing its suitcase!*” Said on the potty seat
- **This astounding complexity** arises as syntax rules combine, just as a dynamic interaction gives **fractals** describing flowers, shells and galaxies.
 - Nature is **simplicity combined**, not complexity reduced.
 - The brain handles life by being itself of the same nature.

Richness: Depends on the amount of **meaning**, not amount of **information**.

- **Rich** video **didn't** replace **lean** text as the top online interaction:
 - Twitter, Chat, Google, Reddit, Amazon, Facebook, email
 - Mobile phones are used more for texts than calls.
 - Text online will never die, because language creates meaning.



Language will never die

PART 3. SENSORY INTEGRATION

How does an object **touched** relate to one **seen**?

- A blind subject, who received corneal grafts at 52, **could** see CAPITALS he had learned by touch but not lower-case letters he hadn't touched
- **Depth**: Thought the ground below a two-story window touchable
- Had to **touch** a familiar object (a lathe) in order to **see** it
 - "Now I have felt it I can see it."

Meaning links sensory subsystems

- Baby grabs what the hand feels while at the same time the eyes observe something else.
- In adults, language is a cross-modal bridge between the senses.

Many senses are better than one.

- Picture + text + voice + spatial... can confirm one meaning.
- **Rule of three**: Three independent sources must be right.
 - Journalists use it, and the brain uses it.



**Tobias curing his father's
blindness from The
Metropolitan Museum of Art**

MEANING

Word **signals** evoke perceptual and conceptual **meanings**.

- **Meaning:** A **conscious** human **experience** or **qualia**
- **Syntax:** How words combine into sentences that also have meaning
- Ideas come **before** words
 - Infants **know** ideas like all done before they **say** the words.
- Ideas start **broad**; a child says **ball** for:
 - A balloon, an egg, the sun, etc. Only later are they discriminated.



Meaning is initially **contextual**.

- “*Mummy shoes*” can mean “Where are my shoes?” or “Help me put on my shoes”, depending on the **context**
- Only after 4-years old do words get meanings apart from context.

Hence, right-click **context menus** are always easier to use.

THE MEANING INTERCHANGE

Language enables meaning interchange:

- **Broca's area:** Damage stops speech, but patients can still sing familiar songs like nursery rhymes – and swear!
- **Wernicke's area:** Damage stops the connection between words and ideas: patients can hear a word but have no idea of meaning.
- **Capgras delusion:**
 - A person thinks a family member is an imposter as fusiform gyrus damage loses the emotional response.

Language allows parts of the brain to share meaning.

- Ideas can be changed by feelings—e.g., having children alters your ideas about your parents.
- Feelings can be changed by experiences—e.g., a near-death experience.
- The intellect and the senses **negotiate** the memory laid down.



People create meaning.

COGNITIVE DISSONANCE

Cognitive dissonance: Brain stress when beliefs, feelings, acts or information conflict—e.g., I love you—but delight when you fall over

- Brain sub-systems **must integrate**, as a system divided cannot stand.
- **Cognitive consonance** is necessary to maintain the brain.

Forward thought: Working logically from facts to new conclusions.

- Science is based on forward thought that gives innovations.
- Innovations create cognitive dissonance.

Backward thought: Working from desired conclusions to explain new facts

- Inventing excuses is the job of those who maintain the status quo.
- Human intellect evolved to justify and excuse, not to innovate.

People need reasons to buy, click, download or register.

- **Real:** Sustainable, so you don't need to change them
- **Fake:** Unsustainable, so you have to keep inventing new ones



PART 4. THOUGHT

Words: Arbitrary signals for ideas

- **Information level** filters struggle with **ideas**; e.g., **Tiananmen square** morphed into **June fourth**, then **May 35**, also **64** (month 6 day 4), **VIIV** (Roman 64) and even **Eight Squared**.
- Is **SNAFU** a rude word? Is the Irish **feck** rude?

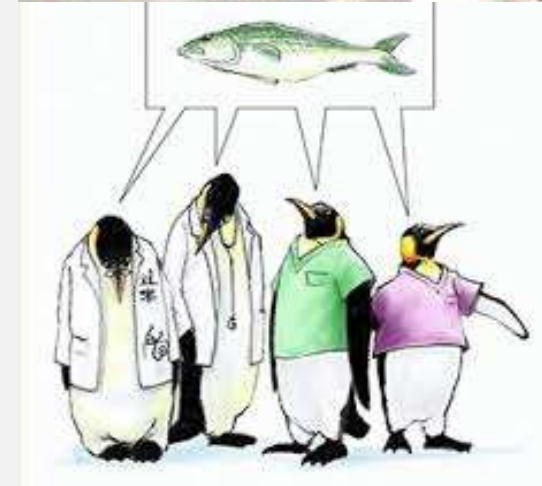
Knowledge:

- **Explicit**: Definable—e.g., squareness
- **Tacit**: Requires experience—e.g., love, selfless service

Concepts: The building blocks of conceptual **thought** can:

- **Connect** to other concepts (**association**): e.g., baby ~ cuddly, fish ~ cold
- **Contain** other concepts (**abstraction**): e.g., dog < animal < thing
- **Derive** from other concepts (**analysis**): e.g., falling plus ground ~> landing

We manage the world by conceptual structures or **mental models**.



**The
penguin
mental
model.**

THINKING

Formatory thinking: Associates ideas


- Memorizing words or dates for an exam

Abstract thinking: Builds up abstract **ideas** from other percepts and concepts

- No one has ever seen a **three**.
- Mathematics needs abstract thinking.

Analytical thinking: Derives new concepts from old by logical argument

- People are stupid. Socrates is a person; therefore, Socrates is stupid. (✓)
- Socrates is somebody. Somebody is stupid; therefore, Socrates is stupid. (X)
- Google search: Who uses logical operators?
 - **Quotes** search for exact **words**
 - **Minus (-)** is Not
 - **Vertical line (|)** is OR



Advanced	What you can do with it	Google this
site:	search only within a specific site	site:www.stanford.edu
filetype:	find a type of file: PDF, DOC, TXT ...	filetype:PDF
define:	find definitions for a word	define:audacity
intitle:	find words in the title of the webpage	intitle:inspirational
..	get ranges of numbers, dates, or prices	presidents 1800..1900
word * word	find other combinations of words between words	creative * writing
-word	search for homer, but NOT simpson	homer -simpson
"word"	find exact words—no synonyms or plurals	"peace" "freedom"
"set of words"	search for exact set of words, quotes or phrases	"I have a dream"

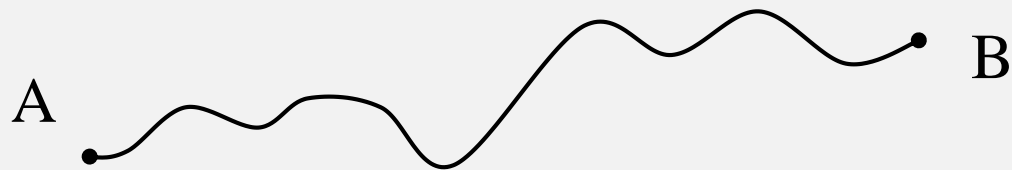
THOUGHT HURTS

The brain evolved to predict, not to think!

To encourage genuine (analytical) thinking:

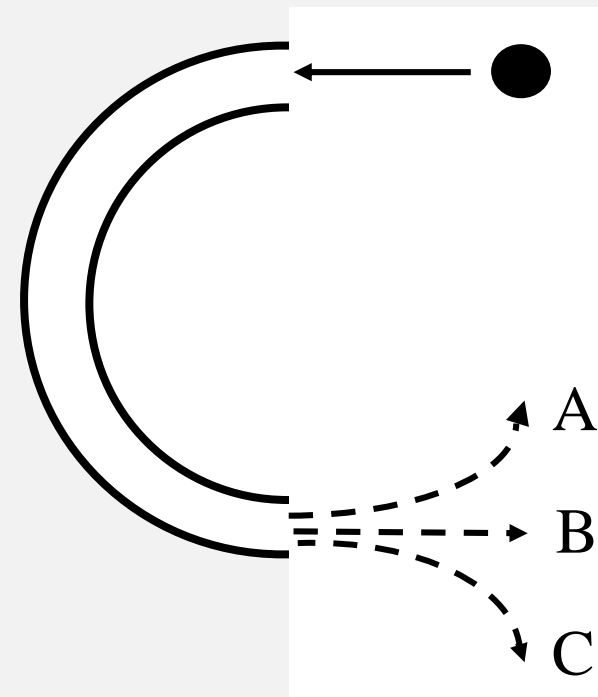
- **Suspend judgement:** Stop intuitive processes from forming **premature conclusions**.
- **Take time:** The real intellect is the last to act.
- **Ponder:** Keep putting the same question to brain until actual thought kicks in, as it will.

Remember: **Thought hurts!**



Bob cycles from A to B at 10 mph;
how fast must he cycle back to average 20 mph for the
whole trip?

A tube flat on a table



Which way does
the ball go?

Answers: B, He
can't.

REASON IS FRAGILE

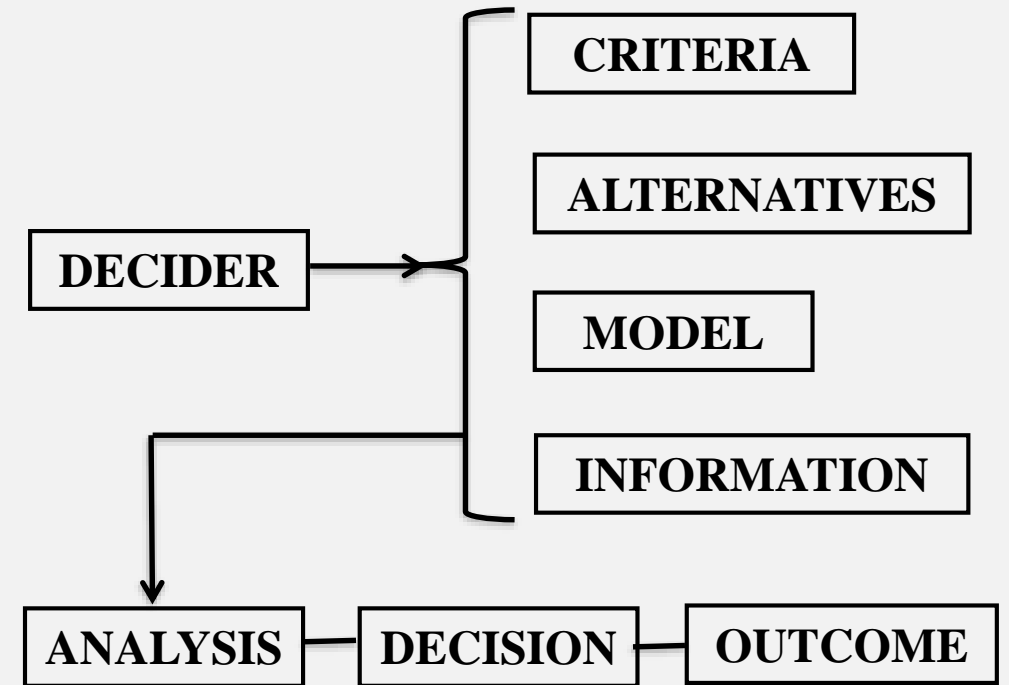
Rational decisions require:

- **Decider.** The decision-making entity: e.g., a company
- **Criteria.** Desired outcome properties: e.g., make a profit
- **Alternatives.** Available courses of action: e.g., a new branch
- **Model.** Predicts outcomes from causes: e.g., profit analysis
- **Information.** Information the model needs: e.g., Tokyo costs

Analysis rates the *alternatives* by the *criteria* using the *model* and the *current information*, **assuming**:

- **Decider agrees:** No internal opposition
- **All Alternatives known:** No left-out options
- **Valid Model:** A right understanding of how things work
- **Correct Information:** No disinformation or lies
- **True Criteria:** We know what we truly want.

Rational Analysis is **fragile**, i.e., often wrong, so people prefer **trusted friends and communities**.



*“A little learning is a dangerous thing;
Drink deep, or taste not the Pierian spring.”
– Alexander Pope*

See Whitworth, B., et al, 2000, **Beyond Rational Decision Making**

WICKED PROBLEMS

Reason works for **tame** problems that are:

- **Clear:** In win-lose games, the goal is clear.
- **Linear:** Every calculation ends—e.g., an 8x8 game of Chess.
- **Objective:** One observes from afar, **like a bird in the air.**
- **Static:** Don't change over time

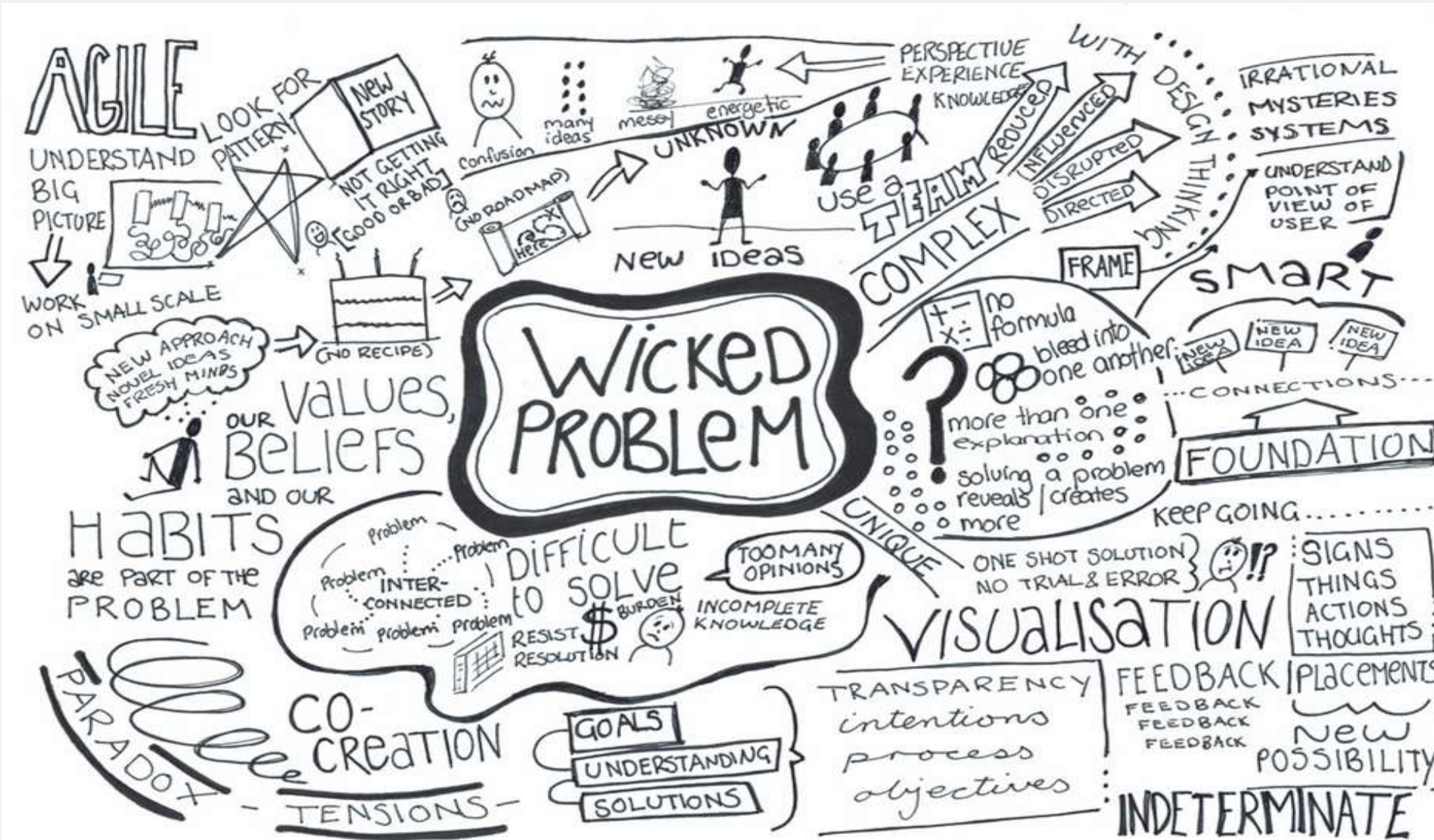
But **wicked** problems are

- **Equivocal:** Unclear what the problem really is—e.g., politics
 - Reeves and Lemke, "The problem as a moving target" 1991
- **Non-halting:** Recursive calculations may never stop.
- **Interactive:** **Like a frog on the ground**, our actions change things.
 - Gathering information alters the situation (spying)
 - The quantum observation paradox
- **Dynamic:** Change rapidly over time
 - You think of a response when the conversation's over.



Wicked problems

BEYOND RATIONAL DECISION MAKING



Real-life problems:

- Marriage
- Family
- Workplace
- Education
- Health
- Politics
- Even Physics: e.g., quantum theory

WHY PEOPLE DON'T READ MANUALS

Technology often has instructions but they are **often not worth reading** because they:

- Use cryptic jargon
- Don't start with what we know.
- Don't start at the start.
- **Language** explains **spatial acts** poorly.
- When Help doesn't help, asking "Did this help?" doesn't help either!
- **People find it easier to**
 - **Copy others**, who **show** don't **tell**.
 - **Re-use past learning**, so assume it works like other technology.
 - **Trial and error** – assuming no fatal choices
 - **Systems need a Home button**, Reset defaults or other interface **reboot**

MATERIAL SAFETY DATA	
SECTION 4 - FIRST AID	
act:	Flush with large amounts of water for at least 15 minutes. Do not
act:	Wash affected area gently with soap and water. Skin cream or
z:	Do not induce vomiting; drink plenty of water.
n:	Remove affected person to clean fresh air.
**If any of the symptoms persist, seek medical attention imm	
SECTION 5 - FIRE FIGHTING MEAS	
it:	Non-combustible
ing media:	Use extinguishing media appropriate to the surrounding fire.
hazards:	None
ing equipment:	Wear full bunker gear including positive pressure self-containe
SECTION 6 - ACCIDENTAL RELEASE M	
rocedures:	Avoid creating airborne dust. Follow routine housekeeping pro filtered equipment. If sweeping is necessary, use a dust suppres containers. <u>Do not use compressed air for clean-up.</u> Personnel : approved respirator. Avoid clean-up procedures that could resu
SECTION 7 - HANDLING AND STO	
Limit use of power tools unless in conjunction with local exha Frequently clean the work area with HEPA filtered vacuum or accumulation of debris. <u>Do not use compressed air for clean-up</u>	
This product is stable under all conditions of storage. Store in c	

RTFM =
How to learn
everything
technical

This is how people want all instructions:

Picture plus text, in easy steps (chunks), known length, simple words



How to
do the
Monty
Python
silly walk

PART 5. DOCUMENTS

A document is any **symbolic structure**— text, spreadsheet, music

- With or without pictures or sound

The structure defines how we read it:

- **English** is left to right, then top to bottom, then front to back.
- **Arabic** is right to left, then top to bottom, then back to front.
- **Chinese** is top to bottom, then right to left, and back to front.

Symbols combine into words that combine into

- **Chapters**, suras, books - A major heading
- **Sections**, verses, parts - A minor heading
- **Paragraphs** - No headings but comma separated
- **Sentences** - With a full stop

Each part needs:

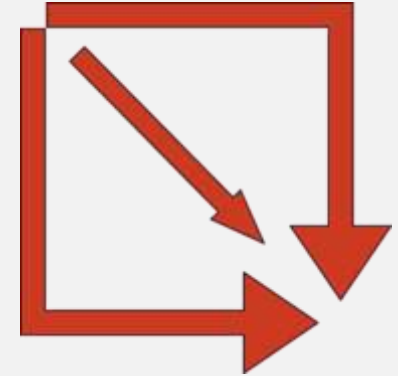
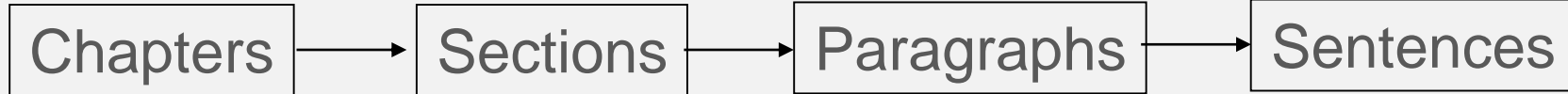
- **A theme**: An idea that runs through it
- **A beginning, middle and end**: Introduce, say and conclude
- **Framing**: To highlight the important – quotes, italics, bold



DOCUMENT STRUCTURE

Abstract

Detail

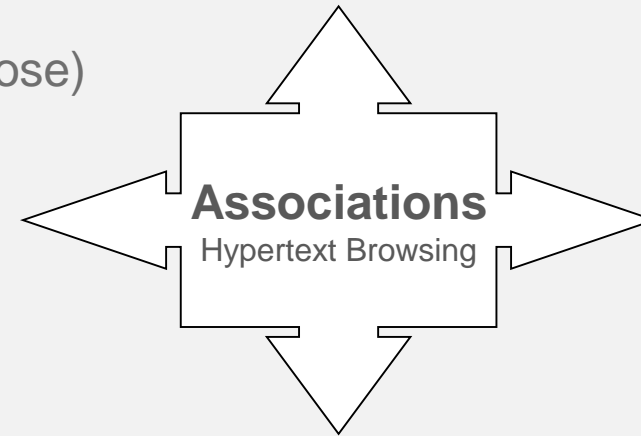


**How we usually
navigate a structure**

Beginning (issue, problem, interest, purpose)

Middle (information, argument)

End (summary or conclusion)



Information links, contents,
index

Sequence




Wikipedia

Main menu

Tab 2nd menu

Link associations

Headings, bullets,
structure



WIKIPEDIA
The Free Encyclopedia

Log in / create account

Main Page Discussion Read View source View history Search

Arts Biography Geography History Mathematics Science Society Technology All portals

Main page
Contents
Featured content
Current events
Random article
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Interaction
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About Wikipedia
Community portal
Recent changes
Contact Wikipedia


Toolbox
Print/export

Languages
Simple English
العربية
Bahasa Indonesia
Bahasa Melayu
Български
Català
Česky
Dansk
Deutsch

Welcome to Wikipedia,

the free encyclopedia that anyone can edit.
3,743,862 articles in English

Today's featured article



Rhabdomyolysis is a condition in which damaged **skeletal muscle** tissue breaks down rapidly. Breakdown products of damaged **muscle cells** are released into the bloodstream; some of these, such as the protein **myoglobin**, are harmful to the **kidneys** and may lead to **kidney failure**. The severity of the symptoms, which may include **muscle pains**, **vomiting** and **confusion**, depends on the extent of muscle damage and whether kidney failure develops. The muscle damage may be caused by physical factors (e.g. **crush injury**, strenuous exercise), **medications**, **drug abuse**, and **infections**. Some people have a hereditary muscle condition that increases the risk of rhabdomyolysis. The diagnosis is usually made with **blood tests** and **urinalysis**. The mainstay of treatment is generous **intravenous** fluids, but may include **dialysis** or **hemofiltration** in more severe cases. Rhabdomyolysis and its complications are significant problems for those injured in disasters such as earthquakes and bombings. Relief efforts in areas struck by earthquakes often include medical teams with the skills and equipment to treat survivors with rhabdomyolysis. [\(more...\)](#)


Recently featured: "Stark Raving Dad" – Second Ostend Raid – Gumbo

[Archive](#) – [By email](#) – [More featured articles...](#)

Did you know...

From Wikipedia's *newest content*:

- ... that the 13th-century **Mårup Church** *(pictured)* was partially dismantled in 2008 to prevent it from falling into the **North Sea**?
- ... that **Lady Gaga** embarked early on her 2009–11 **Monster Ball Tour** due to the cancellation of her **Fame Kills** tour with Kanye West?



In the news


- In basketball, EuroBasket 2011 concludes with **Spain** defeating France in **the final** (*tournament Most Valuable Player* **Juan Carlos Navarro** pictured).
- A 6.9-magnitude **earthquake** near the India–Nepal border results in at least 63 deaths.
- In Gaelic football, **Dublin** defeat **Kerry** to win the **All-Ireland Senior Championship Final** for the first time since 1995.
- The **United Nations General Assembly** **accepts the credentials** of the **National Transitional Council** to represent **Libya** in the assembly's current session.

[Wikinews](#) – [Recent deaths](#) – [More current events...](#)

On this day...

September 20

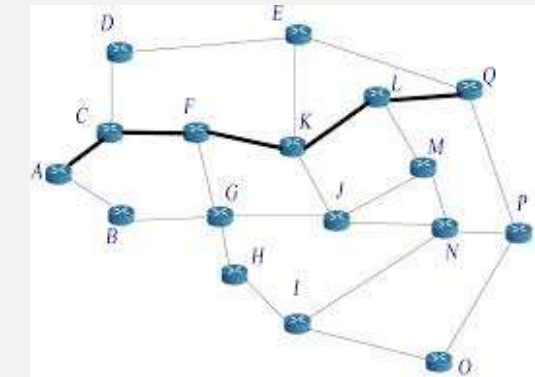
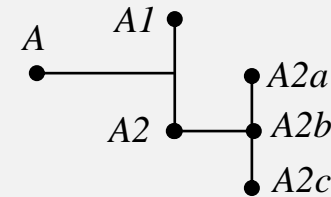
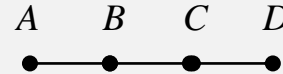
- 1498 – A tsunami caused by the **Meiō Nankaidō earthquake** washed away the building housing the statue of the **Great Buddha** *(pictured)* at **Kōtoku-in** in Kamakura, Japan.
- 1848 – The **American Association for the Advancement of Science**, publisher of the journal *Science*, was founded.
- 1943 – **World War II**: Australian troops defeated Imperial Japanese forces at the **Battle of Kaiapit** in New Guinea.
- 1967 – **Scientology** founder **L. Ron Hubbard** publicly announced the story of **Xenu** in a taped lecture sent to all Scientologists.



IDEA LINK TYPES

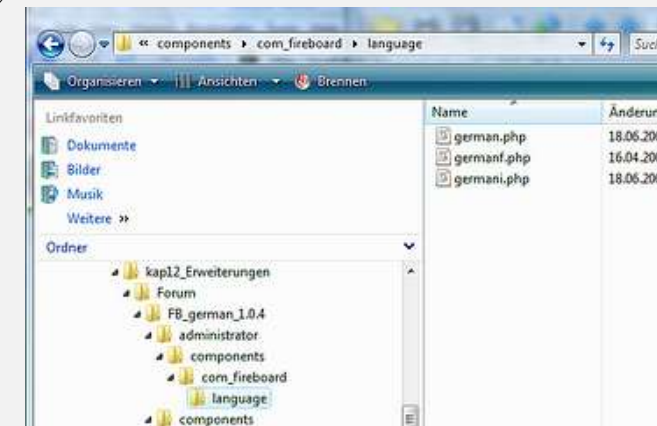
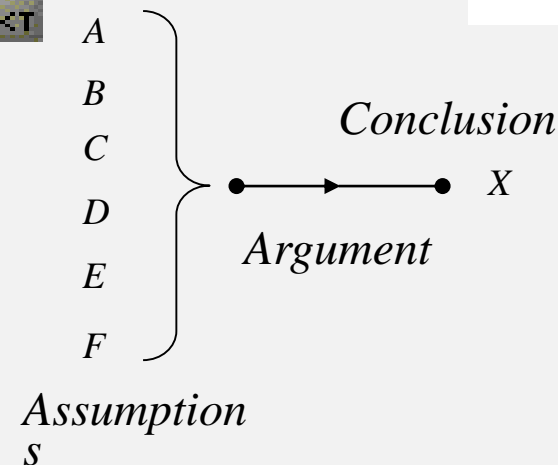
Brain links

- **Associations link** ideas.
 - We chat by associating!
- **Abstractions contain** ideas:
 - Headings, in a hierarchy
- **Analysis joins ideas** into new ideas.
 - An **argument** is an **intellectual journey** from one idea to the next – the basis of science.



Computer links

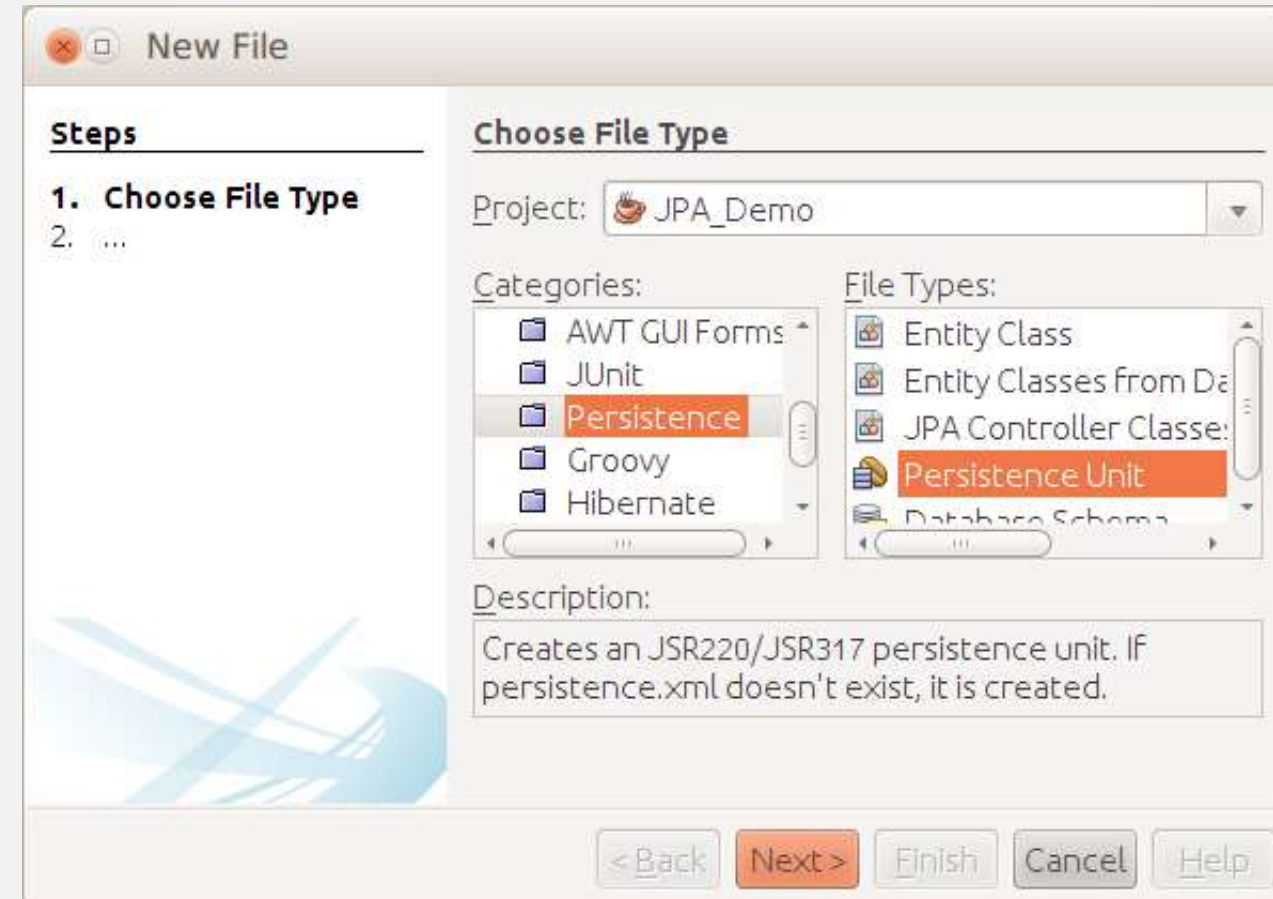
- **Lists:** Tabs, menus, drop down boxes; **easy**
 - **Mesh:** Hypertext, social networks
- **Hierarchy:** Submenus, Explorer; **harder**
- **Sequence:** Wizards, installations, navigation
 - **Easy** if someone else thinks for us
 - **Hard** if we have to discover a path



LISTS VS. BUTTONS

Lists are more work than buttons

- **Button** is one click if easy to read.
- **Drop-down list** is two clicks.
 - **Menu** is also two clicks.
 - Don't use lists for a few options.
- **Long lists** are more work:
 - Must **read down**
 - Or **scroll down**
- **Lists within lists**, menus within menus, are even more work!
- **Dynamic lists**:
 - Move frequently used options up the top!
How hard is that??
 - Make frequently used options bolder or bigger



People tend not to check whats on the drop-down or the scroll-downs

COMMUNICATION LINK TYPES

Interpersonal: One-to-one, two-way, identified

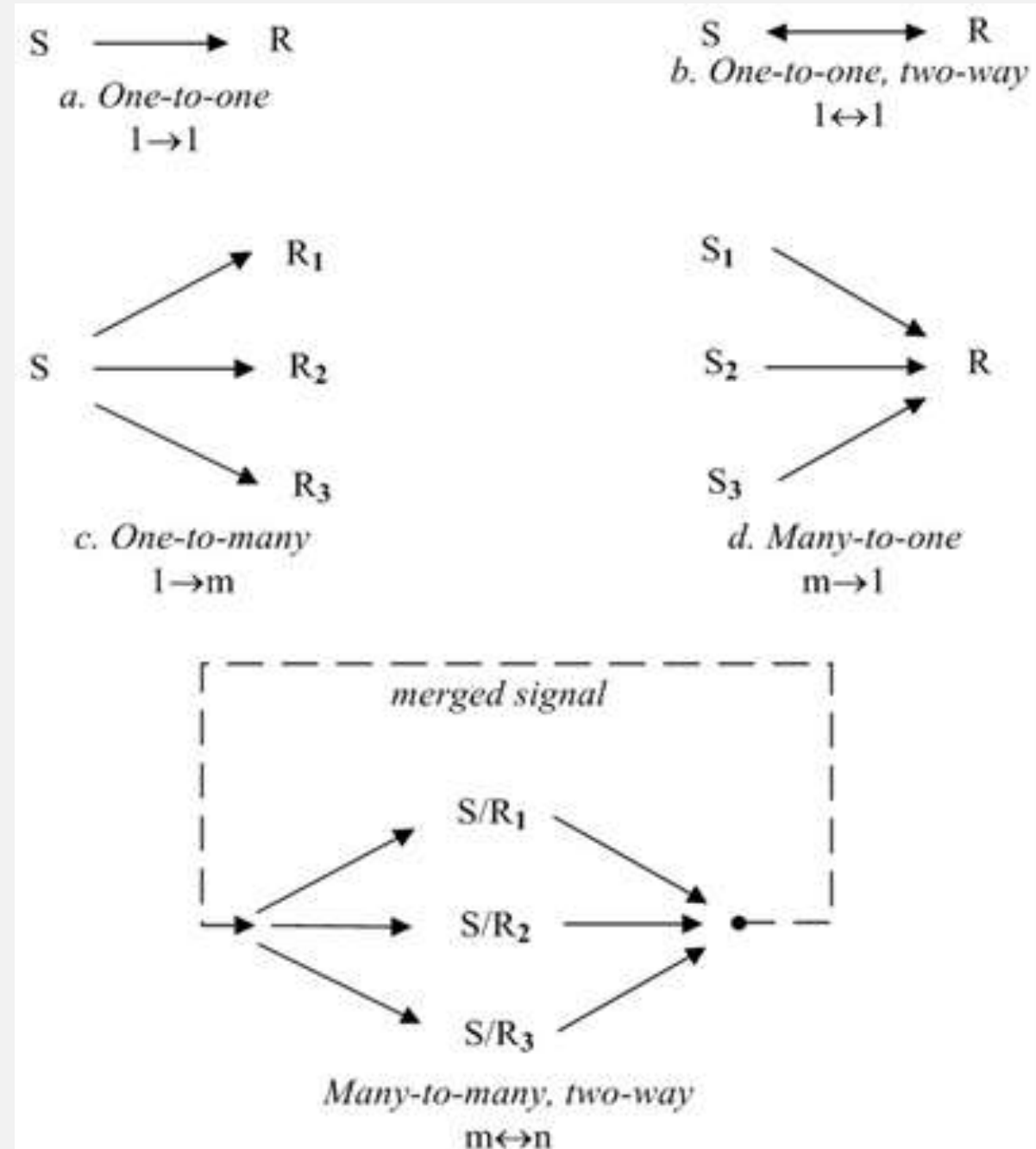
- Supports **person-to-person relations**
 - Telephone, letter, Email, Texting, Skype

Broadcast: One-to-many, one-way

- Supports **public announcements**
 - Speech, Book, Movie, Song, Radio, Web site, Blog

Matrix: Many-to-many, two-way, anonymous

- Supports **group-to-group normative decisions**
 - Applause, referendum, social bookmarks, karma systems, online voting, reputation systems, tag clouds
- **Impersonal yet social**
- People **identify with** or **belong to** groups.



NORMING

Norming: How **groups** make a common **decision**

- What to wear (fashion), who to fight (war) ...
- Norms increase group **cohesion**.
- Members exchange **positions** to deduce a **group norm**.
- Herds/flocks **move** and **follow** to keep together.
- People do the same intellectually.
- Individuals decide to **clap**; an audience decides to **applaud**.
- **Voting** is a **group-to-group communication**.
- Technology makes **matrix communication** easy!

Use groups to **validate**, not **innovate**.

- A \$288-million British polar research ship was naively put on the Internet for the people to name - the **people's choice** was RRS (Royal Research Ship) **Boaty McBoatFace**.



**The Royal Research Ship
“Boaty McBoat-Face”?**

SUPPORT READING

Easier to read a document if it:

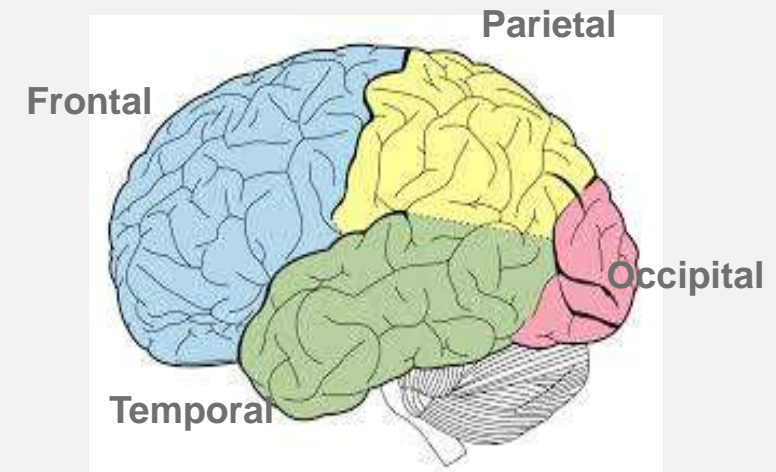
- **Gets your attention:** A good first image, cover or phrase
- **Fulfills expectations:** Give purpose early, lead into story
- **Has a context:** Give author and why they wrote this
- **Has an obvious structure:** Content here - ads there
- **Doesn't waste your time:** Remove unnecessary words
- **Has no distractions:** No annoying ads **stealing attention**
- **Has a logical flow:** A **brain dump** is hard to follow
- **Has no error red flags:** Check spelling and grammar
- **Is easy to navigate:** Table of contents, search, bookmarks
- **Has pictures:** To support and break up the text
- **Has headings:** That summarize its parts
- **Is in bite-size parts:** How much can a reader handle at once?
- **Remembers me:** Where I left off last time—e.g., Netflix



PART 6. REMEMBERING

Memory stores a **brain event** that we **remember** by **re-enacting** it.

- **Spatial memory** of a path taken via mid-brain hippocampus
- **Emotional memory** of a state is a mid-brain re-activation.
- **Kinesthetic memory** of a sense is ~ parietal lobe.
- **Visual memory** of a picture is ~ occipital lobe.
- **Auditory memory** of a tune is ~ temporal lobe.
- **Concepts and consequences** memory is ~ frontal lobe.
- **Memory integrates** - a smell can bring back sensory memories.
- **Associative memory** of the cortex needs a trigger.
- **Formatory memory** stores the sensation, but a **rote learned** word doesn't last long – we read newspapers with formatory memory.
 - A **mnemonic** can chunk facts: “*Every good boy deserves favor*” gives the notes of the treble clef EGBDF
- **Intellectual memory**: Stores a concept in a **mental model**.



DIFFERENT MEMORIES

Different subsystems remember differently: Remember a **face** by visual memory but not a **name** by conceptual memory

- **Instinctive memory:** Based on sensory impact—i.e., input amount
 - Remember a loud noise or shock
- **Psychomotor memory:** Based on repetition—i.e., what I did
 - Remember alphabet letters when said in sequence
- **Emotional memory:** Based on emotional impact—i.e., effect on my state
 - Remember what hurt, degraded or offended me
- **Intellectual memory:** Based on a mental model of how things work
 - Remember **detail** using **abstract concepts**

We don't remember passwords that **mean** nothing.



SUPPORT REMEMBERING

To support remembering:

- **Sensory impact:** Make it clear, bold, obvious - **LOUD** or **UnUsUal**.
- **Repeat:** Nagging works as every mother knows
- **Many channels:** Say it, show it, move it, throw it.
- **Involvement:** **Use** a name immediately to remember it.
- **Refresh:** E.g., recall a name again after leaving.
- **Emotional impact:** Faces evoke emotions that improve memory.
- **Use existing mental models:** Does it fit with what they know?
- **Simplify** – a one-page chapter summary

My exam system

- **One-page summary** of the chapter key points.
- **Rote learn** the summary (repetition, etc.).
- **Recall** the summary to link to the rest.



*“Tell them what you are going to tell them, then tell them it, then tell them what you just told them.”
– Army guideline*

MEMES

Memes: Big ideas passed on by a culture—i.e., cultural memories

- **Evil:** Idea started by the first Zoroaster to allow good agriculturalists to fight evil hunter-gatherer barbarians
 - To help our **Mother Kine** (nature) grow is good.
 - **Today** we know:
 - Everything eats everything else.
 - Without tectonic plates causing earthquakes and tsunamis, earth would be under water.
- **Uncleanness:** Allowed primitive hygiene
 - Saying roaches, rats, pork ... are unclean helps health but the Nazis hijacked it to pursue genocide.
 - **Today** we know that our bacteria (**biome**) are necessary for **health**, to reduce allergies and help digestion.



Rats are
cleaner pets
than dogs or
cats!

*“What we are is the result of our thoughts ...
If one speaks or acts with an impure thought
suffering follows one,
like the wheel of the cart follows the foot of the
ox.”*
– Dhammapada

AGES OF HUMANITY

Age of survival: 70,000 – 7,000 BC

- We **pray** to Nature for help.

Age of power: 7,000 BC – 1989

- We **fight** for world domination.
 - 1989: End of cold war
 - Humanity chose not to destroy itself.

Age of understanding: 1990 – ? Start of WWW

- We **belong** to the Earth, we are a part of it.
 - **Climate change:** Hurting Nature hurts us.
 - **The stars:** Are matter factories.
 - **Evolution:** Created us from animals.
 - **Culture** evolves faster than biology.
 - **Technology** lets the brain of humanity figure out science, morality and religion.



Age of survival



Age of power



Age of understanding?

MEME WARS

- **Win-lose:** For me to win, you must lose.
 - Spam, popups, spyware
 - Business is about scamming and spam.
- **Determinism:** Life is ultimately calculable.
 - Big data, total surveillance, super spies
 - Business needs more data
- **Control:** One ring to rule them all?
 - **Dictators:** Society needs a CPU.
 - **The Internet:** Needs to be controlled.
 - **Information:** Needs to be controlled.
- **Secrecy:** Software that secretly steals personal and business data and records activity
- **Win-win:** If people help each other, everyone wins.
 - Open source, freeware
 - Business is about **synergy**.
- **Free will:** Life is always a free choice.
 - Victor Frankl's concentration camp conclusion
 - Businesses need more **involvement**
- **Decentralization:** Dividing control is better.
 - **Democracy:** Society can change its leader.
 - **The internet:** Needs to be free.
 - **Information:** Needs to be free.
- **Transparency:** Software that tells you what it is doing and asks permission if it wants to take your data or record events

PART 7. DESIGNER NOTES: THOUGHT

Use links

- Make clear content links, similar links, people like you links.

Show congruence

- Match language, colors, layout, style, meaning, words.

People do meaning, computers do grammar, spelling ...

- People create comments, discussion, change notifications.

Reduce dissonance

- Give valid reasons, link to support, recognize alternatives.

Show is better than tell

- Game tutorial vs. text manual, FAQ vs. instructions

Document structure

- Heading tabs, menus, button toolbar, lists or sub-lists?

Support remembering

- Sensory impact, emotional impact, repeat, many channels ...

**The brain is
essentially a device
for creating meaning.**

LINKS

- Download link clear from text, shading and color.
- Bold headings lead to other links.



The image is a screenshot of the iTunes website homepage as it appeared in early 2014. At the top is a navigation bar with links for Store, Mac, iPod, iPhone, iPad, iTunes, and Support, along with a search icon. Below this is a secondary navigation bar with links for What's New, What is iTunes, What's on iTunes, iTunes Charts, and How To, plus a prominent blue button labeled 'Download iTunes'. The main content area features a large headline, 'Your music. Everywhere.', followed by a paragraph about iTunes in the Cloud beta. To the right of the text is a visual representation of music syncing across devices, showing an iPhone, an iPad, and a Mac laptop, all displaying the same music interface. Below the headline is a white box containing the iTunes logo and a button that says 'iTunes 10.4 Free download' with a download icon, specifying 'For Mac + PC'. At the bottom of the page are four columns of promotional text: 'What is iTunes?', 'What's new in iTunes?', 'Gift Cards', and 'Apple TV', each with a brief description and a 'Learn more' link. The bottom of the page features a row of small, colorful images representing various media content.

Apple Store Mac iPod iPhone iPad iTunes Support

iTunes What's New What is iTunes What's on iTunes iTunes Charts How To Download iTunes

Your music. Everywhere.

iTunes in the Cloud beta lets you automatically download new music, apps, and book purchases to all your devices. Or you can download only the stuff you want to just the devices you want.* It's all part of iTunes 10.4.

 **iTunes 10.4**
Free download 
For Mac + PC

What is iTunes?
It's how you play all your media on your Mac or PC and add it to your iPhone, iPad, iPod, or Apple TV. And it's a store that's always open and just a click away. [Learn more](#)

What's new in iTunes?
Buy music, apps, or books on one device and wirelessly download them to all your other devices, too. And browse and buy from the iBookstore right from your Mac or PC. [Learn more](#)

Gift Cards
Give just about anything on iTunes with an iTunes Gift Card. It's a hit for any occasion, so get ready for big thanks.
[Purchase iTunes Gift Cards](#)
[Redeem iTunes Gift Cards](#)

Apple TV
The biggest selection of HD movies and TV shows. Now playing on a TV near you. Even better — Apple TV is just \$99. [Learn more](#)

LINKS

Young person greets,
young colors for
congruence

Good “fresh” theme

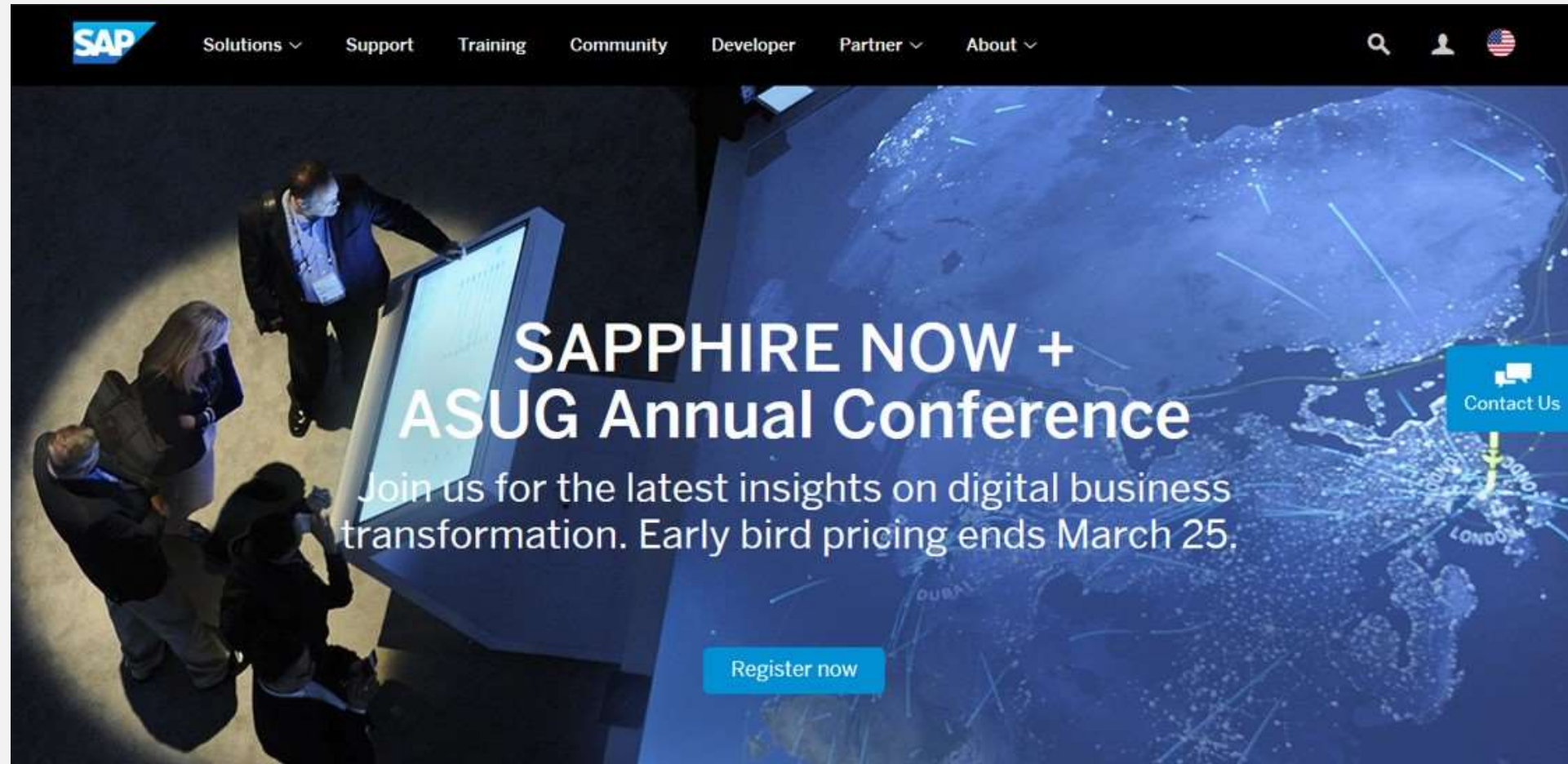
Not clear what is a button
or link

Had to bold “The Boo
Party” due to background!



CONGRUENCE

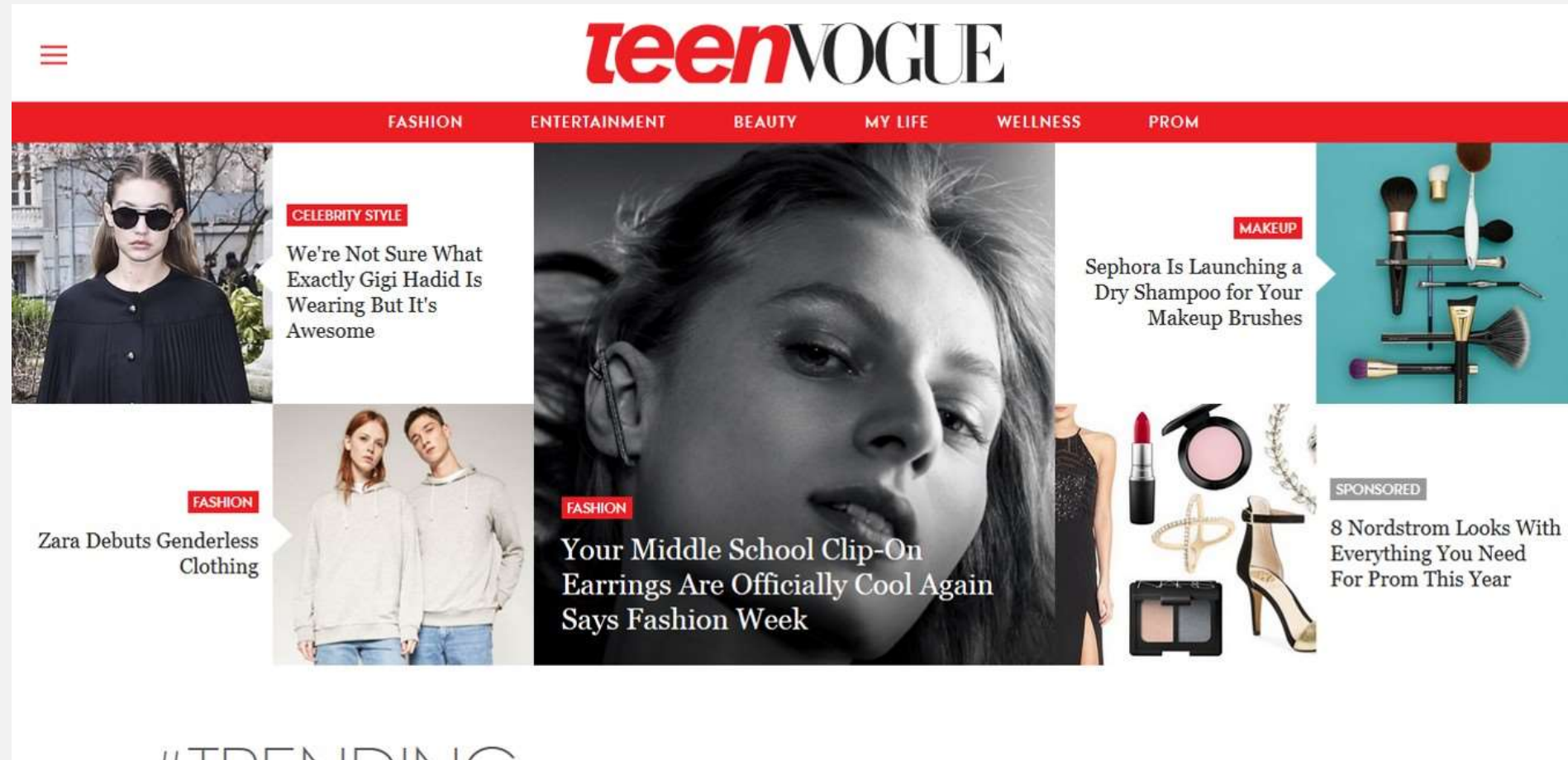
Business web sites
need business
colors (blue, grey
...)



CONGRUENCE

Web sites for the young need to “look young”.

The pictures are links.



WEB SITE STRUCTURE

Main headings on left

Usually ignore the tabs

Search is top centre

Picture gets attention

Ads on the right

The screenshot shows the Yahoo! New Zealand homepage. At the top, a black banner promotes a rugby tournament with a 'New' tag and a 'Register' button. Below this, a navigation bar includes the text 'Make Yahoo! your home page - New Zealand's #1 home page' and a link to 'Get Yahoo! New Zealand on your mobile'. The main header features the 'YAHOO! NEW ZEALAND' logo, a search bar with a 'Web Search' button, and links for 'Web', 'Images', 'News', 'Business Listings', and 'More'. A 'NZ only' checkbox is also present. To the right of the search bar, there's a 'seek' logo and a 'Brought to you by' section. Below the search bar, a navigation bar contains links for 'yahoo.co.nz', 'My Homepage', 'Mail', 'Member Centre', 'Feedback', and 'yahoo.com'. The date 'Saturday August 13, 2011' is displayed on the far right. The main content area is divided into three columns. The left column contains a vertical list of service icons and links: Answers, Autos, Business, Dating, Entertainment, Events, Flickr, Food, Horoscopes, Jobs, and Lifestyle. The middle column, titled 'News and features', includes a Facebook announcement about the name change to 'Yahoo! New Zealand' and a large photo of a man with long hair and sunglasses. To the right of the photo are three news snippets: 'Demonstrators burn Adidas logo in protest', 'Britain says PM failed as leader during riots', and 'Polar weather predicted as extreme cold front moves in'. The right column features a large advertisement for a Samsung smartphone with the text 'Your OWN SMARTPHONE'.

New Place your tips for the world's biggest rugby tournament for your chance to WIN Register

Y! Make Yahoo! your home page - New Zealand's #1 home page Get Yahoo! New Zealand on your mobile

YAHOO! NEW ZEALAND

Web | Images | News | Business Listings | More NZ only

Web Search

Auckland Change Location Brought to you by seek

Today Tomorrow H° L°

yahoo.co.nz My Homepage Mail Mail Member Centre Feedback yahoo.com

Saturday August 13, 2011

Answers Autos Business Dating Entertainment Events Flickr Food Horoscopes Jobs Lifestyle

We've changed our name to Yahoo! New Zealand. Find out more

News and features

Demonstrators burn Adidas logo in protest Yahoo! National News

Britain says PM failed as leader during riots Yahoo! National News

Polar weather predicted as extreme cold front moves in Yahoo! National News

Your OWN SMARTPHONE

DOCUMENT STRUCTURE

Main menu tabs

- Text helps?

Top tab menu

Radio-button menu?

Also right action buttons menu

Search probably won't help.

Have to yell their real function
as the structure doesn't give it

The screenshot displays the Environment Canterbury Regional Council website. At the top, there are navigation tabs for 'Related websites', 'Metro Info', 'Clean Heat', and 'Civil Defence'. To the right, there are links for 'Publications', 'Quick Answers', 'A-Z Index', 'Glossary', and 'Sitemap'. Below these, the council's logo is visible, along with a search bar and a 'My Services Login' link. A horizontal menu bar contains six main categories: 'ADVICE & INFO', 'SERVICES', 'OUR RESPONSIBILITIES', 'NEWS & NOTICES', 'GET INVOLVED', and 'ABOUT US'. Each category has a brief description of its content. Below this menu, a yellow banner with a warning icon announces a 'SNOW AND STAFF UPDATE 11.30AM MONDAY 15 AUGUST 2011'. Underneath the banner, there is a large image of snow-covered branches and a text box with the title 'Snow Update 11.30AM Monday 15th August 2011'. To the right of this, a section titled 'GET IT DONE ONLINE' lists various services: 'Consent search', 'Land Information Request (LIR)', 'GIS mapping', 'River flows (Latest)', 'Irrigation restrictions', and 'Rainfall (Latest)'.

Related websites Metro Info Clean Heat Civil Defence Publications Quick Answers A-Z Index Glossary Sitemap

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

My Services Login

Search the Environment Canterbury website.. SEARCH

All Publications Quick Answers News & Notices Advanced Search

ADVICE & INFO SERVICES OUR RESPONSIBILITIES NEWS & NOTICES GET INVOLVED ABOUT US

Information and advice on everything from energy efficiency to boating safety

From issuing resource consents to environmental monitoring and testing, find out how we can help you.

These pages show you the main activities into which our work is divided.

Read about our latest news and events, and find out what projects are currently in consultation.

Here's how you can get involved in helping us to look after our environment.

Find out who's who at your regional council, including our contact details.

SNOW AND STAFF UPDATE 11.30AM MONDAY 15 AUGUST 2011 MORE INFO

Snow Update 11.30AM Monday 15th August 2011

Due to adverse weather conditions, Christchurch bus services will not run today. An update will be posted on the Metroinfo website tomorrow morning between 6.15-4.5

GET IT DONE ONLINE

Consent search Land Information Request (LIR)

GIS mapping River flows (Latest)

Irrigation restrictions Rainfall (Latest)

WEB SITE STRUCTURE

Main tab menu indicated by contrast and icons

Secondary menu above it

Tertiary menu above that

Attention goes to the main picture which changes

Actions follow that picture



SUPPORT REMEMBERING

Sensory impact -
clear, bold, obvious

Repeat - large images
repeated below the fold

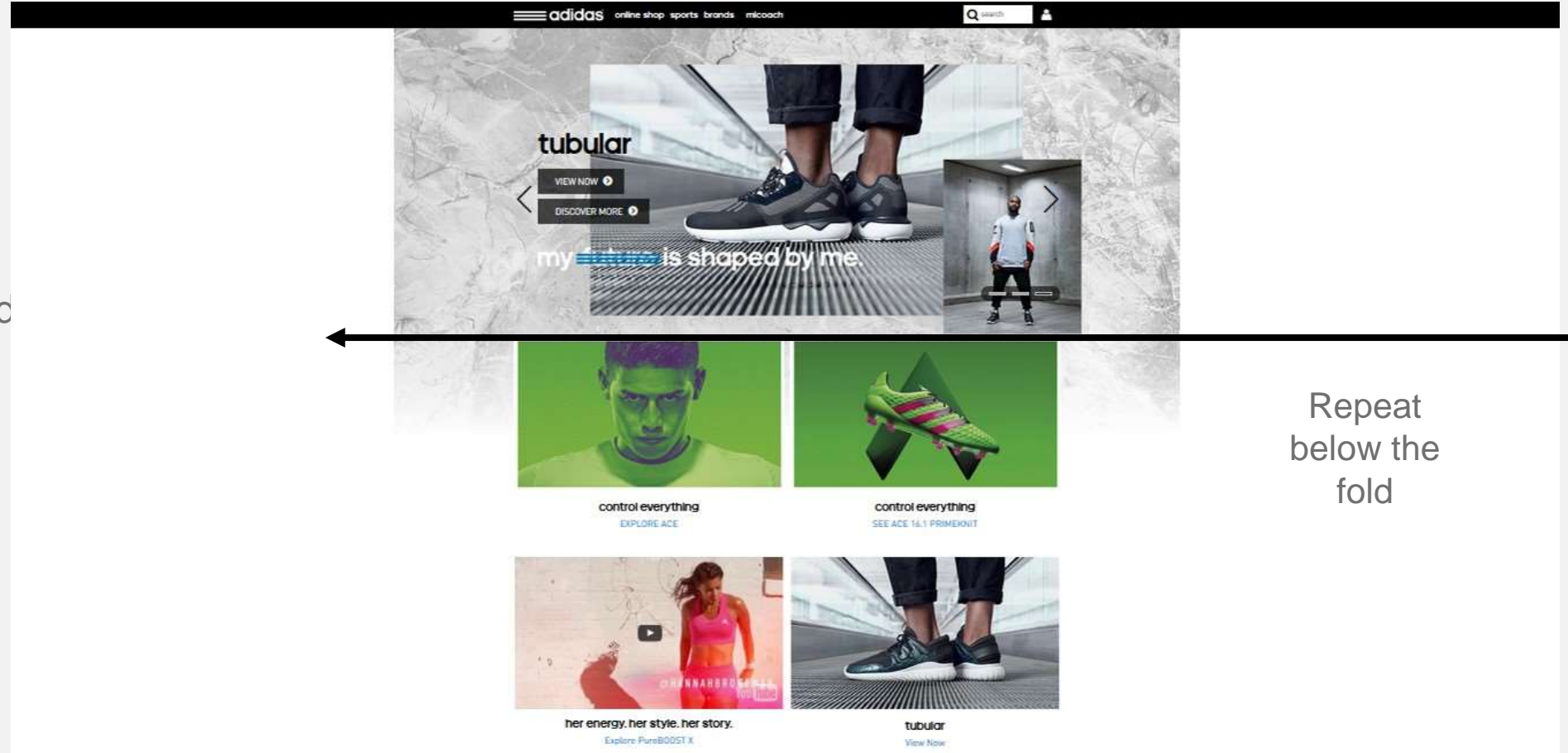
Movement – To
sustain attention

Simple – Yes

Many channels – Yes

Emotional impact –
Faces

Involvement - Not



Repeat
below the
fold