

SBS5222 Indoor Environmental Engineering

<http://ibse.hk/SBS5222/>



Introduction



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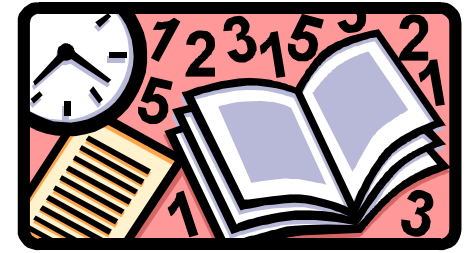
Dec 2016

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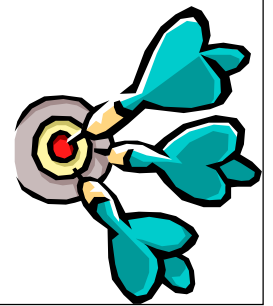
- Background
- Sustainability of buildings
- Indoor environmental quality
- Mind mapping
- Brainstorming exercise

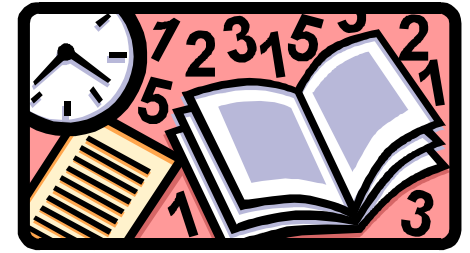




Background

- Module Aim(s):
 - The module aims to develop students' understanding of the philosophy of building design, and the strategies to improve the **sustainability of buildings** in relation to environmental performance from global to local issues.

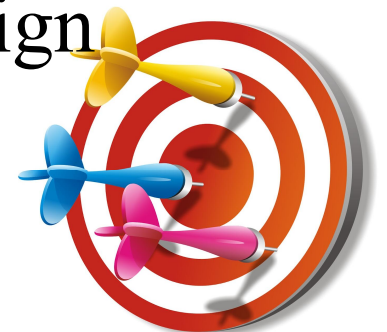


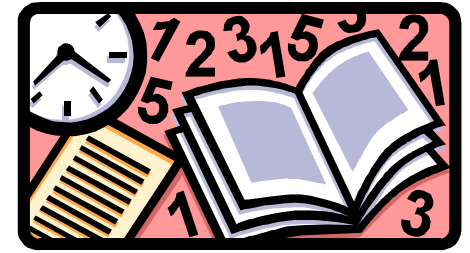


Background

- Learning Outcomes:

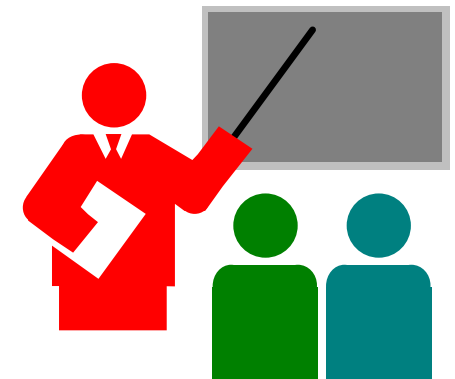
- 1. explain the **environmental issues** and the impact that buildings have on the environment;
- 2. evaluate the performance, condition, adaptability and value of new and existing buildings against various **environmental performance** criteria; and
- 3. study the total **indoor environmental quality** and advancements in building performance design themes.

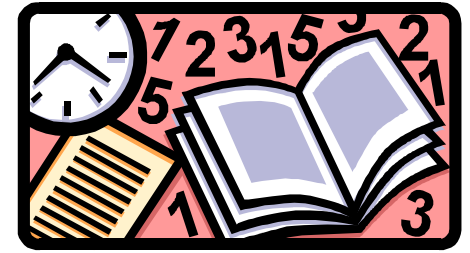




Background

- Lecturers:
 - Dr. Sam C. M. Hui (cmhui@vtc.edu.hk)
 - Dr. Yimo LUO, Constance (yimo.luo@vtc.edu.hk)
- Assessment Methods:
 - Assignments (30%)
 - Presentation (10%)
 - Examination (60%) (3 hours)
- Course Website:
 - <http://ibse.hk/SBS5222/> + Moodle



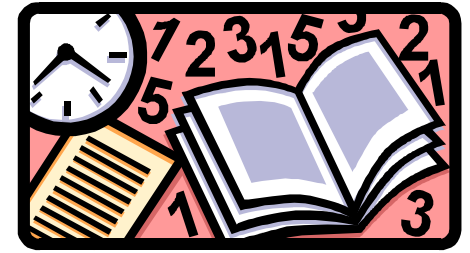


Background

- Assessment Components:
- Assignments (30%)
 - Assignment(s) by Dr. Hui (15%)
 - Assignment(s) by Dr. Luo (15%)
- Presentation (10%) – group project
 - Oral presentation (jointly assessed by Dr. Hui and Dr. Luo)
- Examination (60%) (3 hours)
 - Section A by Dr. Hui (2 out of 3 questions @ 25 marks)
 - Section B by Dr. Luo (2 out of 3 questions @ 25 marks)



Background



- Study topics:

- Introduction
- Sustainability
- Environmental issues
- Building environmental performance
- Green building assessment and case studies
- Technical visit

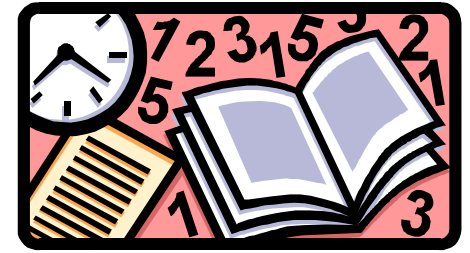


Dr. Hui

- Indoor air quality (IAQ)
- IAQ management and remediation
- IAQ assessment
- Indoor environmental quality (IEQ)
- Building ventilation systems
- Sick building syndrome

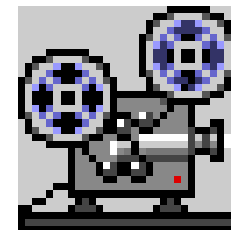


Dr. Luo



Background

- Learning Methods:
 - Lectures + Further Reading
 - Individual Assignments
 - Discussions
 - During lectures/tutorials
 - When doing the group project
 - Technical Visit
- Resources:
 - Video presentations
 - Web links + References



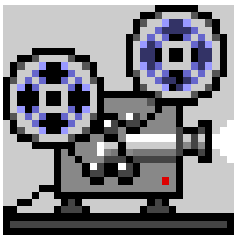
Sustainability of buildings



Sustainability of buildings



- **Environmental concerns:**
 - The growth and development of our world has a large impact on the **natural environment**
 - Manufacturing, design, construction, and operation of the buildings in which we live and work are responsible for the consumption of many of the **natural resources**
- **Green building** – challenge and opportunities
 - Video: Green Building: Jobs of the Future (11:59)
 - <http://www.youtube.com/watch?v=rr0IAWO9lnk>

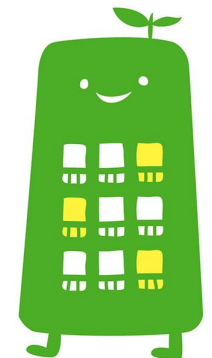
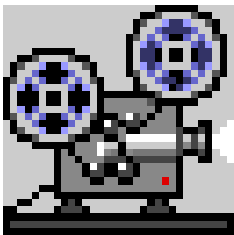


綠色建築

Sustainability of buildings



- Important trends:
 - Green building assessment, e.g. LEED rating system by U.S. Green Building Council
 - Video: What is green building? (1:16)
<http://www.youtube.com/watch?v=MyIOtsx3wDs>
 - Video: Introducing LEED v4 (1:34)
<http://www.youtube.com/watch?v=UJzdnykumTU>
 - Hong Kong Green Building Week (HKGBW)
香港綠色建築週 <http://www.hkgbc.org.hk/eng/gbw.aspx>
 - Green building movement in HK



HONG KONG
GREEN BUILDING WEEK
香港綠色建築週

Sustainability of buildings



- Going “Green” is the “right thing”
 - Reduce resources consumption
 - Decrease carbon or green house gas emissions
 - Enable energy independence
 - Encourage community growth and enhancement
 - Preserve and protect natural systems
 - Achieve “sustainable development (可持續發展)”



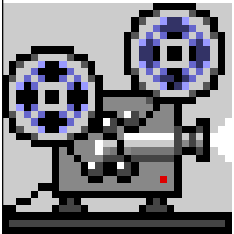
Development of environmental priorities

1970s →	Energy scarcity (energy crisis)
1980s →	Global warming Concept of 'sustainable development' Ozone thinning/depletion
1990s →	Energy scarcity Water distribution and quality Rainforest protection
2000s →	Sustainable construction Energy and health World poverty and disease Mitigation of climate change
2010s →	Adaptation of climate change Eco- and mega-cities Zero carbon technologies Switch to solar and other renewable energy resources

Sustainability of buildings



- Hong Kong situation



- CLIMATE READY HK (2:17)

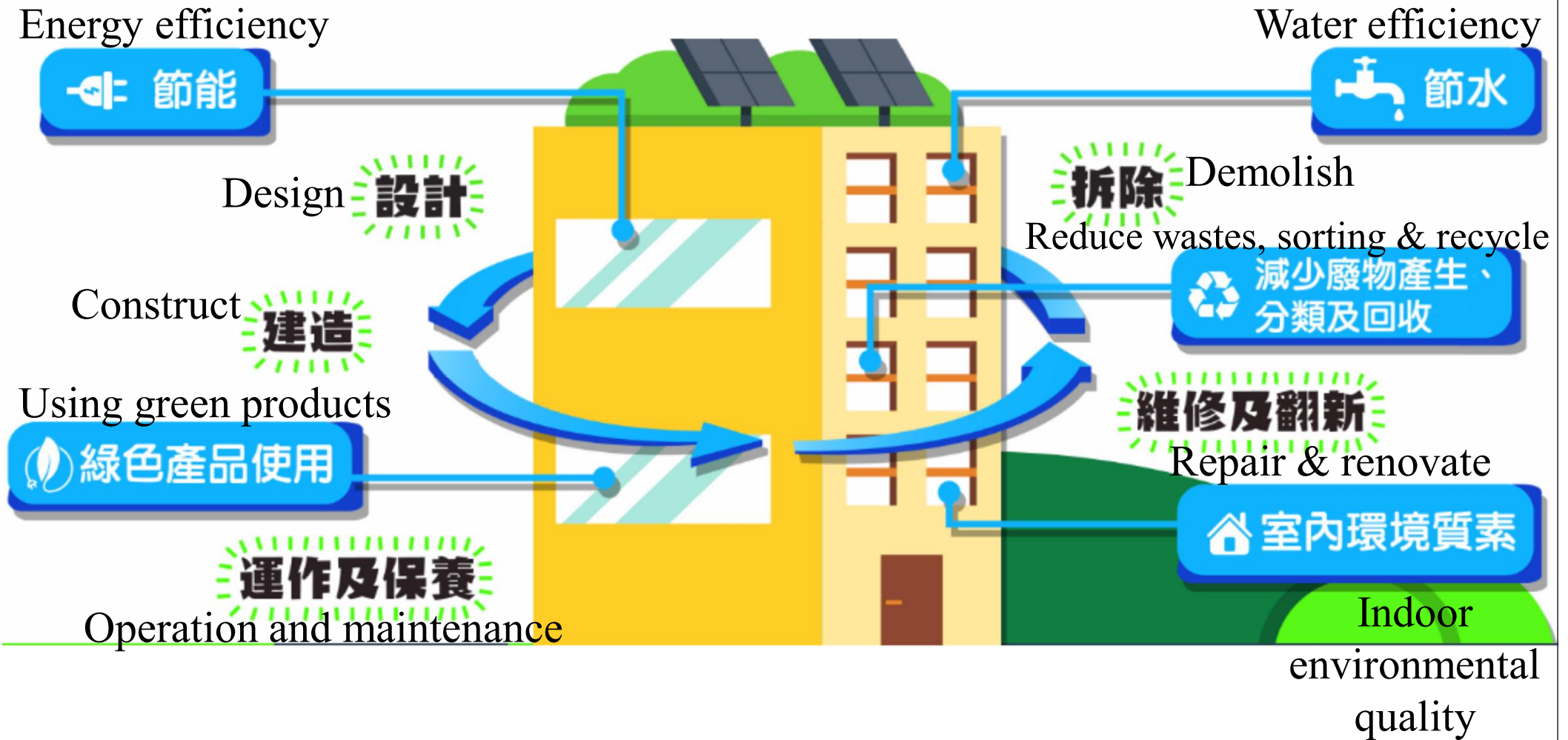
氣候變化 香港行動

- <http://www.youtube.com/watch?v=ta2ixuQ5EN4>

- Key concepts to study:
 - The meaning of sustainability
 - Environmental issues
 - Building environmental performance
 - Green building assessment

What is Green Building?

甚麼是綠色建築?



Indoor environmental quality



Indoor environmental quality

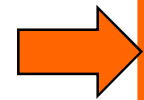


- Building **indoor environment** covers the environmental aspects in the design, analysis, and operation of energy-efficient, healthy, and comfortable buildings
- Fields of specialization include:*
 - Architecture, HVAC design, thermal comfort, indoor air quality (IAQ), lighting (visual environment), acoustics (noise control), controllability (individual control)

*Relate to what you have learnt in other courses, e.g. Arch & Bldg, HVACR.

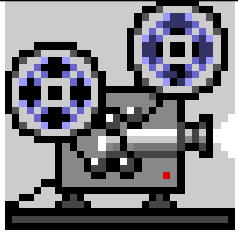
Major aspects of indoor environmental quality (IEQ)

室內環境質量



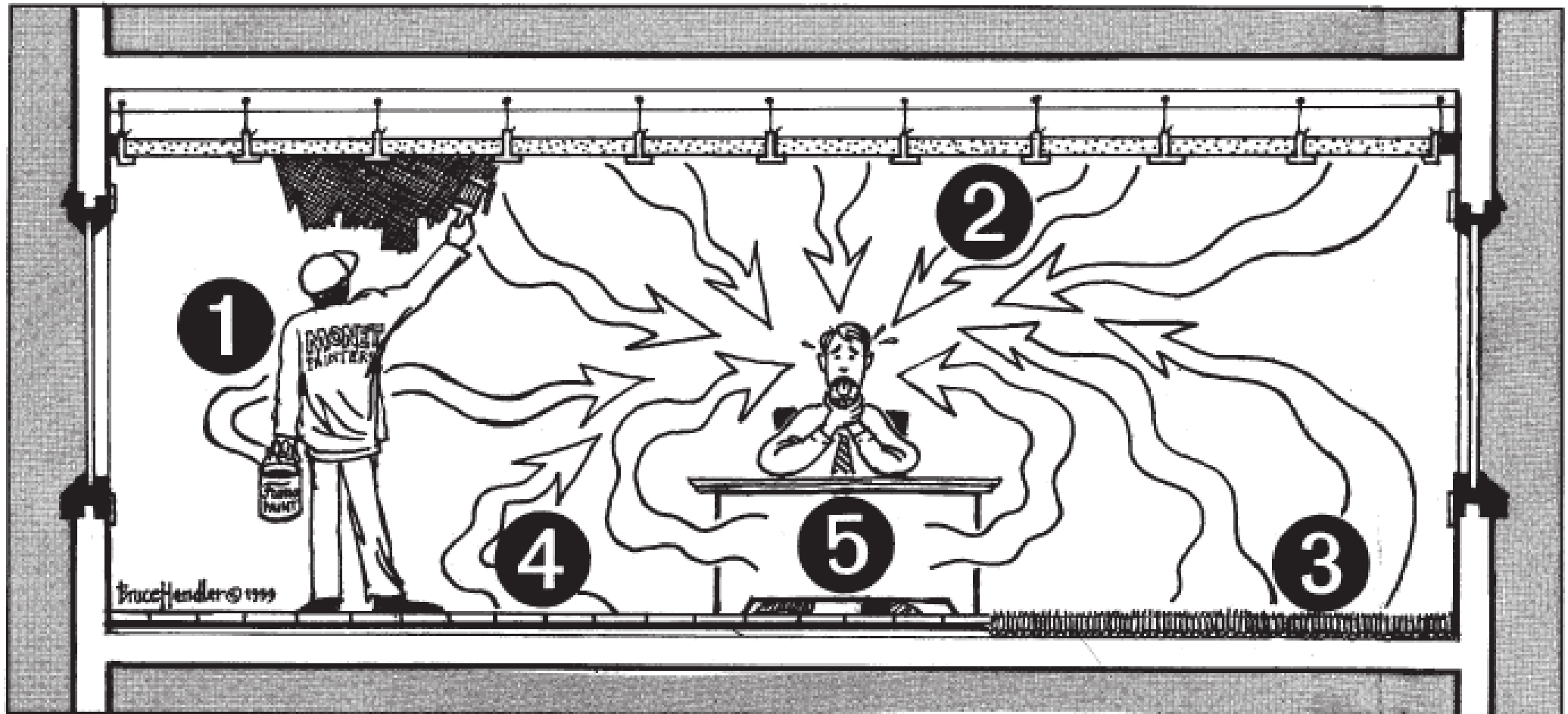
室內空氣質量





Video: Defining Indoor Air Quality (2:15)

<http://www.youtube.com/watch?v=YJ1pBL7SiWI>

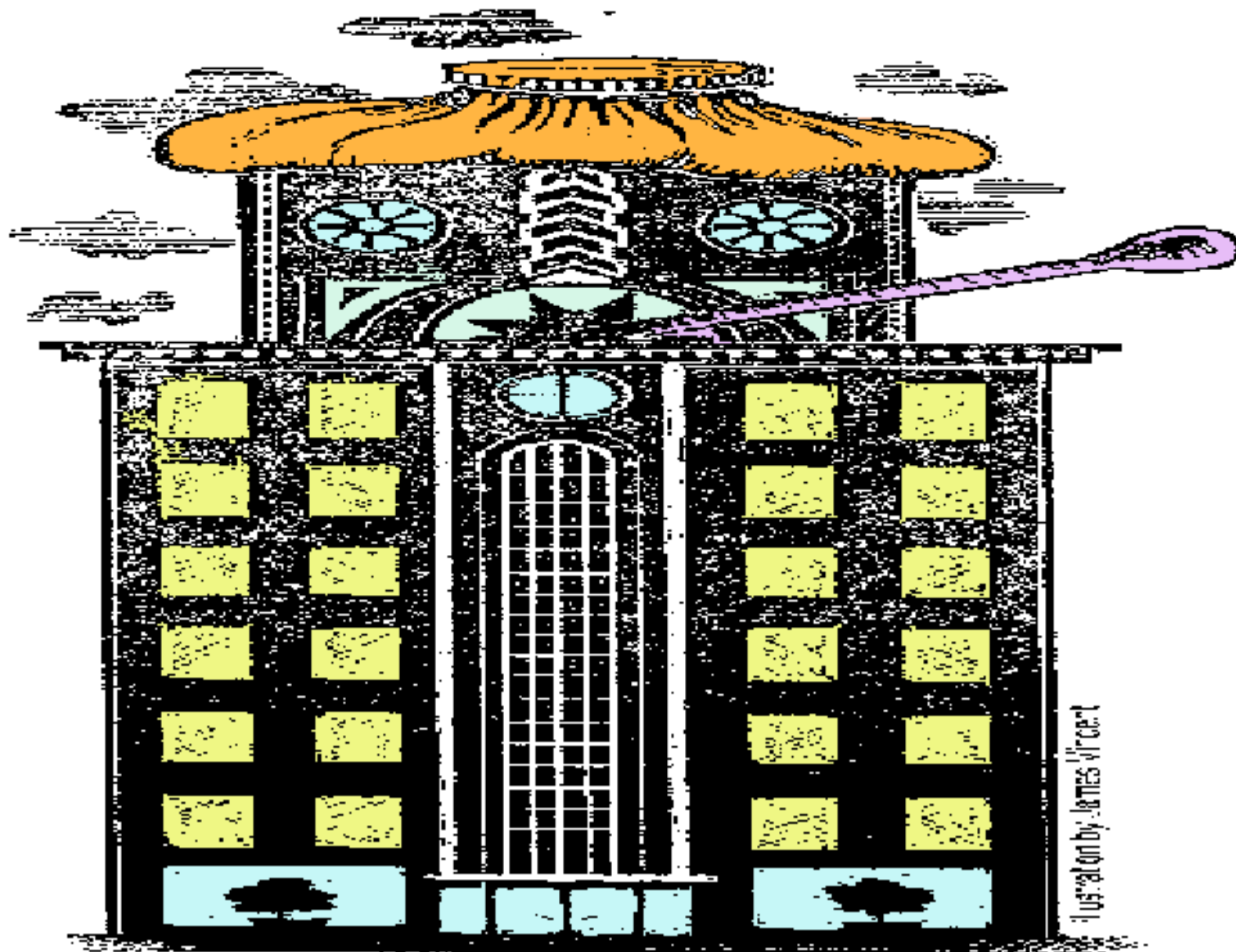


Sources of offgassing in building materials:

- 1) paints, 2) ceiling tiles, 3) carpeting, 4) VCT floor tiles
- 5) manufactured wood products

Avoid “sick building syndromes” by maintaining good indoor air quality

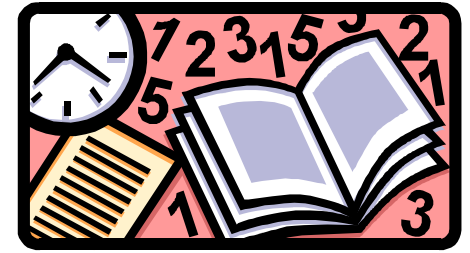
病態建築症候群



Indoor environmental quality



- IEQ addresses the subtle issues that influence how we **feel** in a space
 - It is a fundamental human right to live and work in spaces with **healthy indoor environments**
- Key concepts to study:
 - Indoor air quality (IAQ)
 - Indoor environmental quality (IEQ)
 - Building ventilation systems
 - Sick building syndrome

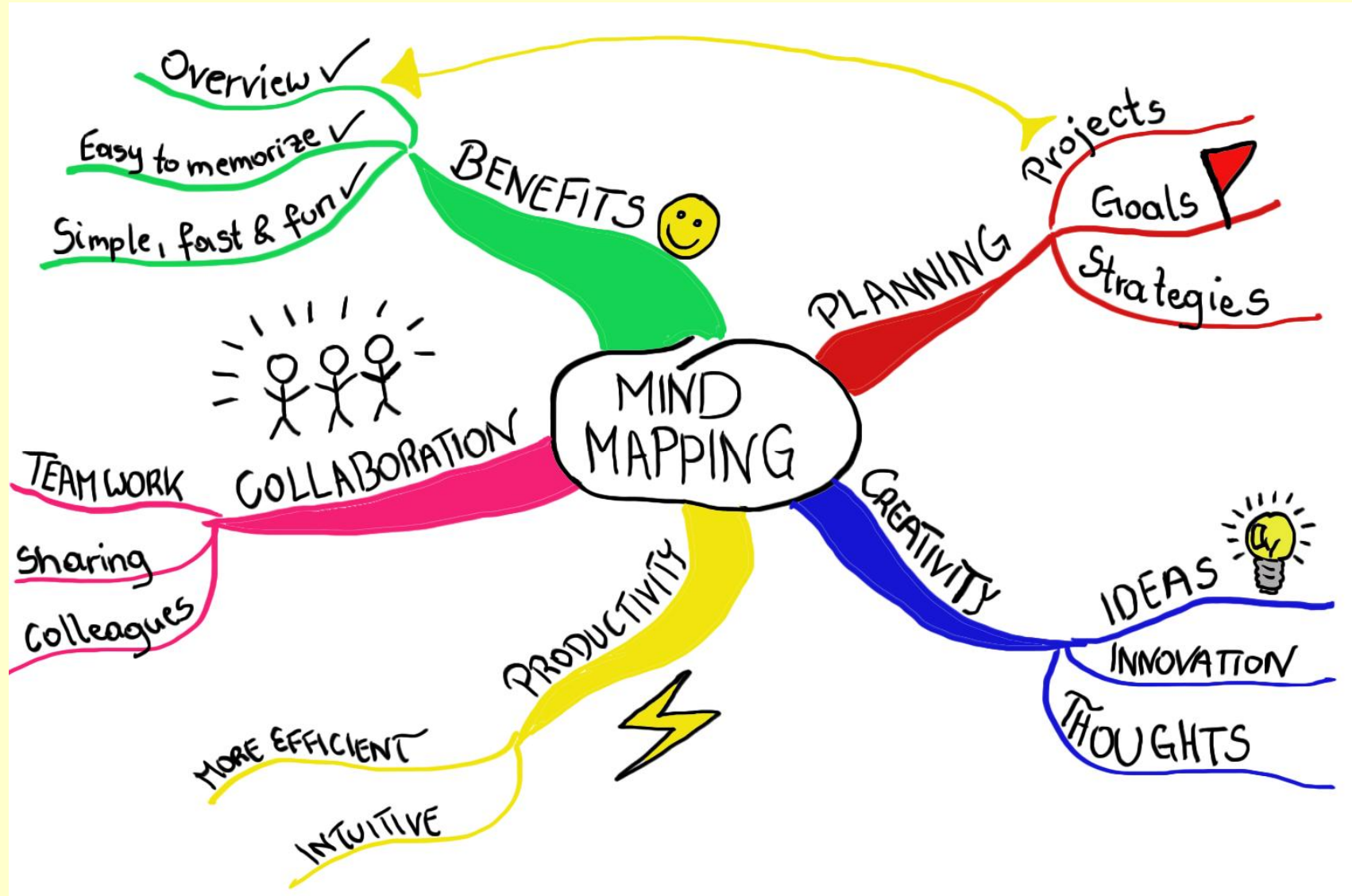


Useful references

(* Available in E-Database: [Construction Information Service \(CIS\)](#))

- Sustainability of buildings:
 - Edwards, B., 2014. *Rough Guide to Sustainability: A Design Primer*, 4th ed., RIBA Publishing, London.*
 - Heywood, H., 2015. *101 Rules of Thumb for Sustainable Buildings and Cities*, RIBA Publishing, London.*
 - Pearce, A. R., Yong, H. A. and HanmiGlobal, 2012. *Sustainable Buildings and Infrastructure: Paths to the Future*, Routledge, London and New York.*
- Indoor environmental quality (IEQ):
 - ASHRAE, 2009. *Indoor Air Quality Guide: Best Practices for Design, Construction and Commissioning*, American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), Atlanta, GA. (available at <http://iaq.ashrae.org/>)
 - CIBSE, 2011. *Indoor Air Quality and Ventilation*, Knowledge Series KS17, Chartered Institution of Building Services Engineers (CIBSE), London.*

Mind mapping



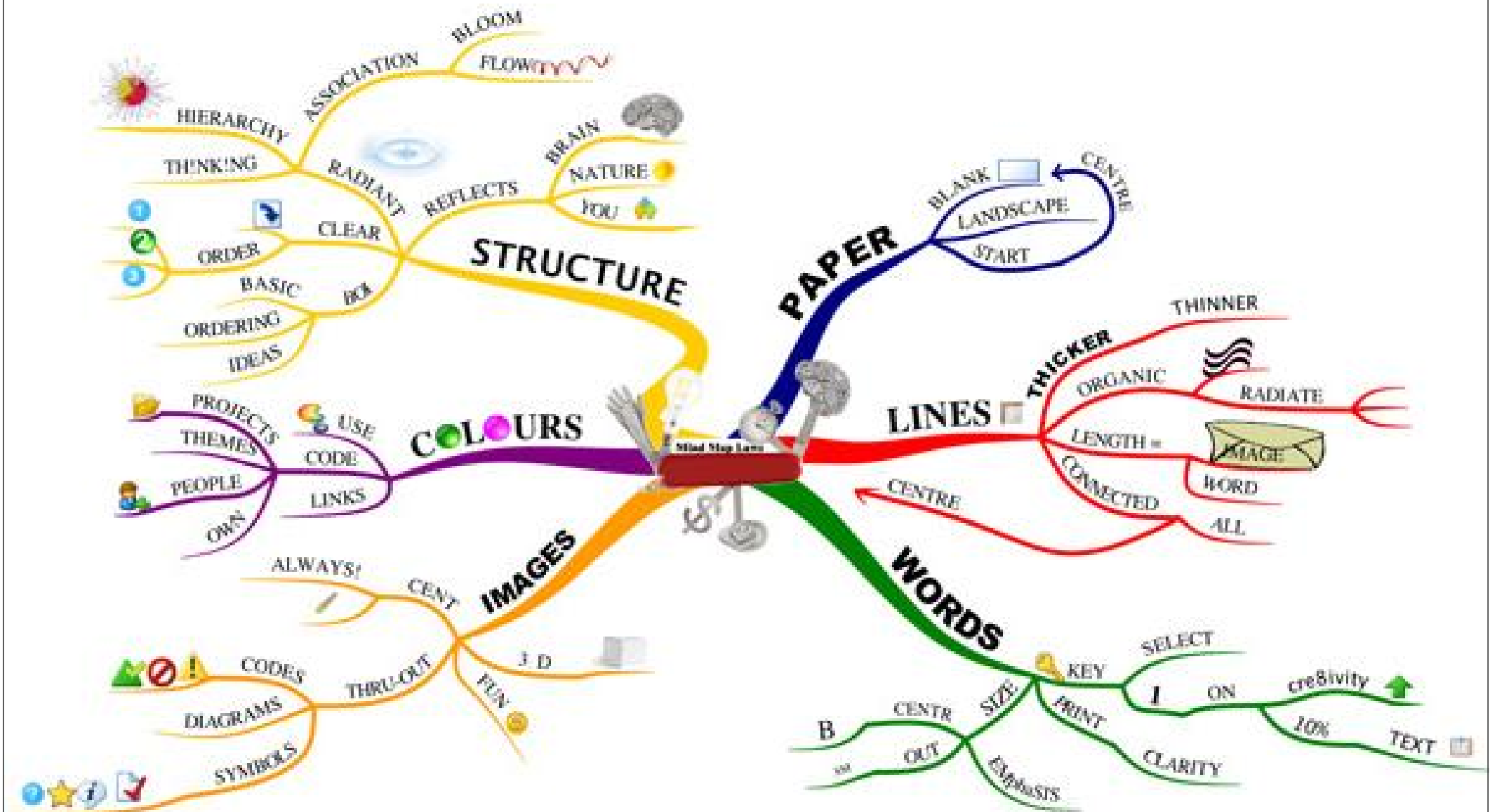
思維導圖

Mind mapping



- A mind map is a diagram used to visually organize information
 - It is **hierarchical** and shows relationships among pieces of the whole
 - It is often created around a single concept, drawn as an image in the center of a blank page, to which associated **representations of ideas** such as images, words and parts of words are added
 - Major ideas are **connected** directly to the central concept, and other ideas branch out from those

Example: Mind map laws



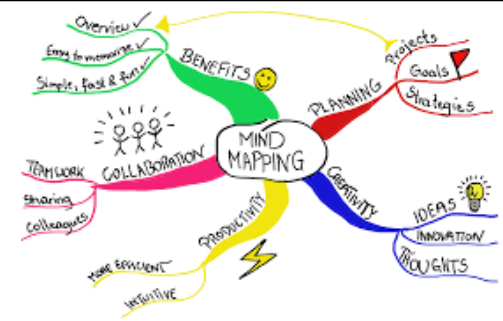
Mind mapping



- Benefits of using mind maps
 - Help you avoid thinking linearly
 - Open you up to creativity & new ways of thinking
 - Help you think outside the box
 - Help you get the big picture
- How to do a mind map?
 - Use an unlined piece of paper
 - Work quickly without pausing, judging or editing
 - Think creatively in a non-linear manner

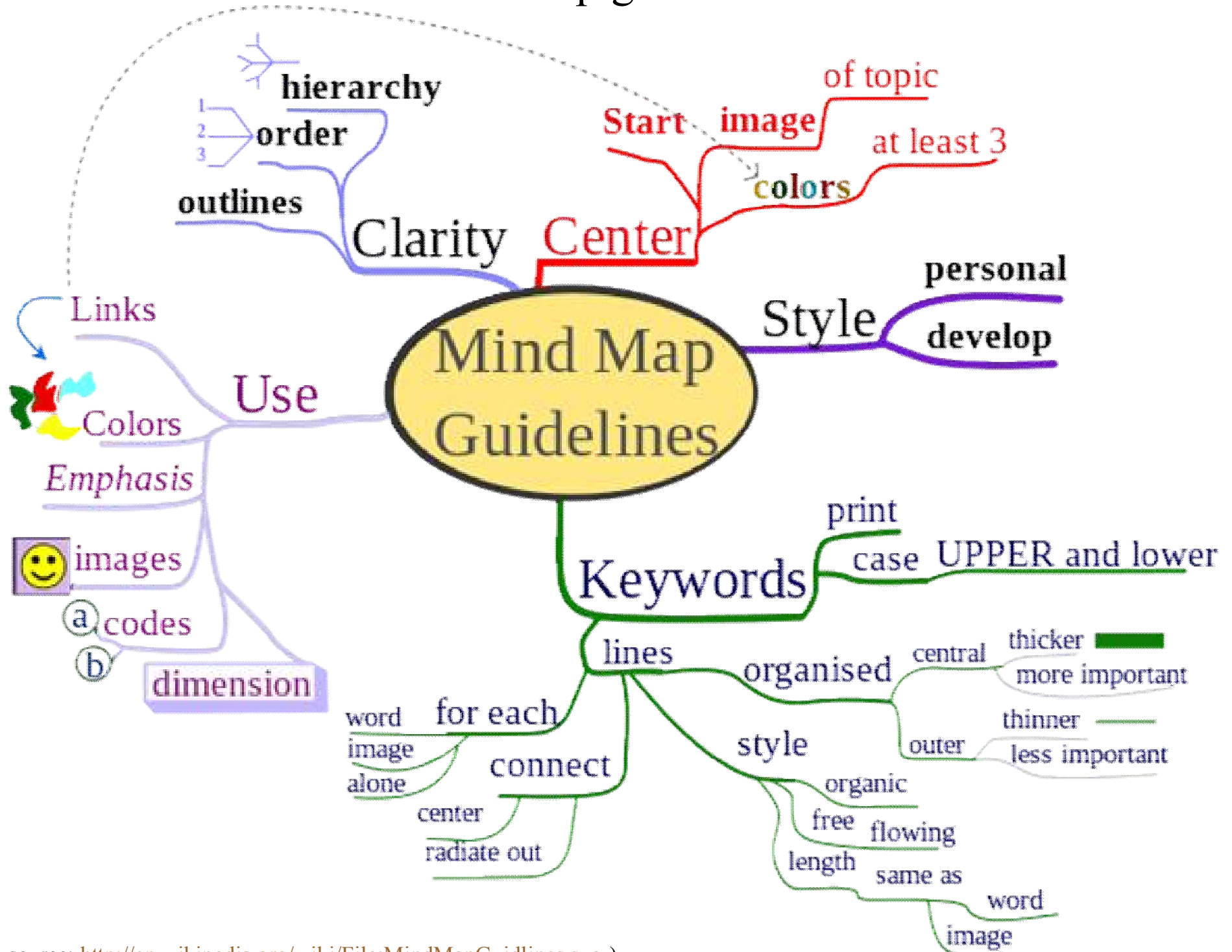


Mind mapping

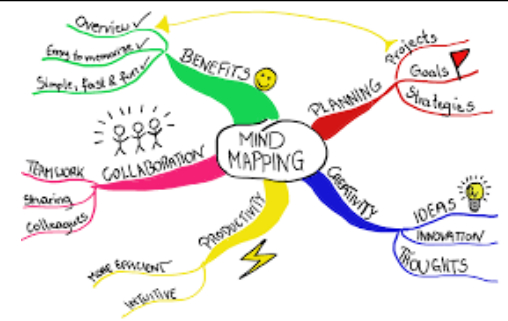


- How to make a mind map in 8 steps
 - Step 1: Start at the centre of the page
 - Step 2: Don't be serious!
 - Step 3: Free associate
 - Step 4: Think as fast as you can
 - Step 5: There are no boundaries
 - Step 6: Don't judge too fast
 - Step 7: Go, go, go....
 - Step 8: Add relationships and connections

Mind map guidelines



Mind mapping



- Learn how to do mind mapping
 - How to Make a Mind Map - The Basics (2:51)
 - <http://www.youtube.com/watch?v=wLWV0XN7K1g>
 - How to Mind Map (6:29)
 - <http://www.youtube.com/watch?v=4wZ5wV5dPZc>
- Free mind mapping software online:
 - <http://mindmapfree.com/>
 - <http://www.mindmup.com/>

Brainstorming exercise



- Brainstorming using mind mapping
 - Form a group of 5 students
 - Select the topic for mind mapping
 - Discuss within the group and divide the works
 - Collect information and ideas
 - Prepare and present the mind map
- Students should make the mind map interesting and informative (The group with the best mind map will receive an award)



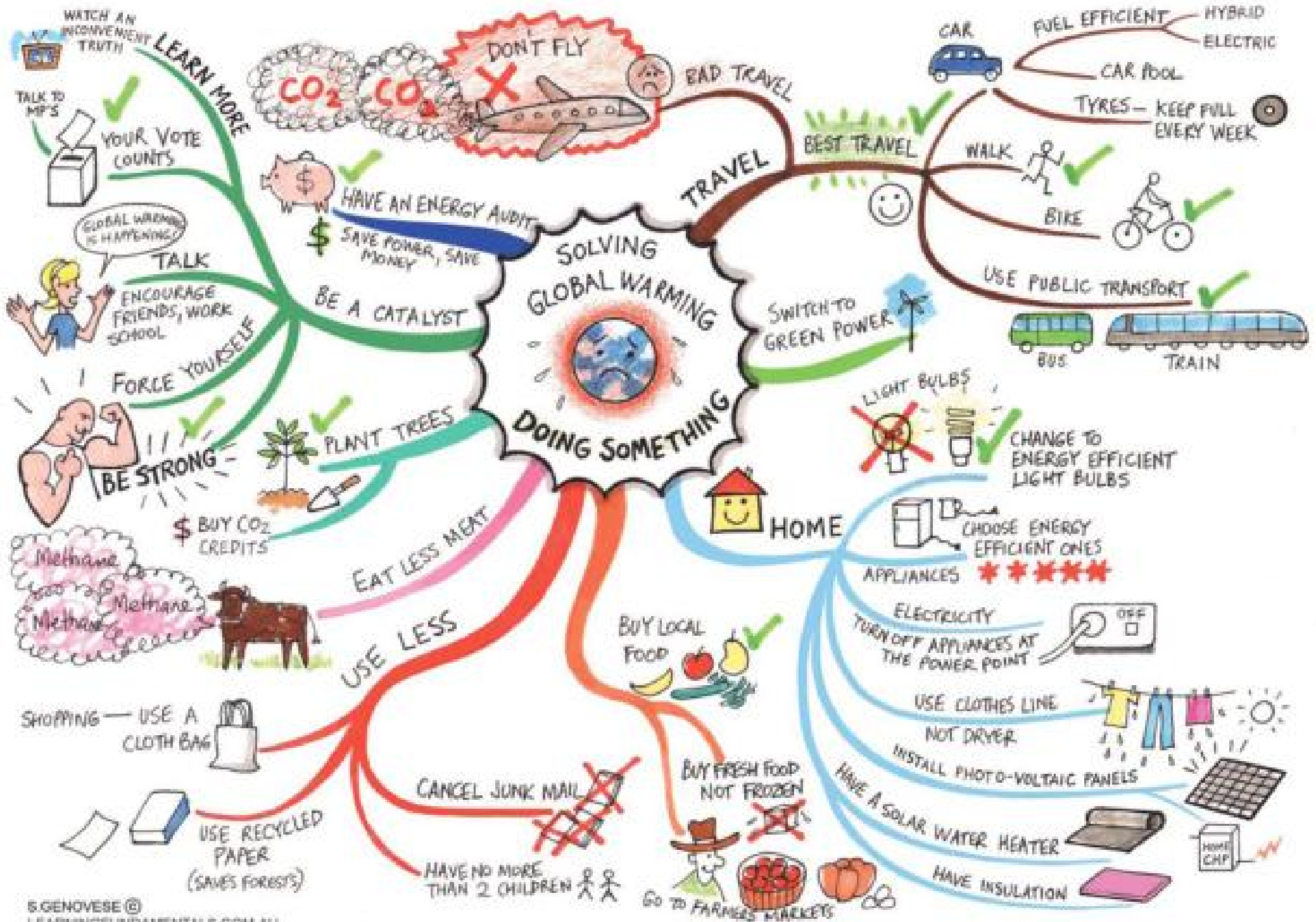


Brainstorming exercise

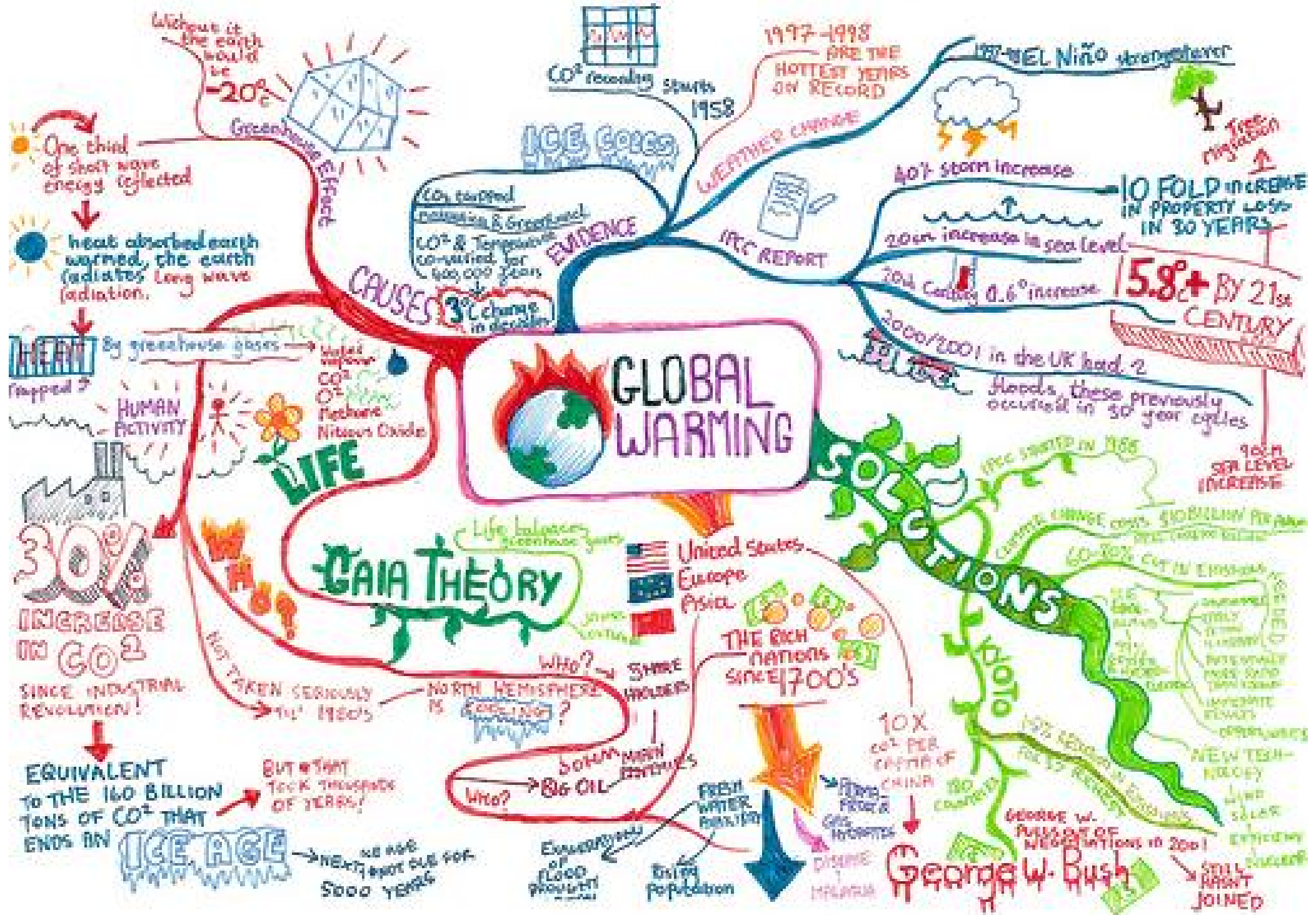
- Topics of mind mapping: (one for each group)
 - 1. Building life cycle
 - 2. Environmental impacts
 - 3. Environmental sustainability
 - 4. Green building
 - 5. Healthy building
 - 6. Indoor air quality
 - 7. Indoor environmental quality
 - 8. Ventilation in buildings

* May also modify the topic or suggest another relevant topic.

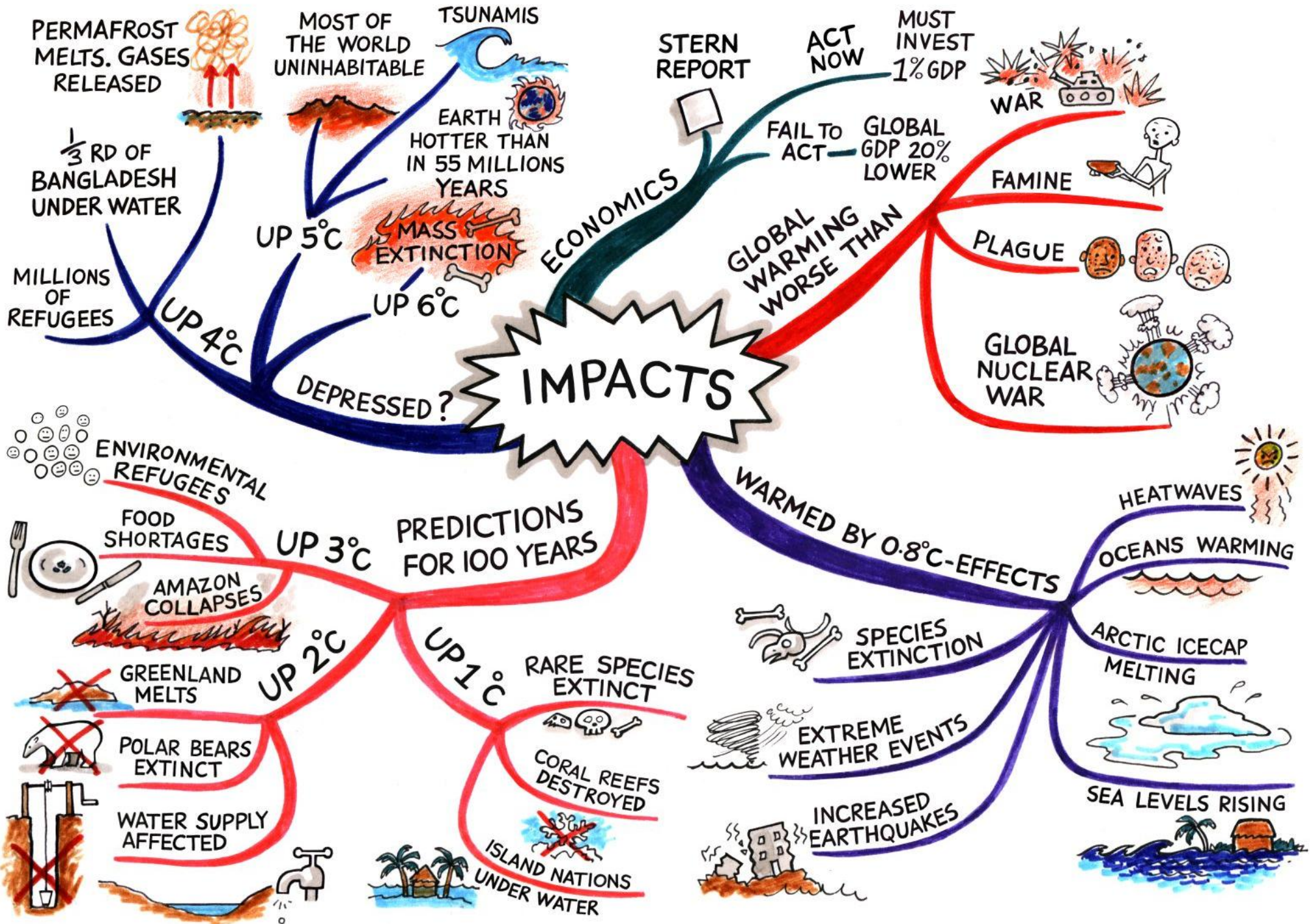
Examples of mind maps



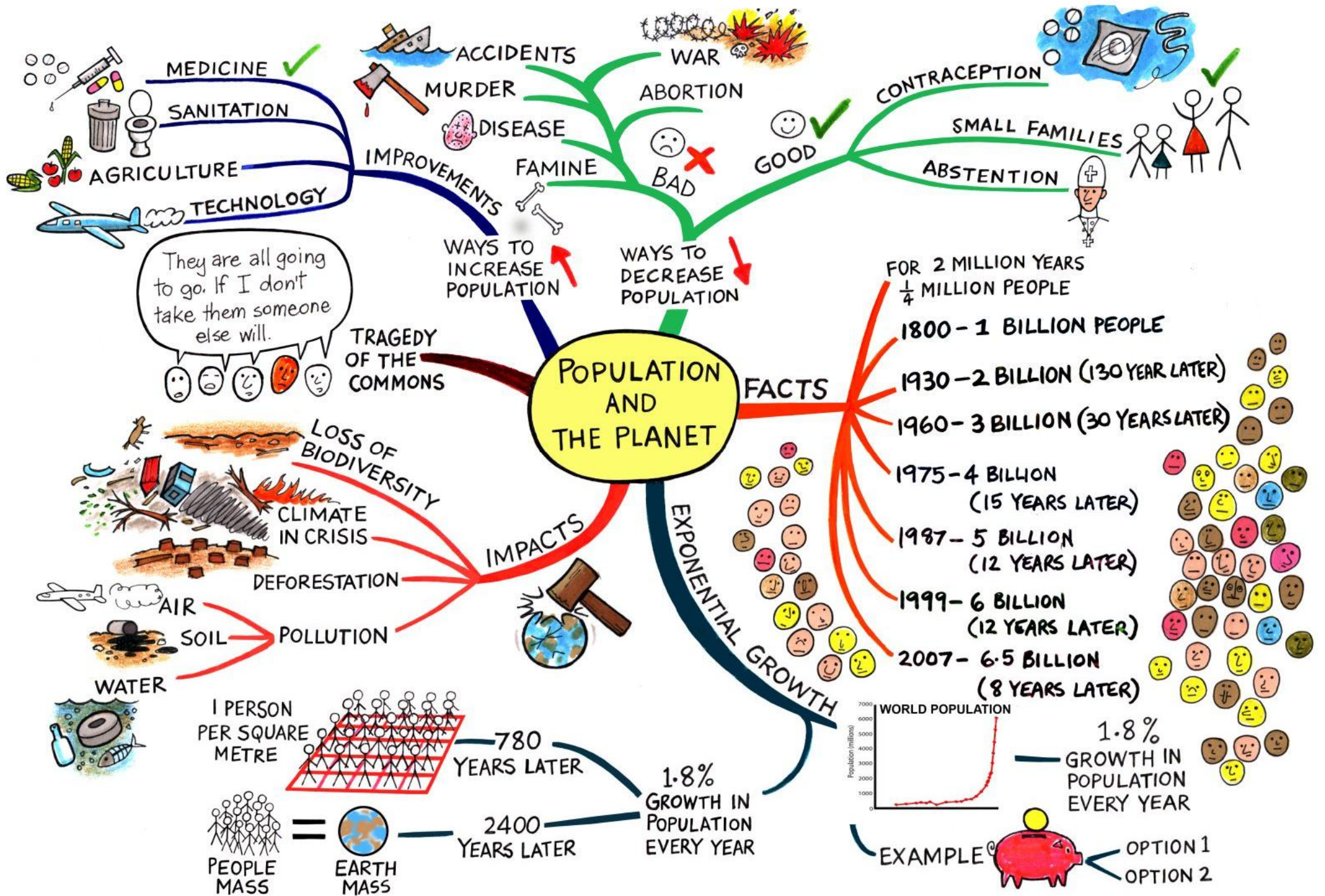
Examples of mind maps



Examples of mind maps



Examples of mind maps





Brainstorming exercise

- Submission and oral presentation
 - Date: 13 Feb 2017 (Mon), 11:30am (tutorial hour)
 - Submission format: (via Moodle)
 - Photo or scanned image of the mind map
 - PDF file from mind map software is acceptable
 - Oral presentation:
 - 5 minutes for each group
 - Highlight the key features or ideas of the mind map
- Students will be asked to vote for the best mind map (to determine the award)