Creativity in the Sciences

Creativity in Interdisciplinary Environments

Peter R.N. Childs

29th April 2009

p.childs@imperial.ac.uk

Imperial College London

Why?

- Creativity enriches our culture, can improve the quality of our lives and provides the opportunity for the solution of societal problems and its development.

- Creativity can provide purpose and a form of expression and to some makes ‘our spirits sing’.

Imperial College London

- What is creativity …

Imperial College London

Some definitions of creativity

- Creativity is the process of change, of development, of evolution, in the organisation of subjective life (Ghiselin (1952))

- Creativity is the forming of associative elements into new combinations which either meet requirements or are in some way useful (Mednick (1962))

Imperial College London

Some definitions of creativity

- Creativity is some sort of mental activity, an insight that occurs inside the heads of some special people (Ciskszentmihalyi (1996))

- Creativity is the ability to challenge assumptions, break boundaries, recognise patterns, see in new ways, make more connections, take risks, and seize upon chance when dealing with a problem (Herrmann (1996))

Imperial College London

Some definitions of creativity

- Creativity denotes a person's capacity to produce new or original ideas, insights, inventions, or artistic products, which are accepted by experts as being of scientific, aesthetic, social or technical value (Vernon (1989))

- Creativity is imagination with responsibility (Sae Ra Kung (2009))

Imperial College London

Some definitions of creativity

- When the concept of creativity is used in reference to language, it is as an adjective that refers to a person who is particularly talented in comparison to the average of the rest of the population.
- *A slightly creative person is definitely more creative than a very creative cat*!

Imperial College London

Metrics for Creativity

‘I know it when I see it’

Imperial College London

Patterns

- We are familiar with the years of toil that in the case of some individuals can lead to a burst of new knowledge that sets a domain that others then occupy for a while.
- The study of creativity reveals patterns to this type of creative burst.
- It is not necessarily that there is a certain kind of person who is pre-destined to be creative although factors such as access to a domain, a culture, people who can assess and understand an idea, recognise its contribution and then take it forward, all help.

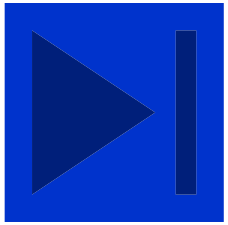
Imperial College London

Your turn - already

- On the 3 green post-its -
  - Examples of creativity – with one example per post-it
- On the 3 pink post-its –
  - Examples of human activity that you think are not creative – with one example per post-it

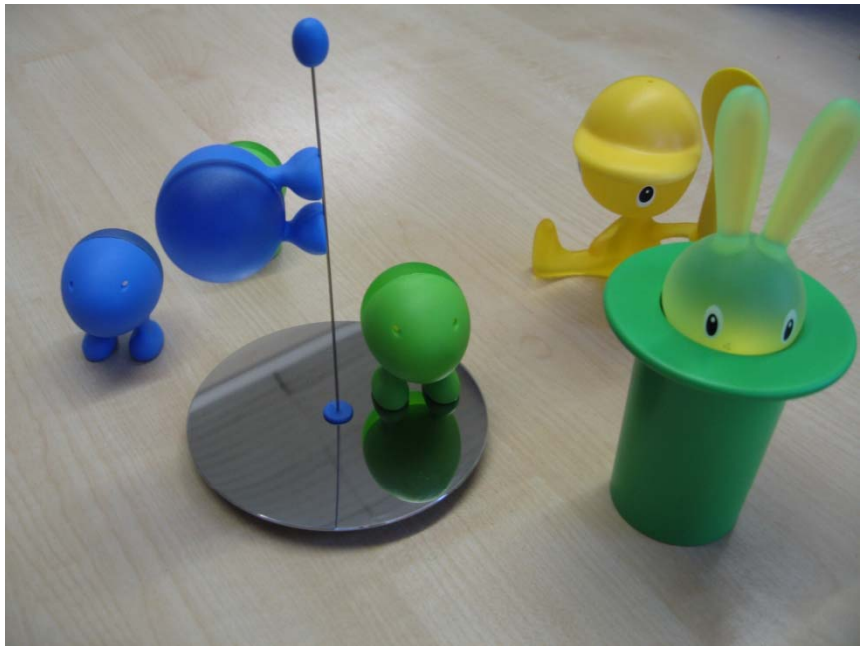
  - Lots of meta-data …

Imperial College London



Creativity

Creativity is perhaps the most prized human attribute and an essential element of the design process.



It is therefore unsurprising that for centuries we have attempted to enhance and mimic these powers with striving, training and technology.

Imperial College London

Taxonomy of creativity

Creativity is often thought to exist on at least five levels:

- a higher level versus a lower level
- grand versus modest
- big "C" versus little c
- paradigm-shifting versus garden-variety
- eminent versus everyday

Imperial College London

Imperial College
London

Taxonomy of creativity

- brilliance
- personal creativity
- paradigm/domain creativity
- forced/industrial creativity

Imperial College London

History of creativity

Periods?

- The prerogative of supreme beings
- Ancient Greece and China and other civilisations
- Early Christian
- Renaissance
- Industrial revolution
- Luxury and power (US)
- 20th Century psychology and neuroscience

Imperial College London

Imperial College
London

Sponsorship

- Patronage
  - Enables attention
    - pays for our cleaning,
    - child care,
    - relieves us from having to teach, enjoyable though that may be,
      - » so that at key times in life we are able to concentrate and develop our skills within a domain, experiment and then apply them.
  - Pays for expansive periods of time
  - Pays for costly rigs, experiments, research and support teams
  - Enables innovation and the realisation of an idea

Imperial College London

Imperial College
London

Imperial College
London

Creativity

- Creativity is the ability to imagine or invent something new of value.

- It is not the ability to create out of nothing, but the ability to generate new ideas by combining, changing, or reapplying existing ideas.

- Some creative ideas are astonishing and brilliant, while others are just simple, good, practical ideas that no one seems to have thought of yet.

Imperial College London

Warm Ups

Mutation

- Tape flip chart pages up around the room
- The facilitator calls out the word of an object
- The participants sketch this simply on the sheets
- The facilitator then asks the participants to redraw this rapidly as if it was stepped on by an elephant; dipped in acid; caught up in a tornado and other catastrophic/transformational experiences that would change its appearance.

Imperial College London

Warm Ups

Mutation

- Variations:
- apply mutations singularly
- apply mutations sequentially
- apply mutations to neighbours images

- Strengthens visualisation skills and gets people drawing

Imperial College London


Minds

Imperial College
London

Body and Mind

- Chemical processes and operations that occur in our brains, while useful and serving a purpose for certain circumstances do not work well for us on other occasions

- To an extent we can and do need to manage the chemistry of our brains otherwise we will not be able to manage our thinking.

!

Imperial College London

Body and Mind

- Attention and stress are intertwined.
- While stress arousal is useful for a real emergency as an on-going state it can be a disaster.
- If you want people to be able to consider novel ideas, you need to take care of the potential stress response. A stress response, can through the release of endorphins, prevent people from being able to think about new ideas.

Imperial College London

Body and Mind

- So we need to create a low stress environment to encourage creative thinking.
- Physical and mental environments need to be considered.
- This can be achieved by protecting participants from the consequence of considering new ideas.
- Reassurance should be given that if a new idea is followed then the whole group will provide support and will try and solve any problems that arise.
- Generating high trust is essential.

Imperial College London

Body and Mind

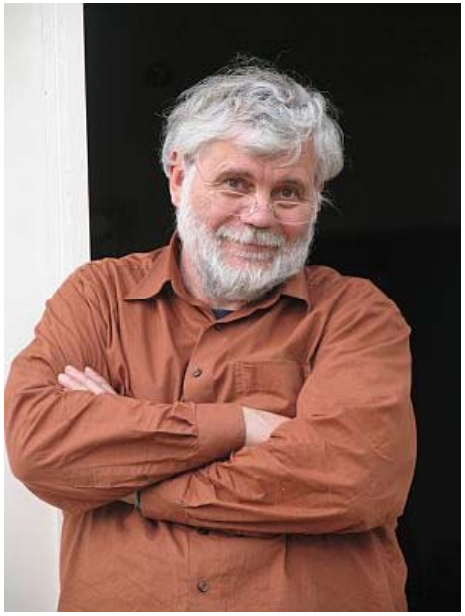
When do you get ideas?

The 5 bs of creativity:

- in the **b**ar;
- in the **b**ath;
- in **b**oring meetings;
- on the **b**us;
- in **b**ed.

Imperial College London

- Is there a certain type of person who is creative?
  - …



Imperial College London

Conservative and expansive nature

- We are born with contradictory nature.
- We have a conservative nature compelling us to self-preservation, to conserve effort, to make ourselves look good
- and an expansive nature that drives us to explore, to enjoy novelty and to take risks.
- Indeed curiosity is an essential element leading us to be creative.
- We need to be both conservative and expansive.
- However if our expansive nature is not encouraged or does not meet with early success it is possible that we become discouraged and this part of our nature can recede.

Imperial College London

Creative characteristics

- Great physical energy – often quiet and restful
- Smart and naïve
- Playfulness and discipline
- Imagination and realism
- Extroversion and introversion
- Humble and proud
- Masculine and feminine
- Independent/rebellious and domain linked
- Passionate and objective
- Suffering and joyful

Imperial College London

Investment theory

According to the investment theory (Sternberg (2006)), creativity requires a confluence of six distinct but interrelated resources:

- intellectual abilities;
- knowledge;
- styles of thinking;
- personality;
- motivation;
- environment.

Imperial College London

Environments

- An environment, spacial and social, physiological and psychological, is required that is supportive and rewarding of creative ideas.
- We can have all of the internal resources needed to think creatively, but without some environmental support (such as forums for proposing ideas and a culture that encourages this), the creativity that a person has within him or her might never be displayed.

Imperial College London

Stanford: D-School

Imperial College London

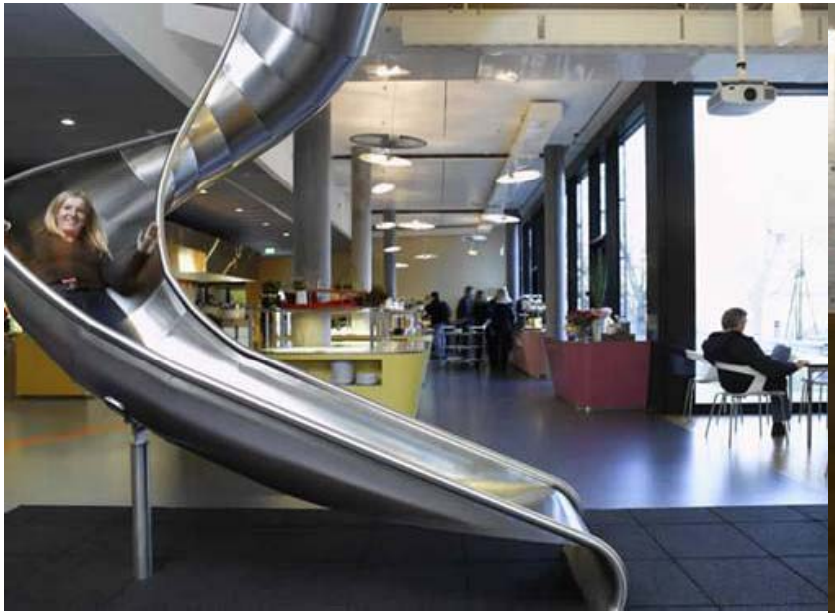
Stanford: Wallenberg Hall 2

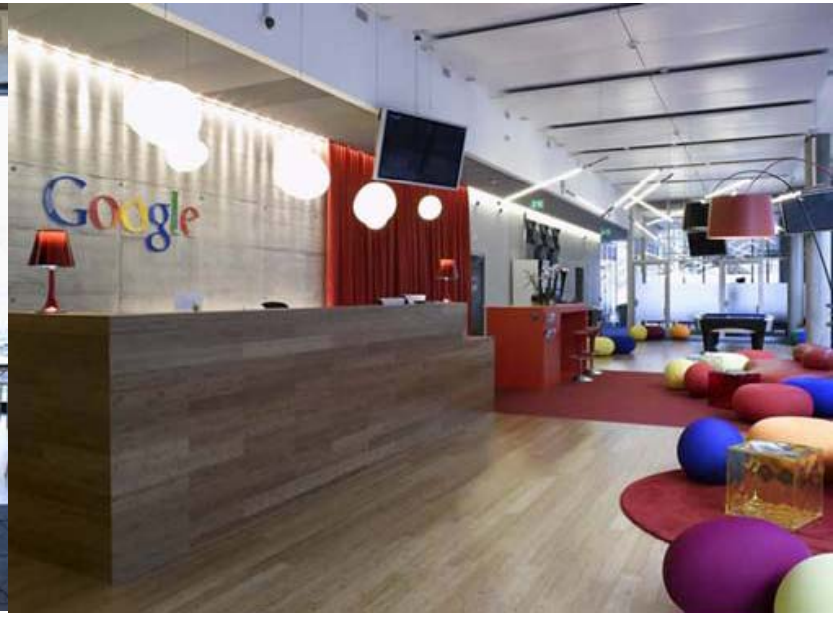
Imperial College London

Pixar Studios: Animators' studios

Imperial College London

Google offices





Imperial College London

InQbate – Sussex and Brighton

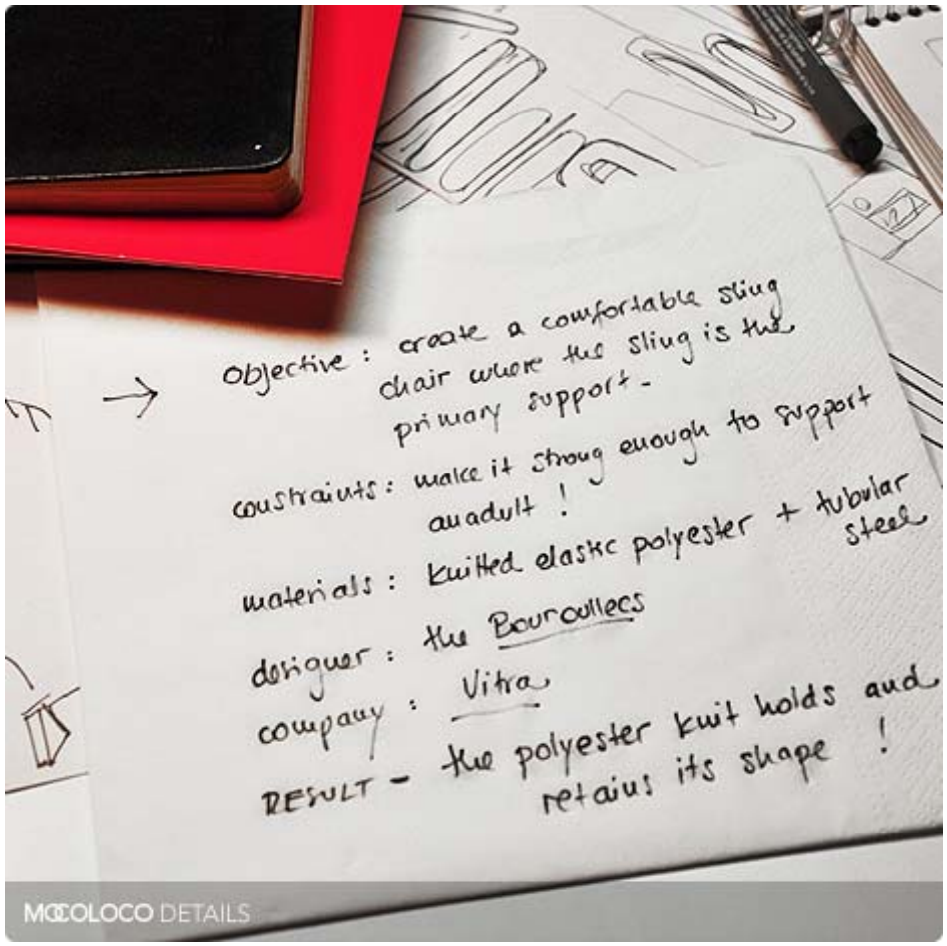
Imperial College London

Business Context

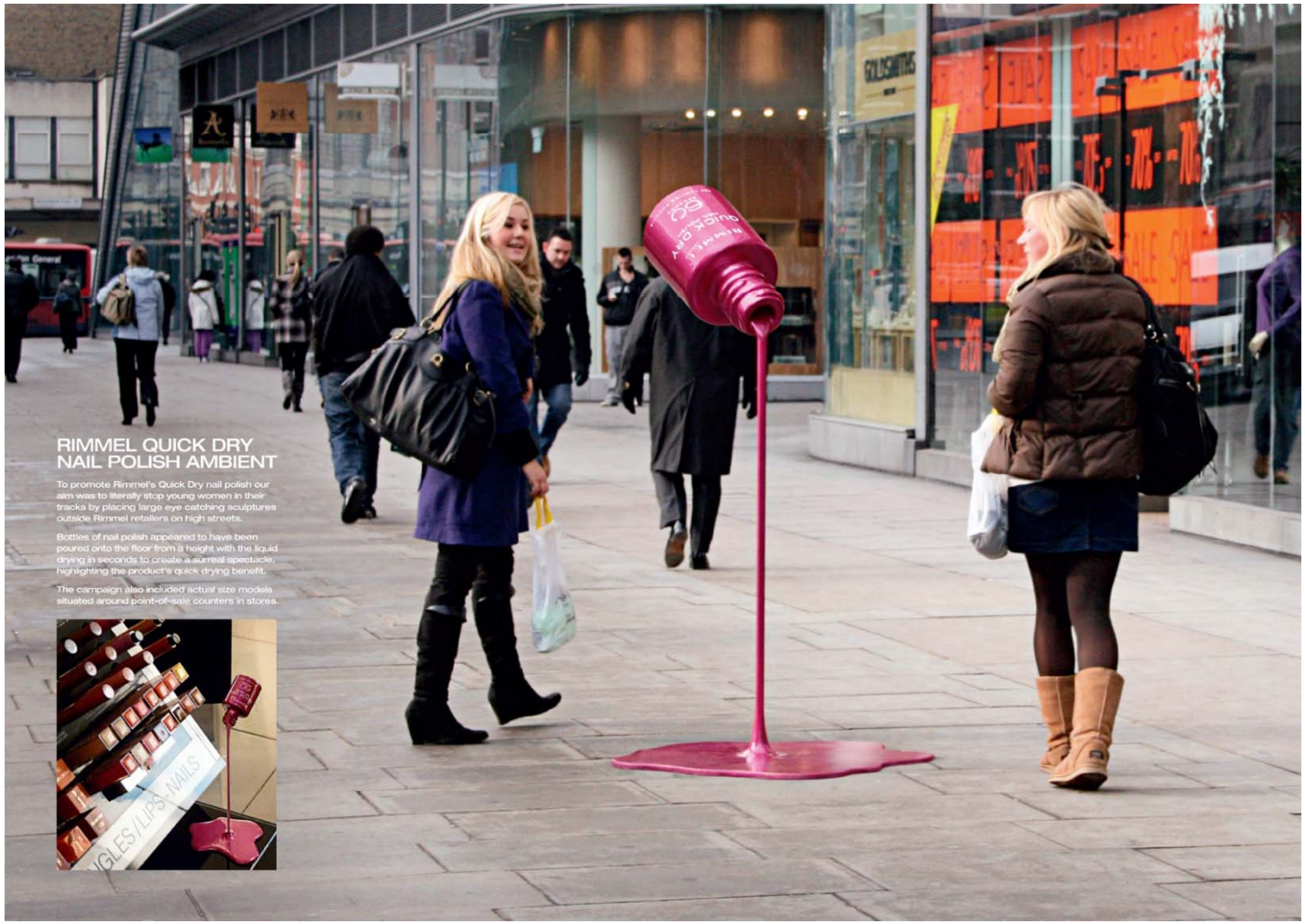
- The history of mature markets reveals the importance of innovative approaches to maintain competitive positions.
- The Cox Review stated that 75% of company turnover in UK based industry stems from products developed within the previous five years.
- This indicates just how critical ideas and the product development that arises from these ideas are to the financial status of industry.

Imperial College London

Industrial creativity



Imperial College London



Imperial College
London


Methods

Imperial College London

Creative Methods

- There are 100s of creative methods available.
- Some professionals tend to restrict their attention to less than 10 in their careers.

Imperial College London

Example Creative Techniques

- Activating the Variables
- Active Crisis Generation
- AIDA
- Algorithmic Composition/Generation
- Alternative Seeking
- Analogy
- Analytical Techniques
- Ask ‘Why’ Five Times
- Assumption Smashing
- Attribute Listing
- Attribute-Value Chain

Imperial College London

Example Creative Techniques

- Boundary Examination
- Boundary Relaxation
- Boundary shifting
- Brain Sketching
- Brainstorming
- Brainwriting
- Browsing
- Brutethink
- Bud Listing
- Bullet-Proofing
- Bunches of Bananas

Imperial College London

Example Creative Techniques

- Card Story Boards
- Catwoe
- Causal Analysis
- Causal Mapping
- Change Matrix
- Charrette
- Checklists
- Cherry Split
- Circle of Opportunity
- Clarification
- Collective Notebook (CNB)
- Combination, Transformation, Exploration

Imperial College London

Example Creative Techniques

- Story Boarding
- Strategic Assumption Testing
- Strategic Management Process
- Strategic Options Development and Analysis (SODA)
- Super Group
- Super Heroes
- Suspension of the Judgment
- SWOT Analysis
- Synectics
- Synectics/Forced Connections via Analogy/Formulation
- Systematized Direct Induction (SDI)

Imperial College London

Types of creative techniques

	TYPE
1	Condition/motivating/organizing techniques
2	Randomization
3	Focusing technique
4	Systems
5	Pointed techniques
6	Evolutionary directed techniques
7	Innovation knowledge

Imperial College London

Creative techniques

Creative techniques function by:

- ensuring that a problem can be understood in relatively simple terms, thereby occupying only a fraction of short term memory;

- supplying cues to make the search of long-term memory more efficient and;

- providing cues to ensure refreshing of short term memory and thereby retention of key information.

Imperial College London

Warm Ups

Icon

- Tape flip chart pages up around the room
- The facilitator calls out a word every 20 seconds
- Working down a column the participants draw the first icon that comes to mind representing the word called out and have 20 seconds in which to do this.

Imperial College London

Warm Ups

Icon

- At the end share the divergent/interesting and funny images within small groups

- Word sequence suggestion: happy; late; quiet; flood; fast; sick; rubbish; stairs; elavator; danger; unsafe; glue; dark; window; escape; music

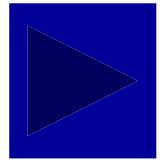
- Icon encourages simple drawing skills and helps communication within the brain and helps to phase out evaluation at the idea generation stage.

Imperial College London

A Selection of Creative Methods

Brainstorming
Morphological Analysis
Boundary Shifting
Reverse engineering
New combinations
Analogies
Checklists
Objective Trees
Synectics
Six Hats
TRIZ

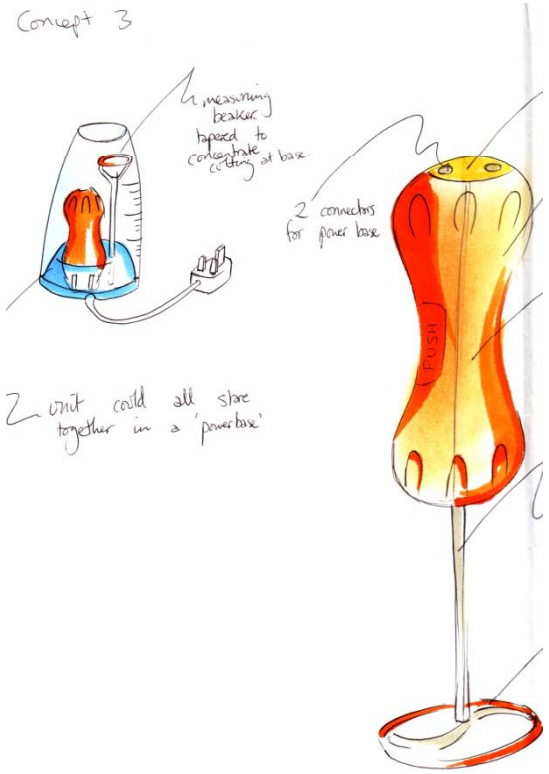
Imperial College London



Creative Process

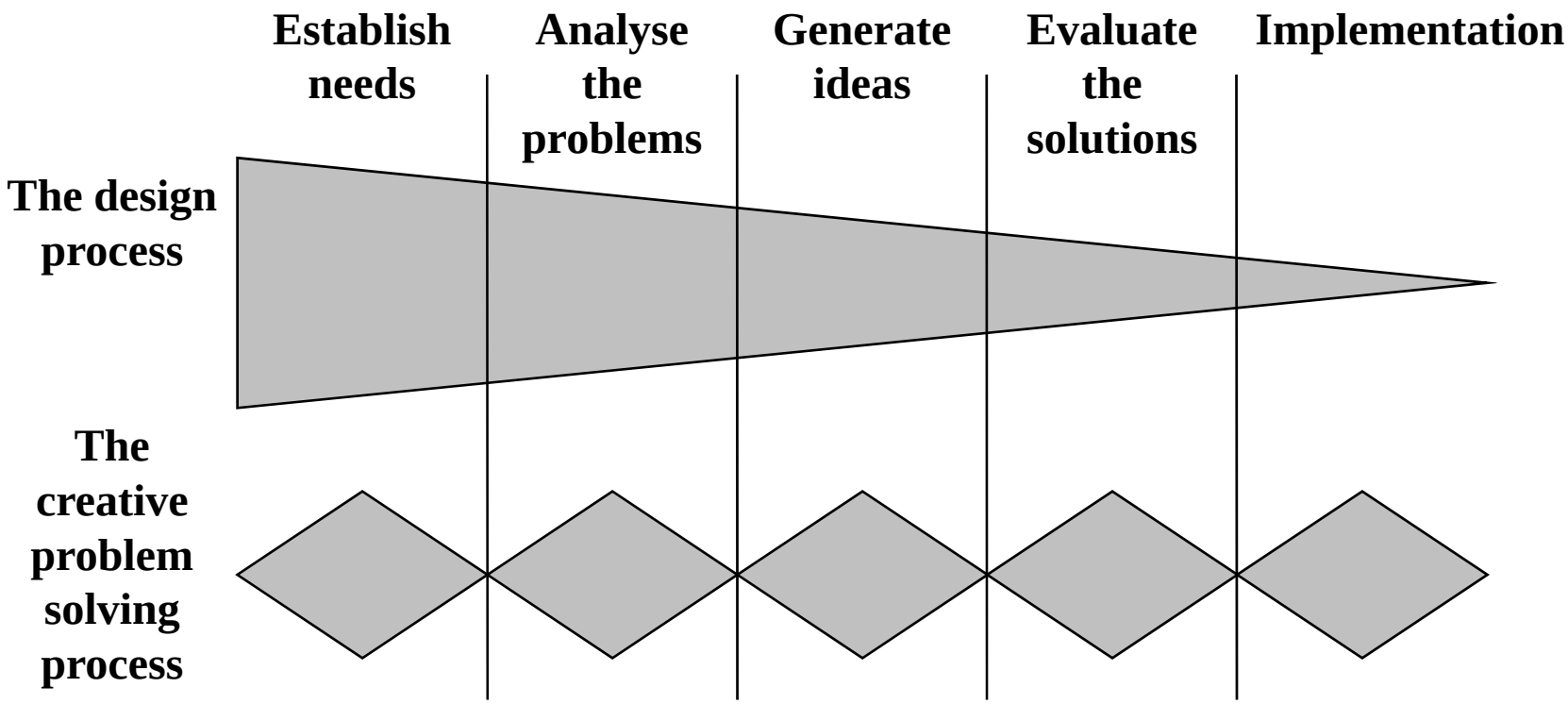
A Creative Process?

- Is there an approach that is valid for groups or do we all have an individual and unique way of doing things?



Imperial College London

Design and Creative Problem Solving Processes



Imperial College London

The CREATE Process

The Create Methodology Phases

- Predisposition
- External Mapping
- Internal Mapping
- Idea Generation
- Evaluation

Imperial College London

Creativity Engine

- Domain
- Need to become familiar and expert within a domain
  - Attention is limited
    - There is a need to focus our limited attention
    - 10000 hours?
      - » Can lead to oft mis-interpreted traits and behaviours
- Facilitate access to our long term memory
  - Creative methods
- Sponsorship
  - To allow us to dedicate our attention
  - To resource expensive programmes of research
- Communication skills
  - Peer and societal acclaim

Imperial College London

10 Selected references on creativity

- Altshuller G. And suddenly the inventor appeared. Technical Innovation Centre Inc. 2004.
- Amabile T., Creativity in context, 1996
- Boden, M. The creative mind, myths and mechanisms, 2nd edition. Routledge, 2004.
- Csikszentmihalyi, M. Creativity. Harper Perennial, 1997.
- De Bono, E. Lateral thinking: a textbook of creativity. Ward Lock, 1970.
- Jones, M.D. The thinker's toolkit. Three Rivers Press, 1995.
- Michalalko, M. Cracking creativity. Ten Speed Press, 2001.
- Osborn A.F., Applied imagination - Principles and procedures of creative thinking, 3rd Revised edition, New York, Charles Schribner's Sons, 1957.
- Sternberg, R.J. (Editor), Handbook of creativity, Cambridge, 1999.
- Wallas, G. The art of thought. Jonathan Cape, 1926.

Imperial College London

Thank you

Peter Childs
p.childs@imperial.ac.uk

Imperial College London

Green

- Lying
- Geriatric medicine
- Novel writing
- Thinking about the future
- The post-it
- Graffiti
- Animation
- Music

Imperial College London

Green

- Art
- Buildings
- Dance
- Writing
- Graphic design
- Road layouts
- Decorative radiator
- Comedy

Imperial College London

Pink

- Breathing
- Hoovering
- Writer's block
- Design of Ipod shuffle
- Eating
- Sleeping
- Laughing
- No human activity is not creative
- Plagiarism

Imperial College London

Pink

- Brushing teeth
- Conflict
- Destruction
- Smoking
- An artist's 2nd painting
- Addition
- War
- Cleaning
- Data entry

Imperial College London