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hybrid event

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Systems Thinking 101

Welcome

from

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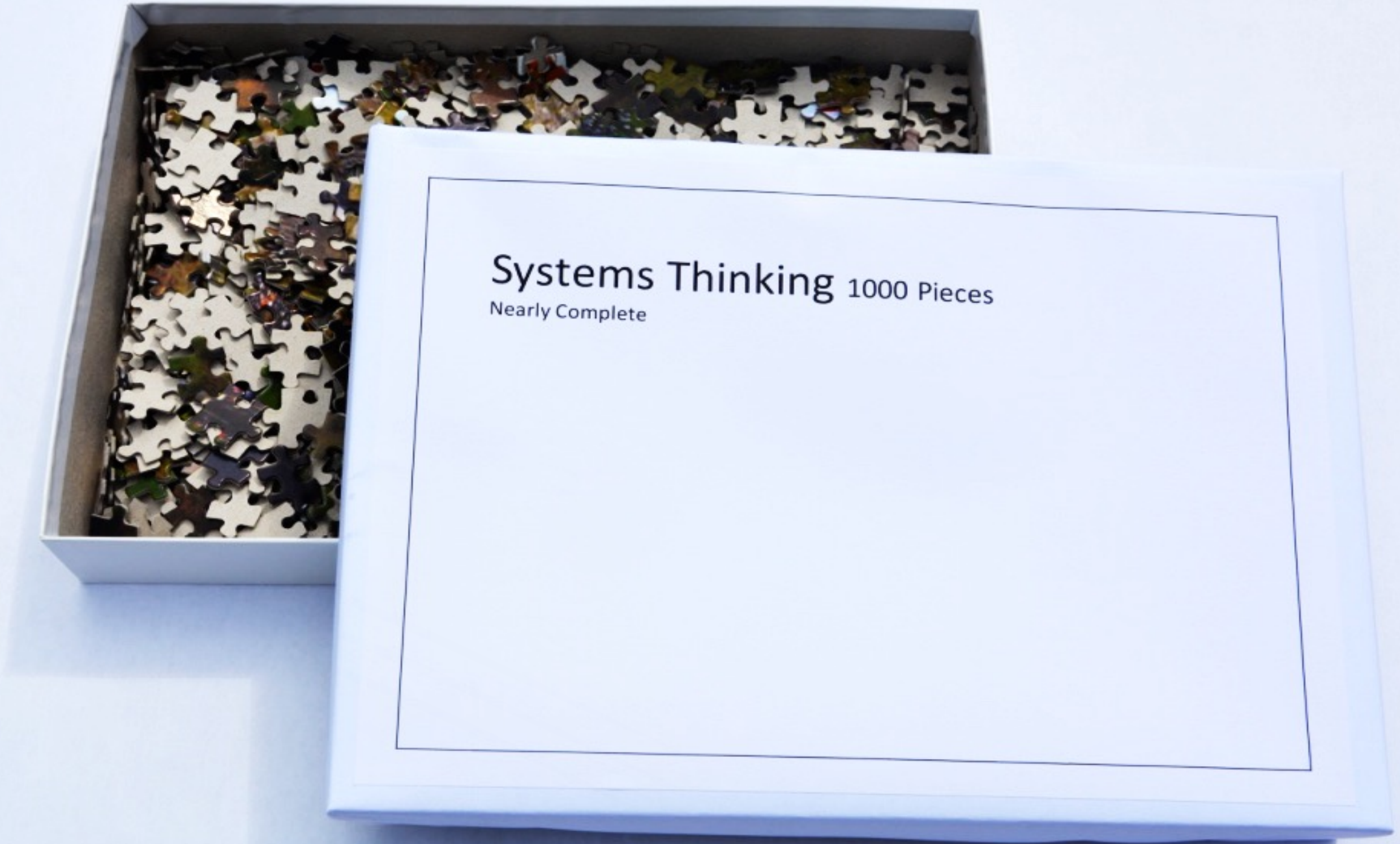
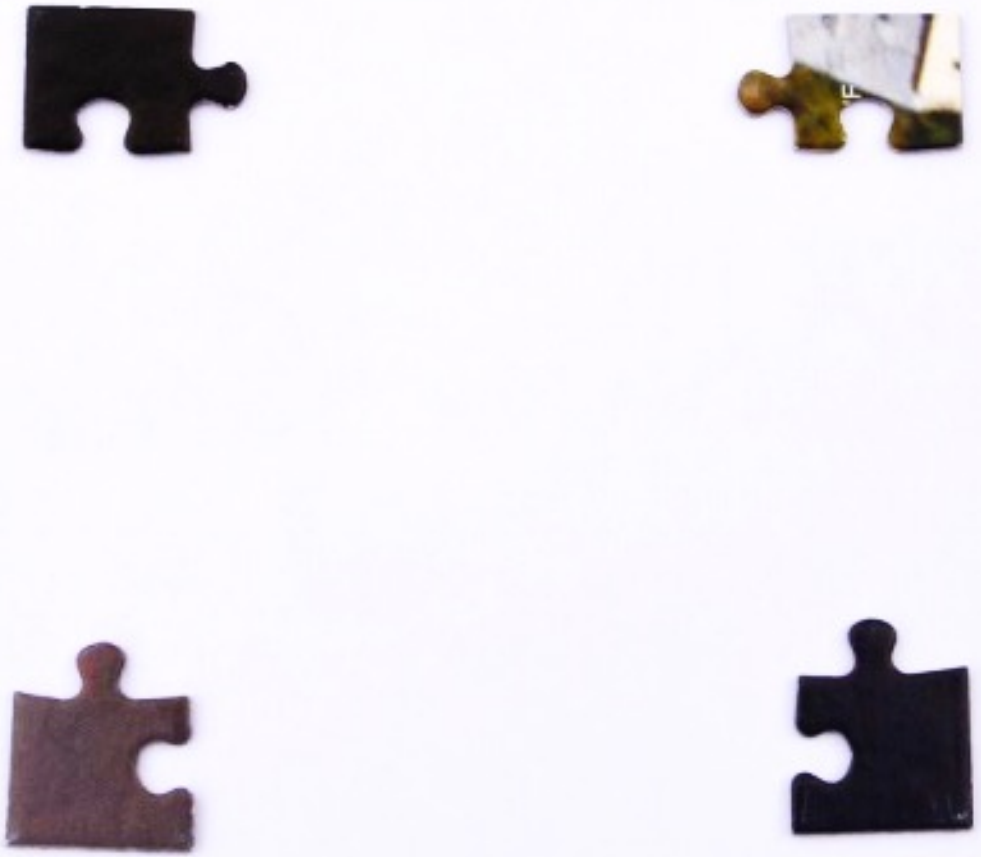

Systems Thinking 1000 Pieces
Nearly Complete

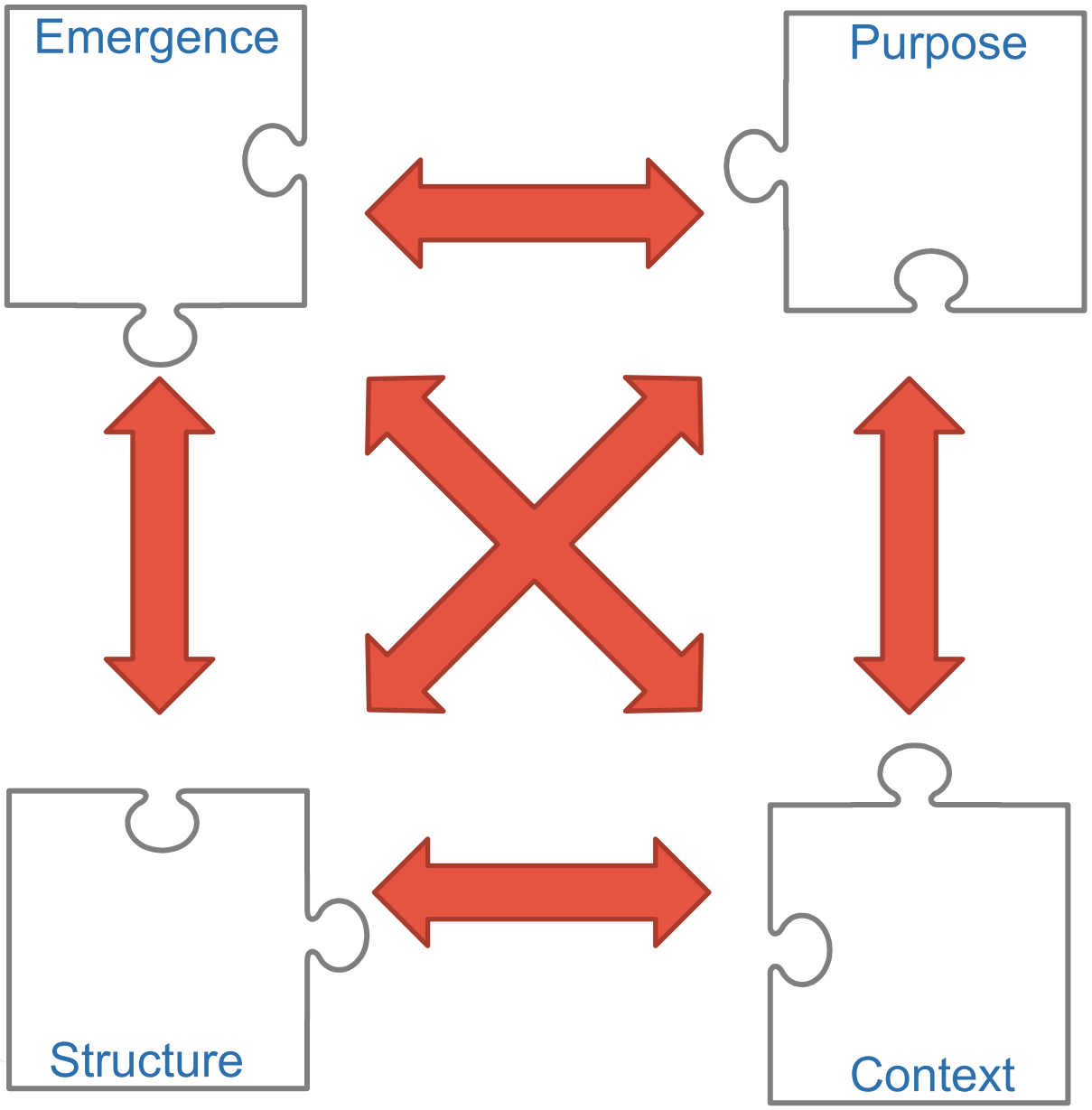
We would start with the corners – so let's look at the four corners of Systems Thinking



They are all connected but we will look at them in isolation

- Emergence
- Purpose
- Context
- Structure

Finally, we will look at putting Systems Thinking into practice



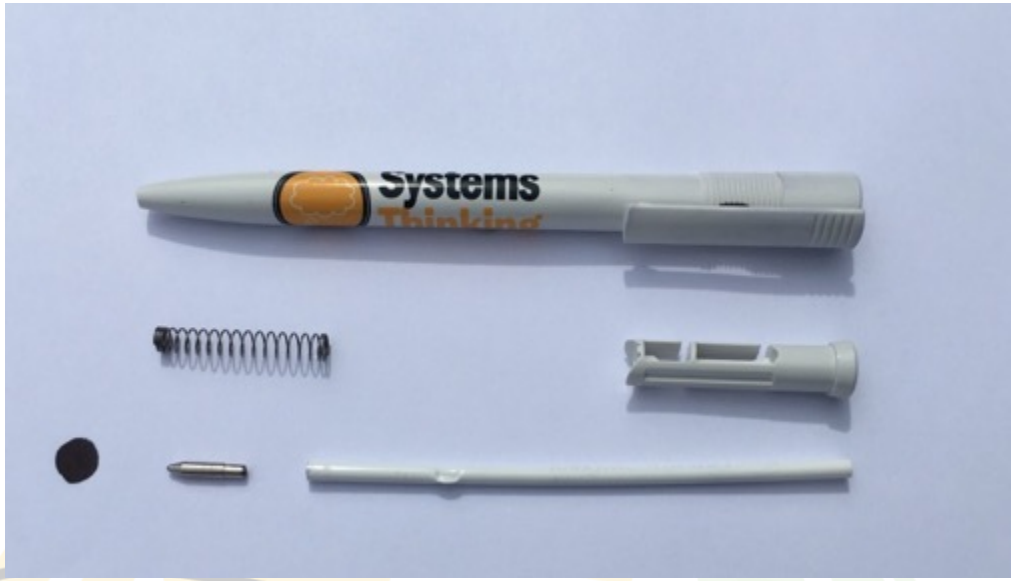
Emergence

All systems display emergence.

- Emergence is the behaviour the system displays as a whole: it only appears (emerges) when the components of the system are put together.
- Emergent behaviour can be desirable or undesirable

The properties and behaviour of a system cannot be deduced by studying the properties and behaviours of the components in isolation

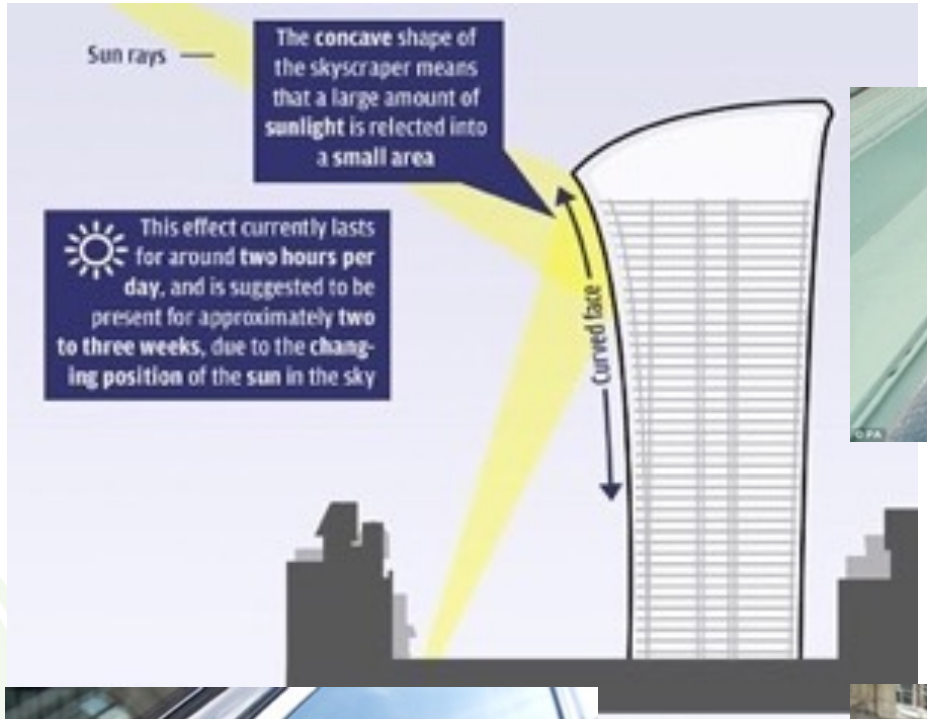
Emergence and Emergent Behaviour



The properties of the pen as a whole are not found in any of the individual components. Only when the components are assembled in the right sequence and the right place does the ability to leave marks on paper emerge

All systems display emergent behaviour – this can be what we desire and also NOT desire

Undesirable Emergence



History

20 Fenchurch Street
Designed by Rafael Vinoly

In an interview with The Guardian newspaper, Viñoly said while he conceded that there had been "a lot of mistakes" with the building, he agreed with the building's developers that the sun was too high in the sky on that particular day.

Vdara Hotel Las Vegas
Designed by Rafael Vinoly

The building's reflective surface and concave design act as a parabolic reflector to create a phenomenon in which the reflected rays of the sun can create dangerously hot conditions at points on the pool deck. Employees have called the phenomenon the "Vdara death ray".

And there's more

Skyscraper's curves put wind up the City

Zachary Spiro

First it was dubbed the Walkie Talkie because its sleek curves resembled a handheld radio.

Then it became the Walkie Scorchie when people realised that those 160m-high curves had the small drawback of reflecting the sun's rays with an intensity that melted cars.

Now 20 Fenchurch Street could be in line for yet another nickname: the Walkie Stormy.

Businesses near the London skyscraper, which was completed last year, have complained that down-draught from the building's 34 storeys has resulted in signs being knocked off nearby stores, trolleys being blown away and pedestrians bowled over. "I've seen people walking next to it and suddenly they fall over from the wind," an employee at the Ideals café said.

Roksana Lenourt, the general manager of Abokado, a fast-food restaurant, said that a former colleague had told her that "during the autumn our food trolley was slowly being blown away. On one of our health and safety audits it was written that this trolley was at risk of falling on someone, and so we had to put a risk warning on it."

Although strong winds in parts of the city are far from unusual, those working in the area around the building are sure of where to place the blame for the latest extreme gusts.

"It has only really been windy since the Walkie Talkie has been here. When they were building it and there were the building works going on, it was fine. But ever since they've completed it, the wind really picked up," an employee at the Fenchurch branch of Molton Brown, the cosmetics company, said.

When it was conceived, the £200 million skyscraper's unique selling point was a covered roof garden that is open to the public.

It became more famous, though, for the curved front of the building having the unintended consequence of concentrating the sun's rays on a section of Eastcheap, raising the temperature high enough on the street to melt parked cars and burn bicycles. The problem caused by its reflection was eventually solved by attaching a series of sunshades to the building.

Sudden gusts catch out the unwary

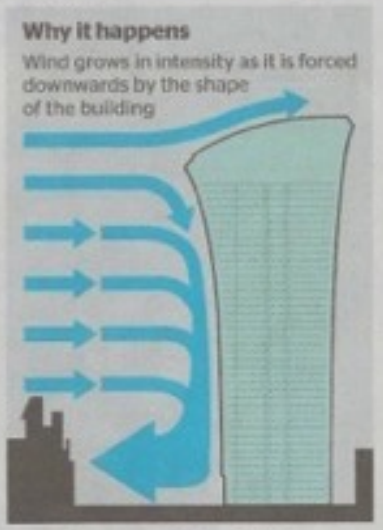
Concern about the number of wind tunnels created by London's rapidly expanding population of skyscrapers has led the City of London Corporation to demand that developers undergo independently audited wind studies.

Another area known for its strong winds is Canary Wharf, where the concentration of sheer glass office blocks leaves bankers battling winds of up to three times the London average.

"The wind outcome at street level experienced post-construction on a number of projects differs somewhat to the conditions we were expecting from the one outlined in the planning application wind assessments," Gwyn Richards, the corporation's head of design, told *City AM*. "This is why we are asking for an independent verification of the wind studies on a number of new schemes to ensure as rigorous and resilient an approach as possible."

Rafael Vinoly, the architect responsible for the parabolic design of 20 Fenchurch Street, ran into a similar problem with his design for the Vdara hotel in Las Vegas, which was named the "Vdara death ray" by local media after sunlight reflected off the building was found to be capable of melting plastic cups and shopping bags.

At least with 20 Fenchurch Street it seems that he also created a wind to cool people while they fried.

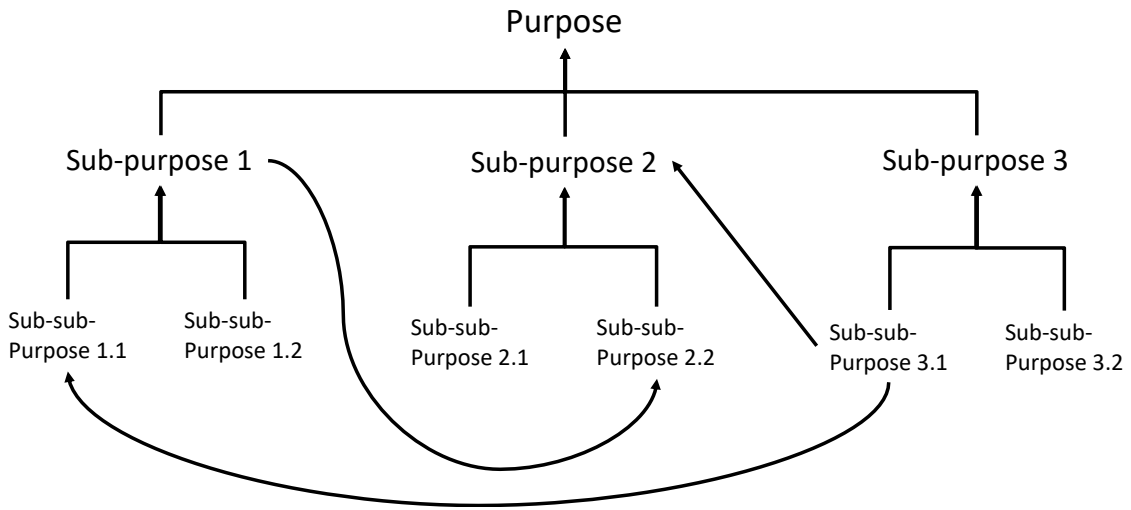


- Discovered late on: - it emerged
- Expensive: - because it was discovered late
- Avoidable: failure to pay attention to the system's environment

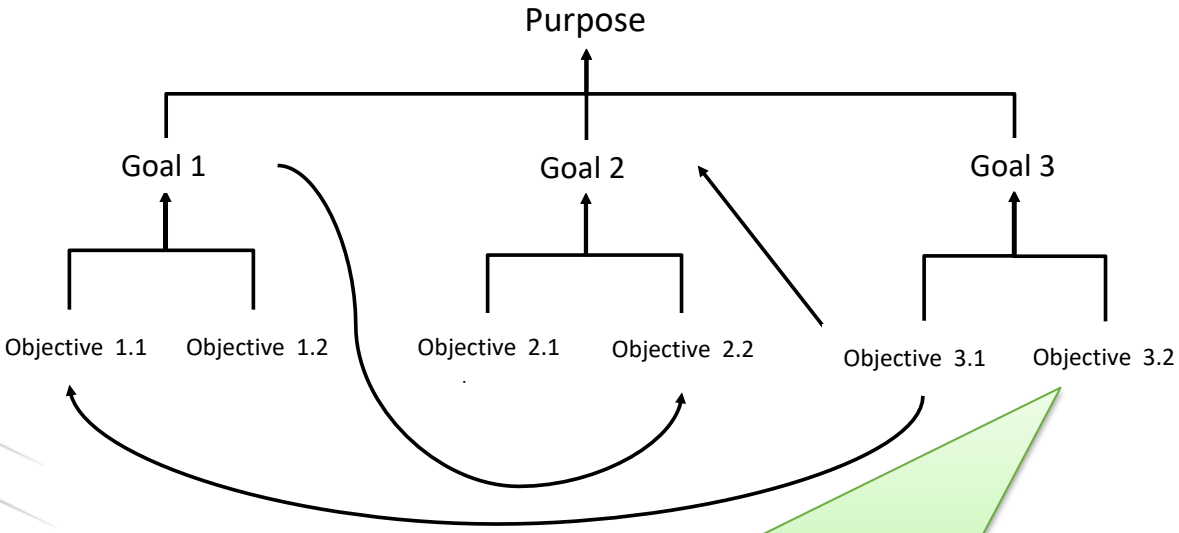
Purpose

All systems seek to achieve a purpose, which is a property of the whole:

- Some systems have more than one purpose.
- The purpose demands the achievement of lower-level purposes because of the laws of physics and logic. These lower-level purposes in turn demand even lower-level purposes which .... BUT it is rarely a simple hierarchy.
- People who use, or are part of, a system are often totally unaware of its purpose. Moreover, when asked, different users have different, and even sometimes conflicting, views as to the exact nature of the purpose.



Rather than talk in sub-sub-purposes”



Goal, Objective, Task, Activity , Function, Job etc. are words we can use to describe purpose.

Make marks on paper

Communicate

Write

What is the purpose of a pen?

Record stuff

Draw things

To transfer thoughts to marks on paper

Purposeful Thinking

Defining the purpose of a system is not easy!

The purpose of a system is often a sentence or two – it's easier to refer to the object!

WE ARE OBJECT ORIENTED we have been brought up from an early age to talk about things and NOT what they DO

IN SYSTEMS THINKING (and ENGINEERING) WE THINK ABOUT THE

PURPOSE

Customers may talk and think about things, but they buy capability (purpose)

When designing a system, we must determine the purpose (capability) that is required by the customer

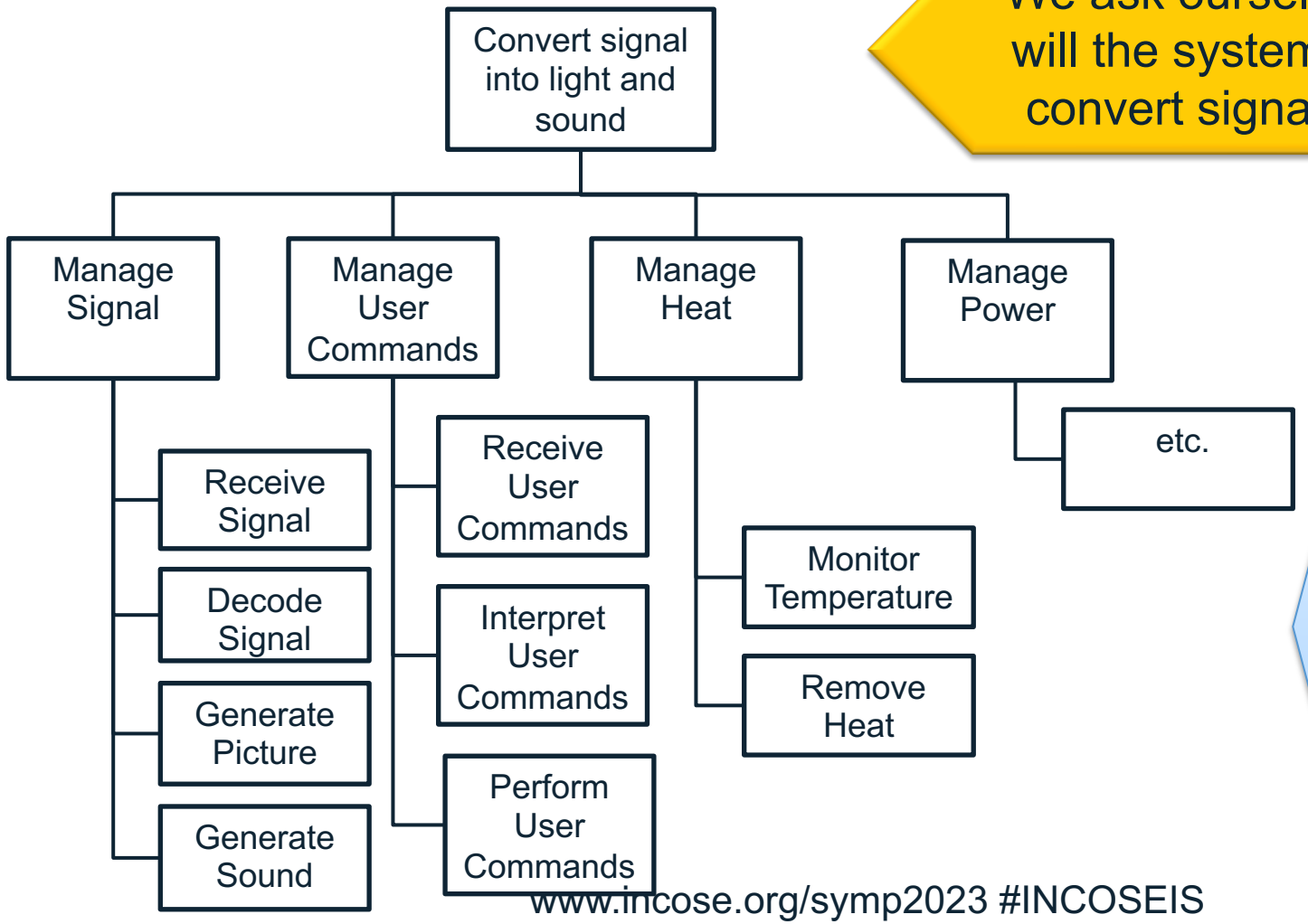
Determining Purpose

Determining the purpose of a system is often not easy. It can be helpful to consider the inputs and outputs of the system and identify the prime ones.

To Convert Signal to Light and Sound

Determining the Purpose depends on what we decide the system is – where is the boundary between the System and the outside world

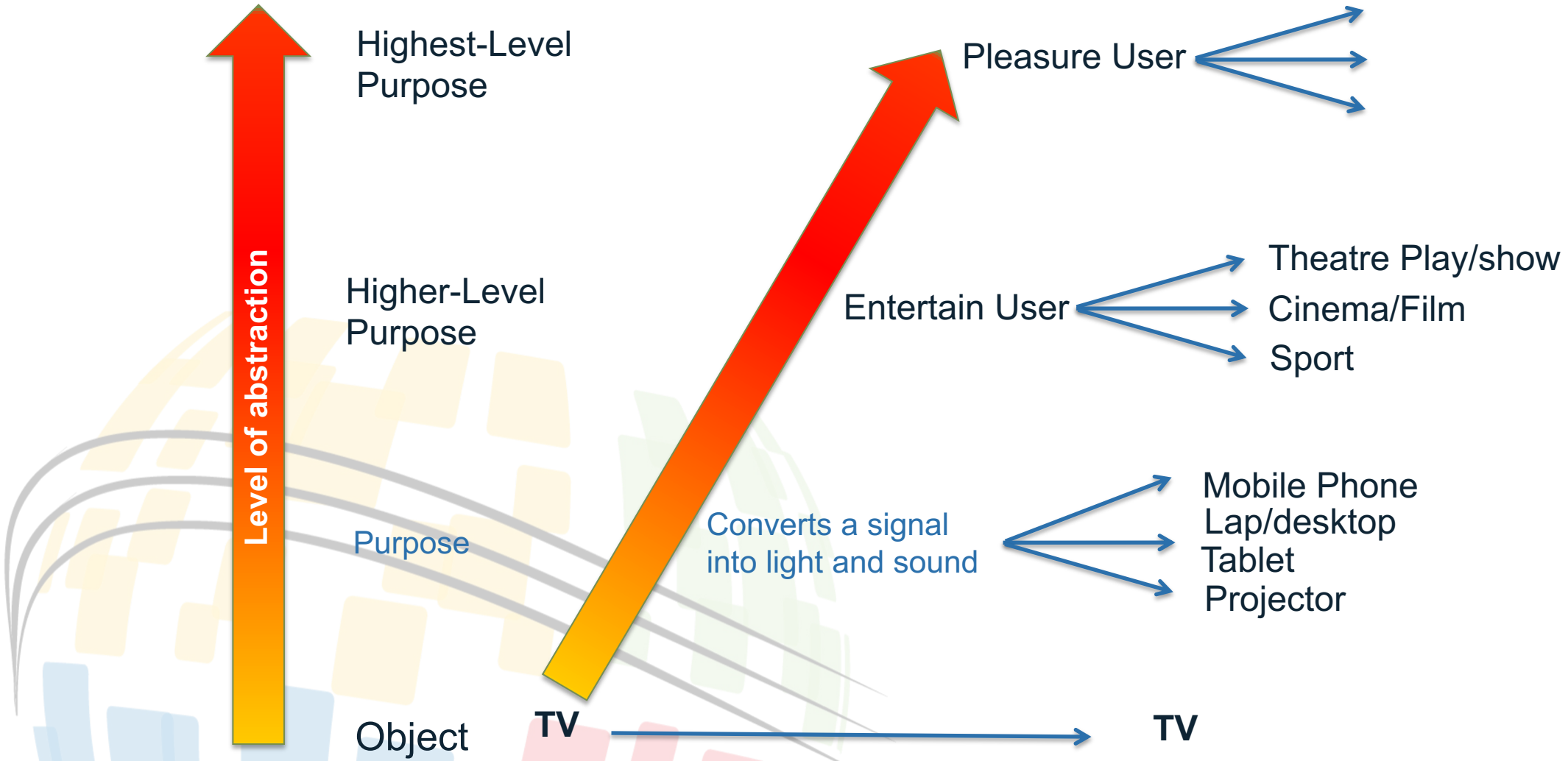
We use purpose to understand



We ask ourselves the question –"what will the system have to DO in order to convert signal into light and sound?"

These are **some** of the lower-level sub-purposes that must be carried out to convert the TV signal into light and sound. Some are there to manage the undesirable emergent behaviour.

Purpose in Design



System Context

All systems have context which depends on:

- The purpose
- The application (the bigger task or job which the system is part of)
- The environment of the system
- The observer
  - an understanding of a system depends upon the perception of the observer. A taxpayer will have a different perception of the “Tax System” to the tax collector or government official who is going to spend the tax revenue.

The Oxford English Dictionary provides a very useful definition of context:

> The circumstances that form the setting for an event, statement or idea, and in terms of which it can be fully understood.

Using this definition specifically for a system yields:

> The circumstances that form the setting for a system, and in terms of which it can be fully understood

Does Context Matter

Can I use this Flip Chart marker?

The PURPOSE is the same in each situation “to transfer thoughts into marks on paper” BUT can the same pen solution be used in all three situations?

Context matters and we need to be able to understand it by defining the extent of the system of interest and its environment

Context is more than just the environment

Can I use this ballpoint pen?

Recording event in a journal

Flip Chart in a Training class

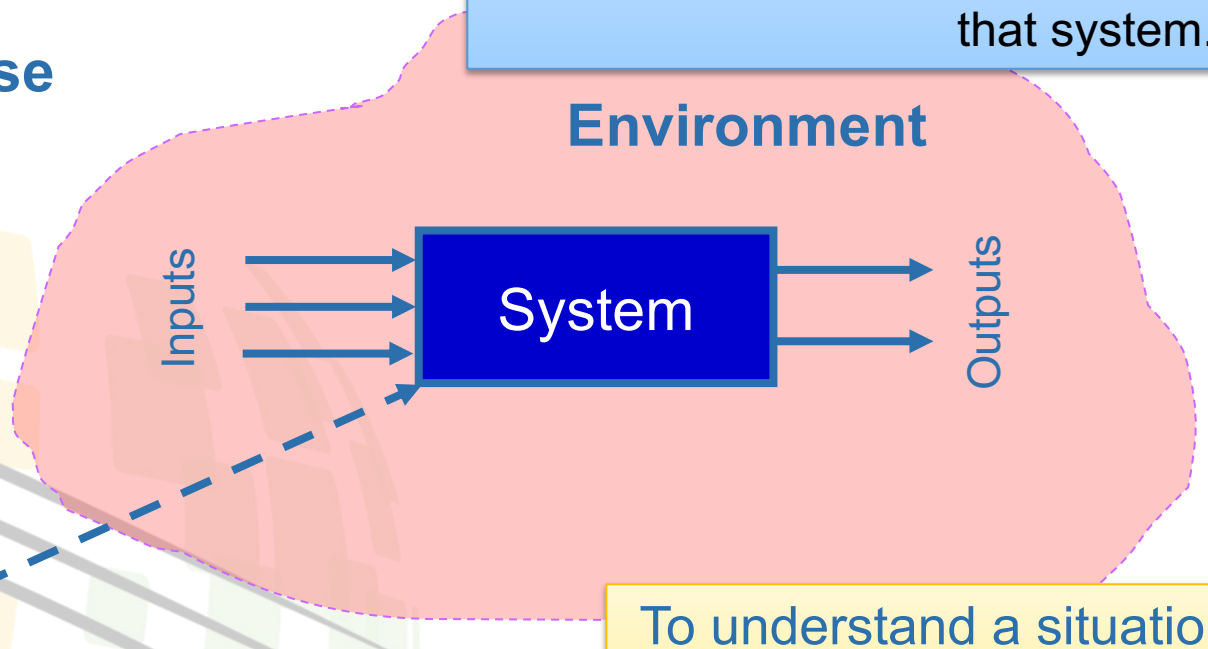
Record of birth in a Registry Office

The purpose is the same, the environment is the same, but the bigger need or application is different

System Boundary and Environment

Those parts of the outside world which do NOT significantly interact with the system are part of its universe. These can be physically very close

The environment of a system is that part of the outside world which significantly interacts with it and impacts upon it. Usually by being the source of system inputs and destination of system outputs. A system's environment is also a major contributor to the context of that system.



A system has a boundary that defines the extent of the system.

To understand a situation as a system we need to define the system boundary and the system environment.

What's the System Here?

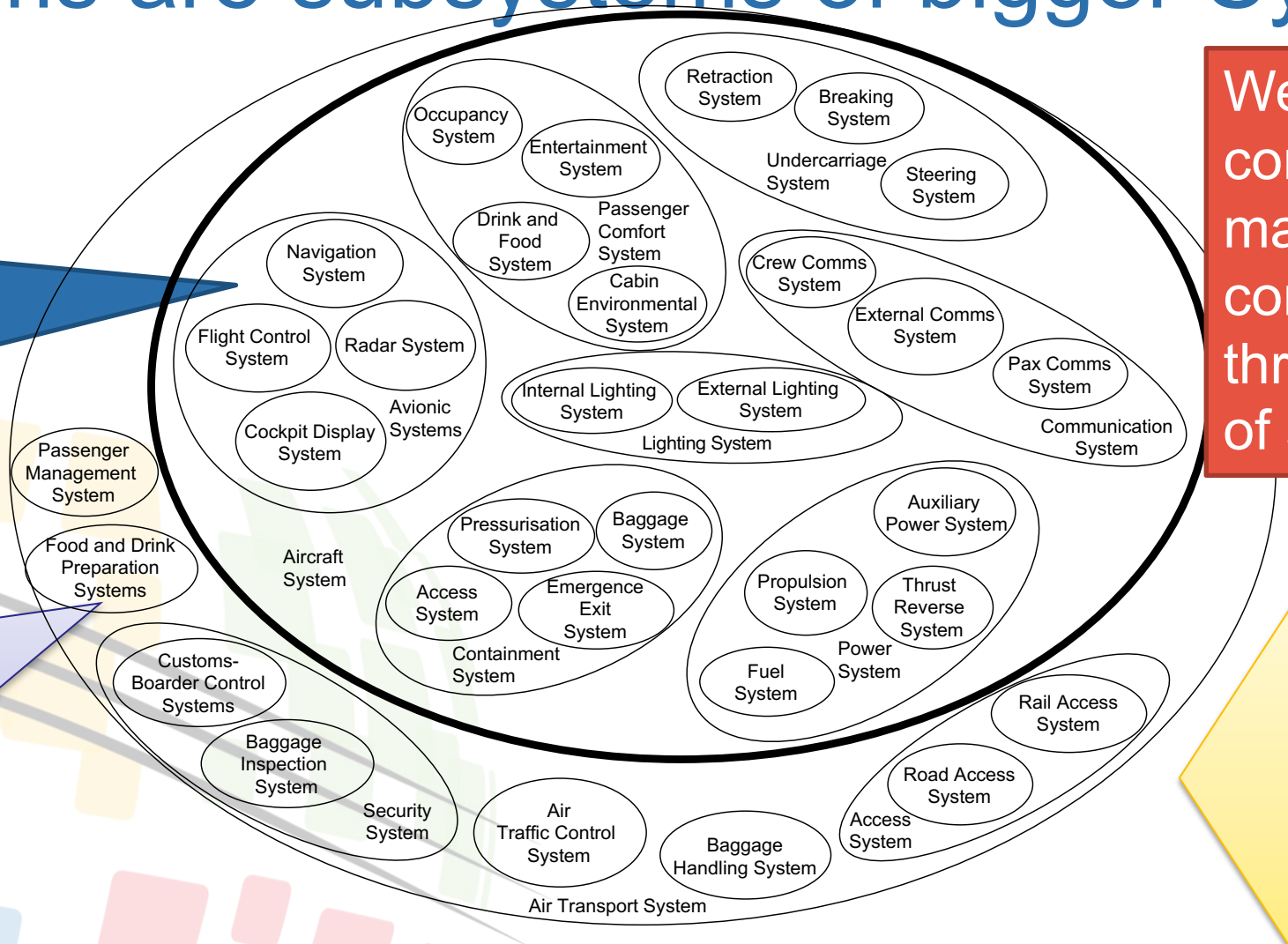
- A system boundary is an artificial (a mental creation) but useful concept in Systems Thinking.
- It provides a way of "bounding" or "scoping" the situation of interest. It helps decide what is inside and what is outside the system
- System boundaries can be:
  - Physically based
  - Purpose based
  - Time based
- The choice of what is and what is not the chosen system of interest depends upon the observer and their reason for examining that system

Defining what is and what is not part of the system of interest is not easy

Pen
Human
Paper
Desk
Floor
Room
Building
Town
Country
Continent

Systems are made up of subsystems and Systems are subsystems of bigger System

Whenever we look "inside" the chosen system of interest we see further smaller systems or subsystems.



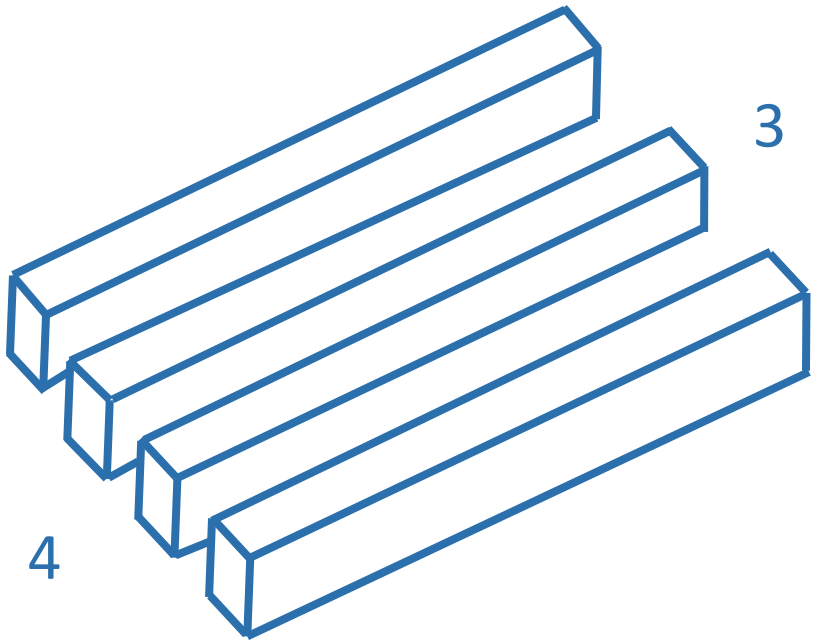
We can use this concept to manage complexity through the use of subsystems

Whenever we look outside the chosen system of interest, we see that it is part of a larger system.

Note that the context of a subsystem will come from the system it sits within

The Observer

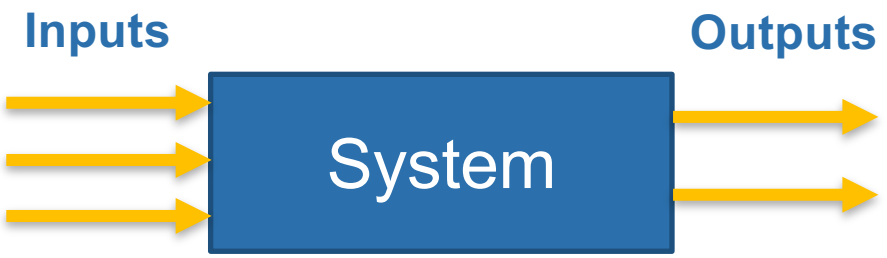
- The context of a system also depends on WHO is looking at it and WHY they are looking at it.
- Different observers will see different things.
- When exploring a system's context we must take multiple perspectives to increase our understanding.



Events, Patterns, Behaviour and Structure

All Systems have structure which determines the system's behaviour:

- Many Systems (particularly organizational and product-based systems) are often concerned with a transformation – converting inputs to outputs. How the output varies over time is called the system's behaviour
- The behaviour of a system manifests itself in two related ways:
  - Events
  - Patterns
- That behaviour is a consequence of the System Structure



All systems display patterns of behaviour if we observe them

Events, Patterns and Behaviour

Humans find events more memorable and often view reality just in terms of events.

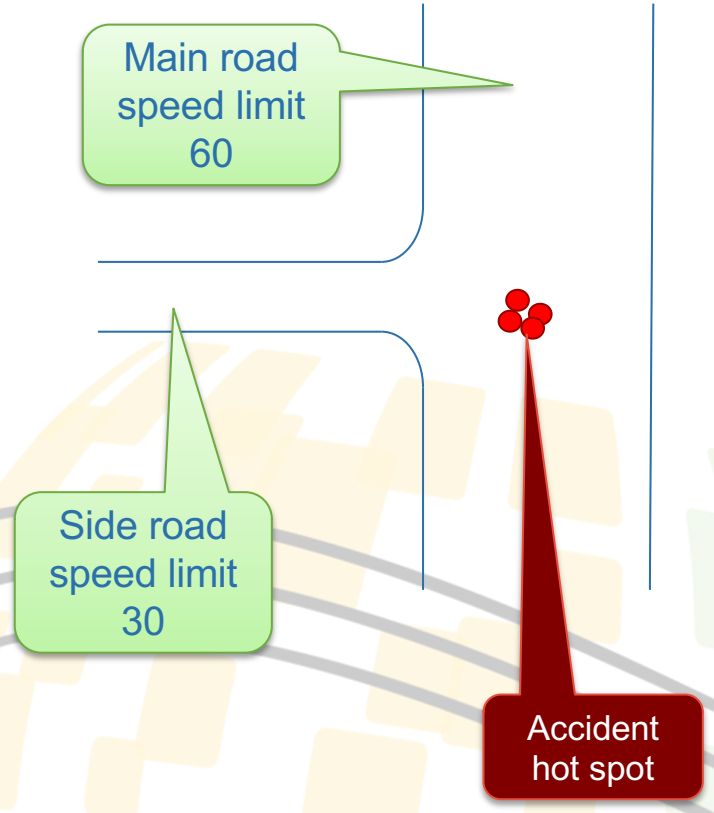
Indeed, it's our ability to react to events that has ensured our survival!

Patterns or "trends" over time offer a deeper understanding of reality.

It's our ability to spot patterns that has lifted us from "just surviving" – but whereas reacting to events is instinctive, finding patterns is not!

BUT something is causing the patterns: the System Structure

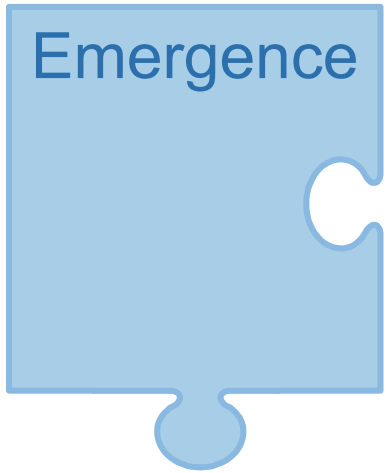
Change the Structure – the Systems Intervention

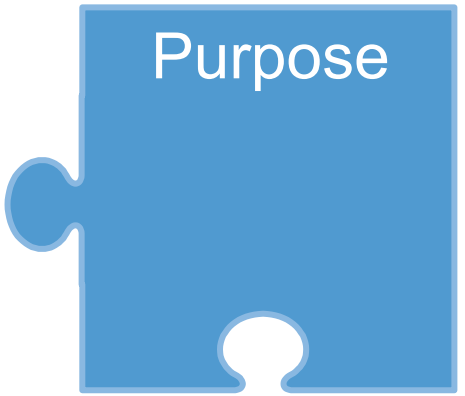


- Traffic lights
- No Right Turn Sign
- Slip road and flyover
- Underpass
- Roundabout
- Reduce 60 to 30
- Increase 30 to 60
- Permanent Traffic Officer
- etc

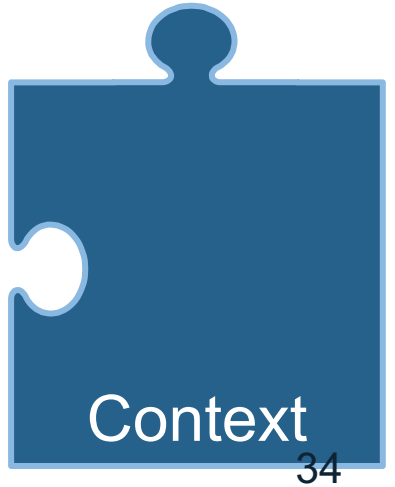
Reacting to events and patterns can make a difference but the real differences come with changes in the structure of the system.

Note that some changes will affect the physical structure or architecture (e.g. a roundabout). Others are “invisible” as they don’t change the physical structure but how that structure is used (e.g. No right turn sign) this is called the CONTROL STRUCTURE.





So, what is Systems Thinking?



What is Systems Thinking

Applying the concept of a system to a situation in order to gain insight and understanding

Who does Systems Thinking?

Anybody

- Systems Thinking has been applied to every discipline to give insights that could not have been obtained by conventional thinking.
- Most humans are not natural Systems Thinkers, we are object and event oriented and assuming linear causes and effect.
- It is a skill that improves with practice
- There are numerous Tools that can help us Systems Think

Systems Thinking, Systems Approach and Systems Engineering

Systems Thinking is:

Applying the concept of a system to a situation in order to gain insight and understanding

Systems Approach is:

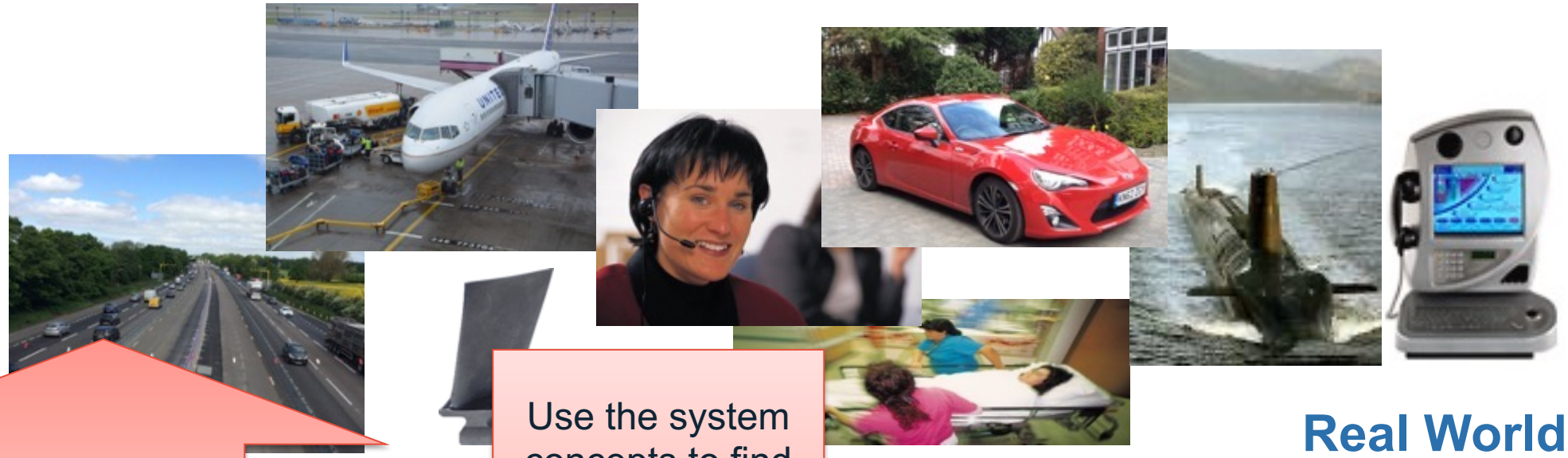
Applying Systems Thinking in a systematic and repeatable manner

Systems Engineering is:

Applying a Systems Approach to the creation of a system

To do Systems Engineering we need to know about Systems Thinking

In Systems Thinking we treat the real-world situation as a system

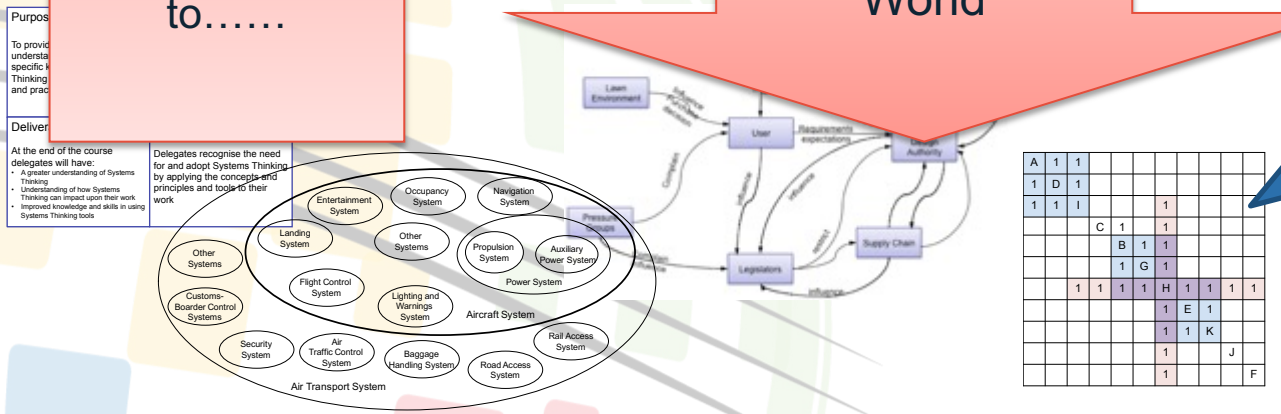


Transfer understanding back in to the real world to……

Use the system concepts to find out more about the situation in the Systems World

Real World

Systems World



In the Systems World we can use TOOLs to help us explore and understand:

Purpose
Context
Structure
Behaviour

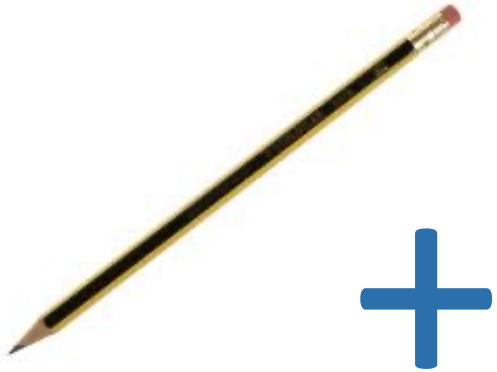
To look at some of the Systems Thinking tools go to https://www.burgehugheswalsh.co.uk/Systems-Thinking/Tools.aspx

Summary

- At one level Systems Thinking is a state of mind – it's something we can aim to do all the time – we can take a systems approach all that we do
- Systems Thinking is not natural however: humans are object oriented – we focus and concentrate on things and events and not the patterns and interrelationships between things
- We have to "force" ourselves to do Systems Thinking by consciously using the Systems tools
- Through practise we can become unconsciously competent
- we can develop the habits of a Systems Thinker

- Think Purpose
- Think Context
- Think Structure
- Think Emergence

Finally: Practical Systems Thinking



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