

# Creativity in Engineering

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# Outline

**Why is creativity important in engineering?**

**Creativity and the Warman Competition.**

**Finding some creativity.**

**The 4Ps**

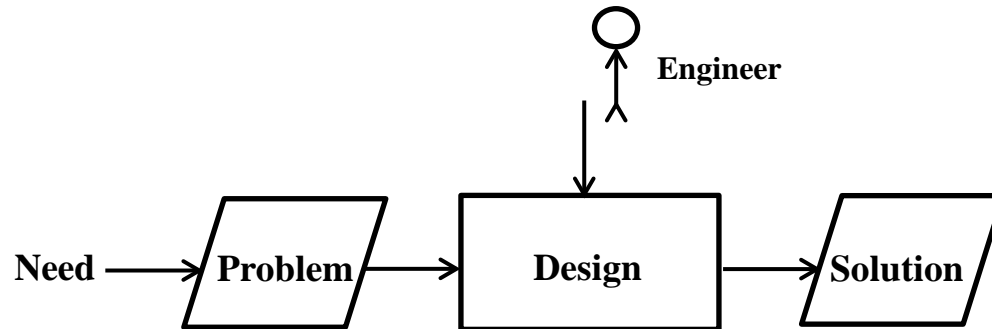
**Summary**

# Why is Creativity Important in Engineering?

Engineering is about satisfying “needs”.

Needs drive “problems”; engineers design “solutions”.

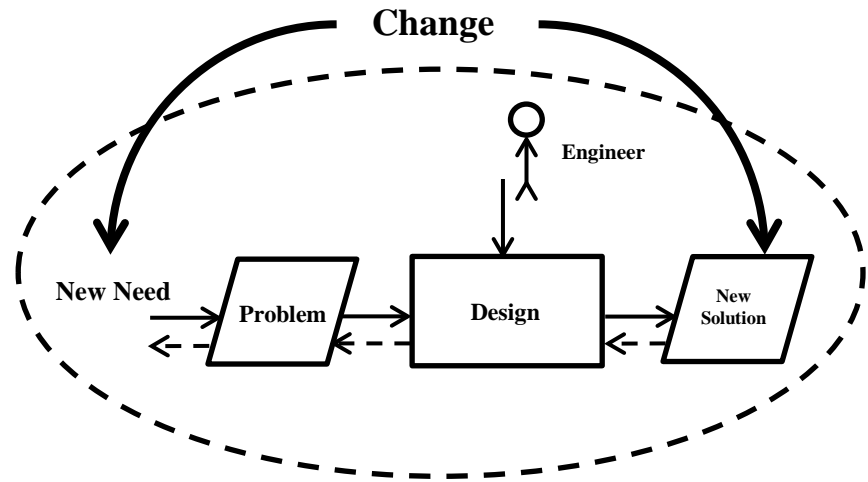
But what drives “needs”?



# Why is Creativity Important in Engineering?

What drives “needs”?

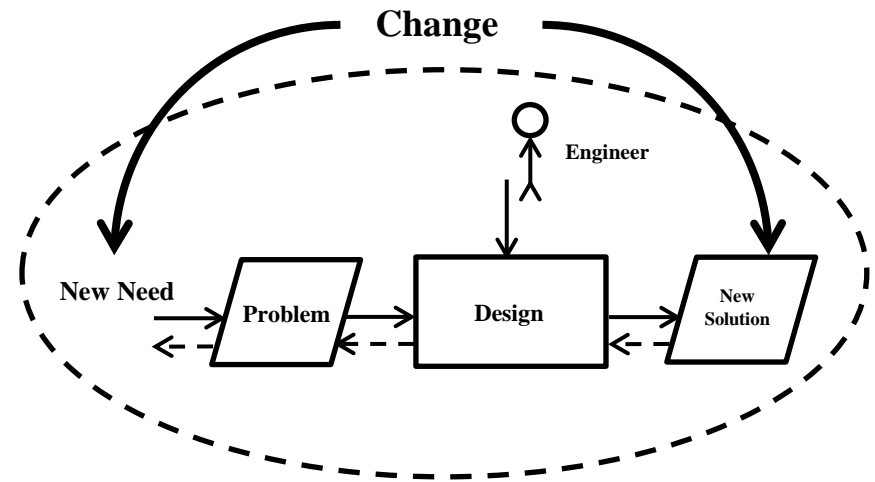
**CHANGE!** E.g. Disease! The Bubonic Plague in Europe (c. 14<sup>th</sup> century) caused a shortage of labour. This created a “need” – for more efficient farming practices.



# Why is Creativity Important in Engineering?

This could be expressed as a specific problem – **“how can farmers work the land using fewer labourers?”**

“Engineers” then have the opportunity to provide a technological solution – e.g. new or improved ploughs.

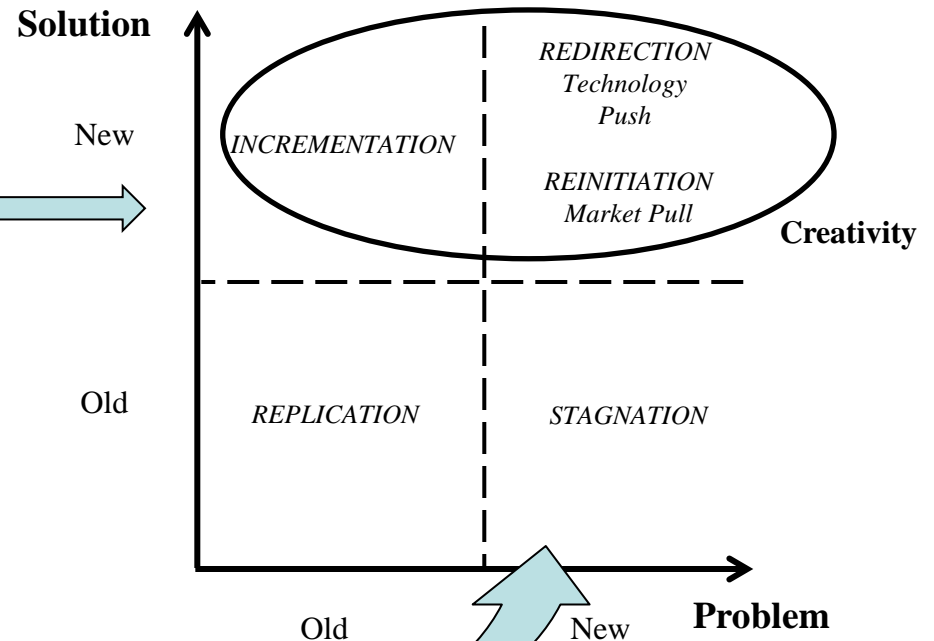
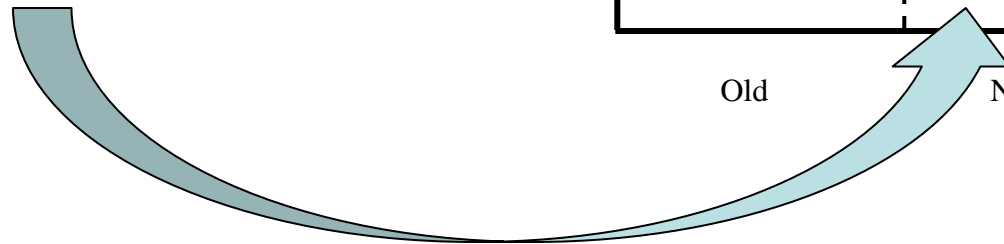


# Why is Creativity Important in Engineering?

“Technology Push” is where new inventions satisfy a need.



“Market Pull” is where new needs (problems) require engineering design.



Problem	Solution	Comment
<b>Old</b> (e.g. how can I hold open the door?)	<b>Old</b> (e.g. a wooden door stop!)	<b>Replication:</b> effectiveness is the key; no need for novelty
<b>Old</b> (e.g. how can I hold open the door?)	<b>New</b> (e.g. a rubber door stop)	<b>Incrementation:</b> improved solution to existing problem ( <i>better, faster, cheaper?</i> )
<b>New</b> (e.g. <i>change</i> = shortage of wood/rubber, “wedge” tax?)	<b>Old</b> (e.g. a rubber door stop)	If the “rules” don’t permit that, then it doesn’t matter – it won’t work! <b>Stagnation.</b>
<b>New</b> (e.g. <i>change</i> = shortage of wood/rubber, “wedge” tax?)	<b>New</b> (e.g. ???)	The “old” solution is not an option. Forced to find a new way. <b>Reinitiation (Market Pull).</b>

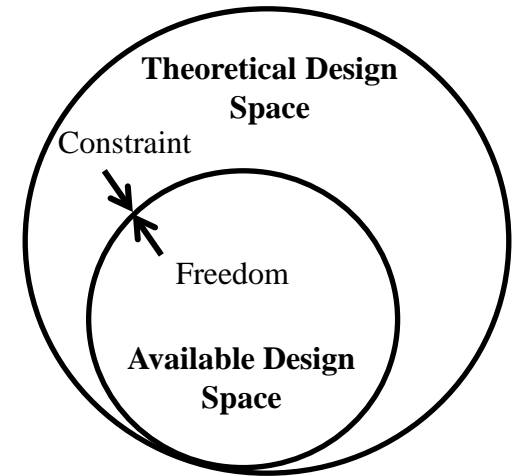
# Creativity and the Warman Competition

You are faced with a new problem, driven by the “market”.

Like a lot of **Market Pull** situations, it comes with a set of **constraints**.

It's easy to think of those as a bad thing, but they can be good.

By defining what you can't do, they help you to identify where you might inject some creativity.





# Creativity and the Warman Competition

**Avoid!**

**Stagnation** – trying to solve a new problem with an old solution. If the rules don't permit it, then you can't do it!

**Build a foundation on:**

**Replication** – routine problems that can be solved with known solutions – focus on effectiveness.

**Look to win with:**

**Incrementation** – routine problems that can be solved better, faster and/or cheaper. **Creativity!**

# Creativity and the Warman Competition

Finally, dazzle them with:

**Reinitiation** – a new solution idea that overcomes a constraint. **Creativity!**

# Creativity and the Warman Competition

Creativity doesn't have to be the spectacular “big bang” overall solution (**reinitiation**)

It can be a novel solution to one small sub-system. A small improvement (**incrementation**) that gains you a few seconds, or a clever alternative design option that overcomes a constraint.

Part of your task is to identify what can be solved with replication, and where you have opportunity for incrementation, or the need for reinitiation.

In other words, what can you solve with what you already know, what can you improve with a little creativity, and what needs a genuinely new solution?

# So how do you find this creativity?

Think back to Engineering Design & Innovation.

Creativity impacted by 4Ps:

Person – who you are – your personality, motivation and feelings.

Process – what you do – how you think, the stages you go through in developing a solution.

Press – where you do it – the environment in which this takes place.

Product – what you create – the outcome itself, the artefact.

# Person

**Openness to new ideas**

**Tolerance of uncertainty**

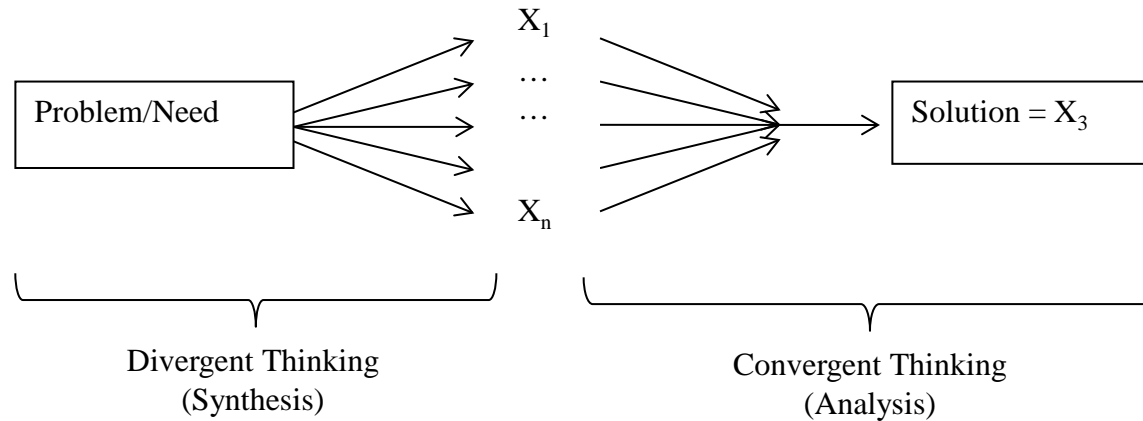
**Motivation**

**Low Pressure**

**Willingness to take some risks**

**Knowing when (phases)!**

# Process



Tools – brainstorming?

When?

# Press

**Time and place**

**Support**

**Fun**

# Product

What makes an artefact creative?

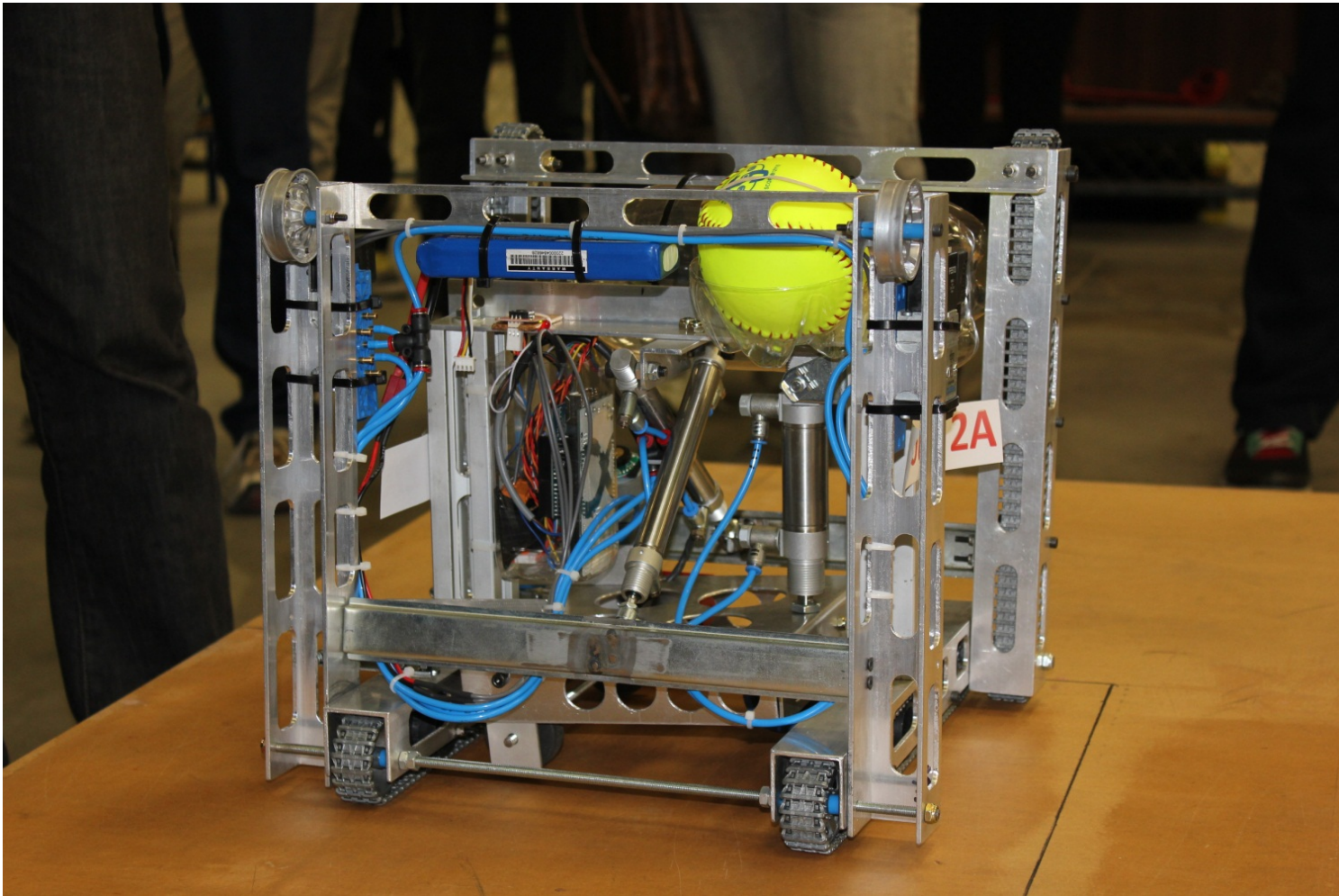
**Effectiveness** it must do it's job, meet the spec.

**Novelty** it must be new, original, surprising.

**Elegant** it must be complete, well-made, safe, understandable.

**Genesis** the really creative ideas open up new perspectives, suggest new ways of looking at the problem, etc.





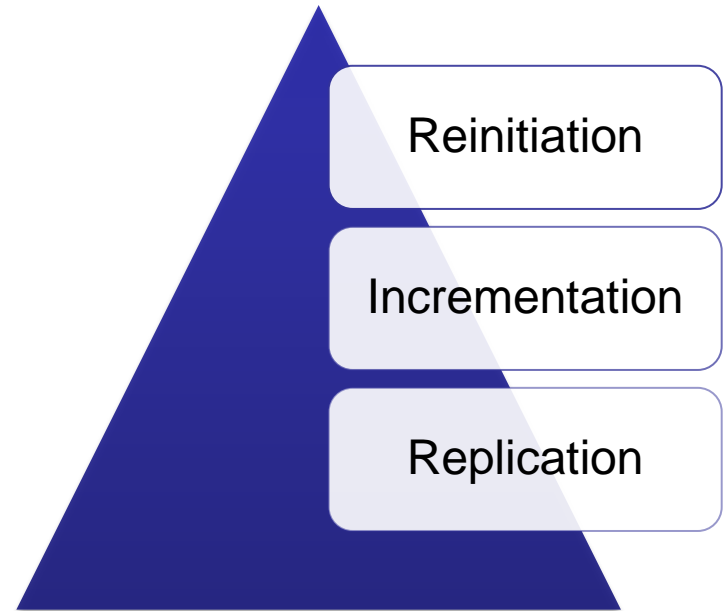
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# Summary

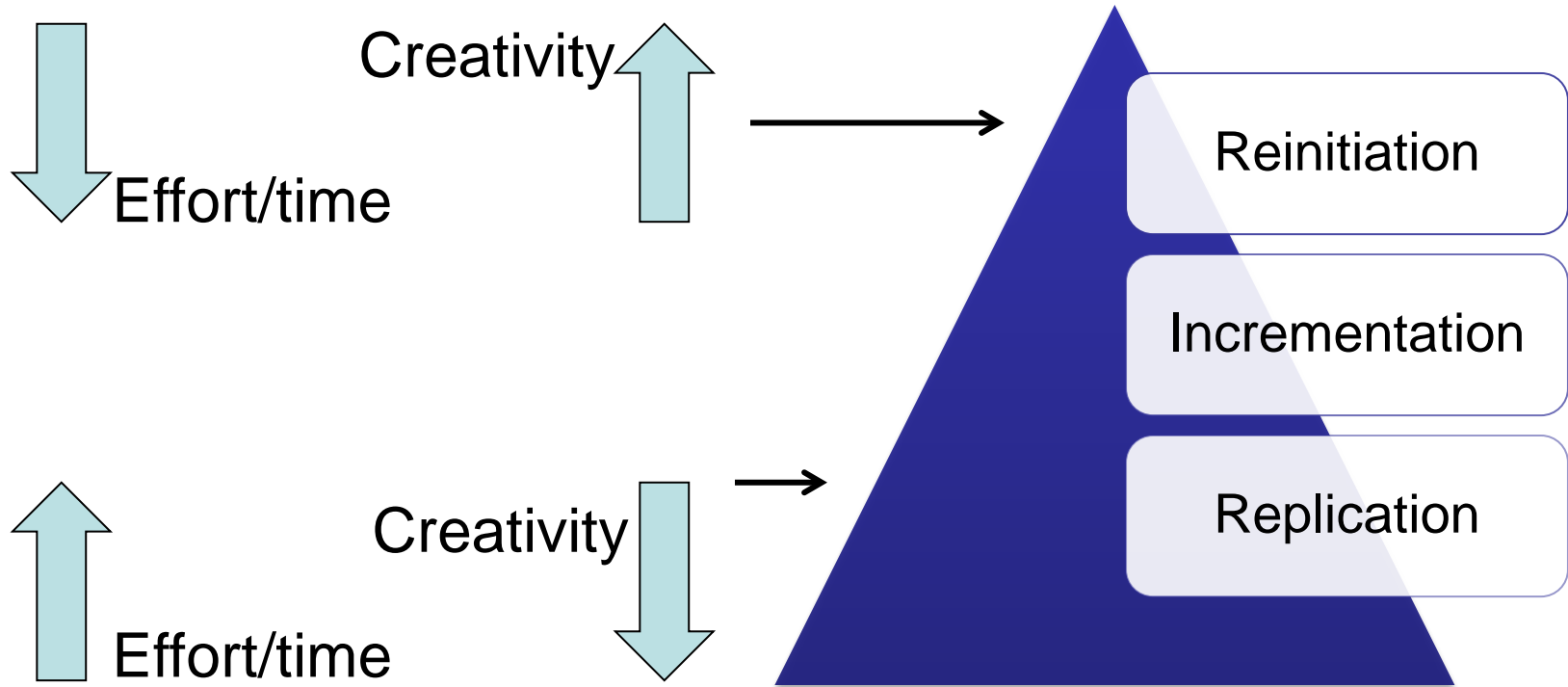
**Creativity adds value in engineering.**

**We need to know when and why we are using it.**

**In the Warman competition you will probably balance a large dose of replication with a proportion of incrementation, and a little reinitiation.**



# Summary



EXPLORATIONS IN CREATIVITY RESEARCH



# CREATIVITY IN ENGINEERING

Novel Solutions to Complex Problems



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