

Product Design



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Section 1. Fundamentals

Who/what is a designer?



Coco Chanel



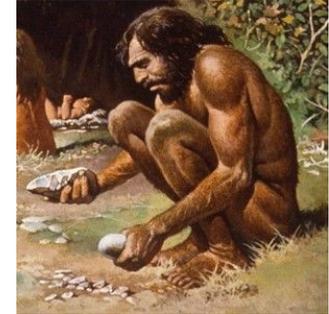
Jonathan Ive



Zahir Hadid



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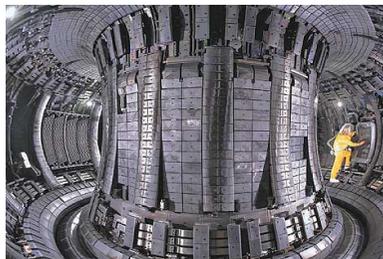


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OK the great news is that we are all designers – we solve problems every day, we create solutions, we innovate, we empathize how our solutions impact others. We just maybe do this in an intuitive way.

What this short workshop aims to do is give you a few tools that can help you to do great product design without having to be design genius

What is product design?



Anything that is created has a component of design. Whether physical or virtual in nature – design is not about making objects pretty or desirable (although that can come into it) but about solving problems with an effective, optimized solution

Solving what problems?

Finding the right problem to solve depends on your motivation:

Work for a corporate or startup = problem that adds value or fixing something that's broken

Personal experience = something you come across

Personal genius = something you realized that no one has ever thought about

Personal interest = something you know about or care about or are interested in

Serendipity = Someone you meet or something that happens out of the blue

Necessity = you have to do something

Important to understand the motivation as that shapes the approach you take to the task

What's with problems?

There are a number of names and nuances for problems – sometimes they are called, needs, or likes, or preferences or wants – it doesn't matter what you call them, they are all things people will value

Clay Christianson calls them jobs to be done, and it goes something like this . . .

Problem

“people don't want to buy a ¼” drill, they want a ¼” hole

Theodore Levitt



Solution

There is also the concept that people 'hire' a product to do a job rather than buy a product as an object to own



Paradigm

The problem is that many companies are stuck in the mind-set of building and selling products not in providing solutions



Paradigm



Drill maker

- Better
- Faster
- Desirable
- Cheaper



Drill makers view of competitors



Real competitors

- Better
- Faster
- Desirable
- Cheaper

So why do people buy drills?

'Need to drill lots holes'
'I need a Screwdriver'
'Hammer drill concrete'
'Need great control to match my skill'
'Want to look capable to my friends – I need a big drill'
'Makes me feel competent like a tradie'
'But is simple enough for me to use'
'Cheap is not cool'
'looks robugged'



Functional	Personal	Social
<ul style="list-style-type: none"> • Drills • Screws • Has great endurance • Controllable • Powerful • Comfortable to hold 	<ul style="list-style-type: none"> • I have great tools that match my skill level • I can drill holes anytime I need • I appreciate the quality of the tool 	<ul style="list-style-type: none"> • My friends respect my tool choice and capability • Tool envy • I spend on tools because I can and I deserve it

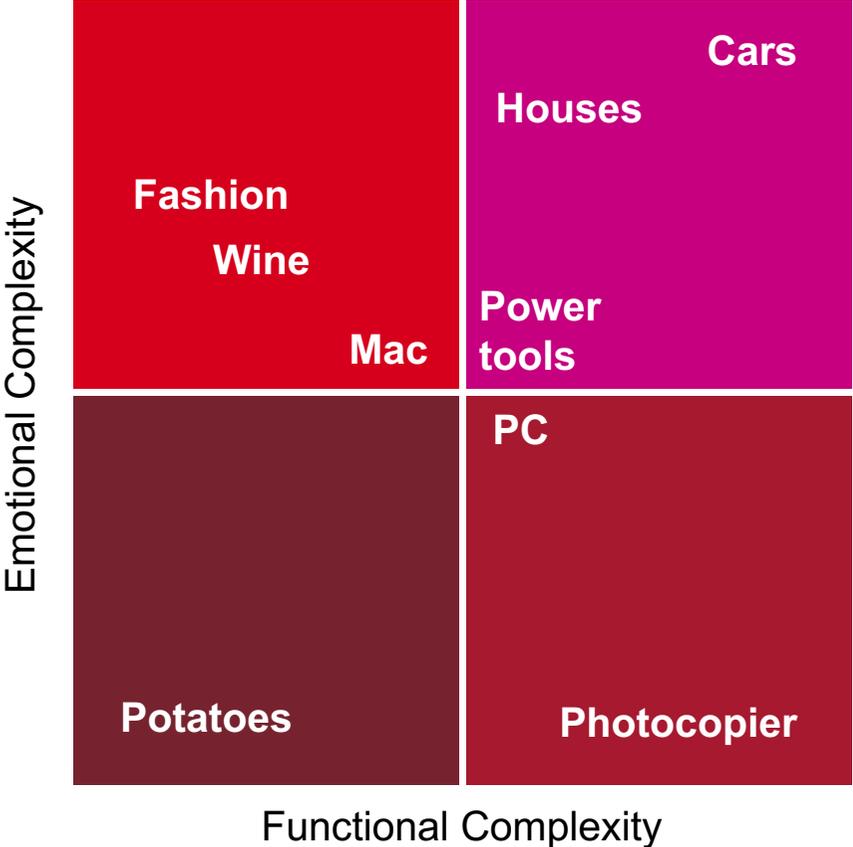


User needs are deeper than you would expect

It's a complex mix

Not all products (solutions) have the same mix of emotional and functional complexity

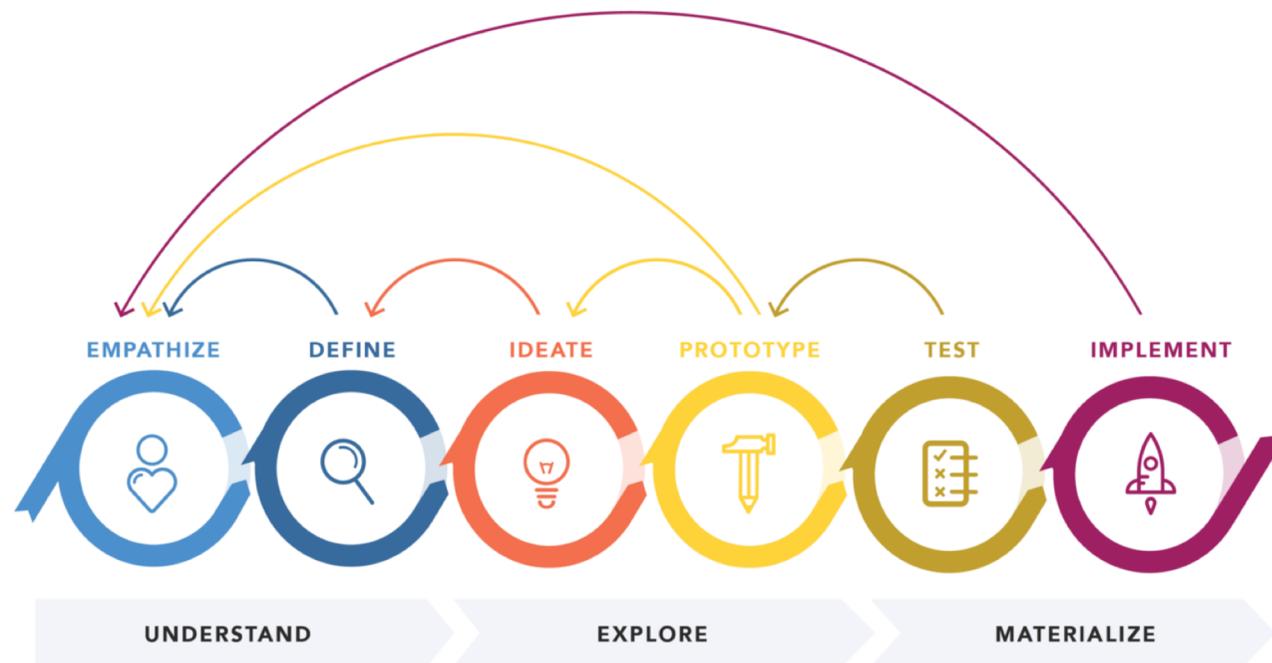
Moving the product around the box can differentiate and change the value perception of the product – sometimes this isn't really practicable



Design Thinking

Design thinking codifies the iterative process of understanding the user needs, exploring solutions, experimenting and testing the outcomes.

A fundamental is always relating the user to the design process – making the design output user centric



NNG Group

Unmet, illmet and unrecognised

Q: how could your journey here have been improved today?

If you ask commuters how their journey to work could be improved you will end up inventing a better car, bike or bus. No one will invent remote working. Similarly if you asked me in the 1980's how you could improve my Walkman I never would have asked for an electronic music library downloadable via a mobile phone from the cloud.

So are visionaries truly visionary ? . . . Well maybe, but we can all be . . .

Disruptive design is all about spotting unrecognized needs and satisfying these usually with enabling technology.



But that is not to say satisfying un-met or ill-met needs isn't important

Unmet, illmet and unrecognized



Unmet needs are things which stop the user from doing something with your product which they want to do – e.g. fly London to New York

B707 was the solution

Illmet needs are things which the user can do with your product but are sub-optimal – e.g. fly London to New York quickly or more cheaply

B747 and Concorde offered different solutions

Unrecognized needs are things which the user would not think of because they are stuck in their paradigm, but if you think outside of the paradigm then disruptive design is possible. e.g. get from London to New York quickly and cheaply: Hyperloop

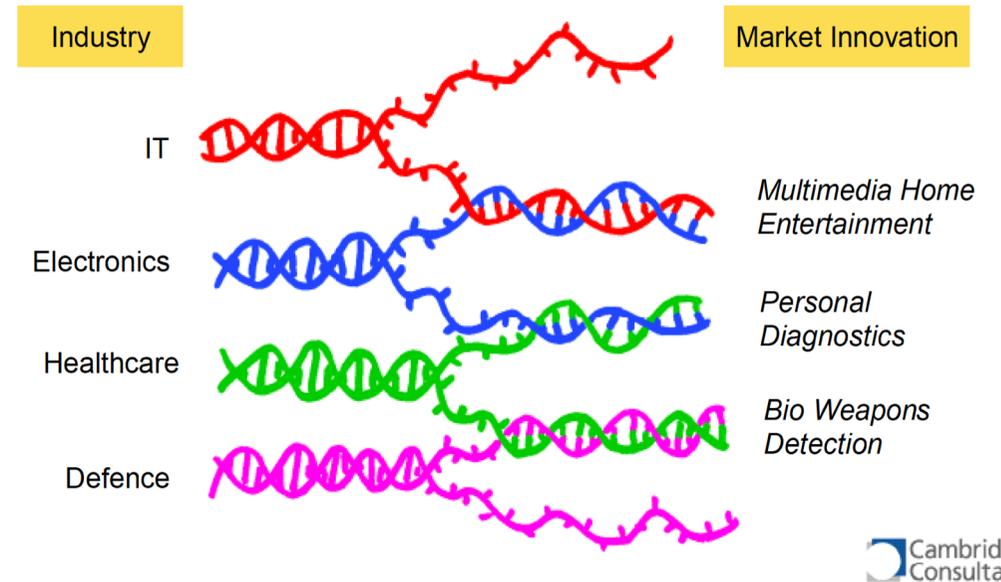
Q: would an aircraft manufacturer come up with Hyperloop solution?

Splicing the design DNA

Just like living things each product has a DNA to its design which is a mix of functions aesthetics, invention, technology, service, emotional content etc etc. This mix can be said to give the design its own DNA.

Now imagine what happens in nature when an organism mutates, its DNA changes to introduce something new – just like in a developmental design – like an evolutionary trait.

A disruptive design is analogous to developing a whole new organism by inventing new sections of DNA and splicing these in - like the iPod, taking solid state memory and splicing this to a Walkman cassette player while reformatting to miniaturize and improve the UX.

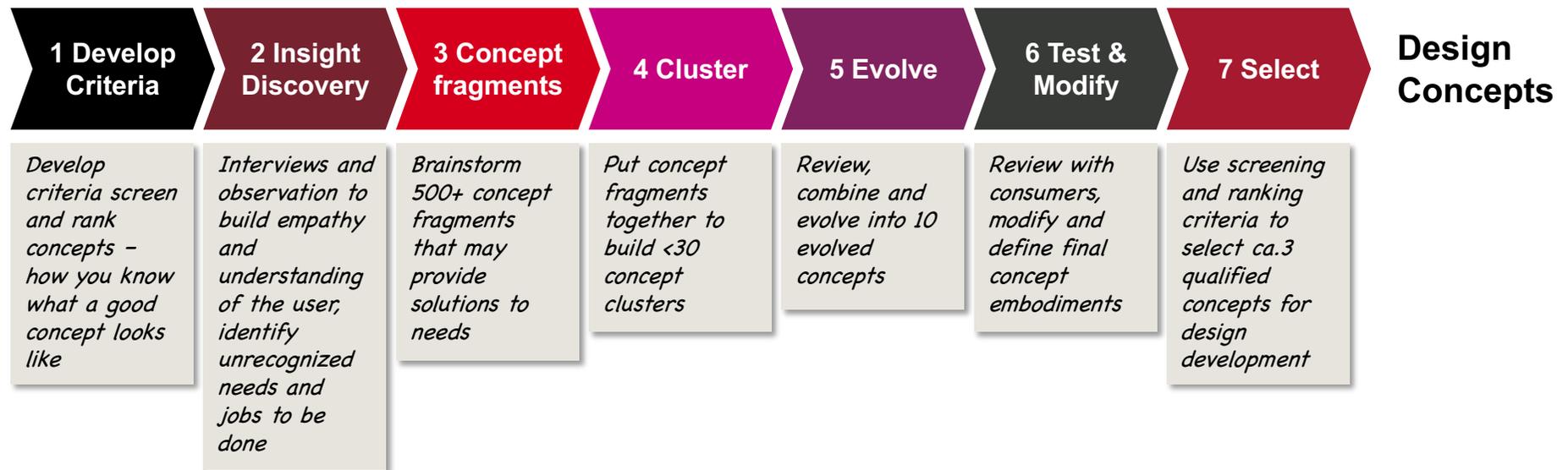


Q: Can you think of other examples?



Section 2. Disruptive Design

Disruptive Design Process



Step 1: Develop Criteria

1 Develop Criteria

Screening and ranking: At the start of the program you need to put down some criteria against which the concepts are judged – this could include things that the concept has to do (screening) and things that it is preferable for the concept to do (ranking).

Screening Criteria (YES/NO)

Usually based on a yes/no factor related to external or internal needs. For example:

- Must be safe, reliable, efficacious
- Must be carbon neutral
- Must be capable of generating \$xxm per year
- Acceptable to >20% customers

The criteria should be as un-interpretive as possible – concepts need to re

Ranking Criteria (1-5)

Usually based on a 1-5 rating. For example:

- Competitiveness
- Defensible technology
- Manufacturing cost / complexity
- Fit with business

The scores are given by a team or several teams to weight one concept against another

The Winning concept passes screening and ranks the highest

Step 2: Insight Discovery

2 Insight Discovery

As discussed, customer interviews are important, but empathizing with the user by role play and observation are really powerful tools to provide insight:

Direct Observation Exercise

The problem we are working on is making a sandwich.

- **Work on your own or with the person next to you to observe what my colleague does.**
- **See if you can identify any insights.**
- Think about un-met, ill-met and un-recognized needs and the jobs to be done.
- Think about the functional, personal and social needs of the sandwich maker

Then I'm going to ask you to shout out some of your insights and we will write them on the board

Step 3: Concept Fragments

3 Concept fragments

As a design team you would brainstorm 500+ concept fragments that may provide solutions to needs:

Concept Fragment Exercise

- **Each of you take the piece of paper and draw a concept fragment as shown that represents a creative solution to an insight you identified previously**
- **Then pass them all to me.**

In reality you would usually work in a design team of 3-7 people and brainstorm concept fragments. Brainstorming or ideation is a fascinating subject in its own right and cant be covered here today. However here are a couple of techniques which really work:

- Analogies (different places and environments)
- Personas (different people would solve the problem)
- Nature (how would nature solve the problem)
- Look in the book (choose a page, paragraph and word – or picture and cue solutions around this)

Step 4: Cluster

4 Cluster

We need to get from hundreds of concept fragments to about 20-30 clusters which represent the output of the brainstorming exercise. Doing this is a challenge and so we use a magic tool:

Clustering Exercise (3 volunteers)

- Put the concept fragments in a pile
- In complete silence, person 1 place them on the table in groups that make sense to you.
- Person 2 you can arrange any you don't agree with
- Person 3 you make your changes
- Now person 1 again, followed by person 2 etc - do this until you all get fed up.
- **Now we have fragment clusters that the entire team agrees with, there were no arguments and no discussions, making this a very efficient process. The clusters may appear arbitrary to those not involved but that doesn't matter at this stage.**

Step 5: Evolve

5 Evolve

The design team now sets to work reviewing, understanding and combining to evolve the 20-30 clusters into about 10 evolved concepts

Evolve

- The design team take each cluster and understand the constituent concept fragments within it
- The team take each of the features of the concepts and try to weave them into a presentative embodiment concept which represents the entirety of the cluster
- This process is iterative, creative and done openly and in collaboration with the others on the team
- Limited judgement is made as to the feasibility of the concepts, the designers work to the challenge of how could I combine this and that to make a product concept. It is important to keep the essence of each concept fragment even if the fragment taken literally is not practicable.
- Next the design teams look to combine concepts and features from different clusters to provide additional workable solutions. Internal broad selection of combinations is used to reduce the number of embodiments to about 10 from the 20-30 clusters.
- **The out-put is 10 concept embodiments, usually described in a concept boards that can be shown to users for further selection**

Step 6: Test and Modify

6 Test & Modify

The 10 evolved concepts are now challenged both internally and externally by customers to understand how they fit with the company and how they fit within the market

Test and Modify

- The design team need to ensure that the evolved concepts are tested with internal stakeholders to ensure that they are feasible, a good fit with the organization and development requirements and risks are broadly understood. The team will usually review the evolved concepts with panels and experts from different functions including finance, engineering, marketing, sales, regulatory etc (In a startup this is a much simple process as the company is usually much smaller – this still needs to be understood though)
- External review can be through expert opinion leaders, focus groups, user reviews etc The purpose being to understand the customer reaction to the concepts.
- This can be an iterative process with evolved designs themselves being modified/combined/changed to suit the feedback obtained
- **The out-put of these reviews and modifications feeds directly into the screening and ranking stage.**

Step 7: Select

7 Select

Each of the evolved concepts and the feedback obtained from step 6 are reviewed against the screening and ranking criteria set at the beginning of the project to identify the highest ranking final concepts for development

Select

- The design team presents each of the evolved concepts to the screening and ranking team who review them against the feedback obtained during step 6 Test and Modify
- The team discusses each concept and then subjects each to the screening criteria.
- Concepts that pass the screening criteria are then ranked by each team member and a score for each concept obtained.
- The team discusses further and decides based on the ranking scores which concepts to select for continued development.
- **The out-put of the review is between 1 and 5 (usually 3) final concepts which go onto further development.**
- **Further development usually involves further initial investigation into the three final concepts and a commercial decision as to which if any are taken forward into product design development. The key here being to do as little work as quickly as possible to be able to make an informed “approximately correct rather than precisely wrong” decision.**

Design and Review Group selection

Getting the right team is a must, and they must understand what they are doing and why

Design Team

- Creative
- Open minded / unconstrained
- Trained
- Balanced individualistic and group
- Introduce catalysts
- Consider triads
- Unbalanced and odd numbers
- Equals
- Collectively motivated
- Diverse

Screening /selection Panels

- Open minded
- Trained
- Unbalanced and odd numbers
- Equals / peers
- Collectively motivated
- Objective
- Managed to avoid group think / company think
- Incentivized to do things differently
- Diverse



Section 3. Design Realisation

Design Development Process

The design process is a journey from concept to product launch. It has many steps but starts with a loose concept which becomes increasingly resolved as it nears completion. The unifying thread being the design specification. Development is not a linear road, there are many iterations and changes which result from discovery and invention along the way. But it is important to understand the direction and vision for the product which is being developed.

There are many methodologies which can be used but these tend to fall into two general camps:

Traditional – sequential, highly controlled, specified (good for capital projects and safety critical)

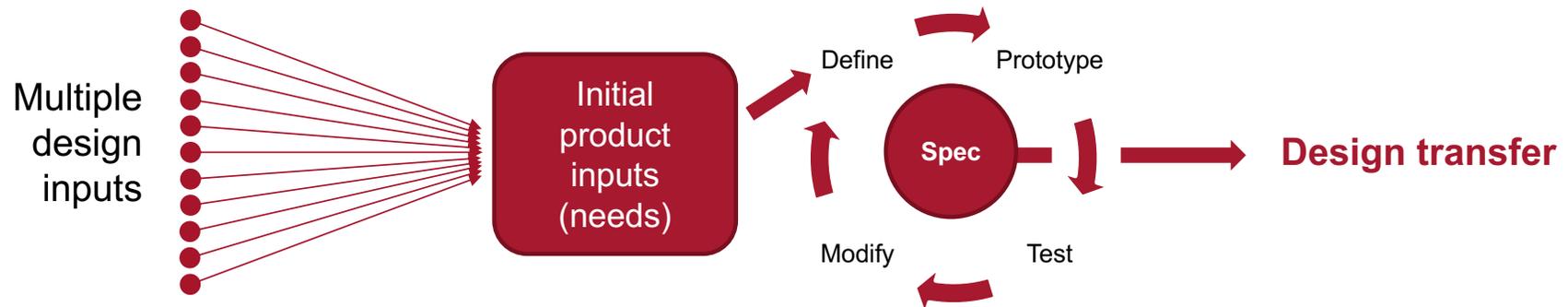
Contemporary – agile, iterative, experimental (good for software and rapid development)

Which process is used is a combination of the product being developed, the preferences and experience of the the team and the culture of the organization.

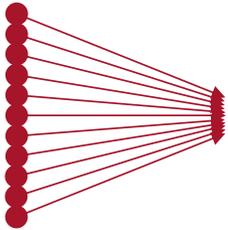
Design Specification

The product specification describes the product design in a way that it can be transferred to manufacturing/implementation. The specification is the output of multiple design inputs, developed over an iterative process of define, prototype, test and modify.

Design transfer happens after design freeze where the specification is locked down



Design for X



Design is a compromise of a number of factors. Design for X or DFX is a term which essentially groups these factors 'the X' to provide a composite specification which satisfies all of them, or at least selects which to satisfy and which not to.

DFX typically includes:

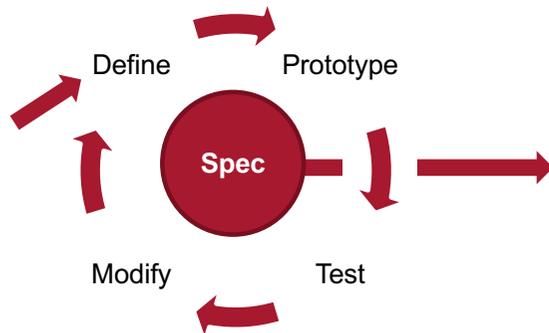
- Design for Manufacture
- Design for user (user experience / ergonomics / culture / language etc)
- Design for environment
- Design for lifecycle
- Design for regulatory compliance
- Design for IP
- Design for cost
- Design for safety and reliability
- Design for logistics

DIDO, a cool tool

The DIDO (Design Input Design Output) is a table which starts at the very top level product features which read off of the initial concept and user insights and then expands these through several levels of enabling features to eventually be specified as performance requirements and then tested for compliance

DIDO - Project Cup						
Design input	Can drink from it					
Sub-need	Can hold it			Fits mouth		
Solution Module	Grip			Rim		
Requirement	Grip is comfortable	Grip doesn't snap	Grip insulates	Shaped to fit mouth	Smooth	Sufficient thickness
Test	User test	Weight test	insulation	User test	edge profile	Thickness
Specification	95% users say its comfortable	Grip resists 1Kg load at 90deg	external surface <50C with internal liquid at 95C for 30 seconds	95% users say its comfortable	radius on edge profile >1mm	Thickness > 2mm
Result	100% users rated comfort at 4/5 or higher	grip resists 15kg load at 90 deg	Surface <43C after 30 seconds	100% users rated comfort at 4/5 or higher	radius > 2mm	Thickness 3.5mm

Experimentation & Validation



At many points you will need to invent solutions to problems – this means experimenting, discovering and learning.

During this process the design embodiment will change and in some cases you may even change the design requirements as you learn.

That's why it is critically important to maintain a dialogue with the customers – make sure that what you are doing still fit their needs and also find out if something else in the environment has changed. Of course you may want to update the spec'.

Allow time for iterative experimentation – talk to customers continually and plan to allow this time

Prototyping & MVP

Prototyping is critical – lets you learn about the product you are creating

Prototype for a reason – engineering, customer discovery, ergonomics, aesthetics etc

Prototyping is easy – rapid prototyping, soft tooling, additive manufacture, machining, design mockups, slide-ware, simulation – all of these are just tools. Use what you can and in the right place at the right time to make 1 offs, short runs or small volumes (thousands of pieces). Use off the shelf solutions save the bespoke optimized version until you know the product will fly.

If you can, build an MVP (Minimum Viable Product) and get user experience feedback early

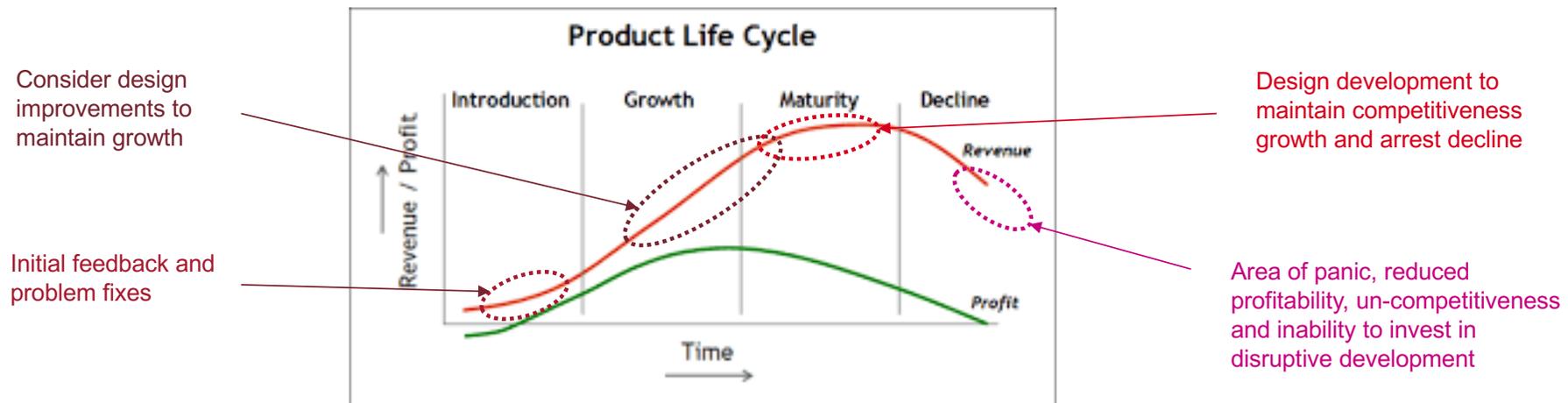
An MVP is all about getting a minimum complexity product in the hands of users as soon as possible. This lets you get their feedback, you learn how they use the product and you understand what value it provides so you can iterate the design

Be quick, be focused on getting the answers you need, get something in the users hands ASAP

Release and adoption

When the product is released the hard work starts. Customer feedback and in market monitoring are critical. This lets you know how the user is experiencing the product and how the competitors are reacting.

This should feed into the product road map to help define the next incremental developments:



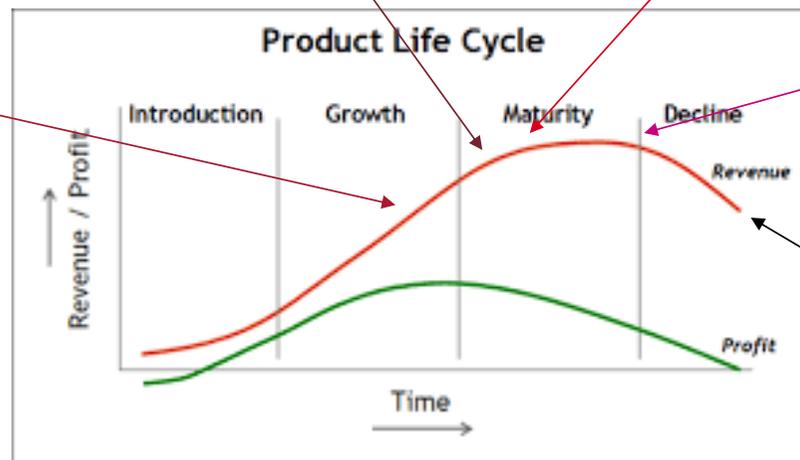
So why don't businesses do it?

Companies develop a disruptive solution – during product product growth and maturity

1. Company invests in incremental design changes or range extensions – building a platform of product and core competence

2. In growth and maturity phase company invests in process development to reduce costs and maintain margin

3. By now the company is heavily invested with massive inertia and an inability to change quickly – its no longer agile and ripe for disruption



Out of the blue a competitor disrupts the market, sales fall, profit drops, inertia and lack of competency, cash reserves and shareholder pressure cripples the company

Response is impossible

Key take-aways

- **Observation** gains empathic insight into unrecognized needs
- **Asking** people what they want **does not provide a disruptive solution**
- Understand the **jobs to be done** – functional, personal and social
- Maintain a **user centric** approach throughout the process
- We are all **naturally creative** – follow the disruptive process if it helps you
- Work with the **right people that understand** what they are doing
- **Experiment – prototype – test – learn – iterate**
- The work starts **after launch**
 - Don't become a dinosaur





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