



# Empreendedorismo2019 @ FCT

## Prototipagem

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# Hello!

## How are you today?

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## Short Bio

**FCT** FACULDADE DE  
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Marco Leite

Engenheiro Mecânico

Mestre no IST

Doutorado no programa MIT-Portugal

Especialista em 3D Printing

Professor no DEMI - FCT

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## Prototipagem

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“Fail often to succeed faster”

Why?

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## Prototipagem



"Ideas don't come out fully formed"

Why?

5

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## Prototipagem



"Nothing endures but change"

(Heraclitus)

Why?

6

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## Prototipagem

No mundo tradicional:

O consumidor é conhecido!

O produto é conhecido!

A solução é conhecida!



Há produtos e serviços para todos?

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## Prototipagem

Os protótipos são grandes facilitadores da inovação.

Oferecem noção do trabalho já desenvolvido.

Oferecem algo tangível.

Oferecem imediatamente oportunidades de melhoria.

Oferecem uma noção de ergonomia.

Permitem interagir com o cliente.

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# PROTOTIPAGEM

What is a prototype?

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## What is a prototype?



1994 – VW concept One



1998 – VW New Beetle

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## What is a prototype?

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2019 – Nos cinemas!

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## What is a prototype?

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## What is a prototype?

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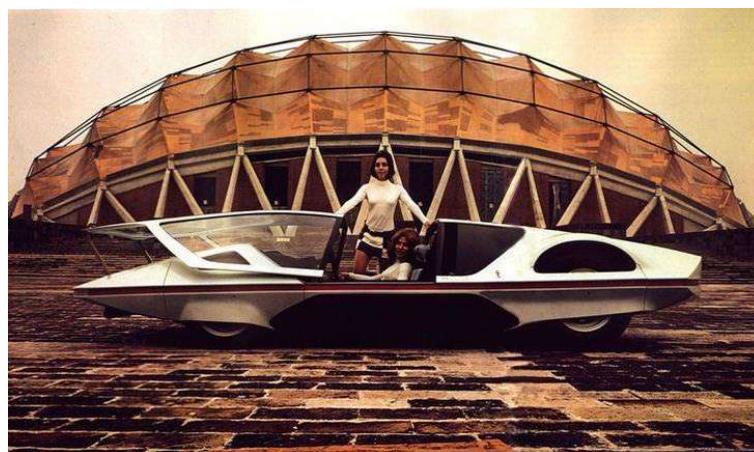
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## What is a prototype?

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Ferrari 512S Modulo

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# What is a prototype?

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# What is a prototype?

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## What is a prototype?

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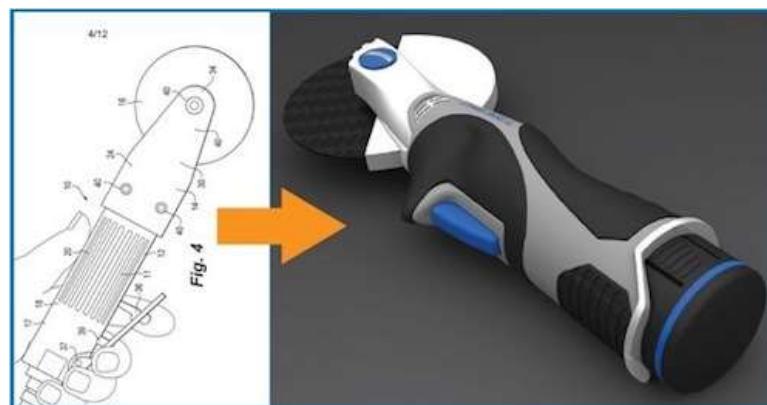
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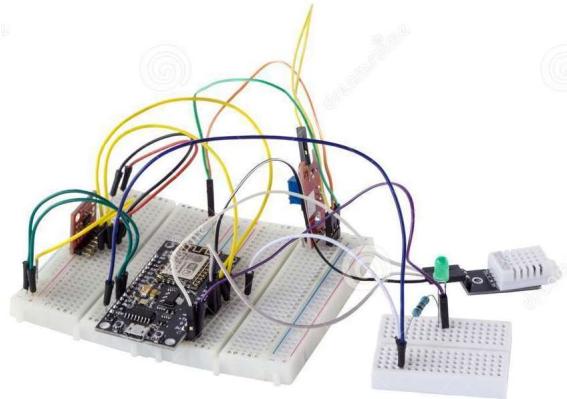
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## What is a prototype?

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## What is a prototype?

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# What is a prototype?





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# What is a prototype?





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# What is a prototype?

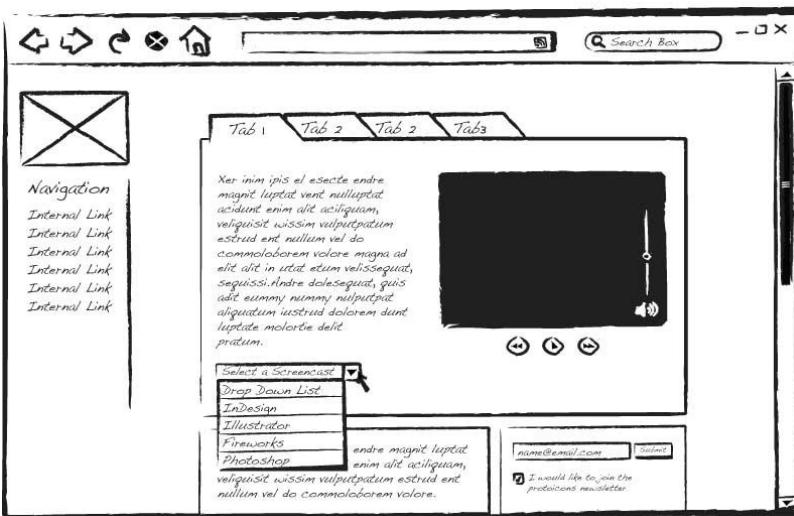


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# What is a prototype?

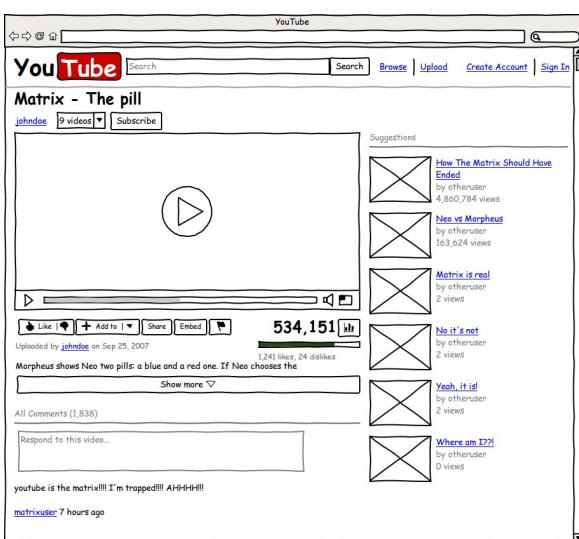


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## What is a prototype?



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## What is a prototype?



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## What is a prototype?



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## PROTOTIPAGEM

Who uses a prototype?

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## Who uses a prototype?

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Product and Service Development Teams  
Entrepreneurs  
Companies  
Artists

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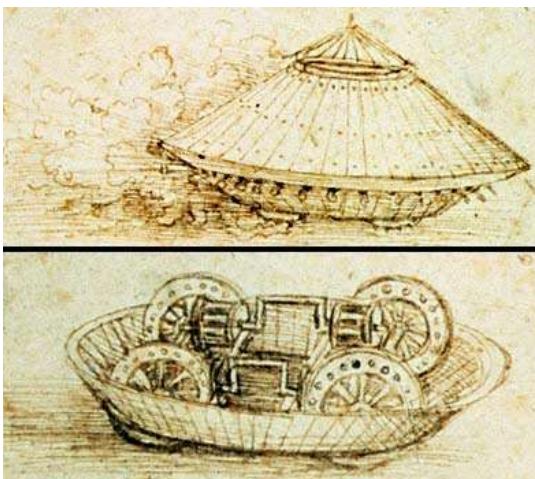


## Who uses a prototype?

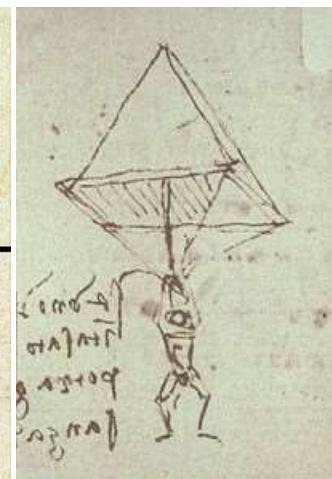
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Study of Hands, Da Vinci



Wonder Weapon, Da Vinci



Parachute, Da Vinci

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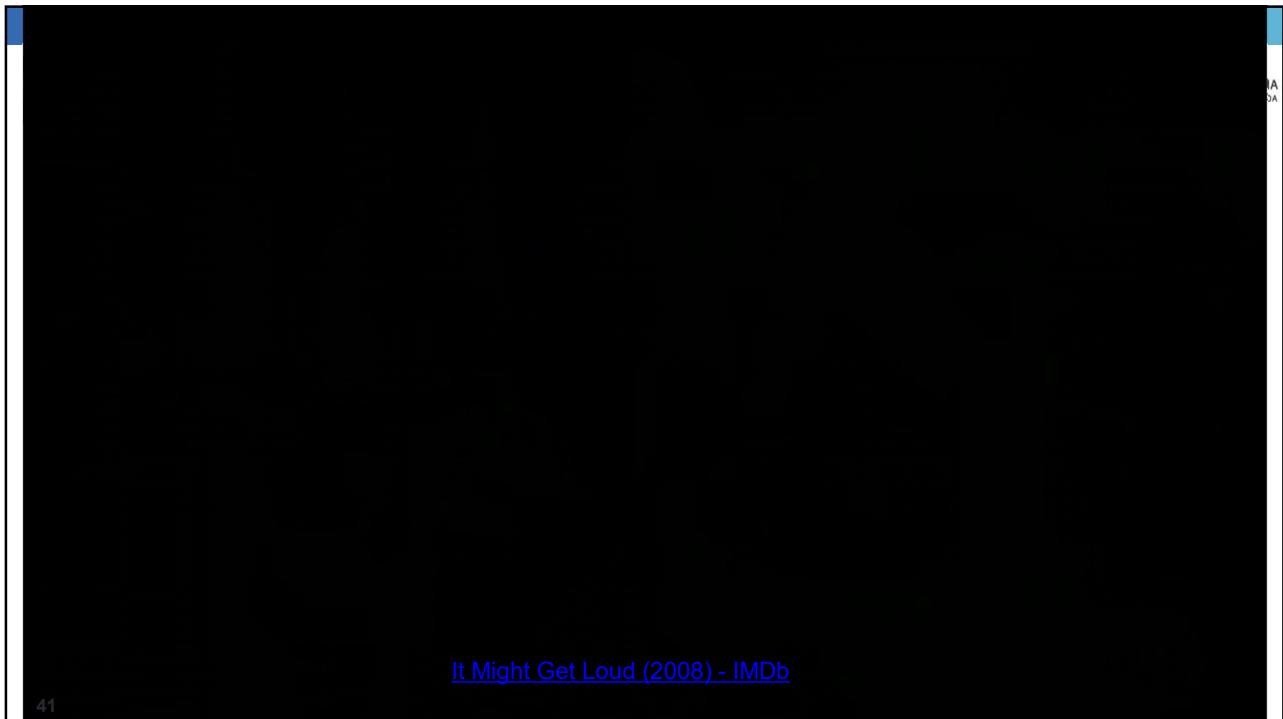
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 Who uses a prototype?



Pablo Picasso 1937

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**PROTOTIPAGEM**

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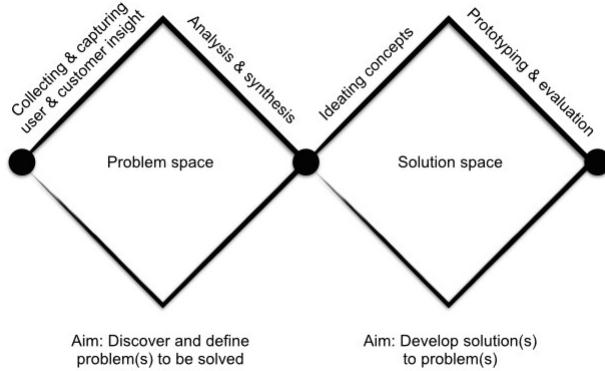
When to use a prototype?

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## When to use a prototype

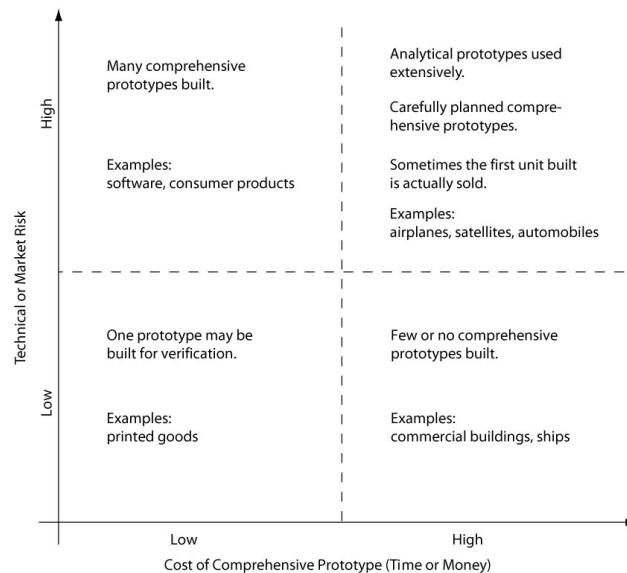


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## When to use a prototype



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# PROTOTIPAGEM

Why use a prototype?

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## Why use a prototype?

Learning!

Communication!

Integration!

Milestones!

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## Why use a prototype?

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To make the development faster and better!

Fail often to succeed sooner!

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## PROTOTIPAGEM

How to make a prototype?

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## How to make a prototype?

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Papel e cartão

Lego

Desenhos e esquemas

Impressão 3D

Plasticina

...

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The slide features a header with three horizontal bars: blue on top, green in the middle, and light blue at the bottom. On the left, there is a logo for 'EMPREENDEDORISMO FCT' with a stylized lightbulb icon. On the right, there is a logo for 'FCT' with the text 'FACULDADE DE CIÉNCIAS E TECNOLOGIA UNIVERSIDADE NOVA DE LISBOA'. Below the header, the word 'PROTOTIPAGEM' is written in large, bold, dark grey capital letters. A thin horizontal line separates this from the subtitle 'Tipos de protótipos' in blue text. The page number '52' is located in the bottom left corner.

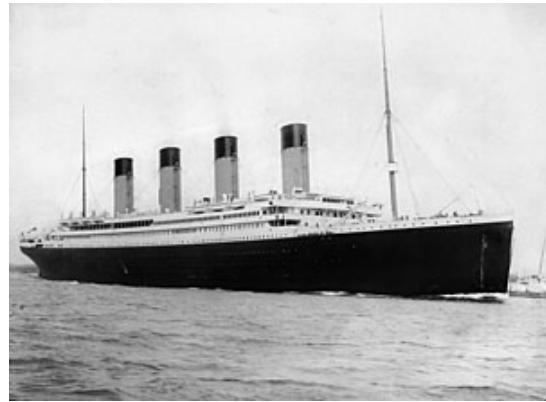
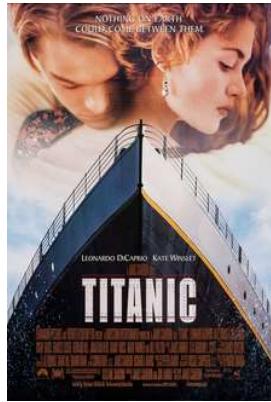
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## Tipos de protótipos

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### Working model



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## Tipos de protótipos

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### Looks like model



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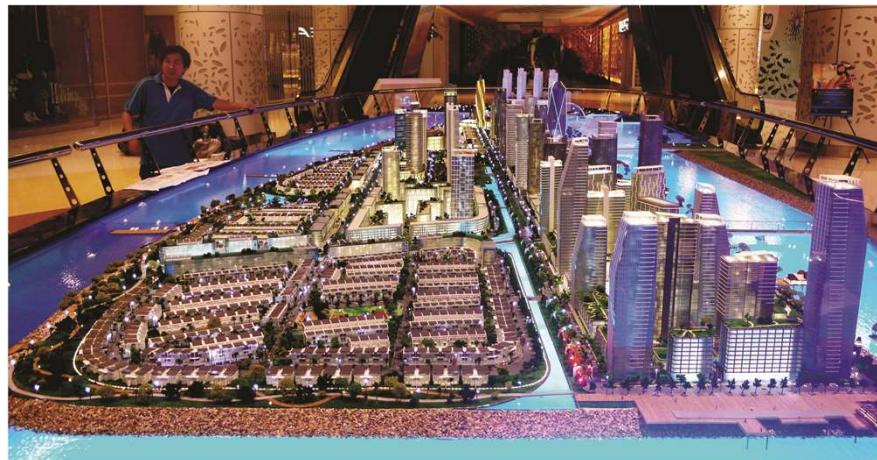
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## Tipos de protótipos

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### Modelos à escala



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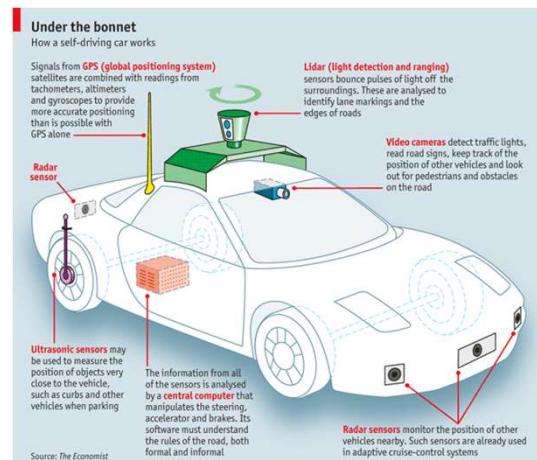
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### Video ou apresentação



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**Tipos de protótipos**

**Protótipo digital**

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<b>Navier-Stokes Equations</b> 3 - dimensional - unsteady			Glenn Research Center
Coordinates: $(x,y,z)$ Velocity Components: $(u,v,w)$	Time : $t$ Pressure: $p$ Density: $\rho$ Stress: $\tau$ Total Energy: $E_t$	Heat Flux: $q$ Reynolds Number: $Re$ Prandtl Number: $Pr$	
<b>Continuity:</b>	$\frac{\partial \rho}{\partial t} + \frac{\partial(\rho u)}{\partial x} + \frac{\partial(\rho v)}{\partial y} + \frac{\partial(\rho w)}{\partial z} = 0$		
<b>X - Momentum:</b>	$\frac{\partial(\rho u)}{\partial t} + \frac{\partial(\rho u^2)}{\partial x} + \frac{\partial(\rho uv)}{\partial y} + \frac{\partial(\rho uw)}{\partial z} = - \frac{\partial p}{\partial x} + \frac{1}{Re_r} \left[ \frac{\partial \tau_{xx}}{\partial x} + \frac{\partial \tau_{xy}}{\partial y} + \frac{\partial \tau_{xz}}{\partial z} \right]$		
<b>Y - Momentum:</b>	$\frac{\partial(\rho v)}{\partial t} + \frac{\partial(\rho uv)}{\partial x} + \frac{\partial(\rho v^2)}{\partial y} + \frac{\partial(\rho vw)}{\partial z} = - \frac{\partial p}{\partial y} + \frac{1}{Re_r} \left[ \frac{\partial \tau_{xy}}{\partial x} + \frac{\partial \tau_{yy}}{\partial y} + \frac{\partial \tau_{yz}}{\partial z} \right]$		
<b>Z - Momentum</b>	$\frac{\partial(\rho w)}{\partial t} + \frac{\partial(\rho uw)}{\partial x} + \frac{\partial(\rho vw)}{\partial y} + \frac{\partial(\rho w^2)}{\partial z} = - \frac{\partial p}{\partial z} + \frac{1}{Re_r} \left[ \frac{\partial \tau_{xz}}{\partial x} + \frac{\partial \tau_{yz}}{\partial y} + \frac{\partial \tau_{zz}}{\partial z} \right]$		
<b>Energy:</b>	$\frac{\partial(E_t)}{\partial t} + \frac{\partial(uE_t)}{\partial x} + \frac{\partial(vE_t)}{\partial y} + \frac{\partial(wE_t)}{\partial z} = - \frac{\partial(uP)}{\partial x} - \frac{\partial(vP)}{\partial y} - \frac{\partial(wP)}{\partial z} - \frac{1}{Re_r Pr_r} \left[ \frac{\partial q_x}{\partial x} + \frac{\partial q_y}{\partial y} + \frac{\partial q_z}{\partial z} \right] + \frac{1}{Re_r} \left[ \frac{\partial}{\partial x} (u\tau_{xx} + v\tau_{xy} + w\tau_{xz}) + \frac{\partial}{\partial y} (u\tau_{xy} + v\tau_{yy} + w\tau_{yz}) + \frac{\partial}{\partial z} (u\tau_{xz} + v\tau_{yz} + w\tau_{zz}) \right]$		

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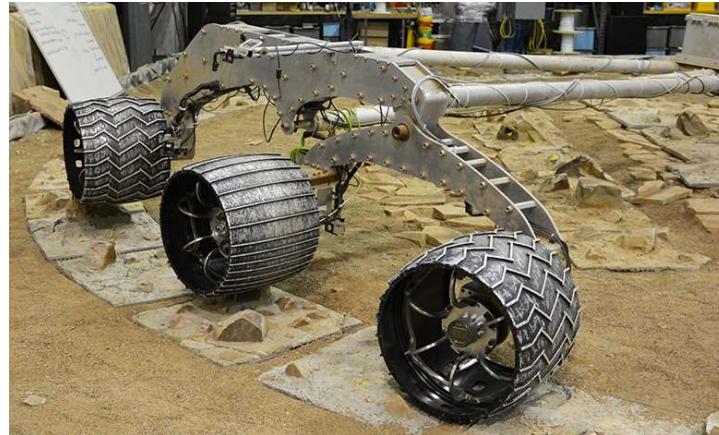
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## Tipos de protótipos

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### Protótipos para um sistema



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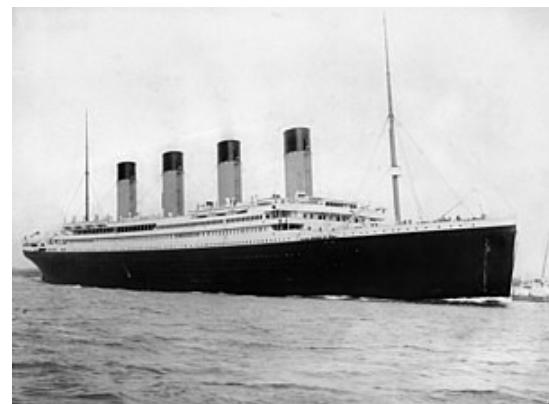
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## Tipos de protótipos

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### Protótipos para um produto completo



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# PROTOTIPAGEM

## Minimum Viable Product (MVP)

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# MVP

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**MVP**

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**MVP**

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# PROTOTIPAGEM

O que pretende evitar!

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# COMO TESTAR IDEIAS DE NEGÓCIOS

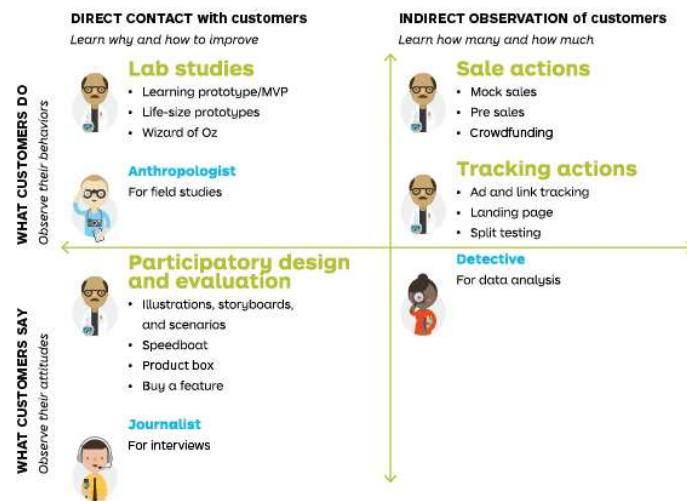
Falar ou não com o Cliente!

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## Testar ou não testar com cliente



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## Testar ou não testar com cliente

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Volkswagen Phaeton. Volkswagen took all of Toyota's lessons in launching its high-end Lexus brand and ignored them.

Cost to date: \$500 million (2006 data)



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## Testar ou não testar com cliente

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Apple's Newton. They were right about the Personal Digital Assistant market but five years too soon. Yet they spent like they were in an existing market.

Cost: \$100 Million (2006 data)



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## Testar ou não testar com cliente

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Motorola's Iridium satellite-based phone system. Engineering triumph and built to support a customer base of millions. No one asked the customer if they wanted it.

Cost \$5 billion. Yes, billion. Satellites are awfully expensive.



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## Testar ou não testar com cliente

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Apple does no market research, and in fact it just wants to “make great products”, Steve Jobs, CEO of Apple. 2008

Consumers are not very good at imagining what they might want to buy if it were available... consumers are not very imaginative, Bart Becht, CEO of Reckitt Benckiser. 2008.

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## Testar ou não testar com cliente



Carefully watch how people live, get an intuitive sense as to what they might want and then go with it. Don't do market research, *Akio Morita, Sony co-founder*

The trouble with research is that it tells you what people were thinking about yesterday, not tomorrow. It's like driving a car using a rearview mirror. *Bernard Loomis, film director and producer.*

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73



## Testar ou não testar com cliente



Existem dados que sugerem que muitas empresas obtiveram sucesso porque se preparam para ignorar os consumidores...

E avançaram o desenvolvimento dos seus produtos porque acreditavam neles.

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## Testar ou não testar com cliente



Carefully watch how people live, get an intuitive sense as to what they might want and then go with it

*Akio Morita, Sony co-founder*

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## Empreendedorismo

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