

Introduction to
Product Design and Innovation

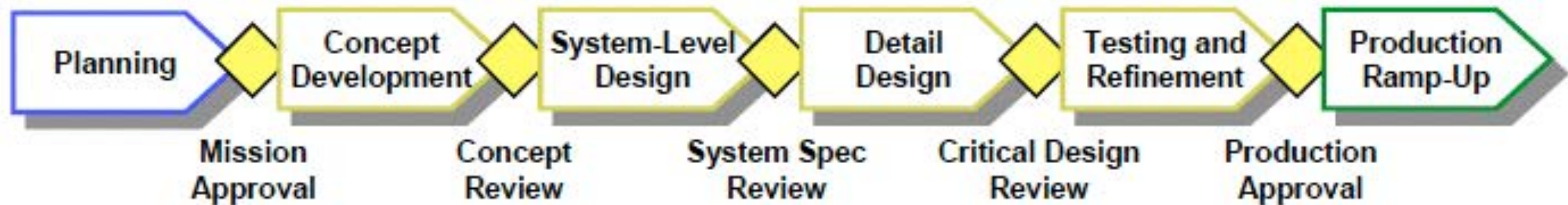
December 10th, 2013

Introduction to Product Design and Innovation

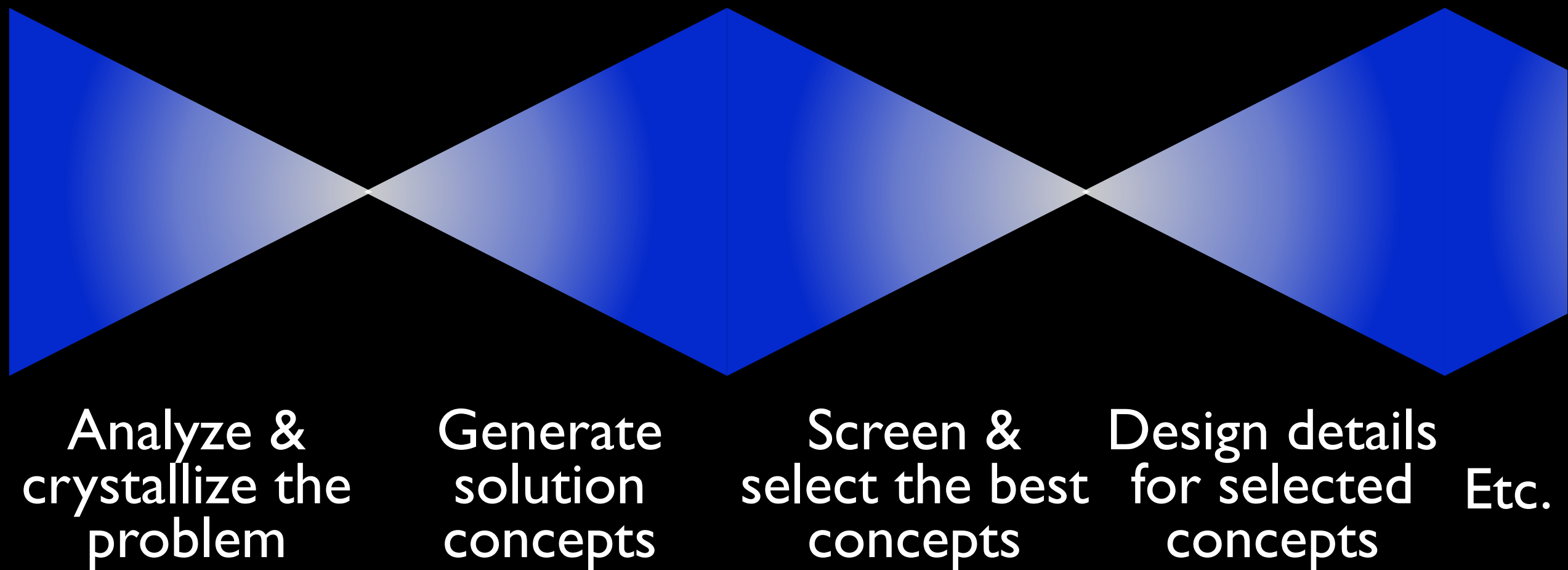
2. Innovation Process Models
3. Idea & Concept Generation
4. Concept Evaluation & Development
5. Internal & External Communication
6. System Level & Detail Design & Design for X
7. Customer & User Needs Assessment
8. Prototyping & Testing

Innovation Process Models

Linear Process Model



Double X



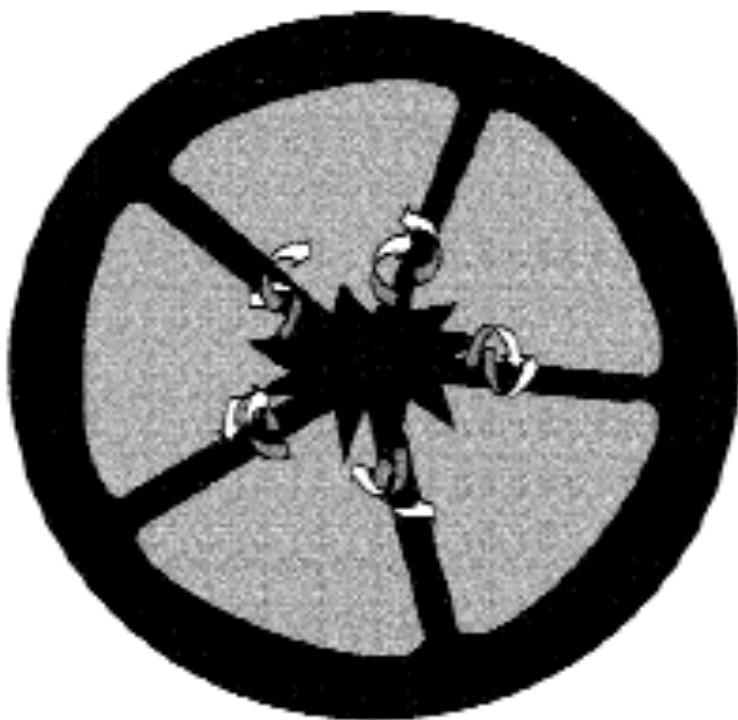
New Concept Development Model

1.

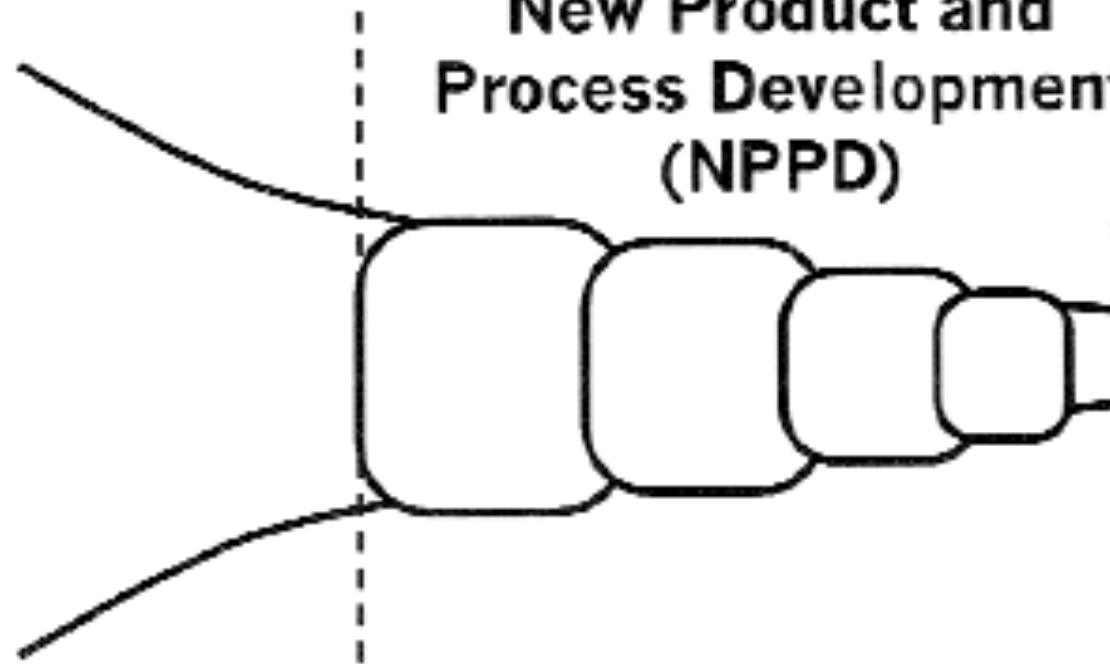
2.

3.

**Front End of
Innovation (FEI)**



**New Product and
Process Development
(NPPD)**



**Commercial-
ization**

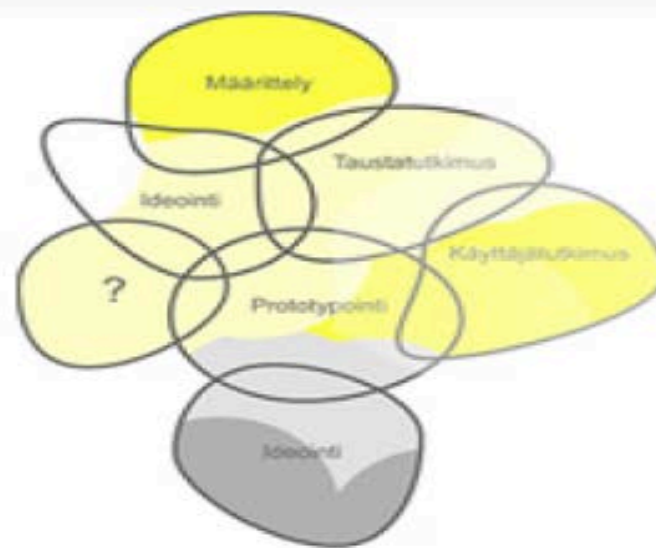
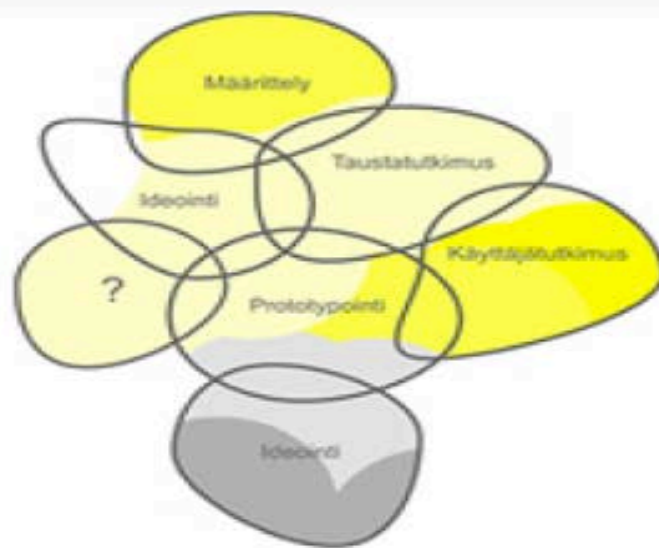
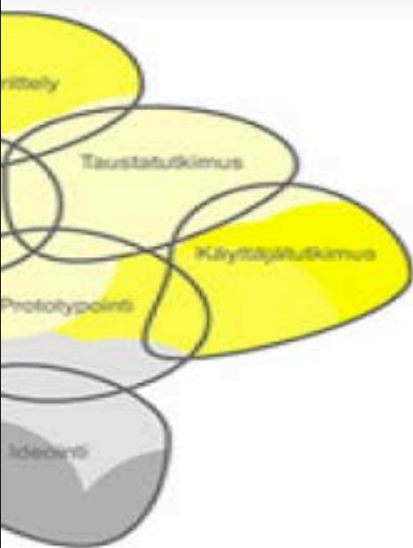
A Linear Process

GLENNZ

...Commonly builds on one idea
...is necessary ...eventually
...is good for execution

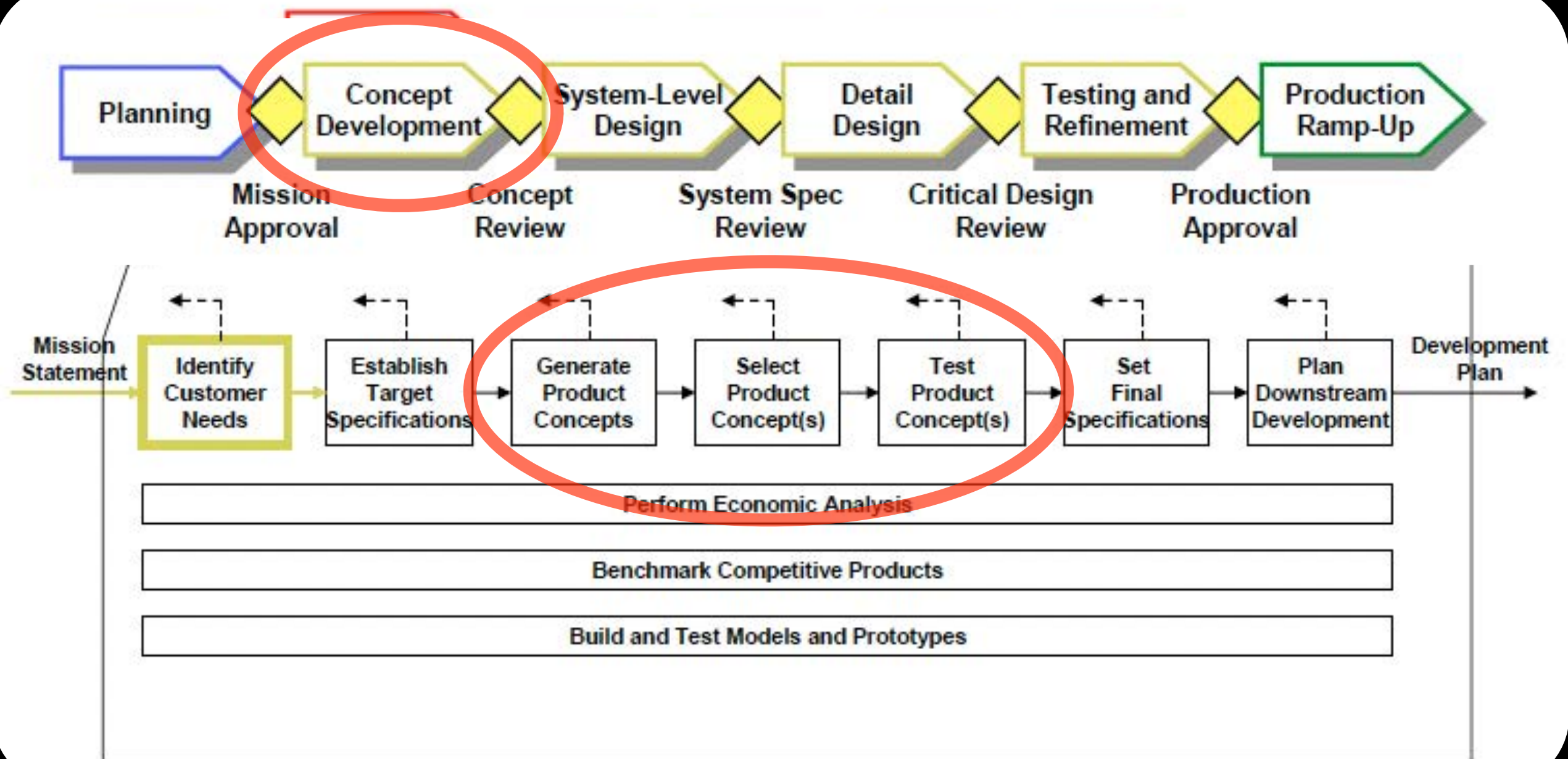


Non-linear Process

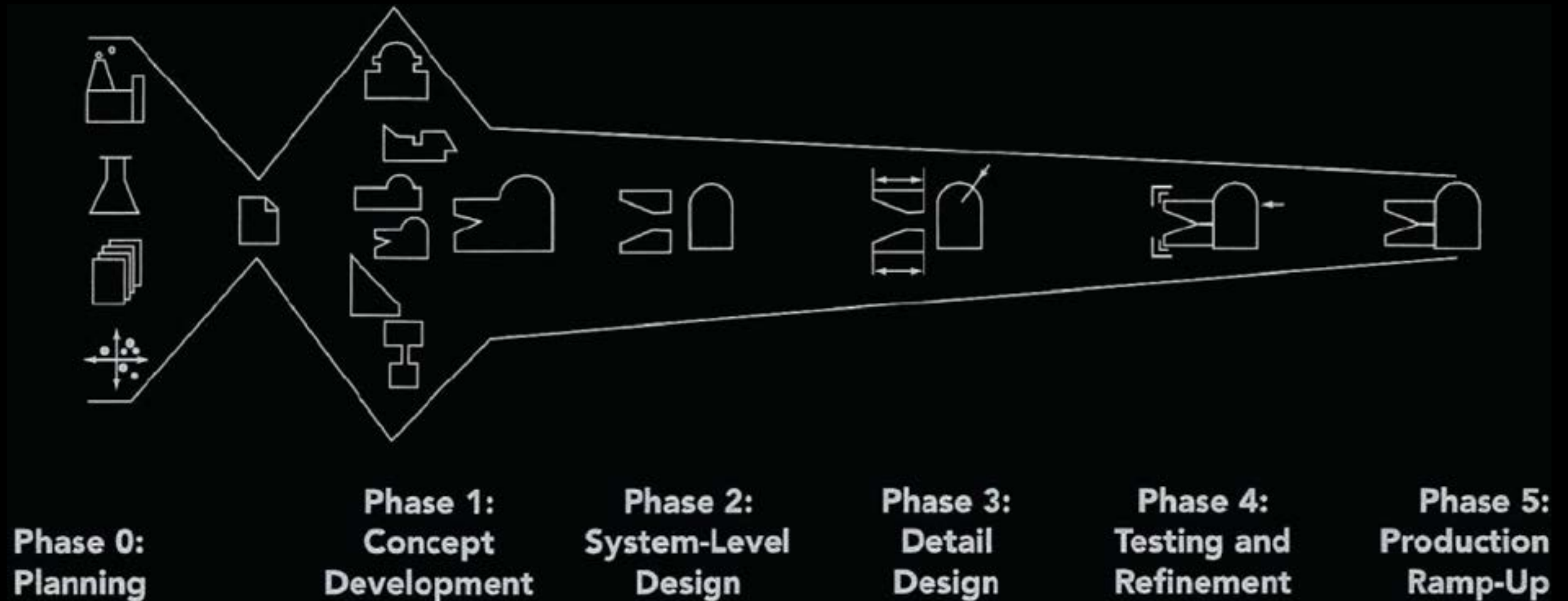


Idea & Concept Generation

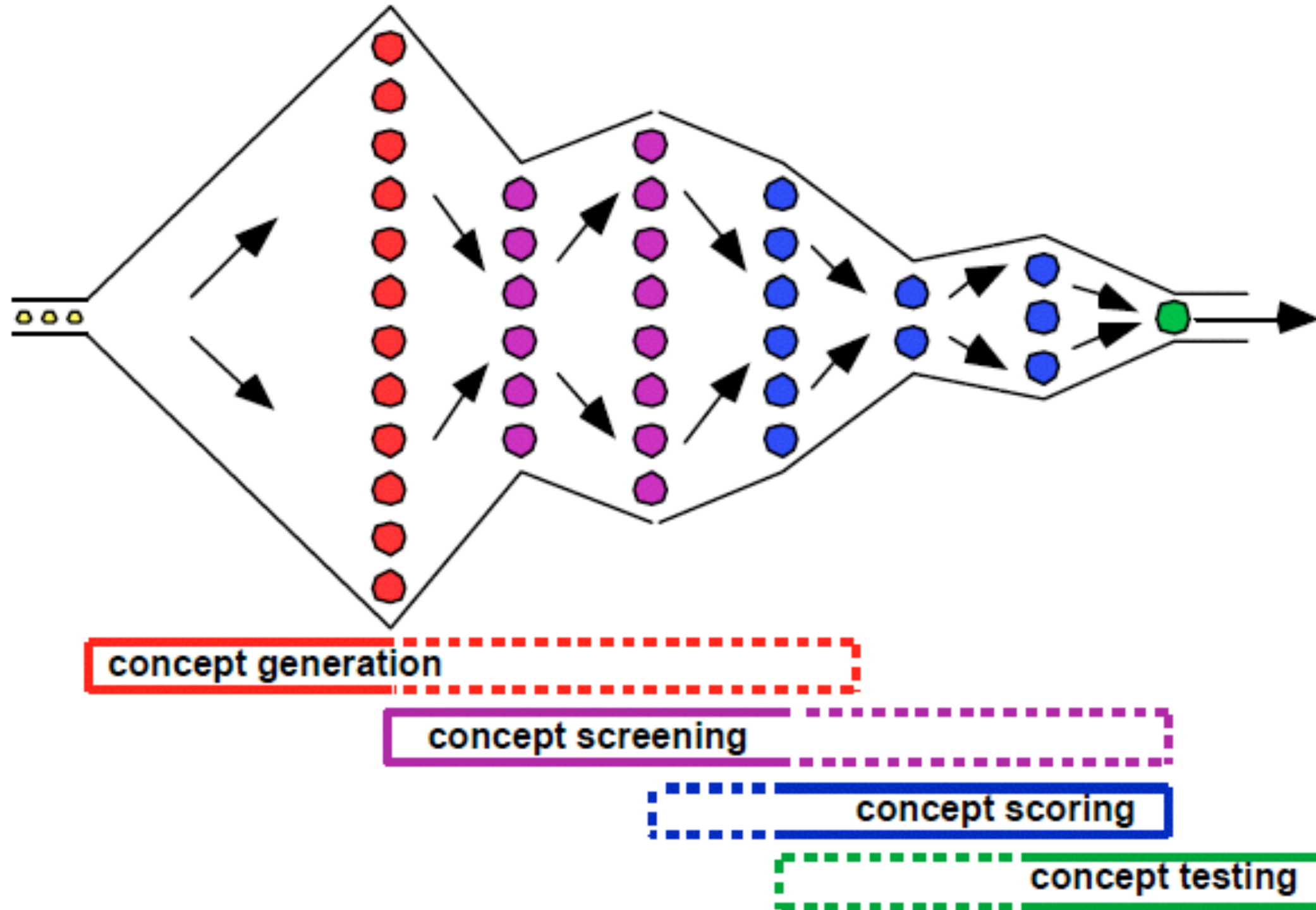
Concept Development



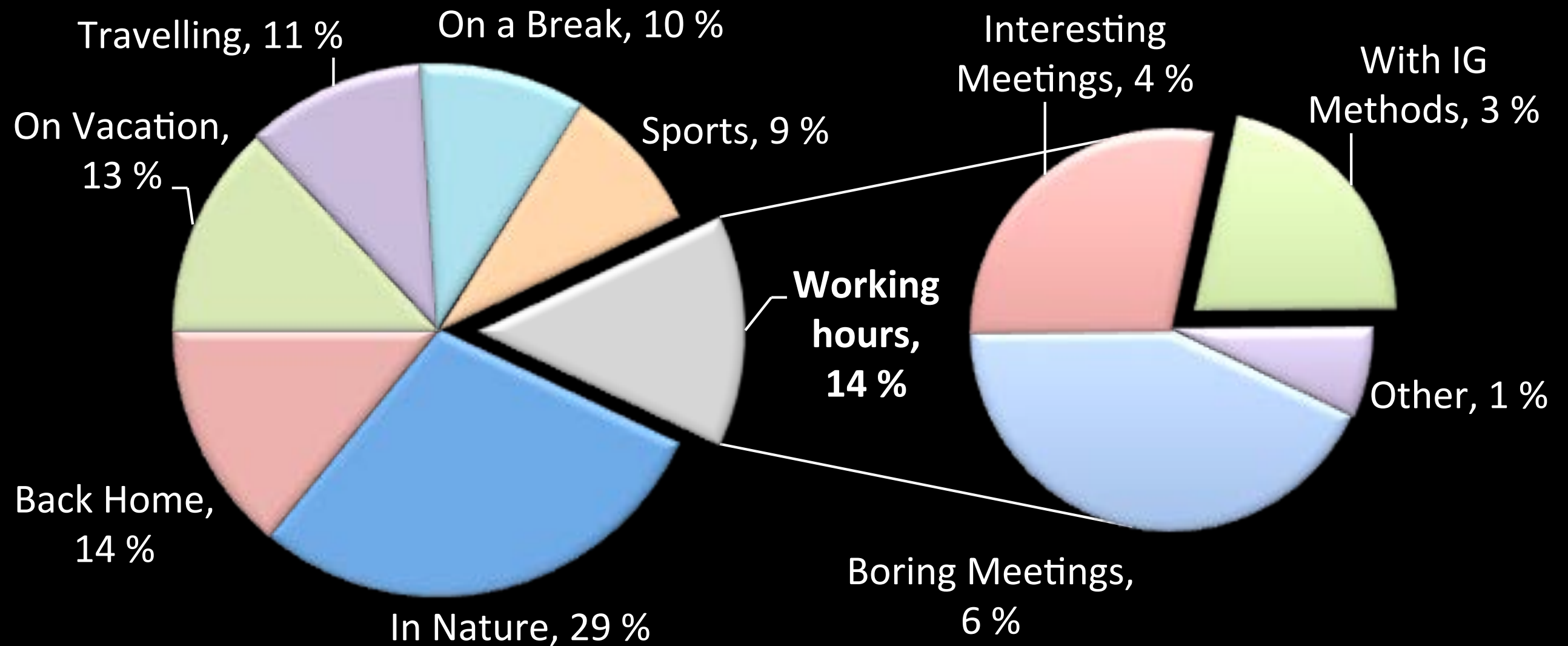
Concept Development



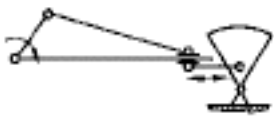
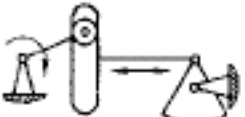
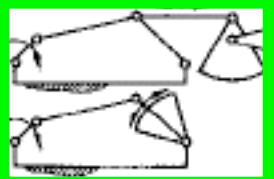

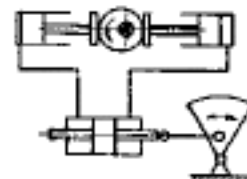

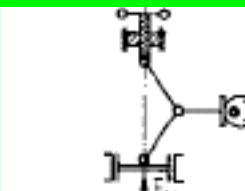
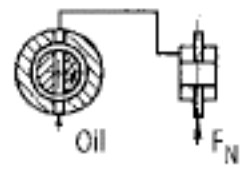
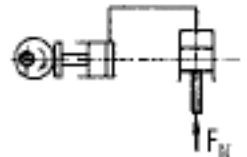
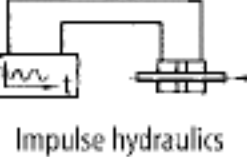
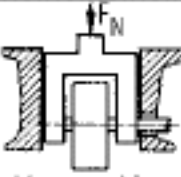
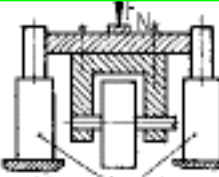
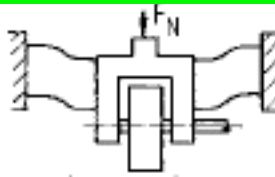
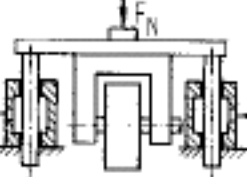
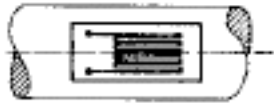
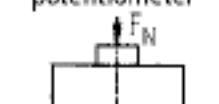
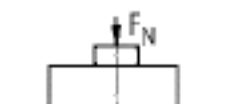
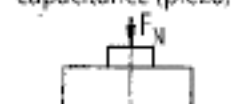

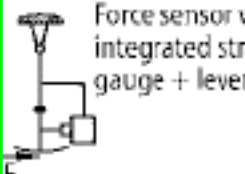
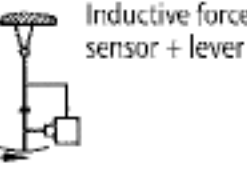
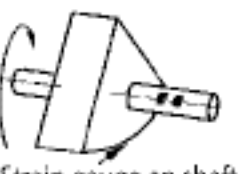
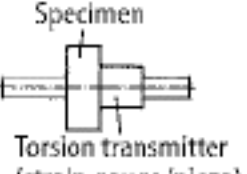
Concept Generation Strategies



Where are product ideas born?



Morphological Matrix

Solutions Subfunctions	1	2	3	4	5
A Generate rolling/ sliding motion					
B Generate normal force					 Impulse hydraulics
C Apply normal force	 Linear guides	 Linear bearings	 Leaf springs		
D Measure normal force	 Strain gauge	 Strain gauge using potentiometer	 Force sensor-induction	 Force sensor - capacitance (piezo)	
E Measure friction force	 Strain gauge + lever	 Force sensor with integrated strain gauge + lever	 Inductive force sensor + lever	 Strain gauge on shaft	 Specimen Torsion transmitter (strain gauge/piezo)
F Measure temperature	Resistance wire	NTC-resistor	PTC-resistor	Thermocouple	

Concept Evaluation & Development

C-K Theory

C–K Theory

- Concept – Knowledge

Design Thinking

- Problem Space – Solution Space

Concept	Knowledge
C_1	K_1
C_2	K_2
C_3	K_3
C_4	K_4
C_5	K_5
C_6	K_6

Concept Screening

SELECTION CRITERIA	A	B	C	D	E	F	G	REF.
Ease of Handling	0	0	–	0	0	–	–	0
Ease of Use	0	–	–	0	0	+	0	0
Number Readability	0	0	+	0	+	0	+	0
Dose Metering	+	+	+	+	+	0	+	0
Load Handling	0	0	0	0	0	+	0	0
Manufacturing Ease	+	–	–	0	0	–	0	0
Portability	+	+	–	–	0	–	–	0
PLUSES	3	2	2	1	2	2	2	
SAMES	4	3	1	5	5	2	3	
MINUSES	0	2	4	1	0	3	2	
NET	3	0	–2	0	2	–1	0	
RANK	1	3	7	5	2	6	4	
CONTINUE?	Yes	Yes	No	No	Yes	No	Yes	

- Quick & easy comparing of concepts
- Rule out worst concepts
- Identify exceptional elements

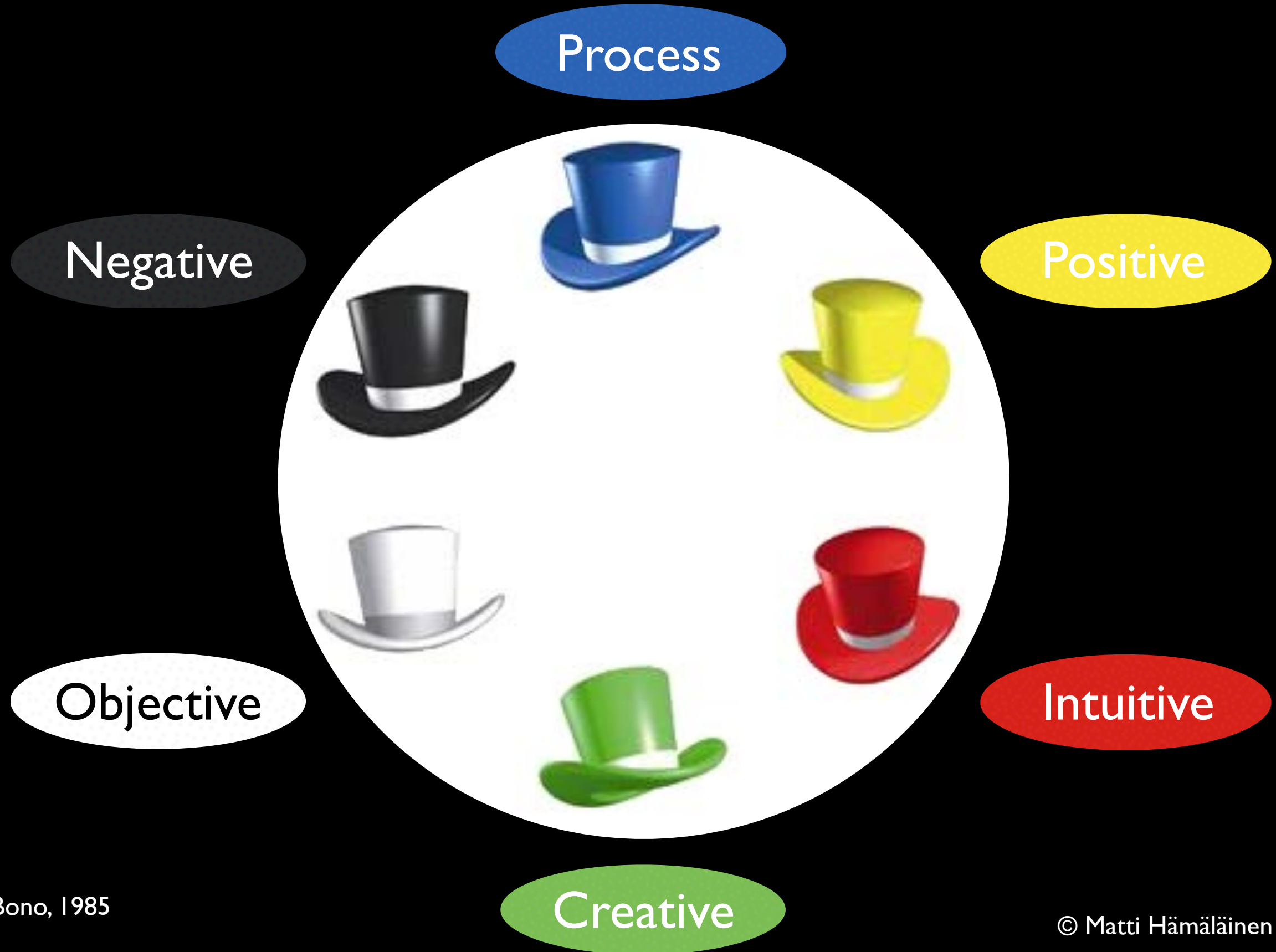


Concept Scoring

Criteria	Weight	A	B (Datum)	C	
Size and appearance	0,25	5	3	2	1 Much worse than reference
Manufacturing and assembly	0,15	2	3	4	2 Worse than reference
Installation and use	0,25	3	3	4	3 Same as reference
Service	0,35	4	3	2	4 Better than reference
Sum		3,70	3,00	2,80	5 Much better than reference
Rank		I	II	III	

- Weighted comparison of selected concepts
- Good for Product Planning & Management

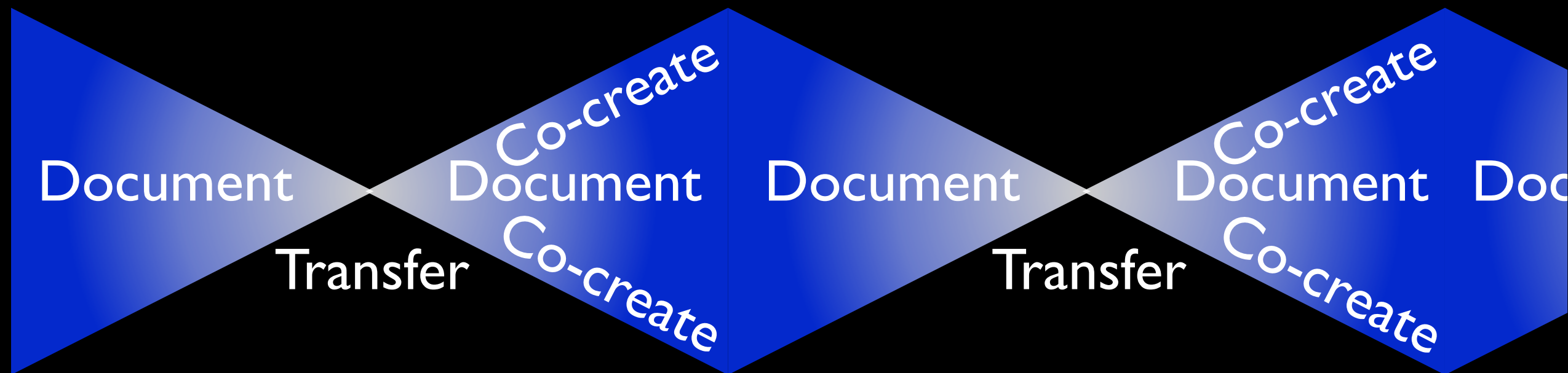
Six Thinking Hats



Internal & External Communication

Communication within the process

Manage &
Coordinate



3 Forms of Communication

THREE TYPES OF TECHNICAL COMMUNICATION

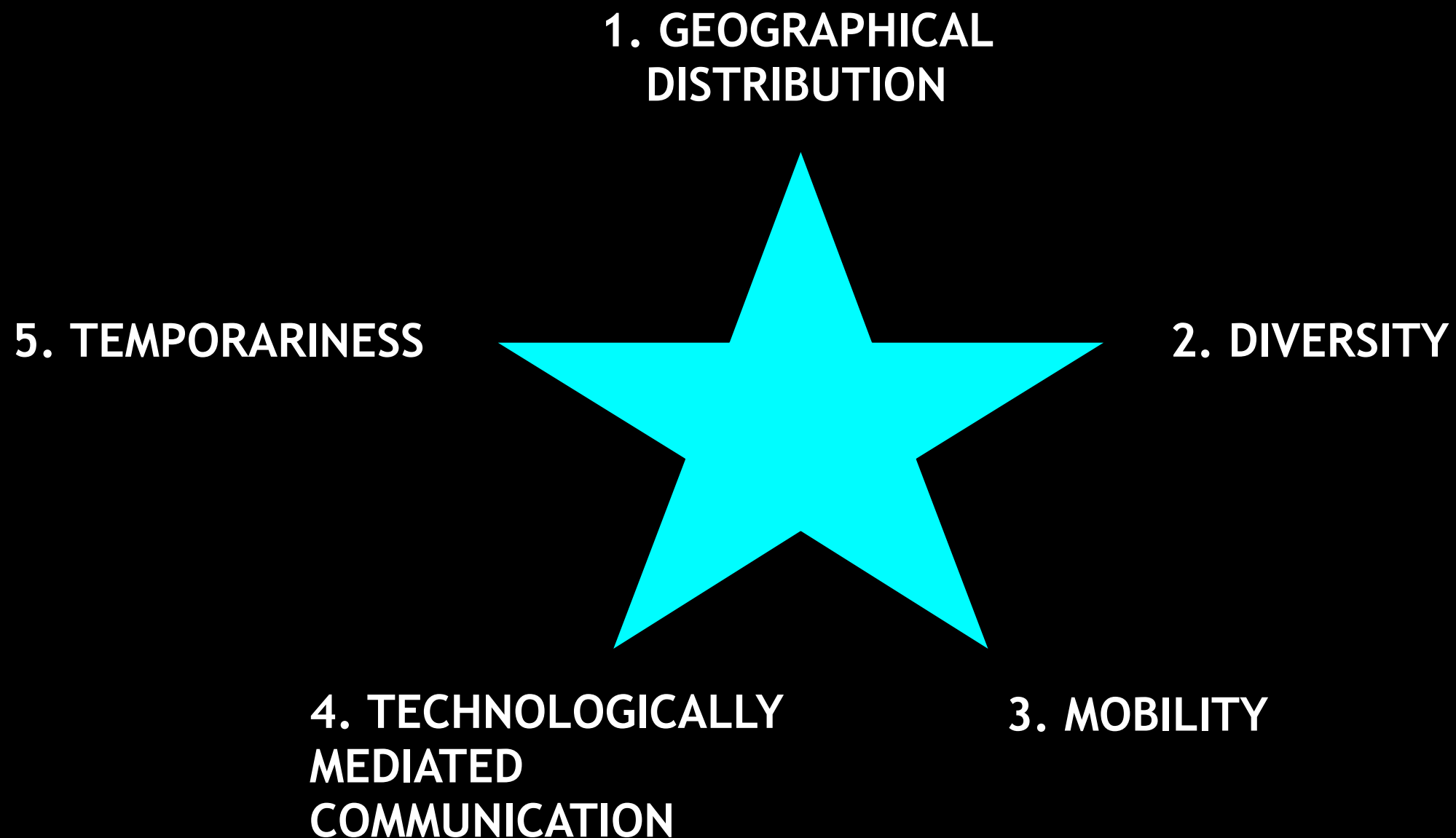
Type of Communication	Description
Coordination Type	<ul style="list-style-type: none">● technical information transfer● task coordination
Knowledge Type	<ul style="list-style-type: none">● consultation● instruction and skill development
Inspiration Type	<ul style="list-style-type: none">● motivation of individuals● managerial affirmation

* Morelli, Eppinger & Gulati, 1995

- Coordination
- Knowledge transfer
- Co-creation

Global PD Problems

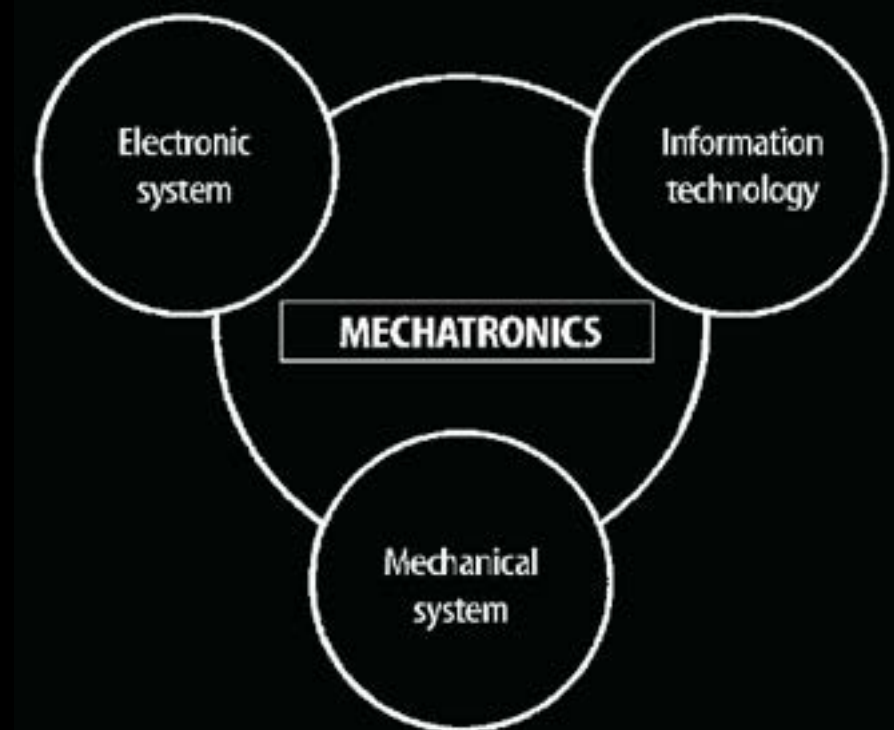
Dimensions of distributed project work



System Level Design
Detail Design
Design for X

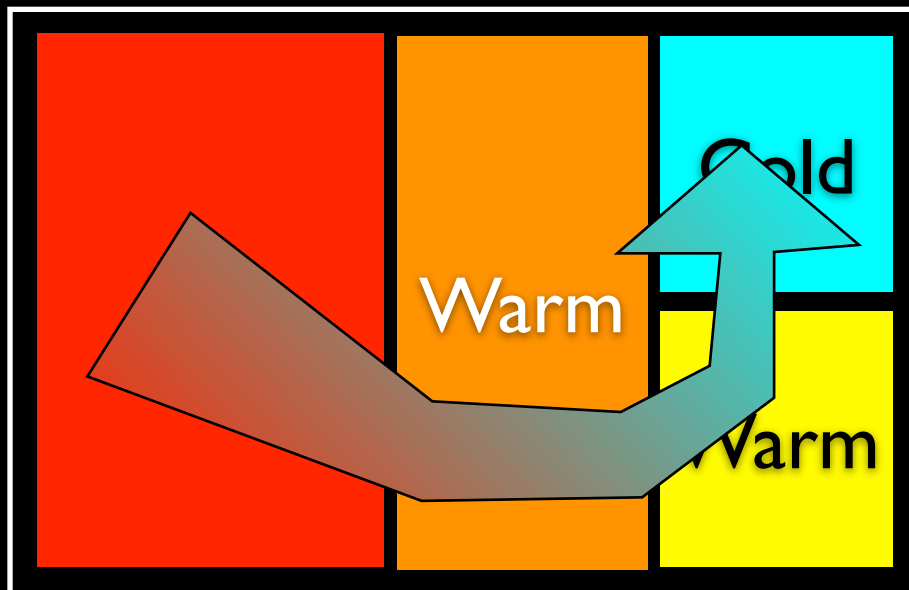
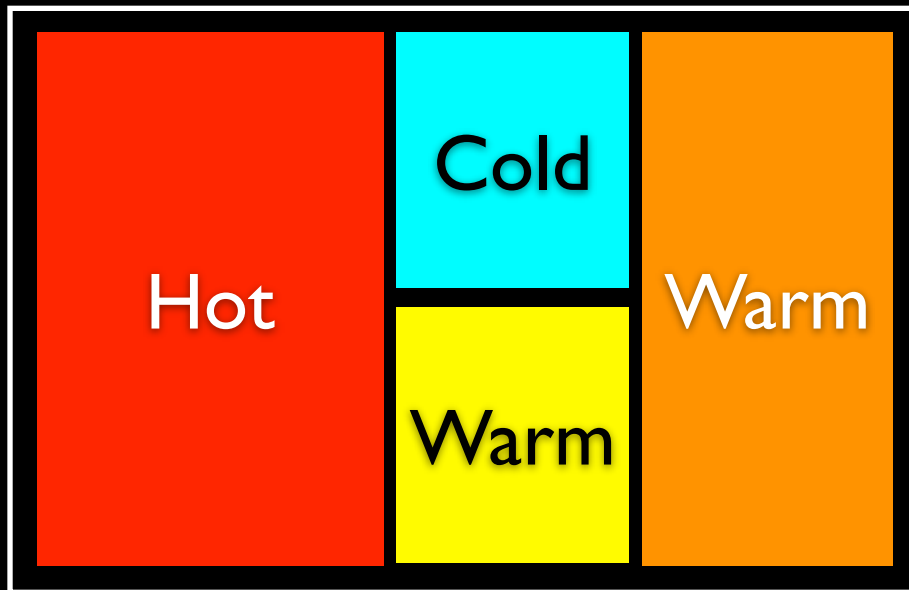
System Level

- Overall layout
- Product architecture
- Interfaces between sub-systems
- Joining
- BoP

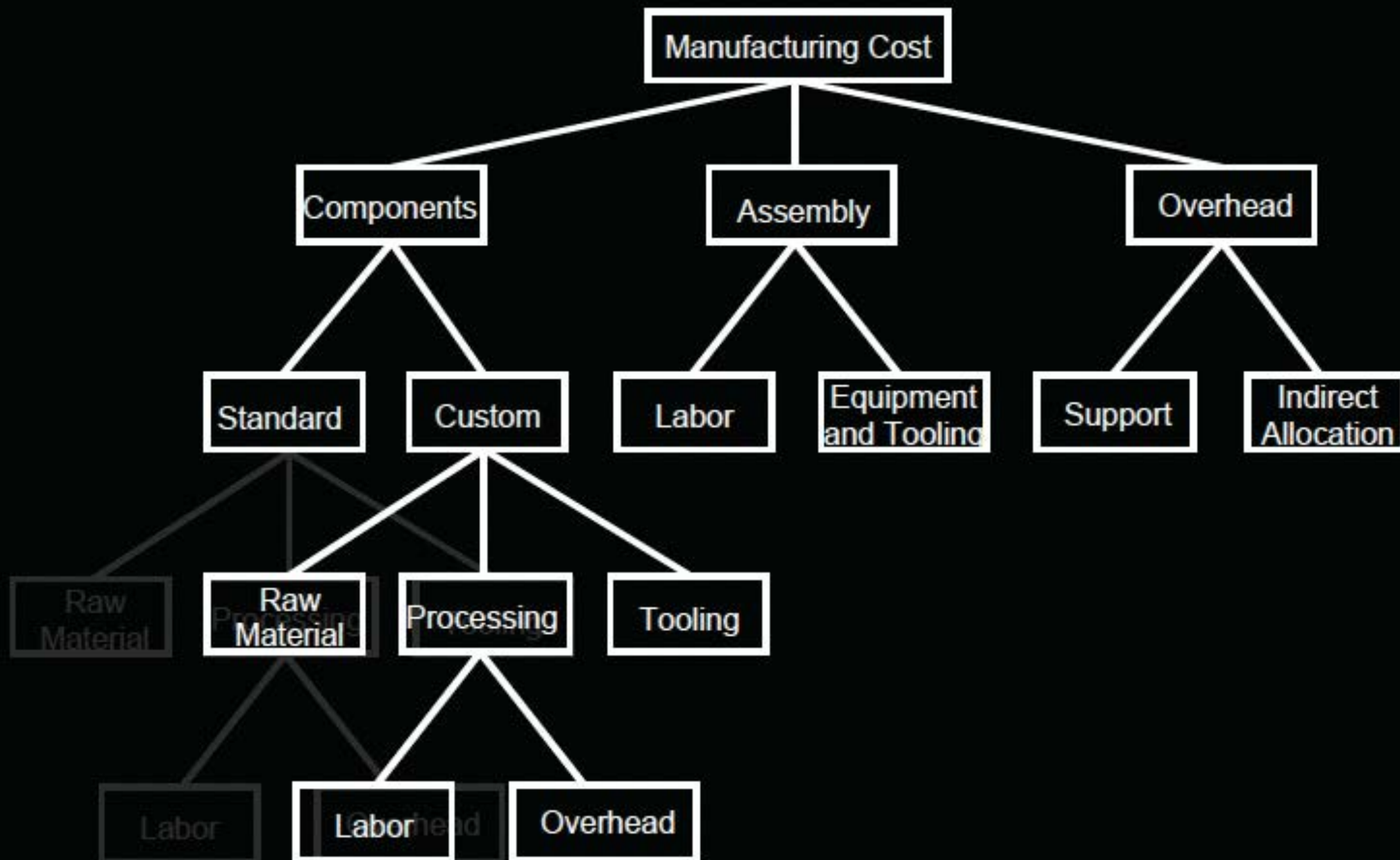


Layout Drivers

- Balance between units
- Energy flow
- Accessibility
- Protection
- DFA



Manufacturing costs



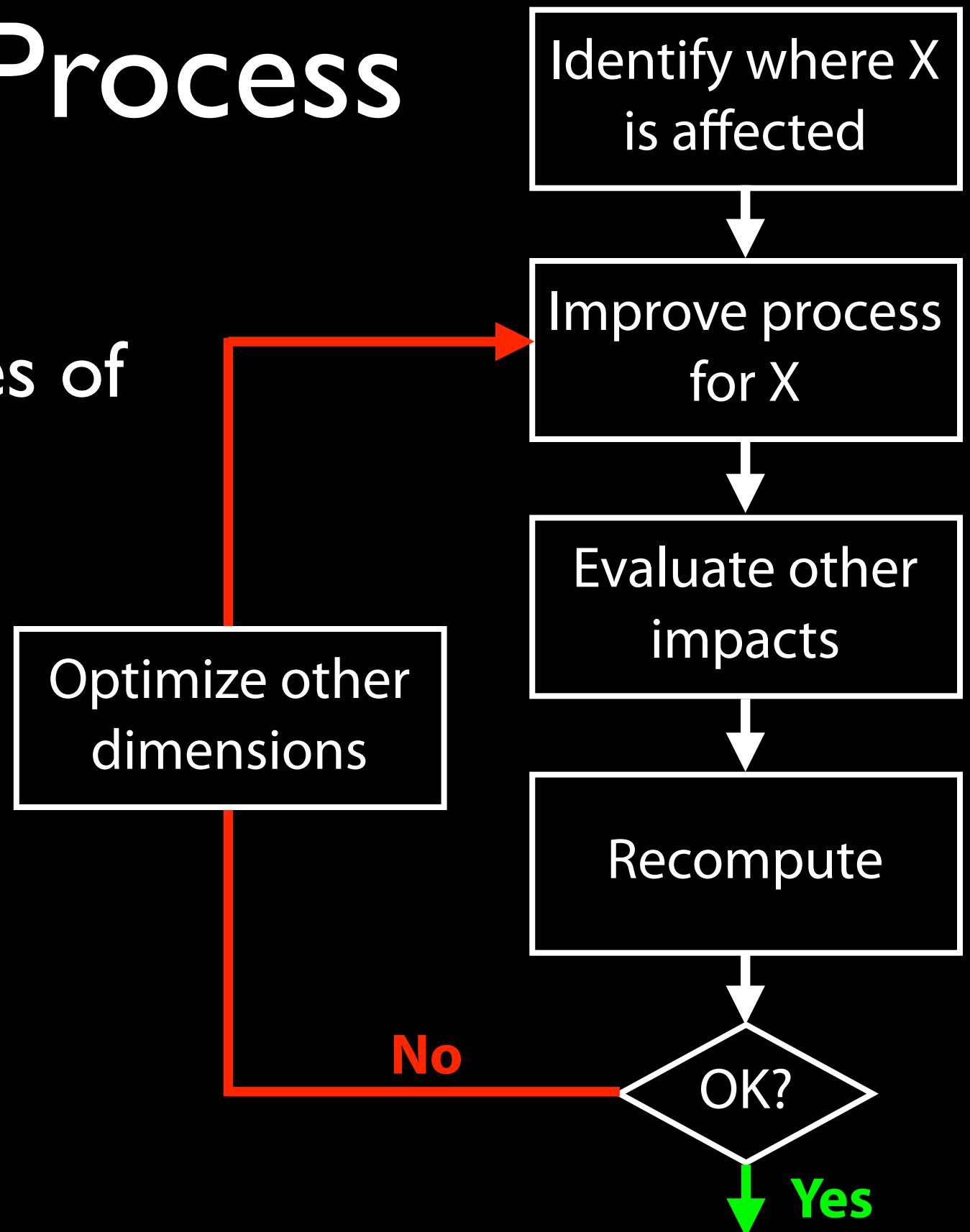
DFX Definition

- Design is often considered to be the process of producing specifications that satisfy *functional requirements* of a product
- Design process must also consider *other attributes*
- In DFX, the X refers to these other attributes
- DFM, DFA, DFMA, DFE, DFR, DFQ, DFX, ...

General DFX Process

Consider different stages of Product Life-Cycle

1. Development
2. Production
3. Distribution
4. Utilization
5. Maintenance
6. End-of-Life

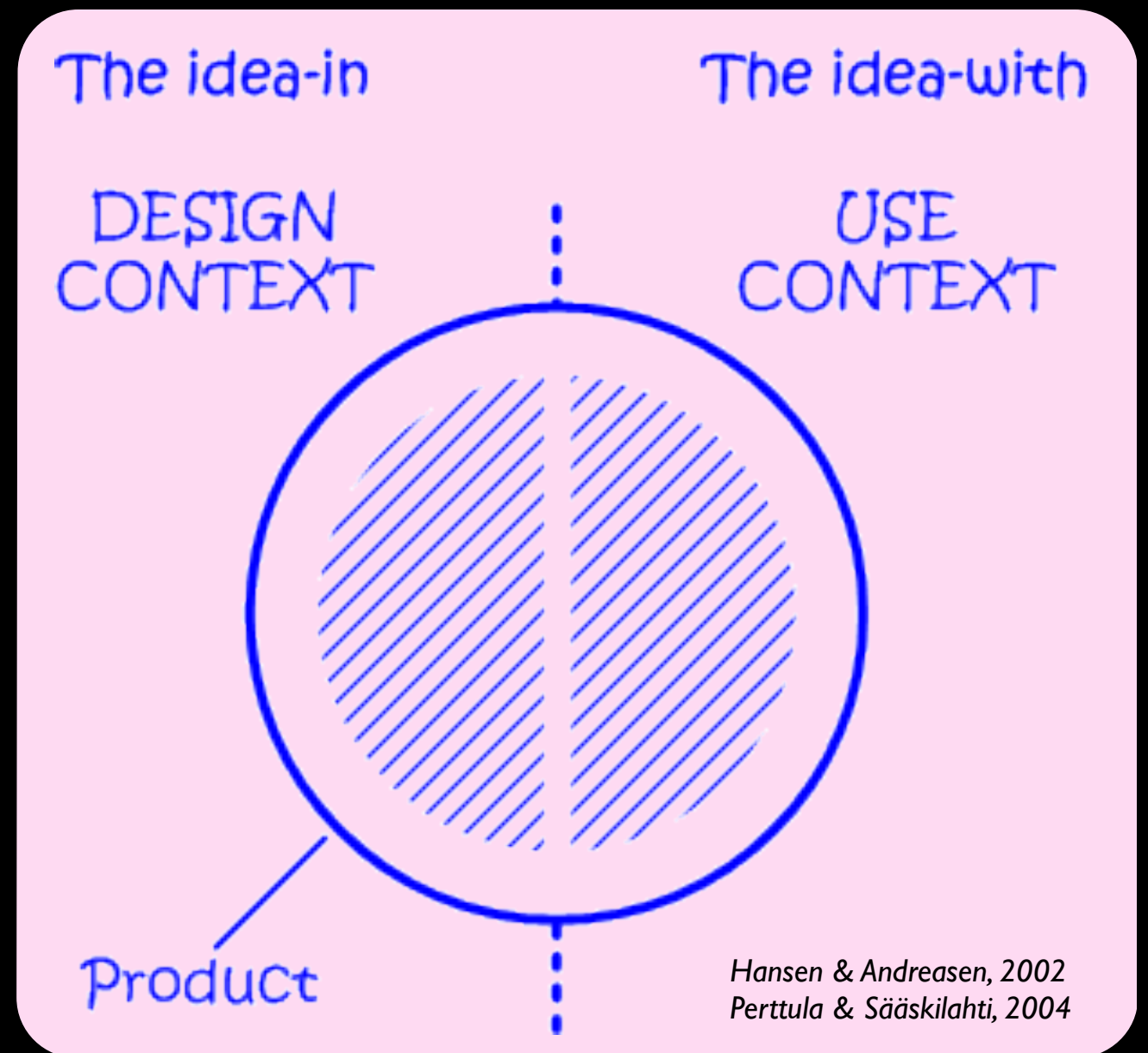


Customer & User Needs Assessment

Needs Assessment

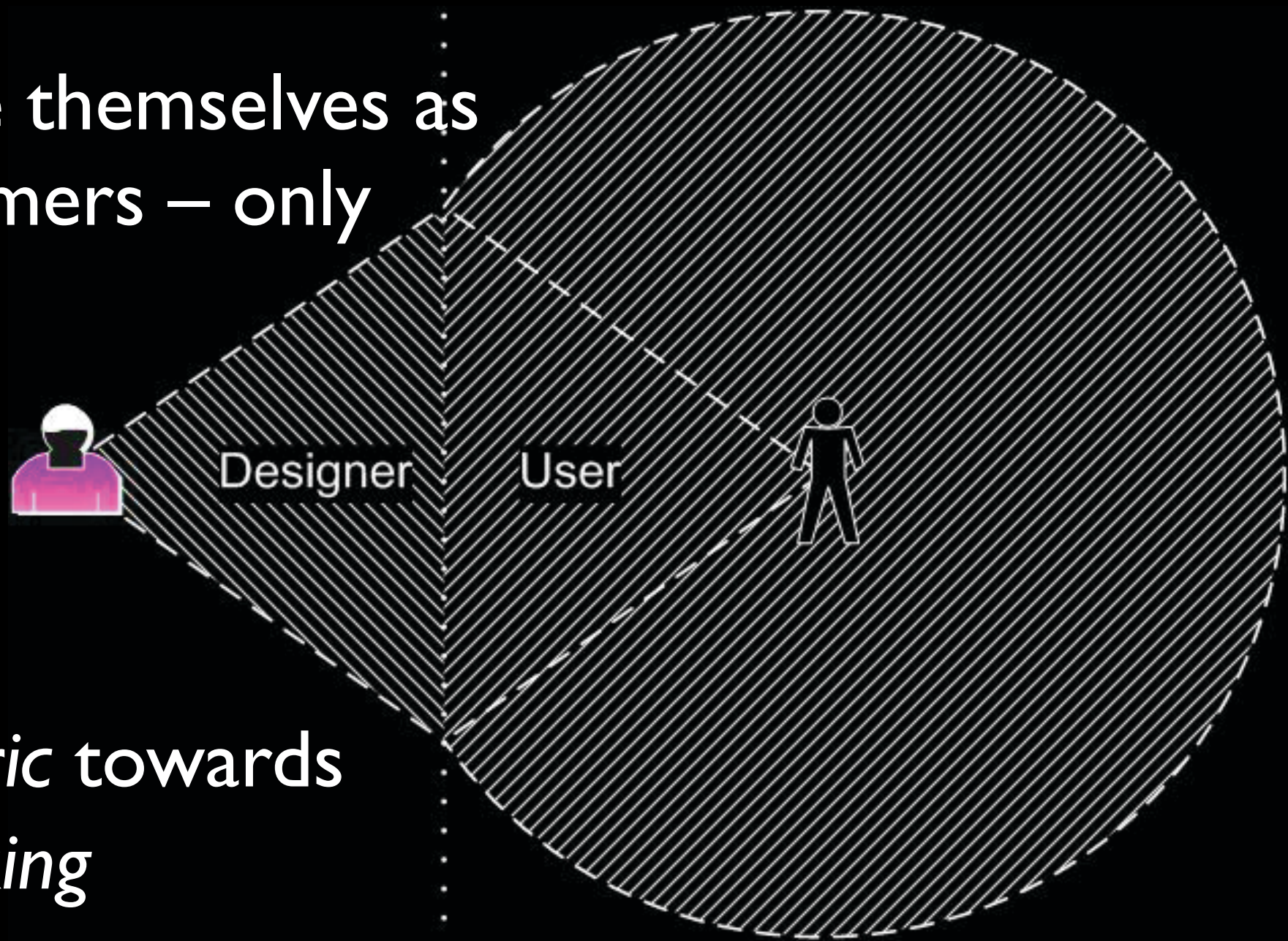
- Customer vs. End User
- Making needs visible
 - Explicit, Implicit, Latent
 - Wants vs. needs?

Two perspectives



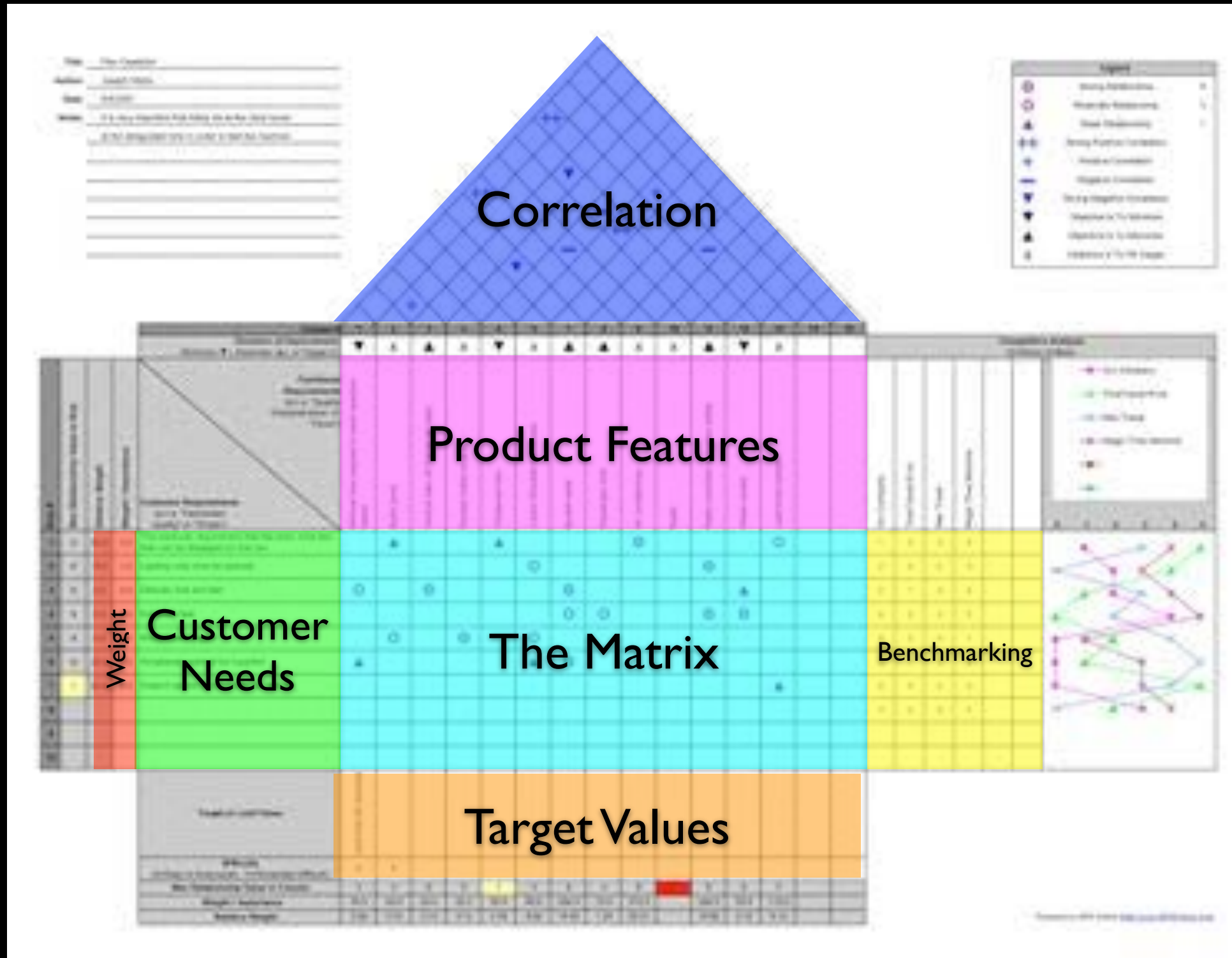
Two perspectives

- Product features vs. Product use
- Users don't see themselves as users or consumers – only designers do



- From *User-centric* towards *Use-centric thinking*

House of Quality (HoQ)



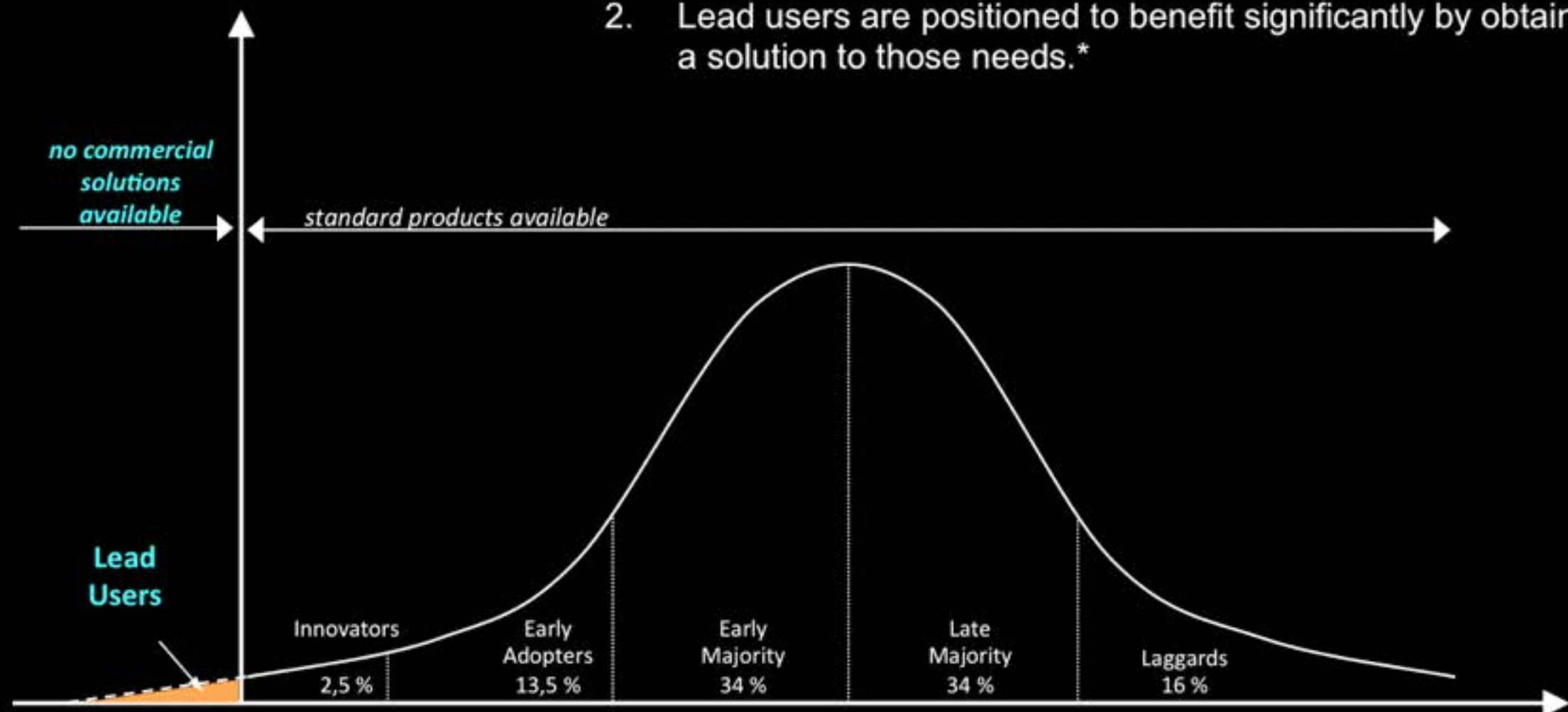
- Needs–metrics comparison
- Scale: 1, 3, 9

Lead Users



Lead Users

1. Lead users face needs that will be general in a marketplace – but face them months or years before the bulk of that marketplace encounters them.
2. Lead users are positioned to benefit significantly by obtaining a solution to those needs.*



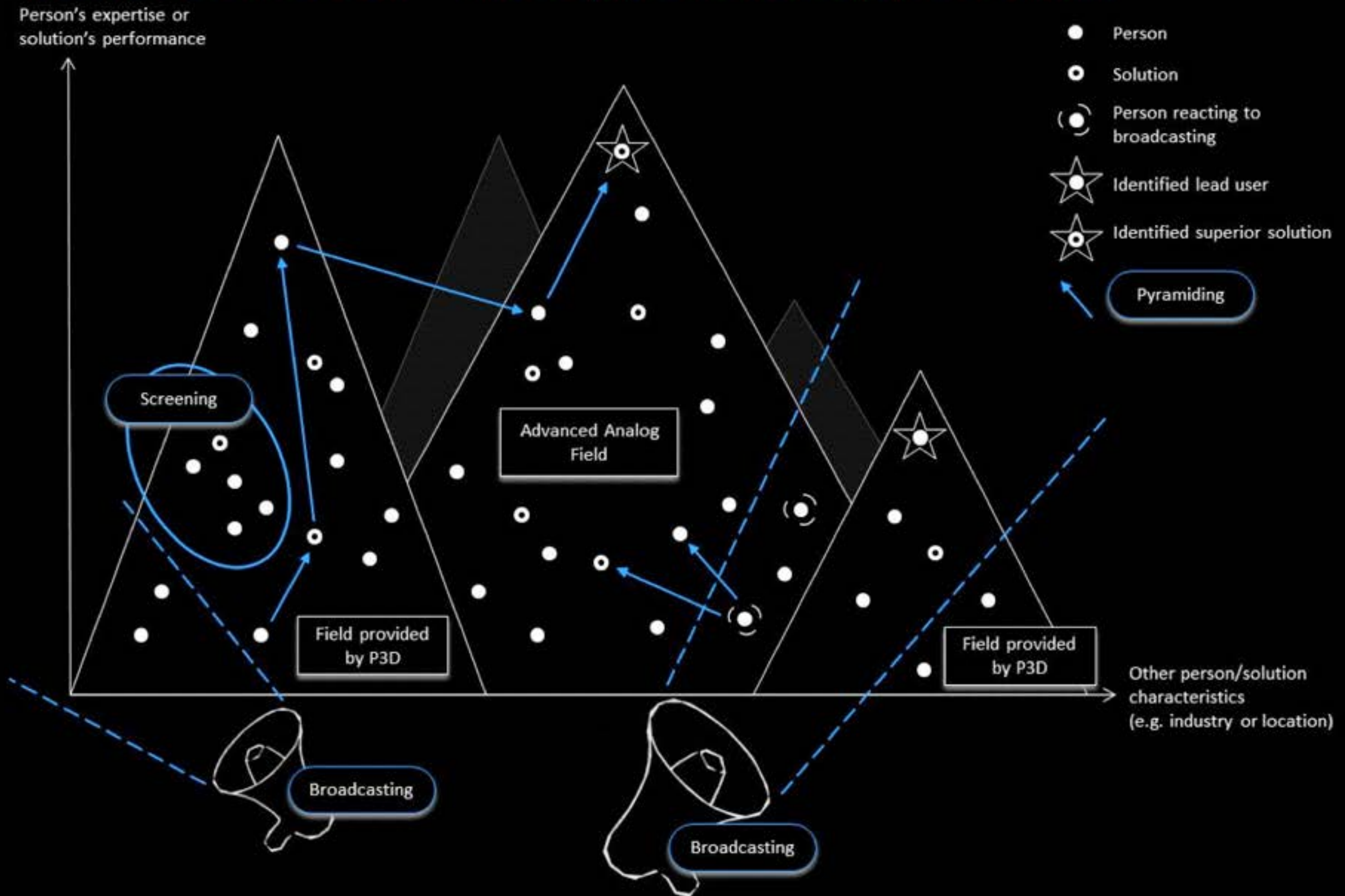
von Hippel's lead user theory + Rogers's diffusion theory

*von Hippel, E. (1986) Lead users: a source of novel product concepts. *Management Science* 32, pp 791–805.

Rogers, E. M. (1995) *Diffusion of innovations*. 4th ed. New York: Free Press.

Helminen, P. (2008) "Disabled Persons as Lead Users for Silver Market Customers. In Kohlbacher & Herstatt (Eds) *The Silver Market Phenomenon: Business Opportunities in an Era of Demographic Change*. pp. 85–102. Springer.

Lead Users – Integrated approach



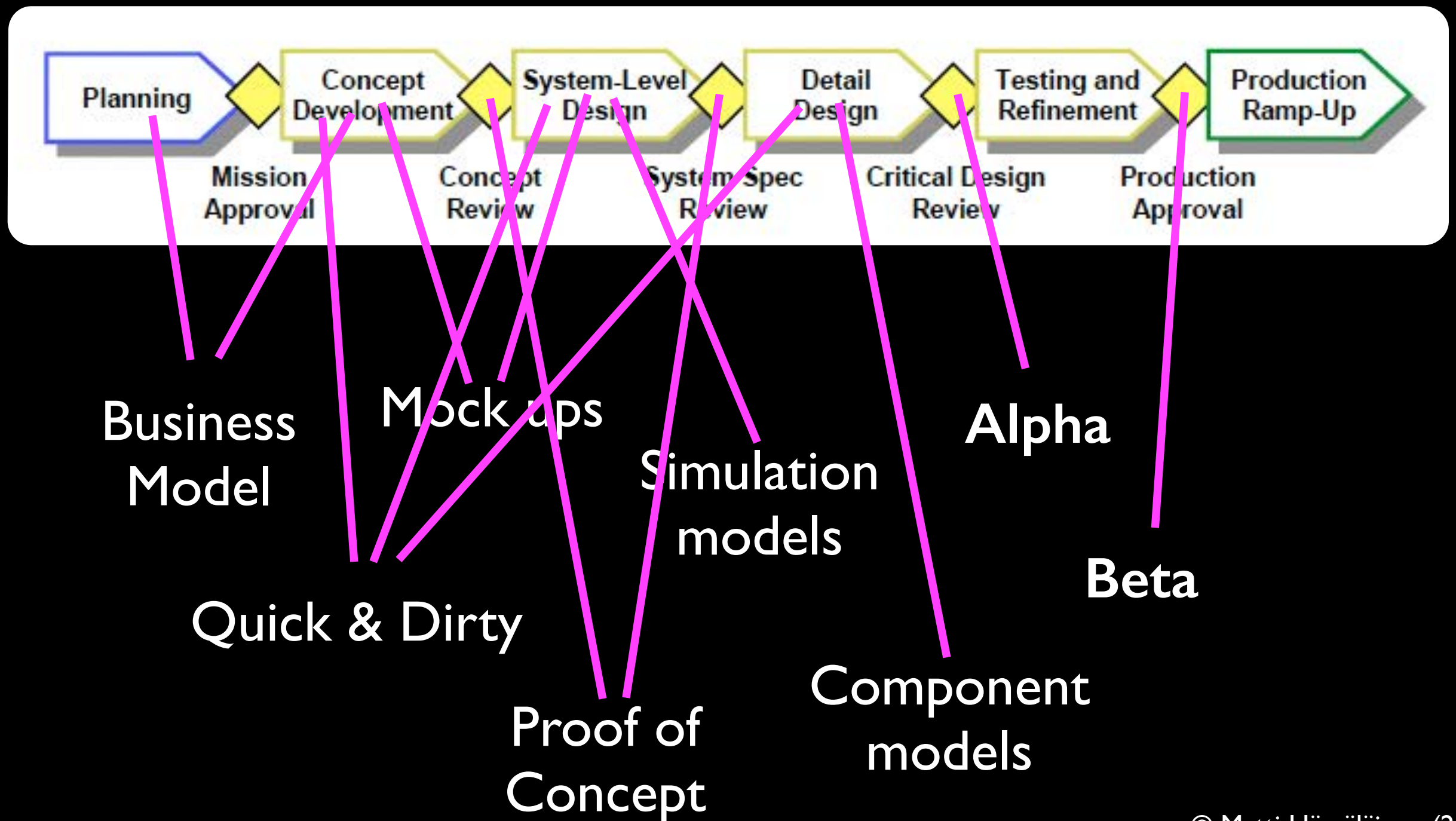
Prototyping and Testing

Proto

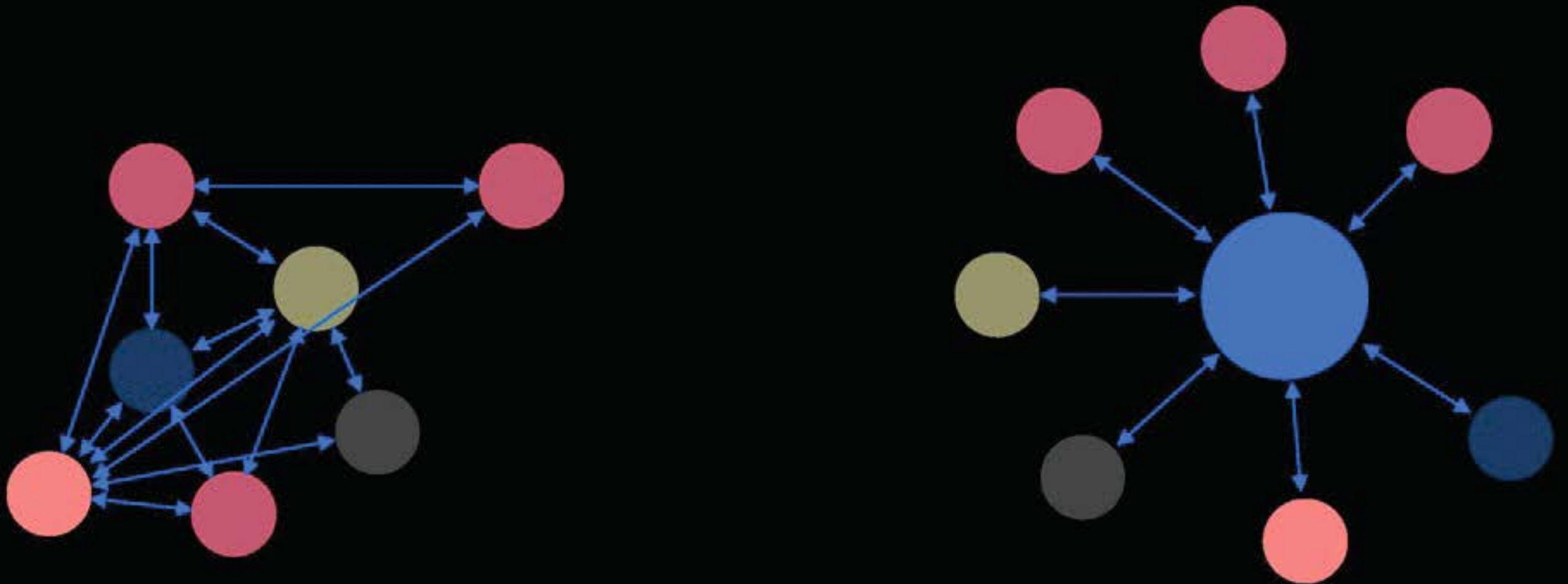
A Shared Model for

- communicating
- testing
- understanding

General PDI Process



Prototypes align the team and give them something to collaborate



THANK YOU!

- Exam will be emailed on December 16th
- Dead-line for answers is December 23rd at 2PM
- If you don't receive the exam, contact Sonja
sonja@sinofinnishcentre.org