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POLICY INNOVATION DESIGN

# THEMATIC WORKSHOP 3: Evaluating design and innovation policies

## A morphogenetic approach to the analysis and evaluation of the design process

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## Why a morphogenetic approach?

### What does it mean?

- We analyse the genetic process of ideas, that is the knowledge process
- Let us start from the Product Development Process defined as *“from picking out a market opportunity to obtaining a product available for sale, a multidimensional activity is needed: making assumptions about technology, sharpening productive functions, tuning product parameters with demand requirements”* [Leoncini, Montresor, Lombardi, 2009]

## THEMATIC WORKSHOP 3: Evaluating design and innovation policies

- **A new interpretation of the production process as ‘space of ideas’**
- **Multilayered (hierarchical) problem solving activities**
- **Exploratory activities in different search spaces in looking for solutions and congruence between different sets of parameters/variables**
- *[References: , Murmann, Frenken, 2006; Peine, 2008, 2009; Leoncini, Lombardi, Montresor, 2009; Lombardi, 2009, 2010]*

## THEMATIC WORKSHOP 3: Evaluating design and innovation policies

$$\begin{bmatrix} CN_1 \\ CN_2 \\ CN_3 \\ \dots \end{bmatrix}$$

$$\begin{bmatrix} FR_1 \\ FR_2 \\ FR_3 \\ \dots \end{bmatrix}$$

$$\begin{bmatrix} SD_1 \\ SD_2 \\ SD_3 \\ \dots \end{bmatrix}$$

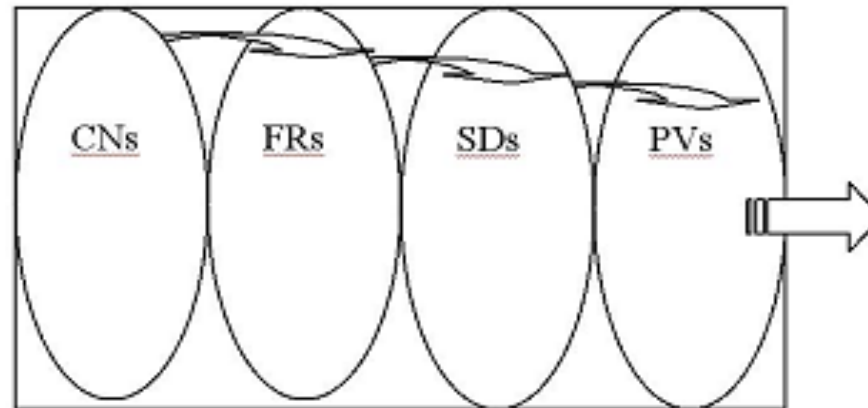
$$\begin{bmatrix} PV_1 \\ PV_2 \\ PV_3 \\ \dots \end{bmatrix}$$

**In order to have a viable product, search and PS activities cannot be completely random.**

**They can start in this way, but a conceptual order evolutionarily emerges to the extent that multiple knowledge spaces and sub-spaces are explored and matched**

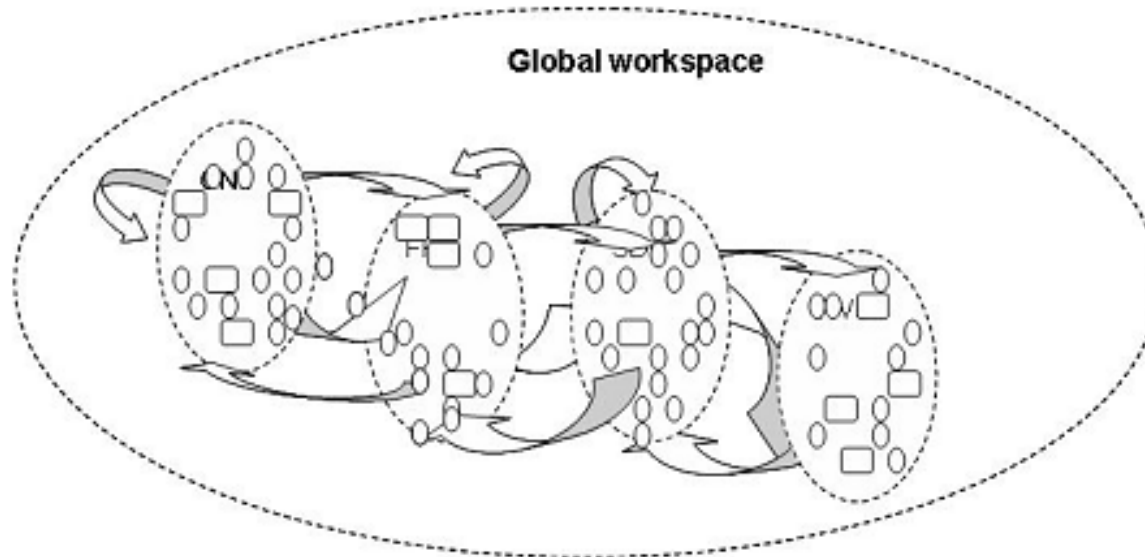
**This happens as information is gathered through trial and error**

- First Archetype: Semantically Transparent Systems



- Properties of STS: Well defined problems, One-to-one mapping process, Integral architecture

- Second Archetype: Combinatorial Systems



- Properties of CS: ill-defined problems, Solutions are not immediately within reach, Knowledge incompleteness, Feed back loops and iterations, Possibility of combinatorial explosion, Evolving morphologies

## *Design spaces*

- **Combinatorial spaces.** They are generated by a set of operants (components as building blocks, routines, heterogenous information packages) [created by individuals, teams, organizations]
- **Design spaces shape problem-solving processes.** Domain of techno-scientific possibilities within which the search processes unfold
- **Design spaces undergo change over time:** 1) addition of new operants, 2) progressive structuring and articulation
- [*Reference: Stankiewicz, 2001*]

## *Design spaces*

- **Structuring of design spaces: construction of techno-scientific grammar, multiplicity of grammars and techno-scientific evolution**

Indeed

- **Multiple mappings between sub-spaces unfold and hierarchies of rules are created until a techno-scientific grammar is formalised that constitutes the knowledge base for designing a product**
- **A grammar defines: 1) the thought style, which “inspires” the way PS activities are developed , 2) general and specific guidelines according to which search activity is framed [trajectories and paradigms]**

## Examples of thought style

- **History is studied with trajectories and paradigms: guiding principles and methodological tools, shared group commitments which structure search activities**
- **1. From Green revolution to Gene revolution**
- **2. From Mass production model to Flexible production model**
- **3. From “Smart home technologies” (“tight co-ordination mode”, in the 1990s) to “loose co-ordination mode” (present)**
- **“TT” as a set of morphogenetic constraints which help to shape the design process (product morphologies)  
[*traditional pc, the next “polymer-based” pc*]**

## Paradigm Dominance

### Few key milestones

1. Firms strategic manevouring
  2. Size of firms (leaders, clusters,...) installed base
  3. Regulation and institutional intervention
  4. Regime of appropriability
  5. Characteristics of technological field
- All these features define what has been called *selection environment*. Multi-level and multi-dimensional evolutionary pathways

# How do we evaluate the design process and its final outcomes?

- **Different sub-spaces of the design space have specific frontiers, the entire design space has a frontier: techno-scientific, archetypical (ideal) boundary limits (general properties as the concept of “wholeness” defined by Alexander, 2003)**
- **For each technology, product, components etc. it is fundamental to define the proximity to the frontier**

## **Evaluation Methodologies: complex system perspective**

**Description of Frontier and technological position to it through:**

- 1. The analysis of the patent data and bibliometric information (*design spaces as nested hierarchies of sub-systems*)**
- 2. The techno-scientific mapping [topological measures of the design space]**
- 3. The network analysis of communities involved in the evolution of given trajectories**
- 4. The morphological approach to the evolution of complex systems**
- 5. Defining “metrics” in the design space**

[Source: Sorenson, Rivkin, Fleming 2006]

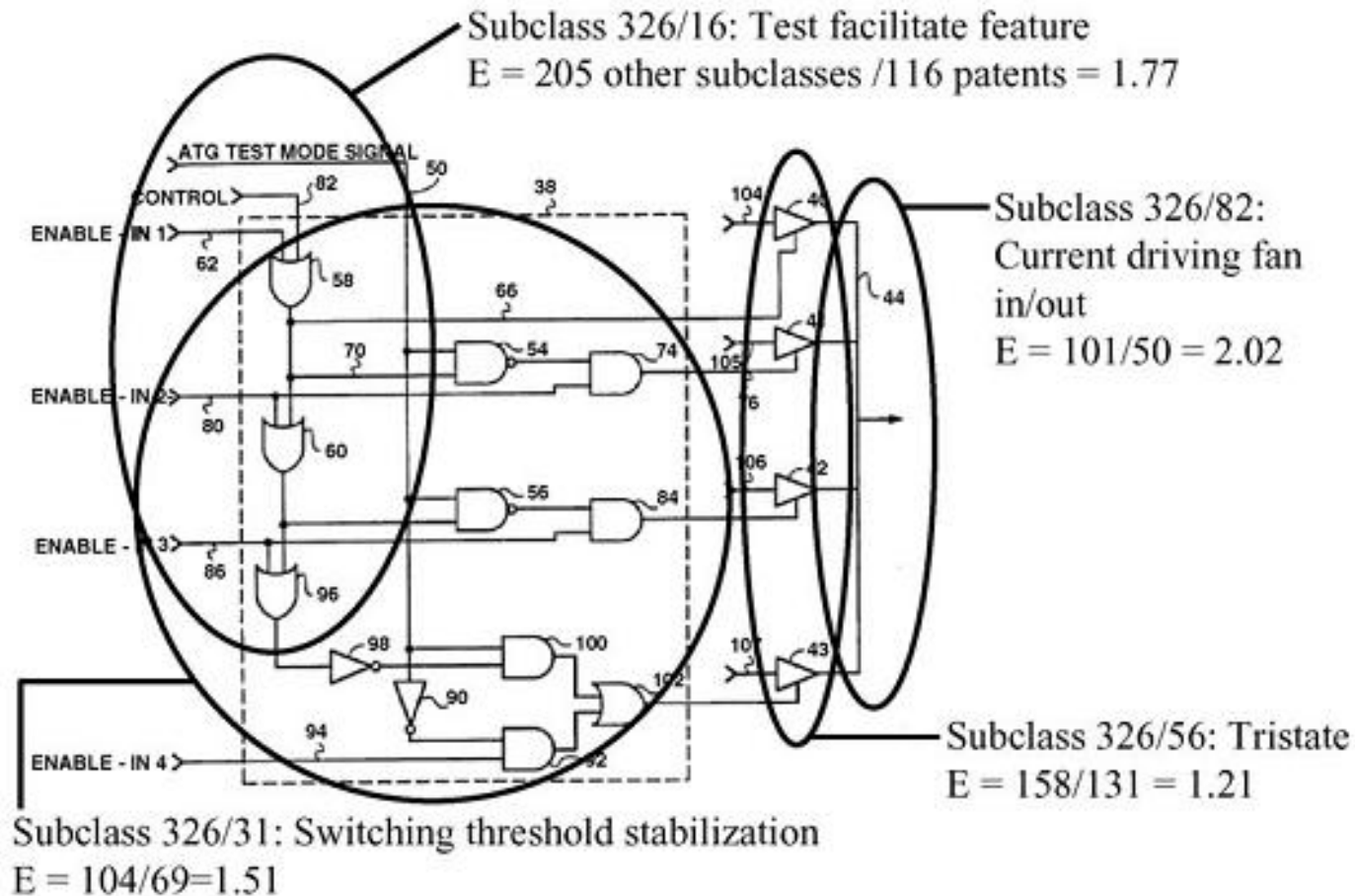


Fig. 1. Calculation of interdependence for patent #5,136,185.

[Source: Stuart, Podolnyi, 1996]

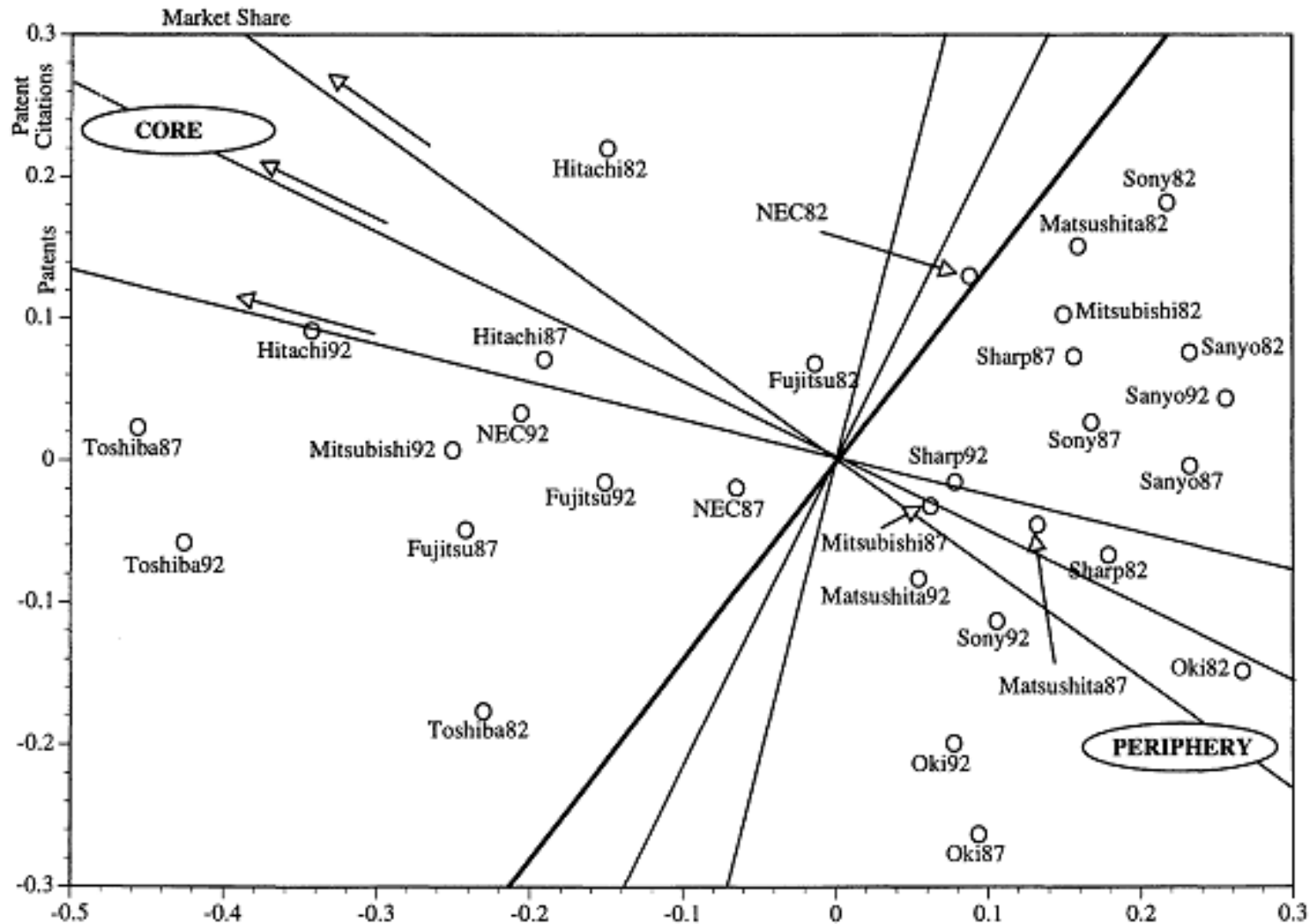


Figure 5. 'Regions' in the technological map of the industry

## **Evaluation Methodologies**

- **Construction of reference points: technological trajectories, technological lineages, ongoing shifts**
- **Multi-level and multi-dimensional analysis: the depiction of forces shaping the selection environment and the definition of parameters which represent them**

### Implications for innovation policy

- ***Scanning of the Techno-economic horizon***
- **Scenario analysis**
- ***Shaping the future***
- ***Construction of a vision: Frame for target setting and monitoring progress [Kemp, Martens, 2007]***
- **Stimulating a dynamic *matching* between self-organised processes and guiding principles, that is**
- **Strategic co-ordination between short and long term goals**

# *Even if..... or unless*

*Source:  
The Economist*





***- Be aware that -***

**“Planning is everything and the plan is nothing”  
[Dwight D. Eisenhower]**