

## Telecom Ecole de Management – KIND Seminar 4<sup>th</sup> April 2013

### Beyond decision paradigm - research perspectives opened by the design paradigm



Pascal LE MASSON  
Chair of Design Theory  
and Methods for Innovation  
MINES ParisTech  
PSL - Paris Sciences & Letters  
F-75 272 Paris, France  
Tel: +33 1 40 51 9221 / 9105  
Mail: [lemasson@ensmp.fr](mailto:lemasson@ensmp.fr)

## The Chair for Design Theory and Methods for Innovation

**Design Theory and  
Methods for Innovation**

Academic chair for research and teaching

[www.cgs.ensmp.fr/design/](http://www.cgs.ensmp.fr/design/)

**STRATEGIC  
MANAGEMENT  
OF INNOVATION  
AND DESIGN**

Pascal Le Masson, Benoit Weil and Armand Hatchuel

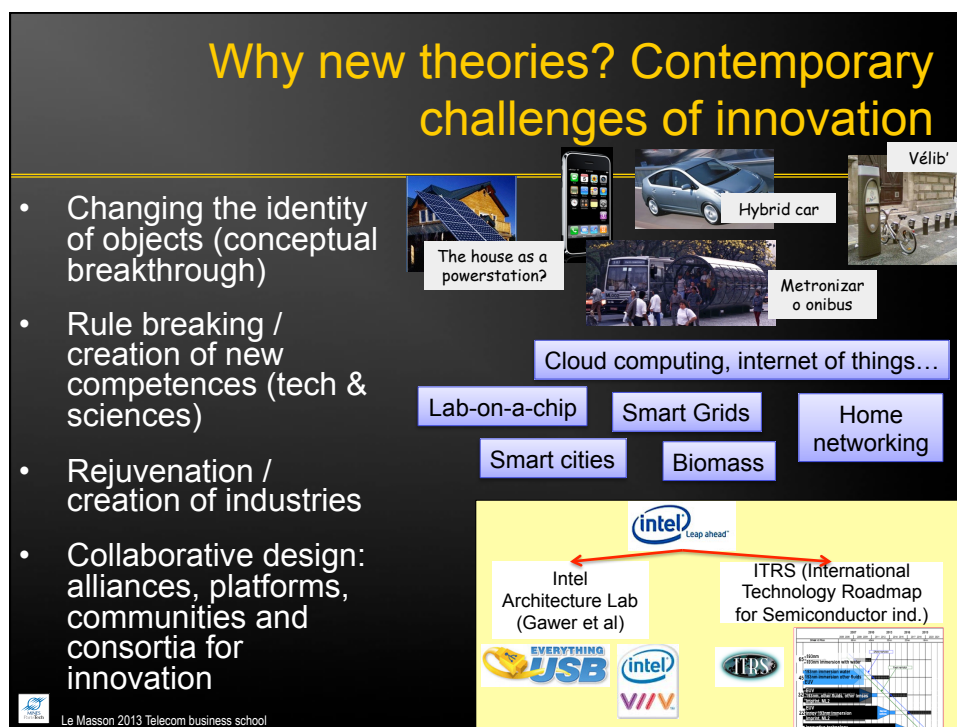
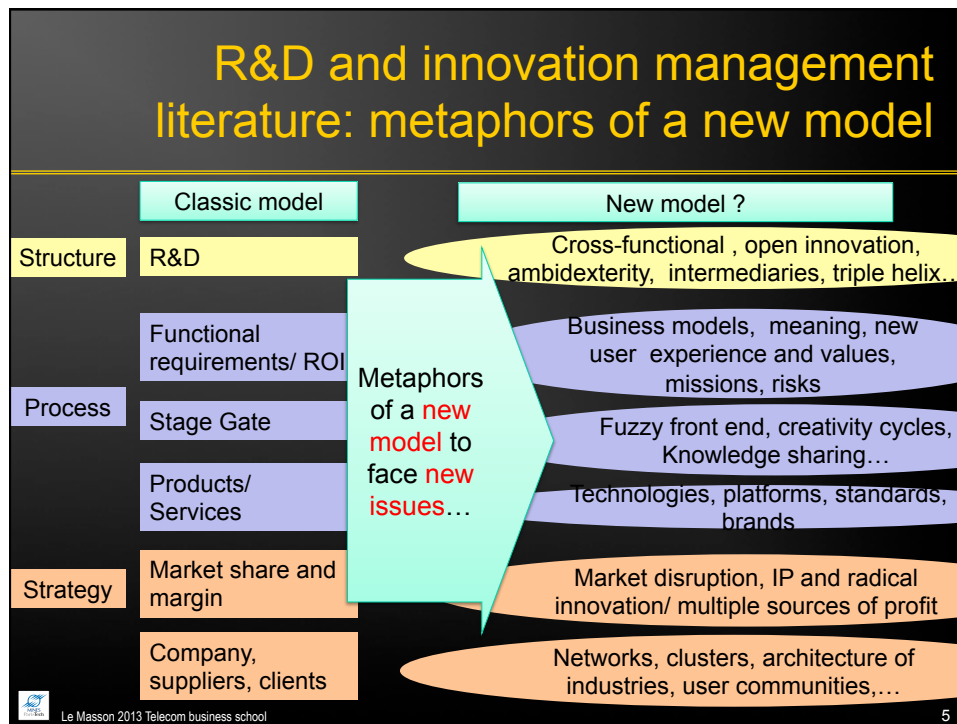
**DESIGN THEORY**

5<sup>th</sup> International Workshop on  
Special Interest Group  
of the Design Society

30<sup>th</sup> - 31<sup>st</sup> January 2012  
Mines ParisTech

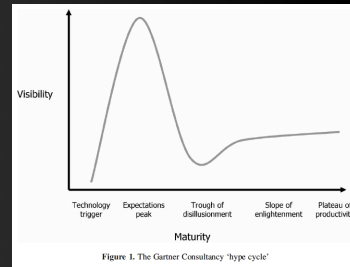
<p><b>1<sup>ST</sup> RESEARCH FIELD</b> fundamental underpinnings of design theories and of reasoning in the unknown</p>	<p><b>2<sup>ND</sup> RESEARCH FIELD</b> organization and tools for innovative design</p>	<p><b>3<sup>RD</sup> RESEARCH FIELD</b> neuropsychological, cognitive and cultural bases of innovative design</p>	<p><b>4<sup>TH</sup> RESEARCH FIELD</b> design regimes, economics and history of design</p>
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## Critical issues for industry (re)creation

- **(Innovation) bubbles** – hype and disappointment
- **Limited success of incubators and start-ups** (slow growth, low innovation rate)
- **Unsuccessful, costly innovations** (food, cosmetics,...)
- **Orphan innovations (Agogu  2012):** autonomy of elderly people, 2-wheelers safety, real estate management, malnutrition,...
- **Forever technologies of the future:** fuel cell, domotic, biofuel,...



Issues: be prepared, monitor, collectively

Question: do we have the relevant methods and organizations to address these issues?



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## The limits of the « decision paradigm» for contemporary innovation management

### Innovation as problem solving (Simon)

- Model : Objective function, constraints, search process
- Theoretical issue: the choice function
  - Decision theory in uncertainty (Savage, Wald, Raiffa): the optimal choice function
  - Or algorithms (branch & bound,...) (Simon)
  - More complex situations: NK models (Kauffman, Levinthal)
- In management: decision in organization
  - Optimal / satisfying (bounded rationality)
  - Consequential / procedural
  - Exploitation / exploration
  - Cognitive biases (Kahneman Tversky)

### Main results:

- Trend towards exploitation
- Path dependency
- Performance = access to better rules to solve the problem → absorptive capacity, networks
- Performance = increase the use of rules → combinative capabilities

### Issues raised by contemporary innovation:

- Major I capa = DynCap (O'Connor 2008). To which decision relate DynCapa?
  - Behavioral rules to change behavior?
  - What is the « pb » solved by dyncapa?
- AC in RI: acquire K without « pb »? Just « more K »? What if RI = break the rules? Then « more K » does not mean better RI?
- Path creation: only « against the rules »? Or are there rules to create paths (see « transition management »)?



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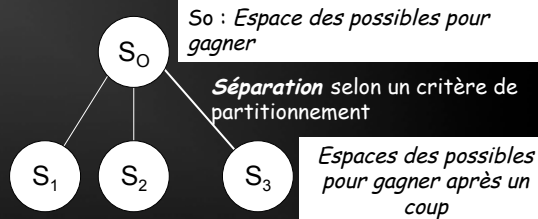
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## Le modèle de l'exploration combinatoire (Herbert Simon et al. 70')

GPS : General Problem Solver. Courant de l'Intelligence Artificielle. En fait le problème est : comment faire "mat" aux échecs en une durée limitée ?

Un processus : partitionner coup par coup l'espace des possibles

- Fonction d'EVALUATION
- Fonction de SEPARATION



Aux échecs : "big blue" : aptitude à évaluer (stratégies d'évaluation avec critères tueurs)

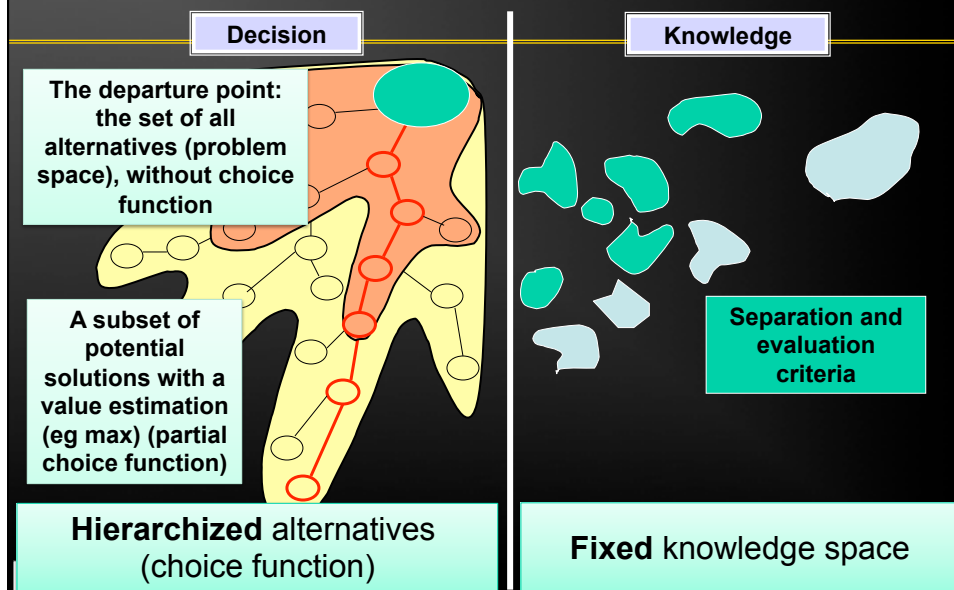
- Espace des décisions : « tous les premiers déplacements »
- Avec une fonction d'évaluation du sous-espace

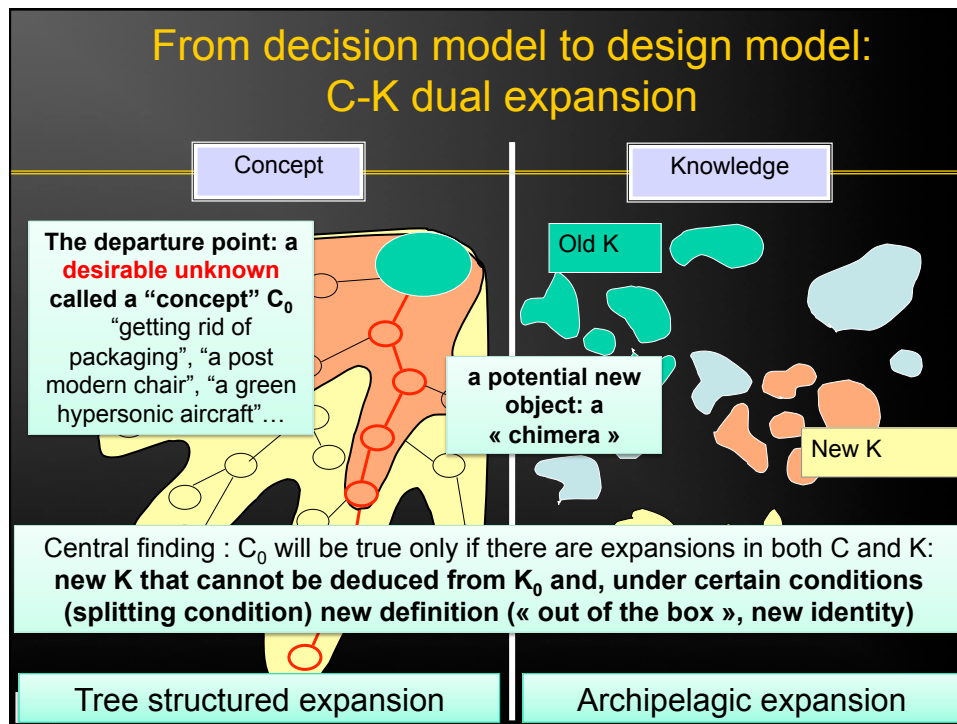


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## From decision model to design model: branch and bound





## Using a design model to study contemporary innovation issues?

**Innovation as design**

- Model : C-K theory
- Compatible with decision model (hence keep all previous results in situations of problem solving: path dependency, exploitation,...)
- Theoretical questions: the various forms of generativity
- From a management perspective: design in organizations:
  - « Bounded creativity »? → fixation effects (individual or collective cognitive bias)

*How to make a square by moving only one match?*

Cognitive fixation on « square »:  
 Square = geometrical form  
 Square = mathematic operation ( $2 \times 2$ )

Individual Fixation (Finke et al. 199x)  
 Collective fixation (group gap filling)

**Dealing with some scientific issues?**

- DynCapa?
- AC in RI?
- Path creation?

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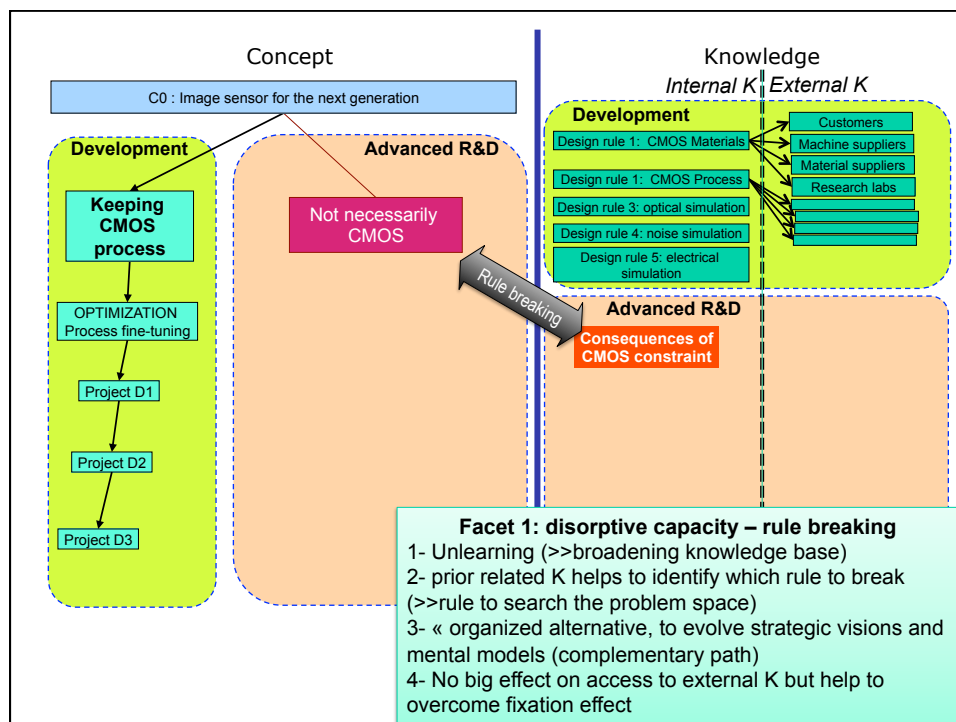
## Some consequences of a design perspective

- AC and RI? → Conceptual AC, based on the C-tree (vs the level of K, which is actually an Epistemic AC)
- DynCapa in MI? → see Rule Renewal vs Rule Reuse

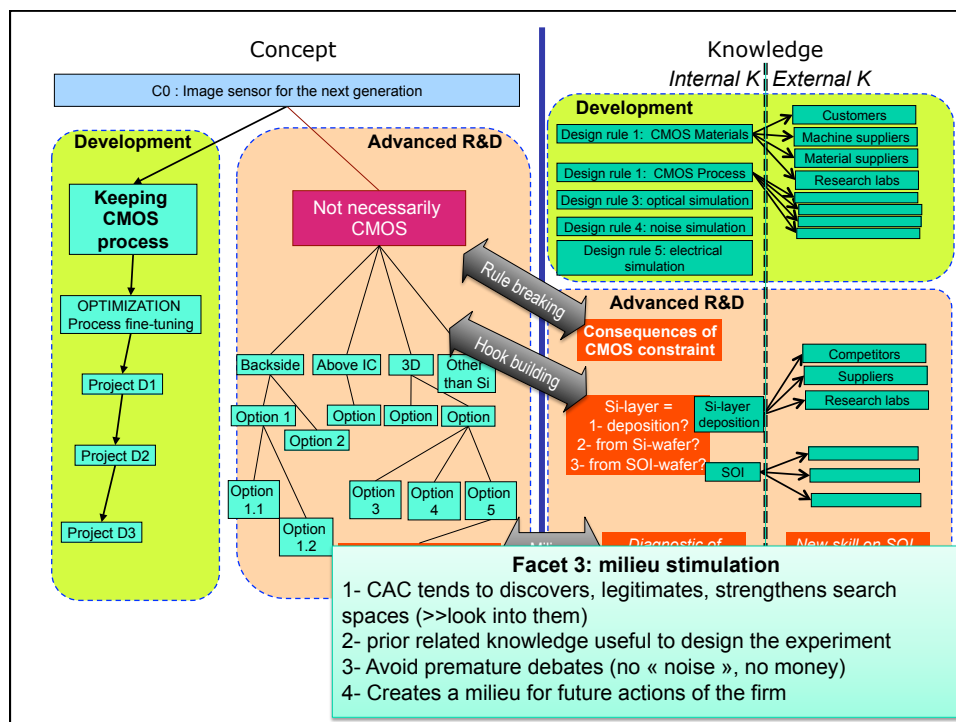
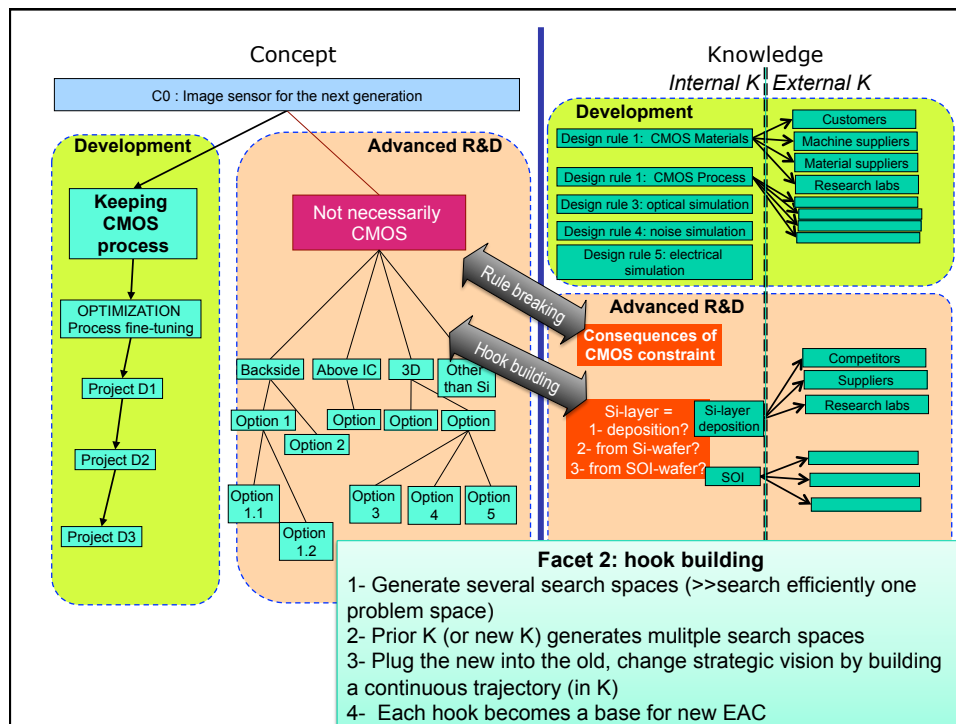


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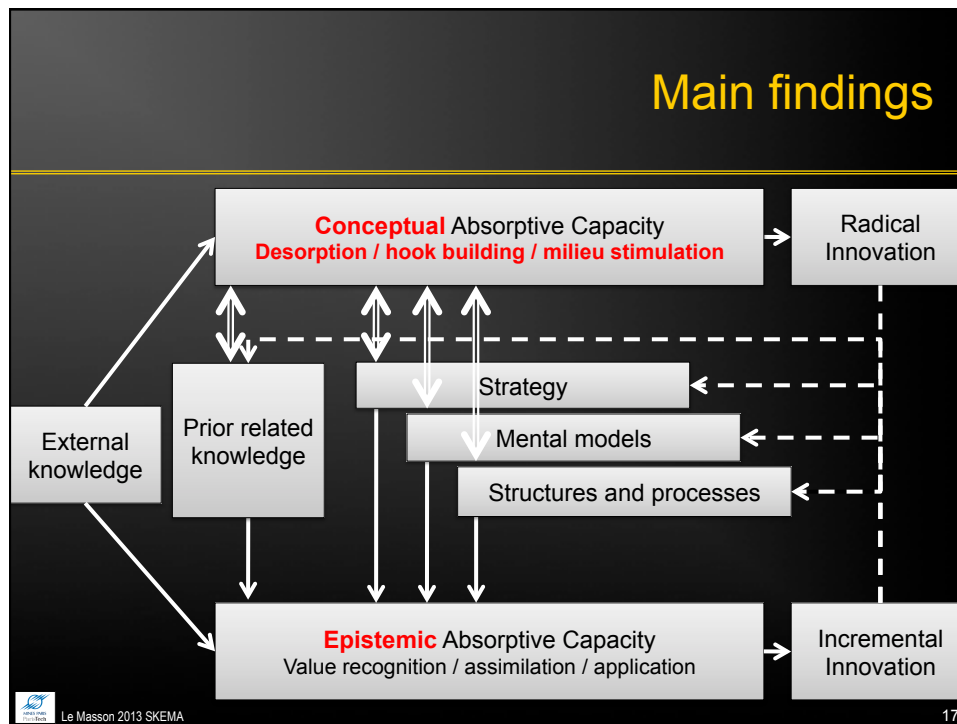








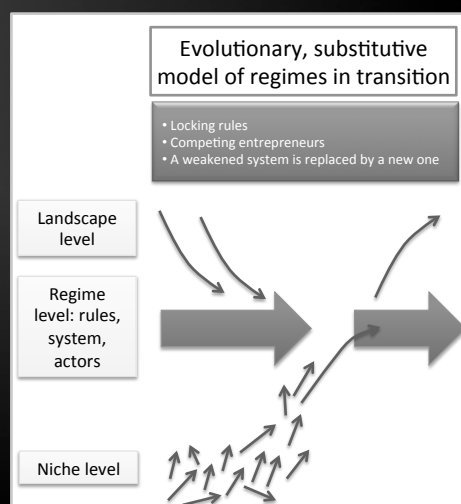
## Main findings



## Path creation in a design perspective: unlocking rules

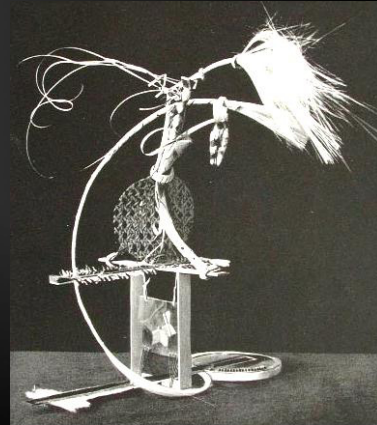
### Classical model of path creation (Geels)

- Landscape level + niche level → pressure on the regime level (weaken the rules)
- BUT:
  - What happens at the « regime level »?
  - Models of regime transitions = rules at the regime level for regime change???



## Rules in a design perspectives

- Rules to design:
  - Design theories as rules for generating new objects and new skills (with increasing generativity) (see Le Masson & Weil 2010; Hatchuel et al. 2011)
  - Rules to be creative in industrial design: Bauhaus
  - Specific structures of the knowledge base to go out of the box! (see Forcing, see Bauhaus teaching)



## An alternative model for regimes in transitions

Table 1. Two models of regimes in transition(s).

	Model 1: evolutionary, substitutive	Model 2: generative, interactive
Interaction between niches and the regime	The weakened regime is replaced by a winning niche	The regime contributes to the emergence of niches and is transformed into a new regime through synergies and hybridisations
Rules	Locking: stabilises one path, reduces uncertainty	Unlocking: inhibits lock-in, generates multiple paths.
Actors	Individual entrepreneurs with their own strategy	Collaboration in the unknown
System	A weakened system is replaced by one stemming from a niche	Actors work on the incumbent system and on the alternatives in niches






«We are not picking winners or losers »<sup>(1)</sup>

**(April 7, 2010 Workshop)**

Before Discussion	After Discussion
Nanothermal: ➢ NW – PCM ➢ Fuse/Antifuse Memory	Nanothermal: ➢ NW – PCM
Nanoionic Memory Electrochemical, Valence change Thermo-chemical	Redox Memory (tentative)
Electronic Effects Memory: ➢ Charge Injection ➢ Mott Transition ➢ FE Polarization reversal	Electronic Effects Memory: ➢ Charge Injection ➢ Mott Transition FeFET Family (?)
Macromolecular Memory	Macromolecular Memory


  
6 ERD/ERM WG 4/6-7/2010, Barco, ITALY Workshop & ExF Meeting      Work in Progress – Not for Publication

**Critical research needs were identified**

(1) ITRS Summer 2008 public conference

