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# FORS IMA MISC Methods and Research Meetings Emergence Dynamics of Social Representations

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le savoir vivant

# Problem

While methodological pluralism may be virtuous, when a theory apparently embraces a range of approaches from ethnography to experimentation, of data sources from pictures to attitude scales, and analytic procedures from qualitative interpretation to multi-dimensional scaling, without an explicit rationale, virtue looks more like an absence of conceptual clarity.

Bauer & Gaskell, 1999



# Why is it so unclear ?

SR are organized in a (very complex) system (Doise, 1992).

SR are dynamic, and evolve over time

(Bangerter and Heath, 2004).

Although SR are socially constructed and shared in a given group, substantial intragroup differences remain, both prior to their formation and after their cristallization (Clémence, 2001). SR both are created by and reinforce the cohesion of their group in which they exist.

 $\rightarrow$  SR are emergent phenomena.



# The Plan : I - Concepts and Tools

Complexity and emergence.Ontology of Social RepresentationsBuilding a toolbox



4

# The Plan : II - Experiments and Results

A quick caveat : Of maps, countries, and the difference between the two.Trial run : Emergence of Consensus in a fully connected group.Serial Reproduction.Going deeper : Comparing larger groups.Discussion & Questions



# Complexity

[Complexity as an idea] always connoted a warning to reason, against clarification, simplification, and fast reduction (Morin, 1990, p. 46).Too many interconnected units, too many interactions, too many interferences for a phenomenon to be thoroughly comprehended.Uncertainty in richly organized systems.Black-box : "Something" happens between input and output that resists analysis.



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# How are SR complex ?

SR are produced and organized inside the minds of a given group. They are also constitutive of said group. They are both a movement of grouping and discrimination of informations. They follow patterns of organization that are informed by the interconnection of hundreds, thousands, or more minds. So instead of opening the "black-box", which can only be done in experimental conditions, it seems a good idea to try and "grow" SR in a simulation.



## Emergence

Emergent phenomena have been studied extensively using simulation (Latané, 1996, Schelling, 1978, Epstein & Axtell, 1996).Emergence happens when micromotives cause different, discernible macrobehaviors that could not be foreseen :



8

## **The Neural Network**

"Human neuroimaging experiments have revealed that virtually all perceptual or cognitive tasks [...] are the result of activity within [...] distributed brain networks." (Sporns, 2003)So, we need our agents to be able to : $\rightarrow$ Enter Neural Networks



9

# The Neural Network (2)

Formal Neural Networks are :

10



#### **The Neural Network (3)**





11

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# **FNN : How they work**

Cells that fire together, wire together (Hebb's rule). When two neurons are supposed to fire together, we reinforce the connexion between them. In formal NNs, connections are represented by a numeric value, which increases when 2 units are supposed to fire together, and decreases when they are not.



12

# **NN : The algorithm**

Take one neural network. Show it a pattern of information. The NN will produce an output based on preexisting (random, at first) connections. Compare the output to the desired output. Propagate the error backward, correcting weights by a small fraction. Rinse, repeat (with a different information). After several iterations, the network produces the correct outputs, even if the patterns are altered.



# Ontology of Social Representations : A Toolbox for Simulation



The Toblerone model of Social Representations. SR at time *t* is a function of :

Source : Bauer & Gaskell, 1999

14



## **Toolbox : Object**



The 8 patterns we use to train our agents.

15

Be it AIDS, Dolly the sheep, the Mozart Effect, madness or psychoanalysis, the object is a perceptible reality that is actualized as a mass of information. We have coded such a mass as 8 patterns of 15 zeroes and ones.

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### **Toolbox : Subjects**





17

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18

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# **Toolbox : Project – The procedures**

Hutchins & Hazlehurst (1994) propose a learning method divided in 2 tasks:

A simple, autoassociative task, during which our agents memorize, activate, and treat the patterns. A micro-influence, in which another agent influences the active agent.



# **Toolbox : Project – The procedures (2)**





20



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# **Caveat : The map is not the country**

With this model, we refute any possibility of representing actual contents of any SR.We focus instead on :



22

#### **Emergence of consensus**

•With every step of the program one agent learns the small part of one pattern, influenced by one other agent. In a fully connected network, intragroup consensus systematically emerges (nAgents = 150, Iterations = 1.5 m).





# **Serial reproduction**

1 trained agent, which has been part of a previous study, becomes generation 0.10 agents are trained 10'000 times with Agent 0 as their teacher (generation 1). For each agent of generation 1, 10 agents of generation 2 are trained (also 10'000 times).



# **Results : Emergence of SR in real time**



25

# **Discussion – Part 1**

The model puts some of the critics (Middleton & Edwards, 1990) of serial reproduction to rest by allowing a dialogic, back-and forth movement between the "teacher" and the "pupil". It reproduces convincingly the general (societal) consensus, the intra-group consensus, and the individual idiosyncrasies. Yet statistically, no proof can be concluded from this experiment, as the groups are too small.



# **Going deeper : Comparing larger groups**

We have selected two of the previous groups, and increased their size tenfold.We have trained them in the exact same way as previously mentioned.Then, we conducted a cluster analysis using R.



27

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28

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The two groups still have a lot in common. They differ greatly on some parts of the information. Individual variations also remain.



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#### **Cluster analysis**



#### d hclust (\*, "complete")

29



The two groups separate perfectly.

# **Discussion – Part 2**

This model sheds a new light on the ontology of social representations, by evacuating individual meanings, and focusing primarily on their structure and conditions of emergence. It proves that a representational system effectively emerges in a strict sense from a set of simple rules, conserving: It may allow us to ask new questions and research SR in new, unexplored directions.



#### Questions





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31