New paths towards artificial creativity

Andrea Roli
DISI
Campus of Cesena
Alma Mater Studiorum Università di Bologna

ALMA-AI Kick-Off Workshop sui Fondamenti dell'Intelligenza Artificiale

April 27, 2021

From the Dartmouth summer research project…

> **7. <u>Randomness and Creativity</u>**
> A fairly attractive and yet clearly incomplete conjecture is that the difference between creative thinking and unimaginative competent thinking lies in the injection of a some randomness. The randomness must be guided by intuition to be efficient. In other words, the educated guess or the hunch include controlled randomness in otherwise orderly thinking.

…to Deep Dream, The Flow Machine, and many others
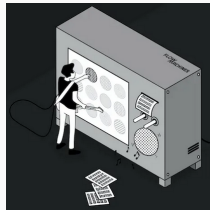
Are there general principles that can guide artificial creativity processes?

CONSTRAINT

AFFORDANCE

CONSTRAINT

AFFORDANCE

Draw a line, which becomes an **enabling constraint**, which in turn creates **new opportunities** for further lines, and so on—exploring the **adjacent possible** (S. Kauffman).

Luciana Rossi

An example from Baroque music

The actual piece of music is a process emerging from the dynamical interaction of two sources of information:
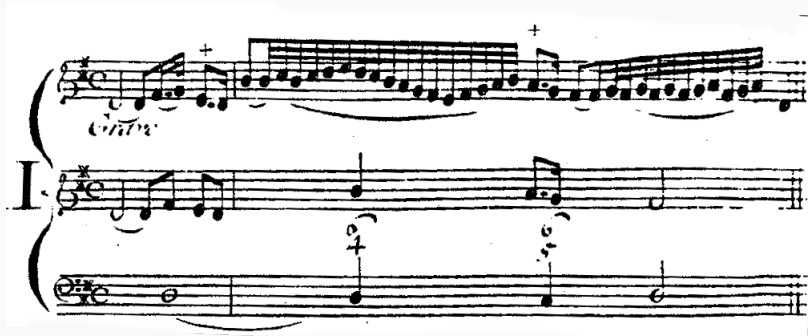
- Musical score

- Performance practice

The score...

An example from Baroque music

A. Corelli, Op. 5, No. 1

...may be played like this

A general property

Music emerges from:

Score
Performance practice
(B. Kuijken, *The Notation Is Not the Music*)

Cell's behaviour emerges from:

Genetic code
Environment
(D.Noble, *The Music of Life*)

Robot's behaviour emerges from:

Control program
Embodiment
(R.Pfeifer & P.Scheier, *Understanding Intelligence*)

Instead of starting from musical examples and training a system to learn to play in a specific style,

start from a simple score and *generate* rules and constraints on the basis of which the score has to be played.

Towards artificial creativity

Equip the robot with a control program rich of possible dynamics (e.g. a critical dynamical system, such as a Boolean net in critical regime),

then let it find the most suitable coupling with the environment so as to attain a given task.

Iteration n   Iteration n + 1

■ = sensor   ⬛ = robot wheel

Conclusion
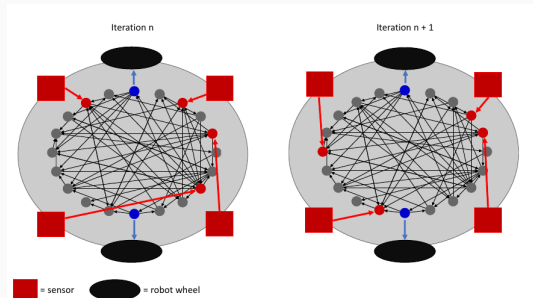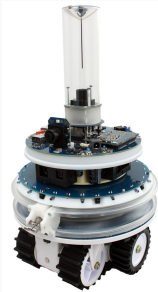
New paths towards artificial creativity can be traced by considering:

- the intertwined relation between constraints and affordances
- exploration of adjacent possible by progressively relaxing or modifying constraints
- exploiting the non-ergodicity of the creative process