The Art of Emergence

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1. Art, Science and Emergence

Since several years, the term *emergence* is mentioned in the paradigm of chaos and complexity. In this contest, complex system constituted by multitude of interacting elements develop global behavioral properties on the base of local chaotic interactions (self-organization). These theories, developed in scientific and philosophical milieus are rapidly spreading as a "way of thinking" in the several fields of cognitive activities [2,6,7,9]. Such a conceptual fertility can be the base for the revision of the artistic activities as flexible instruments for the investigation of imaginary worlds, metaphor of related real worlds. In this sense we claim to the artist a role of "researcher" for the hypothesis generation and idea germination and we look to the complexity theory as a new important topic to enlarge the area of interference between art and science [2,3,4,5].

Through the free exploration of these new concepts, the artist can evoke qualities, configurations and hypothesis which have an esthetical and expressive value and in the most significant cases, they can induce nucleation of cultural and scientific bifurcation [2]. Our vision of the art-science relation is of cooperative type instead of the conflict of the past decades.

The results derived by these positions characterize the expressive elements of a dynamical or interactive artwork as the outcome of emergent behavior both in the sense of esthetical shapes emergent from fertile generative environments, either in terms of emergent relations between the artist, the artwork and the observers, either in terms of concepts which emerge by the metaphor of artificial worlds to produce imaginary hypothesis for the real worlds.

According to this "way of thinking" it is possible to revise some fundamental themes as the economic systems, the cultural systems, the scientific and artistic trends, the communication nets under a new approach where nothing is pre-determined, but the global evolution is determined by specific mechanisms of interaction and fundamental events (bifurcation) [14]. With a jump in scale of the life, also other basic concepts related to the individuals as intelligence, consciousness, psyche can be revised as self-organizing phenomena.

2. The Creative Path

One of the fundamental topics we would outline, is the way to generate and think to the artwork and its development. Our characterization is to see the artwork not as a static finished product, but as an

instance or a dynamic sequence of instances of a creative process which continuously evolves. In this sense, the attention is focused on the "generative idea" which constitutes the envelop of the artworks generable by the process. In this approach the role of technology (computers, synthesizers) is fundamental to create the dimension of the generative environment.

Another characterizing aspect of our artworks is derived by the previous approach and specifically related to the interactive installations. The classical relation between artist, artwork and observers is viewed as an unidirectional flux of messages from the artist to the observer through the artwork. In our approach artist, artwork and observer are autonomous entities provided with own personality which jointly intervene to determine the creative paths. The artist which generate the environment in not longer the "owner" of the artwork; simply he dialectically bring the generative environment (provided by a certain degree of autonomy) towards new cultural and creative spaces. The observers start from these platforms to generate other creative paths, sometimes absolutely unexpected, developing their new dialectical relations with the artwork itself.

In the next paragraphs we describe three of the most significant realized artworks in order to make explicit the concepts and basic themes.

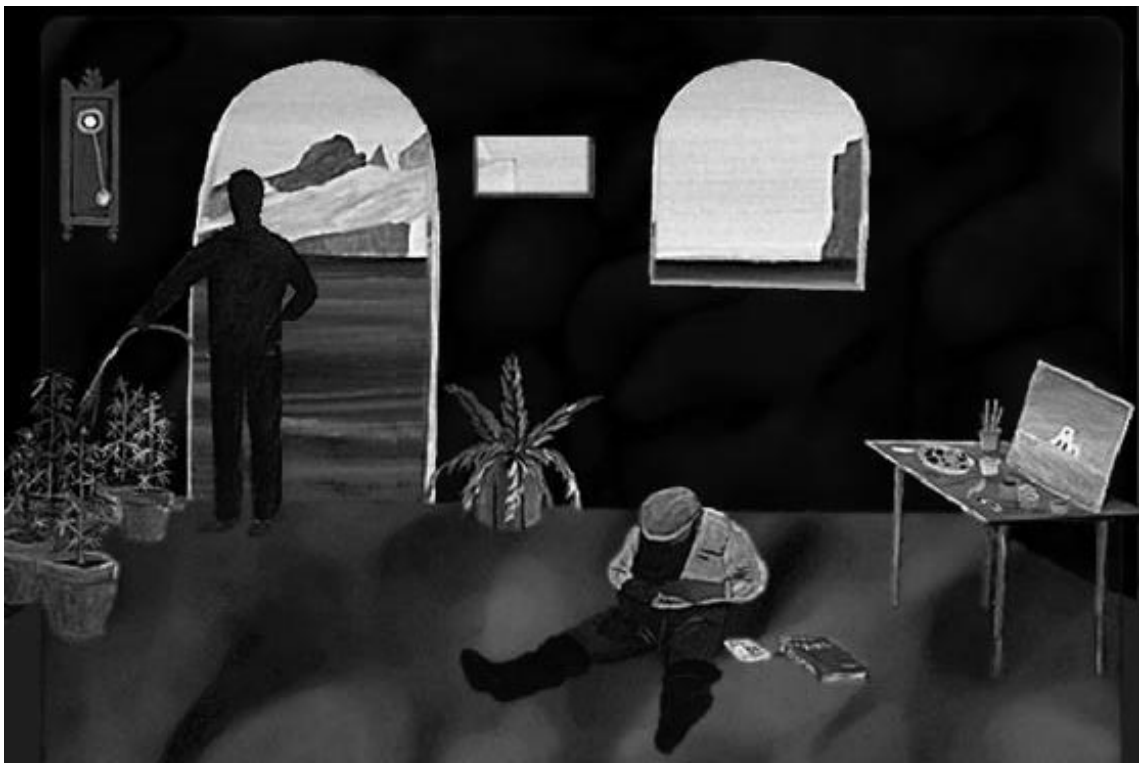
3. The Observer Embodiment: "Stanze" ("Rooms")

This installation (*M. Annunziato, O. Gemma de Julio, P. Pierucci, 1997*) is composed by a video-camera and a back-projected screen located in a void room. The camera is located at the top center of the screen. The observer has freedom to move around the room and several observers can interact with the artwork. The images coming from the video-camera are sent to a computer and elaborated by a program which is able to analyze the scene, to detect the movements and to codify they in terms of action on the image and to play sounds connected with the movements of the observer.

On the screen we superimpose predefined images with that ones of the observers extracted by the image coming from the camera (fig.2). The predefined images represent a path between a sequence of rooms in a farm house where we reproduce painted scenes (and elaborated by digital way) with the authors and their symbols (fig. 1). The real images of the observer, detected by the camera are separated by the background and elaborated in real time in term of the colors. Finally they are inserted in the virtual environments (the imaginary internal rooms) and projected on the screen. The gestures achieved by the observers cause the progressive disappearance of a room and the passage to the subsequent room.

The sounds associated to the images and to the observer movements are synthesized in real time. The sound timbres (instruments) change in relation to the room and to the zone of the image excited by the movement of the observer. The note and duration are completely controlled by the observer movements which, through the interaction, realizes the composing and executing experience of a musical sequence. The artwork manifest itself to the observer movement and it reproduces always new aspects as the result of the creativity of the achieved gestures. In this sense the artwork realize the fusion between the artist creativity and the observer one and it takes energy from this meeting.

The physical, natural gesture is one the most important expressive and immediate channels to exchange information, emotions, images, rhythms and music of silences. In this sense the body of the observer and its movements are completely embodied in the artwork and it constitute the main elements.



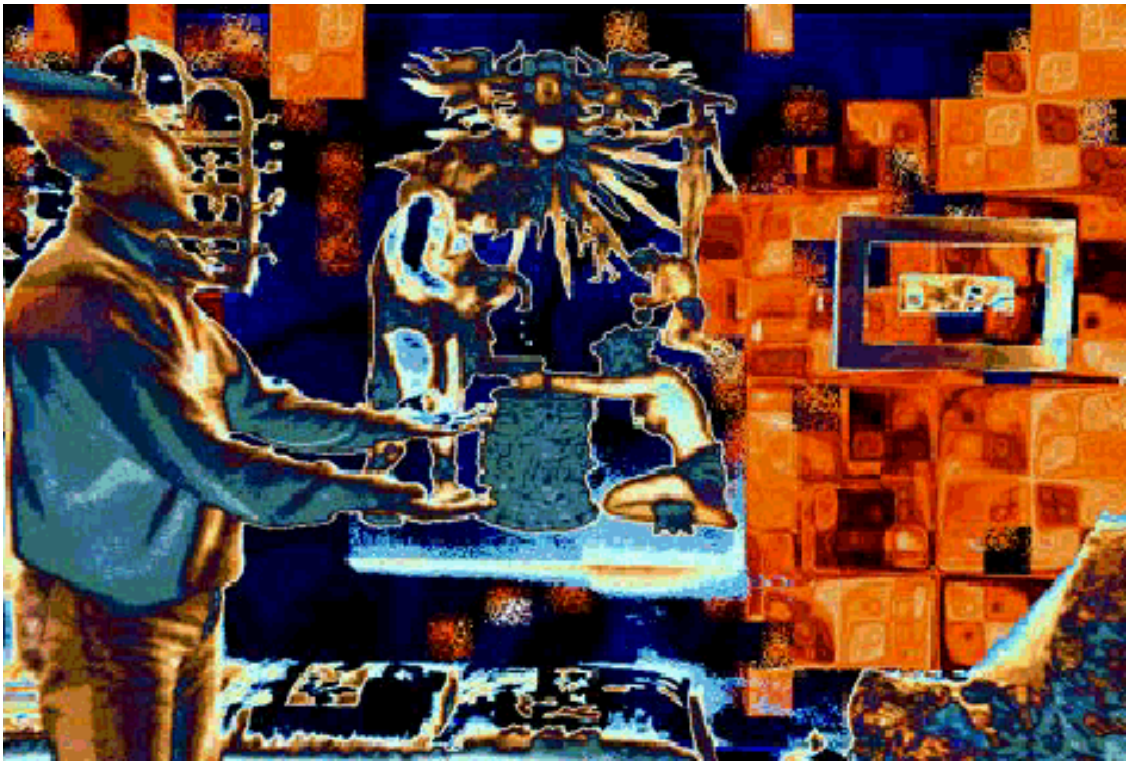


Fig. 1: Scenes from installation: "Stanze" (Rooms)

Fig. 2: Scenes from installation: "Stanze" (Rooms)

The exposition of the installation to the public, has constituted a fundamental experience for us in order to understand the importance of a deep interaction with the public and focalize the effect of the observer embodiment. Often some observers identify itself in the scene choosing a position in the room to be proportioned to the scene and painted personages. The less inhibited observers, after a first phase of study start a dance of iterated movements. This allow they to pass from an episodic and not structured melody to a constant rhythm with tonal and instrumental variation which depend by light alterations on the iterated movements.
The natural gesture is transferred in a musical and visual effect, but this effects strongly influence the movement. So, the feedback is transferred in the perception of the interacting actor who tends to losses the consciousness to drive the installation itself (after a while it is hard to him to understand if he *drives or follows* the sound/images generation).

Finally the images which compose the virtual scenes are realized through the fusion of two different artistic styles (acrylic paintings and digital compositions). The painting is the basic matter for the digital interventions. The experimentation of this synthesis and the fusion in the video and sound media is one of the basic themes of this installation. The driving idea is to think to the multimediality not as - the contemporary presence of different media - but as - a strict connection between the dynamics of different media - up to establish causality link between action achieved on a media and reaction induced on the other media.

4. The Edge of Chaos: "Vid-A-Feeba"

The installation *(M. Annunziato, P. Pierucci, 1999)* is based on a video-feedback loop composed by a video-camera and a screen (retro-projected or a large tv screen). The video camera looks for the screen and the signal is sent to the screen. This setup is a well studied chaotic process [18,19,20] and also applied for some artistic expression producing multiple echoes in the image.

In this setup we have inserted a computer between the camera and the screen. The computer transform the incoming image from the camera, inserting in the process the feedback control parameters. Finally it sends the image to the screen. In this way it is possible to control the chaotic generation of shape, colors, delays and echoes manipulating the image (digital) transformation in the computer. Depending by shape and colors evolving on the screen, a sound codification is elaborated and played. The mapping between audio and video domains using perceptual features related to the colors and intensity. The produced music is strictly connected to the images and creates a perceptive resonance between visual and acoustical dynamic.

The image and sound evolution are the amplification, echoing and interference of very little noises in the "bottom" of the electronic devices (camera and screen). In between the camera and the screen there is an *interaction area* where people can interact with the installation evolution playing with the feedback and determining new dynamics. The interaction of the people allows the installation "to live". The movement inserts disturbances that move the system through ordered of highly chaotic situations. The sound melody reflects colors and dynamics and the emergence of new patterns.

In order to explain the artwork base we have to introduce the concept of *attractor* of the chaotic systems. This concept, introduced by Lorenz in '63 [13, 16], represents the synthesis of the *dynamics* of a system. The dynamical system is *attracted* towards a specific behavior continuously repeating similar *movements* but never repeating exactly the same *trajectories*. This means that the system is continuously evolving on new configurations (continuos creation)

but showing an hidden order which is identified by the attractor.

The charm of attractor is the change in the chaos concept from "something of without order" to "something with an hidden order but we don't know". We could add that we are not able to explain the hidden structure of chaotic events but in most of the cases we are able to perceive the hidden order at the perception level (i.e. see the surprising natural images in [8]) which is exactly the focus of this artwork.

Manipulating the process parameters, we move gradually the system near the *edge of* chaos (the transition between ordered behavior and highly chaotic one). As recognized by several researchers ([25, 26]) in the chaotic systems this zone is rich of bifurcation and resonance and it is highly creative for the emergence of new features. Obviously the movements of the observer is fundamental in order to reach this condition, but what is surprising is that, after a while, it is natural for the interacting people to push the system towards strong creative conditions located at the edge of chaos because off these configurations give the maximum response of the artwork in term of creativity. These situations are the most interesting for the great creative potential connected with the emerging of image and sound shapes from the disorder (total chaos) or from the obsessive repetition of the same patterns (order).

5. The Art of Emergence: "Relazioni Emergenti"

The installation *(M. Annunziato, P. Pierucci, 1999)* consists in one back-projected screen which represents an artificial life environment where the individuals, represented by graphics filaments, are endowed with own intelligence and character. They can interact, exchange information and reproduce. Through the mechanisms of genetic mutations, the population evolves developing progressively ability of adaptation. The emerging behavior is rendered as continuously new shapes and graphical patterns.
Each filament is a bearer of a sound message. The joint filaments exchange information shaping a living neural network. The sound strings are sent to a sound synthesizer. The global result is a whole of parallel individual sonorities creating complex sound architectures.

The observers can interact with the artwork standing or moving in the space just in front of the screen. The interaction area represents a map of the life environment displayed on the screen. A video-camera detects the positions of the observers and compute the corresponding locations on the life environment. These locations become zones of life germination. The result is that the observer can modulate the emerging life in the locations he pass through. The filament he stimulates join and interact with the ones generated by the other observers or by the environment natural development. The observer can play with the complexity: he cannot control the life and interaction in a deterministic way, but he can induce bifurcation in the evolution. The result is a mediation between the observers actions, the a-life environment and the artist original intent.

The central objective of the artwork is to build an artificial society which is a metaphor of the world of the communication webs and the mechanisms of formation of "collective messages" and the new aesthetics. The work is grounded on the complexity theory and artificial life [29, 30, 31, 32, 33]. In the frame of this paradigm, complex systems constituted by multitude of individuals develop global behavioral properties on the base of local chaotic interactions (self-organization).

We would explore with the imagination the transfer of these concepts to the mind scale starting from the idea that the individual context is the emerging own configuration of psychic fragments. In the sense the interaction between two or more individuals is revised as the interaction of two or

more micro-societies. The result of the interaction is neither the translation of the personality of one or the others individual neither the sum of they, but it is something else: an emerging entity with a real existence without a clear, deterministic consistence.

The very first idea for this exploration came from the incredible similitude between pictures of fractures induced on china ink (by heating) and automatic calligraphy drawings. The intuition was that it exists the same creation mechanism at the base of the nature and the mind genesis. We have identified this mechanisms in the concept of self-organization, introduced by Asbhy ('62 [22]) and widely studied by Prigogine ('70-'80 [25,26]) and Kaufmann ('90 [28]). Following this way we developed a project for the exploration of the metaphors of mind and society as self-organization processes inspired to the ancient south-american myth of "Nagual" [1]. This project was based on an artificial life environment and it shown an incredible ability to develop shapes and adaptation (co-evolution of different species). They include an impressive content of emerging shapes, different scale of complexity, high "bio-diversity" in filament patterns [10, 11] (fig. 3).

Following this successfully experience, we have decided to explore the world of the society inter-communication and the emerging trends. The environment become "living" and the acoustic dimension has been inserted in order to carry the individual messages and to enhance the self-organization phenomena using two media strictly connected. Finally a basic synchronic model for the interaction has been included. The raw idea is that the living beings tends to emulate the most reinforced behaviors on the base of a simple synchronic adaptation rule: "more individuals encountered with that behavior, more warranty that behavior is good for survival". In "Relazioni Emergenti" this concept is utilized to evoke the rapid diffusion (behavioral bifurcation) of "winning" (more adaptive ?) messages in evolving environments building collective trends or memories or cultures.

Probably the more interesting particularity of the installation is the ability to produce high level of structured complexity both in graphical images and acoustical tissue. Most of these shape/sound recall archetypal structures of natural or artificial shapes or some not well defined symbols coming out from our dreams or emotions. In a few words the installation is able to generate "metaphors" of dynamics mechanism of the development of interaction and complexity.

The dynamics is one of the most important key of the artwork and it is directly related to the complexity development. The self-organization and genetic mutations induce the population of filaments to compose "micro-societies" which develop adaptation on the base of a unconsciousness co-operation (not defined in the interaction models, but emerging in the formation of coherent "social groups"). Some isolated individual (filament called pioneers) colonize the void graphical spaces (in the metaphor: cultural spaces not still developed). Their action create borders for subsequent development and they induce the formation of islands of development. This effect give to the evolution the aesthetic dimension of the bio-diversity increasing the internal complexity of the environment (fig. 4, 5, 6).

Another interesting particularity is the translation of the graphical phenotypes into the sound dimension producing acoustical phenotypes. In this synergy the self-organization is enhanced by the contemporaneous presence of the two media and completed in the mind of the observer. His perception is able to reconstruct the hidden order without to have a clear consciousness of it. So the only way to have a relation with the artwork is experience it in the two different media. The self-organization is reinforced giving the possibility to the observer to "touch" the high level of abstraction of something of real but without a real consistence.

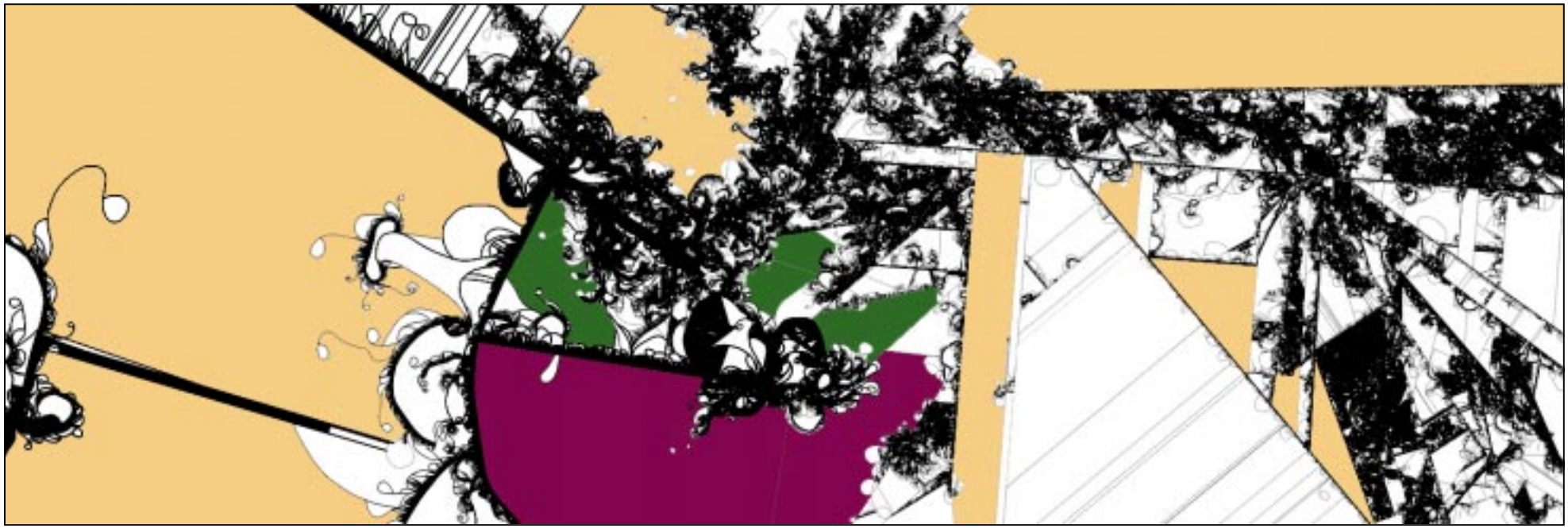


Fig. 3 : "Contaminazione ('99)

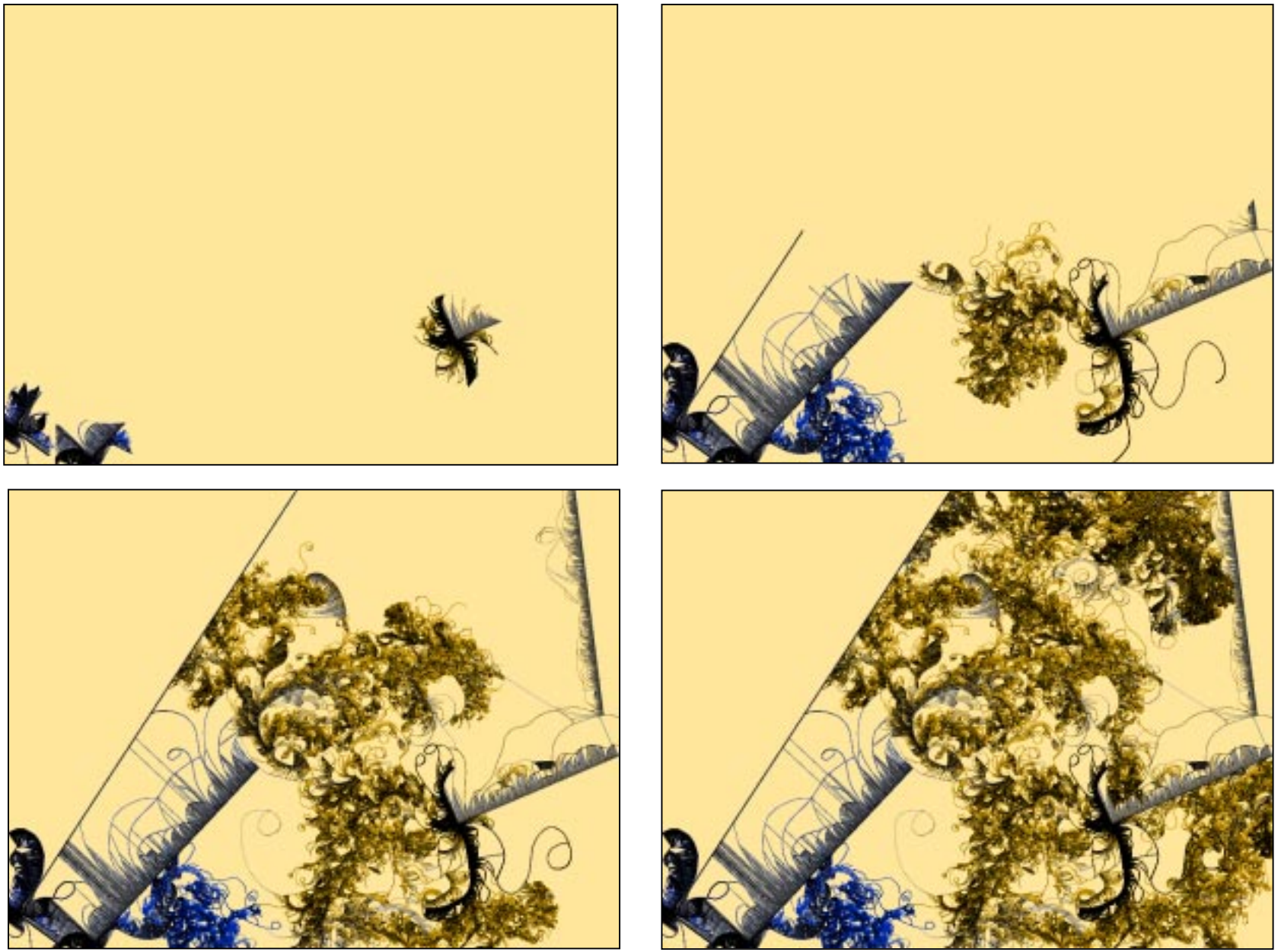


Fig. 4: An evolution sequence from the installation "Relazioni emergenti" ('99)

Fig. 5: An evolution sequence from the installation "Relazioni emergenti" ('99)

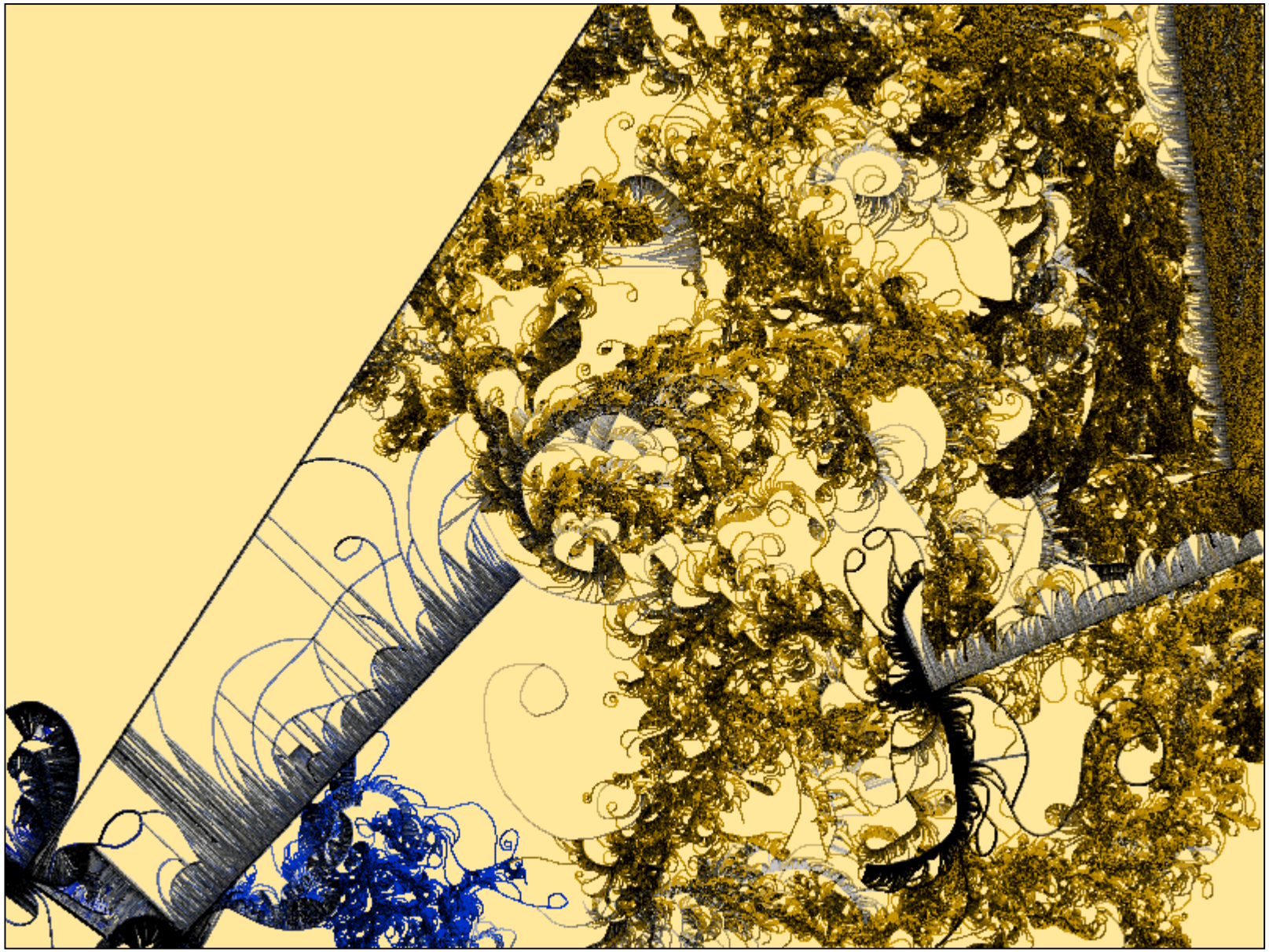
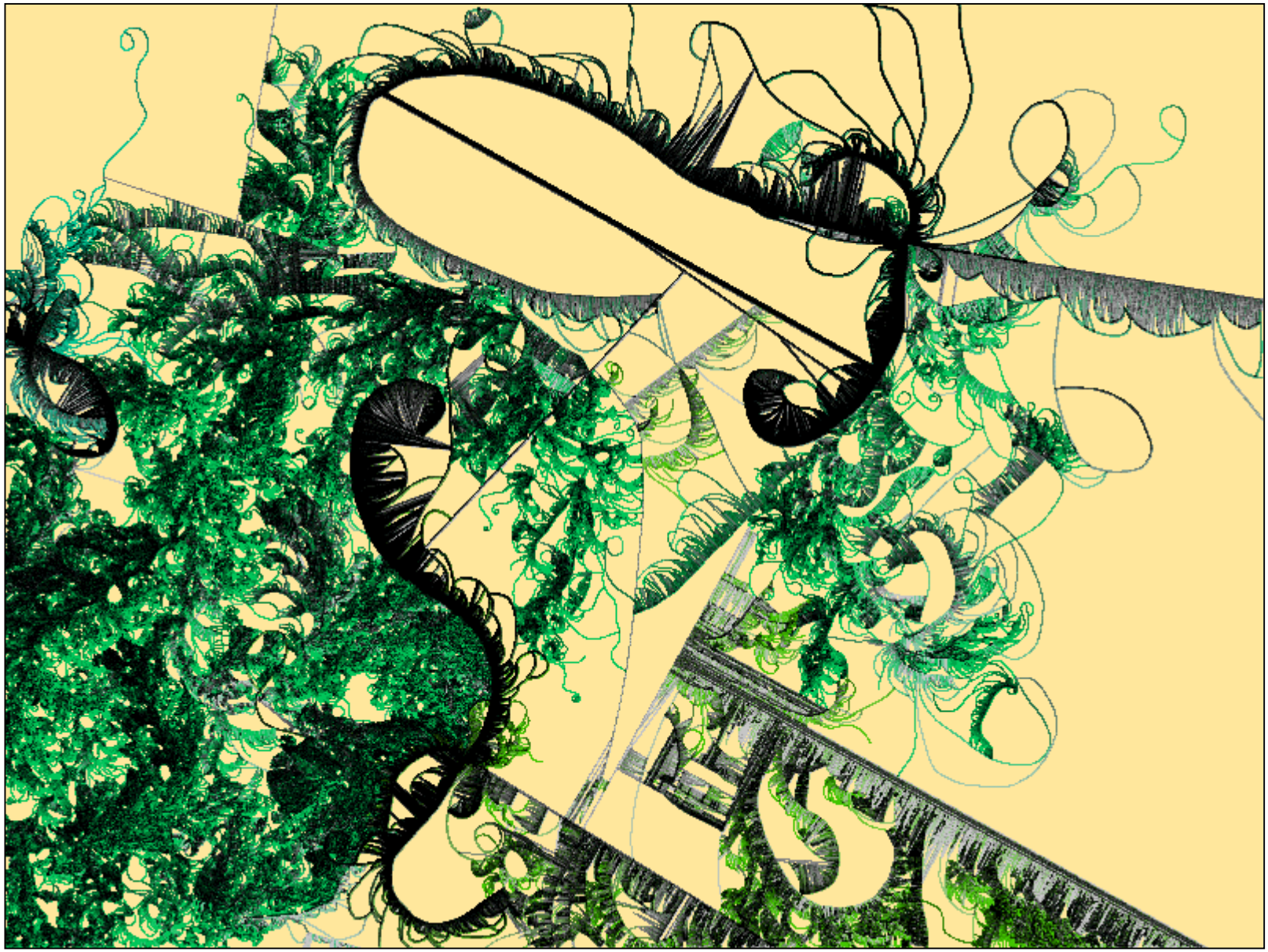


Fig. 6: An evolution sequence from the installation "Relazioni emergenti" ('99)



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