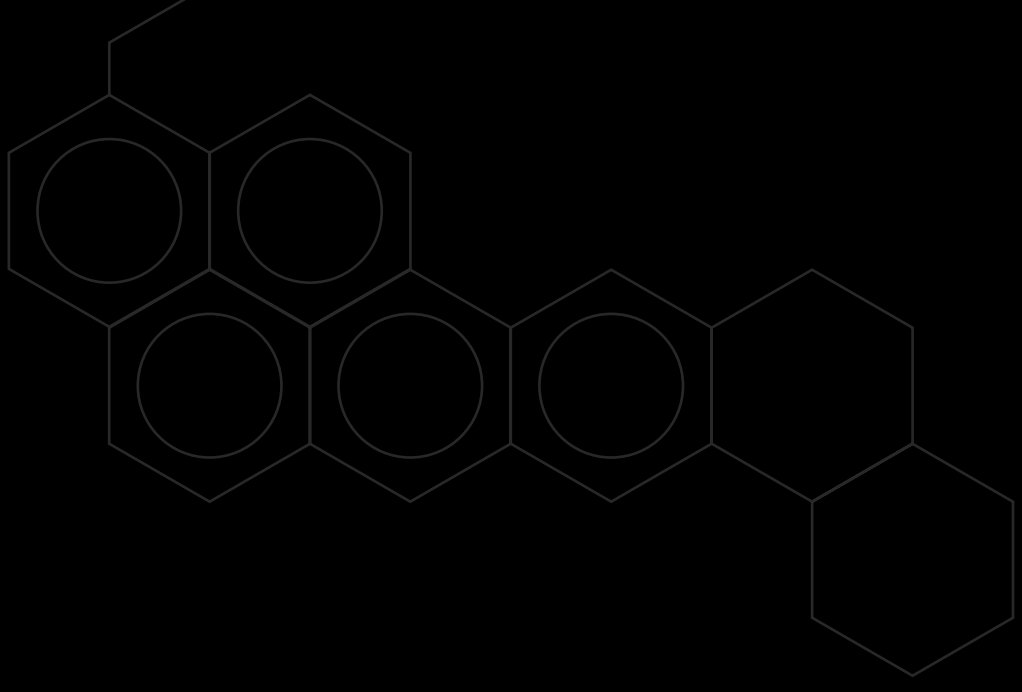

UNDERGROUND CITY XXI 3D

Prague College

Polska 10
120 00 Prague 2
Czech Republic
www.praguecollege.cz
(+420) 222 101 020

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The European Interdisciplinary Platform Underground City (XXI) originates from a long-term project "Underground City XXI". The aims of this project include the protection of an ex-coal mine in Labin and Rasa, in the Region of Istria, Croatia, and the conservation of its industrial and architectural heritage. This project was initiated in 1998 by the cultural and art association Labin Art Express (L.A.E.) and the Region of Istria. The goal of the project is the transformation of an ex-coal mine into a modern underground town with streets, bars, galleries, a swimming pool, shops, restaurants, children play-grounds, a Museum of Coal Mining, and other components of a modern town including a Government, Statute, Mayor, police, laws and regulations, following the historical tradition of the Republic of Labin in 1921.

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PROJECT ART DIRECTOR
Pascal Silondi

EDITORS
Bruce Gahir, Stefano Cavagnetto, Leah Adler

PROJECT MANAGERS AND ADMINISTRATORS
Pascal Silondi, Doug Hajek, Aurélie Besson, Marie Silondi, Mathieu Doussineau, Pamela Ranfaing, Gérard Silondi, Masa Hilcisin, Tihana Valent, Tereza Kunova.

3D MULTIMEDIA ARTISTS, GRAPHIC DESIGNERS, ARCHITECTS, INTERDISCIPLINARY RESEARCHERS AND PROGRAMMERS
Pascal Silondi, Marie Silondi, Jakub Grosz, Rajmond Berisha, Stefano Cavagnetto, Bruce Gahir, Jakub Kopecký, Peter Marencik, Stéphane Kyles/NxGraphics, M2F créations, Quentin Destieu, Sylvain Huguet, Romain Senatore, Christophe Saidi/ Slussareff, Michaela Buchtova, Aurélie Besson, Pavel Roder, Tihana Valent, Dmytro Strapchev, Jorge Boehringer, Marko Puskaric, George Allen, Simon Gray, Gavin Bird, Platforma 9.81, Inge Schiller, Masha Hilcisin, Jana Jarolimova, Gerhard Breytenbach, Patrick Scherer, Natalia Ogneva, Milan Nedved, Aneta Cirusova, Ia Makhatadze, Polina Tikk, Michael Gimenez, Yevgeniya Drovossekova, Wiki Beat, Venera Muftakova, Peter Lecouteur, Azamat Sharapov, Silvia Weinzettelova, Skutr.

MAIN PARTNERS
Prague College (CZ), Libat (FR), Labin Art Express (HR), Nomad Theatre (A).

PROJECT PARTNERS
NxGraphics (CZ), M2F créations (FR), Platforma 9.81 (HR), Vias (A), CVUT (CZ), M77 (CZ), DafLab (CZ), Skutr (CZ), Gamerz Festival (FR), City Festival (PL), Anemic Festival (CZ), Invaze Festival (CZ), Transart Festival (HR), Enter Festival (CZ), Cyberspace Conference (CZ).

OFFICIAL WEBSITES OF THE PROJECT
www.undergroundcity3d.com
www.undergroundcityxxi.com

WEBSITE PARTNERS
www.libat.net
www.praguecollege.cz
http://nomad-theatre.eu
http://www.lae.hr

CATALOGUE
Silvia Weinzettelova, Gavin Bird

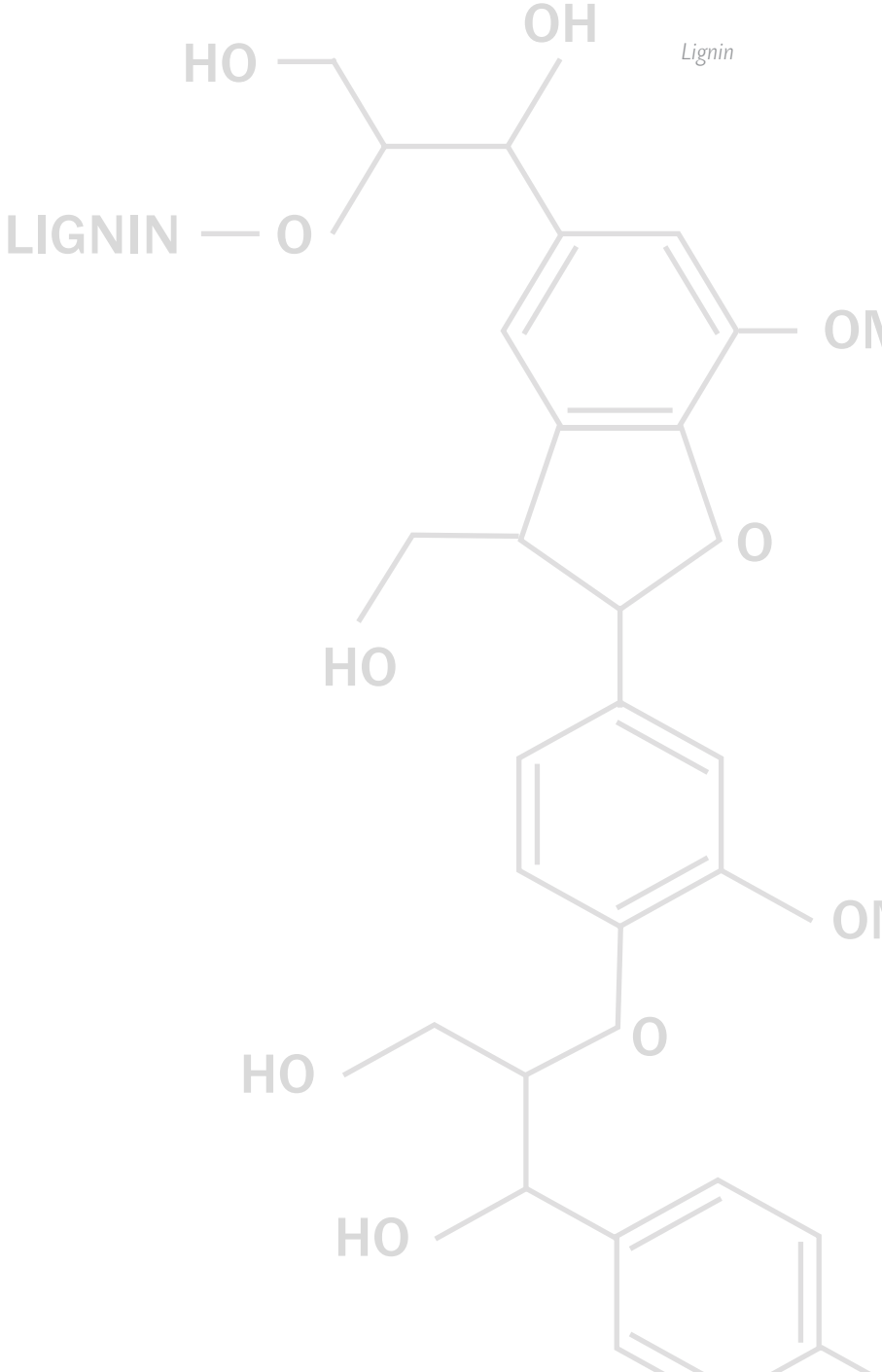
Cellulose

FROM PLANT TO FUEL

The plant material from which coal is derived is composed of a complex mixture of organic compounds, including cellulose, lignin, fats, waxes, and tannins. During coalification, volatile phases rich in hydrogen and oxygen (e.g., water, carbon dioxide, and methane) are produced and escape from the mass; hence, the coal becomes progressively richer in carbon. As volatiles are expelled, more carbon-to-carbon linkages occur in the remaining coal until, having reached the anthracite rank, it takes on many of the characteristics of the end product of the metamorphism of carbonaceous material, namely, graphite. Coals pass through several structural states as the bonds between the aromatic nuclei increase.

We will follow the coal formation process graphically using the chemical structures of major steps in this process.

PART I THEORY



Lignin

UNDERGROUND CITY PROJECT

The main idea of this project was to provide an ample and true testimony of the nearly 400 year old tradition of mining by transforming an ex-coal mine's heritage into an avant-garde cultural and art project with a strong economic and social impact and potentially to become one of the leading Croatian cultural and tourist attractions and a generator of future local and regional development. Construction of the first underground town in the world in the 8th "horizon"(level) of the ex-coal mine (10 km long, app. 50.000 m2 of space, 160 meters below ground surface), would demonstrate how space exploitation can be treated as environmental preservation.

In the summer of 2007, the cultural & art association L.A.E.(Croatia) in cooperation with the art association LIBAT (France), NOMAD theatre (Austria) and Prague College (Czech Republic), established the project "Interdisciplinary Internet Platform Underground City XXI (UC XXI)" – the creation of a virtual, 3D futuristic underground town and establishment of a specific European cultural and interdisciplinary community.

Internet platform UC XXI, a 3D multi-user environment shared and distributed on the Internet, will consist of: an interactive tour through highly developed spatial/urban plans and experimental architectural models of fundamental city buildings including the Museum of Industry and Mining, a City Hall, an exhibition gallery, a movie theatre, a cultural centre, public spaces, public institutions and executive bodies (in the form of specific avatars). The UC community with citizens and residents, statutes, regulations and laws, moral and ethical codes will form permanent communication and social networks. Mixed media art works and hybrid performances will be created by the residents and guests of the virtual underground town.

In 1993, Podlabin pit was officially recognized as a national monument of culture. In September, 1998, the Cultural Centre "Lamparna" (future entrance of the "Underground City") was opened in one of the abandoned mine buildings. In December, 1998, the Assembly of the Region of Istria proclaimed UC XXI a "millennium regional project". In 2000, the Faculty of Mining, Geology and Oil in Zagreb provided technical expertise, which proved the technical feasibility of the project in the areas of security, ventilation, water, electricity, lifts and other means of transport. The entire project development is divided into six different phases from conceptual work on the definition of the interdisciplinary platform to the dissemination of the project's eventual results.

PHASE 1. DEFINITION OF THE INTERDISCIPLINARY PLATFORM (ARTISTIC, SOCIAL AND TECHNOLOGICAL)

The virtual community's statutes, regulations, moral and ethical codes, terms for citizenship, beneficiary's rights and obligations, technical and other requirements, as well as different tools, services and facilities to be offered on the platform, will be discussed internationally and interdisciplinary by inviting European artists, scientists, programmers, other experts and officials to propose the first model for the future platform. This will be accomplished with a regard to artistic, social, political, legal, economical and technological issues. Available tools, technologies and already existing communities such as blaxxun, Second Life, or Active Worlds will be studied and evaluated to enable the definition of a strategy that meets the requirements of the UCXXI community relating to collaborative work, art production and implementation of mixed media content within interactive 3D real time environments on the Internet, in particular:

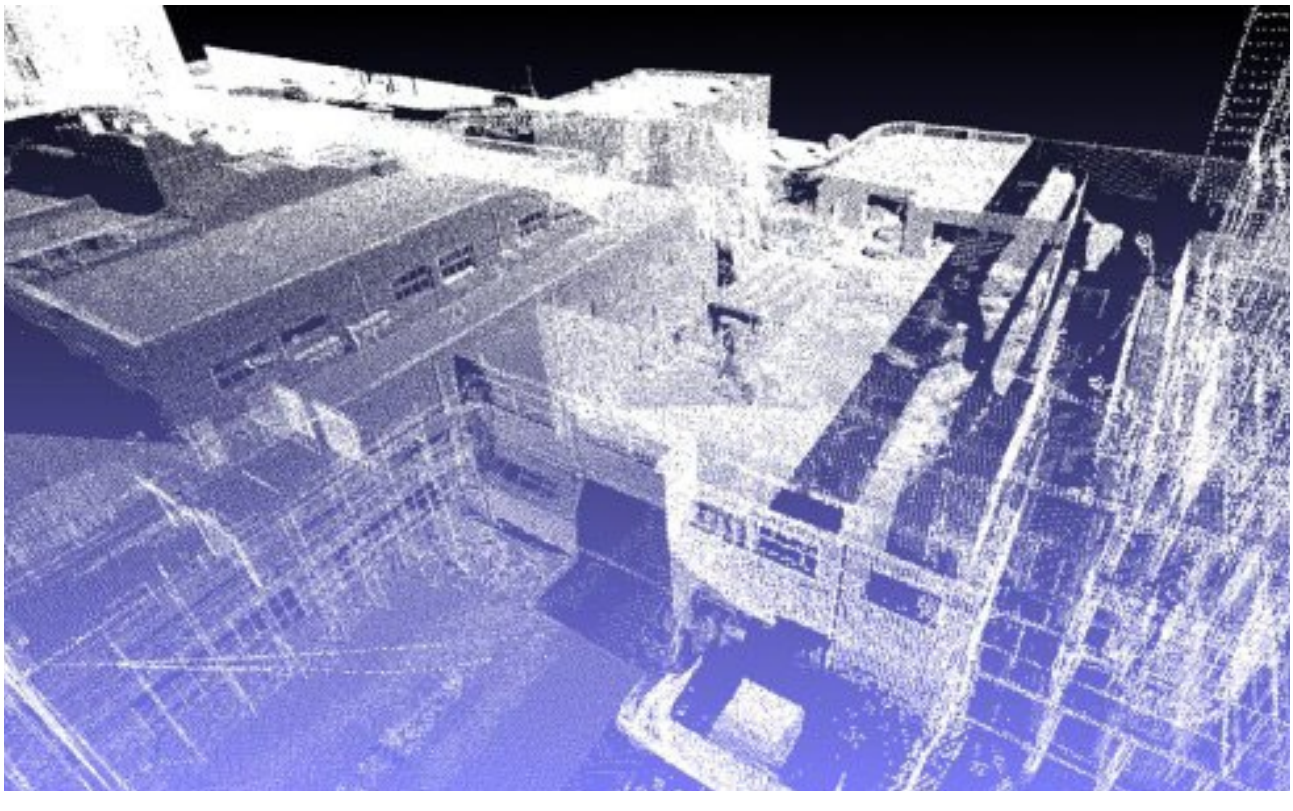
- Various tools will be presented relating to 3D modeling techniques as well as open source, gnu, or other well known software. These tools will be evaluated from the perspective of usability.
- Various languages and applications like VRML/X3D, Java, 3D games engines, OpenGL, DirectX, will be presented and evaluated for quality and network usability.
- Various communication technologies will be evaluated to meet the requirements of the UCXXI network regarding interactivity, collaborative work and virtual Internet communities. Functionalities being explored include real time content manipulation, audio/video streaming, chatting and shared database management.

PHASE 2. DEFINITION OF ARCHITECTURAL AND SPATIAL /URBAN MODEL OF THE FUTURE 3D ENVIRONMENT

The basic virtual city infrastructure will be defined by synthesizing various already realized studies from the Faculty of Mining in Zagreb and using existing digital data provided by laser measurements of the coal mine provided by VIAS in Vienna. An interdisciplinary European expert team will be established to develop proposals for some spatial/urban units with streets, squares, parks, buildings, to design fundamental 'public' buildings like museums, theatres, City Hall, galleries, cultural centres, to propose and integrate various means of transport such as lifts, railways, cycle and walking tracks, as well as some other infrastructure, in preparation for the 3D model construction Phase.

PHASE 3. CREATION OF THE 3D MODEL

3D artists and programmers in a close relationship with architects and designers will create the first 3D model of the Underground City XXI based on the real dimensions and situation of the ex-coal mine, using advanced CAD techniques and the results of the previous mine studies and measuring. They will collaborate in experimentation and integration of architectural studies, installations and utopian architecture projects as well as in the adaptation of gained proposals and ideas to be optimally integrated into the future 3D virtual environment.

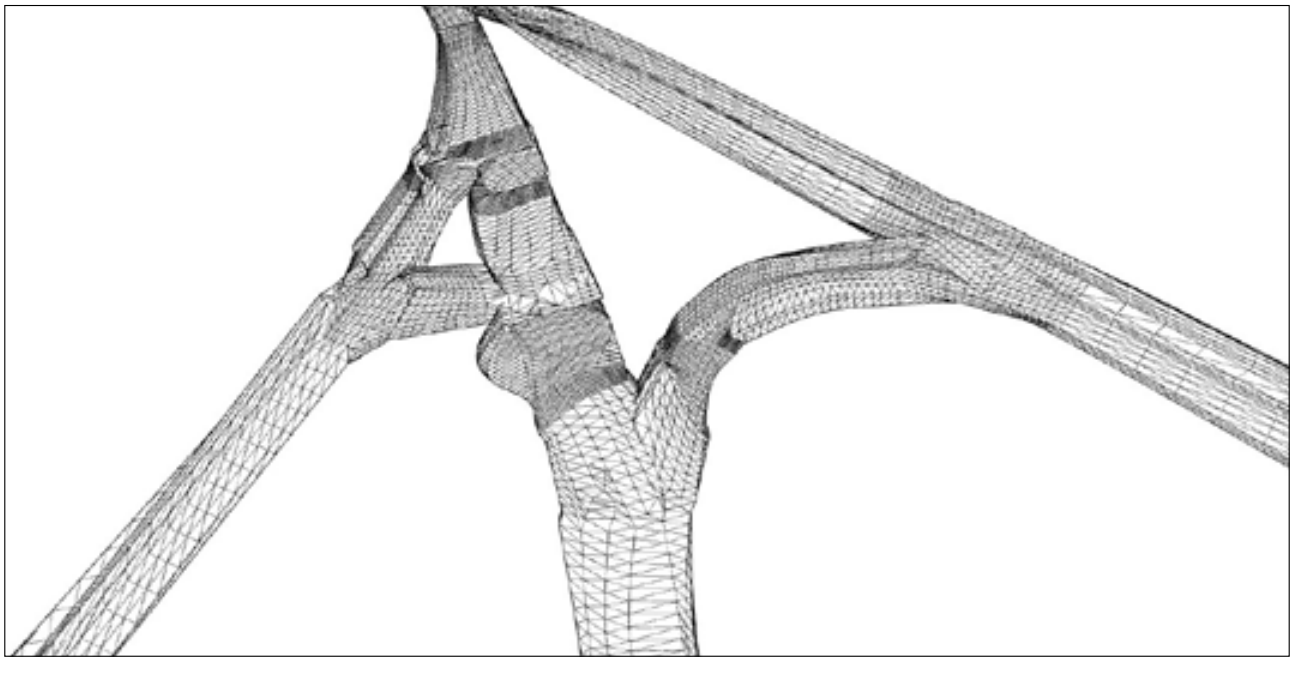


Elevator room, 3D point cloud by P.Silondi, J.Grosz and P.Marencik

PHASE 4. DEVELOPMENT AND IMPLEMENTATION OF THE REAL-TIME MULTI-USER PLATFORM FOR DELIVERY OF SHARED INTERACTIVE 3D CONTENT ON THE INTERNET

Programmers will directly collaborate with an expert team to enhance the potential of virtual 3D environments and provide an advanced multiuser server platform. A server for computer aided architectural design within a real-time multiuser 3D platform will be provided, enabling users and community members to visualize and communicate their proposals. Programmers directly co-operating with expert groups and artists will integrate 3D models developed during Phase 3 into a multiuser environment shared and distributed on the Internet.

The UCC XXI platform will provide community communication tools such as chatting, forums, message boards and clubs as well as extensive multiuser functions with membership members and profile management. It will integrate web 3D formats such as 3D, 2D, audio, video and streaming media. Regarding technology, UC XXI platform will utilize networked 3D rendering engines, with performance comparable to 3D game engines, which support character animation(avatars), which will enhance social experiences as well as web 3D content visualization. Programmers directly co-operating with expert groups and artists will integrate 3D models developed during Phase 3 into a multiuser environment shared and distributed on the Internet.



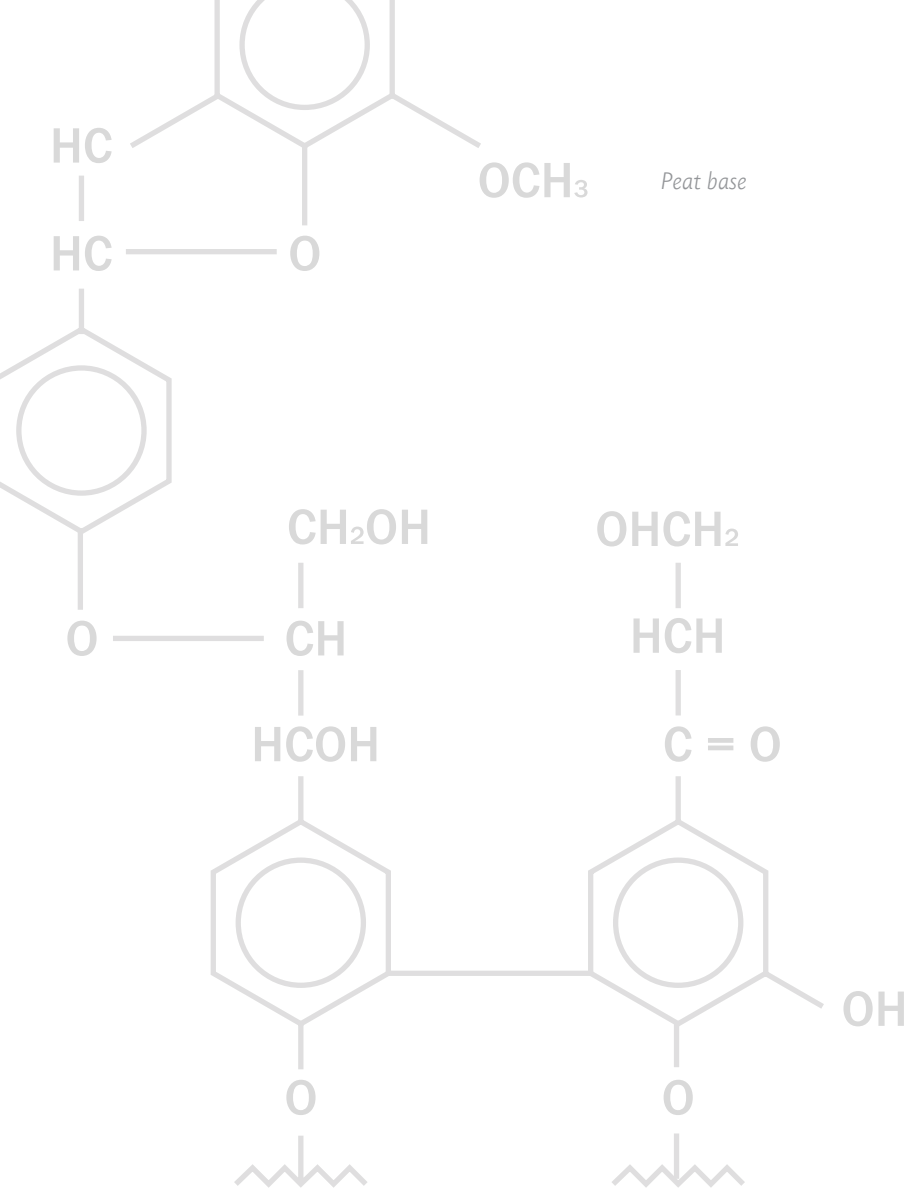
PHASE 5. DISSEMINATION (A): CREATION & PUBLIC PRESENTATION OF MIXED MEDIA ART WORKS & PERFORMANCES, IN BETWEEN REAL & VIRTUAL SPACES

Artists will experiment and create mixed media works in sound, video, 3D volumes, 3D architecture, texts, images, 2D and 3D animations, for example, that will be implemented in the UCXXI platform, in order to stimulate and promote the artistic and cultural dimension of the project. Artists will thus also initiate inter-connection with other artistic forms, based on real-time experimentation with image processing, contemporary poetry, performance, contemporary music events, broadcasting of independent radio programs, robotic installations and other experimental media. This inter-connectivity will help to modify existing creative strategies and make the revolutionary step into the age of mixed reality.

PHASE 6. DISSEMINATION (B): COMMUNICATION / PROMOTION

The public communication strategy is based on the establishment of a trademark "Underground City XXI" and use of different promotional tools, including the organisation of seminars, festivals, internationally announced conferences; website (such as www.undergroundcityxxi.com, www.artservis.org, www.artfactories.net, and other European cultural web sites) and banners on some internationally popular web sites, announcements and press releases for each project's activity in regional, national, and European printed and electronic media, production and public presentations of multimedia art works and performances, digital and printed brochures for UCXXI, flyers and posters, T-shirts, caps, stickers, badges and similar products with the UC XXI logo. Endorsements from UCXXI supporters such as well known artists, musicians, actors, models, sportsmen and other popular public figures, and public presentations of the initial and finalized platform will take place in Zagreb, Prague, Venice, Ljubljana, Belgrade, Vienna, at new media/electronic art festivals and events in Europe. ✖

Above: Origins, an interactive installation by Pascal Silondi in Labin, Croatia, 2007.



Peat base

THE CONCEPTION OF THE SELF IN MULTIPLE CYBER WORLDS

STEFANO CAVAGNETTO
BRUCE GAHIR

Questions relating to multiple selves and personal identity in multiple cyber worlds are a complex subject. It raises many difficult philosophical interrogatives. We call these questions, questions of the first type. What is a Person? Is it identical to my body? Is it my soul? How can there be continuity in time, and yet, a consistent identity? Is Personal Identity uniform? Moreover, how can we even know?

These questions become even more challenging and interesting when we consider multiple worlds outside of our world. In particular, once a clear approach to personal identity has been defined, what happens to identity when we consider many coexisting worlds at the same time? Does the approach remain consistent and are its consequences still acceptable? When questions of the first type are considered in multiple worlds, we call them questions of the second type.

In this introductory chapter, we will investigate the concept of the self and its relation to personal identity in multiple cyber worlds. This investigation has its own justification; several questions concerning personal identity are answered by constructing examples of thought experiments involving fictional worlds. Thus, it seems legitimate to us to discuss the problem in the framework of concrete alternative worlds, which we call cyber worlds. At the moment we just consider questions of the first type. Section 2 deals with a brief history of the problem of personal identity in philosophy and introduces the concept of the self. In Section 3 we introduce important conceptual frameworks that illustrate the idea of the self as composed of information in multiple cyber worlds and as a result pose some important questions to be investigated further, and we finally conclude with section 4 where we consider how some concepts from anthropology may be applied to the study of the Cyberspace. Some authors tend to confuse or overlap the concept of virtual communities or reality with the concept of Cyberspace because this is a rather vague concept. Here we consider virtual communities and virtual reality in a broader sense just one portion of the Cyberspace. Nevertheless, at the moment we are not going to try to answer fundamental ontological questions such as: what is a Cyberspace? Is it or does it have a dimension? We assume that there exists a Cyberspace, a sort of electromagnetic space, where a virtual interaction might be created.

A tree and a rock may be distinguished from one another in terms of their different properties. We might then go further and insist that this also forms the basis for ascribing individuality to them. This forms the basis of the so-called 'bundle' view of individuality, according to which an individual is nothing but a bundle or properties. We could formulate this as follows:

$$\mathbf{I(O_1) = (p1, ..., pn),}$$

where the identity of an object O_1 is denoted by $I(O_1)$ and it is given by the list of properties $p_1....p_n$. which are the properties that individuate this object. On this view, no two individuals can be absolutely indistinguishable, or indiscernible, in the sense of possessing exactly the same set of properties. This last claim has been expressed as the Principle of Identity of Indiscernibles (Leibniz, 1969).

A more thorough-going criticism of this property-based approach to individuality insists that it conflates epistemological issues concerning how we distinguish objects, with ontological issues concerning the metaphysical basis of individuality. Thus, it is argued, to talk of distinguishability requires at least two objects. Yet, we can imagine a universe in which there exists only one. In such a situation, it is claimed, it would be inappropriate to say that the object is distinguishable but not that it is an individual. Although we do not actually find ourselves in such situations, of course, it is still insisted that distinguishability and individuality should be kept conceptually distinct.

If this line of argument is accepted, then the principle of individuality must be sought in something over and above the properties of an object. One candidate for such a representation of substance, in which properties are taken to inhere in some way, was put forth by the English philosopher John Locke (1632 – 1704), one of the great pioneers in this area of research in the modern ages. In his fundamental work "An Essay Concerning Human Understanding" Locke (1689) claims that personal identity is founded on consciousness, and not on the substance of either the body or the soul. We are the same person in the sense of continuous consciousness between past and present in our thoughts and memories. Thus personal identity is fundamentally based on the repeated act of consciousness. In this respect personal identity is the identity of consciousness and not the identity of some substance. The body may change, but the person remains the same, argues Locke.

We can also draw a distinction between two types of questions about identity. First, we can ask what makes it true that an individual that we encounter at one time is the same individual that we have encountered at some earlier time. This is a metaphysical question – a question about being. It can be distinguished from a second question: how can we tell that an item encountered at one time is the same individual as that encountered at another? This is an epistemological question – a question about knowing.

The difference between the epistemological and the metaphysical question needs to be kept in mind. What "criterion" we can use to tell the difference between one thing and another is an epistemological consideration; a metaphysical consideration is one that determines whether one item is identical with another. The problem of identity over time is first and foremost a problem about change. How much can an individual change and yet remain the same individual? Are there particular kinds of change that an individual cannot undergo without ceasing to exist as the same individual? Certainly there are innocuous changes and everyday changes that individual items undergo without any threat to their identity. You can repaint your chair, yet the chair remains the same chair.

There are limits, however; there are changes that you could make to your chair that would mean that the chair no longer existed. If you were to dismantle the chair and use the pieces to make a sled, we could not say that the sledge was the same thing as the chair. But suppose that you dismantle the chair and immediately put the pieces back together in exactly the same way. In this case, many people would say that you have the same chair. But this raises some puzzles. Did the chair still exist while it was dismantled? Or did it go out of existence for a time, and then come back into existence? In the next section the areas that have been discussed will be examined further in relation to the idea of "identity" in MUDs.

SELF AND CYBERSPACE

Gilbert Ryle (1949) in "The Concept of Mind" provided a description of René Descartes' Mind-Body Dualism, where a categorical (ontological) distinction between mental activity and physical activity is presented which introduced the expression "the doctrine of the ghost in the machine". Personal identity is conceived with a psychologistic conception based on the doctrine of the Ghost in the Machine and with a materialistic characteristic. In this "Cartesian Theater," using terminology developed by Daniel Dennett (1991), the Self is not attached to the physical body, but rather is comprised of a collection of mental states. This vision of personal identity has a deep relationship with contemporary information theories. We may here look to Daniel Dennett's "Multiple Drafts Model of Consciousness" which is a theory of consciousness based upon cognitivism and views the mind in terms of information processing.

According to this model, there are a variety of sensory inputs from a given event and also a variety of interpretations of these inputs. The sensory inputs arrive in the brain and are interpreted at different times, so a given event can give rise to a succession of discriminations, constituting the equivalent of multiple drafts of a story. Each discrimination, as soon as it is accomplished, becomes available for eliciting a behavior; it does not have to wait to be presented in the theatre. In the next section we will look to this conceptual model for an explanation of the evolution of the real self when it interacts with the virtual environment.

To paraphrase Norbert Weiner (1954), the father of cybernetics, we may say that a person is something which can be sent in a telegraph. This indicates that the self can be considered as a body of information. The main point is that if a person is consists of nothing more than thoughts and memories, in other words, is composed

of information then this information can be reduced to a collection of bits. "The conception of Self as a body of information is realized in a rather interesting fashion in life on-line, for example, Second Life. In the process of constructing an identity on the internet, (homepage, nickname, and behaviour-text-based information) a person runs more and more of his/her life on-line, so that the manner in which he/she presents him/herself on-line constitutes a more central component of his/her identity" (Shay, 2006). We also might go further with our analogy of thoughts and memories to bits and say that people are simply programs, and that these programs act not only in the real world but also in virtual worlds, and in general, in cyberspace.

Figure 1 below is one way such a representation can be viewed.

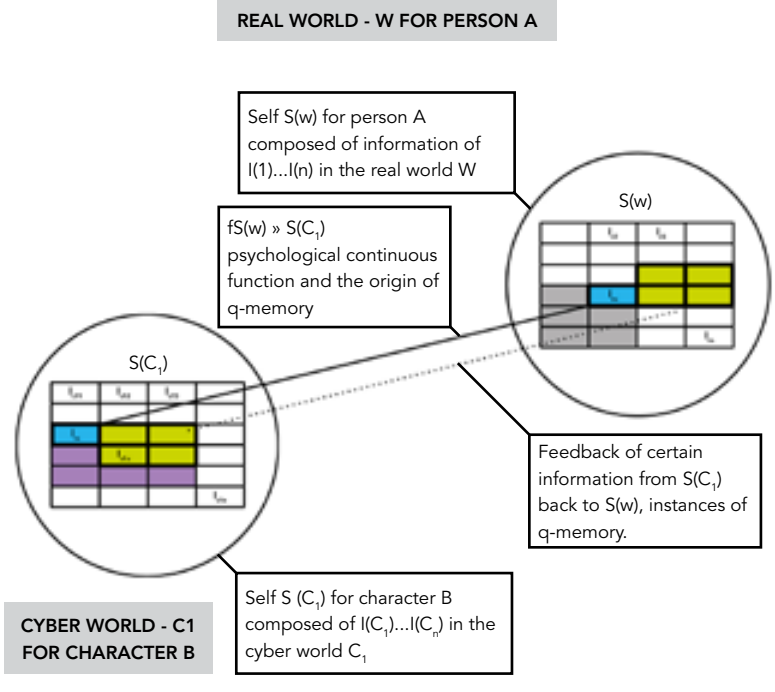


Figure 1: Representation of Real World Selves and their Interaction with the Cyber Worlds

Let the "real" world be symbolized by $\mathbf{W}$, this is the world where the individual exists and performs the daily duties concerning survival. The self in this world can therefore be symbolized by $\mathbf{S(w)}$ and according to what has been discussed above we could say that $\mathbf{S(w)}$ is composed of information from the real world, $\mathbf{W}$. This can be partly formalized as:

$$\mathbf{S(w) = I_{r1}, I_{r2}, ... I_{rn}}$$

Now, in the cyber world $\mathbf{C_1}$ the "self" can be $\mathbf{S(C_1)}$. The process of composition of this "new self" in the cyber world may utilize part of the information content $\mathbf{I_{rx}}$ from the real world $\mathbf{W}$. Via such an interaction with the cyber world $\mathbf{C_1}$, a "new self" $\mathbf{S(C_1)}$ is created, composed of specific information from the cyber world $\mathbf{C_1}$ and the real world $\mathbf{W}$.

$$\mathbf{S(C1) = I_{c11}, I_{c12}, ..., I_{rx}, ... I_{rc1n}}$$

An important point to note here is that $S(C_1)$ is a relation of $S(W)$, we could represent this as follows:

$$S(C_1) = R(S(W))$$

R takes on the role of a "psychological continuous" relation to be detailed later on. For example, part of what characterizes the self in the real world, labeled here as $S(W)$, could be represented by certain information content that the individual has experienced in the real world, such as being a generous person in general and in particular under certain circumstances being generous for self interested reasons. Experience related to this particular virtuous character could be symbolized by I_{rx}. When this individual interacts with the cyber world, C_1, under a different character, Irx is utilized to one's advantage with experiences encountered in the cyber world C_1, and as a result of this interaction a new "self" $S(C_1)$ is formed in this Cyber World. Therefore, a relationship between the real world and the cyber world is formed by such an interaction. We could assume that there are two series of thoughts governed by their respective information content, and that they are both mine, one in the cyber world and the other in the real world. Although these thought processes take place in distinct spatio-temporal locations, one could consider the feedback and the formation of the "new self" $S(C_1)$ associated with the formation of memories, with information content relating to events in the cyber world and the real world.

Here we can look to Taylor (2002) who discusses how social life is created online and how attendant communication occurs; in particular, he says that avatars are particularly powerful artifacts to consider. Avatars prove to be the material out of which relationships and interactions are embodied: much as in offline life with its corporeal bodies, digital bodies are used in a variety of ways- to greet, to play, to signal group affiliation, to convey opinion or feelings, and to create closeness. At a very basic level, Taylor says that bodies root us and make us present to ourselves and to others. Avatars form one of the central points at which users intersect with technological objects and embody themselves, making the virtual environment and the variety of phenomenon it fosters real.

In the above example the notion of presence in virtual worlds is invoked to relate information content Irx from my real self to the "creation" of the virtual self in the cyber world (see Fig. 1). Taylor continues to say that "presence" is one of the most elusive and evocative aspects of virtual systems; and yet it forms the very foundation on which immersion is built. It goes to the heart of what feels "real" and creates the quality of experience that signals to us "I am here". There is ample evidence to indicate (for example Warburton, 2006) that users do not simply roam through the space as "mind," but find themselves grounded in the practice of the body and the world. This grounding of presence in the virtual world not only consists of embodied practice, but of embodied social practice. The bodies themselves thus act as agents of engagement and in the virtual world users have learned to delegate their agency to body-representatives of other individuals.

The feedback to the real self could be formed of memories due to a combination of experiences and social interactions with characters in the cyber world. One could consider this as two sets of memories or information content in one mind: one of

them being due to my experiences in the real world, and the other belonging to the character in the cyber world. There is evidence that this feedback to the real self can be strong. Taylor discusses the case of "Meg" where the level of immersion into the virtual world had created a strong dependency and a connection with the real self, her digital body had come to be tied to her identity. Taylor also discovered that this was the case with most users. There are several questions that arise concerning identity of the self in virtual worlds in relation to what we have just discussed and elaborated upon in the previous section. For example, how is the identity of the real person related to their identity in the virtual world? What does the relation "R" that we have invoked consist of?

We may here look to Bernard Williams (1973) who presents similar arguments in relation to several puzzles about divided minds in the arena of personal identity. Williams presents arguments that cast doubt on the widely held view that people are essentially minds, or that mental or psychological considerations are decisive in issues of personal identity. He suggests that bodily continuity plays a critical role in establishing who the person is.

Williams begins by proposing that a memory belief will count as a genuine memory of an event only if that memory belief has been caused by that event; he also suggests that it may be important that the causal chain linking the event to the memory belief should not run outside the person's body. The question how can we distinguish between apparent and genuine memories is an old one, and has generated literature of its own. So, if I were to originate an avatar in Second Life and experience certain situations as my avatar, then Williams would say that these memories are not "memory beliefs" as the causal link runs outside my body. However, as discussed earlier, if there is relational feedback of experiences from the virtual world to the real world we could say that such memories could be memory beliefs of the type Williams is indicating. How do these memory beliefs relate to my being psychologically continuous with my avatar?

Parfit (1984) in his book "Reasons and Persons" insists that there is a gradual unfolding and development of a particular psychology. With reference to Fig 1, consider what it means to say that B's psychological states are continuous with those of A? According to Parfit we could say that a set of psychological states S_1 can be described as continuous with a later set of psychological states S_2 if S_2 is "developed" from S_1, either directly or through a series of intervening steps. Such a development process could be described by our "psychological continuous" relation. Although this process of development may involve change, any changes must be gradual. There are ways in which it is natural or appropriate for a line of psychological states to develop; for example, my belief that a friend is in danger naturally gives rise to a feeling of anxiety and a desire to help. In this sense, a continuous line of psychological states will develop in a way that is both gradual and natural.

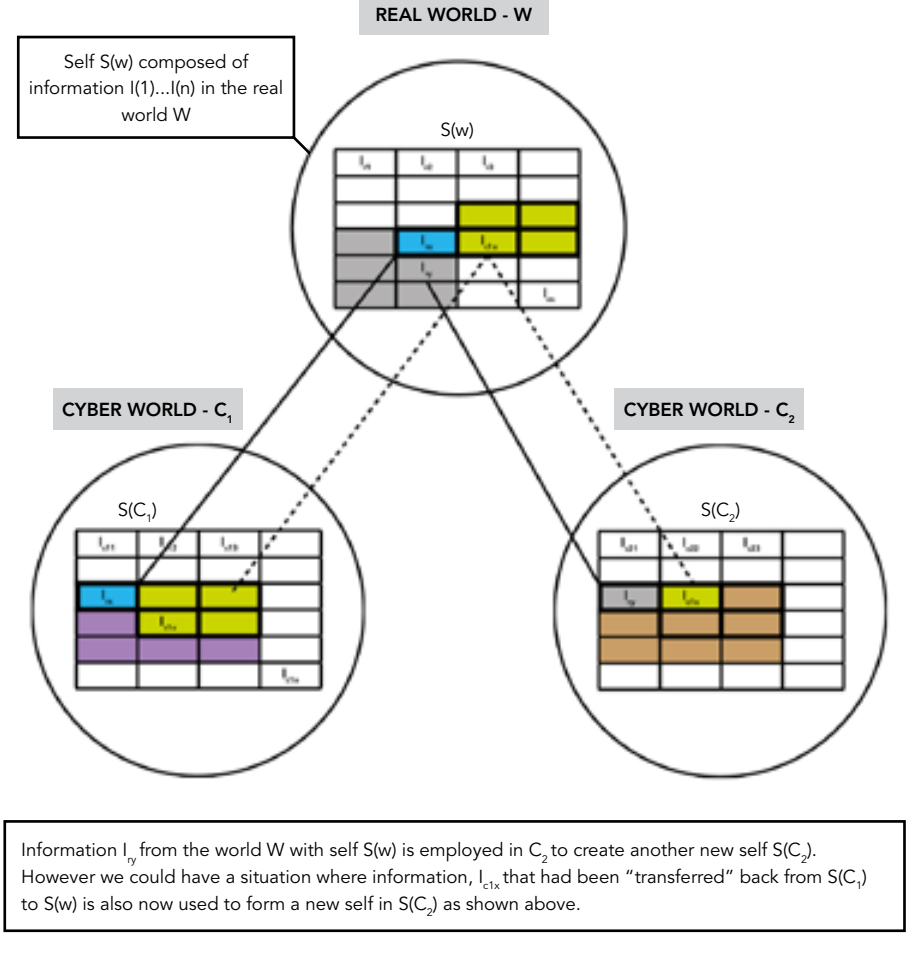
Why does Parfit suppose that it is psychological continuity that we care about, and not bodily continuity? He seems to be assuming that the pattern of our lives depends to a much greater extent on our psychological features than our physical qualities. Parfit introduces the idea of q- memory to get around the problem that continuity of memory presupposes identity. He presents a clear definition of q-remembering in his paper and bases psychological continuity on the notion of q-relations. The basic

notion underlying q-relations, such as q-memory and q-intentions, is that they do not presuppose the identity of the person. Paraphrasing Parfit' s definition of one such q-relation, q-memory must consist in: (1) a relation with a past experience that seems like a memory, (2) the actual happening of such a past experience to some person, and (3) the acquisition of the relation with the past experience in the normal fashion in which memories are acquired.

Thus, q-relations are a subset of relations (i.e., all memories, both real and apparent, are q- memories) and they avoid the problem of circularity, by not presupposing the identity of the one bearing a memory. Parfit bases psychological continuity on the continuity of q-relations, such as q- memory, q-intentions and q-anticipation, rather than on a one-to-one relation of psychological connectedness, of real memories, as does the memory theory of personal identity. Utilizing Parfit's idea we can develop our model and provide some substance to the relation "R", the "psychological continuous" relation mentioned earlier. "R" can be related to the idea of q-memory, such a relation will therefore be a relational mapping between S(W) and S(C) as shown in Fig. 1. "R" would thus be invoked whenever an individual forms an avatar and interacts in the virtual world.

We can extend this model and consider the interaction of several cyber worlds C_1, C_2,... this is shown below in Figure 2 below.

Figure 2: Representation of Several Cyber Worlds



Information I_{ry} from the world W with self S(w) is employed in C_2 to create another new self $S(C_2)$. However we could have a situation where information, I_{c1x} that had been "transferred" back from $S(C_1)$ to S(w) is also now used to form a new self in $S(C_2)$ as shown above.

Considering the interaction of several such multiple cyber worlds where multiple cyber world selves are composed. Several questions arise: how are these "layers of information" formed when the individual experiences these different cyber worlds? Do selves in different cyber worlds have the same kind of moral responsibility as they do in the real world, W? How can we characterize a "virtual moral experience" in such multiple cyber worlds?

Questions relating to identities in cyber worlds having moral status can be considered as reasonable because we started from our assumption that thoughts and memories are a collection of bits or simply programmes. If this is plausible, then the following question might be reasonable and well-founded as well: do programs have a moral status? As pointed out by David Cole (1991) in "AI and personal identity", a conception of self as a body of information allows the possibility of several persons to exist in a single body as shown in the above model where $S(W)$, $S(C_1)$, $S(C_2)$,....., $S(C_n)$ would all exist in a single individual. Advocates of these ideas tend to see unity of body as a motivation to accept a unified self; however since this conception of unity of body has been under attack since the late 20th century (Dawkins, 1990), and in light of the contradicting empirical evidence, this position is maintained by a minority of thinkers today (Shay, 2006). Another consequence of the conception of the self as a body of information is that a person might be seen as something decentralized and less consistent and uniform.

ANTROPHOLOGY OF CYBERSPACE

As it has been widely noticed, the Internet life emphasizes this embedding of personhood in the concept of information. "Life in virtual worlds enables these sorts of divisions, which are nothing more than projections of what exists internally. Several windows open simultaneously and multiple examples of the Self are replicated and projected into the Virtual space". Shay (2006) referes to this as the complementary approach. Cyberspace is the arena where divisions of the Self are possible. The space itself has a normative side which encourages this splitting and maintains a complementary role. Sherry Turkle (1997) in her "Construction and Reconstruction of Self in Virtual Reality: Playing in the MUD's[1] " interprets the cyberspace in this manner and it sees it as a realization of these ideas. She is influenced in this by Foucault (1975) and Derrida (1966), who assert that we live in a society that demands a coherent Self. Their work also emphasizes the fact that beyond the normative aspect this kind of society gives an intrinsic positive value to the self who is monolithic and uniform. This depends on the cultural context, and in fact in other communities the lack of consistency and uniformity is not only legitimate, but also welcome. Tribal examples are classic examples of situations where a decentralized or divided Self (which can occur, for instance, in a state of trance) is normative.

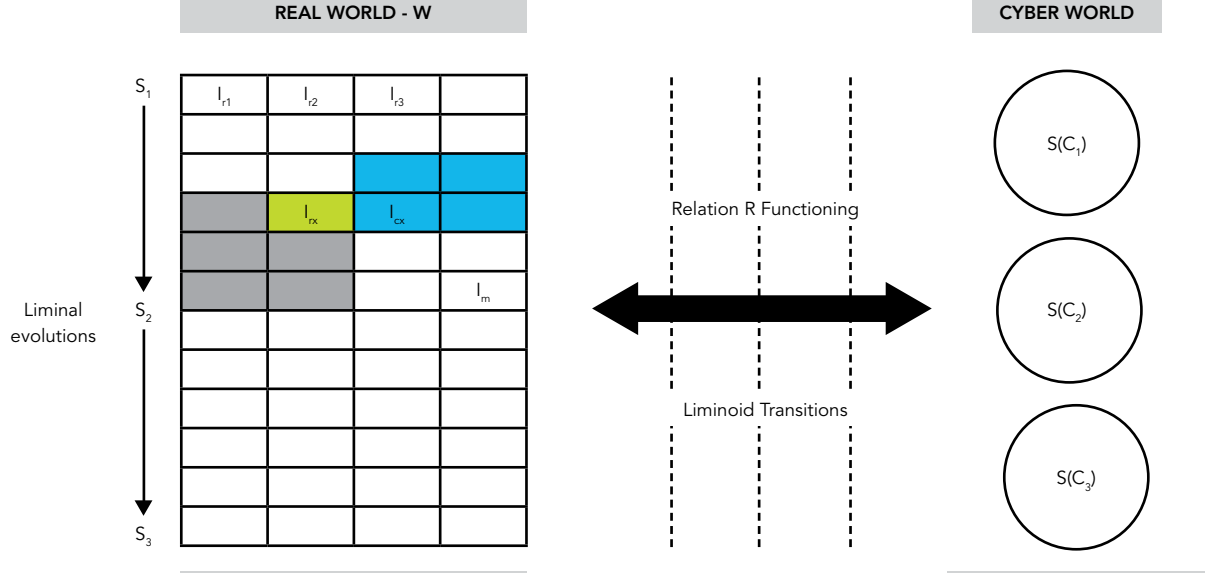
Technically these divided states are called "liminal states;" border-states where the Self is "neither here nor there". To the traveler in a rite of passage, personal characteristics become indistinct. She/he is not as she/he was before, but is still not what she/he will become. The liminal state is characterized by bizarre elements. Through abnormal strangeness, the traveler goes through deconstruction and reconstruction of subject. Thus the liminal state is infused with creative force and its space is an "anthropological arena", hidden and magical (Geertz, 1973). In this manner it configures itself in opposition to the familiar space where work and the normal life takes place. "Liminal entities are neither here nor there; they are betwixt and between the positions assigned and arrayed by law, custom, convention, and ceremony" (Turnea, 1964).

1 Multiuser Dungeon / Dimension. A Moo is a Object-Orientated MUD.

In modern society the liminoid state appears, and the difference between liminoid states and liminal states assumes great relevance when we examine the distinction between play and work. Liminoid phenomena emerge in feudal, but predominantly capitalistic societies, with a complex social and economic division of labor. With stress on individuality and open-ended processes, they are seen to occur within leisure settings apart from work, are experimental and exploratory, forming social critique and providing the potential for the subversion of the status quo. The essence of liminoid is characterized by the permanent change and the role-playing aspect which confers to the player a greater freedom and flexibility. Thus the main dissimilarity among liminal and liminoid states consists in the fact that the former are characterized by transitions towards some defined end where the change becomes permanent and stable. In this way, liminal cultural phenomena are perceived to be collective, integrated, and obligatory ritual action of pre-modernity, such as found in tribal and early agrarian cultures, enforced by necessity but containing the potentiality to create new symbols, models and ideas. They can be seen as collective representations, symbols having common intellectual and emotional meaning for all the members of the group. We can interpret liminal as part of the society, an aspect of social or religious ritual, while the liminoid is a break from the actual society (Floridi, 2005).

Cyberspace exhibits some liminoid characteristics, for example, anyone can join in a cyber community and be somebody else for a few hours as depicted by the model explained in Figs. 1 and 2 and detailed further in Fig. 3 below. Movement of the individual from the real world, W into the cyber world C1 in order to experience the cyber world and as a result allows for a composition of S(C1), and can therefore be considered as a liminoid transitional state. Such a state would allow the individual to have experiences that have characteristics of liminal experiences but are optional for the individual as such an individual can decide to engage or not engage with C1. The subject moves between leisure and seriousness, work and play, enters the virtual world and exits it, essentially a two way relational process once a virtual identity is formed.

Figure 3: Liminoid and liminal state analogies with the suggested model

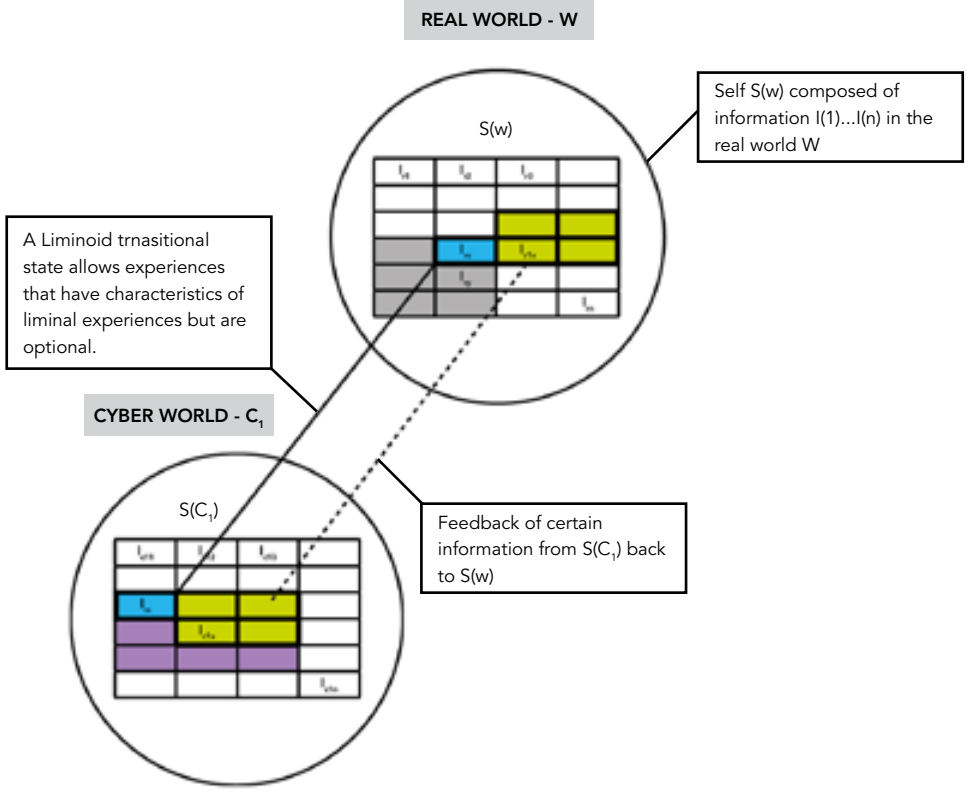


Liminal evolutions of the self in the real word as "layers" of information are formed after experience from the cyber world. Similar "layering" can also exist in the cyber world.

A liminoid transitional state allows experiences that have characteristics of liminal experiences but are optional.

The liminal evolution of the self can be viewed as the composition of memory layers of information forming the self after experiences from the virtual world as shown in Figs. 3 and 4. Essentially a one way process is taking place between the real and virtual worlds. Every social interaction in cyberspace contains a dominant component of playfulness which weakens the normative side of work, and the cyberspace game becomes a social simulation for the outside world in which the main actor is a hybrid social player that moves in a different dimension and explores a different interaction.

Figure 4: Representation of Real World Selves and their Interaction with the Cyber Worlds as Liminoid States



CONCLUSION

In this introductory chapter it has been our intention to produce a framework for assisting in the formulation and development of the concept of identity in virtual worlds. A two way psychological continuous relation anchored in Parfit's q-memory was put forward as a mode that connects the real self with the virtual self (the avatar). From an anthropological point of view, a liminoid state was related to the two way interaction that mediates the real self and the virtual self. The liminal state was related to the evolution of layers of information that defines the self in both the real and virtual worlds after the initial relationship relation has been initiated. Several questions have been raised as a result of these elaborations, and it is our intention is to explore these further in future chapters of this book. ✖

MULTIPLE PERSONALITIES & THE PROTEUS EFFECT IN COLLABORATIVE VIRTUAL ENVIRONMENTS

A WITTGENSTEINIAN VIEWPOINT

STEFANO CAVAGNETTO
BRUCE GAHIR

This chapter details a paper that was presented at the 8th International Cyberspace Conference, November 2010, Brno, Czech Republic. It builds upon the ideas in an earlier paper presented in the same conference last year.

Some important questions that concern the nature of identity and personality in virtual environments lead to interesting consequences. For example, what does it mean to be you in a virtual environment? How drastically can a person change and still remain, in the eyes of either themselves or their peers, the same person when being involved in collaborative virtual environments? Until recently, these questions were typically asked in the context of philosophy, psychoanalysis, or science fiction. However, the increasingly common use of avatars during computer- mediated communication and collaborative virtual environments (CVEs) in particular, are quickly changing these once abstract questions into practical quandaries. Such quandaries are fascinating, thought-provoking and potentially paradigm-shifting for those who study social interaction, and could be devastating to the traditional concept of human communication.

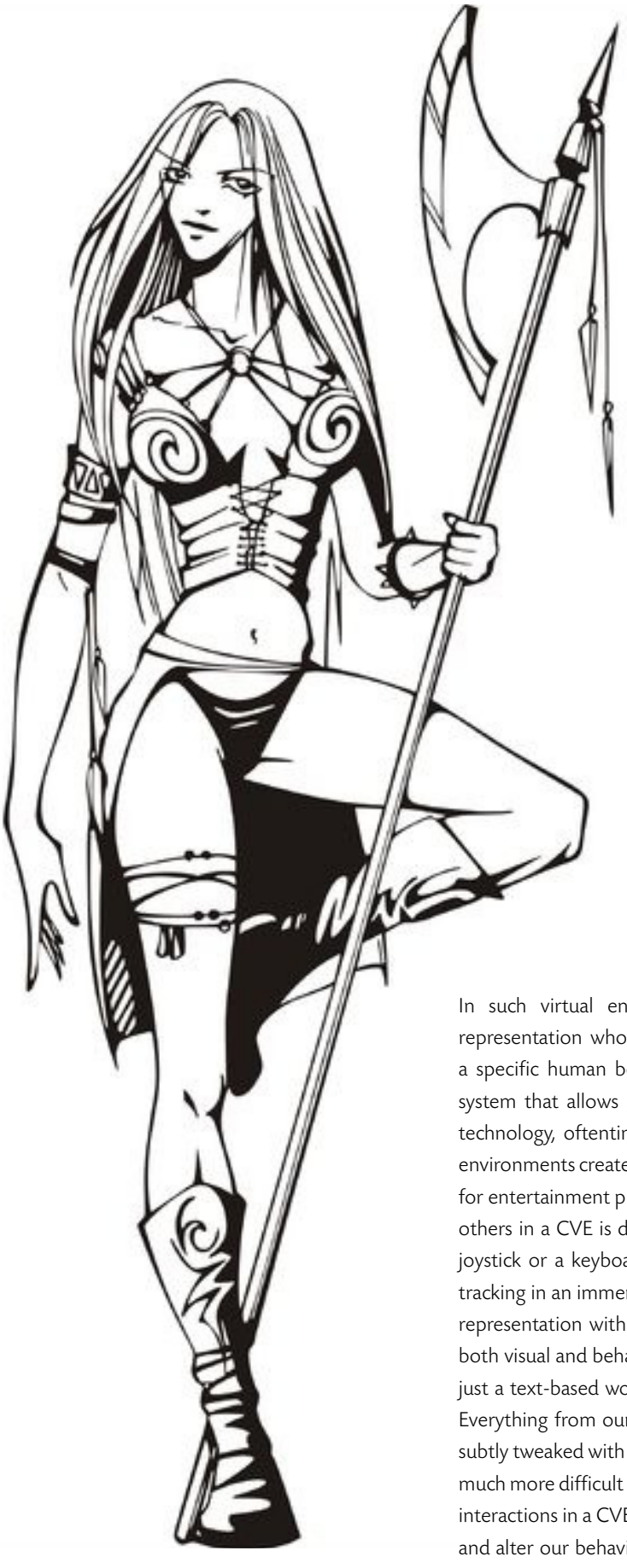
Given the advent of collaborative virtual reality (CVR) technology, researchers have begun to systematically explore the phenomena of *Transformed Social Interaction* (TSI) (Bailenson, Bealle, Loomis, Blaschovich, Turk, 2004). The *Proteus effect* is a particular application of TSI in which a user's self-representation is modified in a meaningful way that is often dissimilar to the physical self. When the user then interacts with another person, the user's behaviour conforms to the modified self-representation regardless of the true physical self or the others impressions (Yee, Bailenson, 2007). In an earlier introductory paper (Cavagnetto, Gahir, 2009) we detailed a conceptual framework that illustrated the idea of the self as composed of information in multiple cyber-worlds, this tentative framework was utilised to explain a "layering" feedback process that may occur as a result of the self interacting in a CVE, in addition we expanded this framework to integrate an anthropological viewpoint of the self (Turkle, 1997).

In this chapter, we provide a further understanding of the relationship between the Proteus effects and the conceptual model of multiple virtual personalities interacting in CVE. Using the Wittgensteinian language-games framework, we expand our earlier paper to incorporate the notion of a "virtual personality" and "virtual game grammar" to explore the earlier framework from a conceptual point of view, it is our intention that this may hopefully bring a refreshing approach to examining the Proteus effect. When people play video games and interact in virtual environments, they adopt social stereotypes and roles (e.g., soldier, doctor, mafioso, wizard) and interact in situations that go beyond real life (Shapiro, Pena, Hancock, 2006). In doing so, people "become" someone else by employing digital bodies or *avatars* that serve as users' self-representation in a virtual setting (Eastin, 2006; Yee, Bailenson, 2007).

In most cases, the morals of multiuser game characters are implied by the appearance and the stereotypical associations raised by their avatars (Isbister, 2006). For instance, one visual stereotype is that evil characters are portrayed by pale avatars dressed in dark clothes (e.g., Arthas in the lore of World of Warcraft), while good characters are usually depicted in light and vivid colours. We employ avatars to represent ourselves in computer-mediated settings, but does our cognition change in relationship to our virtual persona? And if so, what mechanisms underlie the influence of avatars on users cognition?

Initial studies have uncovered reliable evidence that avatars can affect users behaviour. Consistent with the prediction that attractiveness bestows more confidence in social interactions, Yee and Bailenson (2007) found that, in an immersive 3D environment, participants using avatars with more attractive faces walked closer to each other and disclosed more information when compared to those using avatars with less attractive faces.

In addition, consistent with the assumption that tallness confers higher status, participants using taller avatars tended to negotiate more forcefully in comparison to those using shorter avatars. Yee and Bailenson (2007) referred to the effects of virtual self-representations on users as the Proteus effect (PE). Building on self-perception theory (Bem, 1972), Yee and Bailenson (2007) hypothesized that the Proteus effect is explained by people evaluating themselves as an imaginary third party would, observing their own behaviours to explain what attitudes may have caused them.



"Avatars with more attractive faces walked closer to each other and disclosed more information when compared to those using avatars with less attractive faces."

In such virtual environments, an avatar is defined as "a perceptible digital representation whose behaviours reflect those executed, typically in real time, by a specific human being" (Bailenson, Blascovich, 2004, pg. 65). A CVE is a digital system that allows geographically-separated individuals to interact via networking technology, oftentimes with graphical avatars. Thus, CVEs encompass both digital environments created for communication applications as well as online games created for entertainment purposes. The manner in which a user navigates and interacts with others in a CVE is dependent on the particular system itself. This can range from a joystick or a keyboard in a video game to a headset with translation and rotation tracking in an immersive virtual reality system. CVEs allow us to tailor our digital self-representation with a degree of control not possible elsewhere. This encompasses both visual and behavioural changes. First of all, CVEs, whether a 3D online game or just a text-based world, give us a great deal of control over our self-representation. Everything from our age, gender, ethnicity, or height can be dramatically altered or subtly tweaked with a few mouse clicks. Analogous changes to our physical bodies are much more difficult (or impossible) to accomplish. Because digital systems mediate all interactions in a CVE, the digital system can also be programmed to strategically filter and alter our behaviors. This has been referred to as Transformed Social Interaction (TSI) (Bailenson, Beall, Loomis, Blascovich, Turk, 2004).

Research in computer-mediated environments (Walther, 1996) has shown how the technical affordances of these environments can lead to more intimate interactions. For example, the limited communication channel together with self-presentation biases leads to a positive bias in impressions among interactants. Instead of focusing on the structural affordances of the computer-mediated environment, studies in TSI have shown how strategic changes in an avatar's appearance or behavior can affect how other users interact with that avatar, such studies TSI show that subtle changes in an avatar's appearance or behavior can influence how other users interact with the transformed avatar. The current work of Yee and Bailenson (2007), has explored an interesting variation of this effect. Instead of exploring how an avatar's appearance can change how other people behave, they were interested instead in how an avatar's appearance can change the user's own behavior.

Bruckman's work (1993) in MUDs has shown how avatars can change a user's behavior. In the case of gender-bending, "many people, both male and female, enjoy the attention paid to female characters. Male players will often log on as female characters and behave suggestively, further encouraging sexual advances" (Bruckman, 1993). The same observation has been noted by Suler (1996) in his participant observation study of the Palace, a graphical avatar space that was a precursor to the avatar-based online environments available today, that expanded on the technological capabilities of existing MUDs. As such, the Palace blended the features of graphical CVEs and the ad-hoc communities of MUDs. In the Palace, "a seductive, sexy, or simply 'attractive' avatar can have a powerful impact on other members". These anecdotes suggest that a two-way process may be at play. A seductive avatar elicits more attention from other users, but, as Bruckman suggests, the seductive avatar may also enable or embolden the user to act in a more flirtatious manner. This is also reported by Suler. He notes that "many members have told [him] that what they are wearing affects how they behave, as well as influences how others will react to them" (Suler, 1996). These studies suggest that our avatars can change our personalities by changing how others interact with us, and more intriguingly, by changing how we behave directly by enabling certain behaviours.

Studies in self perception have shown that altered self-representations can directly lead to changes in a person's behaviour. Self perception theory argues that people infer their own attitudes and beliefs from observing themselves as if from a third party (Bem, 1972). For example, when participants were made to believe that their own heartbeat increased while viewing certain photographs, they rated the people in those photographs as being more attractive (Valins, 1966). This is because participants assumed that a photograph of an attractive person causes heightened arousal which in turn led to an increased heartbeat. When participants observed their heartbeat increase, they inferred that it must have been due to heightened arousal, which in turn implied that the person in the photograph was attractive. Thus, an observation of their own behaviour led participants to modify their attitudes.

In addition to observations of one's own behaviour, it has also been demonstrated that observations of one's own appearance can lead to changes in behaviour. Frank and Gilovich's (1988) paper on the effect of wearing black uniforms best illustrates the causal chain underlying this process. They were interested in whether wearing black uniforms causes athletes to behave more aggressively. In a set of four studies, they first demonstrated that blind coders rated athletes wearing black uniforms as being more aggressive than athletes wearing uniforms of other colours. In the second study, they explored whether athletes wearing black uniforms were more aggressive in actual athletic events. They analysed past records from the National Football League and the National Hockey League to show that teams wearing black uniforms received more penalties than teams wearing uniforms of other colours. We may now invoke Wittgenstein's language games as a possible framework for CVE's.

Through his articulation of language and its practice as a type of game, Wittgenstein has been both adopted and critiqued for purposes of circumscribing what are now commonly held as the necessary constituents of games. These include a games systemic nature and the acquiescence of the participants to an agreed-upon rule structure: a set of rules which Wittgenstein likens to the "grammar" of language. However, the relatively recent consideration of Wittgenstein's work as a contributor of modern game theory and its application to virtual environments is intriguing given that it was Wittgenstein who originally turned to games as a model for the dynamics, boundaries and rule-based activities of language. Wittgenstein's view of language in the *Philosophical Investigations* seems to be as an activity that involves the uses of words as tools. In this interpretation words have a multiplicity of uses. If one wants to understand the meaning of a word then one has to understand the uses to which it is put. It is confusing, therefore, to consider words as merely standing for objects.

According to Wittgenstein, philosophy does not bring out theories, nor does it attempt to find objects for words as labels. A constant position in Wittgenstein's philosophy is that "philosophical problems" arise because language is misconceived, misunderstood. For him the expression "to investigate philosophically" means to attend to the uses of language and to come at a problem from numerous directions. Understanding language on the model of games, Wittgenstein asserts that games, like languages, are rule-based modes of practice that are to be considered part of their own "form of life" (1953, p. 11). This is not to say that "form of life" is a designation exclusive to games or even languages, but acknowledging games as being embedded within "forms of life" is undoubtedly the first step in using Wittgenstein's concept of language-games as a means to conceptually examine "virtual game play"[1]. Wittgenstein's detailing of language-games and forms of life supports the idea that a language-game itself is not only a culmination of words and utterances, but a meaningful activity: a practice that intones a particular organic quality and which is ontologically rooted in the dynamism of those participating. It is an activity capable of changing, evolving and growing through its very conduct. A nebulous and yet fundamental concept, "forms of life" to Wittgenstein are what enable language-games to function as they do: They are the fertile soil that allows the growth and development of language-games and act as the basis from which language grows and develops. Forms of life are thus the underlying foundation for human understanding and meaningful exchanges within particular conditions and cultural contexts and thus for language-games themselves (Brenner, 1999) (Finch, 2001). They are the "common behaviour of mankind" (Wittgenstein, 1953, p. 82).

1 We are here using the term "virtual game play" to stand for game playing in CVE specifically of the types examining the role of the Proteus effect.

Virtual games may therefore be viewed as being constantly protean and culturally situated phenomena rooted in action and in practice, and this notion is exemplified by Wittgenstein's allegory of the "builder's language": a series of fictional exchanges in Wittgenstein's Philosophical Investigations, which depict two individuals communicating with one another in an effort to build a structure from a collection of materials. Builder scenarios feature one individual who gives instructions to the other, who through a common understanding, must retrieve the appropriate materials and supply them as asked. Wittgenstein makes use of the builders' language vignettes in order to explicitly bring the resulting praxis that stems from language exchange to the fore, but he also does so to accentuate in particular how the use of language constructs and reinforces meanings within a particular language-game. To Wittgenstein, language moulds and massages the contextual reality shared by its users and it is here where the notion of epistemology begins to emerge in Wittgenstein's discussion of language-games. Language becomes the form with which we express and describe our knowledge and which subsequently reinforces it. The meanings and descriptions that become associated with words through the use of rules consequently shape conventions: the shifting rule-based foundations of language-games.

With a sense of Wittgenstein's epistemology in tow, outlining what constitutes "virtual game play" is crucial. What can we learn by mobilizing Wittgenstein's "language games" approach to epistemology as a way to interrogate virtual game play and the intentional structuring of games themselves? At first glance, as with many other processes, activities and rituals, virtual game play has its own language: its own terminologies, its own discourses, its own way of addressing phenomena within the "space" of the game, within a genre and within a method of development (i.e. programming tools).

There are also the languages of play within a "virtual community" : the manipulation and exchange of formal language transformed into action, the following of rules, the abidance of etiquette, colloquial banter and the development of terminology. These elements are simultaneously situated within and contribute to the very act of play: they are the languages and the activities constitutive of the language-game of "virtual game play". The idea of looking at the way which language shapes the way we speak and ask questions within any 'form of life' as outlined in Wittgenstein's example of Greek philosophy already demonstrates a glimmer of relevance to game design--but what is it that "virtual game players" are actually doing?

First, there is a literacy involved in the participation in a given domain, a kind of semiotic domain, including the linguistic and practical conventions and knowledge of the rules, signs and meanings of those signs (Gee, 2001).

Secondly, we can consider semiotic domains as designed spaces, and much like Wittgenstein's language games. Gee places great emphasis on the practice that has gone into the construction of, and participation in, semiotic domains. A semiotic domain then can denote the practice of anything from "baseball" to "stamp collecting" to "stock market investing" and although Gee would note that CVE's give access to their own semiotic domains, these domains have the potential to be designed and laden with subject matter that carries with them their own set of practices and multiple modalities.

Lloyd Rieber (1996) argues that these domains, or "microworlds" as he terms them can be designed or changed and he cites the example of a child's sandbox where different elements can either be added (such as buckets, shovels) or even changed (larger buckets, differently shaped shovels).

We could adopt the phrase "virtual game player's grammar", which could refer to the rules that organize elements in a "virtual game player's space", a kind of semiotic participation space that sets the standards and rules for participation in that virtual domain. Wittgenstein describes grammar much in the same way theorists frequently describe play itself: the rules, degrees of freedom and the loopholes that support potentiality and possibility within language (Wittgenstein, 1953; Salen, Zimmerman, 2001). Grammar serves as the fundamental groundwork in the creation, negotiation and comprehensibility of semiotic domains. One could consider such semiotic domains as virtual communities, according to semiotician Yuri Lotman, "every culture begins by dividing the world into 'its own' internal space and 'their' external space"; this is the main function of the boundary, which he defines as "the outer limit of a first-person form" (Lotman, 2001, pg. 131). Analogously, virtual communities delimit their semiotic space through topics of interest, which can be expressed by keywords that have the function of outlining the relevant field of communication of the community, i.e. of establishing the topics members are allowed to discuss about or the way players are supposed to play the virtual game.

Following our earlier work (Cavagnetto, Gahir, 2009), we could model the above as information content Irw contributing to the formation of a personality P(W) of the player in the real world W, what Gee has referred to as the real person. If we now assume C_1 to represent a virtual gaming community, a semiosphere, then we could define $P(C_1)$ to represent the "altered" personality of the player while being immersed in such a community, being referred to above as the virtual character. The feedback of certain information from activity in the cyber-world influencing the personality of the player, eventually leading to the Proteus effect, could be described as the projective identity (Figure 1). Thus, conduct within a language-game can be conceived of as the crafting and constant refining of semiospheres that can be viewed as virtual communities with their respective virtual grammars. What Wittgenstein essentially adds to our own conceptualization of a "virtual game player's space" is the epistemological ramifications of the "grammar of play". Being thoroughly entrenched in the language of a given language-game is to be bathed in the conventions, accepted modalities and ideologies that support a way of knowing and taking part in the language-game itself.

Virtual personality, created through the transmission of knowledge and values in semiospheres, through education and virtual communities, through virtual remembrances, and through our own ideals and symbols, can therefore be viewed as more shifting, fluctuating, mobile, and protean than ever. The opportunity for social interaction in virtual communities therefore creates a sense of immersion and engagement different from anything that sensory or motor realism alone can provide (Schiano, 1999). Personality cues are few in the virtual world; they still exist, but in different ways. For instance, people adjust themselves to the nuances of email addresses and signature styles. Virtual reputations are developed and maintained or challenged and blasted. By looking closely at these cues, at how they work and when they fail, we can learn a great deal about interaction within on-line environments.

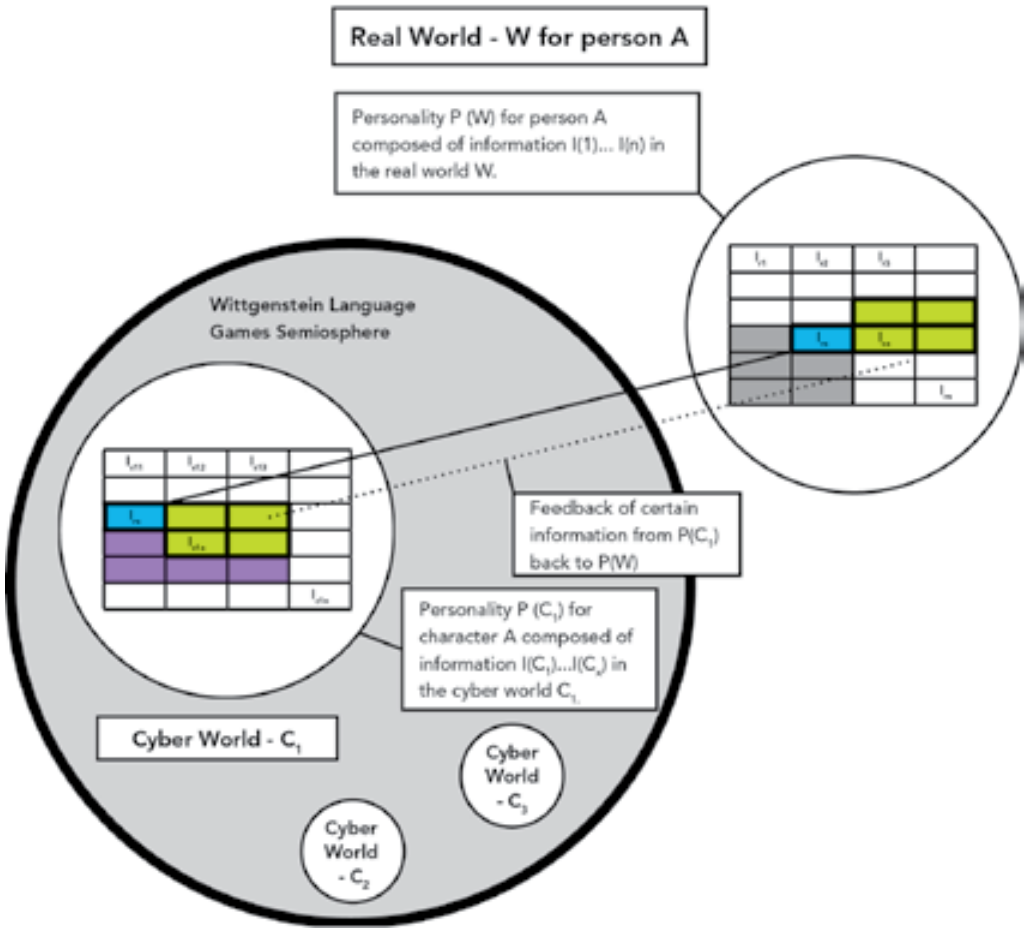


Figure 1: Depicting the analogy of personalities in cyberworlds and James Paul Gee's Identities

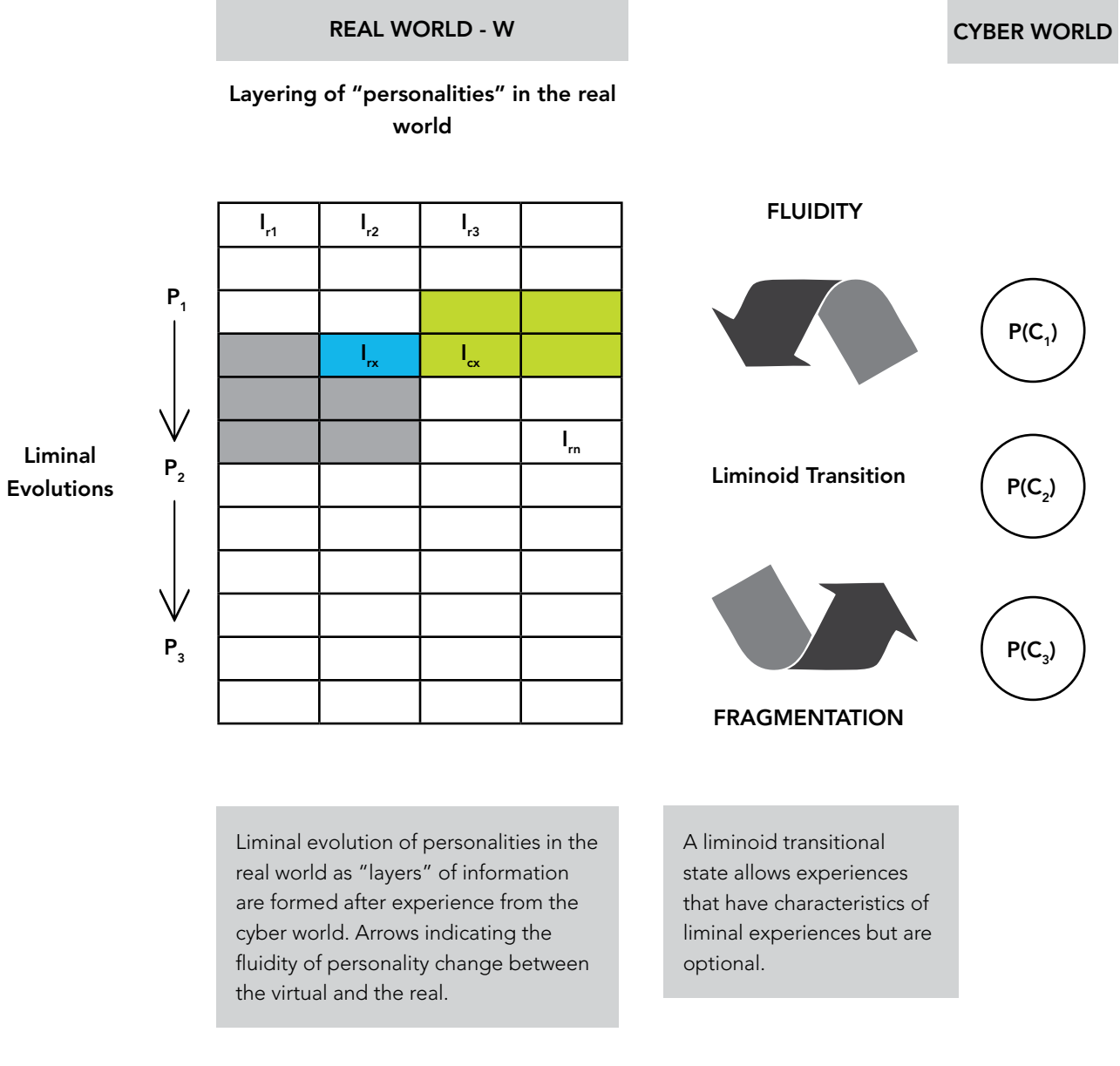
From a semiotic perspective, the difference between the look and the self is important for the construction of virtual personality, taking on a new symbolic form in the virtual world. The idea that virtual identities are divergent from identities in the real world is common sense. Indeed, on the Internet, identity is occupied by an outside beyond itself (Day, 1999), that is, an Other, a "self" online that cannot be denied because the very existence of consciousness in the real world also implies the existence of consciousness in cyberspace, where the self takes on a different meaning and where every personality is represented rather than real. This justifies the existence of Otherness. Otherness dwells in identities and systems – both in their production of meaning and in their interpretation. Personality does not exist without meaning and interpretation, even in cyberspace. Therefore, in order to play the role of the Other, one has to produce meaning and interpretation.

However when dealing with interaction between humans and machines, individuals are confronted with a compound system of personalities, language, and (visual) communication, all of which are part of a web. Goffman (1969) describes the web as a medium that represents a separation from previous modes for the presentation of self in everyday life. Geertz (1973, pg. 5) adds that the human being is an "animal suspended in webs of significance he himself has spun". The virtual world is a world of opportunities for intrapersonal and interpersonal semiosis to occur.

2 The ideas presented here relating to Liminal and Liminoid states are detailed in our earlier paper, Cavagnetto, S., and Gahir, B. (2009). The Conception of the Self in Multiple Cyberworlds, paper presented at the 7th International Cyberspace Conference, Brno, Czech Republic.

Given the magnetism and power that the Internet has on our perception and on our semiotic practice, it is obvious that not only our personalities but also space and time are being modulated in the virtual world. Indeed, the traditional demarcation between image, language, and writing is beginning to move in a radical way. Virtual environments such as the Internet have the power to create personalities and enable us to explore very new forms of authorship in a way that expresses emergent meaning. These environments can be navigated, engender new forms of experience, and be modified or radically restructured. Consequently, our personalities begin to fluctuate or, more accurately, to float in that new space, a semiotic space. As a matter of fact, one of the unique qualities of the virtual environment is that it enables the web user to have a more free-floating experience of perception. In the virtual world, he or she might choose to occupy various positions that would not be possible within actual space, where the individual's identity has a physical component.

Figure 2: Illustrating the fluidity of personality and its relationship with Liminal and Liminoid States[2].



As we have seen, virtual masks and nondisclosures of identity are part of the grammar of cyberspace. Deception on the Internet, however, is not always acknowledged as such, by the receiver or the sender of the message. Philosophers like Turkle (1997) argue that human beings are not deceptive on-line because they do not really become someone else (what they actually do is split their personalities into real life and on-line parts. An individual's personality, she contends, "is the sum of his or her distributed presence". The personality no longer simply plays different roles in different settings. Rather, the personality exists in many worlds and plays many roles at the same time (Turkle, 1997). Having multiple personalities in cyberspace is not a deception but extends the range of selves that are available, what we term as the layering effect, as depicted by figure 2. People self-fashion and self-create. They "are able to build a self by cycling through many selves" (Turkle, 1997, pg. 178). From this critical perspective, there is an extension rather than a different order of existence because personality is "something complex and decentered" (Turkle, 1997, pg. 20), as well as dispersed and multiplied in continuous instability (Poster, 1990). This is why we should talk about "alterity" instead of difference. The belief that individuals are unitary is itself an illusion (Turkle, 1997).

From all this, we may conclude that the boundaries between the virtual and the real are blurred, that cyberspace is a myth with its own reality and its own place (or "space"). Myth symbolizes the relationships among human beings and "real" multiple personalities. In doing so, myth establishes a rapport between communication and understanding. As Barthes (1972) puts it so nicely: from the beginning, myth is a communication system and a message.

Thus, with these new forms of space and time, specifically in reference to cyberspace, a provocative model through which to consider the process of personality evolution is being presented. The changes of personality begin to converge under the sign of the virtual environment. We enter the nature of the real that enables the virtual, and the virtual that enables the real. Personality then becomes a flux between the virtual and real depicted by our model, a flux or, as Rheingold (1998, pg. 84) suggests, a "fluid" in the sense that we take a fluid role in the construction of real and virtual personalities through different levels and qualities of interaction within the semiosphere and its language games. The Proteus effect therefore becomes a consequence of such fluidity within a semiosphere and since fluidity implies that something can be manipulated on the whims of its creator; it also implies fragmentation - a term of post-modern identity construction - fluidity and fragmentation therefore co-exist within the grammar of virtual games. While modernist conceptions of personality are based on the ideal of a stable, unchanging personality, post-modernism sees personality as continuously being reconstructed (Deibert, 1997). In other words, in the construction of virtual personalities, the disembodied worlds of the Internet and cyberspace seem to be a symbol of post-modernism, where many of the basic cues to personality and the social roles we are accustomed to in the physical world are absent. As a result, individuals lose their consistency, and their real lives suffer because they are living a lie and further, suspect that those with whom they communicate are also guilty of deception. (In a similar vein, individuals are in contact with people from different cultures and with people they have met only as virtual constructs). Consequently, by interacting beyond the stigma of real life, it is difficult to determine how personality is to be projected and what role it plays in our grammar of virtual games. ✖

MORALITY AND ARTIFICIAL AGENTS IN CYBERSPACE

Artificial agents, particularly those in cyberspace, extend the class of entities that can be involved in moral situations. In this paper it is our intention to present arguments that show that such artificial agents can be conceived as moral agents.

In section 1 of this chapter we analyse the concept of an artificial agent (AA), from a broad point of view, without any particular emphasis in relation to avatars in Multiuser Dungeons (MUD's). In section 2 we introduce the fundamental principle of a "level of abstraction" (LoA) as defined by Floridi (2009). The reader is invited to pay particular attention to this section as it is essential for the current development of ideas and its application in any ontological analysis is crucial. We then continue to expand upon the idea of an artificial agent as an information object that has intrinsic value and hence moral worth. Finally we review the consequences of the above approach for artificial agents in cyberspace and conclude that the framework provided by Floridi is a pluralistic approach that is essential to the development of a global information and computing ethic at the cross-cultural level.

CHARACTERIZATION OF ARTIFICIAL AGENTS

Complex biochemical compounds and abstruse mathematical concepts have at least one thing in common: they may be unintuitive, but once understood they can all be defined with total precision, by listing a finite number of necessary and sufficient properties. Mundane entities like intelligent beings or living systems share the opposite property: one naively knows what they are and perhaps could be, and yet there seems to be no way to encase them within the usual planks of necessary and sufficient conditions.

The term "Artificial Agent (AA)" is a similar entity that is difficult to define. AA's are often described as entities with attributes considered useful in a particular domain or what Floridi would refer to as a level of abstraction. Several researchers (Bradshaw, 1997) have attempted to provide a meaningful classification for the attributes that AA might have, some common ones can be listed as follows:

- **ADAPTIVITY** – the ability to learn and improve with experience.
- **AUTONOMY** – goal-directedness, proactive and self-starting behavior.
- **COLLABORATIVE BEHAVIOR** – the ability to work with other agents to achieve a common goal.
- **INFERENTIAL CAPACITY** – the ability to act on abstract task specifications.
- **'KNOWLEDGE-LEVEL" COMMUNICATION ABILITY** – the ability to communicate with other agents with language more resembling human-like "speech acts" than typical symbol-level program-to-program protocols.
- **MOBILITY** – the ability to migrate in a self-directed way from one host platform to another.
- **PERSONALITY** – the ability to manifest attributes of a "believable" human character.
- **REACTIVITY** – the ability to selectively sense and act.
- **TEMPORAL CONTINUITY** – persistence of identity and state over long periods of time.

According to these attributes, AA's could be classified as showing weak or strong notions of agent-hood (Jennings, 1997). The weak notion of agent-hood, which comes from Distributed Computing (DC) and Distributed Artificial Intelligence (DAI), sees AA's as a paradigm of network based cooperative automation. The strong notion of agent-hood, from Artificial Intelligence (AI), leads towards an anthropomorphic view where AA's are seen as conscious, cognitive entities that have feelings, perceptions and emotions just like humans (Mamdani, 1998).

Classifying the above attributes as:

$$\mathbf{a_1, a_2, a_3, \ldots\ldots, a_n}$$

we could formulate a set-theoretic framework for agent hood (A_{gh}) as:

$$\mathbf{A_{gh} = \{a_1, a_2, a_3, \ldots\ldots, a_n\}}$$

In other words, agent-hood can be formalised as a set of attributes that define a minimal level at which one could consider interaction as being an important attribute of AA's, from the point of view of developing an agent-relative framework of morality, since AA's recurrently interact to share information and to perform tasks to achieve their goals. In this case if we let,

$$\mathbf{a_1 = Interaction}$$

then

$$\mathbf{A_{gh}^* = \{a_3\}}$$

where

$$\mathbf{A_{gh}^* \acute{I} A_{gh}}$$

We could further define each attribute a_1, a_2, a_3…., a_n in terms of a set of elements, thus:

$$\mathbf{a_1 = \{e_1, e_2, e_3, \ldots\ldots e_n\}}$$

where e_1, e_2, e_3,……..e_n would define the key elements of the attribute a_1, e.g. if a_1= Interaction then the key elements of interaction could be defined as:

$$\mathbf{e_1 = A\ common\ agent\ communication\ language\ and\ protocol}$$
$$\mathbf{e_2 = A\ common\ format\ for\ content\ of\ communication}$$
$$\mathbf{e_3 = A\ shared\ ontology}$$

Researchers investigating agent communication languages mention these three key elements as essential components of multi-agent interaction (Finin, Labrou, Mayfield, 1997), Floridi defines his guidelines for "agent hood" as:

1. **INTERACTIVITY** (response to stimulus by change of state).
2. **AUTONOMY** (ability to change state without stimulus) and
3. **ADAPTABILITY** (ability to change "the transition rules" by which state is changed).

Floridi also takes the view that an effective characterization of AA's depends on the specific level of abstraction (LoA) at which one chooses to analyse and discuss a particular entity and its context[1], therefore the proposal put forward by Floridi, consistent with recent literature (Allen, Varne, Zinser, 2000), indicates that the right LoA is probably one which includes the above three criteria, namely:

- **INTERACTIVITY** - means that the agent and its environment (can) act upon each other. Typical examples include input or output of a value, or simultaneous engagement of an action - for example gravitational force between bodies.
- **AUTONOMY** - means that the agent is able to change state without direct response to interaction: it can perform internal transitions to change its state. So an agent must have at least two states. This property ascribes an agent with a certain degree of complexity and decoupled-ness from its environment.
- **ADAPTABILITY** - means that the agent's interactions (can) change the transition rules by which it changes state. This property ensures that an agent might be viewed, at the given LoA, as learning its own mode of operation in a way which depends critically on its experience, a kind of self-learning entity. Note that if an agent's transition rules are stored as part of its internal state then adaptability follows from the other two conditions.

1 Levels of Abstraction (LoA) are discussed in detail in the next section.

We therefore note that Floridi's definition of agent hood utilizes what we have referred to as attributes, a_1, a_2, a_3,……., a_n, in fact, Floridi's set of attributes is a subset of $\{ a_1, a_2, a_3,……., a_n\}$. Form the point of view of this paper we are interested in systems that change, which means that some of those attributes defining "agent hood" evolve over time, thus, such entities can be thought of as having states, determined by the value of the properties which hold at any instant of thier evolution. The kind of evolution that we have in mind is that often experienced by avatars of MUD participants. From this viewpoint the entity becomes a transition system that moves from state to state by execution of actions or transition rules depicting the character development that is evolving in time, the definition of agent hood $\mathbf{A_{gh}(t)}$ for such time-dependent AA's could therefore be defined by a set of time dependent attributes:

$$\mathbf{A_{gh}(t) = \{ a_{t1}, a_{t2}, a_{t3},……., a_{tn}\}}$$

In the following sections we assume the characterization of AA's that has been provided in this section and continue to explore the role that morality has to play in environments such as the cyberspace, however before this, it is important for the reader to understand the principle of levels of abstraction as presented by Floridi.

THE PRINCIPLE OF LEVELS OF ABSTRACTION (LOA)

The idea of a 'level of abstraction' plays an absolutely crucial role in our account of artificial agents. The concept comes from modeling in science where the variables in the model correspond to observables in reality, all others being abstracted. The terminology we use has been influenced by an area of Computer Science, called Formal Methods, in which discrete mathematics is used to specify and analyse the behavior of information systems. Despite that heritage, the idea is not at all technical. The fact is that in the exact discipline of mathematics, for example, definitions are 'parameterised' by generic sets. In section 1 we formulated a set-theoretic approach to define agent hood for AA's in terms of a set of attributes which were in turn defined by a set of elements, we could view this as providing a technique for regulating a level of abstraction (LoA). Indeed abstraction acts as a 'hidden parameter' behind exact set-theoretic definitions. An x is never defined as y absolutely (i.e. LoA-independently), as a Kantian 'thing-in-itself', but always contextually, as a function of a given LoA or following a set-theoretic approach, as a set of attributes. When a LoA is sufficiently common, important, dominating or in fact is the very frame that constructs the definiendum, it becomes 'transparent', and one has the pleasant impression that x can be subject to an adequate definition in a sort of conceptual vacuum. So for example glass is not a solid but a liquid, tomatoes are not vegetables but berries and whales are mammals not fish, such views are all accepted without further complaint because one silently bows to the uncontroversial predominance of the corresponding LoA.

When no LoA is predominant or constitutive, things get messy. In this case the trick lies in deciding on an adequate LoA, before embarking on the task of understanding the nature of the definiendum. The example of intelligence or 'thinking' behavior is enlightening. One might define 'intelligence' in a myriad of ways; many LoA are all equally convincing and no single, absolute, definition is adequate in every context. Turing solved the problem of 'defining' intelligence by first fixing a LoA—in this case a dialogue conducted by a computer interface—and then establishing the necessary

and sufficient conditions for a computing system to count as intelligent at that LoA: the communication game. The LoA is crucial and changing it invalidates the test, as Searle was able to show by adopting a new LoA represented by the Chinese room game.

Floridi (2008) provides the following interesting example. Suppose we join Anne, Benand and Carole in the middle of a conversation. Anne is a collector and potential buyer; Ben tinkers in his spare time; and Carole is an economist. We do not know what they are talking about, but we are able to hear this much:

A. Anne observes that it has an anti-theft device installed, is kept garaged when not in use and has had only a single owner.

B. Ben observes that its engine is not the original one, that its body has been recently re-painted but that all leather parts are much worn.

C. Carole observes that the old engine consumed too much, that it has a stable market value but that its spare parts are expensive.

The participants view the object under discussion according to their own interests, at their own LoA. We may guess that they are probably talking about a car, or perhaps a motorcycle or even a plane. Whatever the reference is, it provides the source of information and is called the system. A LoA consists of a collection of observables, each with a well-defined possible set of values or outcomes. For the sake of simplicity let's say that Anne's LoA matches that of a buyer, Ben's that of a mechanic and Carole's that of an insurer. Each LoA makes possible an analysis of the system, the result of which is called a model of the system. Evidently an entity may be described at a range of LoA's and so can have a range of models.
We are now ready for a definition as provided by Floridi (2008):

Given a well-defined set X of values, an observable of type X is a variable whose value ranges over X. A LoA consists of a collection of observables of given types.

Thus, in the example above, Anne's LoA might consist of observables for security, method of storage and owner history; Ben's might consist of observables for engine condition, external body condition and internal condition; and Carole's might consist of observables for running cost, market value and maintenance cost. In this case, the LoA's happen to be disjoint but in general they need not be. A particularly important case is one in which one LoA, D, includes another, E. Suppose Emily analyses the system using a LoA that contains only a subset of the observables constituting the LoA used by Daniel. For Emily the system is a vehicle, where as for Daniel it is a motor vehicle. In this case, LoAE is said to be more abstract or higher and LoAD more concrete or lower, for E abstracts some observables apparent at D.

A LoA is therefore formalized in the concept of "interface", which consists of a set of features, the observables (or attributes). The LoA is determined by the way in which one chooses to describe, analyse and discuss a system and its context. It must be stressed that a clear indication of the LoA at which a system is being analysed allows ethical pluralism without endorsing relativism. It is a mistake to think that 'anything goes' as long as one makes explicit the LoA, because LoA's are mutually comparable and assessable. Introducing an explicit reference to the LoA clarifies that the model

of a system is a function of the available observables, and that **(i)** different interfaces may be fairly ranked depending on how well they satisfy modeling specifications (e.g. informativeness, coherence, elegance, explanatory power, consistency with the data etc.) and **(ii)** different analyses can be fairly compared provided that they share the same LoA.

For the analysis of AA's an adaptable LoA at the informational level would be an appropriate framework to explore. Donald Michie's (1961) concept of a mechanism's adaptability can provide a good introduction to the concept of machine learning, from the field of Computer Science to explain the underpinnings of adaptability. The subtlety revealed by this example is that if a transition rule is observed to be a consequence of a program state then the program is not adaptive. Floridi points out that this distinction is vital for current software. Early software used to lie open to the system user who, if interested, could read the code and see the entire system state. For such software, a LoA in which the entire system state is observed, is appropriate. However the user of contemporary software is explicitly barred from interrogating the code in nearly all cases. This has been possible because of the advance in user interfaces; use of icons means that the user need not know where an applications package is stored, let alone be concerned with its content. Similarly applets are downloaded from the internet and executed locally via a click of an icon, without the user having any access to their code. For such software a LoA in which the code is entirely concealed is appropriate, such an informational level of abstraction, call it LoAi would be appropriate for the analysis of AA. We now progress to examine how an LoAi could be defined as a minimal state for AA's to be conceived as moral agents.

LEVELS OF ABSTRACTION, ARTIFICIAL AGENTS AND MORALITY

Suppose we are analyzing the behavior of a population of AA's in a cyberworld (let us for this argument suppose that these AA's are represented by entities capable of learning* and intentionality* - the asterisks signify that the learning and intentionality of such artificial agents may not be perfectly identical to those of human beings) through a system that gives us complete access to all the observables available at a LoA provided by informational analysis, call this LoAi (a kind of "god's eye view")[2], we observe that the AA's are able to:

1. Respond to environmental stimuli, this presupposes that AA's are informed about the environment through some data-entry devices, for example some preceptors or sensors.
2. Change their states according to their own transition rules and in a self-governed way, independently of environmental stimuli (autonomy),e.g. by taking flexible decisions based on past and new information, which modify the environment, and
3. Change, according to the environment, the transition rules by which their states are changed (adaptability), e.g. by modifying past procedures to take into account successful and unsuccessful actions.

2 Such a system providing an observation 'view-point' and acting as and LoAi has been developed as part of the Underground City XXI project.

In such a dynamic system any action to be classified as a "moral action" we must have the logical structure of a variably interactive process relating one or more sources (depending if one is working within a multi-agent context): The agent, $\mathbf{a}$, with one or more of its destinations, the patient $\mathbf{p}$.

More generally, the agent initiates the process and the patient reacts more or less interactively to it[3]. Once a and p are interpreted, their analysis depends on the LoA and the corresponding set of observables. If we consider $\mathbf{a} = \mathbf{AA}_1$ and $\mathbf{p} = \mathbf{AA}_2$ where $\mathbf{AA}_1$ and $\mathbf{AA}_2$ are artificial agents characterized by the framework explored in section 1 then at the LoA provided by an informational analysis, say LoAi, both $\mathbf{AA}_1$ and $\mathbf{AA}_2$ are informational objects. This means that $\mathbf{AA}_1$ is analysed as an informational object that interacts and shares a number of attributes with other objects, like a high level programming code. This does not mean that $\mathbf{AA}_1$ and $\mathbf{AA}_2$ are necessarily only information objects.

For a LoAi to be defined as a minimal state, Floridi[4] takes the conceptual approach of modeling information systems by using the Object Orientated Programming (OOP) methodology. This provides a very flexible and powerful methodology with which to clarify and make precise the concept of "information object" as an entity constituted by a bundle of properties (Cavagnetto, Gahir, 2009), to use the Humean expression. When $\mathbf{AA}_1$ and $\mathbf{AA}_2$ are analysed as information objects at LoAi this means that they are considered and treated as discrete, self-contained, encapsulated[5] packages containing:

1. The appropriate data structures, which constitute the nature of the entity in question, state of the object, its unique identity, and attributes.
2. A collection of operations, functions or procedures (methods) which are activated by various interactions or stimuli, namely messages received from other objects or changes within itself, and correspondingly define how the object behaves or reacts to them.

At LoAi a moral action can now be modelled as an information process, i.e. a series of messages (M) invoked by $\mathbf{AA}_1$, that brings about a transformation of states directly affecting $\mathbf{AA}_2$. Following Floridi (2008) we can define the following information components for $\mathbf{AA}_1$ and $\mathbf{AA}_2$ that could be considered as the minimal components for a moral action to be modelled as an information process. The first three are $\mathbf{AA}_1$, $\mathbf{AA}_2$ and M, the fourth component is the personal or subjective frame of information within which the $\mathbf{AA}_1$ operates. This shell, which is really an integral part of $\mathbf{AA}_1$'s nature, is the information frame that encapsulates the subjective world of information of $\mathbf{AA}_1$ (or in general the agent). It can be considered as being constituted by internally dynamic and interactive records (modules) of $\mathbf{AA}_1$'s moral values, prejudices, past patterns of behavior, attitudes, likes and dislikes, phobias, emotional inclinations and so forth. In short this could represent the ethical and epistemic conceptualizing interface between $\mathbf{AA}_1$ and the environment. This shell, although it embodies aspects of $\mathbf{AA}_1$'s "life", is constantly evolving through time, may contain shared or imported attributes from other AA shells.

The factual information concerning the moral situation represents the fifth dynamic component of the system, according to Floridi, it is the only element in the model that remains unmodified when the LoA changes. We can still speak of factual

3 The terms "agent" and "patient" are standard in ethics and therefore will be maintained in this paper, however, it is essential to stress their interactive nature of the process and hence the fact that the patient is hardly ever a passive receiver of an action. The unidirectional, bivalent, casual model is often far too simplistic. A better way to qualify the patient in connection with the agent would be to refer to it as the "reagent".

4 Rambaug, on the conceptual modeling of informational systems, see also Flinn and Diaz Fragoso, 1996, Veryard, 1992 and Boman et al. 1997.

5 Encapsulation or information hiding is the technique of keeping together data structures and the methods (class-implemeted operations), which act on them in such a way that the package's internal structure can only be accessed by approved package routines. External aspects of the object, which are accessible to other objects, are thus separated from the internal implementation details of the object itself, which remain hidden from other objects.

information even at the lower LoA, where there are sufficient observables to analyse both AA_1 and AA_2 not just as two information objects but also as two software entities. The majority of ethical theories are ready to recognize factual information as playing an instrumental role in any moral action, for example, Socratic positions explain the existence of evil in terms of ignorance and according to Warnock (1971) lack of information is one of the main factors that cause "things to go badly".

We can now introduce the sixth component. At LoAi being considered, Floridi (2009) describes this as the informational environment, the infosphere, it is a context constituted by the whole system of information objects, including all agents and patients, messages, their attributes and mutual relations. The specific region of the infosphere in space and time within which the moral action takes place represents the last component of the system, namely the moral situation, Floridi terms this the envelope, borrowing a term from robotics. To summarise here is a complete list of the information components attributed to our information entities AA_1 and AA_2:

- a = moral agent (AA_1).
- p = moral patient (AA_2).
- M = moral action, constructed as an interactive information process, the message.
- Shell = a's personal world of information.
- Factual information = information about the moral situation.
- Infosphere = the general environment.
- Envelope = the moral situation.

In the model being considered, we could say that from the observation of group dynamic behaviour at LoAi, the function M could act like a vector, with given direction and a discrete force. Once the message has been released, its direct and indirect effects almost immediately cease to be under the control of its source a, while their life extends in time and space, in the form of a gradually decreasing continuum. Following Floridi we may use another concept from OOP and speak of the propagation of an operation, which starts at some initial OBJECT and flows from OBJECT to OBJECT through association links in the system and according to possible specifiable rules during the propagation, the vector may change both in direction and in force.

We now observe that such a model of "information ethics", where AA's are considered as information entities[6] at LoA^i, and modelled according to the principles of OOP, allow us to model a moral action as an information process. This leads us to Floridi's claim that all entities, even when interpreted as only clusters of information, still have a minimal moral worth qua information objects and so may deserve to be respected. It is worth elaborating upon the different ways and degrees in which an entity may have some instrumental value. When the value in question is neither instrumental nor only emotional, one can first distinguish between extrinsic and intrinsic value and correspondingly, between two types of respect, therefore an entity x has extrinsic value when it is respected as y. For example, a piece of cloth may be respected as a flag, a person may be respected as a police officer, or a practice may be respected as a cult.

6 From the point of view of a set of attributes defining agent hood for AA's as detailed in section 1, one could consider the set of elements defining each attribute as information entities.

This sense of relative respect is associated with a sense of value that is no longer instrumental or emotional and may be called symbolic. Symbolic value is still utterly contingent, maybe acquired or lost, and can be increased as well as relaxed, in brief it is utterly extrinsic.

In order to capture in full the fact that x has moral value in itself, a value that necessarily belongs to x in all circumstances, not just under certain conditions, and is not subject to modification unless x ceases to exist as x, one needs to consider the case in which x deserves to be respected not just symbolically, as something else, but qua x. Floridi introduces a second distinction: the moral value of an entity is based on its ontology, what the entity is determines the degree of moral value it enjoys. Minimalist theories of intrinsic worth have tried to identify in various ways the inherited attributes, i.e. the minimal condition of possibility of the lowest possible degree of intrinsic worth, without which an entity becomes intrinsically worthless, and hence deserves no moral respect. Investigations have led researchers to move from more restricted to more elusive, anthropocentric criteria and then further on towards biocentric criteria. At the most recent stage in this dialectical development, Information Ethics (IE) maintains that even biocentric analyses of the inherited attributes are still biased and too restricted in scope. As Deep Ecologists argue, inanimate things too can have an intrinsic value. Today there are geologists' codes of ethics stating, for example, "Don't disfigure rock surfaces with brightly painted numbers, symbols or clusters of core-holes" for apparently no other reason than a basic sense of respect for the environment in all its forms.

Indeed, even ideal, intangible or intellectual objects can have a minimal degree of moral value, no matter how humble, and so be entitled to some respect. UNESCO recognizes this in its protection of "masterpieces of the oral and intangible heritage of humanity". What lies behind these examples is the view that:

if *x* can be *p*, then *x*'s nature can be taken into consideration by *a*, and contribute to shaping *a*'s action, no matter how minimally

Floridi (2008) argues that such a minimal guiding criterion for qualifying an object is more general than any biocentric reference to it's attributes as a biological or living entity.

What, then, is the most general possible common set of attributes which characterizes something as intrinsically valuable and an object of respect, and without which something would rightly be considered intrinsically worthless (not just instrumentally useless or emotionally insignificant) or even positively unworthy and therefore rightly to be disrespected in itself? The least biased and most fundamental solution is to identify the minimal condition of possibility for an entity's least intrinsic worth with its nature as an information object. The information nature of an entity x that may, in principle, act as a patient p of moral action is the lowest threshold of inherited attributes that constitutes its minimal intrinsic worth, which in turn may deserve to be respected by the agent. Alternatively, to put it more concisely, being an information object qua information object is the minimal condition of possibility of moral worth and hence of normative respect. This is the central axiological thesis of any future Information Ethics that will emerge as a Macroethics according to Floridi, and for the purposes of the present paper we are inclined to agree with this thesis.

Following on from the previous section, we further note that Floridi takes "information" as the primary ontological category. In this way, "to be is to be an information entity" (Floridi). That is, Floridi's philosophy of information (PI) is motivated from the outset by the observation that other metaphysical frameworks are ill-suited to take on and help resolve the multiple ethical issues and challenges evoked in the emergence of ICT's. His PI seeks to offset these deficits by starting all over metaphysically and redefining our understanding of reality in terms of information. At the same time, Alison Adam (pg. 141 - 154) and Soraj Hongladarom (pg. 175 - 187) point out that this ontology resonates with feminist and environmental views as well as with the views of Spinoza and Kant in a number of ways.

The ethical consequences of this ontological emphasis on relationship are immediate and crucial. To begin with, this relational ontology represents a foundational shift from the modern Western emphasis on the (human) moral agent – i.e. the individual who, as a moral autonomy, is primarily responsible for his or her actions – to the recognition that "moral actions are a result of complex interactions amongst distributed systems integrated on a scale larger that the single human being" (Floridi, 1998). Whether in terms of our interactions with one another from different cultures via distributed networks in cyberspace models such as the Underground City XXI project, or, in Floridi's example, within the processes of globalization as such, we are in need of developing notions of distributed responsibility in an ethics of distributed morality. Alison Adam (pg. 149 - 154) points out that such a viewpoint can be reinforced further with insights drawn from actor-network theory, as well as Daniel Dennet's account of "as-if" intentionality (Dennet, 1994) and Lorenzo Magnani's (2007) description of "moral mediators". Our evaluation of the relative worth or value of diverse entities in the infosphere therefore depends entirely on the level of abstraction that we take up to make such an evaluation, one that would endorse a wide but not unlimited number of LoA's – each one of which is defined by a specific goal.

According to Charles Ess (2006) such an IE thereby makes available a plurality of frameworks that will work especially well in relation to a particular culture, ethical tradition, etc. However, the further implicaties of these ideas are crucial to our development of an ethical framework for AA's in a cyberworld such as that being developed in the UC XXI project, as such an environment allows the interaction of individuals from different cultural backgrounds. What is important here is Floridi's notion of flourishing as the final norm and the telos defining our actions in relation to interaction within such environments. This is similar to the works of Norbert Wiener who takes up flourishing as an overarching goal and value of IE, for Wiener, "flourishing" includes advancing and defending human values. This convergence between Floridi and Wiener is crucial not only as it identifies the ethical norm towards which all actions should aim, but also because it stands as an example of ethical pluralism within cyberworld environments, and such an ethical pluralism will be an important factor in the characterization of interaction at the multicultural level within cyberworld environments.

Any analysis at this level will tend to reflect irreducible differences that define individuals across cultures and will further influence moral action and behavior in cyber communities not only involving AA's but also in general. Charles Ess has stressed that preserving cultural plurality while developing an ethical framework at this global level is therefore an important goal and one of the conditions of developing such a

framework is that the ethics must emerge from cross-cultural dialogues, marked by a fundamental respect precisely for irreducible differences that define our cultures and our identities. Here we can look to the notion of resonance that governs our ethical framework, and consider how far we are prepared to engage "the other" as Other, i.e., in ways that recognize, respect, indeed foster our irreducible cultural differences when engaging in cyber communities via AA's such as avatars.

One could introduce here, what I believe is a central model for encountering "the Other"- namely, the Japanese Buddhist and comparative philosopher Kitaro Nishida's understanding of resonance. This notion of resonance is of interest because it represents a notion that is shared between such Western philosophers as Plato and Aristotle, and such Eastern philosophers as Confucius – as it is found in Taoist and Buddhist traditions. As well, if our goal in the intercultural engagements made possible by internet communication technologies in the electronic global metropolis is to take up relationships with "the Other" that seek to foster the irreducible differences that makes these resonances possible, then such a framework would be beneficial towards the development of a global ethics. Nishida emphasizes that our relationships with one another always takes place across the difference of "absolute opposites" if we are to preserve our identities as irreducibly distinct from one another. However if only sheer differences define our relationship – then there will be no connection or unity. To describe human relationships as a structure that holds together both irreducible differences and relationships, Nishida turns to the term and concept of resonance. How do we know the Other as absolute Other? In part....

> *"Through the resonance of my personal behavior (with you) I can know you, and you can know me through the resonance of your personal behavior (with me)."(Kitaro, 2002)*

This resonance clearly entails a relationship that sustains the irreducible differences required to keep our identities and awareness separate. What emerges, then, is the conjunction of what appears to be contradictory – i.e., connection alongside irreducible differences. A framework for ethics that allows interaction at different cultural levels will require such resonance and complimentarity for our engagements with "the other", a kind of harmony within pluralism. In particular these conditions may emerge as necessary conditions for a global cyberworld ethics. One must be reminded that the difficulty of developing an ethics that works across diverse cultures and traditions is an ancient problem – we should not be surprised to note that the ancients in both Eastern and Western traditions have developed often highly sophisticated ways of resolving the apparently conflicting demands between agreement and difference.

Both Plato and Aristotle – and subsequently, Aquinas – responded to this complex requirement in at least two key ways. To begin with, Plato develops a view that Ess characterizes as "interpretative pluralism" (Ess, 2006). On this view, as elaborated especially in The Republic, we may conjoin shared ethical norms with irreducible differences by recognizing that diverse ethical practices may represent distinctive interpretations or applications of those shared norms. Such differences do not necessarily mean, as ethical relativists would argue, that there is no universally legitimate ethical norms or values: rather, such differences may mean only that a given norm or value is applied or understood in distinctive ways – precisely as required by the details of a given context as shaped by a particular traditions, cultural norms, or practices.

Aristotle builds on Plato's teaching in several ways building his notion of pros hen or "focal" equivocal. Such equivocals stand as a linguistic middle ground between a homogeneous univocation (which requires that a term have one and only one meaning) and a pure equivocation (as a single term may have multiple but entirely unrelated meanings – eg. "bat" can refer both to a winged mammal and a wooden stick used in cricket). Pros hen or focal equivocal, by contrast, are terms with clearly different meanings that simultaneously relate or cohere with one another as both point towards a shared or focal notion that anchors the meaning of each. Aristotle uses the example of "healthy" to illustrate his point: "…..the term "healthy" always relates to health (either as preserving it or as producing it or as indicating it or as receptive of it..." (Aristotle, 1968). In his later elaboration on Aristotle's understanding of such equivocal, Aquinas illustrates the point more fully:

> *"….there is the case of one word being used of two things because each of them has some order or relation to a third thing. Thus we use the word "healthy" of both diet and passing water, because each of these has some relation to health in a man, former as a cause, the later as a symptom of it" (Aquinas, 1969).*

So we could say, for example, that a particular diet is healthy(1) – and good kidney function may also be said to be healthy(2): but the two terms are not univocals – that is they do not have precisely the same meaning. On the contrary: with healthy(1) we mean that the diet contributes to the state of being healthy – while healthy(2) means s good kidney function is a reflection of the state of being healthy. At the same time, however, precisely because healthy(1) and healthy(2) refer to the same "state of being healthy" that, as a shared focal point, thus grounds their meanings - their differences in meaning are thus conjoined with a coherence or connection alongside these differences.

For Aristotle (as well as for Aquinas) this linguistic analysis is significant because language is assumed to reflect the structure of reality itself. In particular, Aristotle says rather famously that being itself is such a focal or pros hen equivocal "...there are many senses in which a thing is said to "be", but all that "is" is related to one central point, one definite kind of thing, and is not said to "be" by a mere ambiguity" (Aristotle, 1968). That is, all things are – in ways that are both irreducibly different and yet at the same time inextricably connected with one another by way of reference to a single focal point. For Aristotle, our ability to negotiate the complex ambiguities of pros hen equivocal is affiliated with a particular kind of practical judgment – what Aristotle calls phronesis. Just as we can recognize and appropriately utilize terms that hold different but related meanings – so phronesis allows us to discern what and how general ethical principles apply to diverse contexts, thereby making ethical decisions and actions possible. As Aquinas puts it:

> *'Practical reason... is connected with contingent matters, about which human actions are concerned, and consequently, although there is necessity in general principles, the more we descend to matters of detail, the more frequently we encounter deviations.... Accordingly, in matters of action, truth or practical rectitude is not the same for all in respect of detail but only as to the general principles, and where there is the same rectitude in matters of detail, it is not equally known to all" (Aquinas, 1969).*

This is to say: phronesis allows us to make a general principle and discern how it may be interpreted or applied in different ways in different context. It thereby makes possible an ethical pluralism that recognizes precisely that shared ethical principles and norms will necessarily issue in diverse ethical judgments and interpretations, as required by irreducibly different contexts defined by an extensive range of fine-grained detail. Such ethical pluralism, finally, as engaging such structures of connection alongside irreducible differences, and as rooted in a phronesis that is precisely the cultivated, experientially-informed ability to judge as to how to interpret and apply shared principles to diverse contexts, thereby carries us beyond Hinman's notion of "potential compatibility" and even the notion of "overlapping consensus" put forwad by Rawls. In fact, Aristotle's understanding of phronesis and thus of ethical pluralism is intimately connected with a central component of computation – namely, cybernetics. Of course, most of us are familiar with the term – as originally developed by Norbert Wiener – as referring to the ability of computer systems to self-regulate and self-correct their processes through various forms of feedback mechanisms. What is apparently forgotten or unacknowledged is that "cybernetics" is derived from Plato's use of cybernetes. The cybernetes is a steersman, helmsman, or pilot, and Plato uses the cybernetes as a primary model of ethical judgment – specifically, our ability to discern and aim towards the ethically-justified path in the face of a wide range of possible choices. So Plato has Socrates observe in The Republic:

> *"... a first-rate pilot [cybernetes] or physician, for example, feels the difference between the impossibilities and possibilities in his art and attempts the one and lets the other go; and then, too, if he does happen to trip, he is equal to correcting his error" (Plato, 1991).*

"Cybernetics" means more originally the capability of making ethical judgments in the face of specific and diverse contexts, complete with the ability to self-correct in the face of error and/or new information. This is to say, the cybernetes, as a model of ethical self-direction, thereby embodies and exemplifies the sort of ethical judgment that Aristotle subsequently identifies in terms of phronesis – i.e., precisely the ability to discern what general principles may apply in a particular context – and how they are to be interpreted to apply within that context as defined by a near-infinite range of fine-grained, ethically relevant details.

Given this conjunction between the cybernetes and phronesis, where phronesis is the ethical judgment capable of discerning what general principles may apply and how they apply in diverse ways as required by diverse contexts – we can then meaningfully speak of a "cybernetic pluralism" in Information and Computer Ethics. Indeed, there are at least two examples of such pluralism operating in contemporary theoretical work, beginning with Terrell Ward Bynum's (2002) synthesis of the work of Norbert Wiener and Luciano Floridi in what Bynum calls "flourishing ethics". Briefly, Bynum argues that the ethics of both Wiener and Floridi converge towards the central values of: contributing to human flourishing; advancing and defending human values (life, health, freedom, knowledge, happiness); and fulfilling the great principles of justice drawn from Western philosophical traditions. In fact, Bynum further points out agreement on these central values in the ethics of such computer ethics pioneers as Deborah Johnson, Philip Brey, James Moor, Helen Nissenbaum.

Similarly, Luciano Floridi has developed more recently a conception of what he calls a "lite" information ontology developing a view towards avoiding a cultural imperialism that would thereby remain fragmented and isolated from other cultures and frameworks. Such a "lite" ontology can serve as a shared framework that allows precisely for a pluralistic diversity of understandings and applications of a shared notion of information ethics, as, in effect, the focal, pros hen notion, Floridi makes explicit that his notion of "lite" ontology is intended precisely to avoid the cultural imperialism of imposing a single norm, language or culture across cyberspace: rather, his vision is of a pluralistic structure of a shared framework – in this case, information ontology as something of a shared language.

These various structures of pluralism require the interpretation or application of a shared focal norm or value within the diverse contexts established by distinctive cultural values, traditions, practices, etc. such a conception of multi-cultural ethical pluralism extends globally and includes states and regimes that are clearly not liberal or democratic. Despite these radical cultural and political differences, however, the sort of focal, pros hen pluralism that has been articulated above makes possible ethical alignments – indeed, resonances and harmonies – between diverse cultural traditions and ethical systems. As a minimal requirement, it is therefore possible to begin our encounters with one another in cyberspace environments with a reasonable and understandable search for commonalities, including a set of minimal rights and obligations towards one another. More broadly, our emerging and global interaction in cyberspace also depends very much on how far we want/will/need/ought to go in meeting "the Other" in such environments. Presuming that we seek to meet with and engage "the Other" in a more robust way – i.e., one defined by our willingness to acknowledge not only commonalities but also the irreducible differences that define our individual and cultural identities – we are required to move to a more complex mode of thinking and behaving, one shaped precisely by the structures of pluralism and harmony, as these hold together both similarity and irreducible differences.

In addition, two of the most important factors of successful general cross-cultural communication that sustain the irreducible differences defining individual and cultural identities are trust and the ability to recognize and effectively respond to the linguistic ambiguity that thereby allows for a pluralistic understanding of basic terms and norms holding different interpretations or applications in diverse cultures (Sees, pg. 109 - 119). Moreover, these elements of human communication finally require the now familiar work of judgment – beginning with judgments as to how far or close one's meaning is understood by "the Other", and in turn how far one understand the meaning of the Other. Even though we may use the same word or term, their differences in our diverse cultural settings require careful attention and judgment to determine whether or not we are sliding into equivocation and misunderstanding. However, earning and sustaining trust, successfully recognizing and comfortably negotiating linguistic ambiguities, and utilizing the needed judgment in establishing and sustaining resonant relationships that preserve our irreducible differences are capacities are not easily captured in set-theoretic analytical frameworks as such those detailed in earlier sections, much less taught in any formal way.

Such compassionate attributes, after all, are essential to healing the ruptures that follow upon the first mistakes we inevitably make, especially in our first efforts to understand "the Other" – and most especially as we venture out into new linguistic and cultural settings offered by cyberworld communities. Finally, attributes such as compassion and care are essential to building and sustaining the trust, essential to all human interactions. One could not agree more with the views of Floridi, Hongladarom and Ess who echo the point of shared norms expressed in diverse ways and diverse traditions, i.e., as respectful care or compassion. Nor could we agree more with their shared call to a sort of pluralistic virtue ethics that has to attend to our feelings and requires us to cultivate a compassion that will deeply challenge those modern Western ethicists who take a more purely conceptual approach, which, rests, we suspect, on Cartesian dualism.

CONCLUSION

It has been our intention to provide a set-theoretic model that defines AA's from the point of view of their attributes and to relate this model to the levels of abstraction (LoA) approach provided by Floridi. In adopting the LoA approach we developed the most general possible common set of attributes which characterized an AA as intrinsically valuable and identified the minimal condition of possibility of such an entity's least intrinsic worth with its nature as an information object. In other words, being an information object qua information object is the minimal condition of possibility of moral worth and hence of normative respect for AA's. This was seen as the central axiological thesis of any future Information Ethics that will emerge as a Macroethics according to Floridi.

The ethical consequences of such an ontological relationship for a cross-cultural cyber-ethics were developed to include pluralism and resonance that tends to reflect irreducible differences that define individuals across cultures and further influence moral action and behavior in cyber communities not only involving AA's but also in general. ✖

Bituminous coal

A FRACTAL MODEL OF THE UNDERGROUND CITY

PASCAL SILONDI
BRUCE GAHIR
AURÉLIE BESSON
STEFANO CAVAGNETTO

We will begin by tracing the various changing conceptions of how space and time have been abstracted across the broad sweep of human history. Our tendency to continually abstract through simplification manifests itself in the way we use mathematics to portray order and regularity. The way we conceive time as a continuous flow, and the way we perceive space as composed of simple geometries. But this is rapidly changing and we are entering a time when many of these traditional notions are being intensely scrutinized by the framework of fractal geometry. It has been discussed extensively that living cities have intrinsically fractal properties that are in common with all living systems. Our intention is to propose a similar fractal nature for the Underground City project (UCXXI) and develop a viewpoint of an organism as a consequence of such a fractal structure in the process expanding upon the application of the notion of spatial justice as a guiding principle that originates due to such fractal properties.

From the earliest examples of the written record, there is evidence that human being has always made sense of the world through powerful simplifying abstractions which seek out the underlying principles and order in our experiences and perceptions. The power to abstract is one which probably sets the human beings aside from the rest of the animal kingdom and it is clear that the ability to impress order and structure on diverse phenomena though casting aside detail irrelevant to the quest in hand, is strongly correlated with our conventional view of human progress. In short, abstraction leads to theory and theory enables the kernel of any phenomena to be isolated, defined and thence explained. From prehistory, such abstraction has been associated with the power to simplify the world visually and from the earliest cave paintings, the human beings has sought to impose smooth geometry on art so that its meaning can be communicated in the simplest and most effective way. Taking the city as an example, life in any city can be thought of as being directly dependent upon its matrix of connections and substructure, because the geometry either encourages or discourages people's movements and interactions. We can therefore say that the geometrical structure of a city has an influence on its life. Such a depiction is crucial for understanding the structure of cities in cyberspace like the one being developed as part of the Underground City (UCXII) project. It has been claimed that the enormous conceptual gain results from thinking of a city as a multiple fractal structure (Batty, Longley, Frankhauser).

Urban typologies used throughout history up until the twentieth century lead automatically to a fractal structure as detailed by Salingaros. Traditional urban form follows the pedestrian transportation web and the predominantly pedestrian city was built over time with continuous incremental additions on a fractal model, without its builders being aware of it. It has aslo been claimed that the human mind has a fractal model imprinted in it, so what it intuitively generates will have a fractal structure as detailed by Mikiten et. al.. We propose that such conceptual frameworks can also be applied to virtual cities and the interconnection of tunnels in the virtual Underground City can similarly follow a fractal model incorporating the notion of spatial justice.

A FRACTAL MODEL FOR THE UNDERGROUND CITY

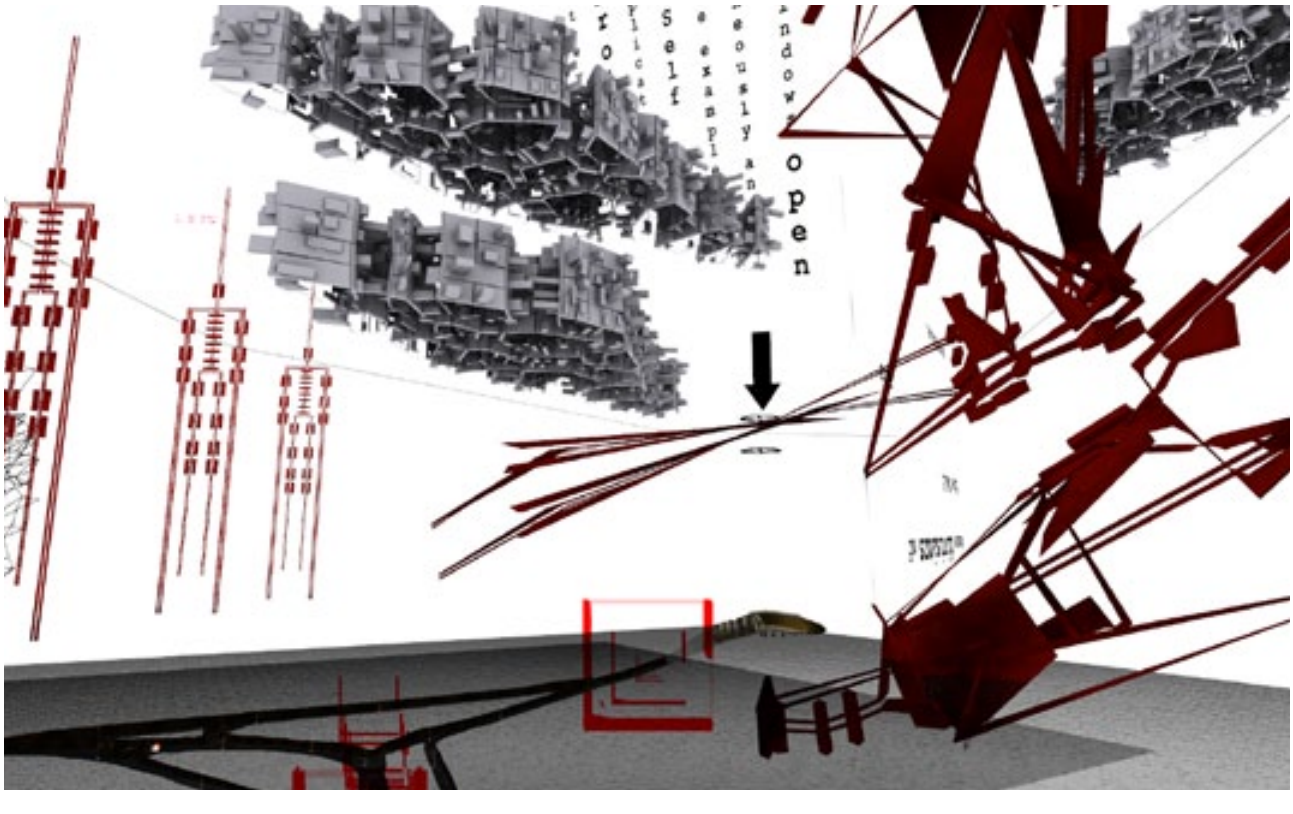
The city itself can be seen as a living organism. Fractal modelling offers a method that develops predictive models of how cities may grow under different conditions. Fractal models that have been developed to possess the same reproduction characteristics of organisms like the sponge and coral are of great inspiration in the development of cities. Further, fractal structures are predominant in nature and have been studied extensively to assist towards our understanding of the form of organisms and cities. This fact begs the question as to whether all organism and cities could be modelled in a similar way, or could the city be a by-product of the iteration process inherent in fractal geometry since random factors added to the fractal equation can result in fractals closer to the 'real' world. There is a significat evidence to indicate that great buildings of the past, and the vernacular (folk) architectures from all around the world, have essential mathematical similarities. One of them is a fractal structure: there is some observable structure at every level of magnification, and the different levels of scale are very tightly linked by the design. In contradistinction, modernist buildings have no fractal qualities; i.e., not only are there very few scales, but they are different scales that are not linked in any way. Indeed, one can see an unwritten design rule in the avoidance of organized fractal scales. It can be observed that cities,

at least the most pleasant ones, are fractal. Everything, starting from the paths and streets, to the shape of facades and the placing of trees, is fractal in the great cities such as Paris, Venice, and London. This has been measured mathematically by people like Michael Batty and Pierre Frankhauser.

The science of fractal geometry has emerged during the last ten years. Fractal objects are irregular in shape but their irregularity is similar across many scales thus enabling them to be described mathematically, and to be generated computationally. Fractals cannot be described using the geometry of regular figures based on points, lines and planes – Euclidean geometry. It is now well known that the morphology of cities is fractal. Over the past twenty years a particular view has been gaining ground, this is that insight not prediction must be the goal of science. This has been spurred on by discoveries in mathematics that simple, deterministic systems, from which equally simple and incontestable predictions have always been assumed, are not predictable in the traditional sense.

The fact that simple systems were manifested with a level of complexity that was completely unknown went some way to explain why more complex systems, which were often built from simpler elements were entirely unpredictable, in fact even chaotic. Cities, the weather or stock markets are all examples which demonstrate chaotic behaviour under certain conditions, whose traditional models were unable to yield predictions with scale and form known in advance. In mathematical terms, this is largely due to the fact that the mathematical space within which such models operate is so convoluted and infinitely divisible that it is impossible to guess the accurate starting position of systems within this space.

Division of the self, by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, unity3D



Fractals can assist in the understanding of "natural" or "organic" growth systems that can be used to understand the structure of cities. Cities that grow naturally are formed from a myriad of individual decisions at a much smaller scale than those which lead to planned growth which invariably embody the actions of somewhat larger agencies. Planned cities or their parts are usually more monumental, more focused and more regular, reflecting the will of one upon the many or at best, reflecting the will of the majority through their elected representatives.

Organically growing cities develop much more slowly than those which are planned, also organic development involves both growth and decline, while planned change is more asymmetric, frequently embodying growth but rarely dealing with decline. Thus in this sense, a more complete picture of a virtual city can be based on natural or organic growth interwoven both in space and time by planned structures, as depicted by figure 1 below. The system of underground tunnels in the Underground City networked together in organic form underlying a fractal structure would be representative of natural growth. In terms of visual and statistical order an organic form of such a virtual city, when viewed in plan form would resemble cell growth. For the Virtual Underground City (UCXII) such cellular growth of networked tunnels weaving in and out, closely following the virtual underground terrain and other natural features may seem geometrically irregular, but this does not imply "disorder". Such naturally growing structures of a virtual city are in fact more workable, more efficient and more equitable. Indeed more democratic embodying the principle of spatial justice to be elaborated in the section below.

THE FRACTAL CITY VIEWED AS AN ORGANISM

Although Life is very likely the most complex phenomenon in the Universe, many of it's most fundamental and complex phenomena scale with size in a surprisingly simple fashion. It can be shown that such basic underlying principles embedded in the dynamical and geometrical structure of space-filling, fractal-like, hierarchical branching networks are presumed to be optimised by natural selection. These ideas lead to a general quantitative, predictive theory that potentially captures the essential features of many diverse biological systems that can be used to understand the development of virtual cities.

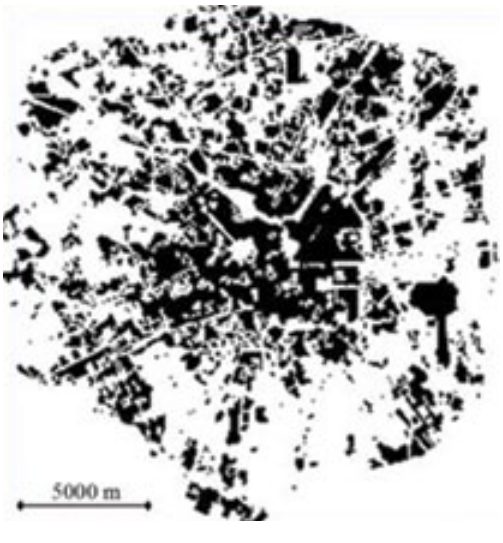
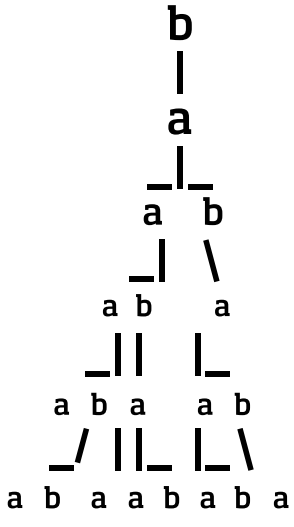


Figure 1: A study of the metropolitian area of Milan

In 1952, the British mathematician, Alan Turing, wrote a seminal paper that developed these ideas. In it he hypothesized that to understand the mechanism of development in plants and animals, which was essential to investigate how basic processes interacted. These processes were collectively known as the reaction diffusion mechanism. To illustrate this process, Alan Turing as a founder of computer science proposed a model where two homogeneously distributed solutions would interact to produce stable patterns during morphogenesis. These patterns would represent regional chaotic differences in the concentrations of the two substances and these interactions would produce an ordered structure out of random chaos. Similarly, a well known mathematical model called as the L-system was proposed by the biologist Aristid Lindenmayer in 1968. Two principal areas of application of L-systems include generation of fractals and realistic modelling of plants.

Figure 2: Formal definition of a D0L System



The L-systems is about the notion of rewriting, where the basic idea is to define complex objects by successively replacing parts of a simple object using a set of rewriting rules. The simplest example of the L-system is a D0L-system.The following example given by Prusinkiewicz and Lindenmayer (1991) (see figure 2) lets us consider strings built of two letters a and b (they may occur many times in a string). For each letter we specify a rewriting rule. The rule $a \rightarrow ab$ means that the letter a is to be replaced by the string ab, and the rule $b \rightarrow a$ means that the letter b is to be replaced by a. The rewriting process starts from a distinguished string called the axiom.

Let us assume that it consist of a single letter b. In the first derivation step (the first step of rewriting) the axiom b is replaced by a using production $b \rightarrow a$. In the second step a is replaced by ab using the production $a \rightarrow ab$. The word ab consists of two letters, both of which are simultaneously replaced in the next derivation step. Thus, a is replaced by ab, b is replaced by a, and the string aba results. In a similar way (by the simultaneous replacement of all letters), the string aba yields abaab which in turn yields abaababa, then abaababaabaab, and so on. We soon arrive at the magnificient pictorial representation as shown in figure 3.

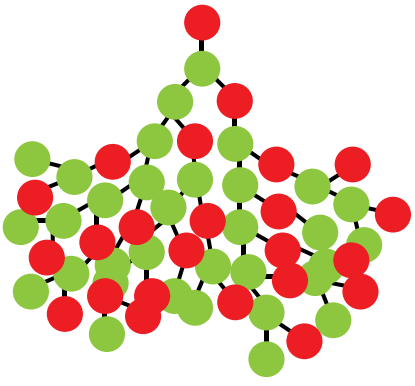
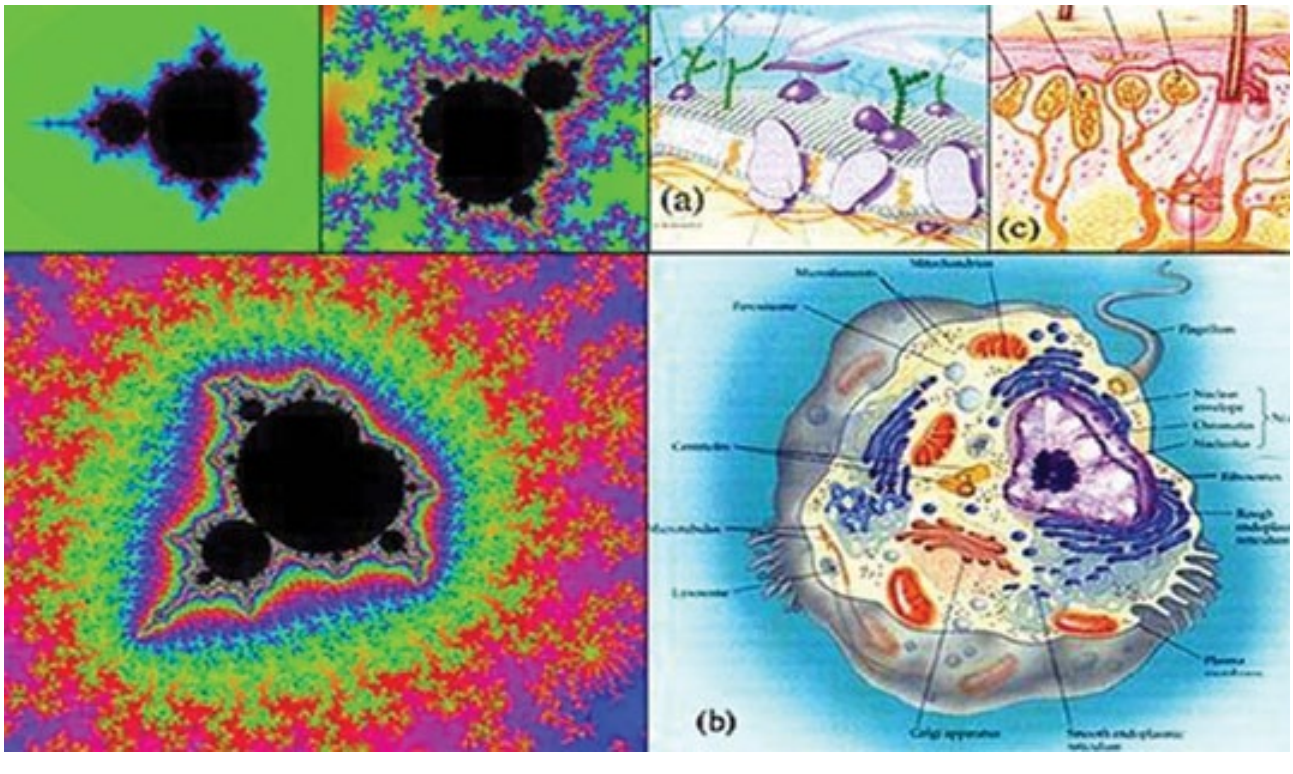


Figure 3: A graphic model of the D0L-system where 'b' is a red spot and 'a' is a green spot

These ideas can be extended to social organisations: to what extent are cities or corporations an extension of biology? Are they "just" very large organisms? Analogous scaling laws detailed above, reflecting underlying social network structure, point to general principles of organization common to all cities, but counter to biological systems the pace of social life systematically increases with size. This has dramatic implications for growth, development and particularly for sustainability: innovation and wealth creation that fuel social systems. Just as the cardiovascular network distributes energy and materials to cells in an organism, urban road networks distribute energy, materials and people to locations in cities.

Understanding the topology of urban networks that connect people and places leads to insights into how cities are organized and such concepts can be extended to virtual city networks where the connectivity of material flows can be visualized via D0L system networks.

Figure 4: Depicting similarities between fractals and natural forms



SPATIAL JUSTICE AND THE FRACTAL CITY

The organization of space, a crucial dimension of human societies, reflects social facts and influences social relations as detailed by Lefèbvre. Consequently, both justice and injustice become visible in space. In other words, the analysis of interactions between space and society is necessary to understand social injustices and to formulate territorial policies aiming to tackle them.

The specific term "spatial justice" has not been commonly used until very recently, and even today there are tendencies among geographers and planners to avoid the explicit use of the adjective "spatial" in describing the search for justice and democracy in contemporary societies. Either the spatiality of justice is ignored or it is absorbed (and often drained of its specificity) into such related concepts as territorial justice, environmental justice, the urbanization of injustice, the reduction of regional inequalities, or even more broadly in the generic search for a just city and a just society.

This so-called spatial turn is the primary reason for the attention that is now being given to the concept of spatial justice and to the broader spatialization of our basic ideas of democracy and human rights, as in the revival of Lefebvre's notion of the right to the city. Whereas the concept would not have been easily comprehensible even five years ago, today it draws attention from a much broader audience than the traditionally spatial disciplines of geography, architecture, and urban and regional planning.

Figure 5: Spacial Analytics depciting the social class groups in London (The red areas indicate higher social class groups)

Thinking about space has changed significantly in recent years, from emphasizing flat cartographic notions of space as container or stage of human activity or merely the physical dimensions of fixed form, to an active force shaping human life, one such representation of social forces generating fractal imagery can be seen in figure 5. A new emphasis on specifically urban spatial causality has emerged to explore the generative effects of urban agglomerations not just on everyday behavior but on such processes as technological innovation, artistic creativity, economic development, social change as well as environmental degradation, social polarization, widening income gaps, international politics, and, more specifically, the production of justice and injustice in spatial locations. Figure 5 above depicts the social class groups in the city of London, the red areas indicating the upper social class groups occupying significant areas in the center of London, note the fractal nature of the image.

It can be said that critical spatial thinking today hinges around three principles:

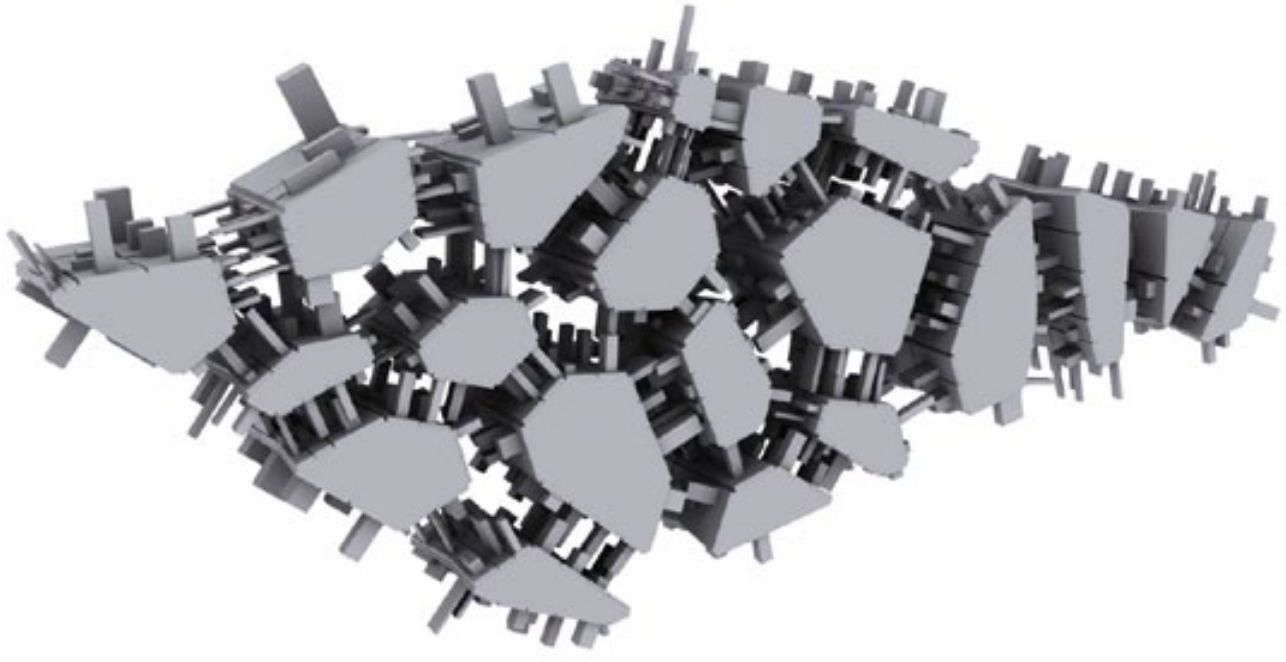
1. The ontological spatiality of being (we are all spatial as well as social and temporal beings).
2. The social production of spatiality (space is socially produced and can therefore be socially changed).
3. The socio-spatial dialectic (the spatial shapes the social as much as the social shapes the spatial).

Taking the socio-spatial dialectic seriously means that we recognize that the geographies in which we live can have negative as well as positive consequences on practically everything we do. Foucault captured this by showing how the intersection of space, knowledge, and power can be both oppressive and enabling. Building on Foucault, Edward Said states the following:

> *"Just as none of us are beyond geography, none of us is completely free from the struggle over geography. That struggle is complex and interesting because it is not only about soldiers and cannons but also about ideas, about forms, about images and imaginings."*

In the broadest sense, spatial (in)justice refers to an intentional and focused emphasis on the spatial or geographical aspects of justice and injustice. As a starting point, this involves the fair and equitable distribution in space of socially valued resources and the opportunities to use them. Spatial justice as such is not a substitute or alternative to social, economic, or other forms of justice but rather a way of looking at justice from a critical spatial perspective. From this viewpoint, there is always a relevant spatial dimension to justice while at the same time all geographies have expressions of justice and injustice built into them. Our intention is to utilise the concept of spatial justice to the fractal structure of a virtual city.

Spatial (in)justice can be seen as both outcome and process, as geographies or distributional patterns that are in themselves just/unjust and as the processes that produce these outcomes. It is relatively easy to discover examples of spatial injustice descriptively, but it is much more difficult to identify and understand the underlying processes producing unjust geographies. Locational discrimination, created through the biases imposed on certain populations due to their geographical location, is fundamental in the production of spatial injustice and the creation of lasting spatial



Cells and blocs by P.Silondi, unity3D, 3dsmax

structures of privilege and advantage. The three most familiar forces shaping locational and spatial discrimination are class, race, and gender, but their effects should not be reduced only to segregation. Seeking to increase justice or to decrease injustice is a fundamental objective in all societies, a foundational principle for sustaining human dignity and fairness. The legal and philosophical debates that often revolve around Rawls' theory of justice are relevant here, but they say very little about the spatiality of justice and injustice especially in the area of virtual cities. We propose to extend such notions of spatial justice, as discussed above, to the virtual city.

Thinking spatially about the nature of fractal cybercities not only enriches our theoretical understanding, it can uncover significant new insights that extend our practical knowledge into more effective actions where justice plays a greater role in the organization of space, by not making the spatial explicit and assertive, these opportunities will not be so evident.

The prominent psychologist Carl Jung, during the development of his theory of the collective unconscious, hypothesized that the aesthetic experience in art consists of the elevation of archetypal images towards the conscious mind by means of stimuli generated by artistic objects. These archetypal images are deposited in the collective subconscious. Jung proposes that, just as the human body conserves the traces of our mammalian ancestors, the human mind maintains images imprinted in the deepest part of our psyche; structures and models that were captured during our evolutionary process. Our instinctive judgments are directed by universal archetypes, which were configured by the interaction of human beings with their surroundings during the distinct stages of our evolution.These ideas are supported by current research in evolutionary biology, brain physiology and cognitive science.

These disciplines come together in what we may call evolutionary psychology, providing a picture of how the mind evolved over millennia to adapt to the changing world. There is a continuous link from the earlier unconscious action routines of other animals, to the development of language and the conscious mind.

Our view is that there should be support from psychology for what defines a good building or city that supports organic form depicted by fractal geoometry. The fractal structure of nature clearly follows from mechanisms of physical interaction and the evolution of matter. So, we could similarly infer that the structure of our psyche, the collective subconscious of Jung, is essentially fractal. This great reservoir of our ancestral memories have to be structured in the most economical way, not only to allow an almost unlimited capacity, but also with many interconnections to facilitate the free flux of information. What could be more suitable to this than a fractal structure? If this is so then our discussion above concerning the proposed fractal structure of the Underground City would evidently point to the direct relationship between an organism structure and the notion of spatial justice. Uniform fractal scaling laws reflecting an underlying social network structure within the city point to a general form that has a fundamental notion of spatial justice.

We have made use of the word 'form' extensively already without attempting any definition, for in one sense, the term is self-evident: as D'Arcy Thompson implies, form means shape, and in this context, shape pertains to the way cities can be observed and understood in terms of their spatial pattern incorporating the notion of spatial justice as detailed above. In fact, we will need to reflect a little more deeply on the word because our usage here implies a certain approach to geometry and space as well as process and function.

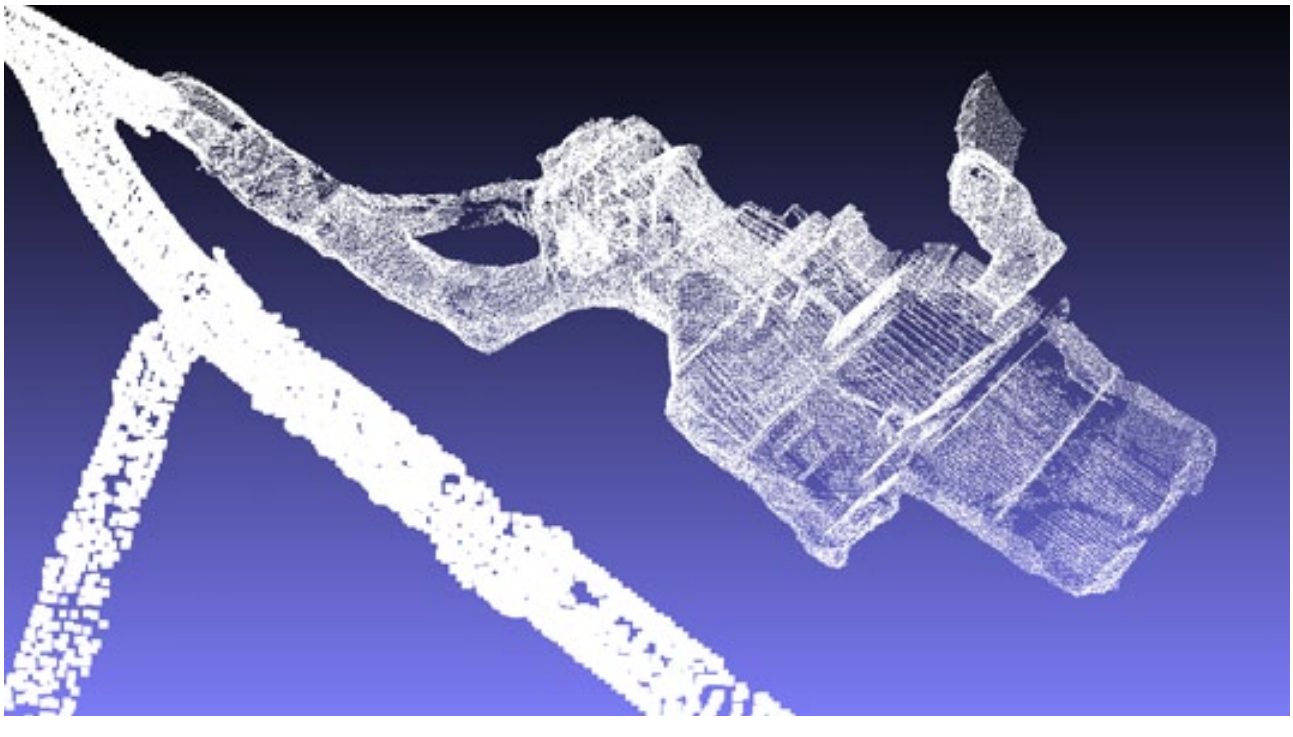
The word 'form' has many meanings, such as shape, configuration, structure, pattern, organization, and system of relations. Here we are interested in these properties only in so far as they are clearly set in space, which is the usage we will follow. Form is broader than shape per se, although our immediate and first attack on its measurement and understanding is through the notion of shape, in the outward appearance of things. In terms of the study of cities, form will represent the spatial pattern of elements composing the city in terms of its networks, buildings, spaces, defined through its geometry mainly, but not exclusively, in two rather than three dimensions.

It is therefore our intention to propose that a fluid expression of form is depicted by the fractal generation of spatial structure and this is turn is associated with organic properties that incorporate the notion of spatial justice. Using the example of the virtual Underground City we propose that such a fractal structure would incorporate the notion of spatial justice as detailed above. ✖

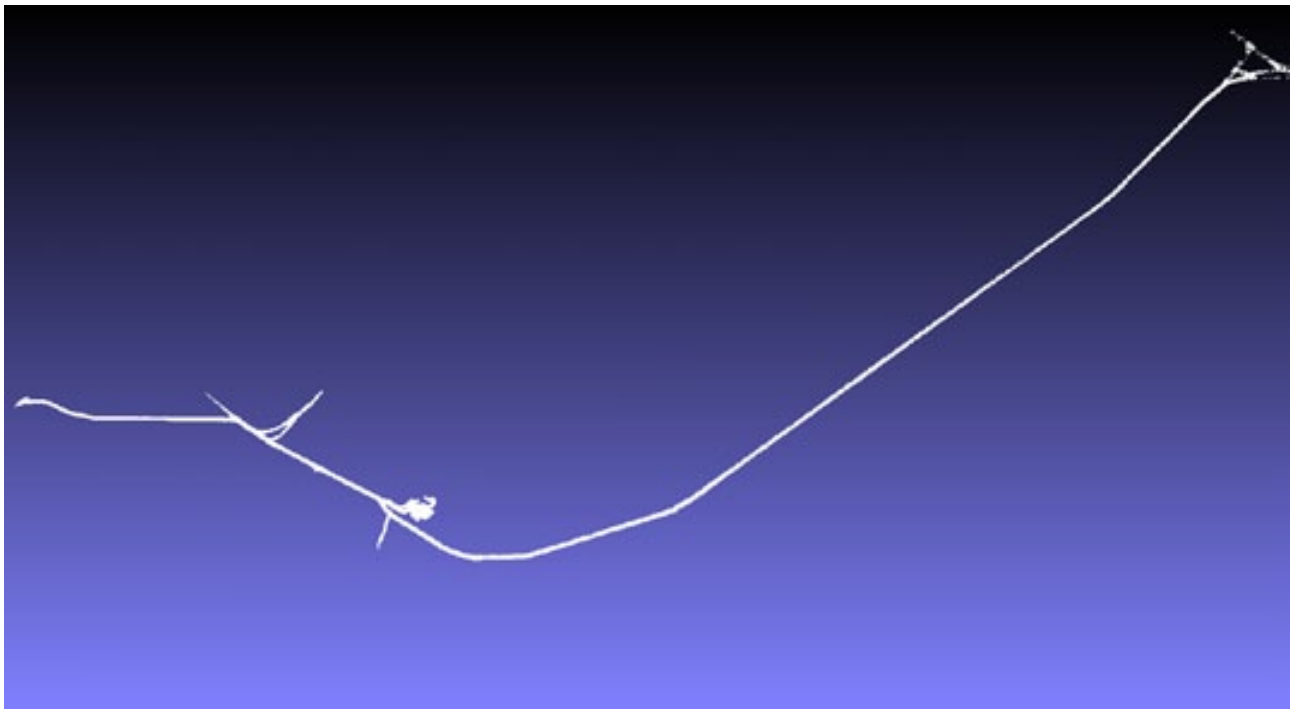
PART II
GALLERY

3D POINT CLOUDS

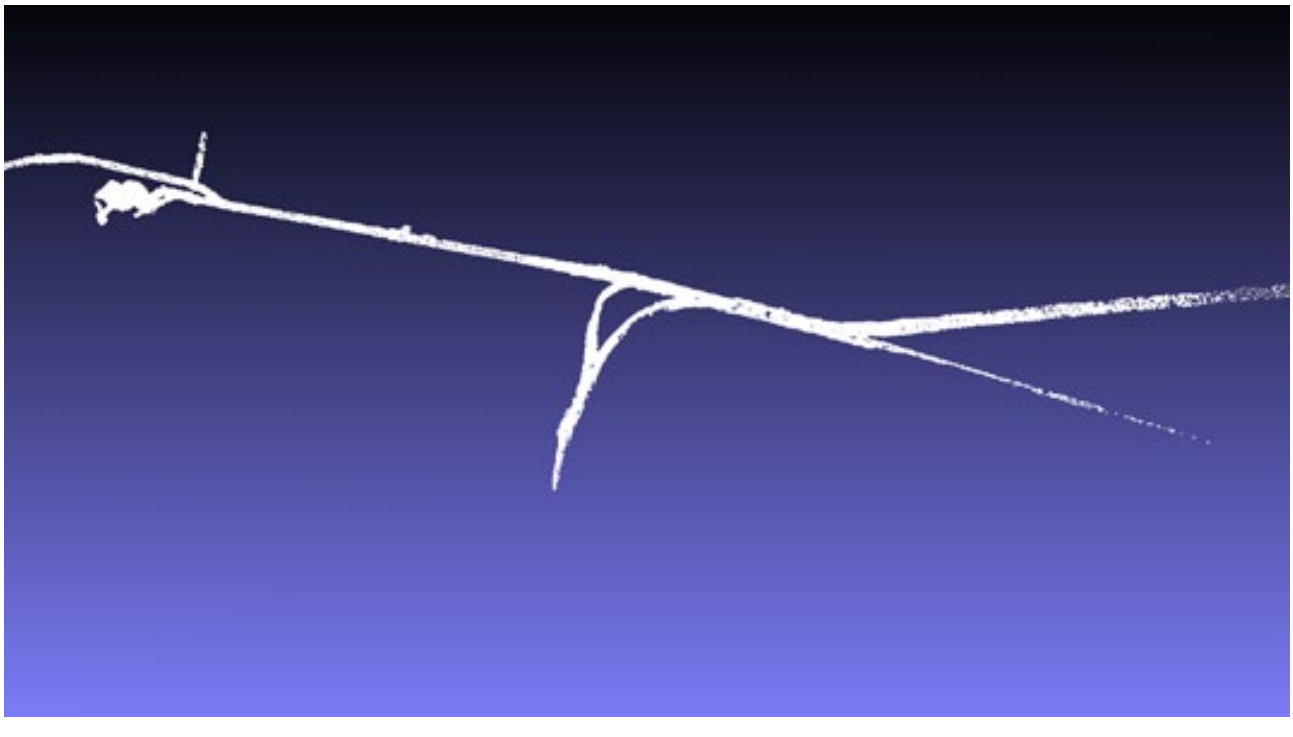
3D visualizations of point clouds created by Pascal Silondi, Jakub Grosz and Peter Marencik using 3D Data from Laser measurement of the Labin ex-coal mine tunnels provided by Vias, Vienna Institute for Archeological Science.



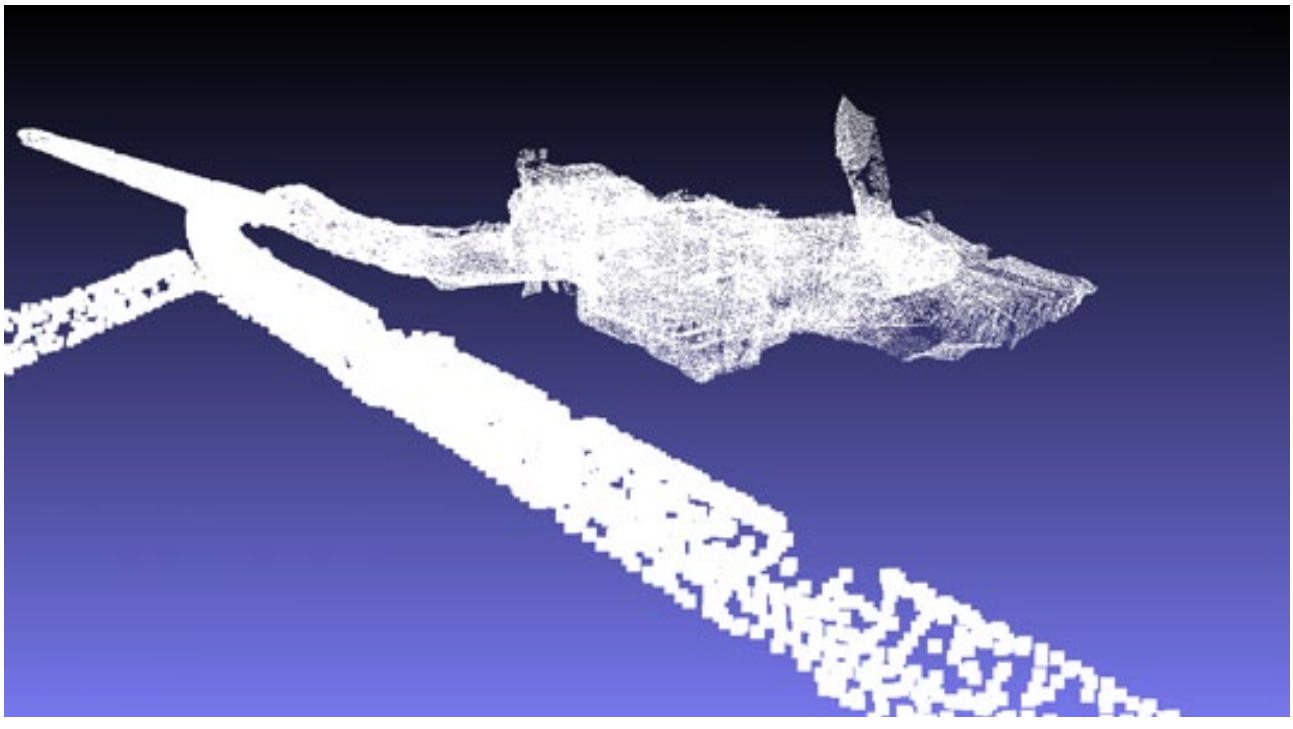
Elevator room, 3D point cloud by P.Silondi, J.Grosz and P.Marencik



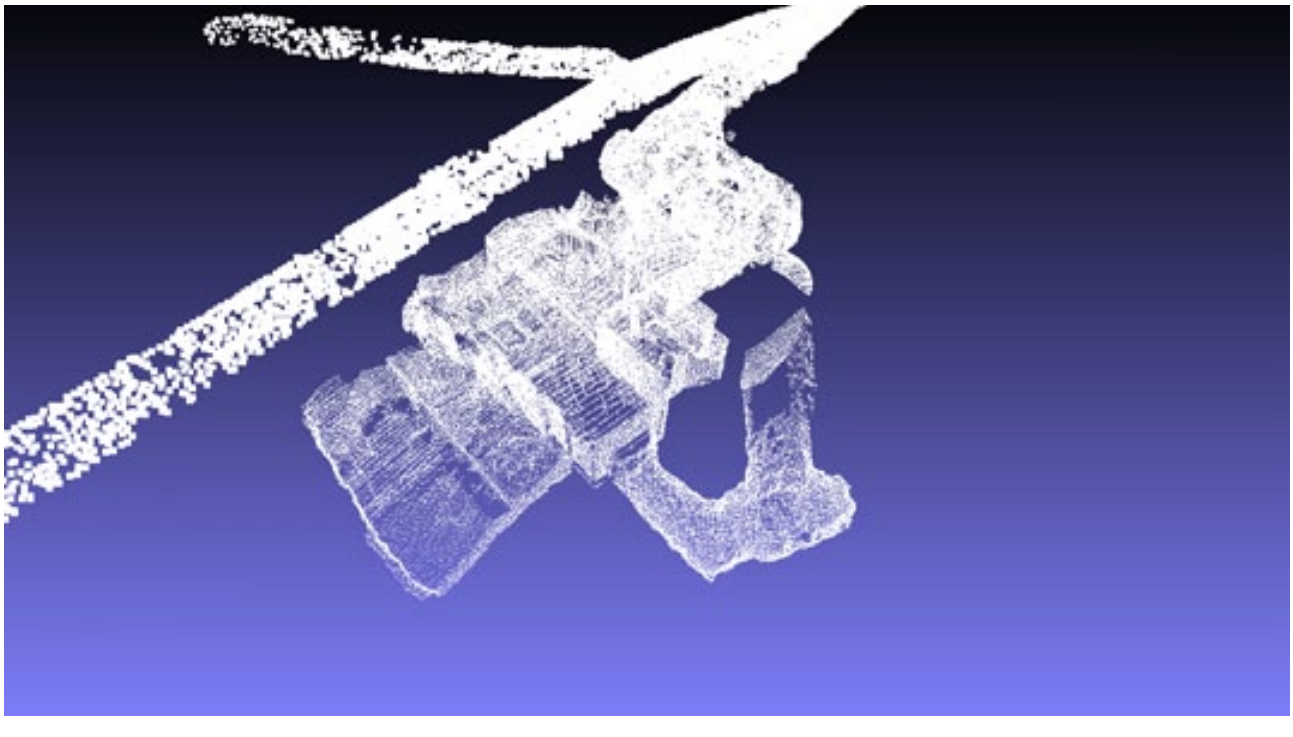
Horizon8, 3D point cloud by P.Silondi, J.Grosz and P.Marencik



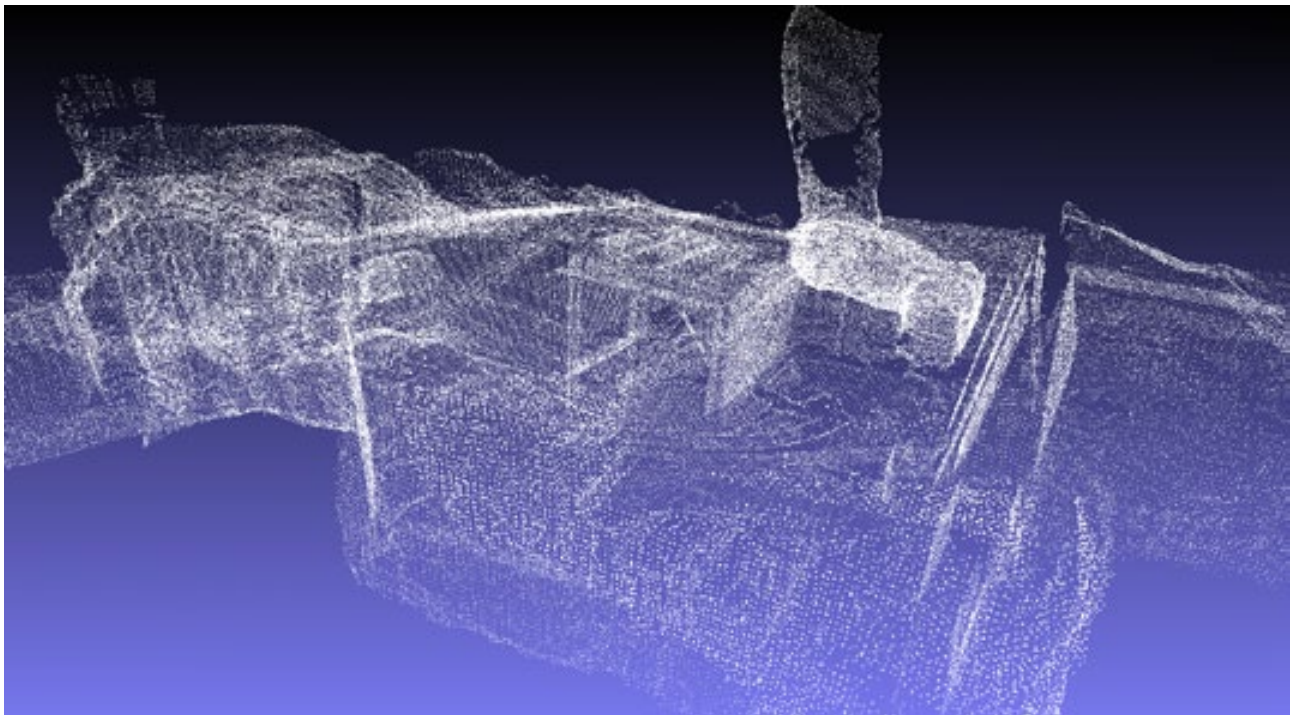
Horizon8, 3D point cloud by P.Silondi, J.Grosz and P.Marencik



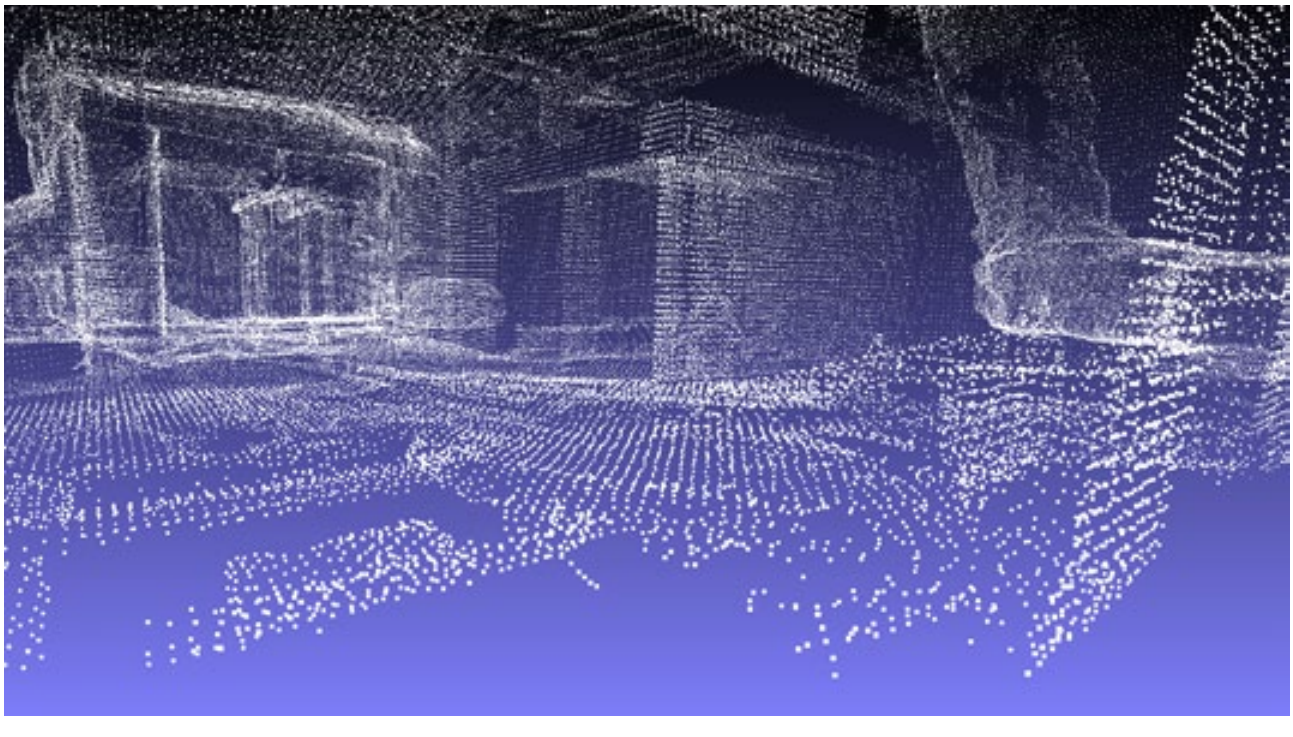
Elevator room, 3D point cloud by P.Silondi, J.Grosz and P.Marencik



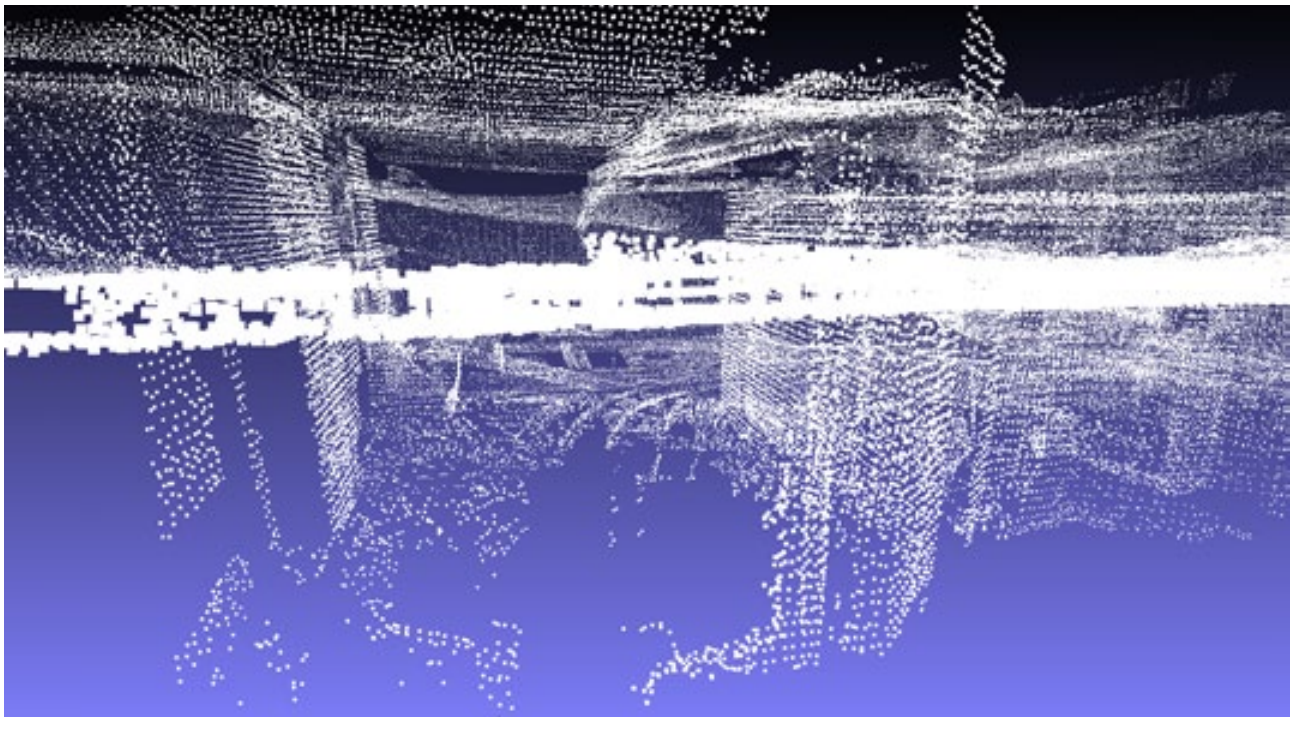
Elevator room, 3D point cloud by P.Silondi, J.Grosz and P.Marencik



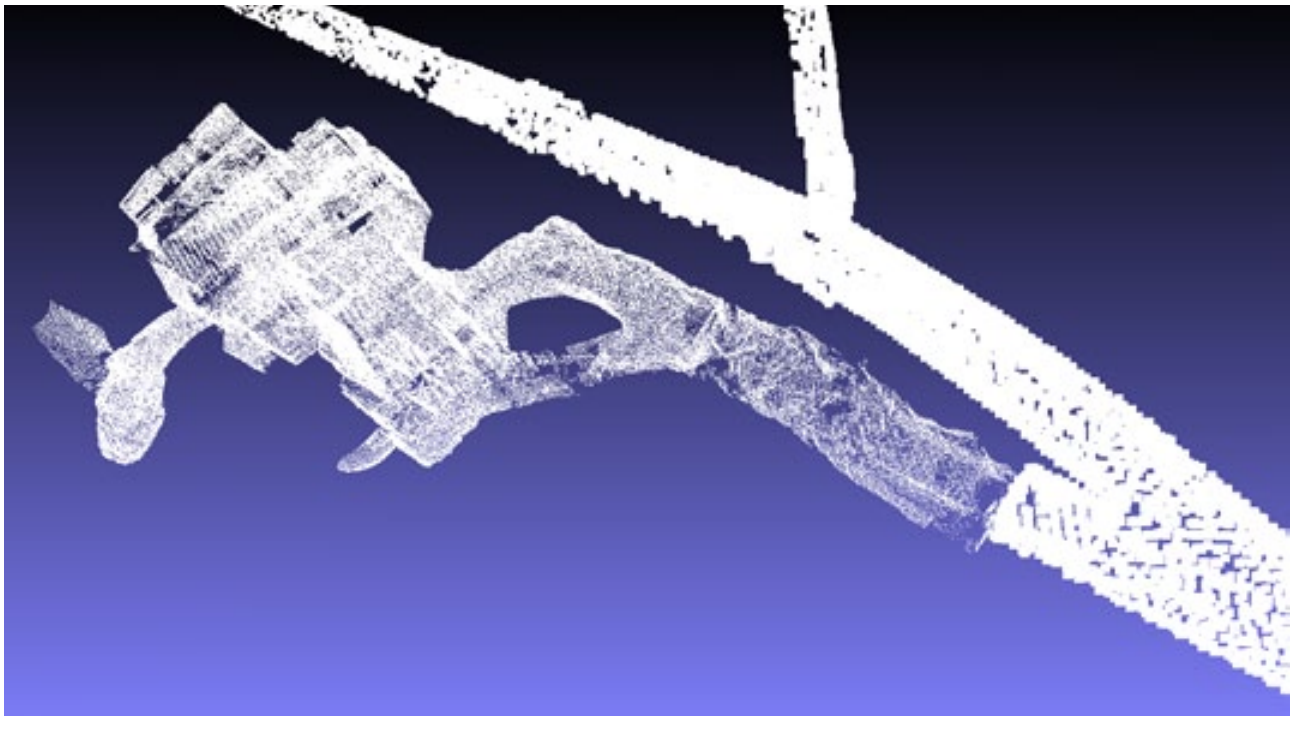
Elevator room, 3D point cloud by P.Silondi, J.Grosz and P.Marencik



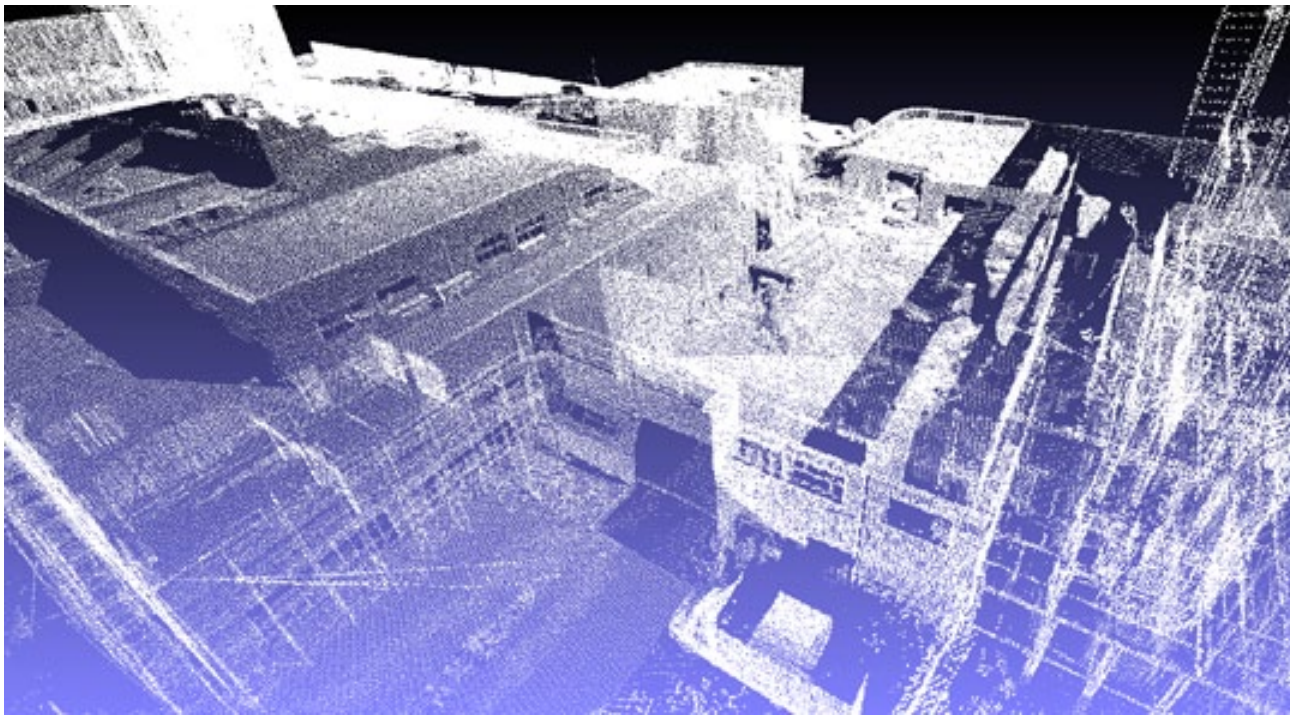
Inside the Elevator room, 3D point cloud by P.Silondi, J.Grosz and P.Marencik



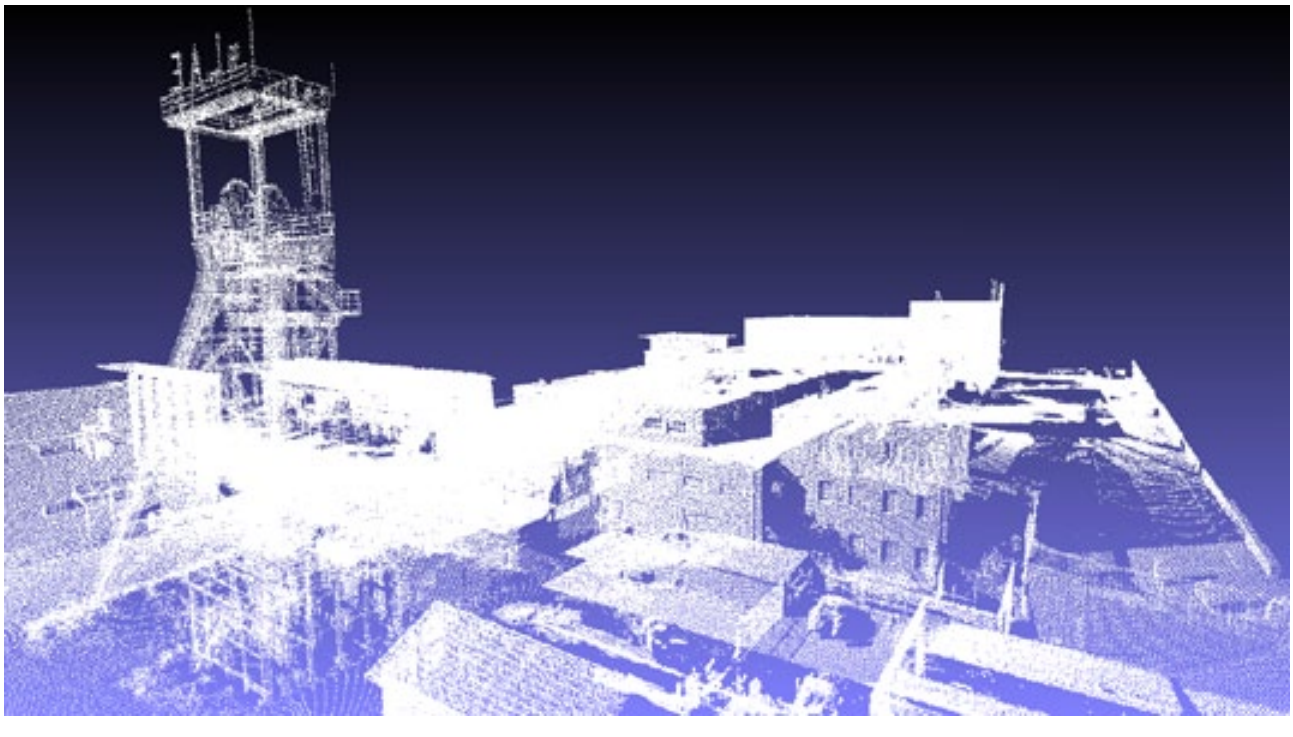
Inside the Elevator room, 3D point cloud by P.Silondi, J.Grosz and P.Marencik



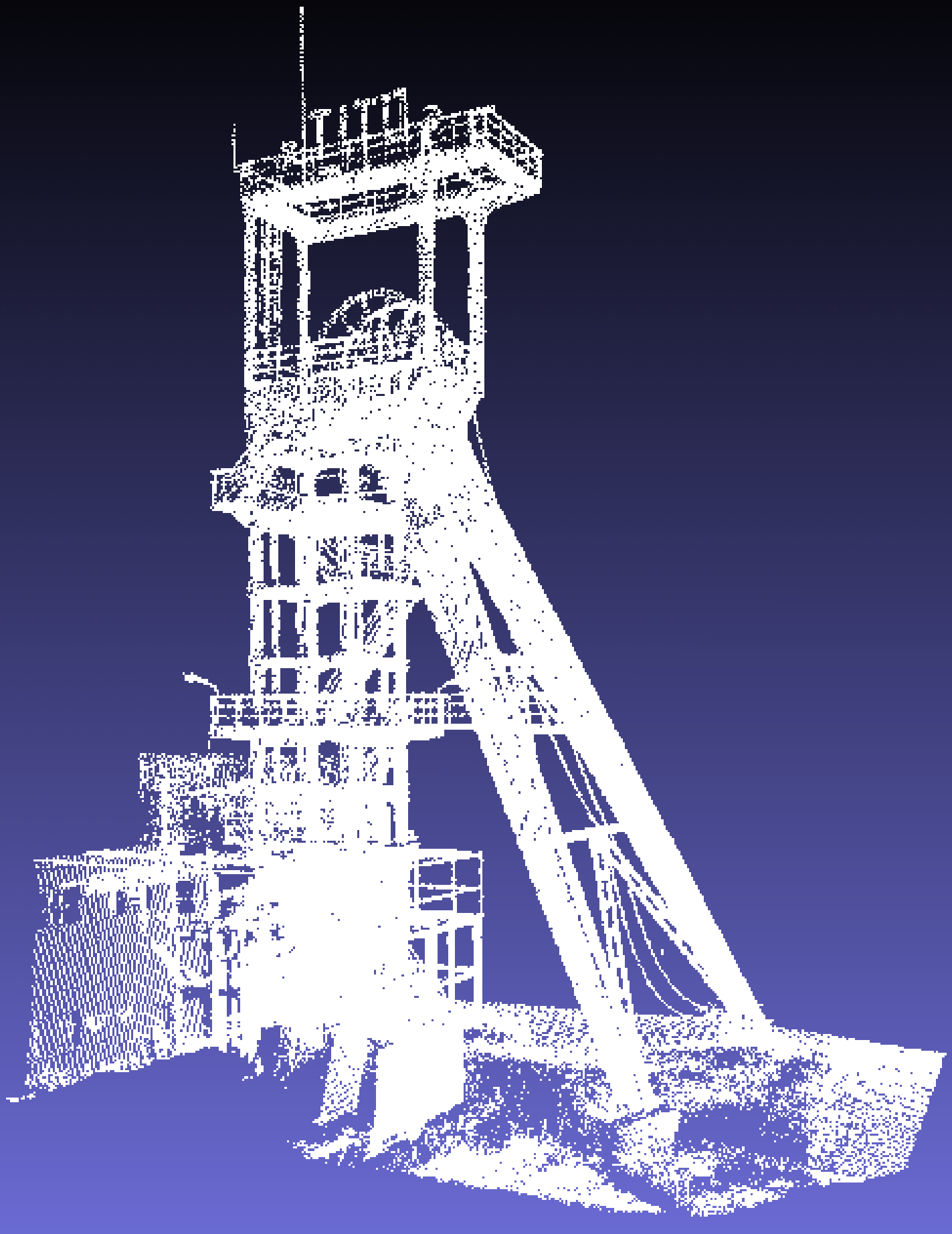
Elevator room, 3D point cloud by P.Silondi, J.Grosz and P.Marencik



Lamparna art center, surface structures, 3D point cloud by P.Silondi, J.Grosz and P.Marencik



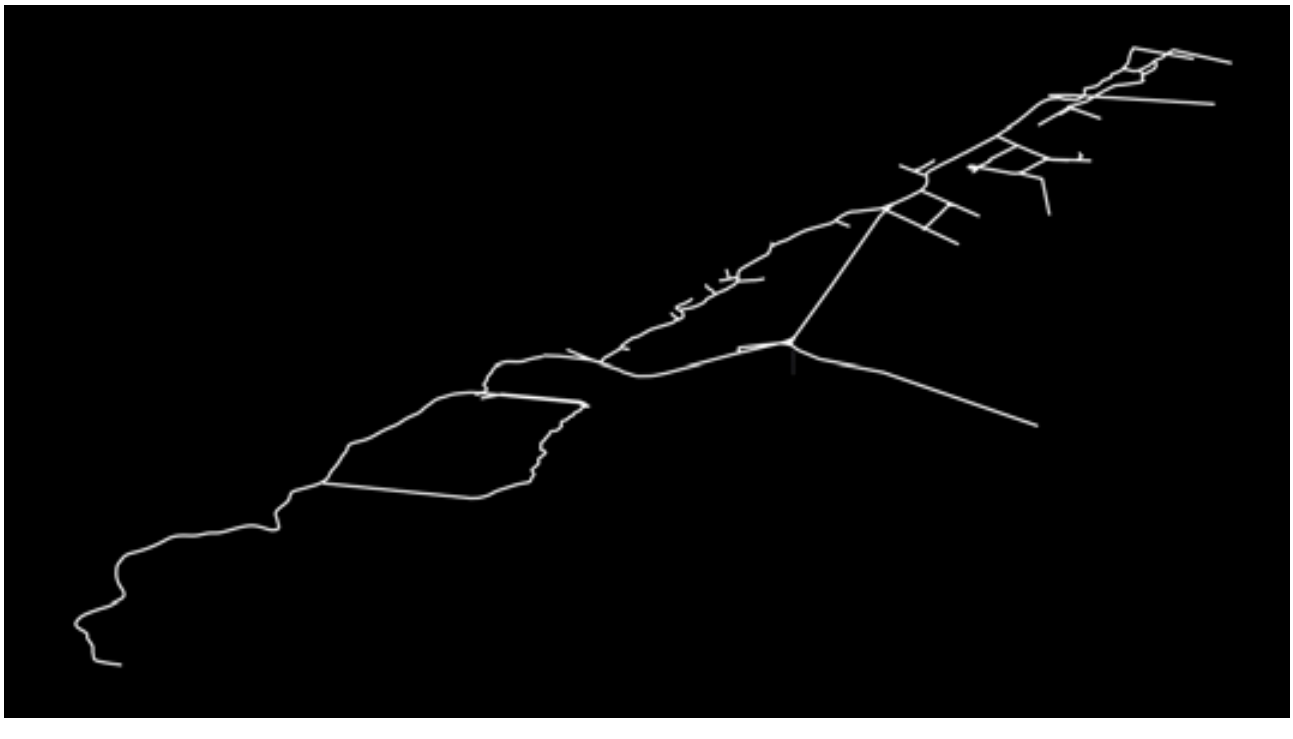
Lamparna art center and shaft, surface structures, 3D point cloud by P.Silondi, J.Grosz and P.Marencik



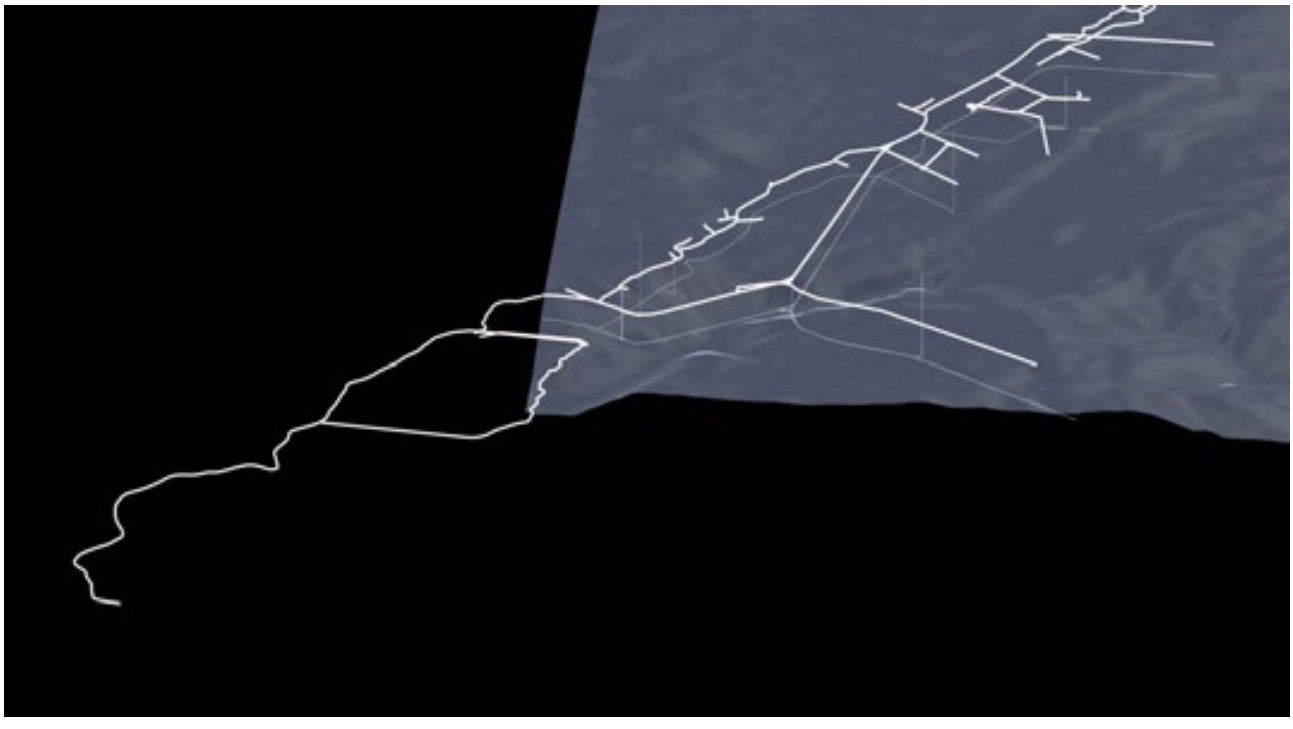
Labin shaft, 3D point cloud by P.Silondi, J.Grosz and P.Marencik

3D TUNNELS

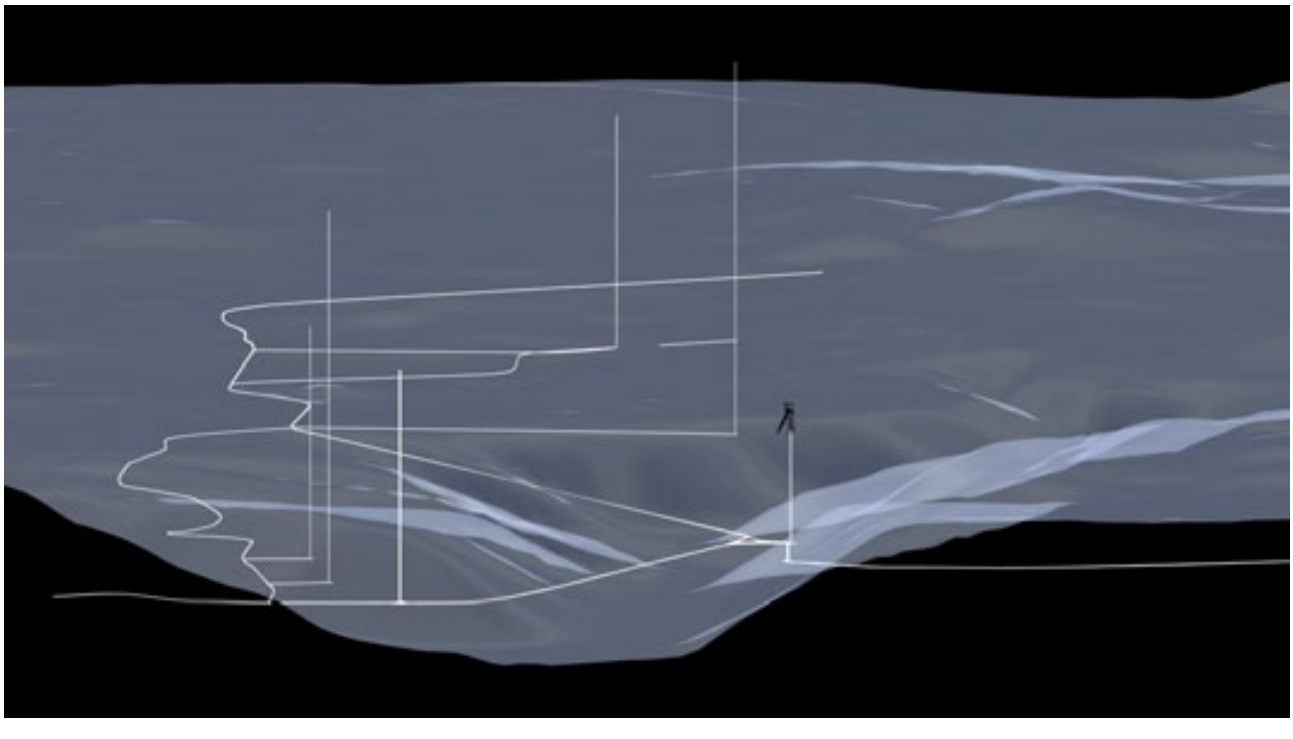
3D visualizations of the 8th horizon created by Pascal Silondi and Jakub Grosz using 3D Data from Laser measurement of the Labin ex-coal mine tunnels provided by Vias, Vienna Institute for archeological science and 2D maps provided by architects from Platforma 9.81 and models by Inge Schiller.



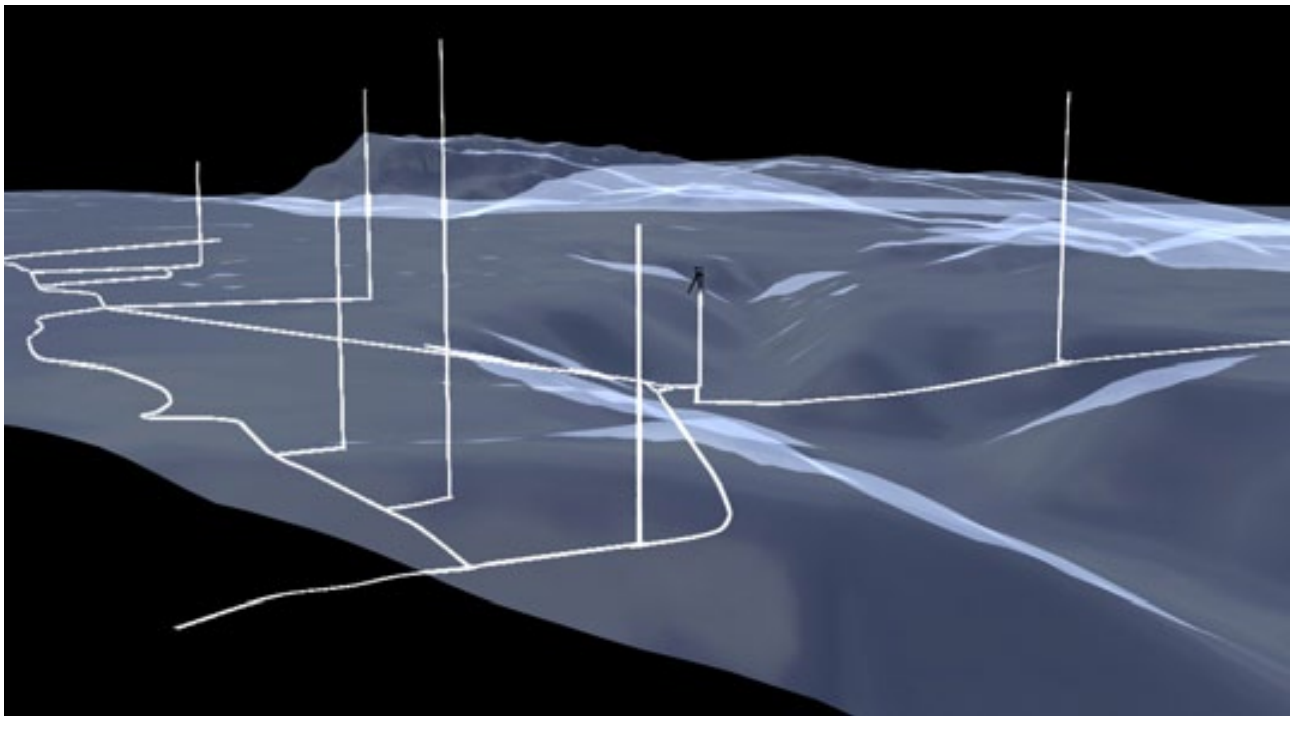
Horizon8, by P.Silondi and J.Grosz, 3dsmax



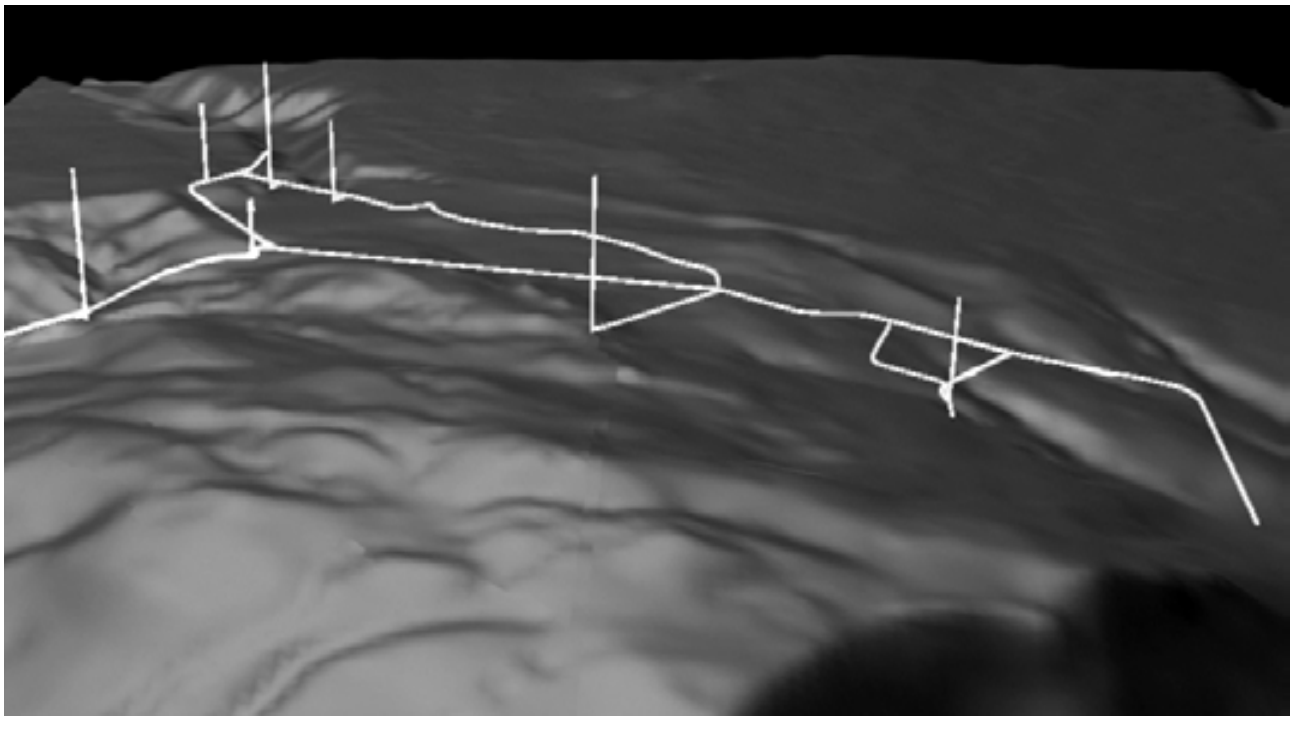
Horizon8, by P.Silondi and J.Grosz, 3dsmax



Landscape, by P.Silondi and J.Grosz, 3dsmax



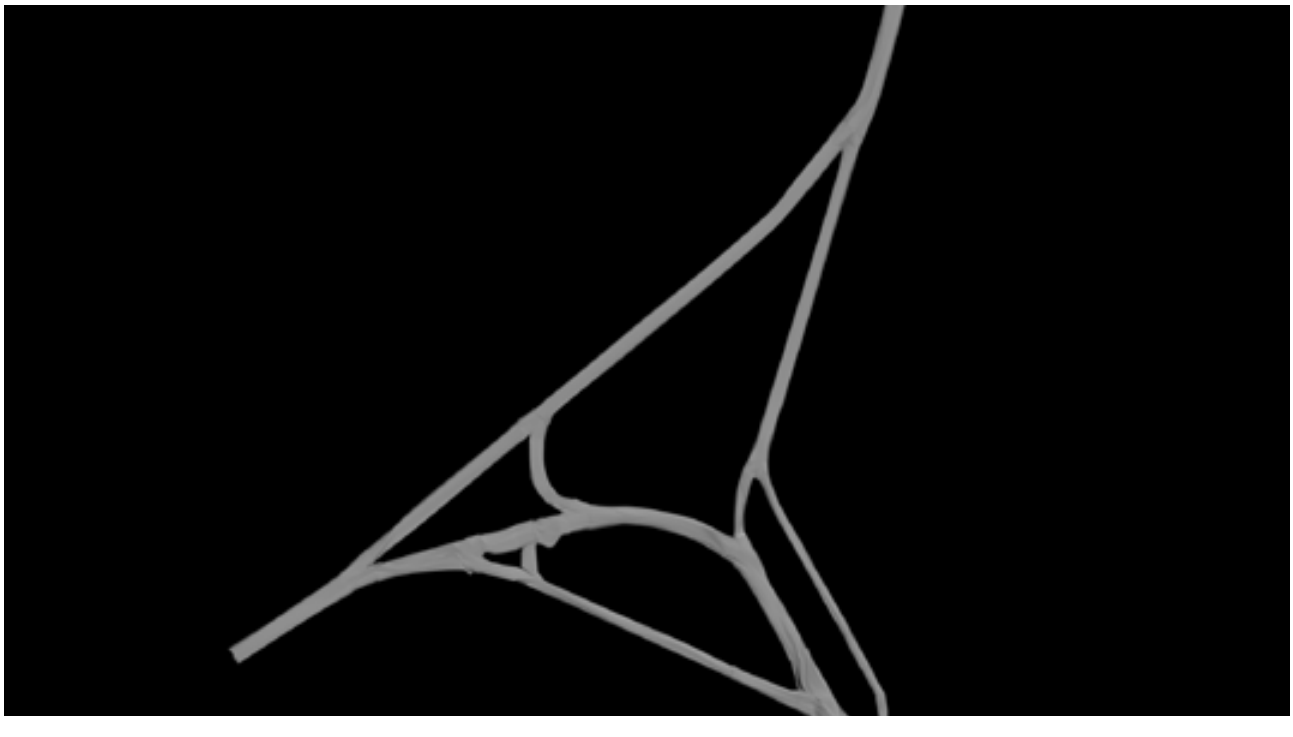
Underground City center, by P.Silondi and J.Grosz, 3dsmax



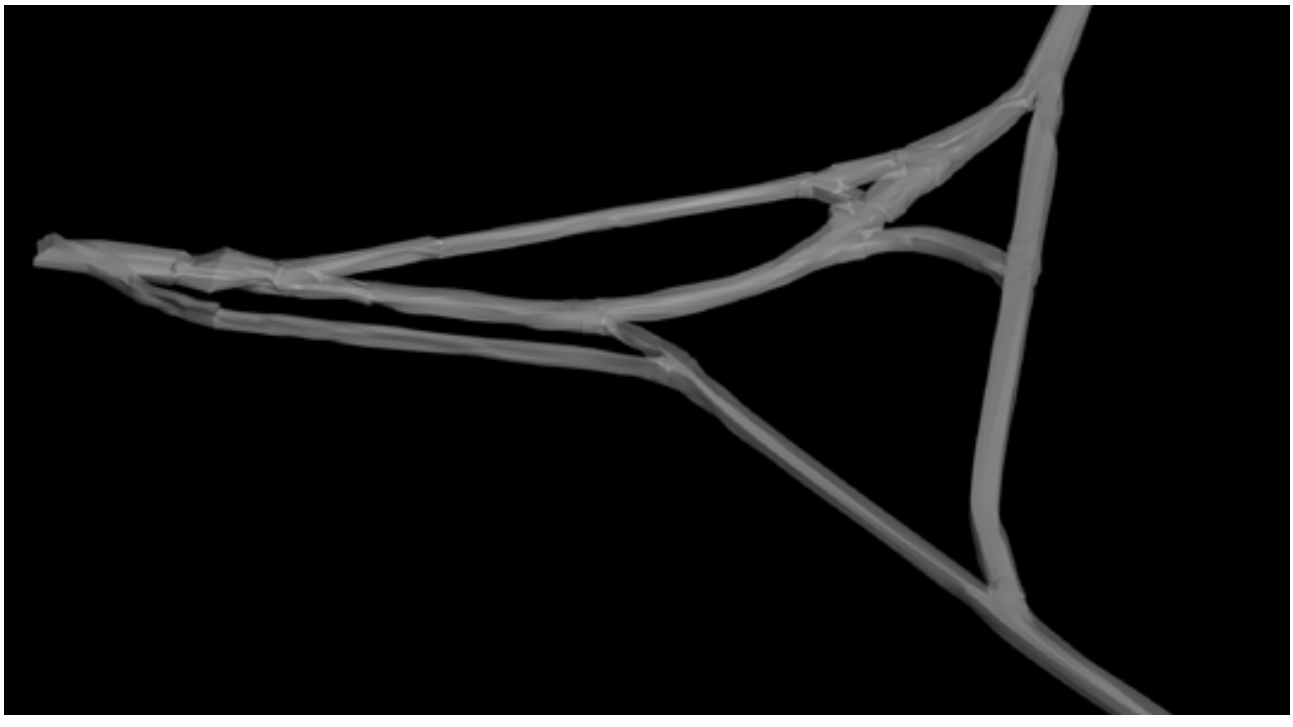
Landscape, by P.Silondi and J.Grosz, 3dsmax

WORK PLANS

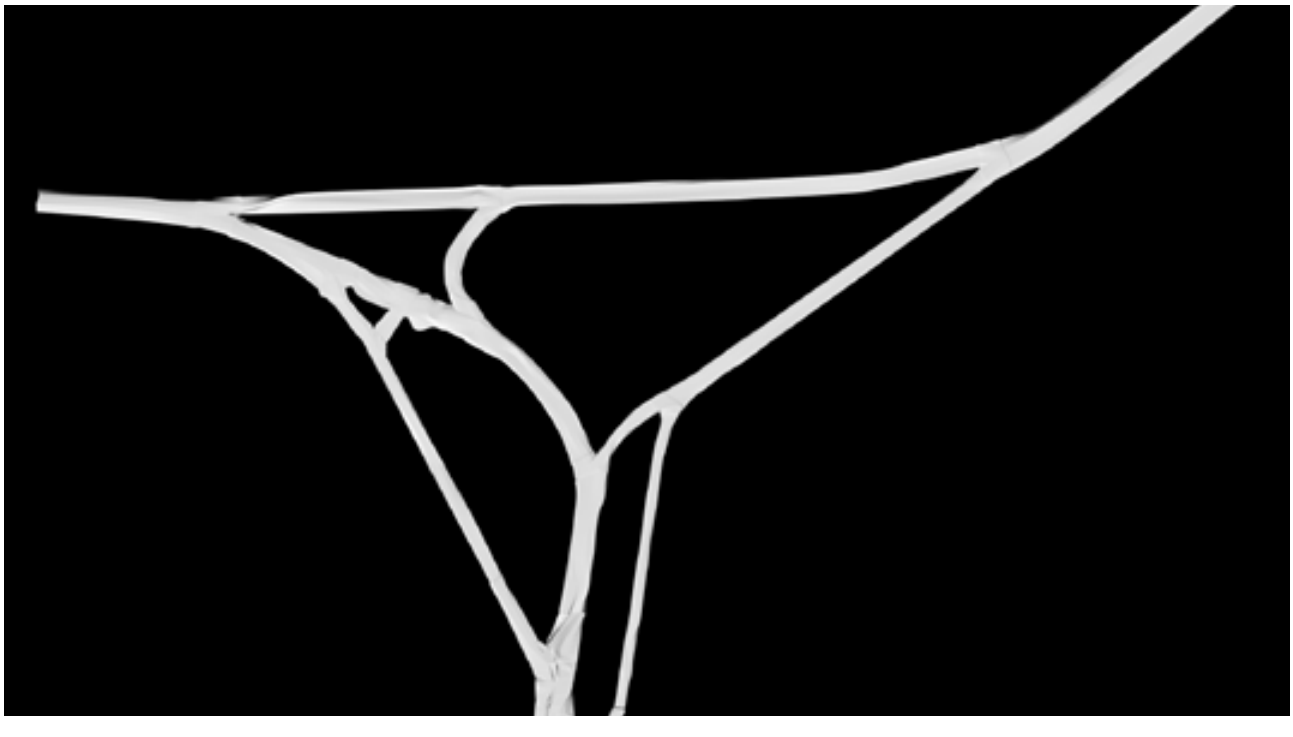
2D plans and 3D visualization of the Labin ex-coal mine tunnel system created by Pascal Silondi and Jakub Grosz after reconstruction from 3D Data from Laser measurement of the Labin ex-coal mine tunnels provided by Vias, Vienna Institute for archeological science and 2D maps provided by architects from Platforma 9.81 and models by Inge Schiller.



Underground City center, by P.Silondi and J.Grosz, 3dsmax

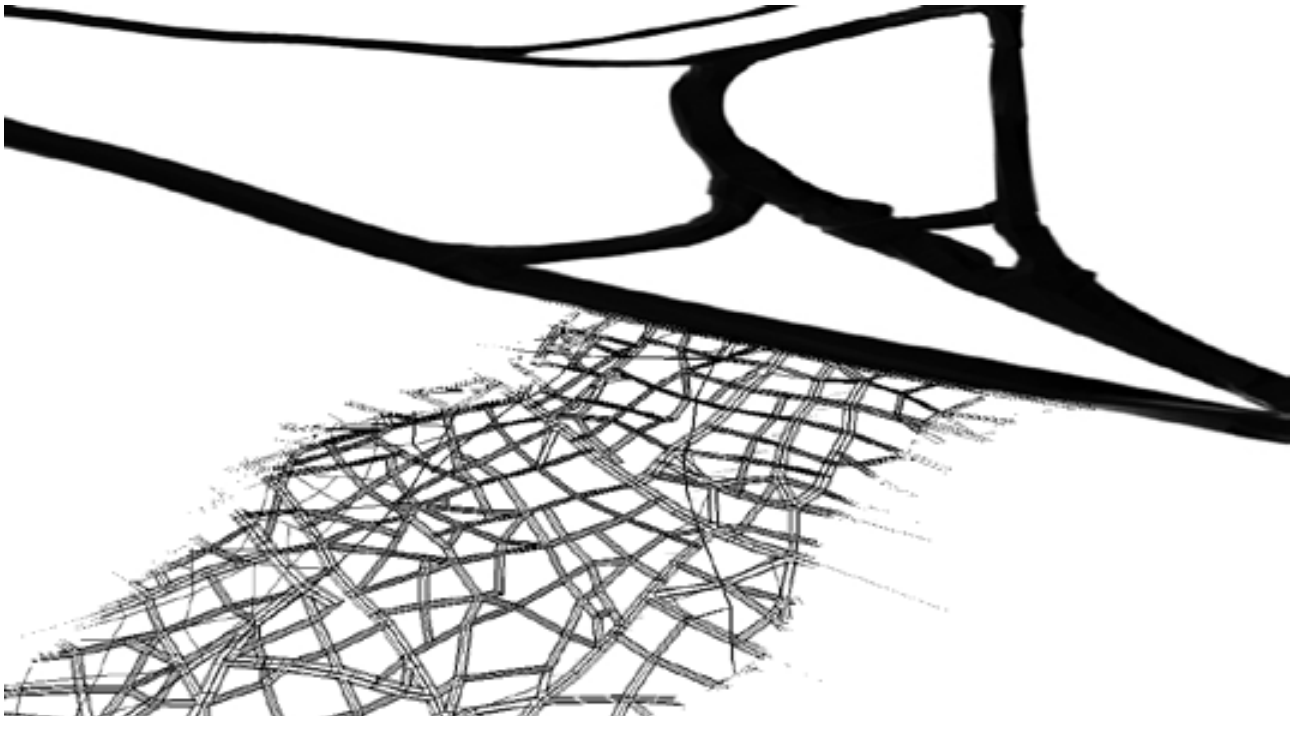


Underground City center, by P.Silondi and J.Grosz, 3dsmax

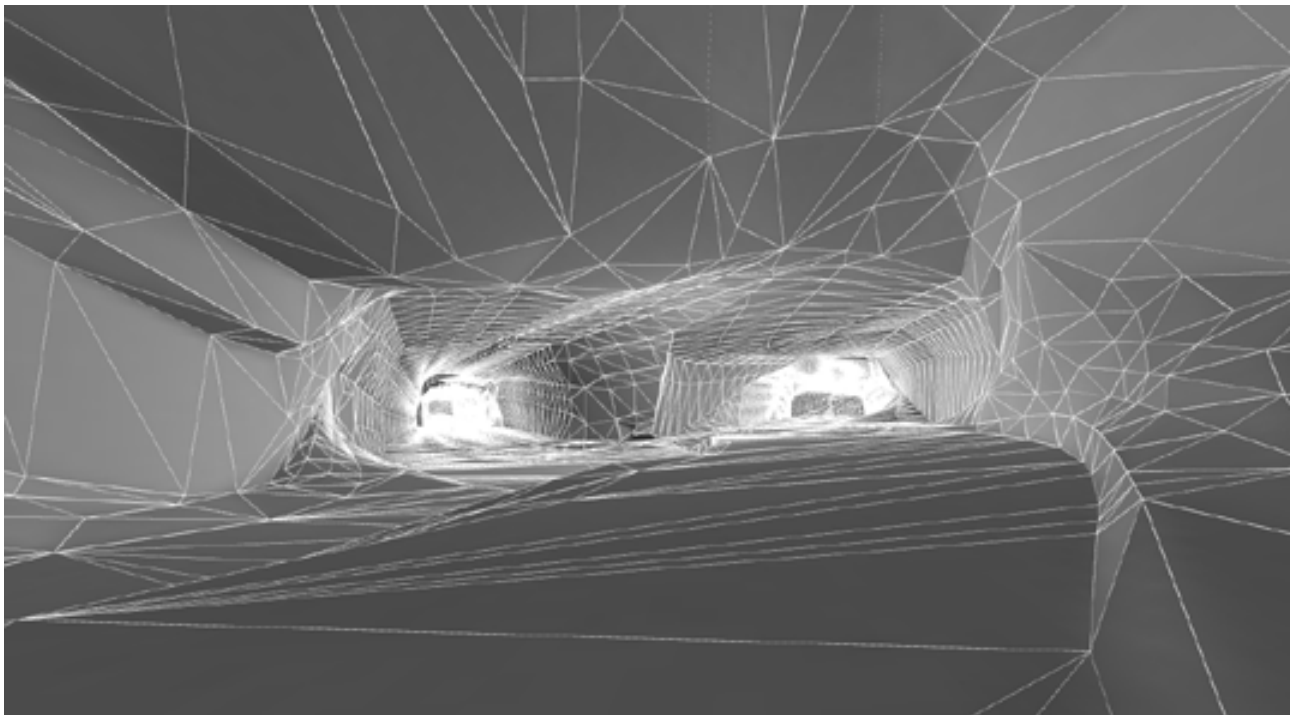


Underground City center, by P.Silondi and J.Grosz, 3dsmax

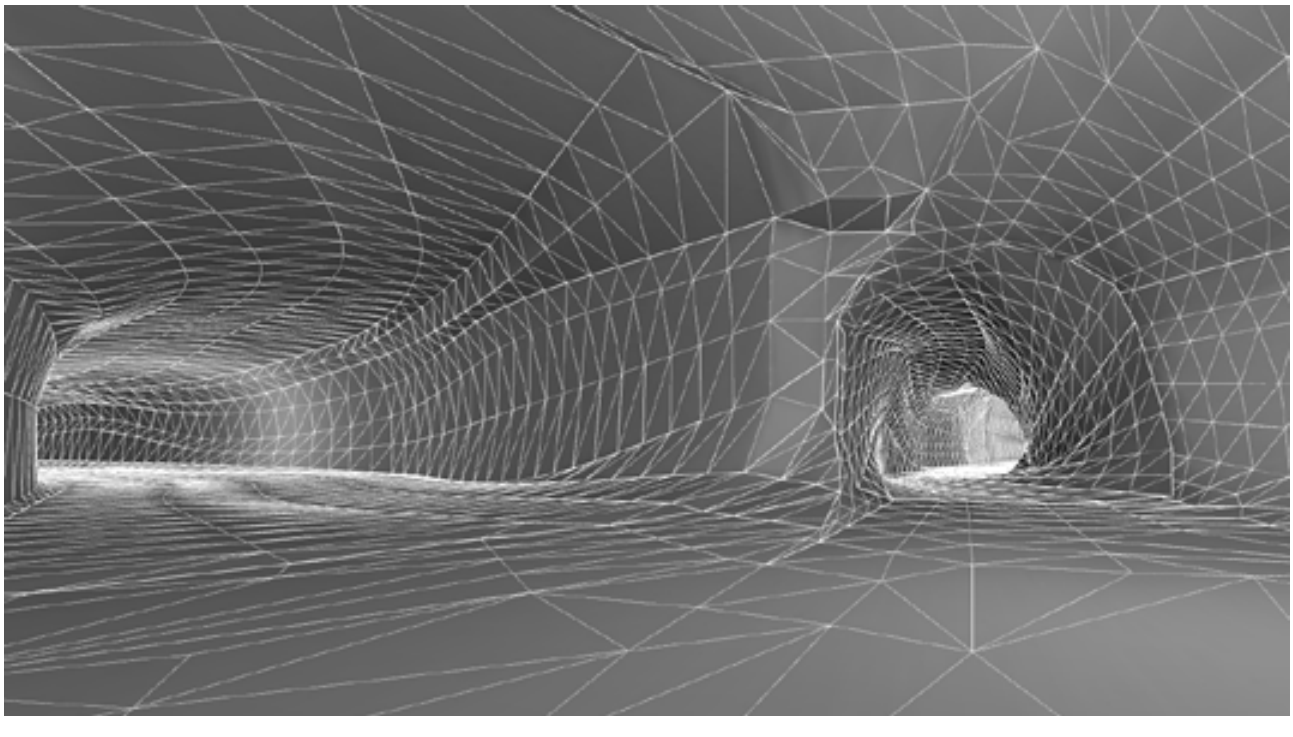
Expansion, by P.Silondi and J.Grosz, 3dsmax



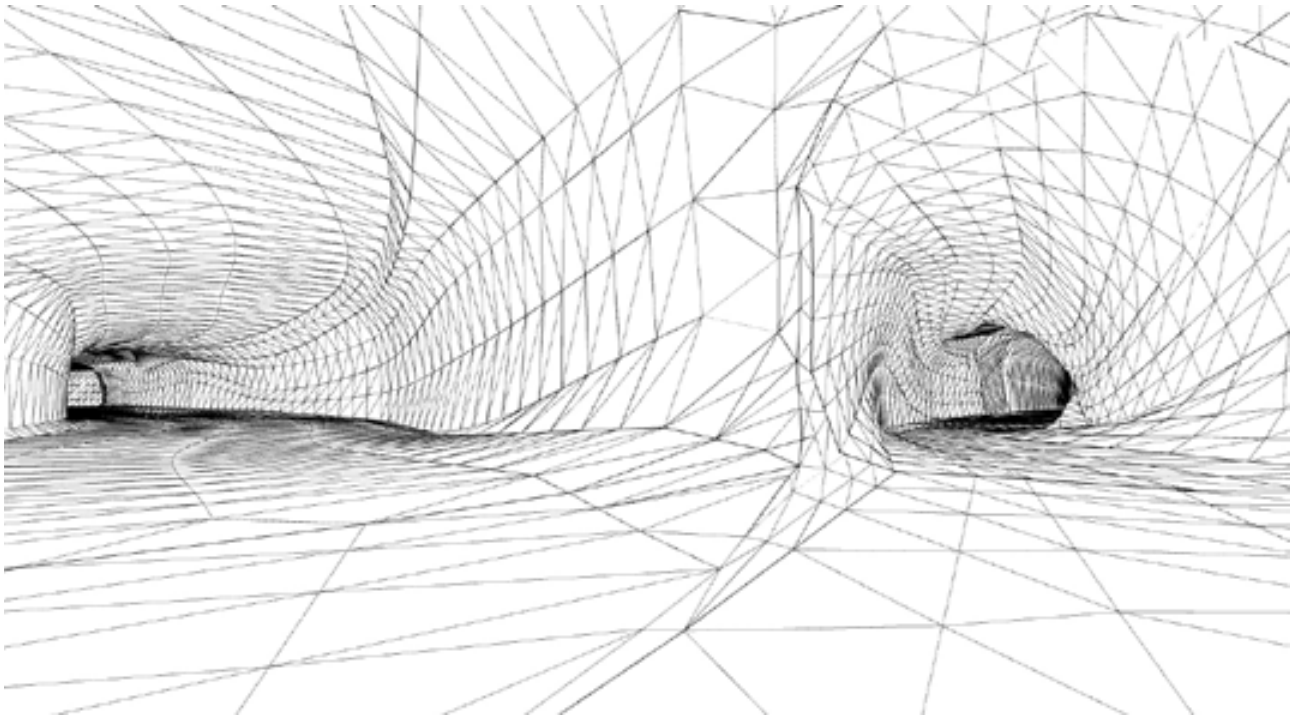
Expansion, by P.Silondi and J.Grosz, 3dsmax



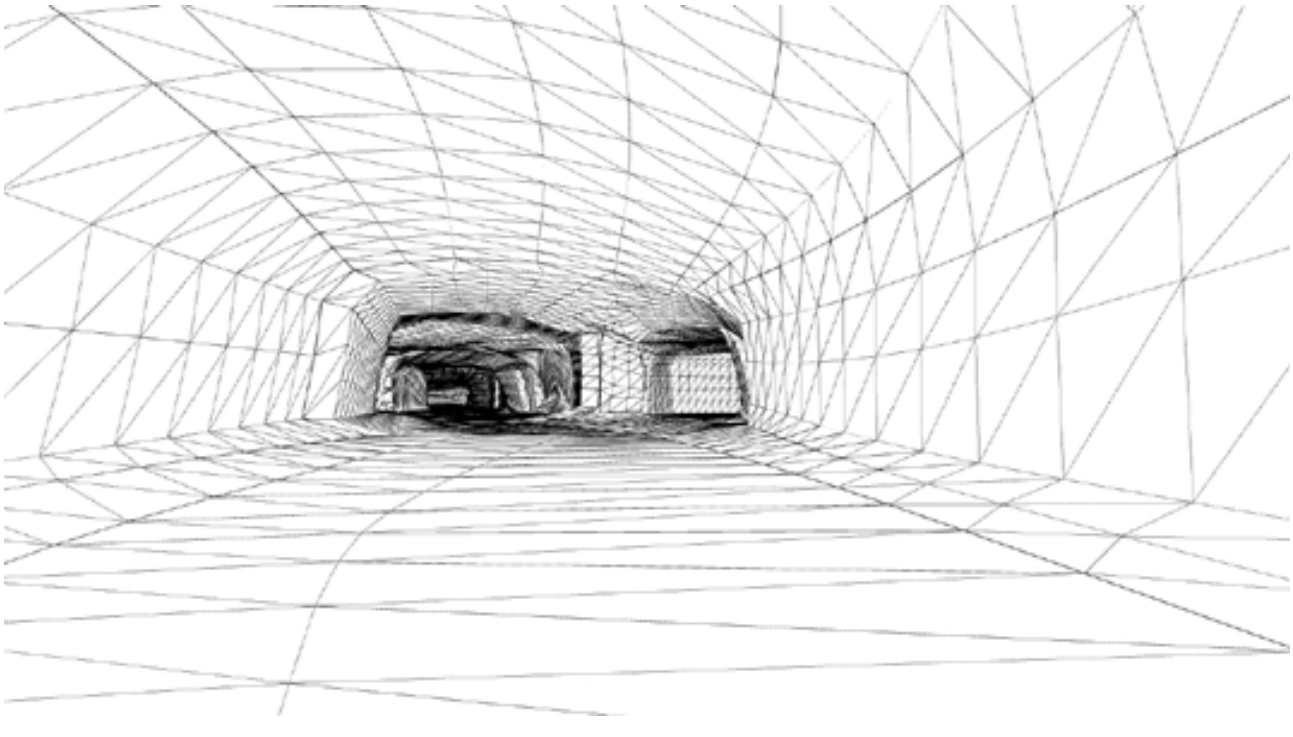
Underground City center structure, by P.Silondi, VRML/X3D



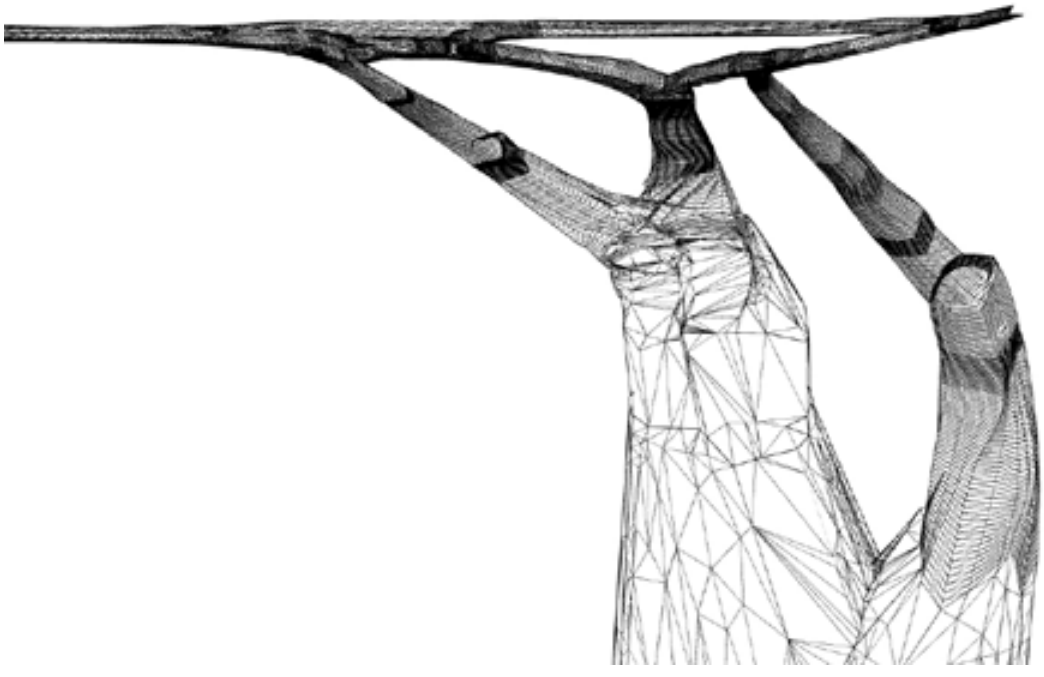
Underground City center structure, by P.Silondi, VRML/X3D



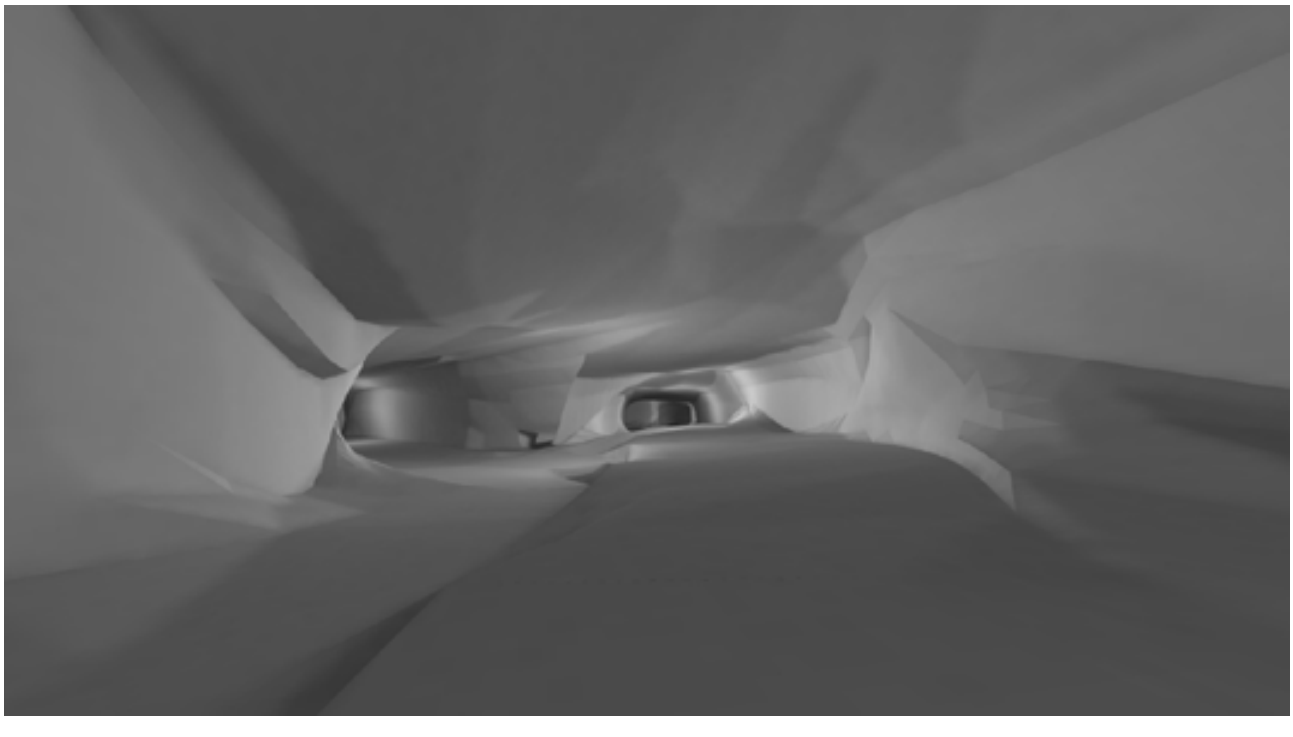
Triangulation 1, by P.Silondi, VRML/X3D



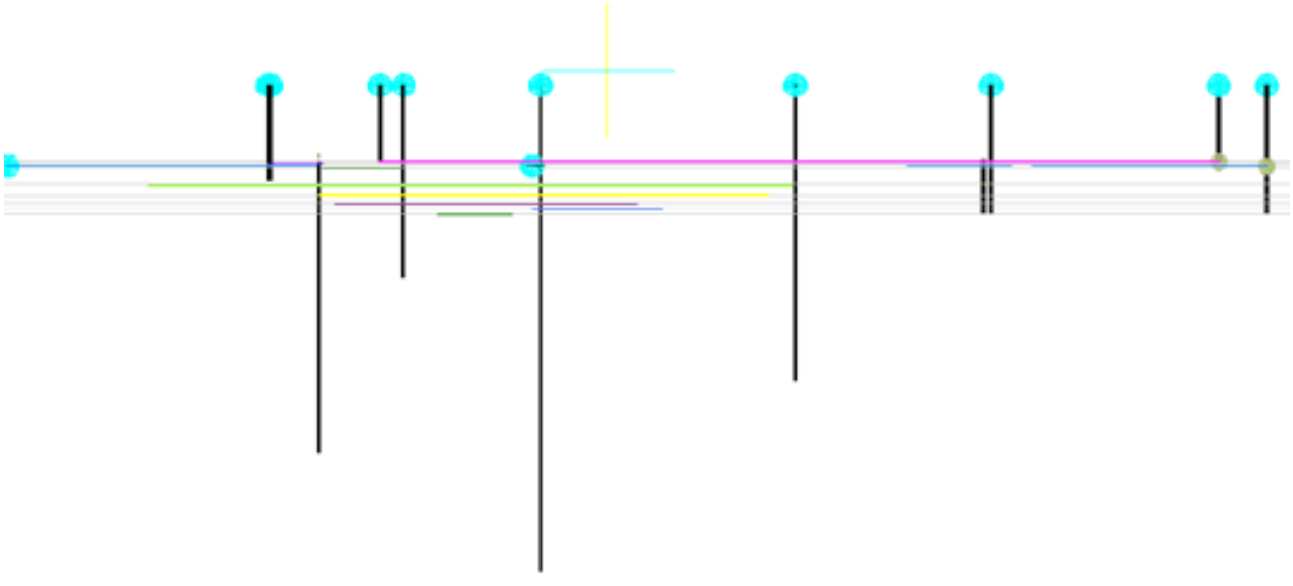
Triangulation 2, by P.Silondi, VRML/X3D



Triangulation 3, by P.Silondi, VRML/X3D



Inside the Underground City center, by P.Silondi, VRML/X3D



Rhizome, by J.Grosz, 3dsmax

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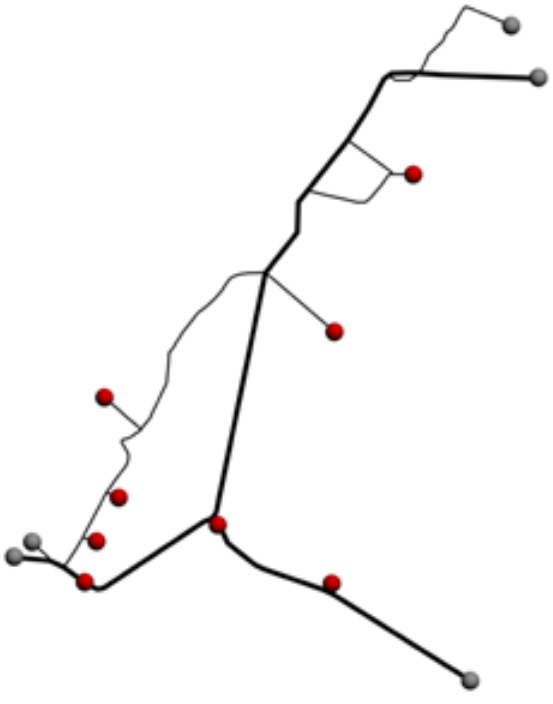
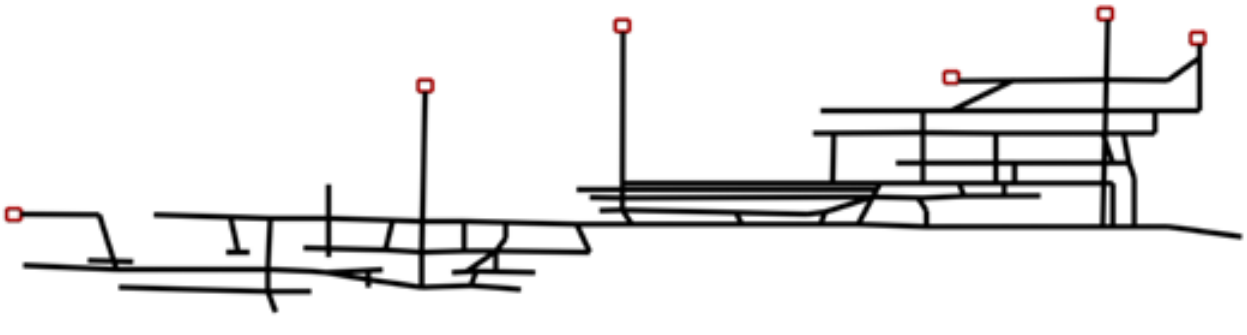
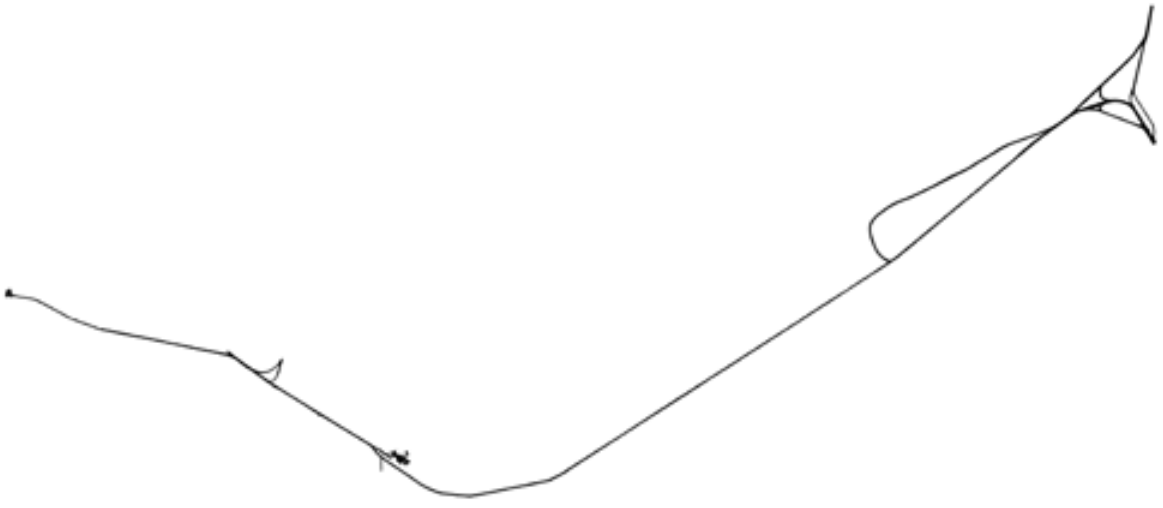


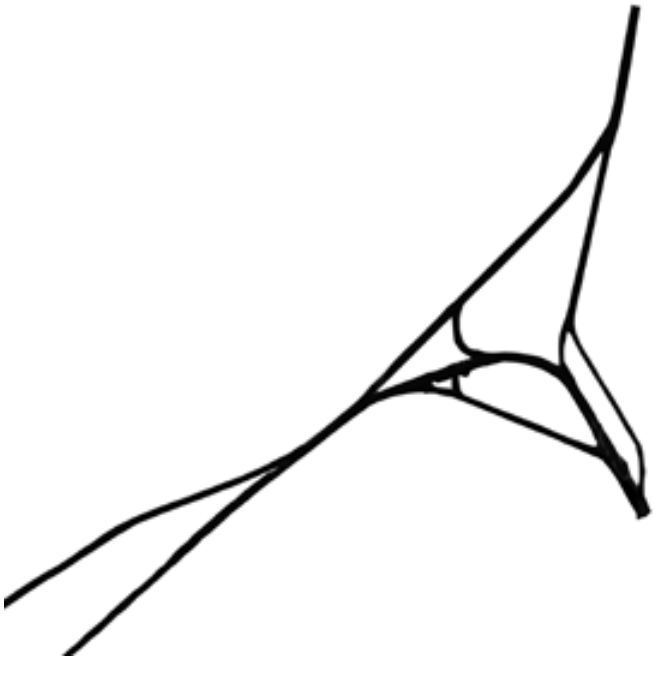
Horizon 8, by P.Silondi, 3dsmax



Mine Profile, by P.Silondi, 3dsmax

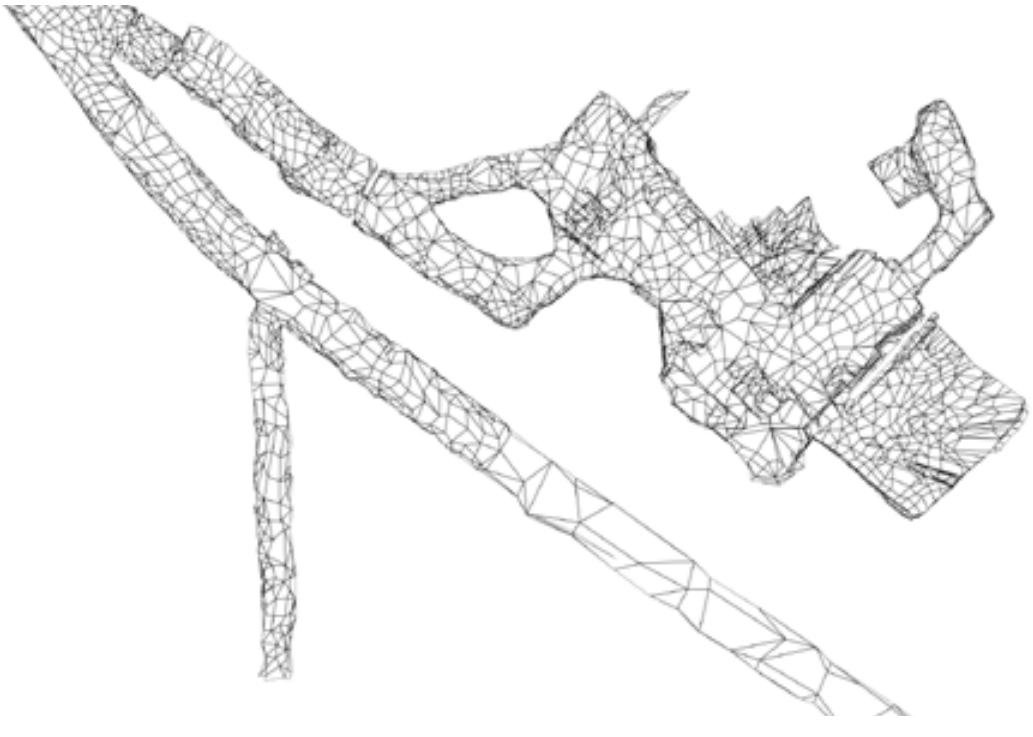


Horizon 8, by P.Silondi, 3dsmax



Underground City center, by P.Silondi, 3dsmax

Elevator, by P.Silondi, 3dsmax



Elevator, by P.Silondi, 3dsmax

MULTIUSER

Online participants are interconnected into 3D environments which react to their presence, behaviors and interventions. The aims of the multiuser environments is not only to visit and discover a static "already built world", but further to live a collaborative and creative online experience building and transforming the 3D environment, sharing visions with other participants from all over the world.

Alone in the dark, by P.Silondi, unity3D

Alone in the dark, by P.Silondi, unity3D

Realistic vision after reconstruction, by P.Silondi, unity3D

Realistic vision after reconstruction, by P.Silondi, unity3D

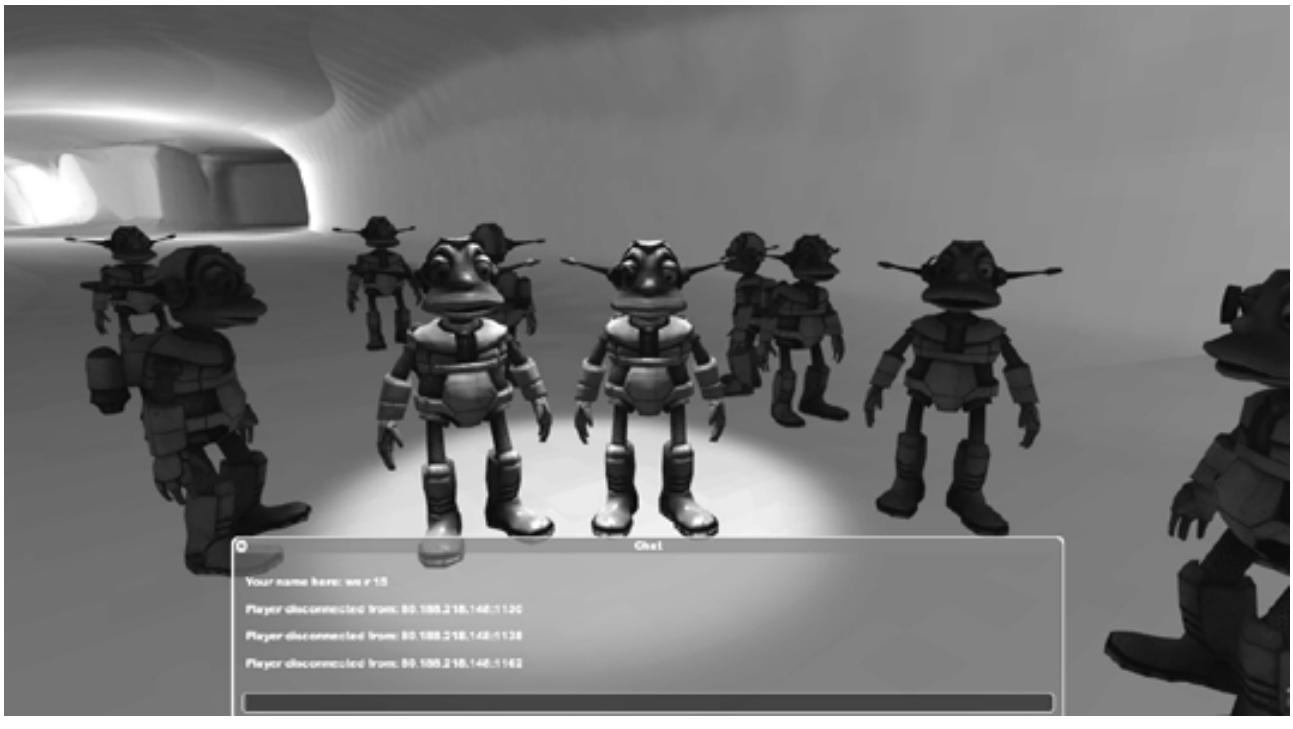
Video implementation, by P.Silondi, unity3D

Video implementation, by P.Silondi, unity3D

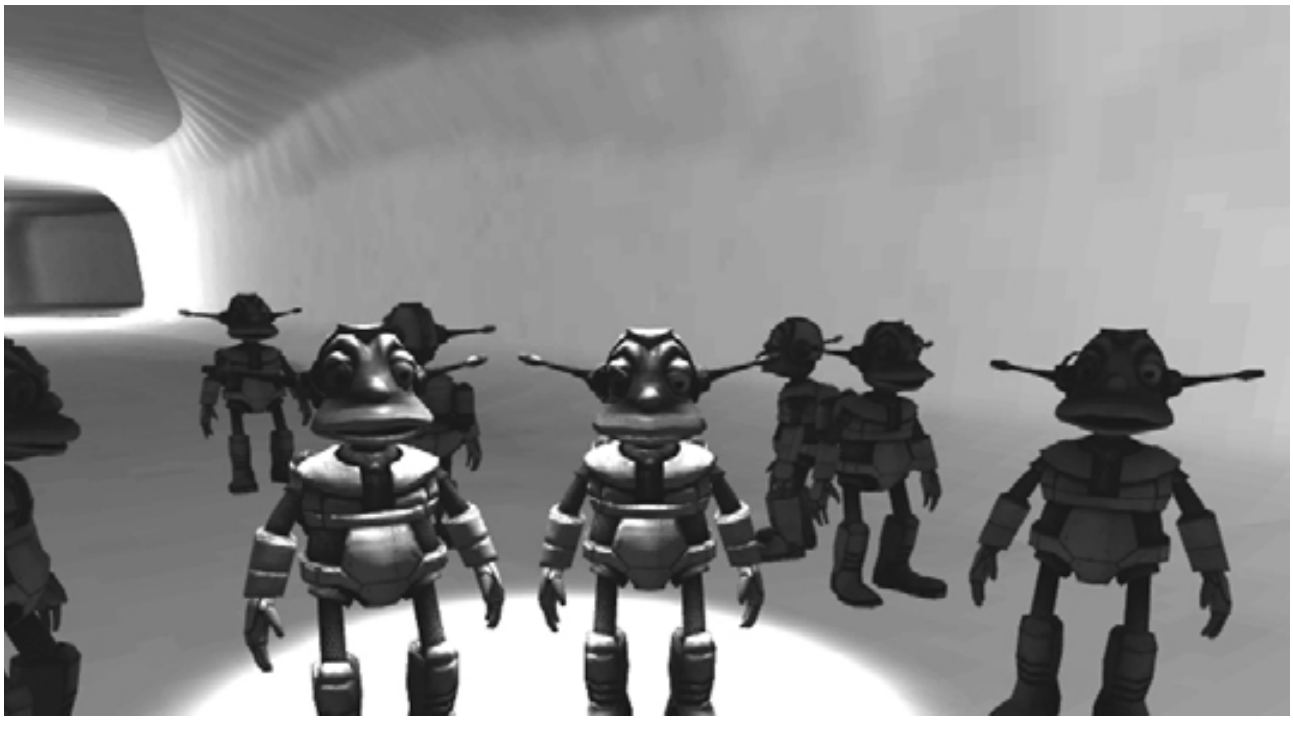
Video implementation, by P.Silondi, unity3D

Video implementation, by P.Silondi, unity3D

A First multiuser afternoon in the dark, by P.Silondi, Marko Puskaric and Rajmond Berisha, unity3D



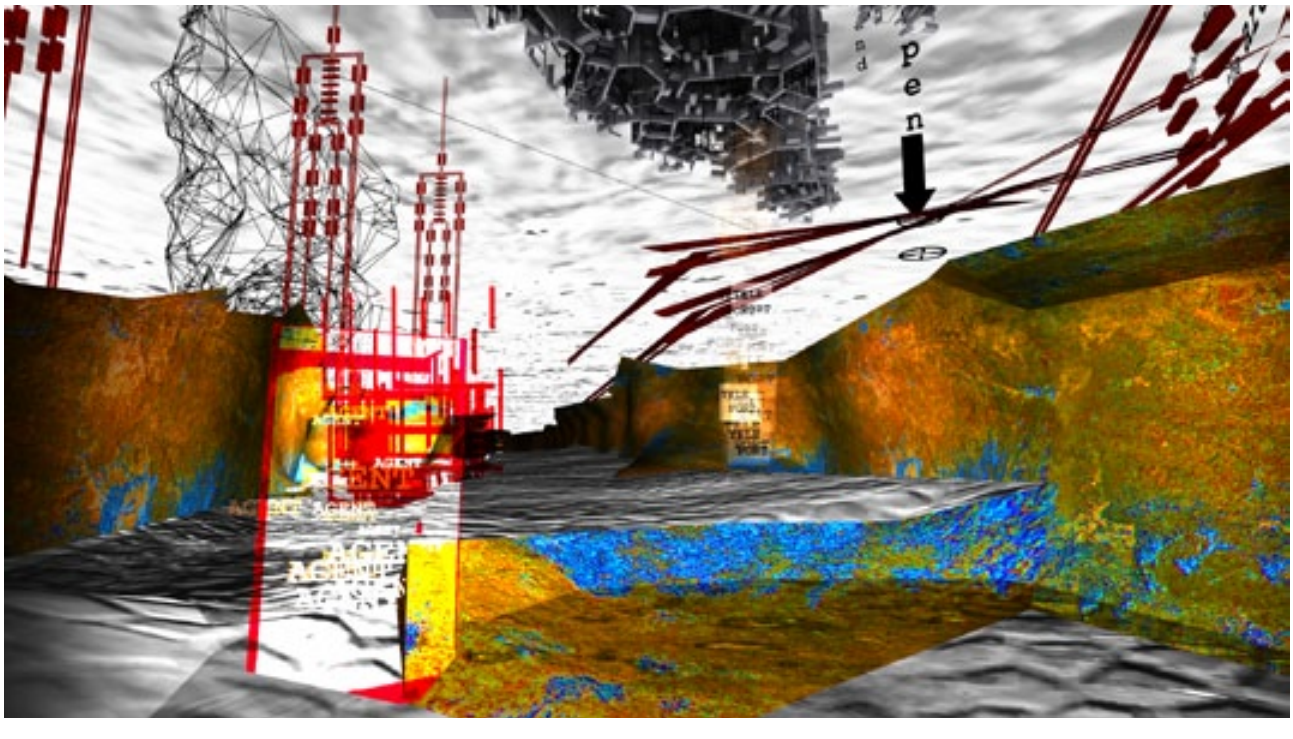
A First multiuser afternoon in the dark, by P.Silondi, Marko Puskaric and Rajmond Berisha, unity3D



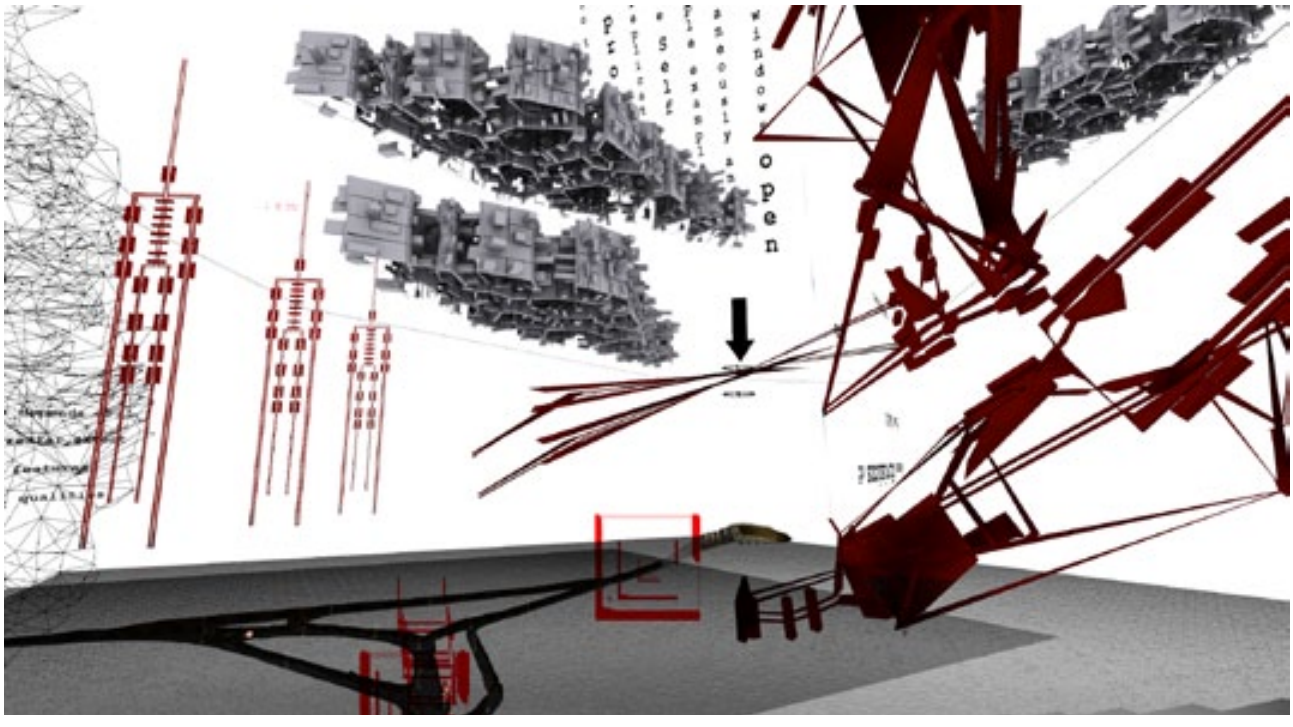
A First multiuser afternoon in the dark, by P.Silondi, Marko Puskaric and Rajmond Berisha, unity3D

3D ARTWORK

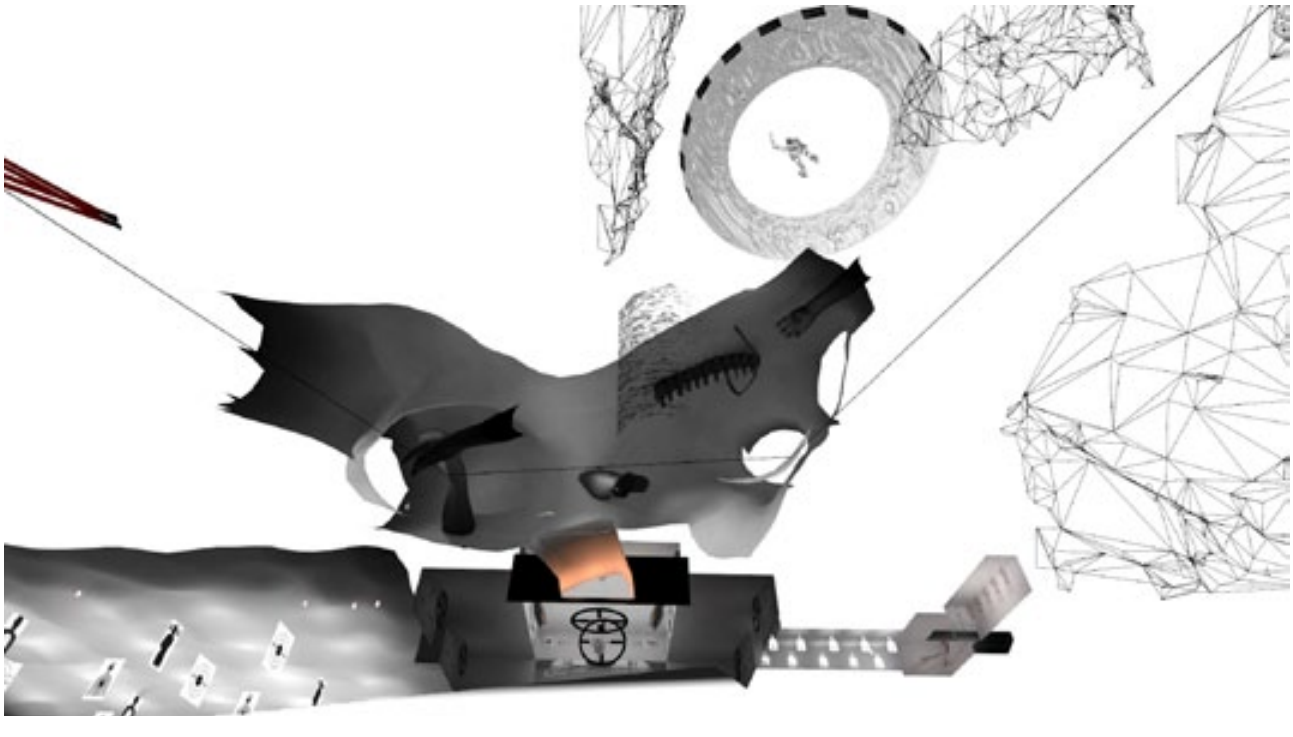
Online participants are interconnected into 3D environments which react to their presence, behaviors and interventions. The aims of the multiuser environments is not only to visit and discover a static "already built world", but further to live a collaborative and creative online experience building and transforming the 3D environment, sharing visions with other participants from all over the world.



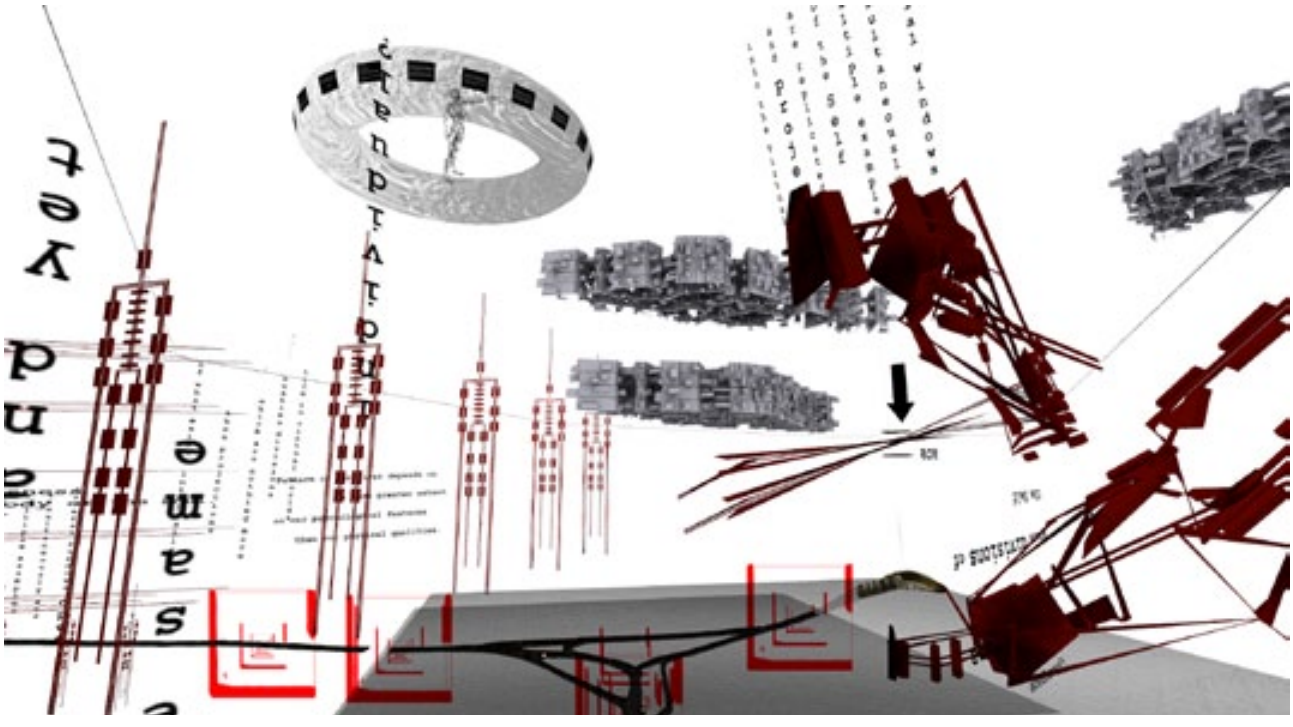
Division of the self, by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, unity3D



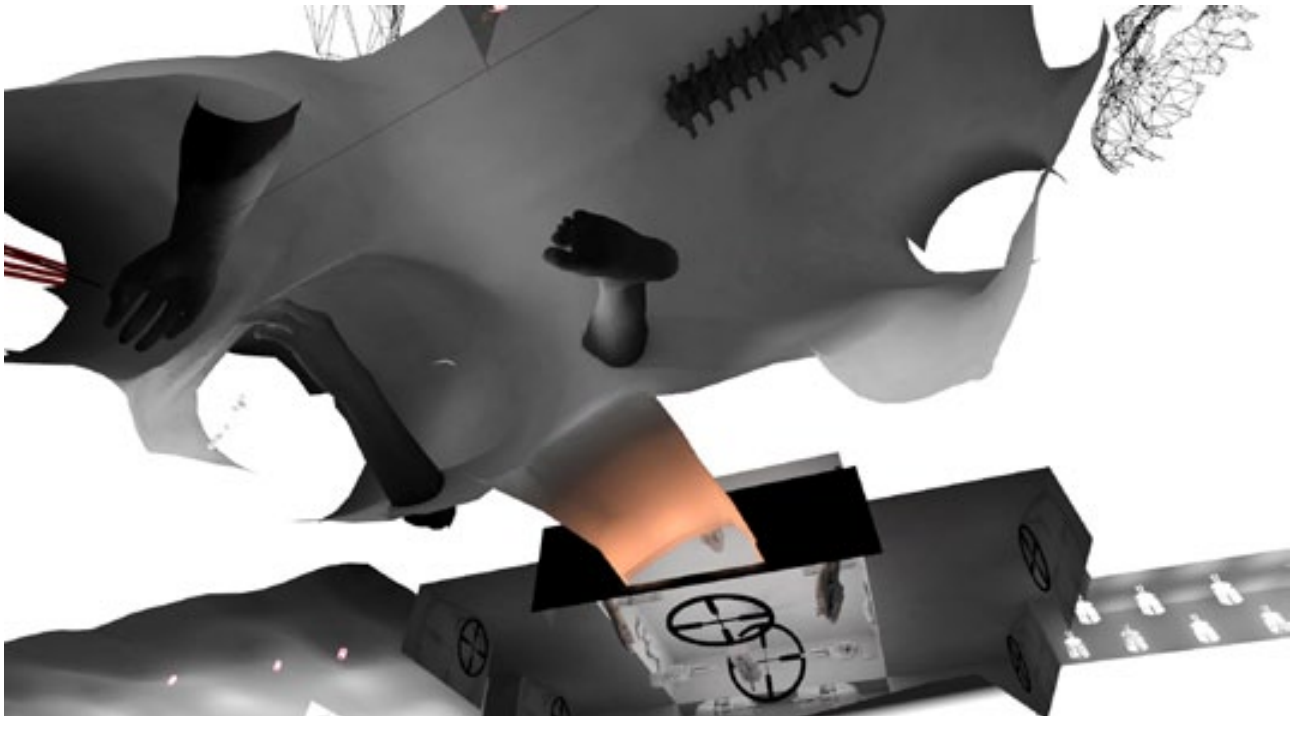
Division of the self, by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, unity3D



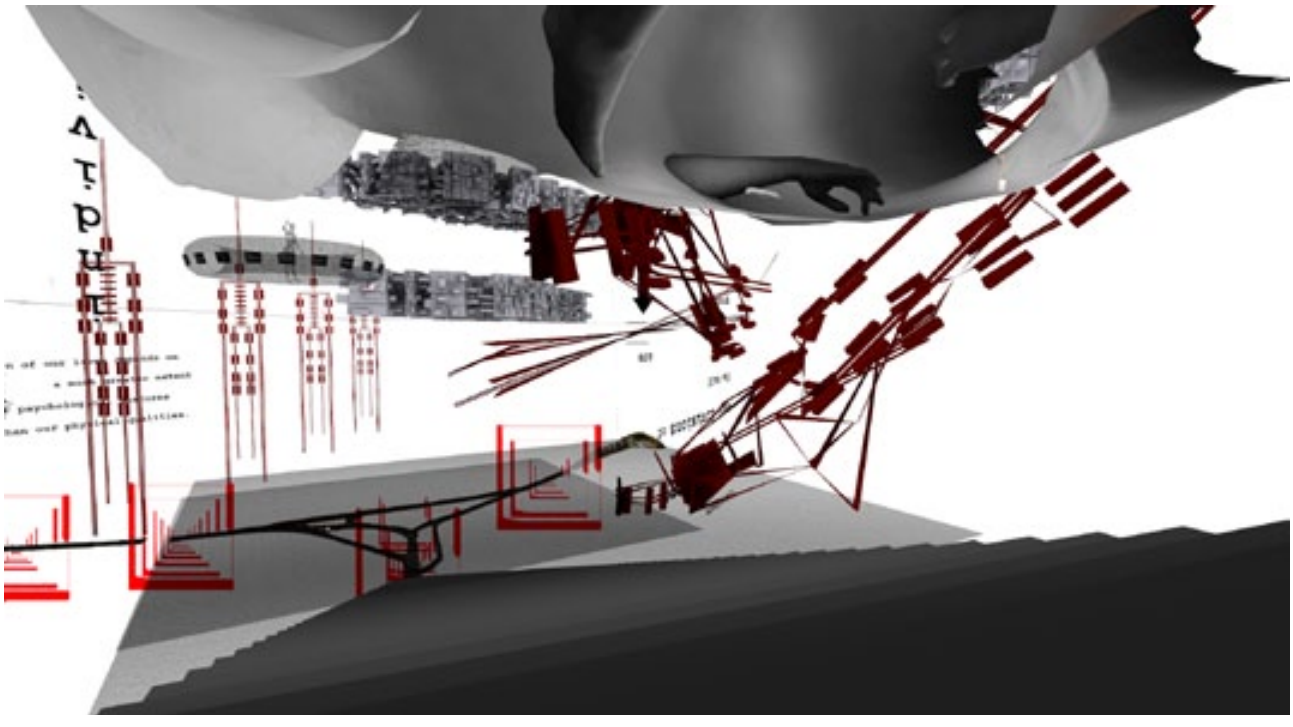
Division of the self, by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, unity3D



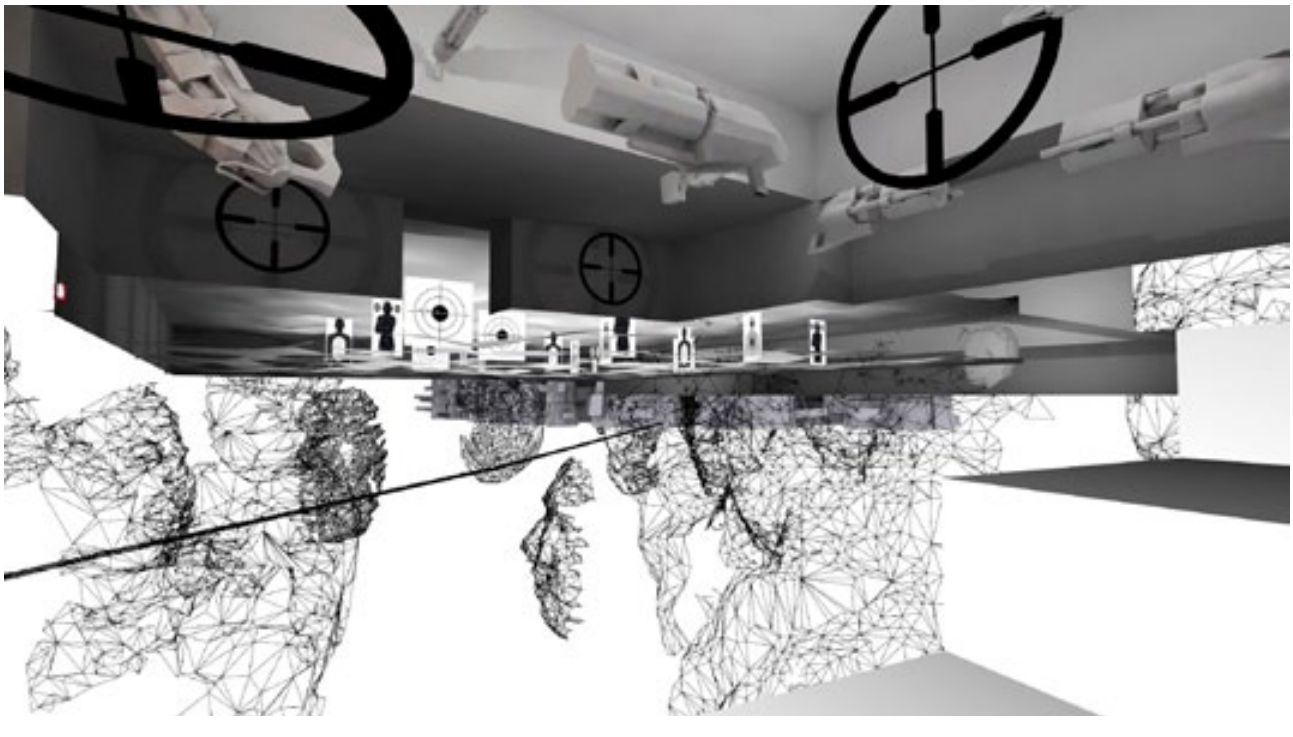
Division of the self, by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, unity3D



Targeted body, by P.Silondi, unity3D



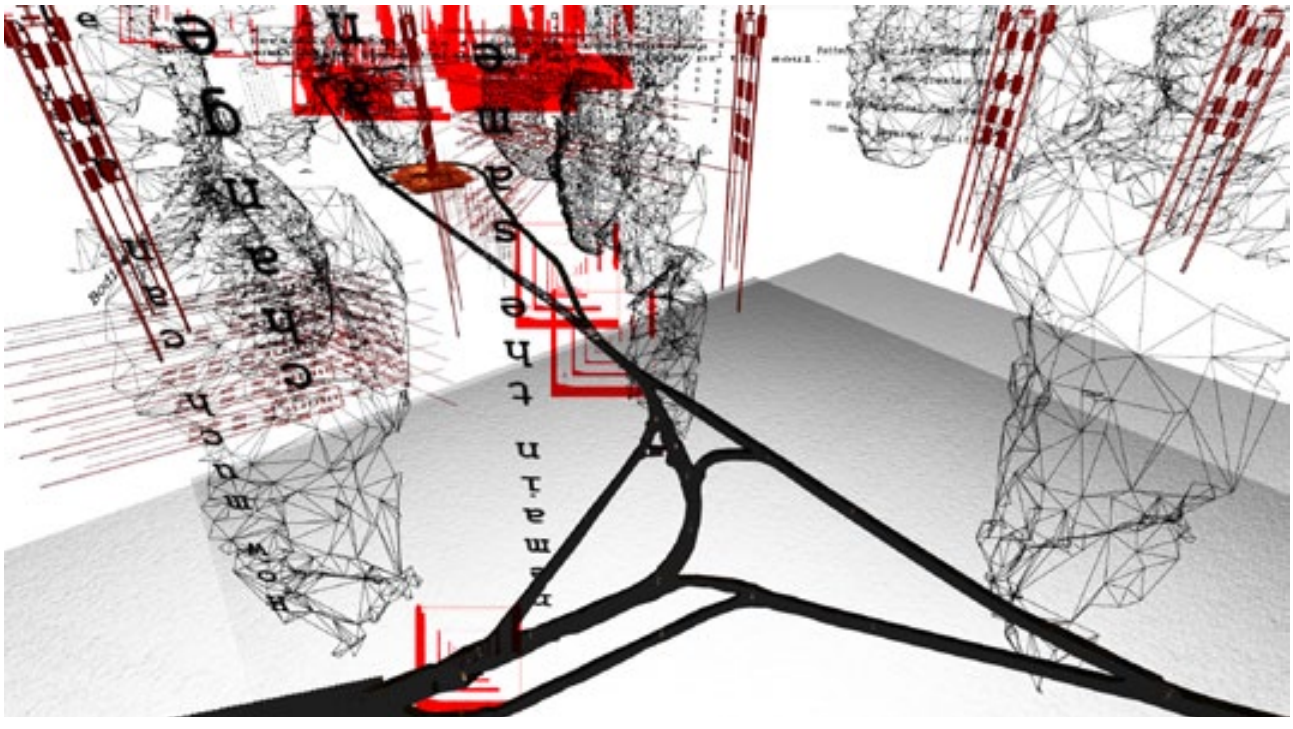
Division of the self, by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, unity3D



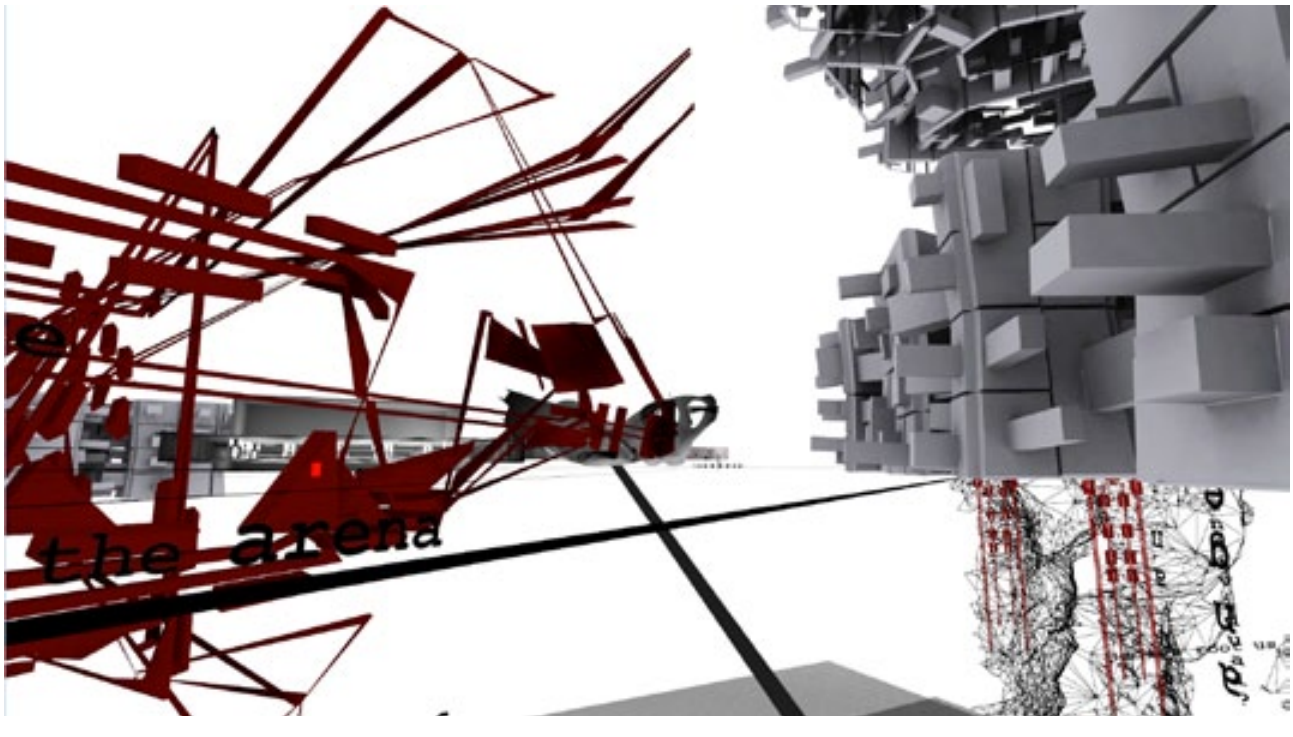
Targeted body, by P.Silondi, unity3D

Targeted body, by P.Silondi, unity3D

Division of the self, by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, unity3D



Division of the self, by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, unity3D



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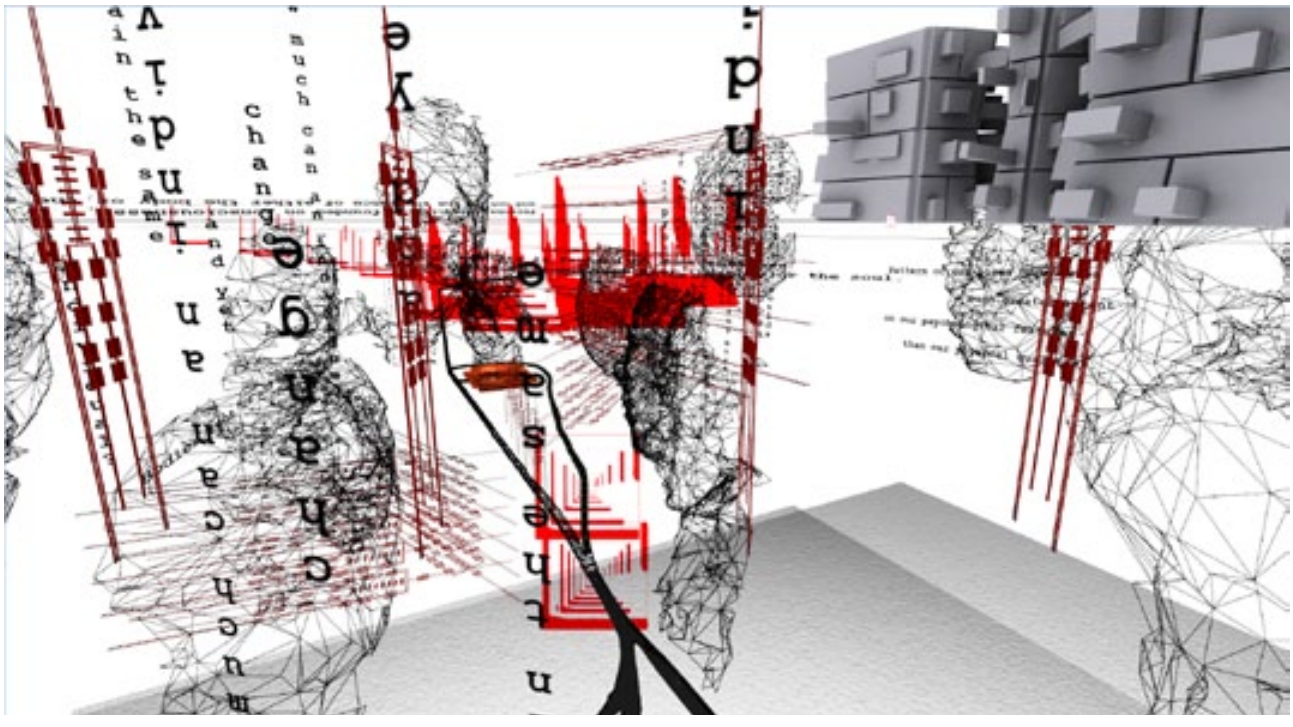
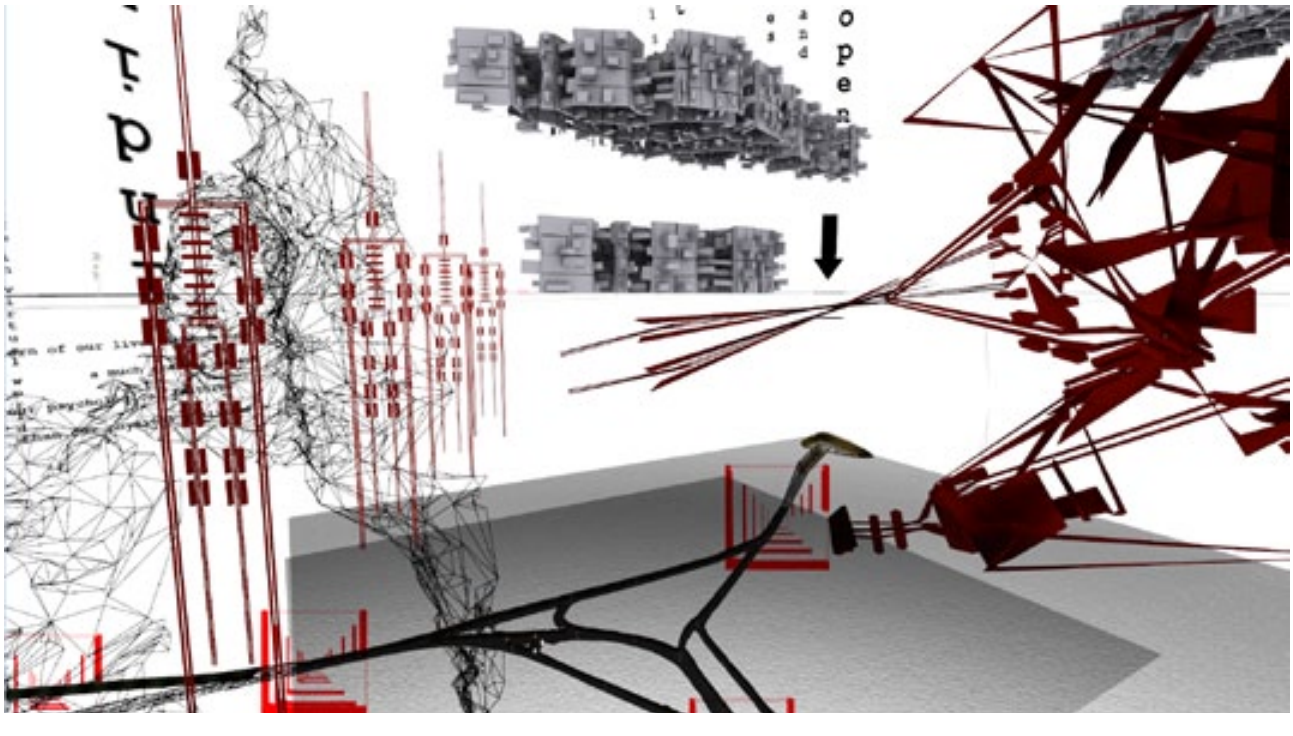
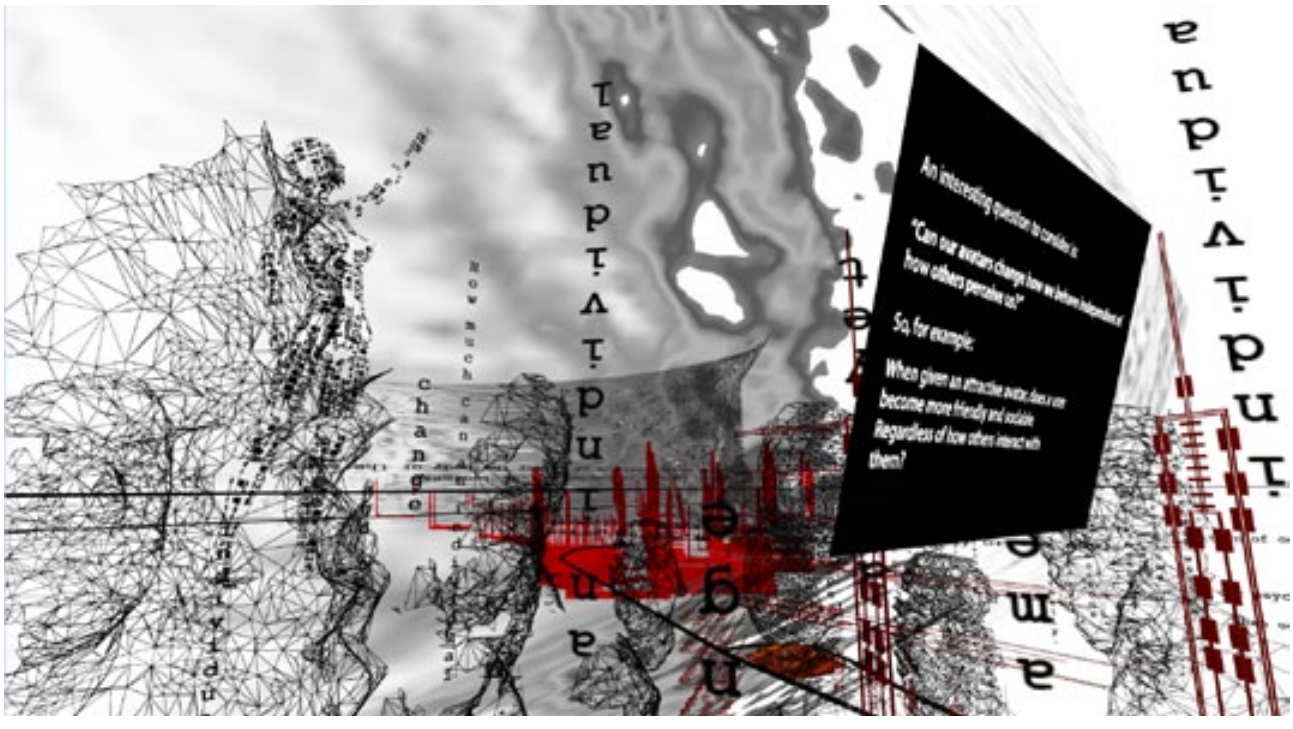


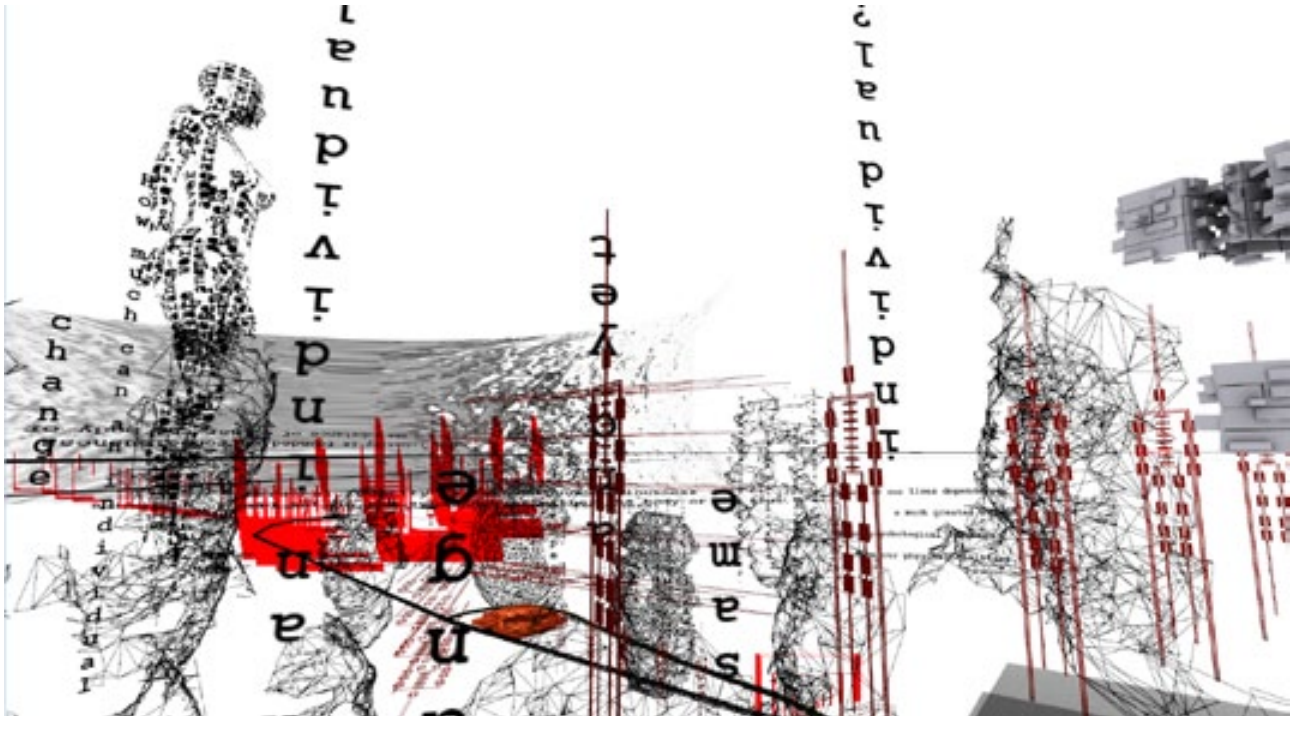
Division of the self, by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, unity3D



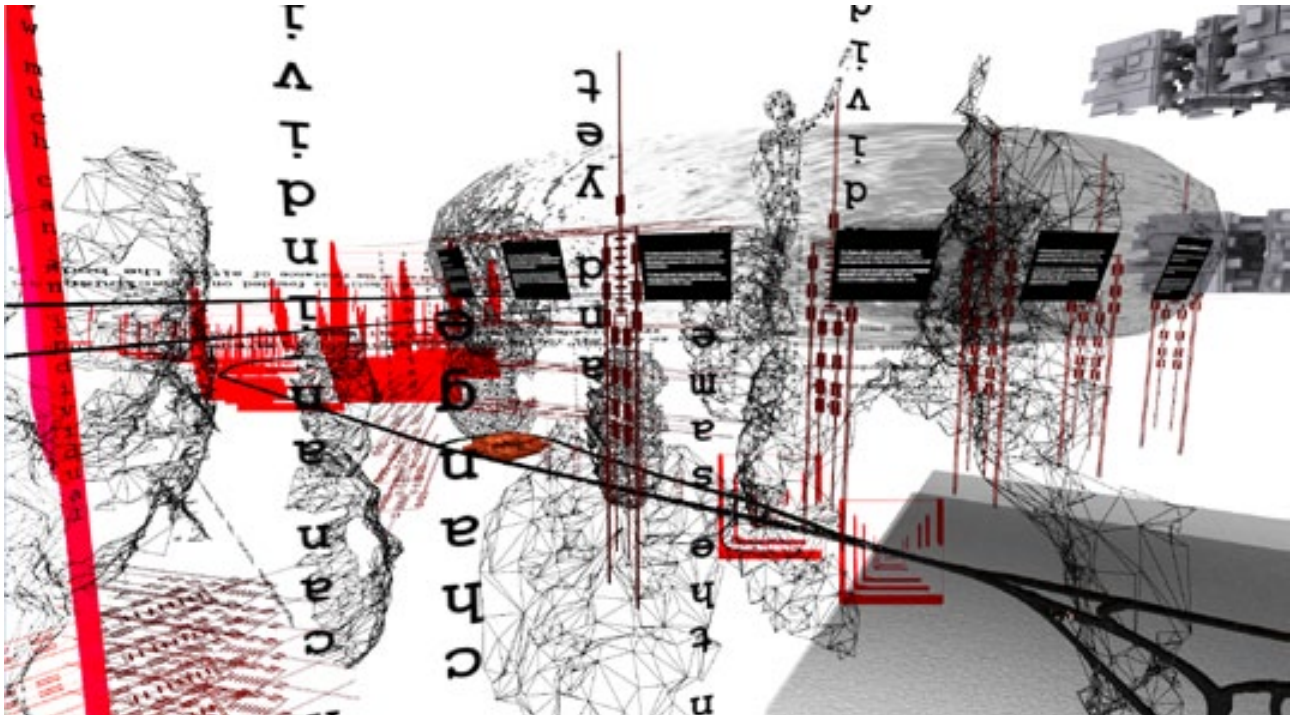
Division of the self, by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, unity3D



Lecture in Cyberspace, by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, unity3D



Lecture in Cyberspace, by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, unity3D



Lecture in Cyberspace, by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, unity3D

Targeted body, by P.Silondi, unity3D

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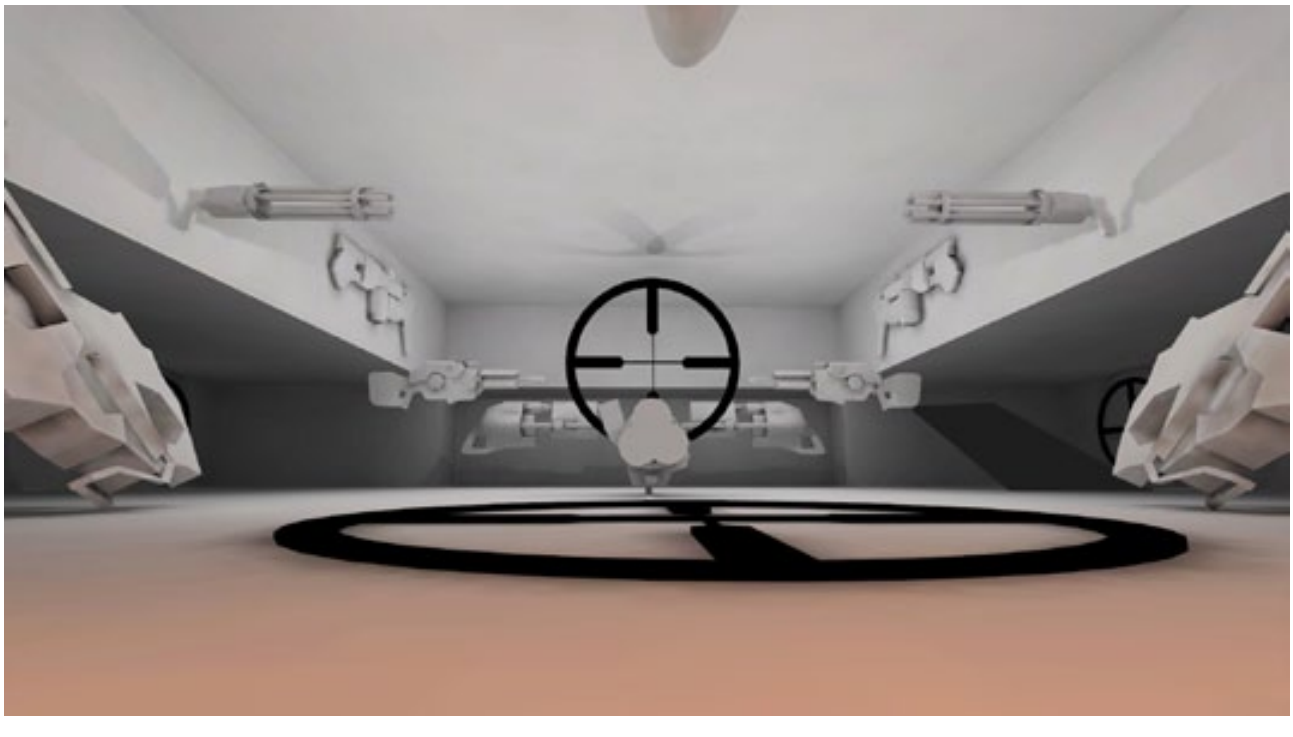
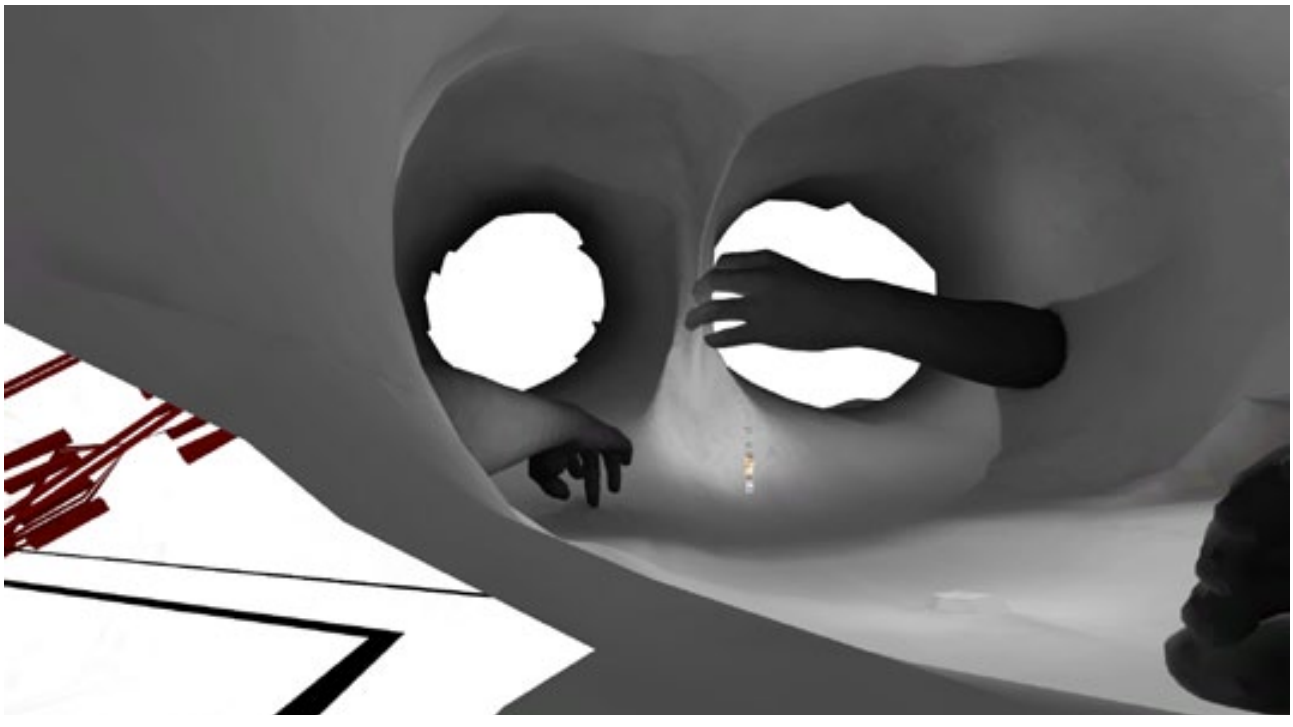
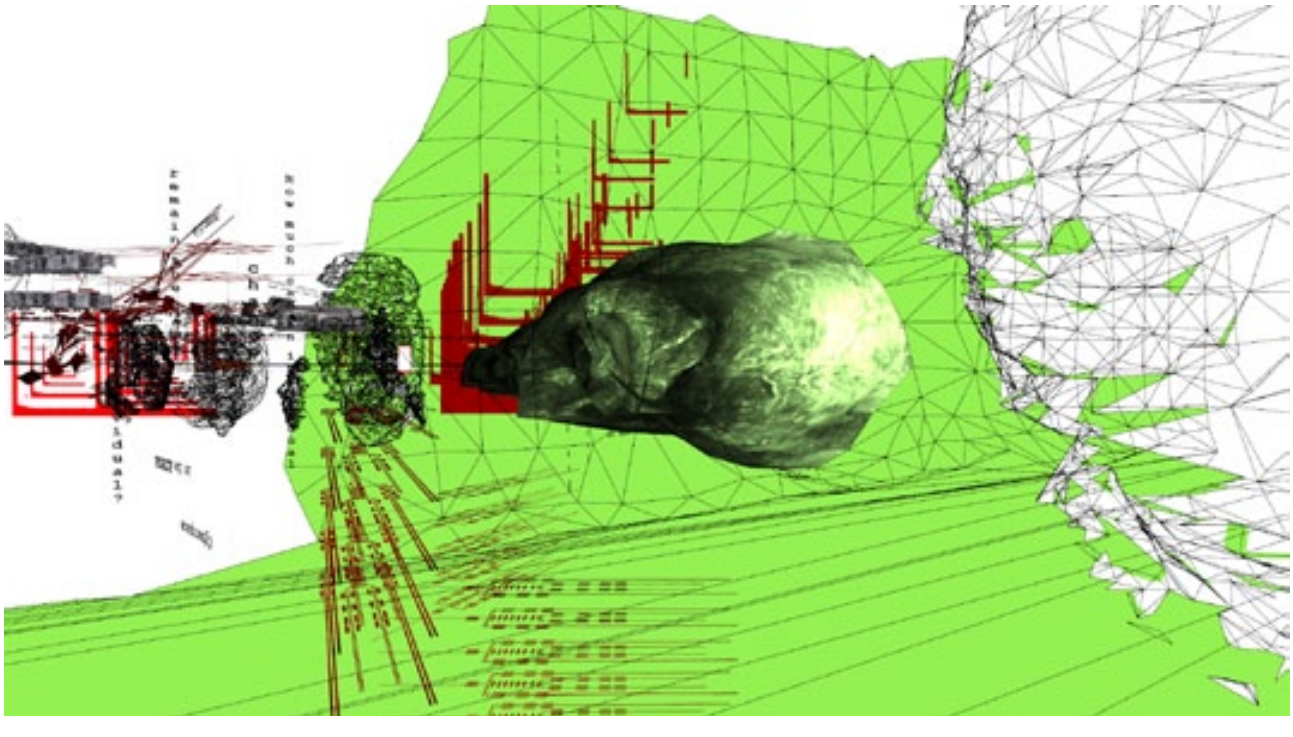


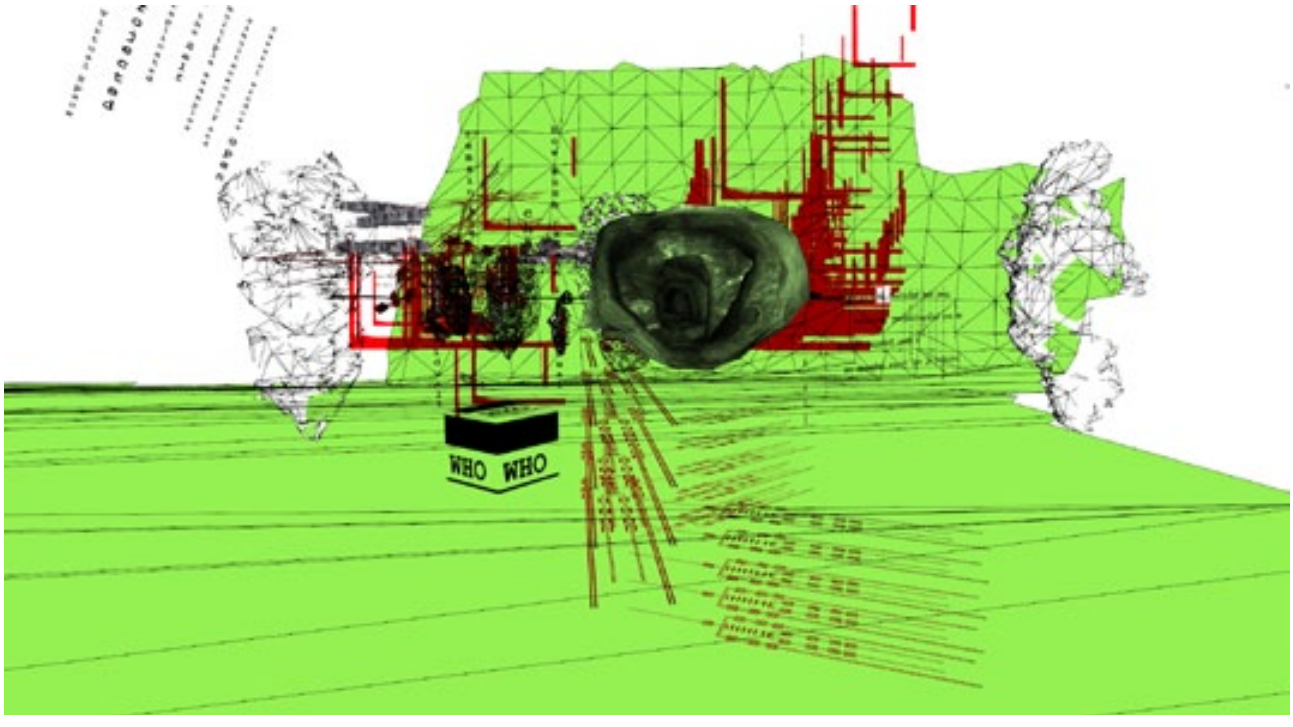
Targeted body, by P.Silondi, unity3D



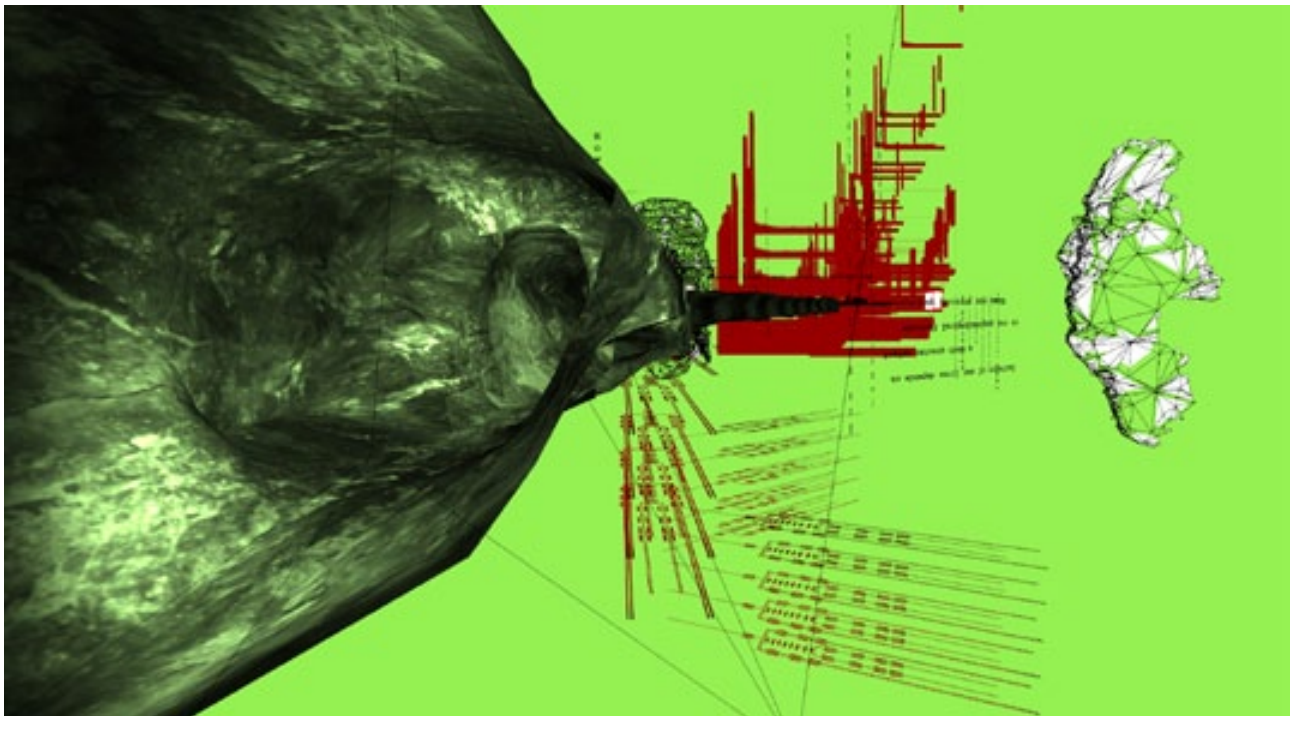
Targeted body, by P.Silondi, unity3D



L'ombilic by P.Silondi, unity3D



L'ombilic by P.Silondi, unity3D



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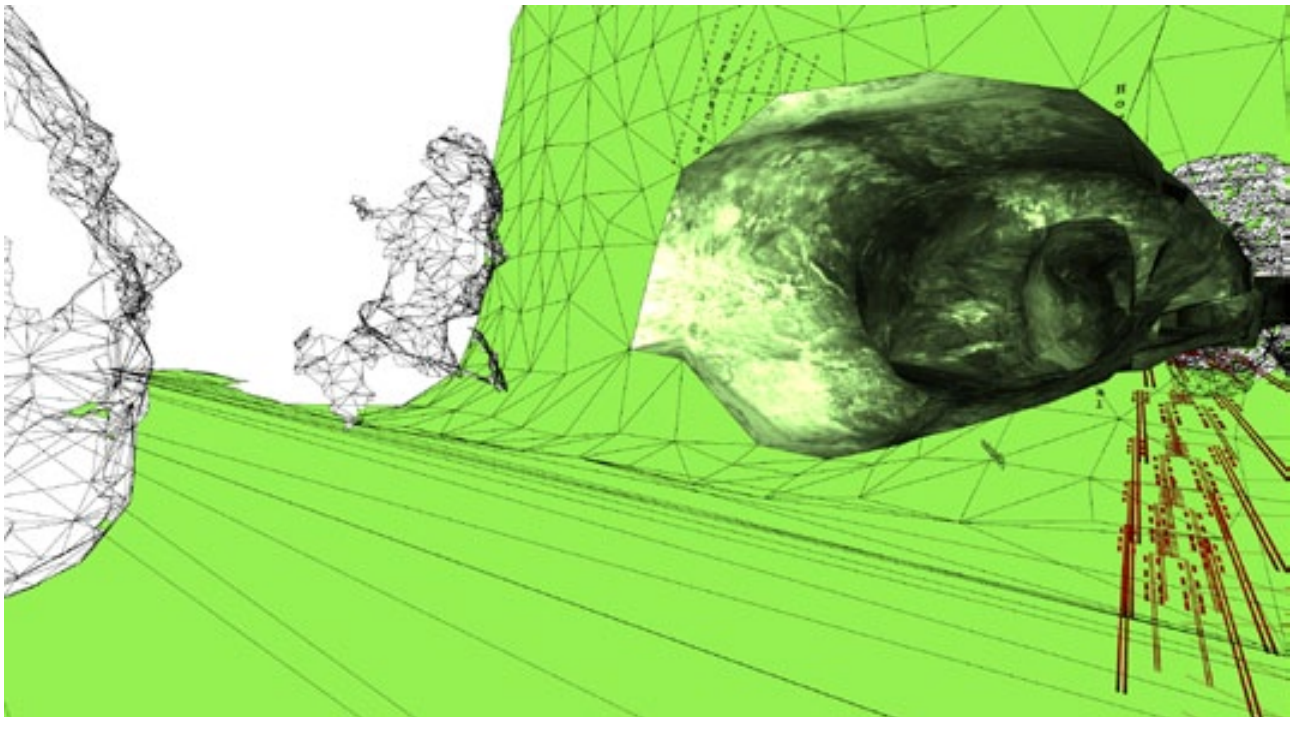
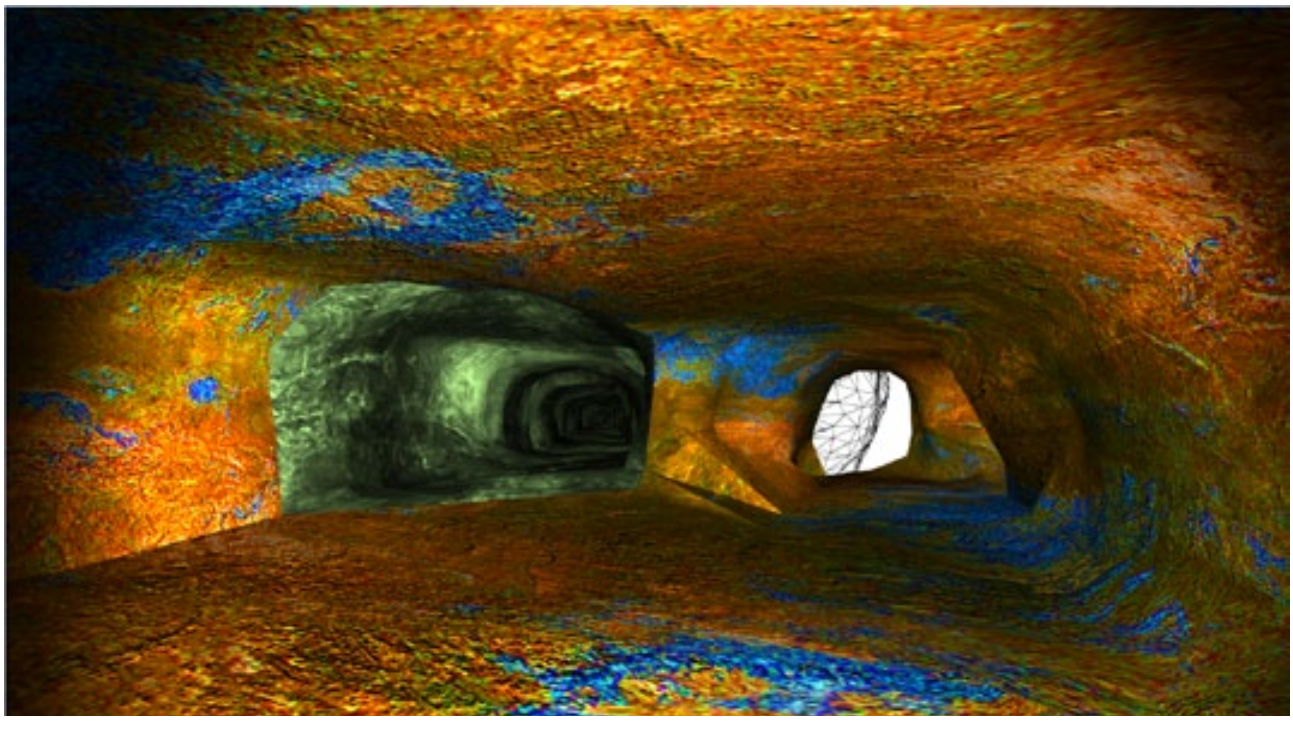
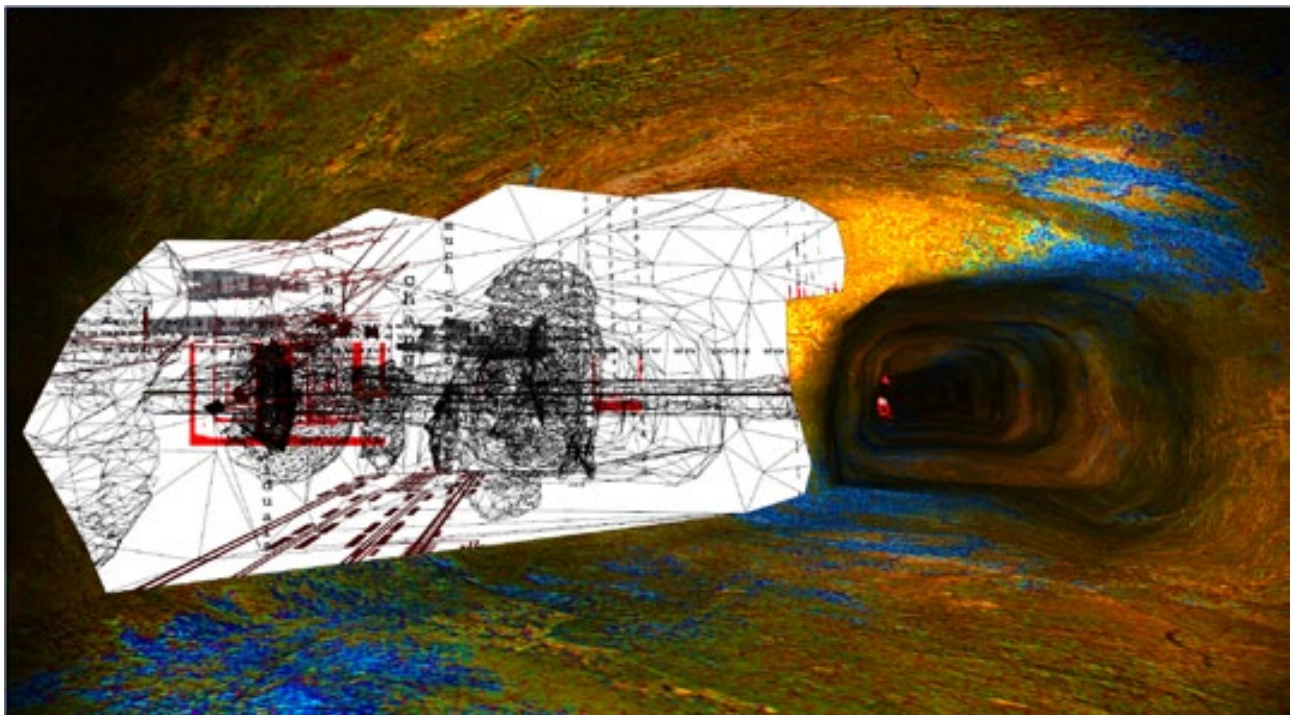


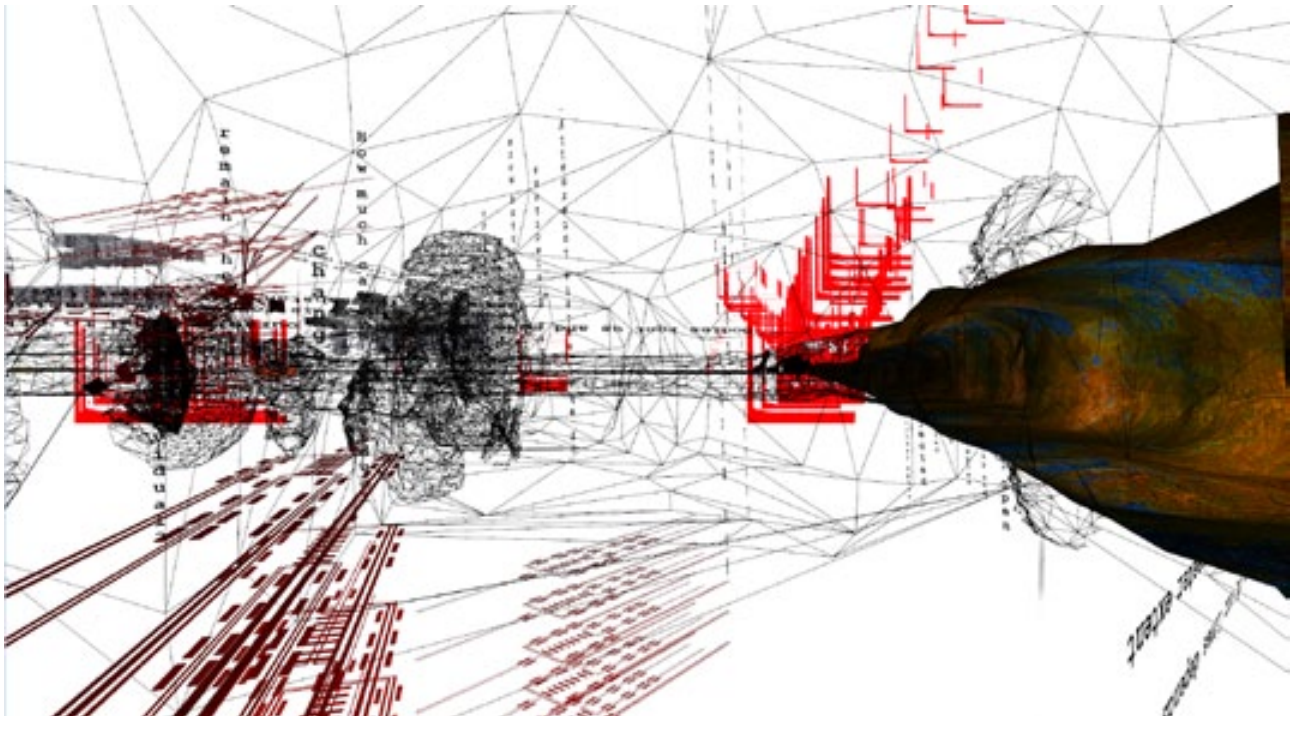
L'ombilic by P.Silondi, unity3D



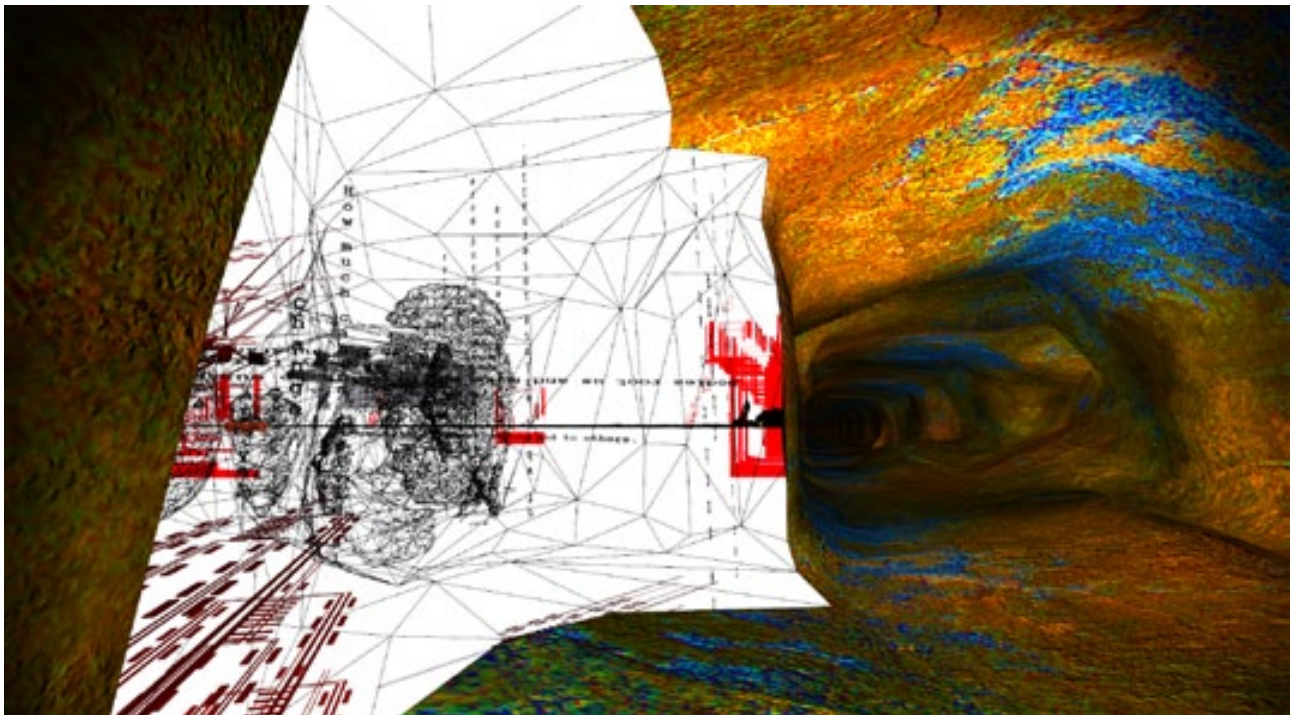
L'ombilic by P.Silondi, unity3D



L'ombilic by P.Silondi, unity3D

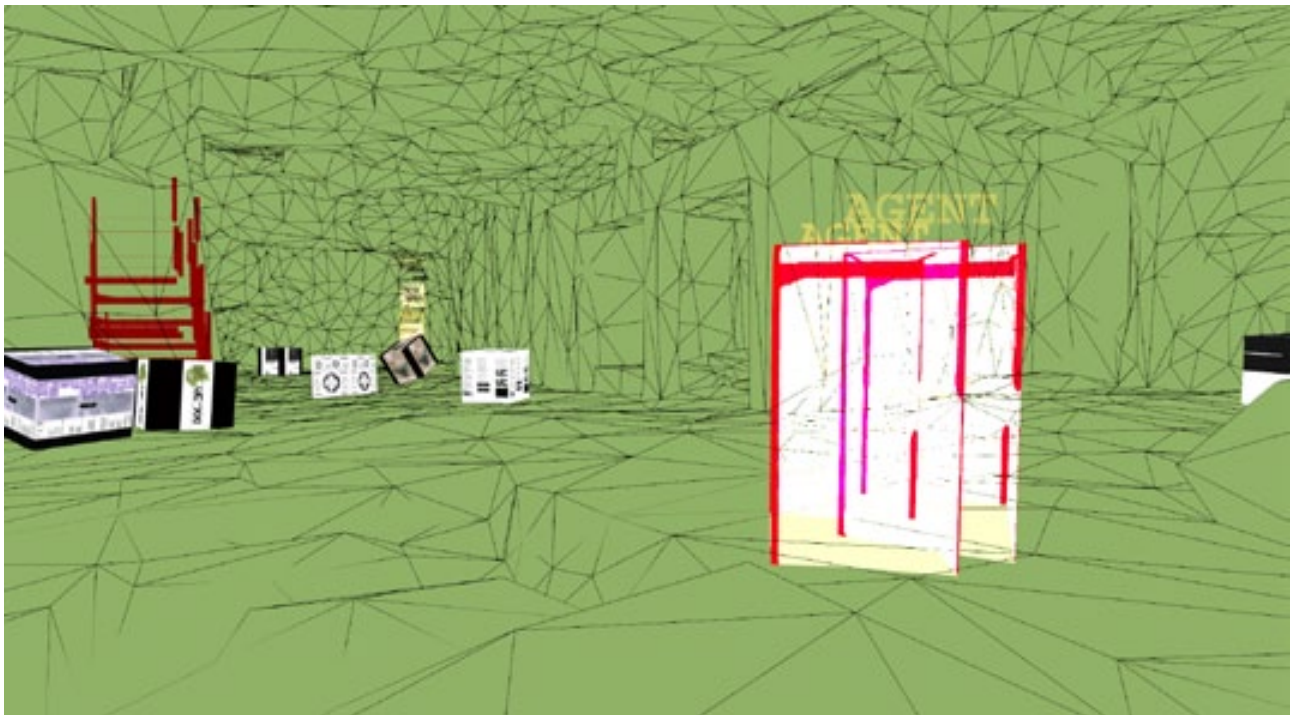


L'ombilic by P.Silondi, unity3D

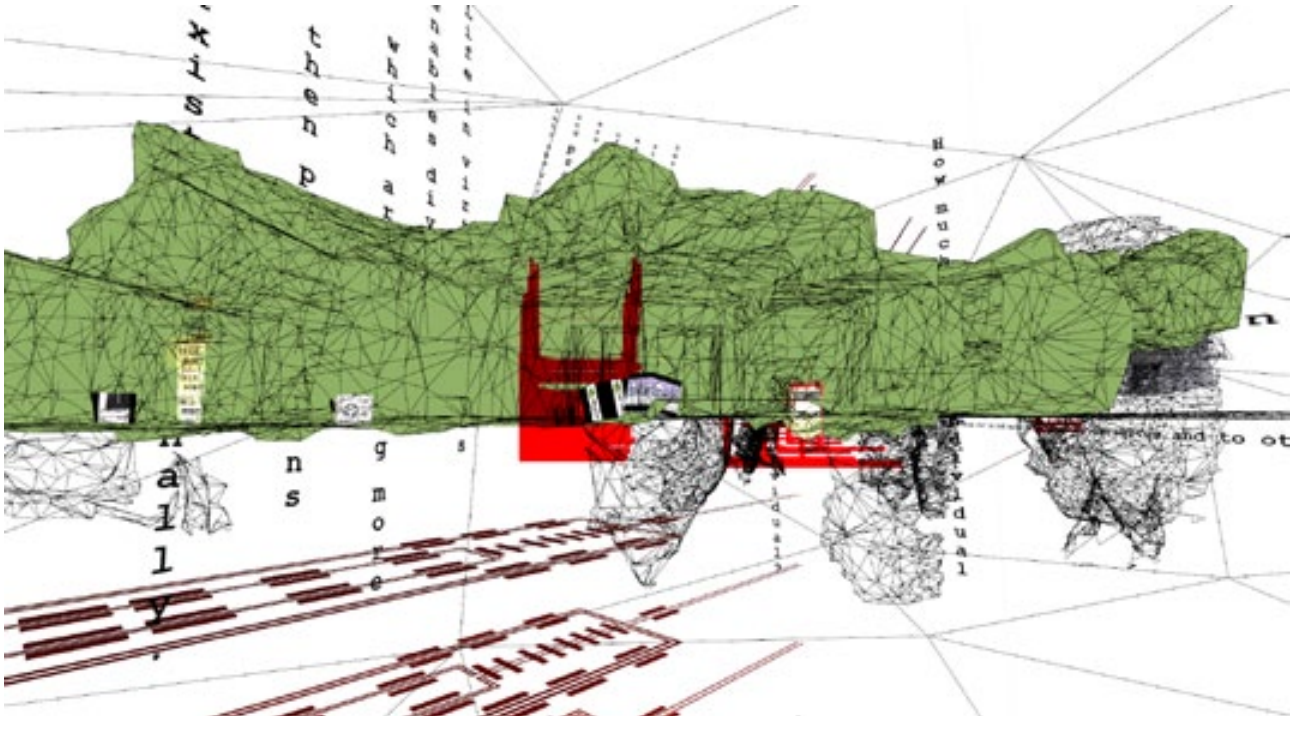


L'ombilic by P.Silondi, unity3D

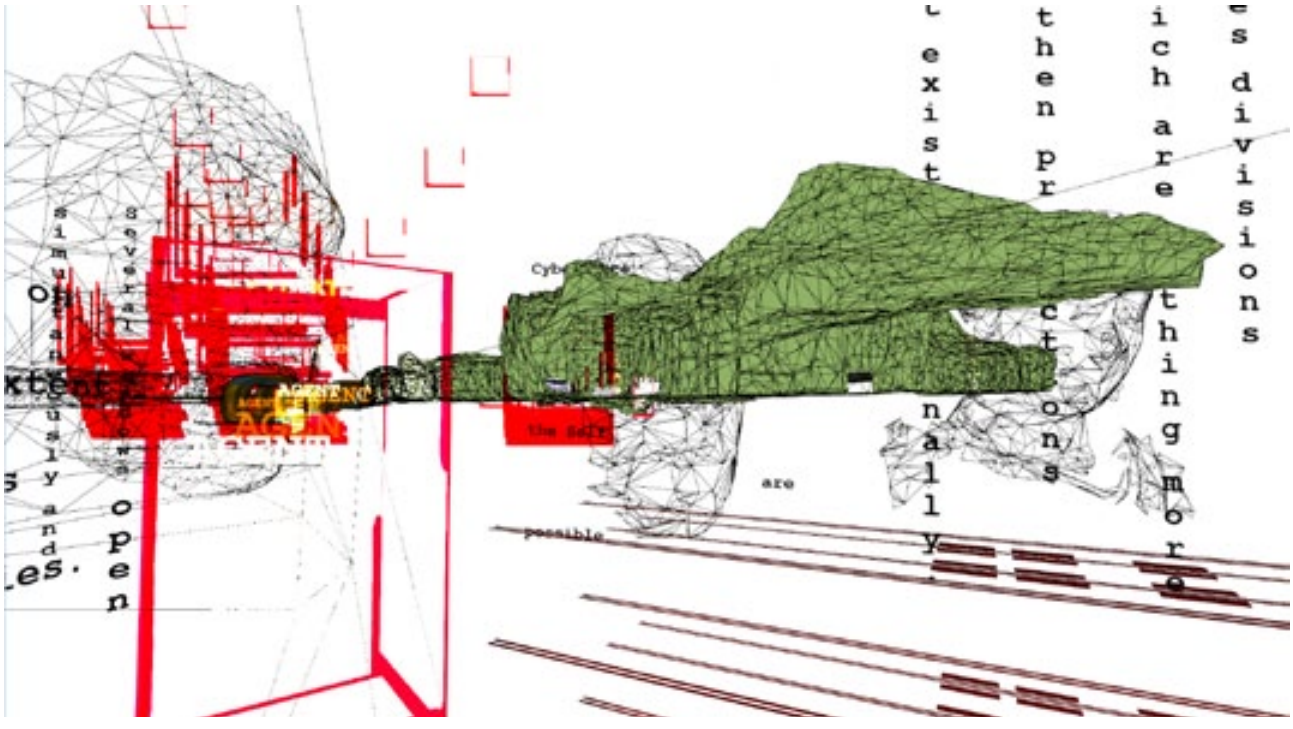
Gallery by P.Silondi and Graphic Design students, unity3D



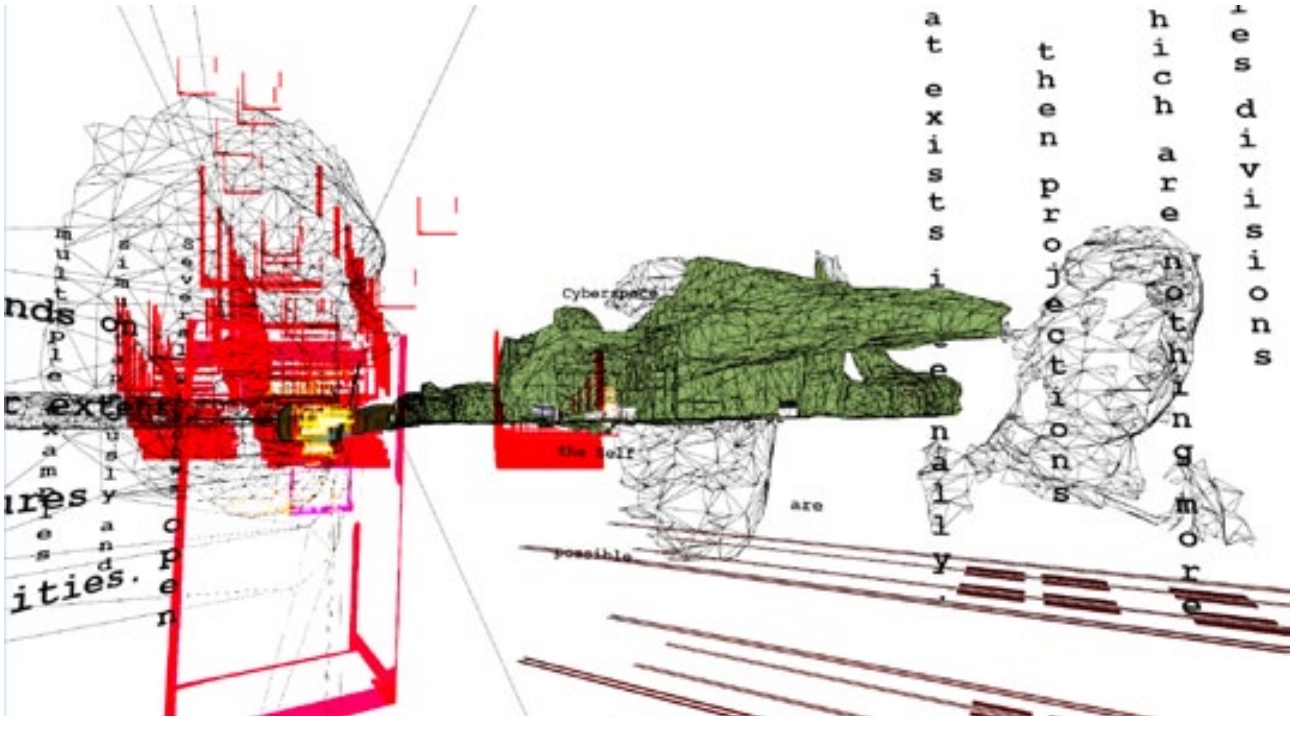
Gallery by P.Silondi and Graphic Design students, unity3D



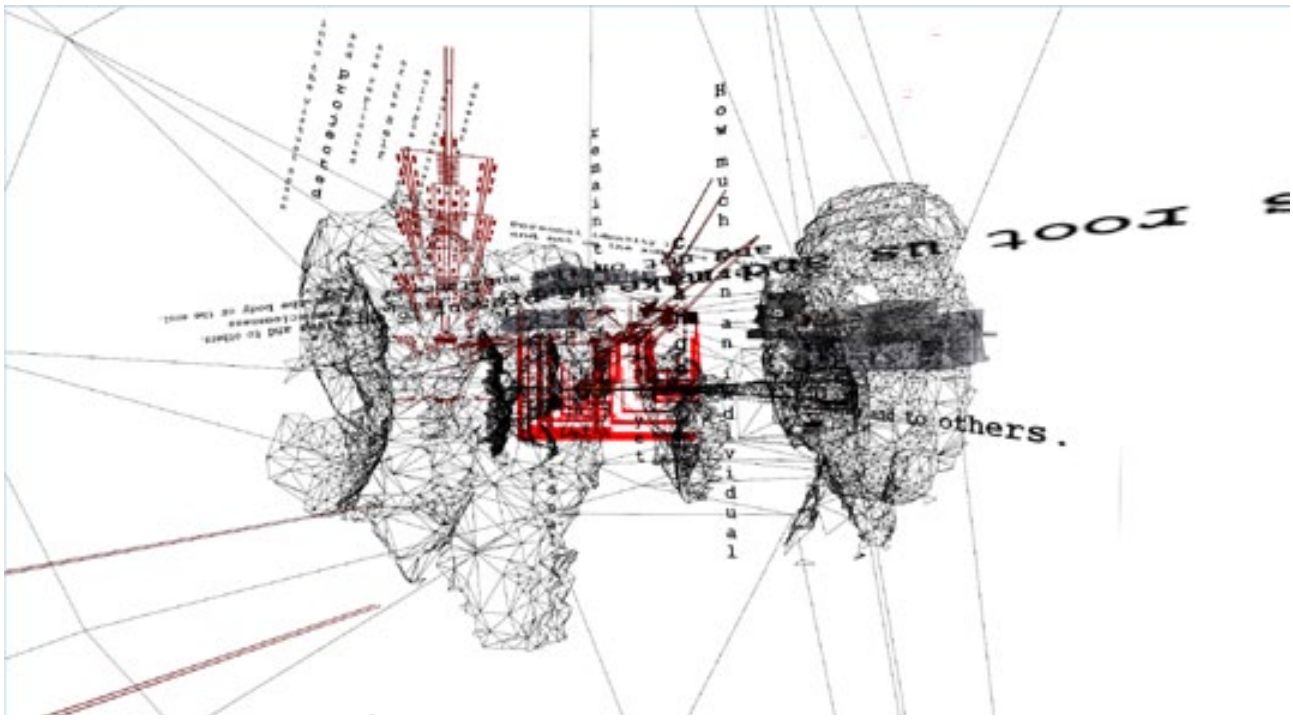
Gallery by P.Silondi and Graphic Design students, unity3D



Painting particles by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, unity3D

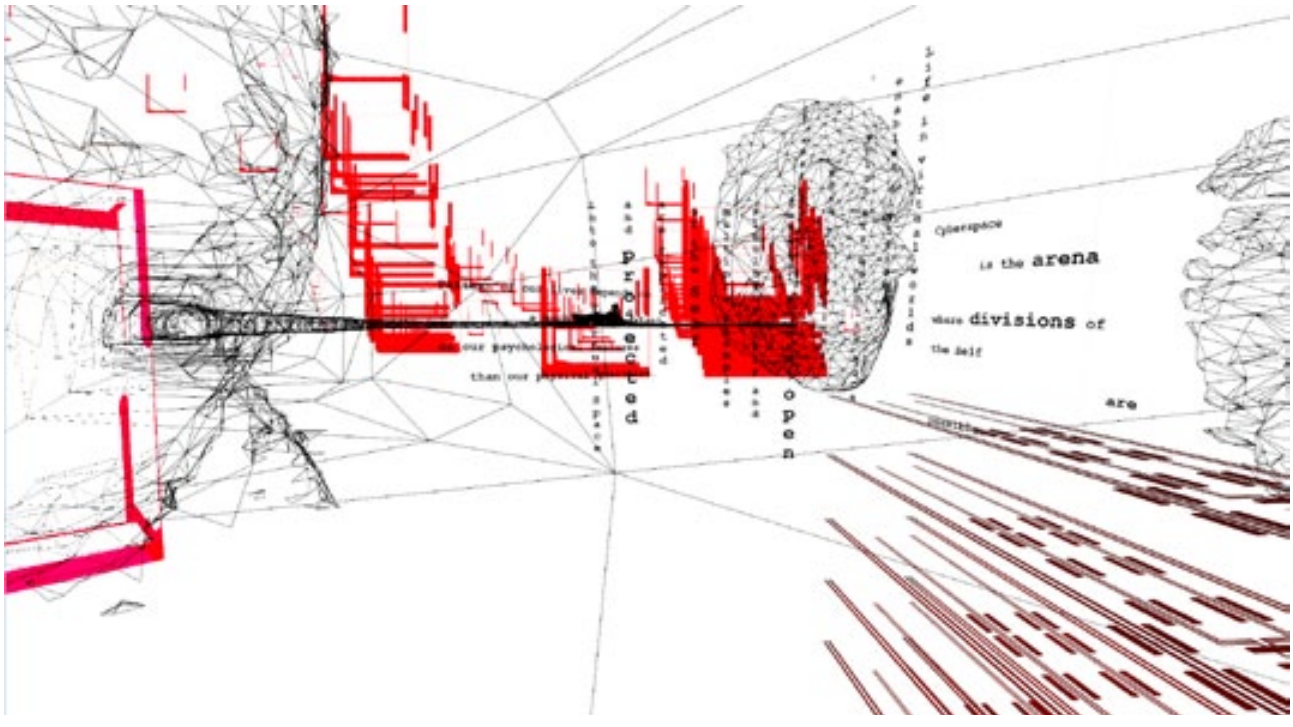


Painting particles by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, unity3D



Orbit by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, P.Marencik, unity3D

Orbit by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, P.Marencik, unity3D



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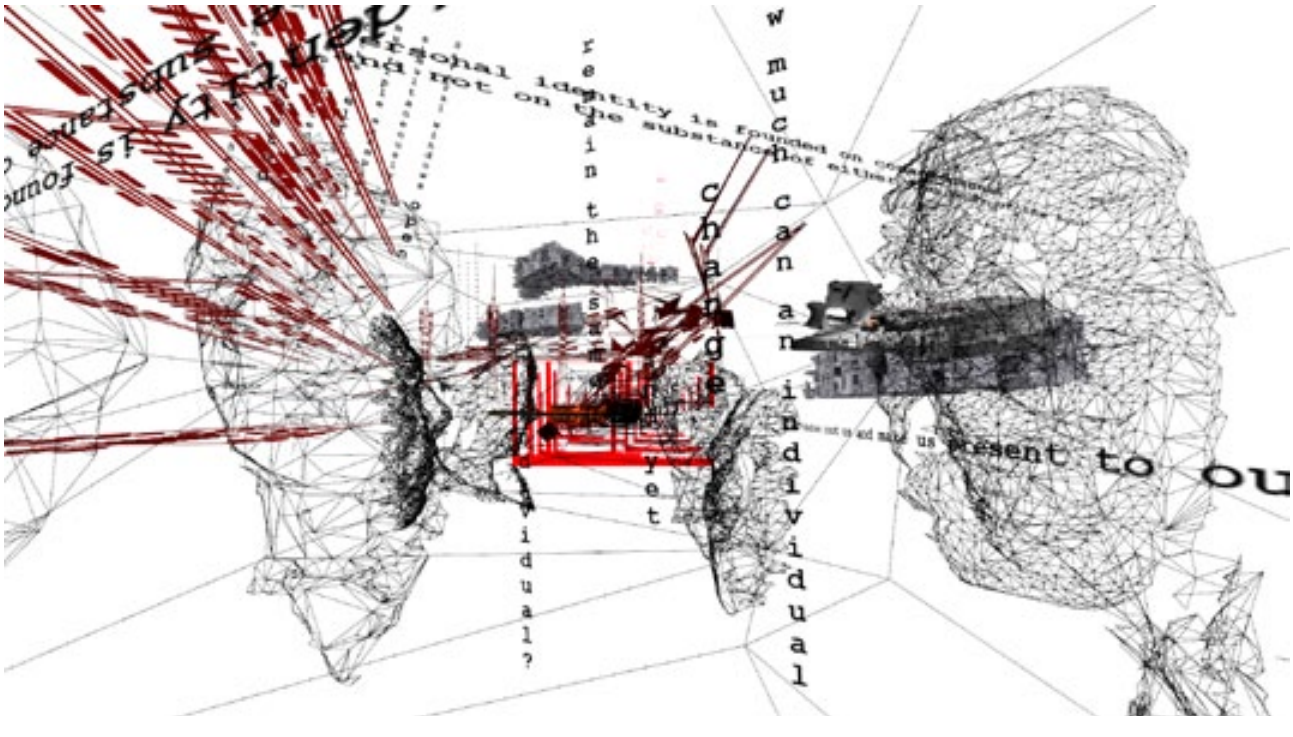

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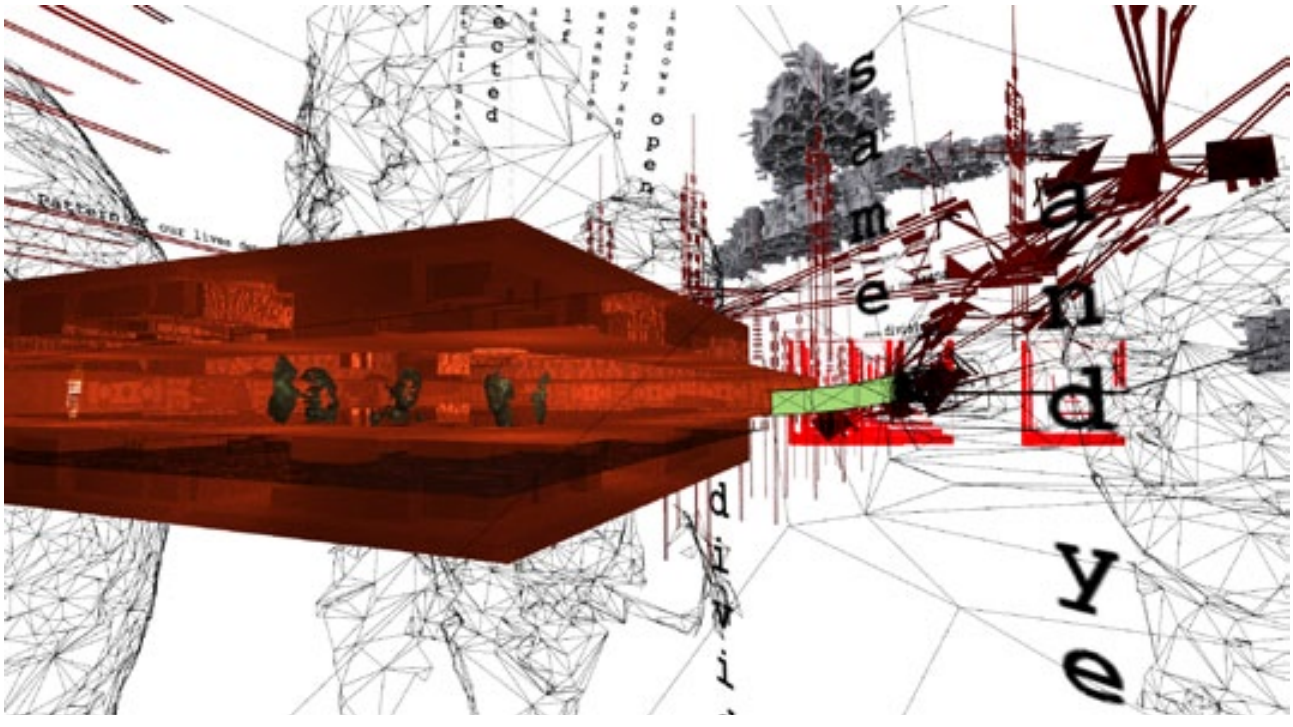
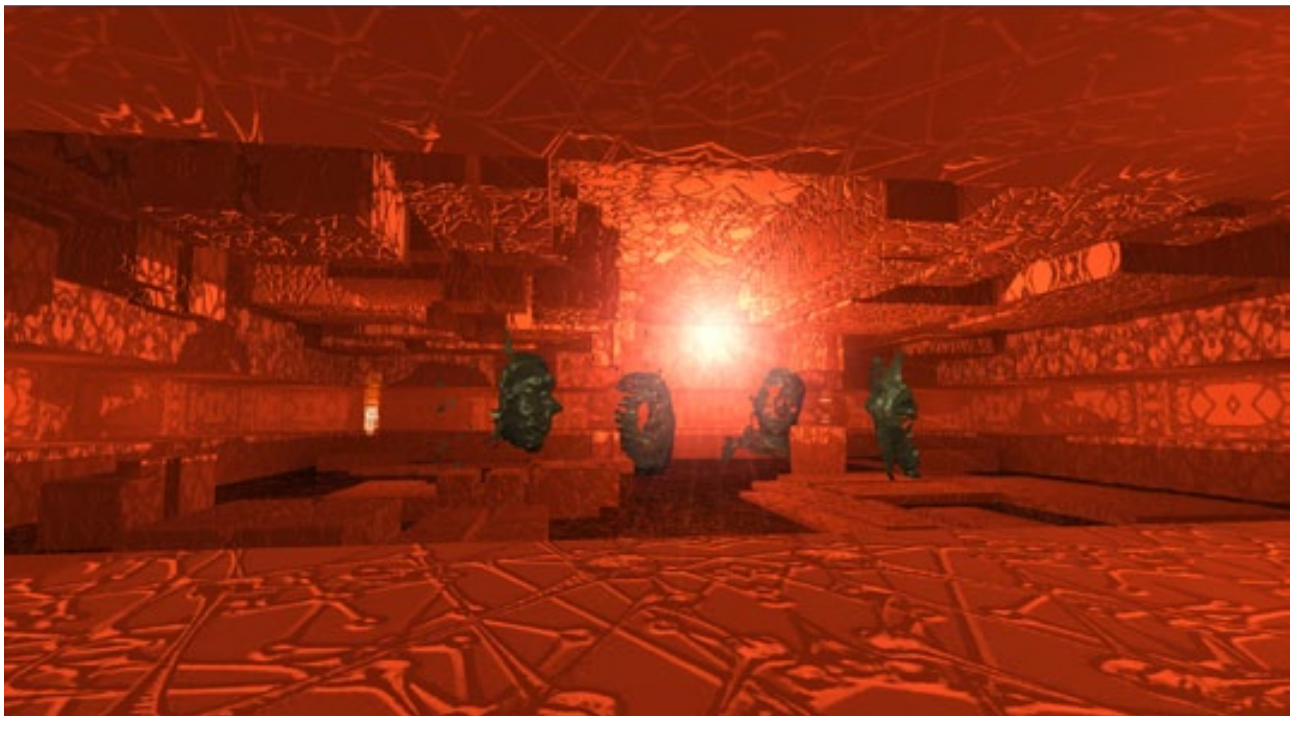


Agora by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, P.Marencik, unity3D



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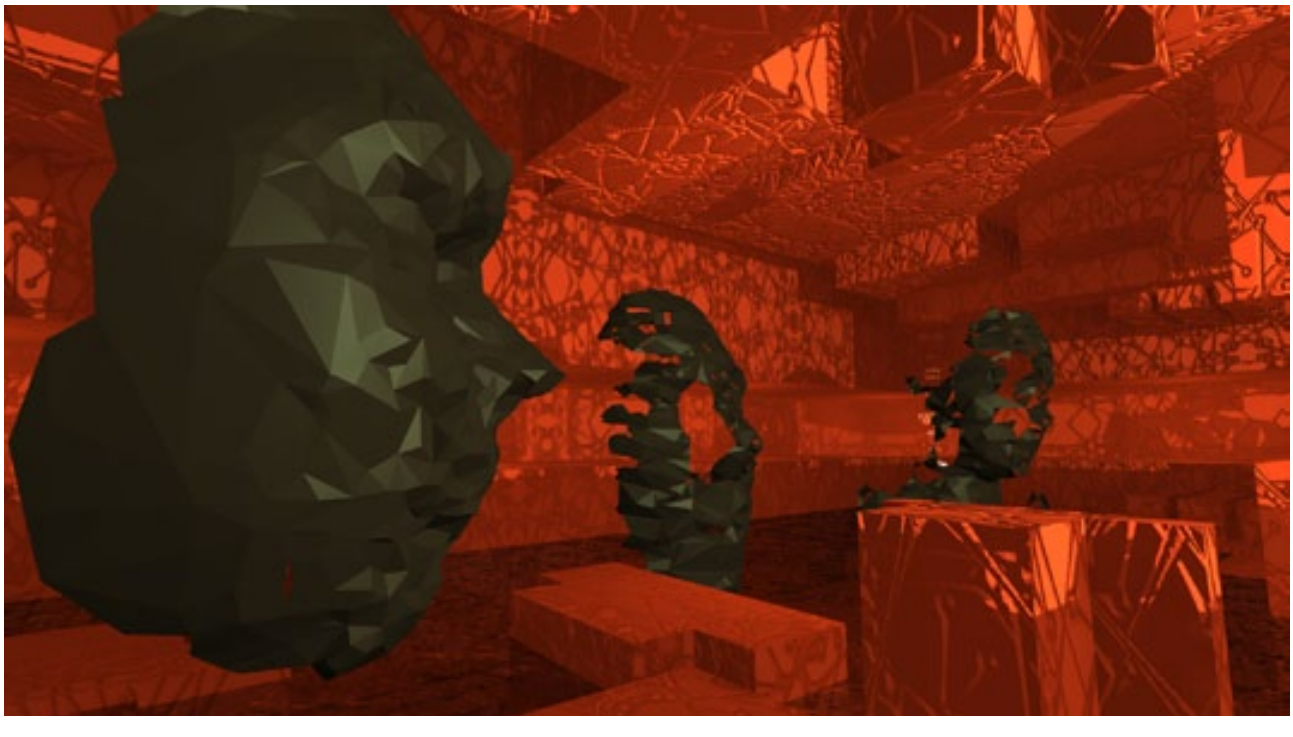
Agora by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, P.Marencik, unity3D

Agora by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, P.Marencik, unity3D

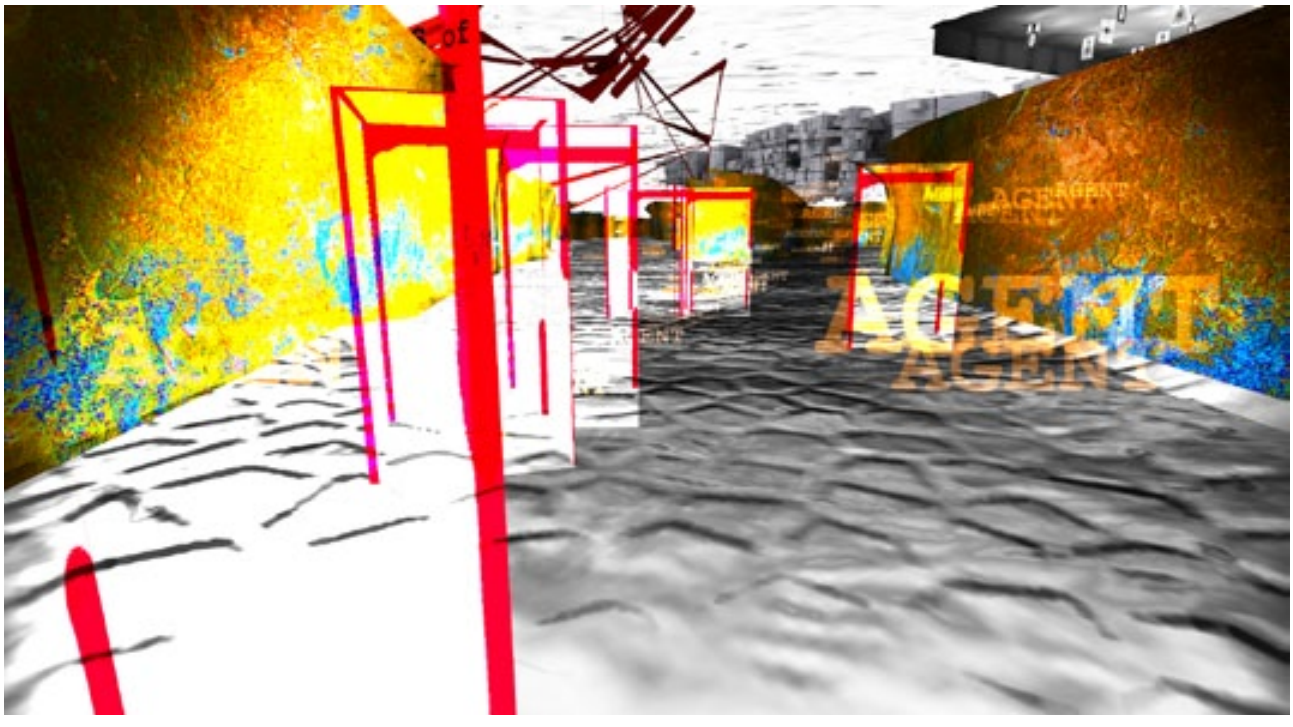
3D scans of UC builders by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, P.Marencik, T. Valent, unity3D



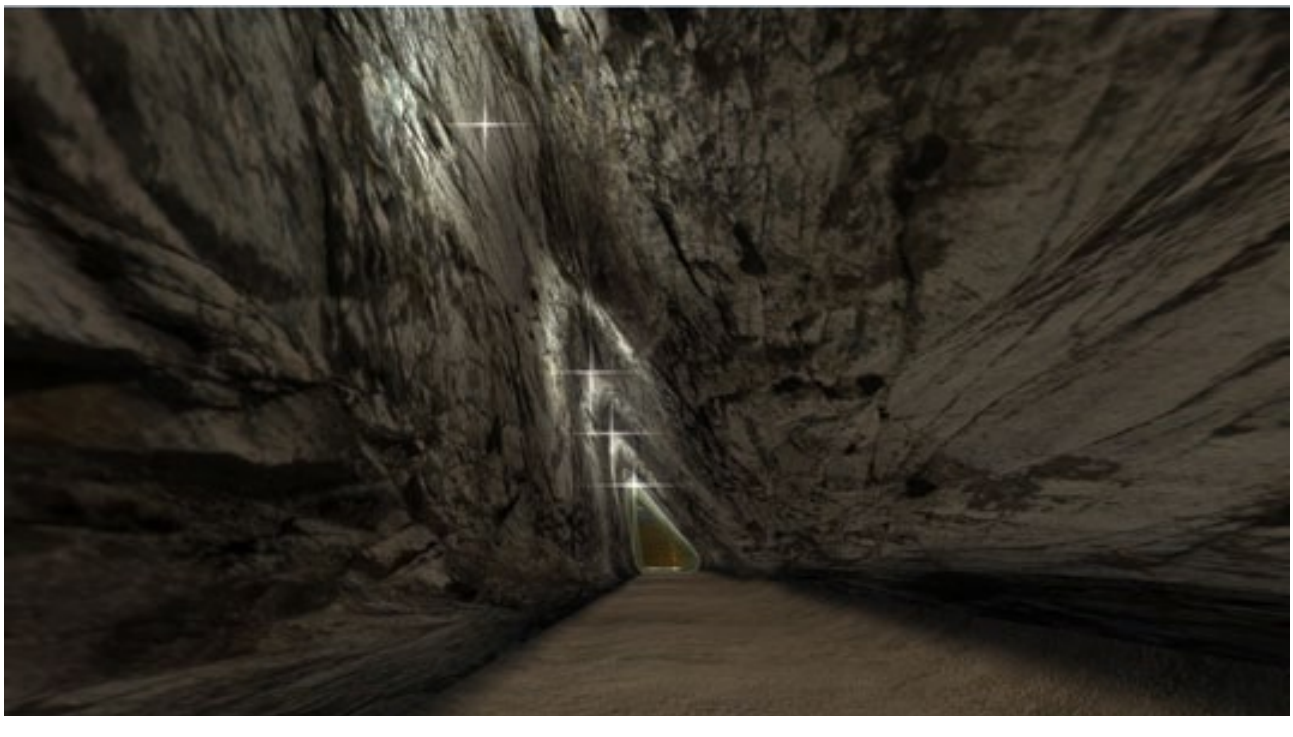
3D scans of UC builders by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, P.Marencik, T. Valent, unity3D

3D scans of UC builders by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, P.Marencik, T. Valent, unity3D

Autonomous agents in Agora, by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, P.Marencik, unity3D

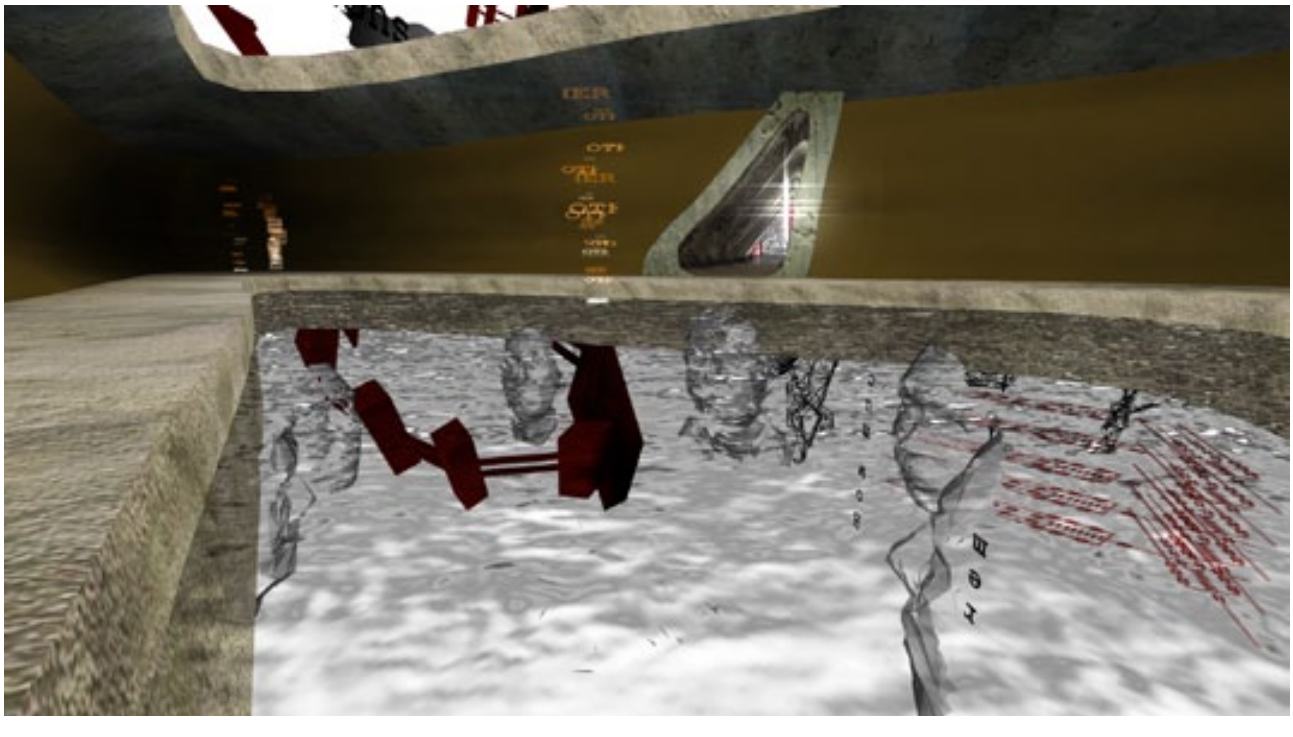


Autonomous agents in L'ombilic, by P.Silondi, unity3D



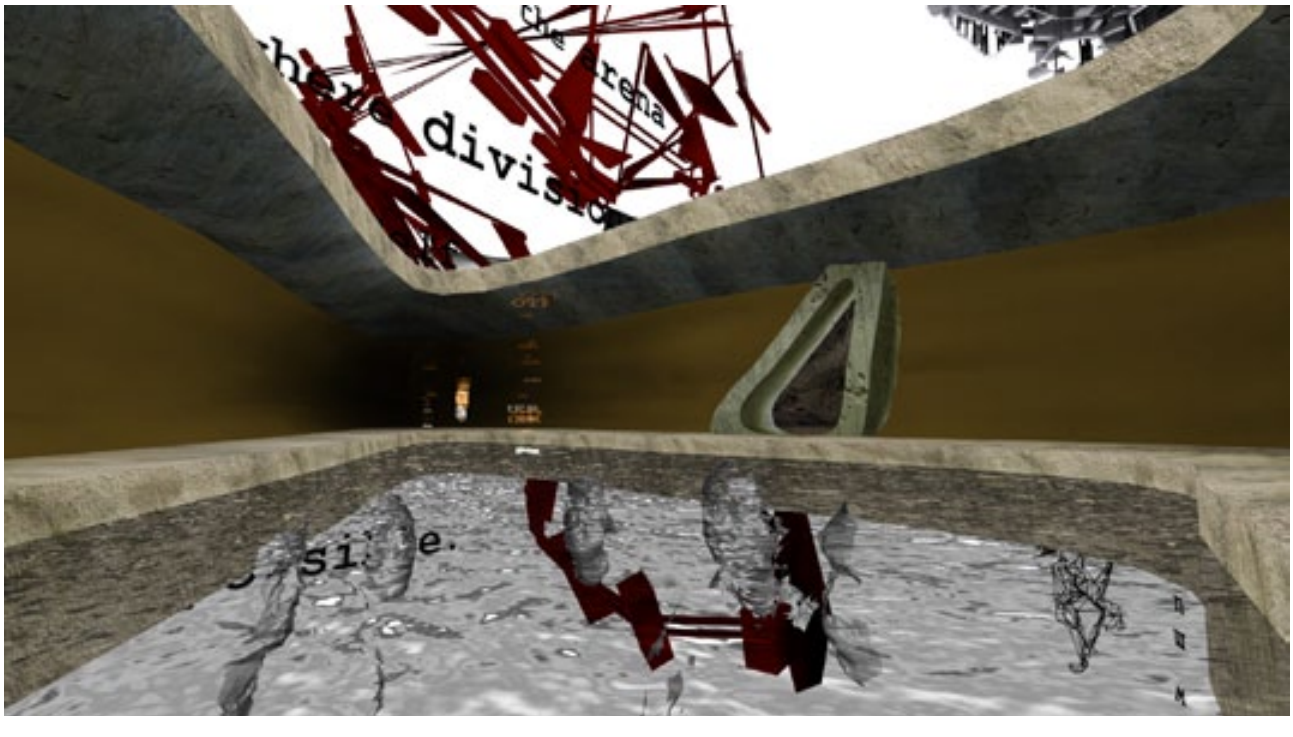
Entaille by P.Silondi, unity3D

Entaille by P.Silondi, unity3D

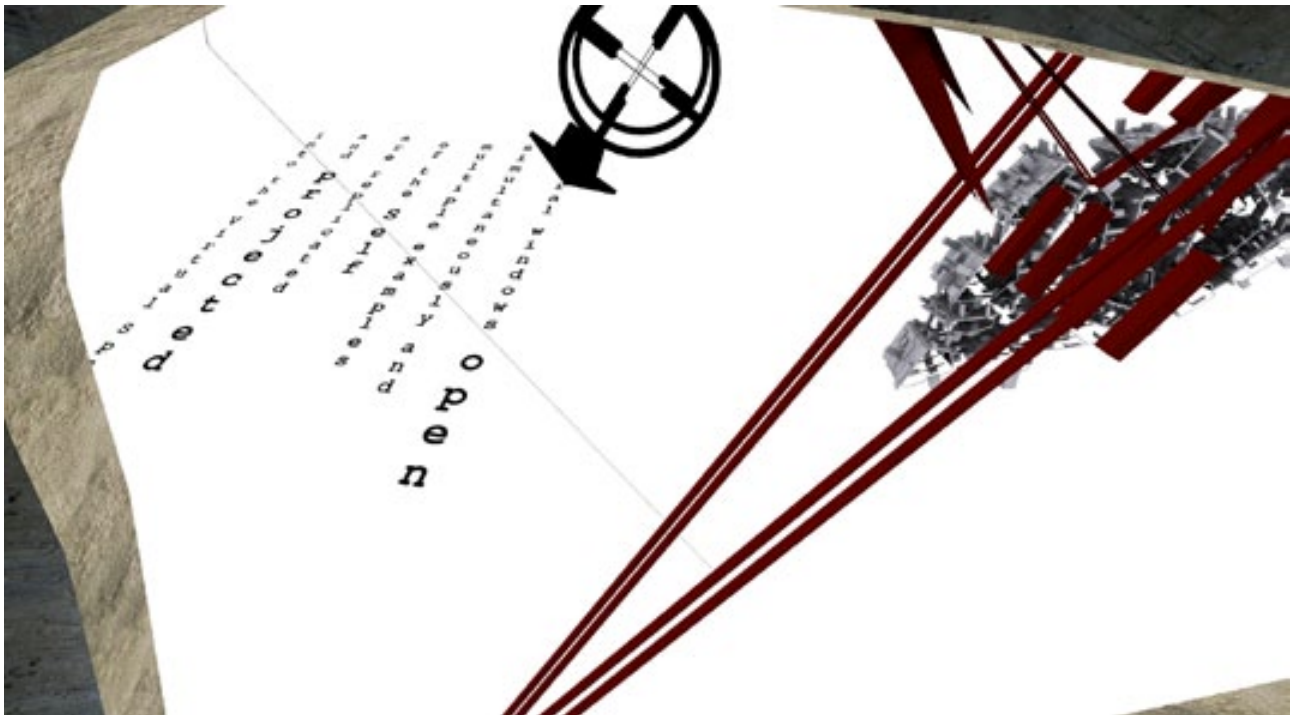


Le bassin by P.Silondi, unity3D

Le bassin by P.Silondi, unity3D



Le bassin by P.Silondi, unity3D

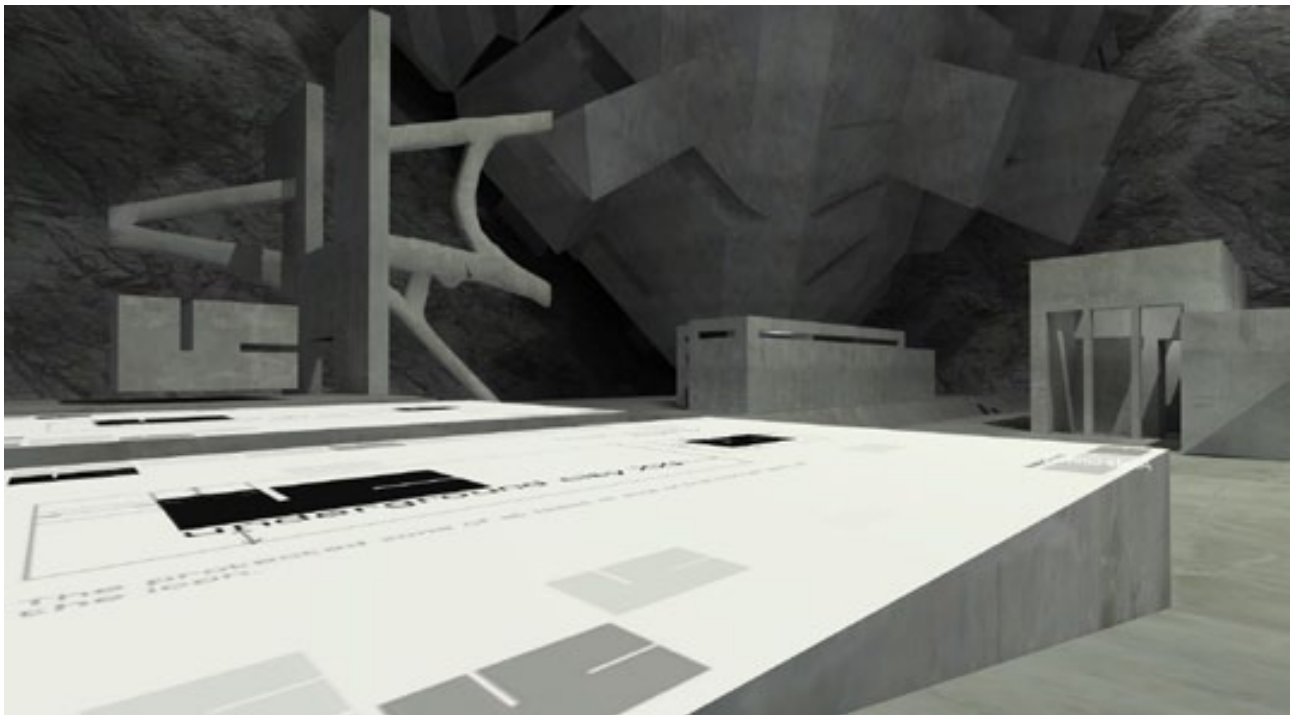


Le bassin by P.Silondi, unity3D

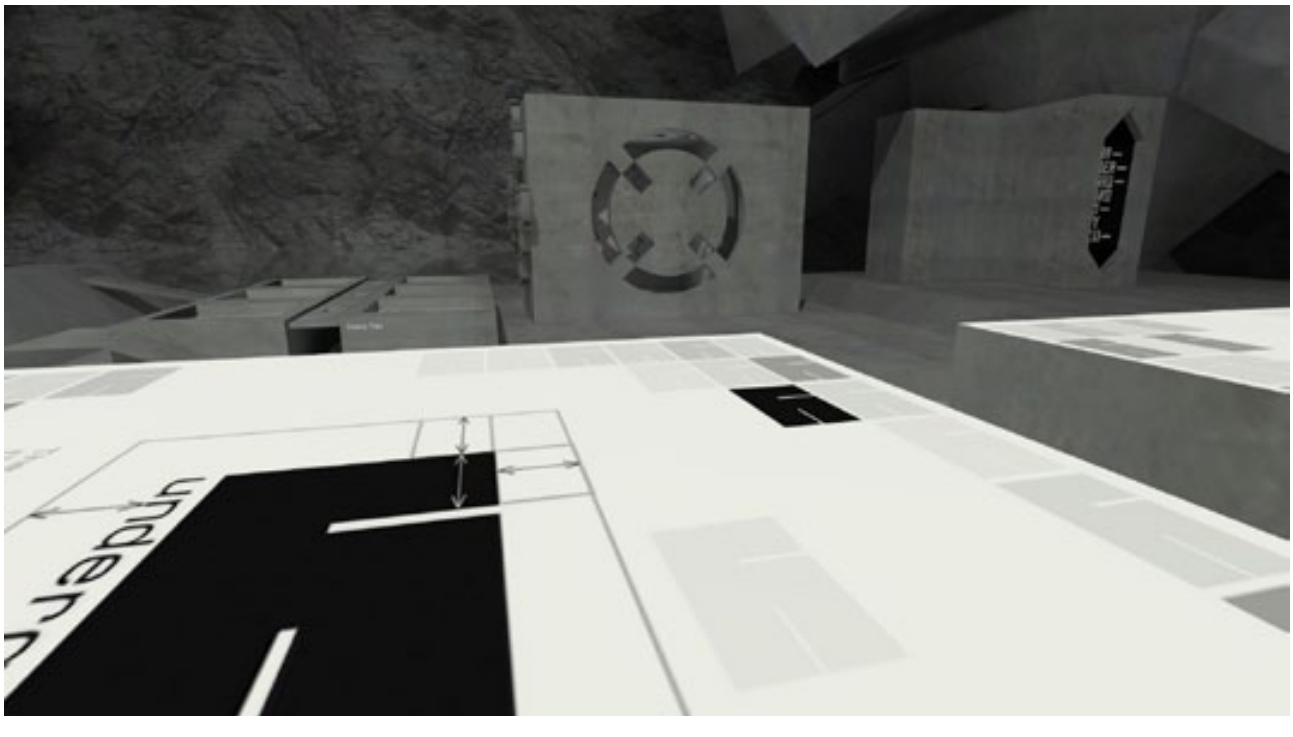
Fractal city by P.Silondi, Sierpinski Pyramid,
unity3D, 3dsmax

Fractal city by P.Silondi, Sierpinski Pyramid, unity3D, 3dsmax

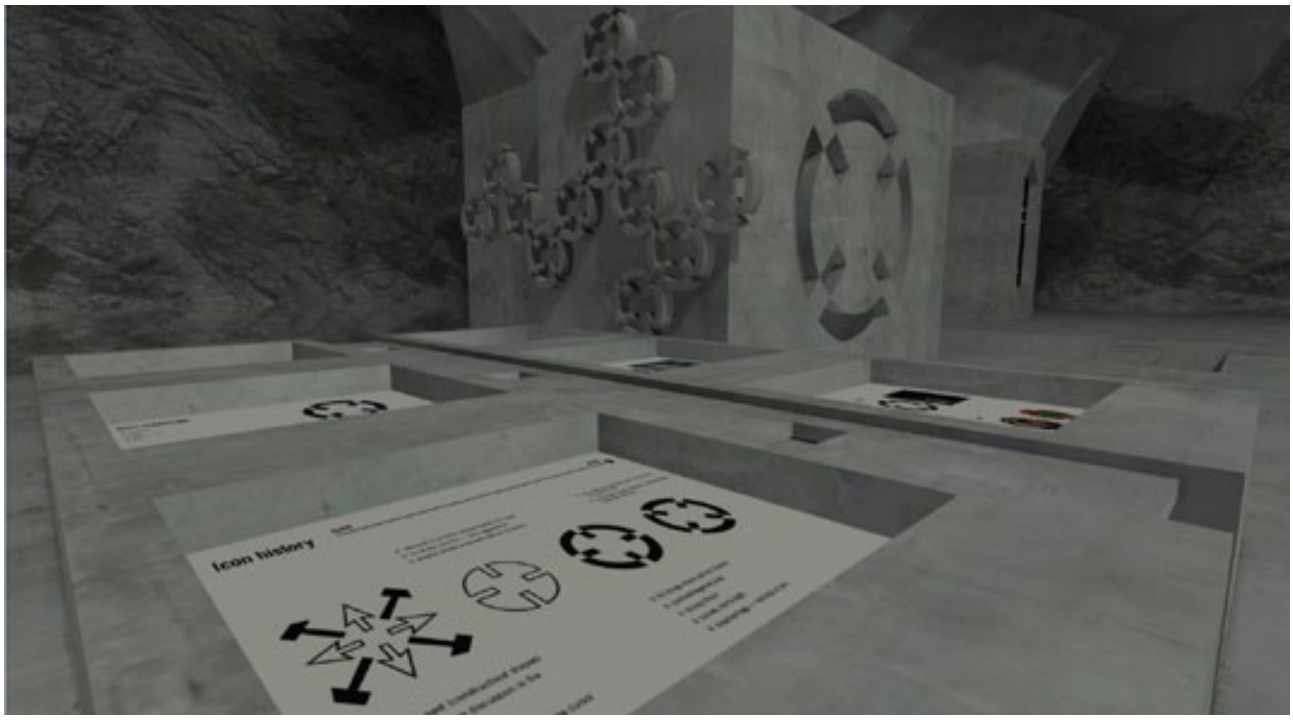
Graphic Design exhibition in Fractal City, by P.Silondi, Aneta Cirusova, unity3D, 3dsmax



Graphic Design exhibition in Fractal City, by P.Silondi, Aneta Cirusova, unity3D, 3dsmax

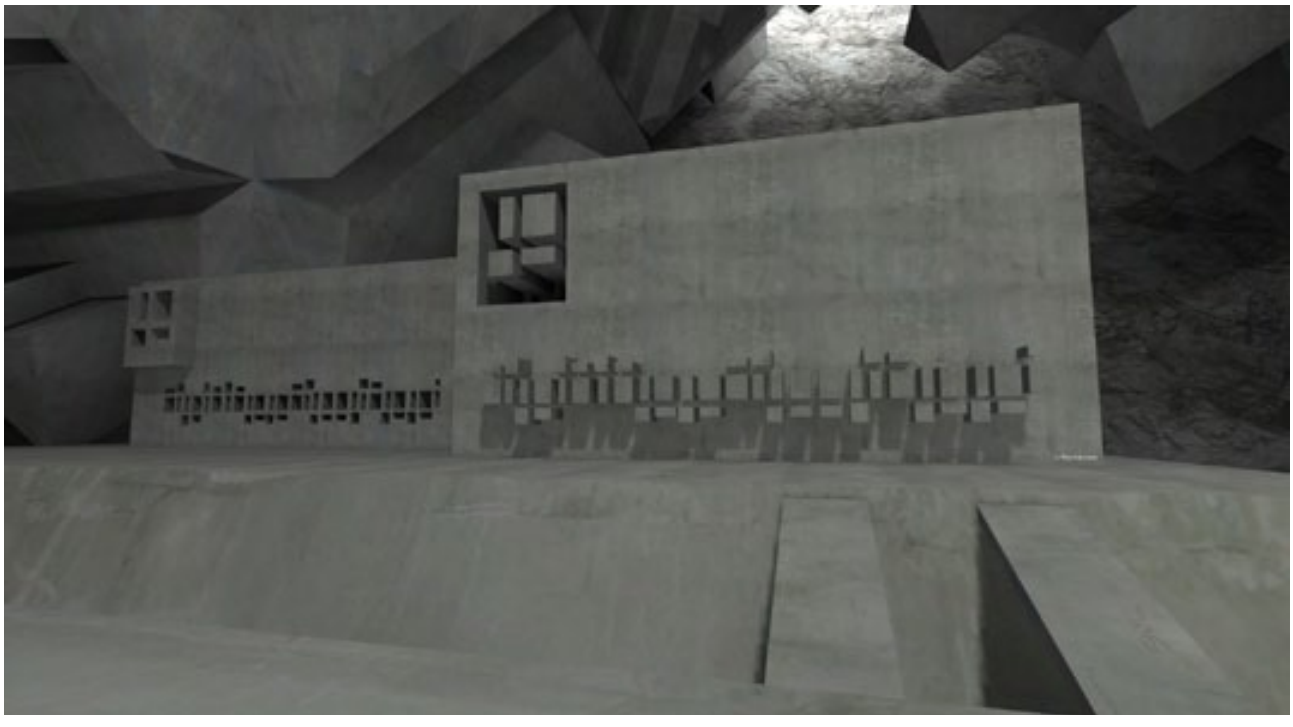


Graphic Design exhibition in Fractal City, by P.Silondi, Aneta Cirusova, Polina Tikk, unity3D, 3dsmax



Graphic Design exhibition in Fractal City, by P.Silondi, Polina Tikk, unity3D, 3dsmax

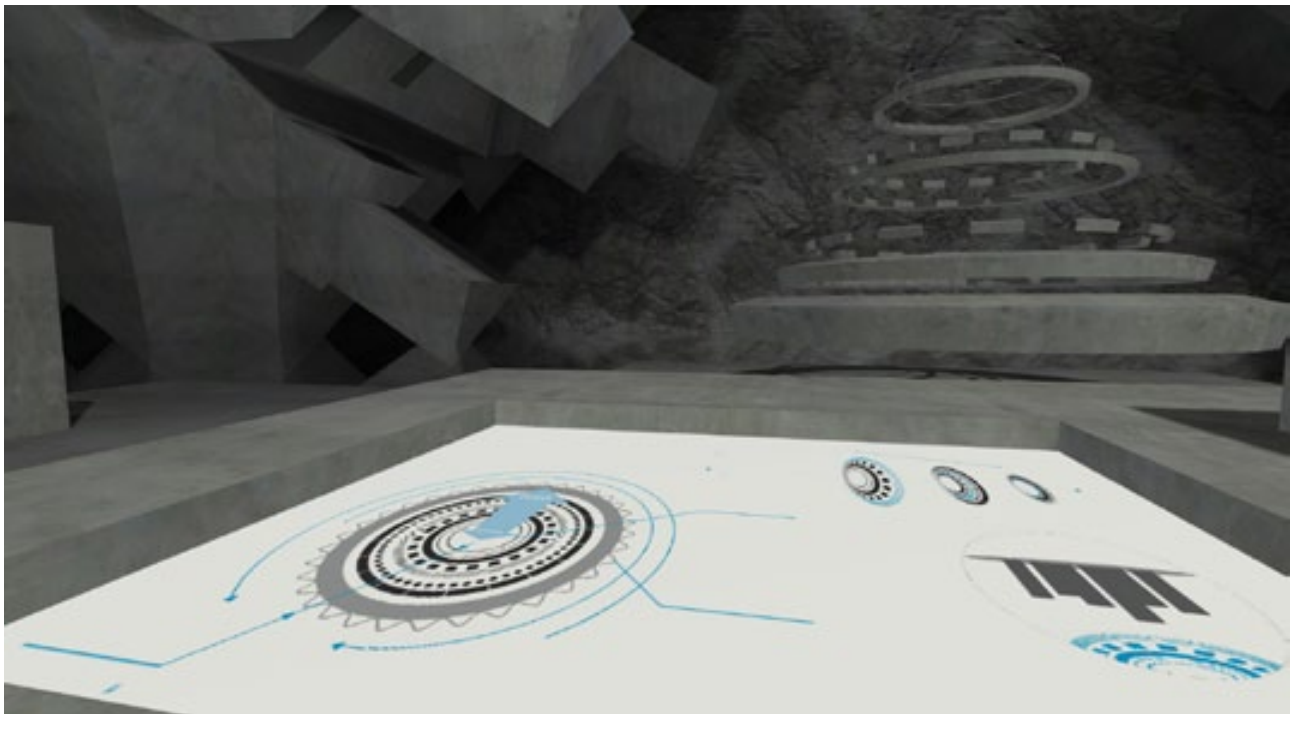
Graphic Design exhibition in Fractal City, by P.Silondi, Polina Tikk, unity3D, 3dsmax



Graphic Design exhibition in Fractal City, by P.Silondi, IA Makhatadze, unity3D, 3dsmax

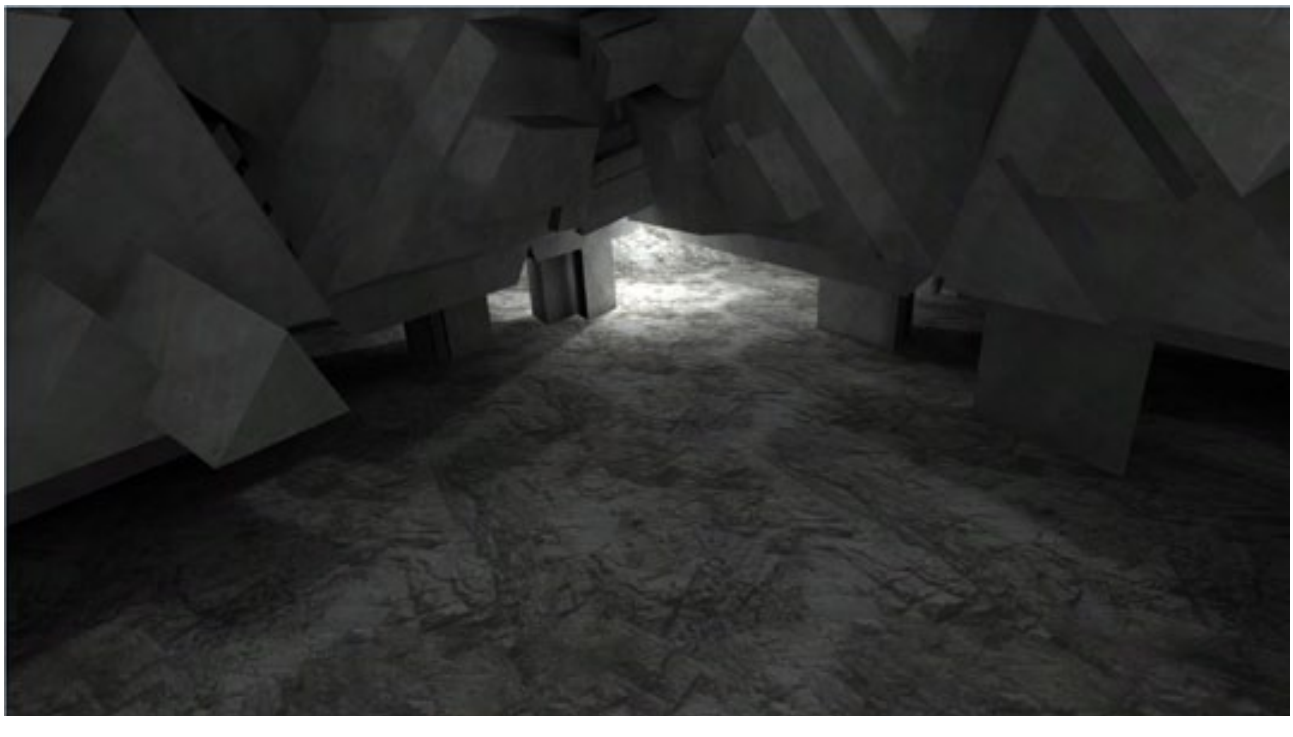
Graphic Design exhibition in Fractal City, by P.Silondi, Dmytro Strapchev, unity3D, 3dsmax

Graphic Design exhibition in Fractal City, by P.Silondi, Dmytro Strapchev, unity3D, 3dsmax



Graphic Design exhibition in Fractal City, by P.Silondi, Dmytro Strapchev, unity3D, 3dsmax

Graphic Design exhibition in Fractal City, by P.Silondi, IA Makhatadze, Polina Tikk, unity3D, 3dsmax



Fractal city and the Sierpinski Pyramid, by P.Silondi, unity3D, 3dsmax

Fractal city and the Sierpinski Pyramid, by P.Silondi, unity3D, 3dsmax

Graphic Design exhibition in Fractal City, by P.Silondi, unity3D, 3dsmax

Fractal city and the Sierpinski Pyramid, by P.Silondi, unity3D, 3dsmax

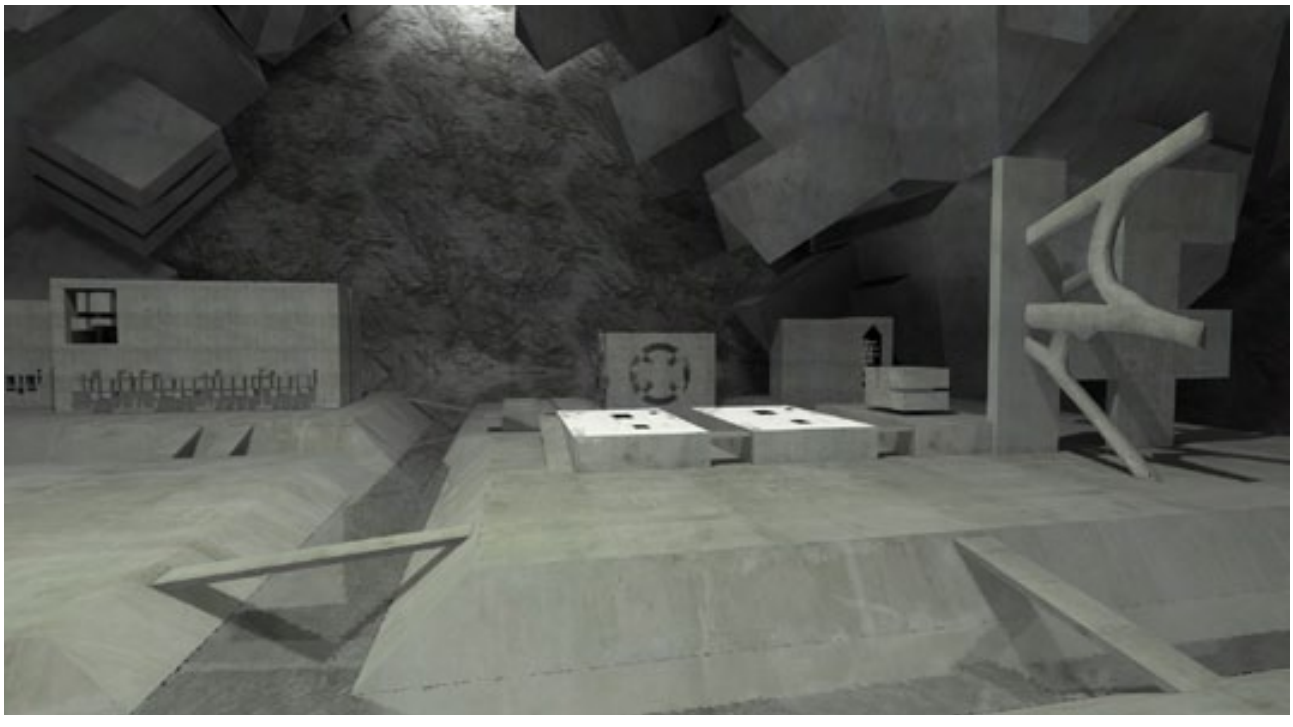
Graphic Design exhibition in Fractal City, by P.Silondi, unity3D, 3dsmax

Interior for fractal city by P.Silondi, unity3D, 3dsmax

Graphic Design exhibition in Fractal City, by P.Silondi, IA Makhatadze, Polina Tikk, Milan Nedved unity3D, 3dsmax

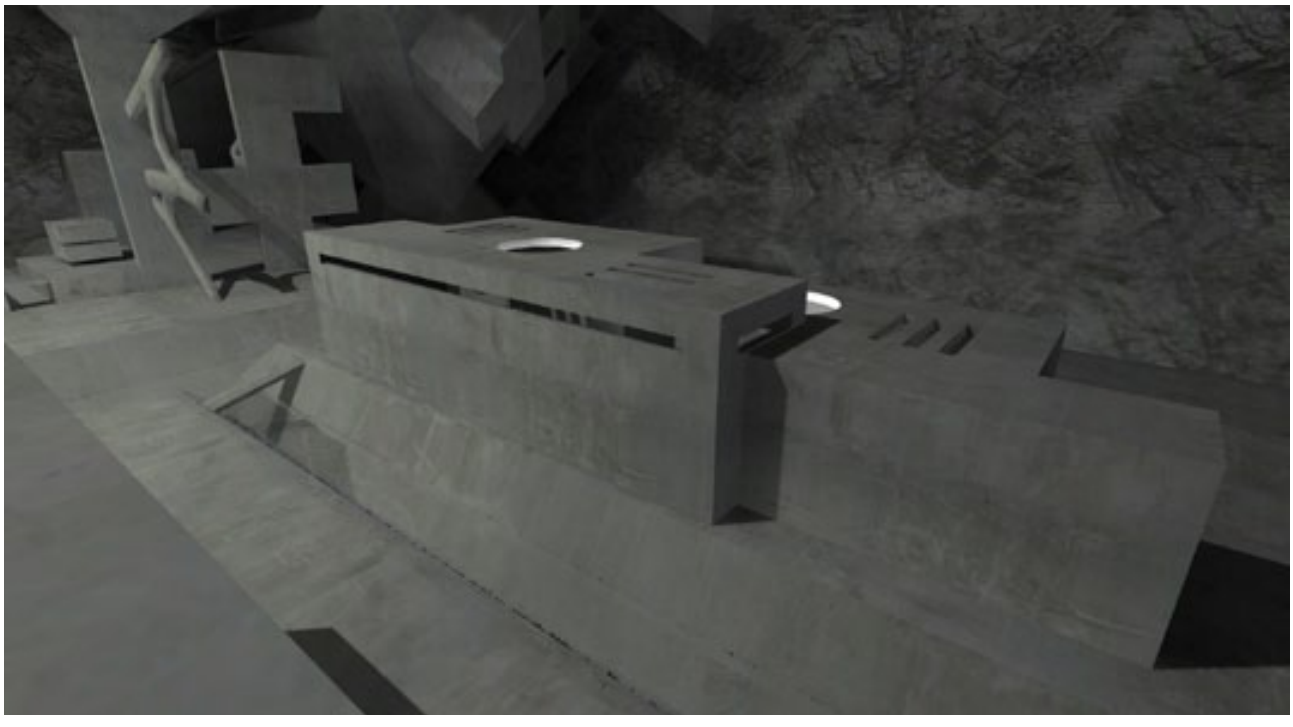
Interior for fractal city by P.Silondi, unity3D, 3dsmax

Interior for fractal city by P.Silondi, unity3D, 3dsmax



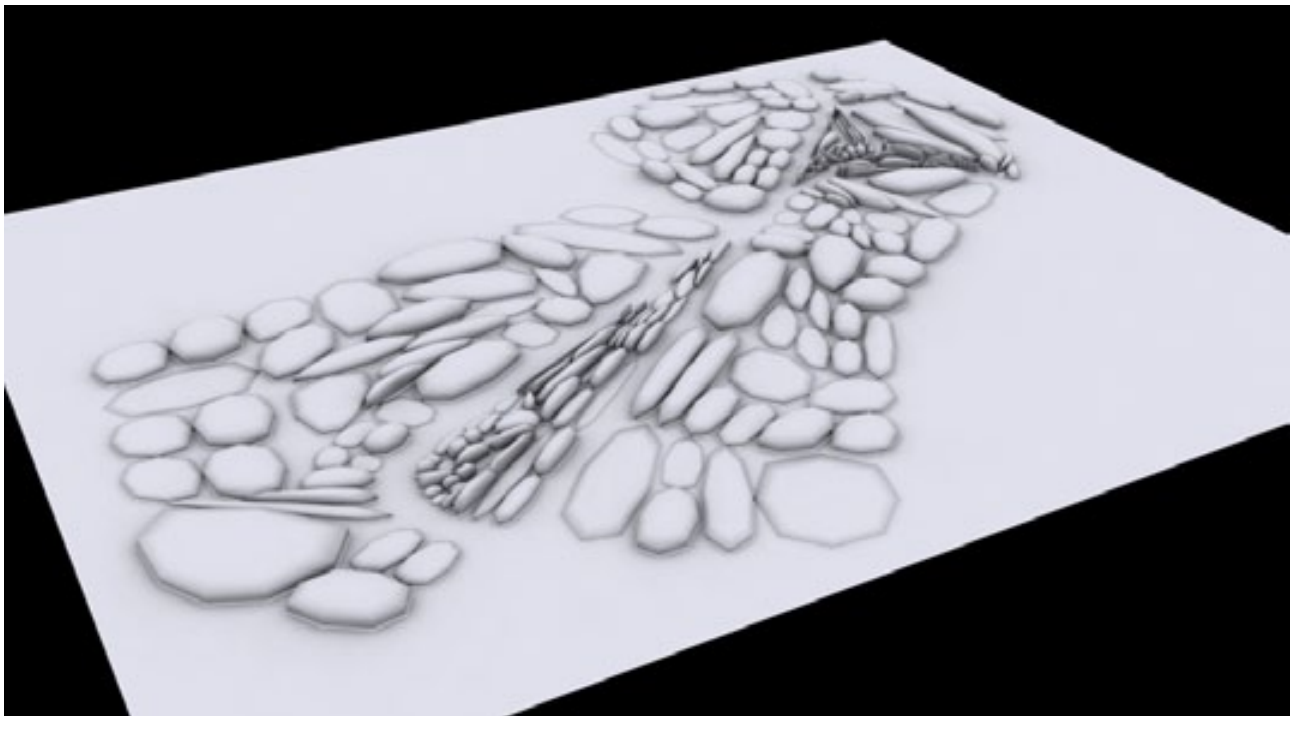
Graphic Design exhibition in Fractal City, by P.Silondi, IA Makhatadze, Polina Tikk, Milan Nedved unity3D, 3dsmax

Graphic Design exhibition in Fractal City, by P.Silondi, IA Makhatadze, Dmytro Strapchev , unity3D, 3dsmax

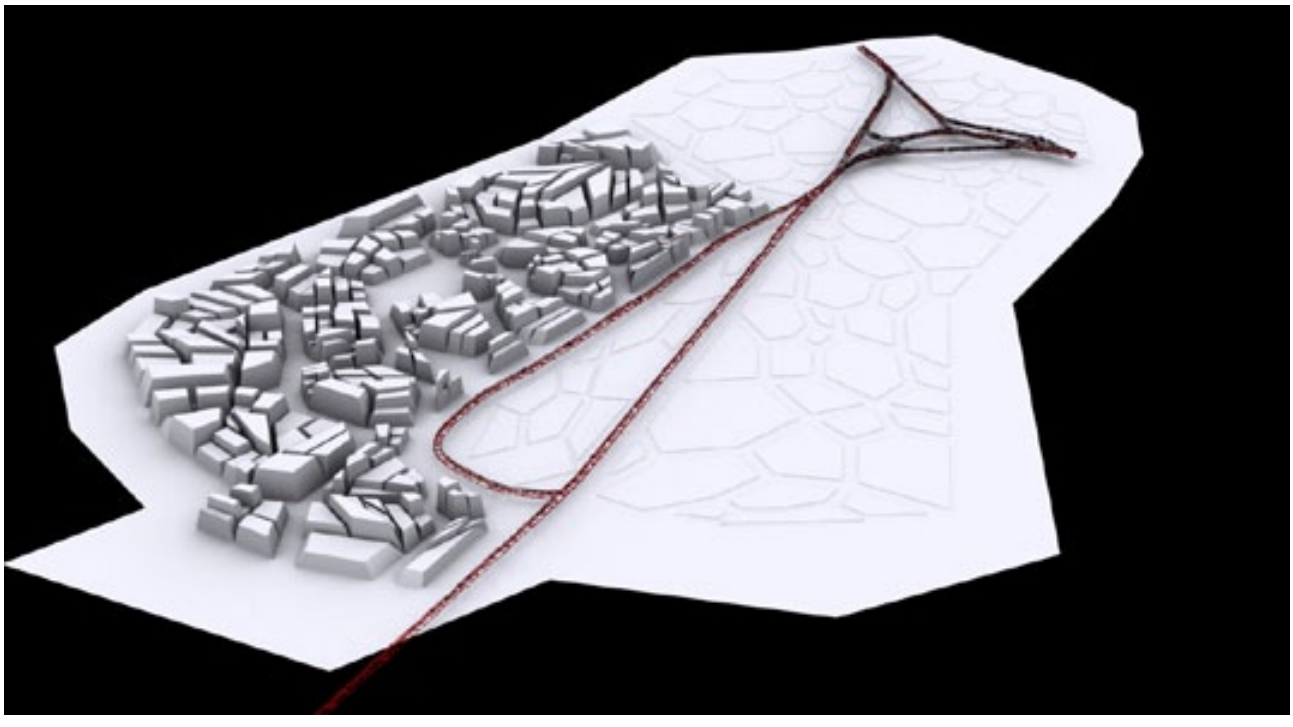


Bloc 1 for Fractal City by P.Silondi, unity3D, 3dsmax

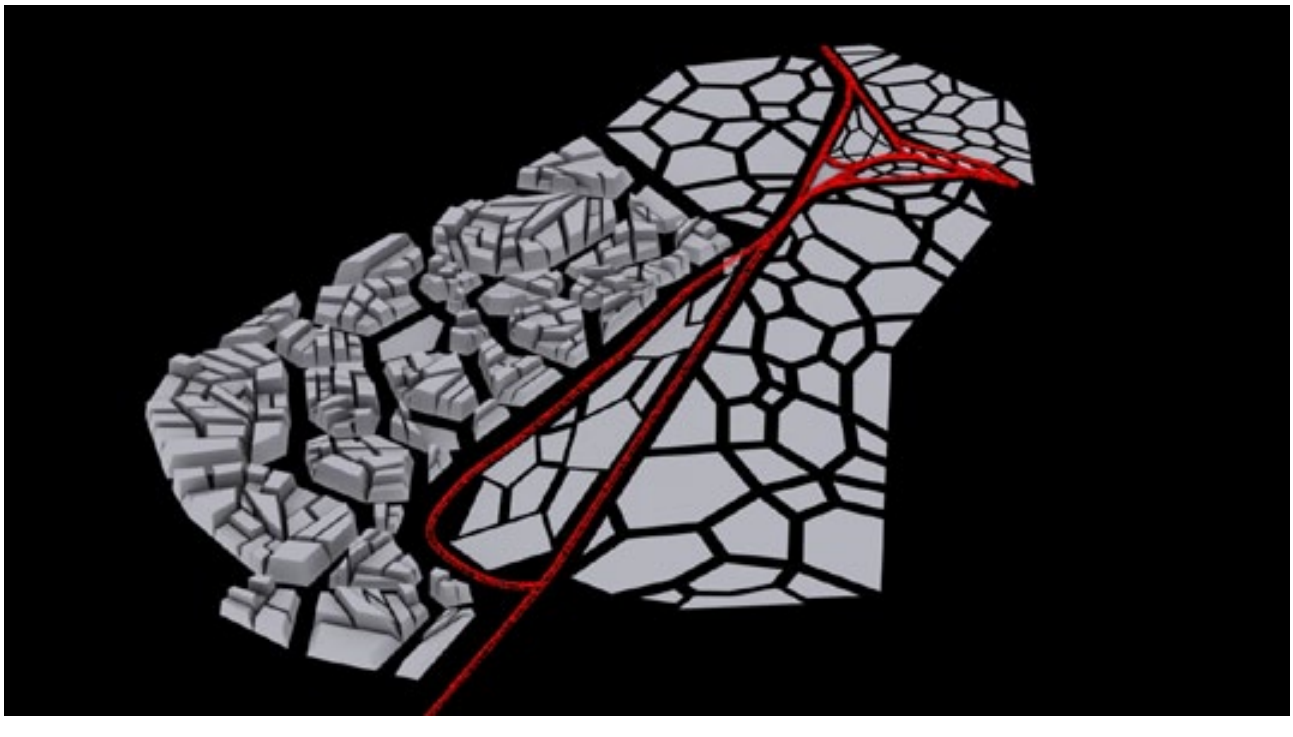
PARAMETRIC CONSTRUCTIONS ARTWORK



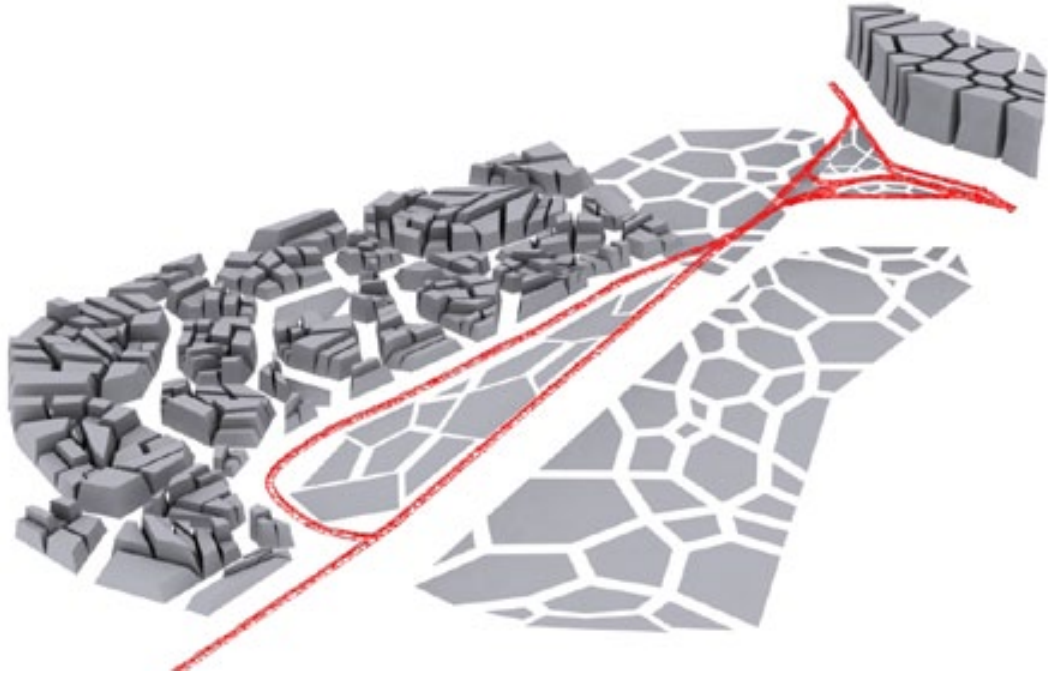
Cells by P.Silondi, unity3D, 3dsmax



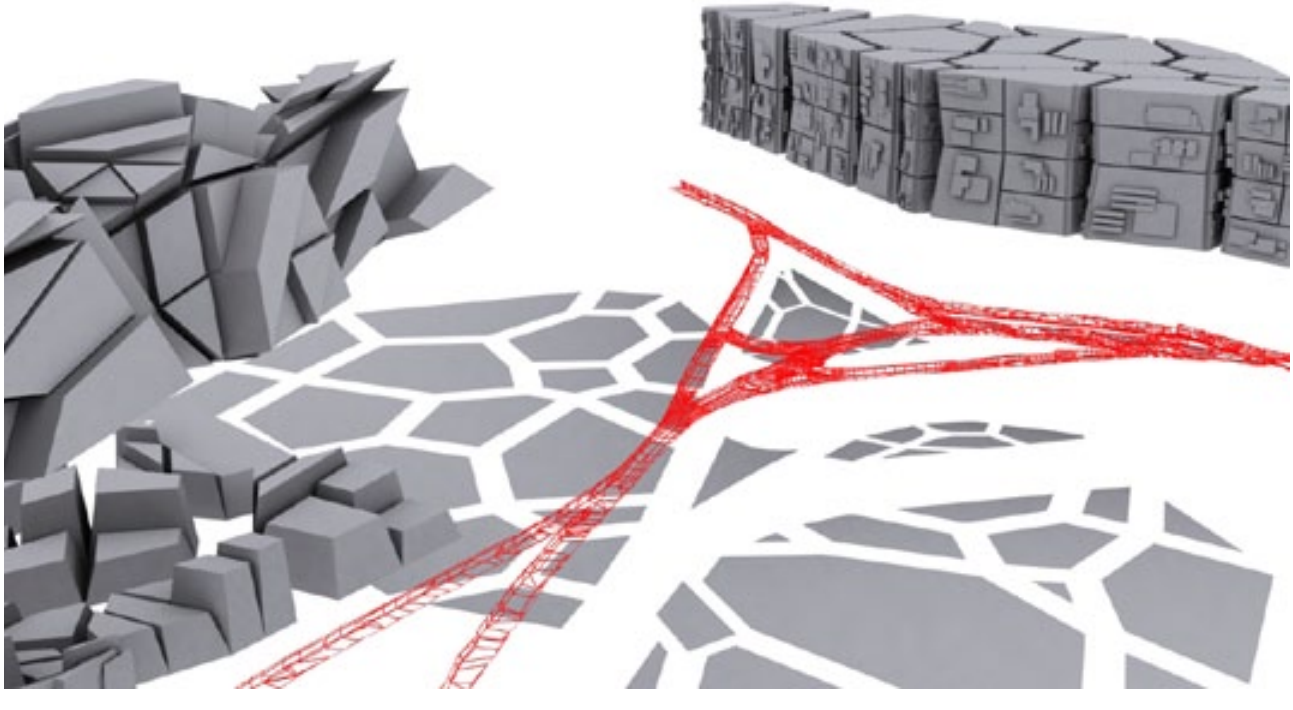
Cells and blocs by P.Silondi, unity3D, 3dsmax



Cells and blocs by P.Silondi, unity3D, 3dsmax



Cells and blocs by P.Silondi, unity3D, 3dsmax



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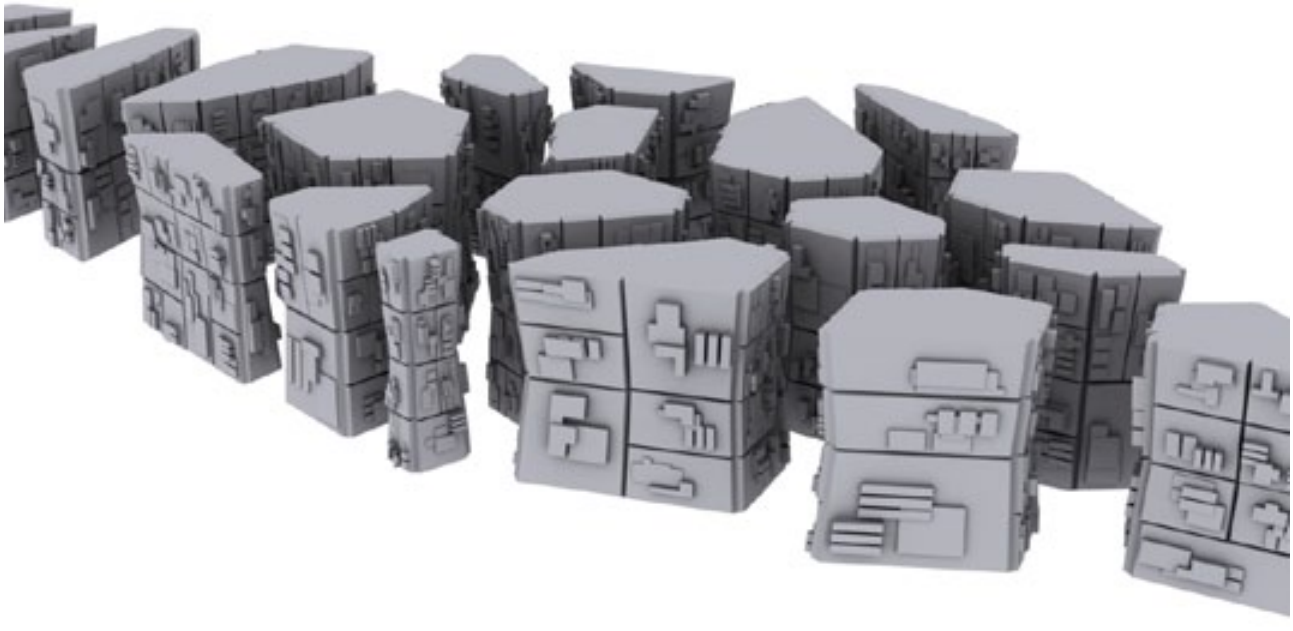

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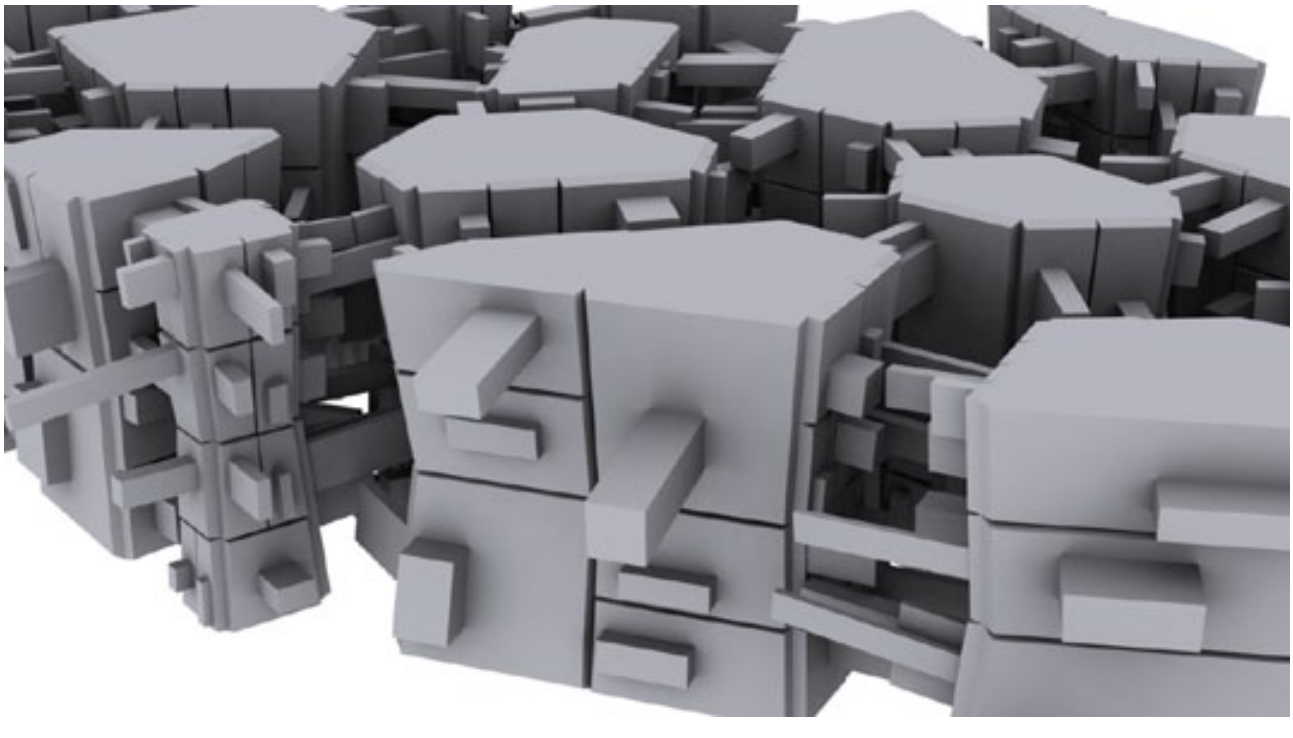

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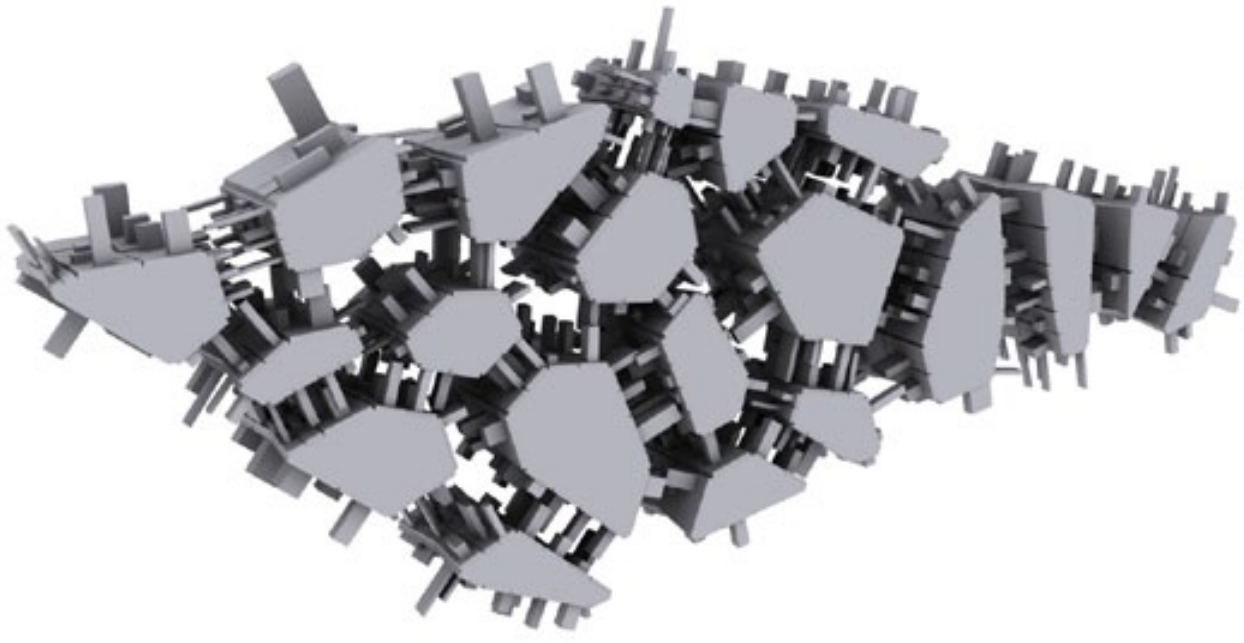

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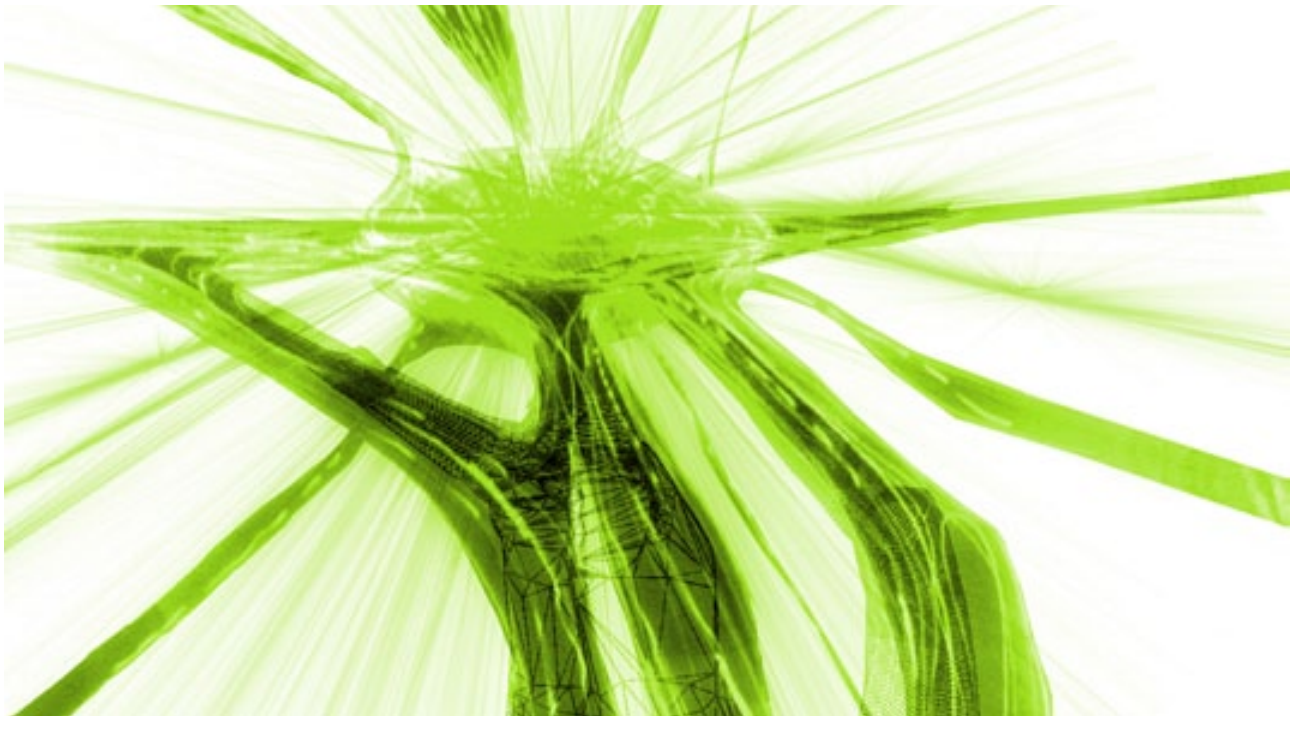
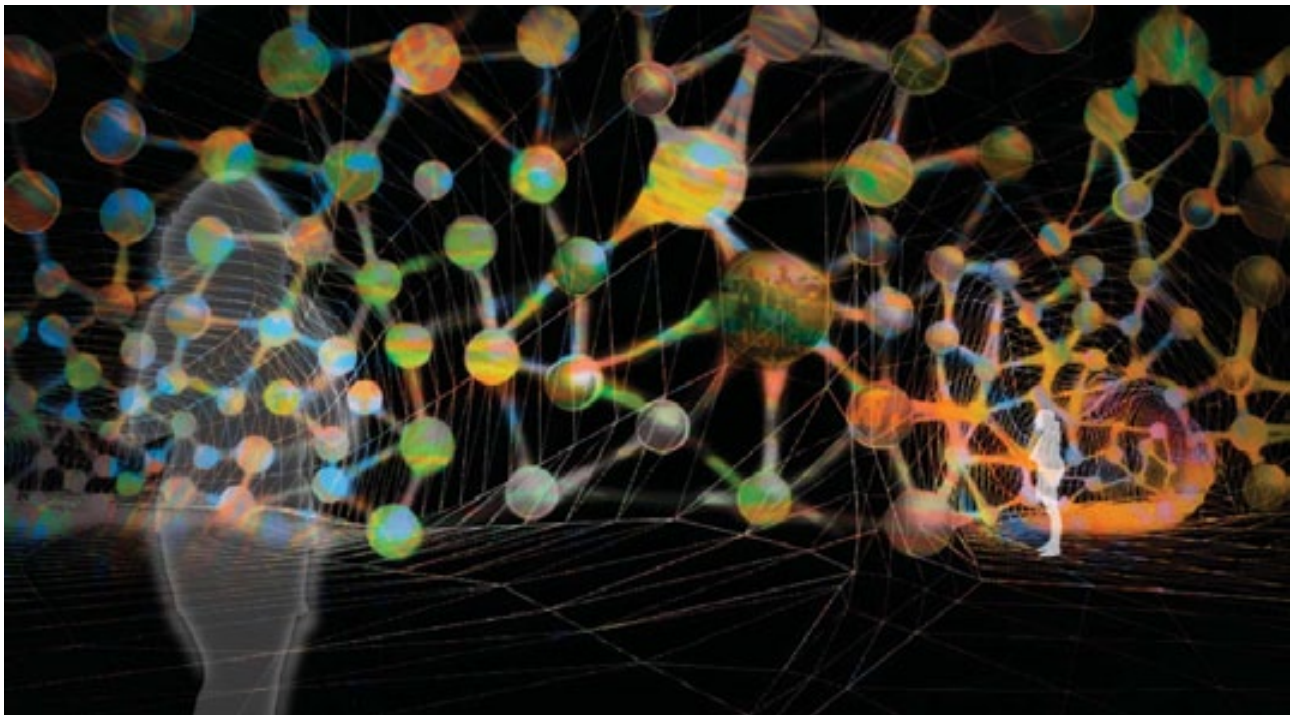


Neural architecture principles by Jan Císař, Jonáš Krýzl

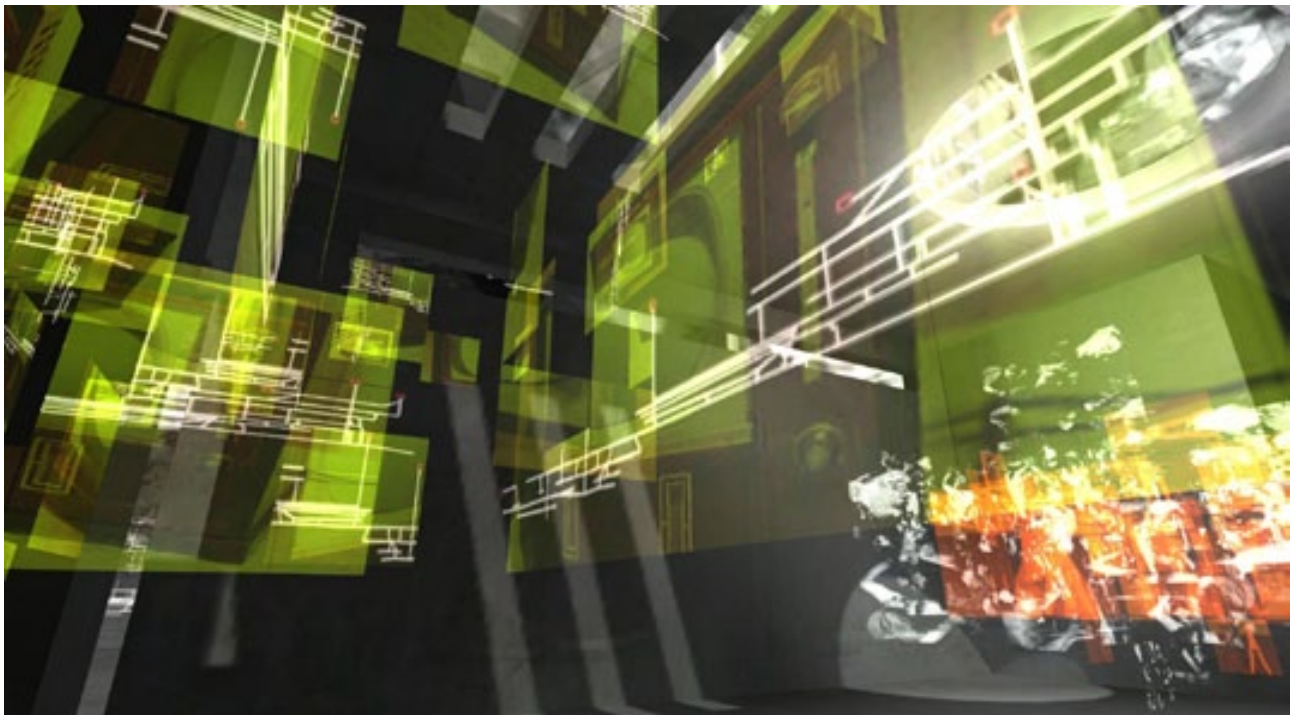


Neural architecture principles by Jan Císař, Jonáš Krýzl

Neural architecture principles by Jan Císař, Jonáš Krýzl

FRACTAL CITY

Fractal city and the Sierpinski Pyramid, by P.Silondi, unity3D, video and sound samples, 3dsmax



Fractal city and the Sierpinski Pyramid, by P.Silondi, unity3D, video and sound samples, 3dsmax

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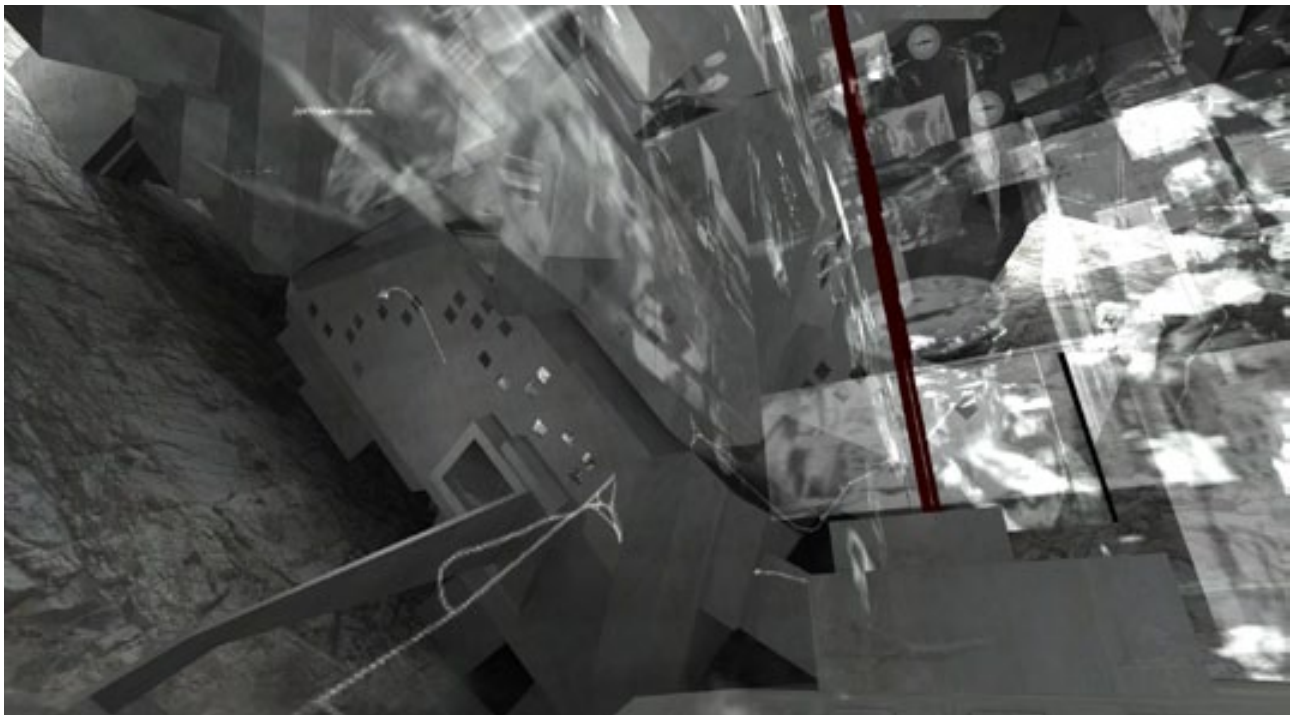

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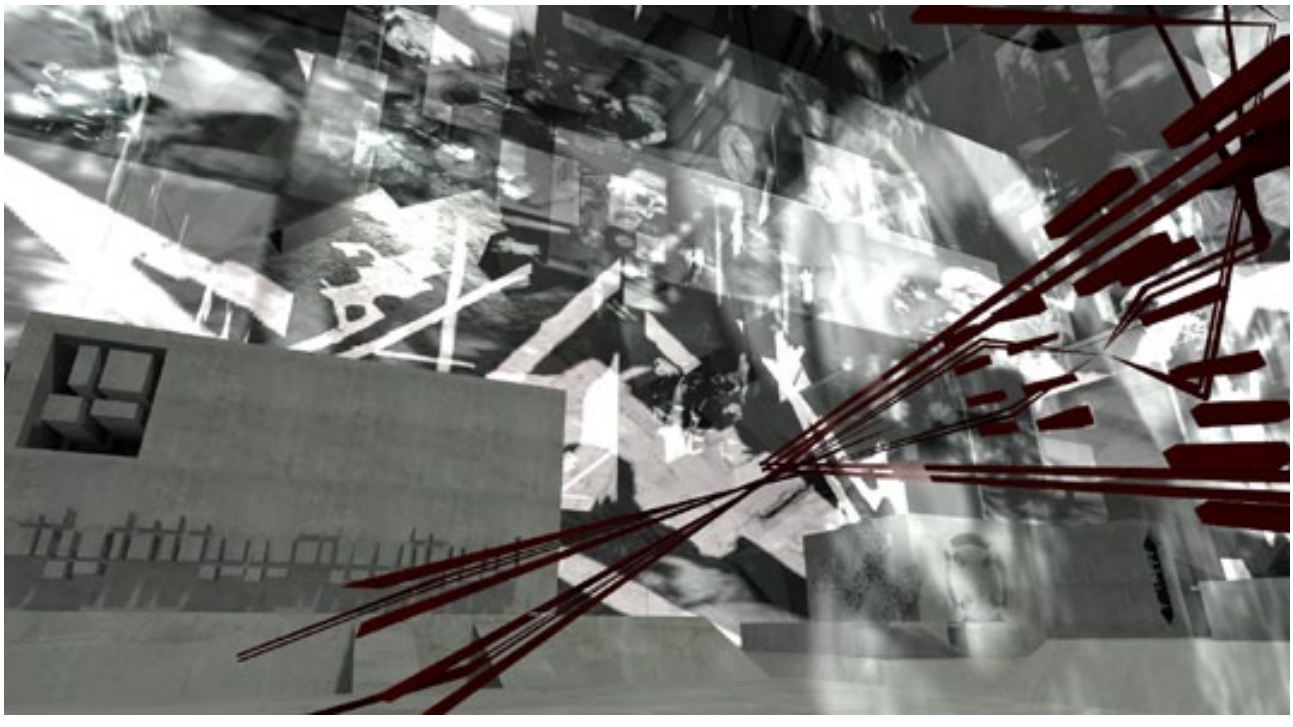

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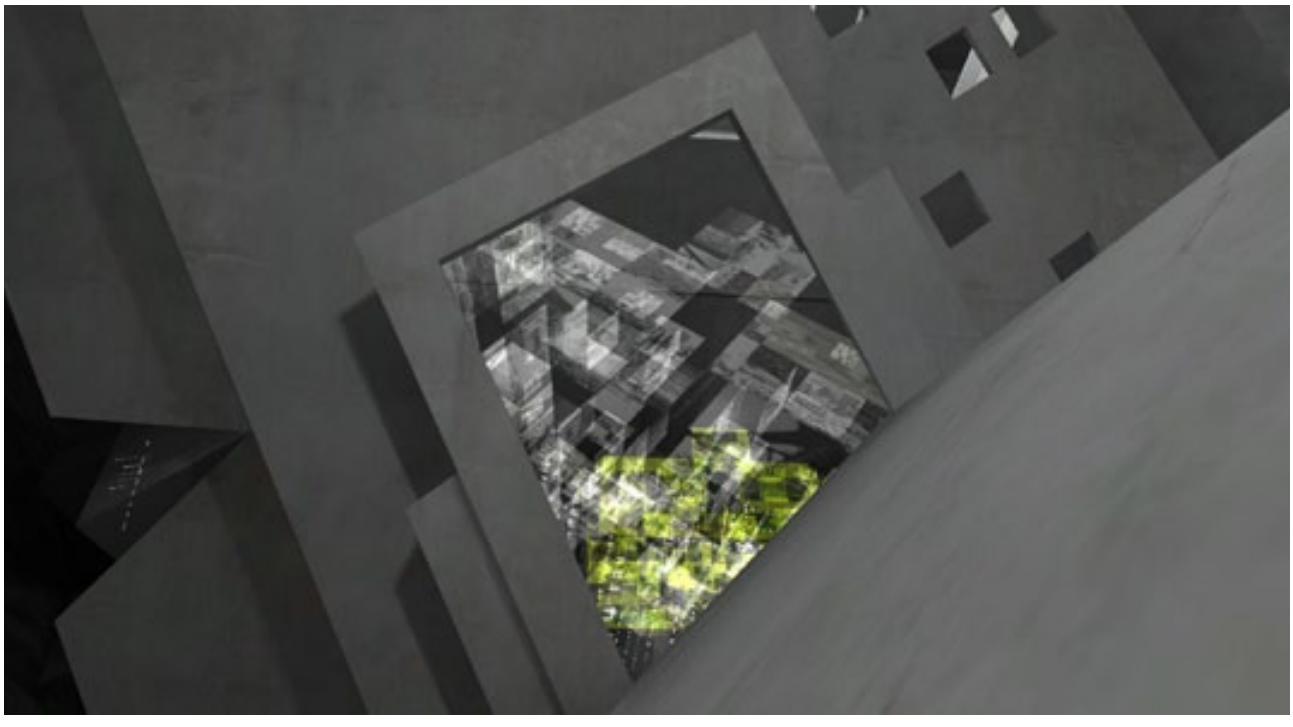

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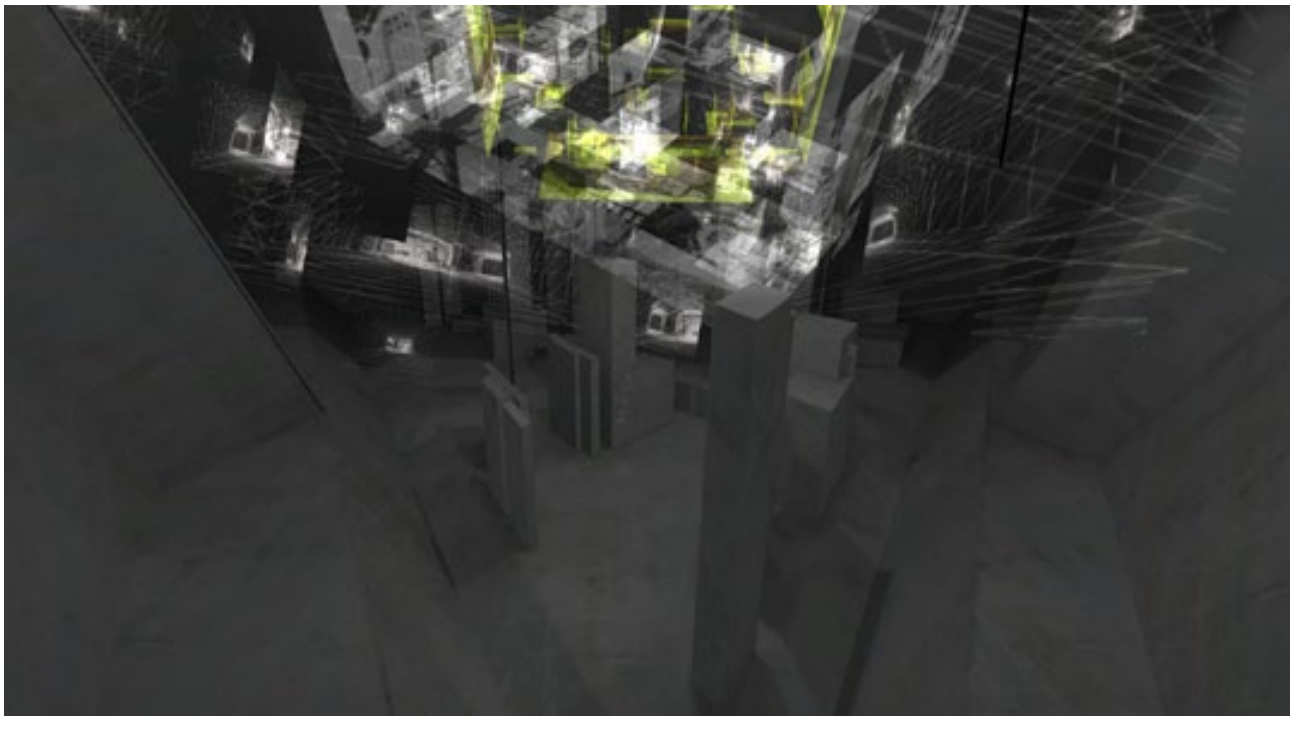

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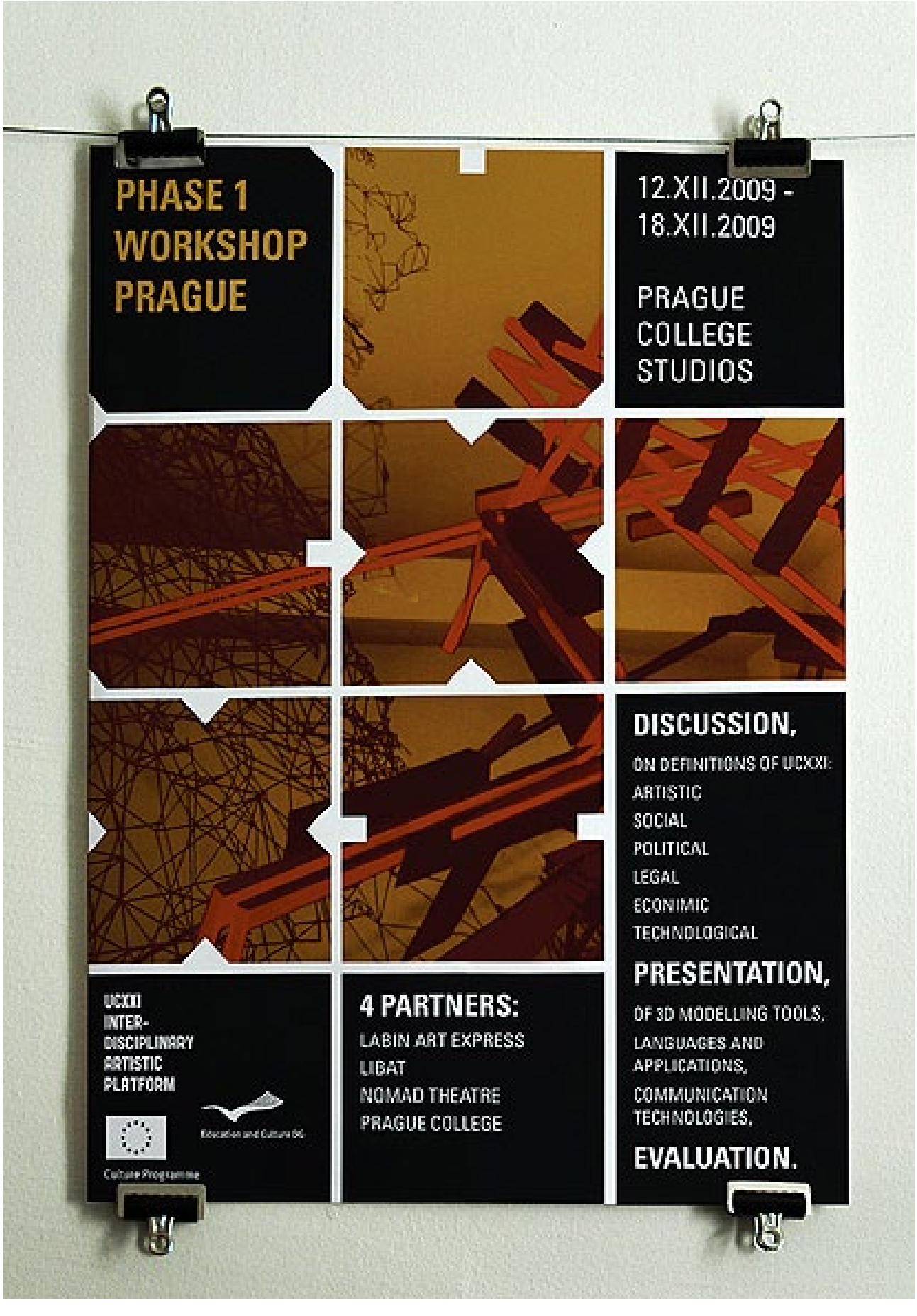
GRAPHIC DESIGN STUDENTS' WORK

UC XXI T-shirt by Oksana Shmygol



Poster by Oksana Shmygol

Workshop 1 poster by Milan Nedved

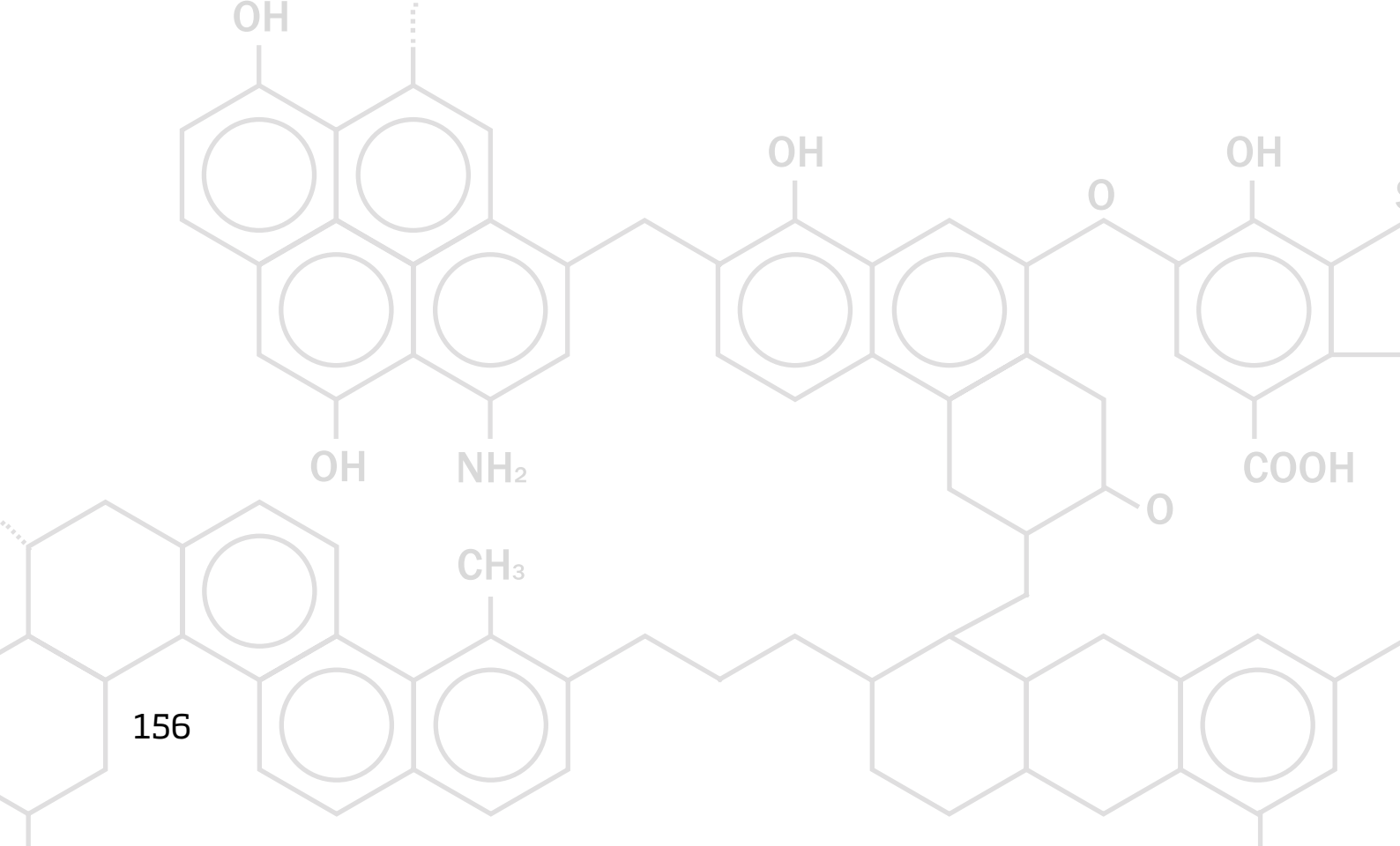
Workshop 2 poster by Natalia Ogneva

Workshop 3 poster by Natalia Ogneva

Poster by Dmytro Strapchev

PART III
ACTIVITIES

Coal



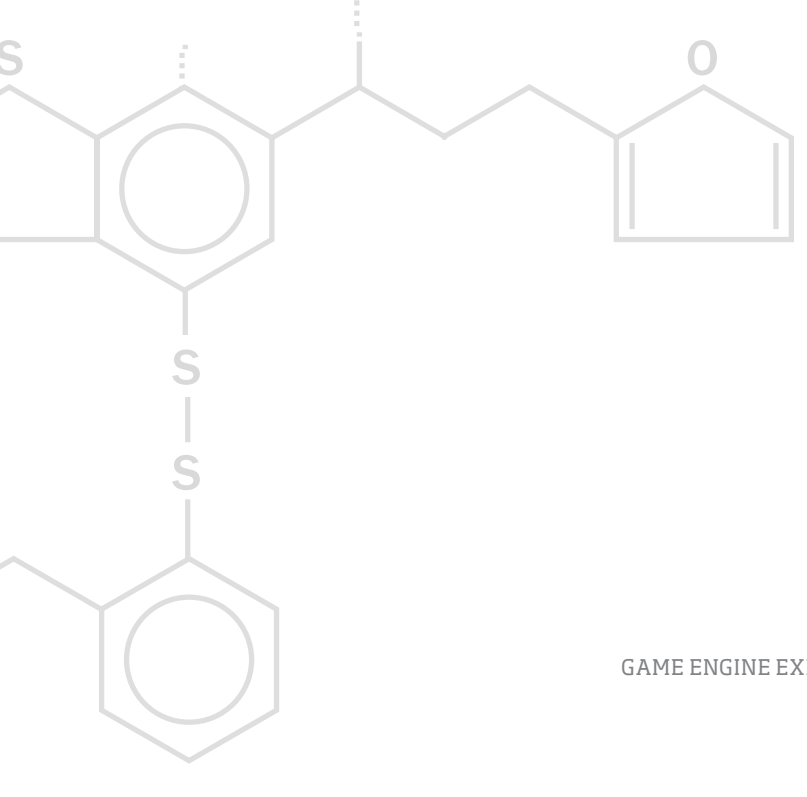
GAME ENGINE EXPERIMENTATION: UNITY AND THE UC3D PLATFORM

PASCAL SILONDI

In this report we discuss and outline some of the work that has been done during the development of Phase 1, the evaluation phase of the project. In this respect a careful investigation of several existing technologies relating to cyber worlds, collaborative experimentations and 2D/3D multimedia creation in mixed 3D multiuser environments shared on the internet was carried out. We did not exclusively work on one system but we tested, interconnected and evaluated different technologies that could be used to build the future UCXXI multi-layered Platform.

The first months of investigation were designed as a concrete continuous work session where artists, interdisciplinary researchers, IT experts and students were invited to present and exchange ideas about the UCXXI project. During this time participants investigated and worked collaboratively in order to build bridges between social network concepts, the art and technology.

The main aim was to customize specific technologies for artistic creation and interdisciplinary research, as to develop new collaborative and educational models, and to identify which software, hardware or programming languages could be used to create the multiuser 3D platform.



within the content of digital worlds using a range of sensors, motion tracking techniques and different programming languages. Various systems (3D Rad[1], Unity3D, Unreal Tournament) and languages (Lite-C Atari, Virtual Reality Modeling Language) were explored. The first result of this research was the performance in the "Army House of Culture" in Legnica (PL) September 2009. The title of the performance was Multimedia Triangular Propaganda. A second important outcome of the research was the creation of the installation titled Underground Landscape which was presented in the Gamerz # 5 festival in Aix en Provence (FR) in December 2009[2].

The First Phase of experimentation resulted in organizing the first Workshop in Prague, in December 2009. Thus workshop proposed to all UCXXI participants a synthesis of the investigations carried out in the last trimester of 2009. An essential research session has been suggested to interconnect analogical and digital systems, and to discuss and test their capabilities and limits.

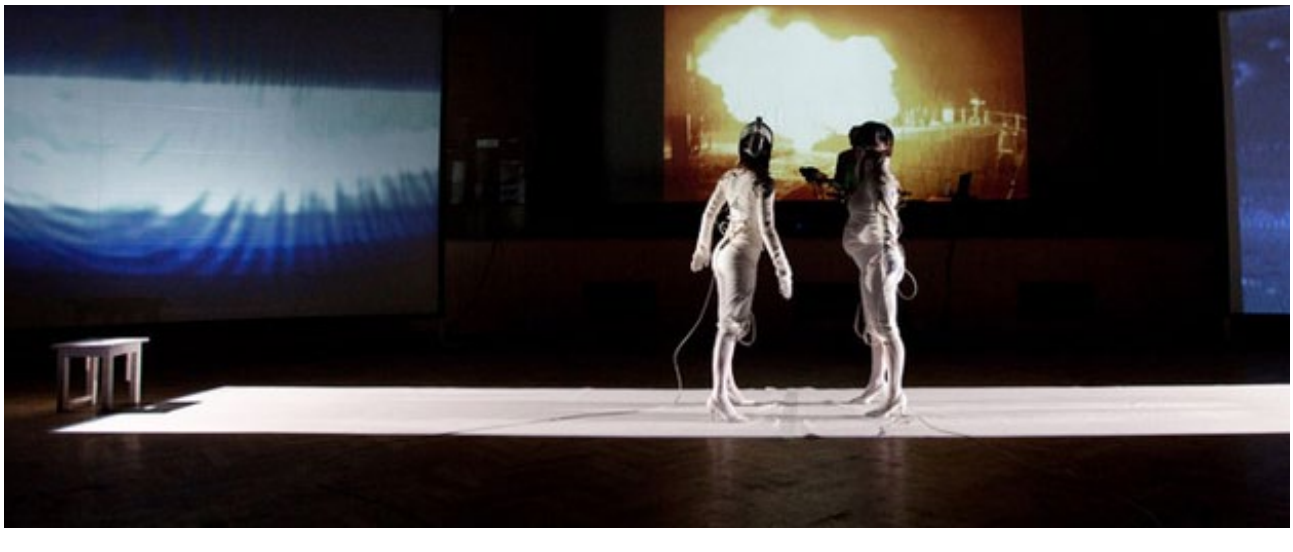
The principal aim of the workshop was to identify the needs and wishes of all participants correctly in order to identify the technologies which will be used for developing the UC XXI platform during the next phases.

The main aim of this report is to summarize in detail the activities which were done during this first phase. They can be outlined as follows:

1. *Creation of Interactive 3D environments*
   - **1.1** *3D modeling and animation for UCXXI*
   - **1.2** *VRML/X3D language and cyberspaces*
2. *Experimentations using 3D game engines*
   - **2.1** *Advantages of Unity 3D*
   - **2.2** *Experimentation with Unity 3D*

1 http://www.3drad.com
2 http://www.festival-gamerz.com

Special attention was devoted to the creation of 3D multimedia worlds which can be shared and distributed on the Internet, and to the realization of alternative interfaces to interact



Multimedia Triangular propaganda, city festival of Lednica (Poland)

1. CREATION OF INTERACTIVE 3D ENVIRONMENTS

This part deals with creation of 3D environments that might be useful for the final platform.

3D MODELING AND ANIMATION FOR UCXXI

The architecture of 3D tunnels is based on the actual dimensions of the ex-coal mines located in Labin, Croatia, and was created using Laser measurement and data processing carried out by VIAS, Vienna Institute for Archaeological Science and Vienna University of Technology.

These initial 3D models were drafts and had to be rebuilt. This data was interesting as a reference and helped us to understand the complexity and organic nature of the mine. However it was not suitable to be a part of the future 3D environment without a serious reconstruction.

The first task was to properly rebuild the 3D volumes and surfaces. We refined and reconstructed the 3D meshes, welding the different shapes and their vertices, re-connecting edges, re-triangulating faces and optimizing the geometry. We tried to make the best artistic choices and not lose the precision of the Laser measurements and the organic nature of the mine.

The first part the "Labin entry" was reconstructed by Inge Schiller and Pascal Silondi and was used as the foundation of the "Underground Landscape" immersive installation (see 1.2 for more details).

Reconstructions of the 3D geometry as well as 3D models were necessary before they could be used in the 3D game engine. It was also an essential task for the next steps of the 3D environment creation to apply visual materials to geometry (2D graphics, videos), in order to create and to render light solutions and to prepare the physics, the dynamics and the animation principles of the future Cyber world.

Electro-magnetical motion capture system (eGaLab)

Underground City XXI first Prague workshop

THE VRML/X3D LANGUAGE, WORKING WITH VIRTUAL REALITY MODELING LANGUAGE AND CYBERSPACES

The VRML, Virtual Reality Modeling Language was first presented in 1994 during the World Wide Web Conference and is used to describe 3D scenes for the Internet or for stand alone applications. It is a text file format that defines the 3D geometry, (position, orientation, scale of the objects and XYZ coordinates of the vertices that compose the shapes), the appearance of the 3D objects, (colors, UVW mapped textures, transparency, and URLs of the textures be they static pictures or movies), the animation keys, the physical principles (collisions, gravity), hyperlinks, sounds, lights and cameras.The VRML is not exactly a programming language, it is more a descriptive language. To program advanced functionalities, programmers will add to their VRML files, JAVA or JavaScript code. The 3D scenes can be created and described directly in text editors like those for HTML. However, most 3D modeling software can be used to create the 3D scenes and then to export it as a VRML file (.wrl). VRML/X3D files can be read using players such as are used for flash files or plug-ins integrated into web browsers.

Another choice was the BS Contact player developed by Bitmanagement[3]. This option allowed for advanced functionalities proposed by they visualization platform such as shaders, multi-texturing support, advanced Physics, flash playback, audio-video streaming integration and more, as put of the development platform.

VRML/X3D was the main technology used to develop and present "Underground Landscape". It was created by Pascal and Marie Silondi and it is an interactive audiovisual installation where users are immersed simultaneously in multiple 3D cyber underground worlds projected in parallel in a gallery prey to erosion. This is an enclosed and partitioned space in which the subject is immersed in sound dissonance as part of the contemporary digital exhibition.

3 See http://www.bitmanagement.com

The new 21st century miner equipped with hammers extended with motion sensors may initiate his descent into the abyss. There the miner can explore a network of multimedia tunnels lined of pixilated shadows, virtual characters glued to frantic loops, mechanical rhythms and over-cadenced sounds, all inspired by the past industrial revolution.

The Underground Landscape offers the user the chance to multiply his influence, an opportunity offered by the use of a computer network, to interact simultaneously with the contents of several interconnected cyber tunnels. It is a schizophrenic installation-system, an organism sensitive to stimuli that react, at times contradictory to their translation.

The Underground Landscape proposes a non-linear immersive and chaotic storytelling architecture that uses 3D gaming technologies (VRML/X3D, 3Drad) to integrate and manipulate videos, sounds or 3D objects, and to allow the "free" exploration of the virtual "triptyque" while multiplying viewpoints and interactive principles. The Underground Landscape is the first installation proposed by Libat as part of the platform Underground City XXI project. The architecture of 3D tunnels is based on the actual dimensions of the ex-coal mines located in Labin, Croatia, and was created using Laser measurement and data processing carried by VIAS, Vienna Institute for Archaeological Science and Vienna University of Technology.

VRML/X3D language example

```
#VRML V2.0 utf8

WorldInfo {info [ "Underground Landscape by P. and M. Silondi" ]}

DEF Camera10 Viewpoint {
  position -258.966 -4.22235 228.244
  orientation 0.0176876 0.999789 0.0104696 -1.06908
  fieldOfView 1.18752
  description "Camera10"
}
NavigationInfo {
    avatarSize [1, 1.6, 0.75]
    speed    1
}
DEF Tunnels_05 Transform {
  translation 0 0 0
  rotation 0 0 1 0
  scale 1 1 1
  children [
    Shape {
      appearance DEF MAT-tunnels Appearance {
          material Material {
              diffuseColor .35 .16 .12
              specularColor .21 .11 0
              ambientIntensity .0533
              shininess .05}

              texture DEF _T-t_05completemap ImageTexture {url "maps/t_05completemap.jpg" }}

              geometry DEF T_05-FACES IndexedFaceSet {
        creaseAngle 3.14
        solid FALSE
        coord DEF T_05-COORD Coordinate { point [
          135.984 -7.35477 92.8235,135.773 -6.1057 92.8929,135.664 -4.97232 92.8127,
          135.709 -3.87303 92.3398,135.477 -2.09602 93.1516,135.336 -1.38953 93.693,
          135.164 -0.519989 94.3594,136.461 1.11327 94.3337,136.992 1.34827 94.9827,
          137.484 1.56763 95.5884,138.883 1.84396 96.2509,140.234 1.8777 96.7838,
          141.086 1.87901 97.1061,142.898 1.38968 98.3652,143.898 0.860916 100.044,
          144.414 0.582611 100.927,144.414 -1.13708 101.245,144.453 -2.66798 101.801,
          144.266 -4.41243 101.839,144.203 -6.57948 100.839,142.695 -7.63123 100.474,
          141.211 -7.66805 100.065,139.055 -7.68723 99.5144,136.32 -7.65654 98.8879,
          134.617 -7.72644 98.4303,133.734 -7.77103 98.1891,135.383 -7.29529 94.9309,
          135.219 -6.04189 94.948,135.125 -4.93302 94.844,135.109 -3.88896 94.6062
```

The "Underground Landscape" 3D environment is based on the central part of the mine (the "Labin entry").The geometry was reconstructed and prepared by Pascal Silondi using 3D modeling software. The 3D meshes were unwrapped to create proper UV mapping coordinates for textures and to make possible the design of the objects' appearances. Thus the aesthetic ground was ready for the next step: the light mapping process.

The light solution was set up to create an abyssal immersive feeling and was rendered to texture and print the lights and shadows directly on the objects' surfaces optimizing the future display of the 3D space. Various 3D objects were integrated in the 3D tunnels with the ability to receive a moving image texture. Video streaming in real time was controlled by users the acceleration parameters were provided by controllers built from mining hammers. Sound nodes were also implanted in the 3D tunnels as "Audio clips/samples" designing the sound scape to function as audio geography in the Cyber space. Sound in 3D environments can be spacialized. It has a location, an orientation, intensity and fall off parameters that can be fixed, animated or manipulated by the users.

Hammers served as an interface to navigate in the 3D space, to interact with the 3D objects and to control the audio and video streaming. They were augmented by analogical sensors, such as accelerometers and gyroscopes. The analogical information generated by the sensors was converted into MIDI messages that were then sent to the 6 computers that compose the installation network and control the 3 parallel cyber spaces: the video manipulation and streaming, the sound manipulation, and the video tracking.

The VRML/X3D is a polyvalent format. It is very flexible and adaptable for installations, performances or internet purposes. If it is possible to prepare objects and spaces visually using 3D modeling software and to export worlds to VRML, the next steps will be to work fully in the code in order to finalize the scene and to program the interactive principles of the 3D environment. There is not yet an advanced enough graphical editor that can help with the final stage, therefore the creation process of those VRML environments stays remains an area reserved for specialists. That is one of the main reasons why we chose to test other technologies like 3Drad, Unity3D, Unreal Tournament, Lite-C Atari. These are all interesting 3D game engines in that they utilize graphical game editors that help to assemble the 3D scenes in order to design and to program the interactive principles.

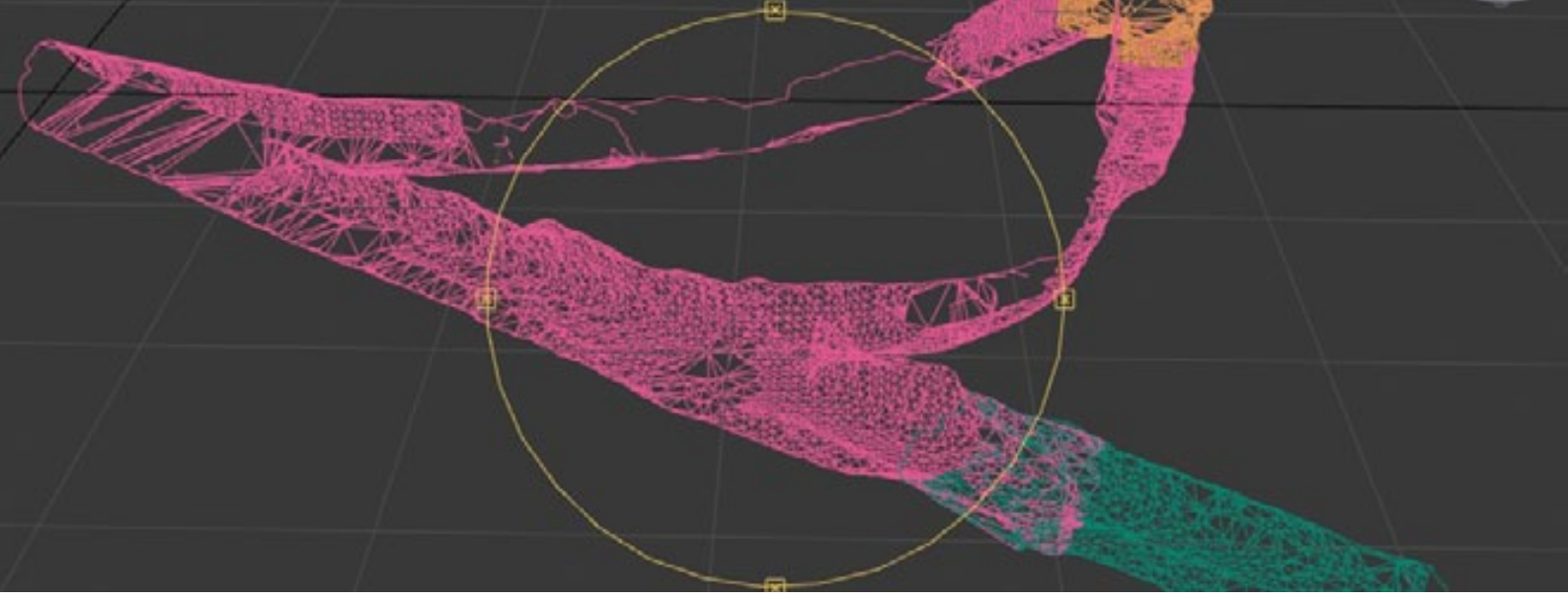
2. EXPERIMENTATIONS USING 3D GAME ENGINES FOR THE UCXXI PLATFORM

ADVANTAGES OF UNITY 3D

As mentioned before we tested different existing technologies and tools, 3D engines and editors, e.g. Unreal Tournament, Lite-C Atari, and Unity3D[4]; Unity3D most closely met our artistic and pedagogical needs and can be used to develop the UCXXI 3D multiuser environment that will be shared and distributed on the Internet.

Unity3D is multi platform compatible. It is possible to compile for PC, MAC, IPhones, IPod and Wii, and should be available for Linux, Xbox, PlayStation and androids in the next versions.

4 See http://unity3d.com



Model under-reconstruction of the coal-mine

Unity3D is compatible with most of the 2D/3D editing tools and most of the web2D/3D media and file formats present on the Internet. It is possible to import 3D scenes and objects including textures and animations from most of the 3D modeling tools, not only professional software like 3Dsmax or Maya but also open source like Blender. This accomplished through the use of the FBX format. The creation process of the 3D scene will be pretty much the same as the one used for the creation of VRML worlds.

The Game Editor in our investigation is an advanced visual tool used to set up the 3D environment properties and assemble the different assets that can be used in the Cyber world, (3D space composition, real-time lightning, texturing, FX). It allows us to use and program game principles in the Underground City platform. It must be noticed that such a tool is definitively missing for the creation of VRML/X3D environments and in this case most of the work was done mainly by coding in a text editor. Thus Unity, in its full functionality, represents a great advantage in the construction of the final work.

Unity3D is optimized for both DirectX and OpenGL graphics. We can create and use animated 3D objects that can be avatars, digital organisms, artificial life forms etc. Artificial intelligence principles, physics realized using the Ageia PhysX™ Physics Engine, particle systems, advanced lighting and shadows are implemented as well. This allow for not only a great visual quality, but alsp a really dynamic 3D environment that is constantly changing. This represents an element missing from all existing on-line 3D multi-user environments as Second life. In terms of programmability, Unity supports three scripting languages: JavaScript, C#, and a dialect of Python called Boo; all three are equally fast and compatible. All three can use the underlying.NET libraries which support databases, regular expressions, XML, file access and networking[5].

Such support can be useful in the implementation into the platform of advanced functionalities for the multi-user 3D walkthrough. Examples of such functionalities include chat, collaborative object manipulation tools, and advanced shared events. Thus, development could include artificial intelligence principles, avatars' gallery, audio-video endless streaming, 2D web content access, interactive html/flash, inputs like physical devices, digital messaging and media , for instance.

5 Idem.

Image of a real coal mine

EXPERIMENTATION WITHIN UNITY 3D (MODELING AND ANIMATION)

The first step was to identify how to create, model and prepare the 3D objects and then how to import them into the Unity Game Editor. The workflow has been established and the techniques and principles which were used to set up the VRML scenes are similar for Unity.

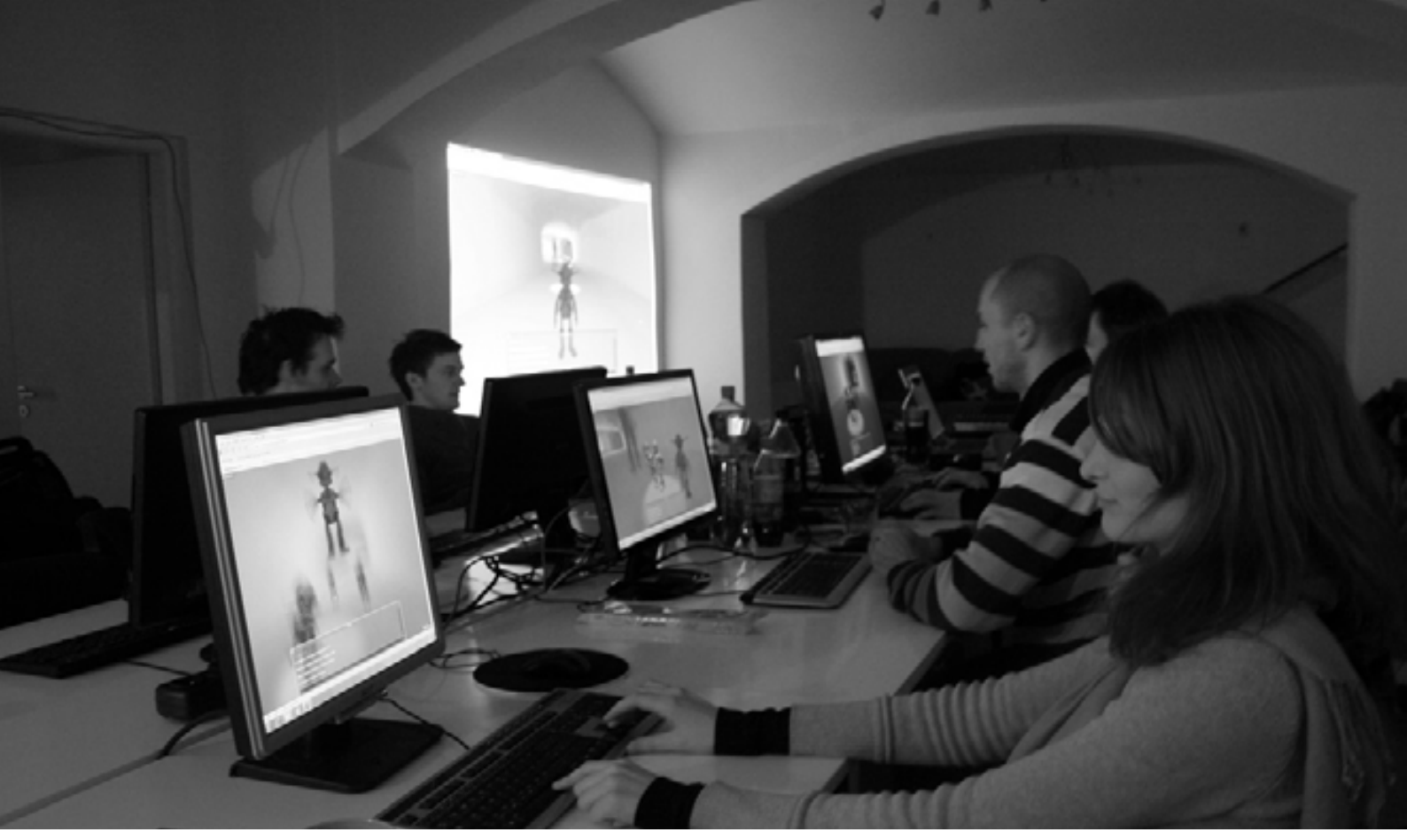
The geometry was well reconstructed to be recognized and used for physicsal properties and interactions (collision, mass, etc). The 3D meshes have to be unwrapped to create the proper UV mapping coordinates that will be used for the Diffuse, bump textures (main appearance) and the Light maps. Unity is only able to import two independent UV map channels, but this is enough to create the materials needed. It is important to maintain precision in terms of the units (1 unit =1 meter) when preparing a 3D scene in a 3D modeling software.

For example, we can create and import animations and then set up the animation cycles such as walk/run/jump. We imported the models of the 3D tunnels used for "Underground Landscape" in the Unity editor and used them as the test scene for our experimentations. First we created a 3D walkthrough, as a first or third person view and we added step by step new functionalities and new graphical qualities. Futher, we made tests using some realistic textures extracted from the real coal mine photos. Finally, we set up different visual atmospheres, and we experimented with the physical principles of the engine. Properties such as gravity, collisions to control other objects, sound playback on collision detection and other functionalities were explored.

Video integration and realistic 3D tunnels in Unity 3D

Two students of the school of IT and Computing, Marko Puskaric and Rajmond Berisha, created a way of transforming the 3D tunnels into online multiuser environment using Unity server classes. The resulting work was a double version of the environment; in both versions a chat successfully implemented. The first version might be integrated in a web browser with the limitation that plugins are not supported, while the second one with more advanced functionalities may be compiled as a standalone application, and can be downloaded from the Web.

An important requirement for us was the possibility to display videos and sounds into the Cyber world. We would like to use videos as textures mapped on 3D volumes to compose or present artworks, archives or learning materials and to place sound sources in the 3D geography. We imported and successfully used video samples that were applied to the surfaces of the landscape. The videos can be exported as.avi,.mov or.mpg but they are finally converted into .ogg format when imported into the Editor. The videos can be imported, compressed, and looped directly in the editor. When they are used in the 3D scene, they are compiled with the other assets and stored in the final package. The videos and sounds can be also linked to a URL stream. In that case the stream must be an .ogg file and it is not stored in the original package but it is stored on a server. A serious issue is that endless video streaming types are not supported natively. If we can use a webcam as source, we cannot at the moment, stream from a live camera to the Internet and use that live audiovisual stream in the 3D space. One of the important plug-ins we will have to develop during the next phases of the project which must enable endless audiovideo streaming, allowing for example , live audio visual performances, concerts, discussions, lectures, and presentations between users directly inside Cyberspace and connected from their respective countries.



Experimenting with multi-user aspects

We investigated and found possible ways how to interact collaboratively with the objects and scene parameters. Two plug-ins were partly used to connect Wiiremote and MIDI sensors to the 3D environment and to manipulate the scene content. We were then able to manipulate the 3D objects, to sculpt the mesh, pushing/pulling vertices and painting volumes on the fly. We created or tested different graphical user interfaces (GUI) to prepare the future menus that could be created and proposed to the user to interact within the UCXXI environment. We developed some "radar systems" and layers to recognize the position of the other users and special objects present in the scene, and we created some triggers and buttons to control some of the animations' parameters. We also created or adapted the first scripts to be able to write, to draw and paint directly on the object surfaces and are currently in discussion regarding improvement of those functionalities next months.

A major point of interest is to integrate HTML, desktop and Flash as textures in the 3D environment with full interactive functionalities. That would not only enable web navigation principles, but also make possible the creation and the use of advanced white boards and collaborative writing tools directly accessible into the 3D environment. This feature was already implemented in VRML and Second Life. It remains for us to find a way how to implement it in Unity3D. Thus, the bridge between web content and 3D environments could become the key functionality to be implemented in the proposition of new models for cyberspaces. ✖

UNDERGROUND CITY IN PROCESS

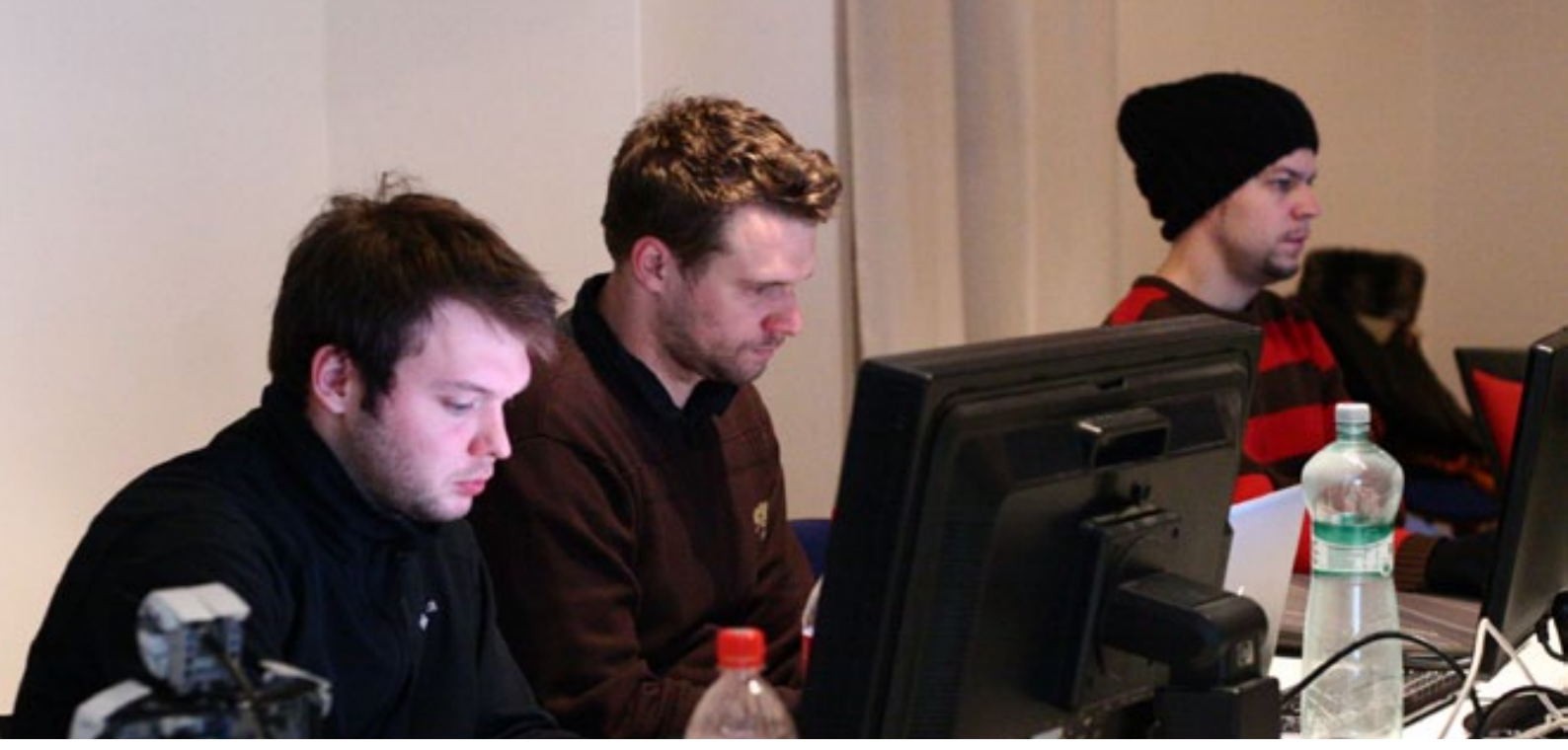
THE PRAGUE COLLEGE-LIBAT WORKSHOPS-PUBLIC EVENTS AND THE UNDERGROUND CITY PROJECT

The Underground City project has been the source of inspiration for a series of workshops organized by Pascal and Marie Silondi involving a strict collaboration between Prague College, Libat and Labin Art Express as a special guest.

These workshops are conceived as "studio- atelier" in which participants have the possibility of sharing their knowledge and skills coming from several different backgrounds.

Three workshops have been organized at Prague College Studios since the beginning of the project (Workshop 1 held on the 12th of December 2009, Workshop 2 held on the 30th of March 2010, Workshop 3 held on the 3rd of July 2010). The main aim of these events is to create a moment in which participants can discuss, share their experiences, present their results and work together in order to develop the entire project in a very stimulating environment. The workshops are characterized by practical and theoretical session in which lectures and seminars are integrated with concrete experimentation of different elements composing the various areas of the project. The workshops always conclude with a public exhibition event presenting what has been achieved in the previous months and weeks of intense collaborative work.

Anthracite



Experimenting with multi-user aspects

Below we propose a summary of the theoretical underpinning of the previous lectures given in the first three workshops. In the first workshop a lecture was given by Stefano Cavagnetto titled "The conception of the Self in Multiple Cyber Worlds". The talk mainly regarded questions concerning personal identity when an augmented cyber reality is taken into account. And some of the concepts from anthropology were applied to the study of Cyberspace.

In the second workshop a public lecture was given by Bruce Gahir and Stefano Cavagnetto regarding artificial agents and morality. Artificial agents, particularly those in cyberspace, extend the class of entities wich can be involved in moral situations. Several arguments were presented in order to show that such agents can be conceived as moral agents. Bruce and Stefano used the fundamental principle of a "level of abstraction" (LoA) as defined by Luciano Floridi as a key-concept in order to develop their work. Then they continued to expand upon the idea of an artificial agent as an information object that has intrinsic value and hence moral worth. Finally, they reviewed the consequences of the above approach for artificial agents in cyberspace and concluded that the framework provided by Floridi is a pluralistic approach that is essential to the development of global information and computing ethics at the cross-cultural level.

In the same workshop a second lecture was delivered regarding the chemical structure of the coal as a possible computational grid for artificial (digital) organism. The chemistry of coal is connected to Cellular Automata and the structure of chemical groups of the coal is implemented as a computing grid for running cellular automata. The famous Game of Life is then run by adopting a new definition of neighborhood on the defined computing grid. This lecture was given by Stefano Cavagnetto in a seminar format at Prague College. It's an interesting connection which shows how cellular automata can be used at the macroscopic level to model architecture and at the microscopic level to model molecular structure. This reflects a sort of perception and deeper intuition about a possible order and pattern wich we can find on the

edge of complexity, but also a better understanding of techniques where a simple rule iteratively applied on a computer may generate an immensy complex behaviour simulating that of nature. In the third workshop Stefano Cavagnetto gave a lecture about automatic crypto machines particularly the talk focusing on how the crypto-machine Enigma works and on its internal structure from a mathematical point of view. He also explained the conceptual consequences on how this structure may be used to generate "different types of space".

THE ARTWORKS PRESENTED DURING THE WORKSHOPS' OPEN DOORS

UC^{3D} environments (2010)
by Pascal Silondi (France), Jakub Grosz (Czech Republic), Rajmond Berisha (Kosovo).

Lamparna prototype (2010)
Interactive installation - Real time 3D environment light tracking and sensible floor
by Pascal Silondi (France), Marie Silondi (Czech Republic), Tihana Valent (Croatia), Jakub Grosz (Czech Republic), Rajmond Berisha (Kosovo), Yevgeniya Drovossekova (Kazakhstan).

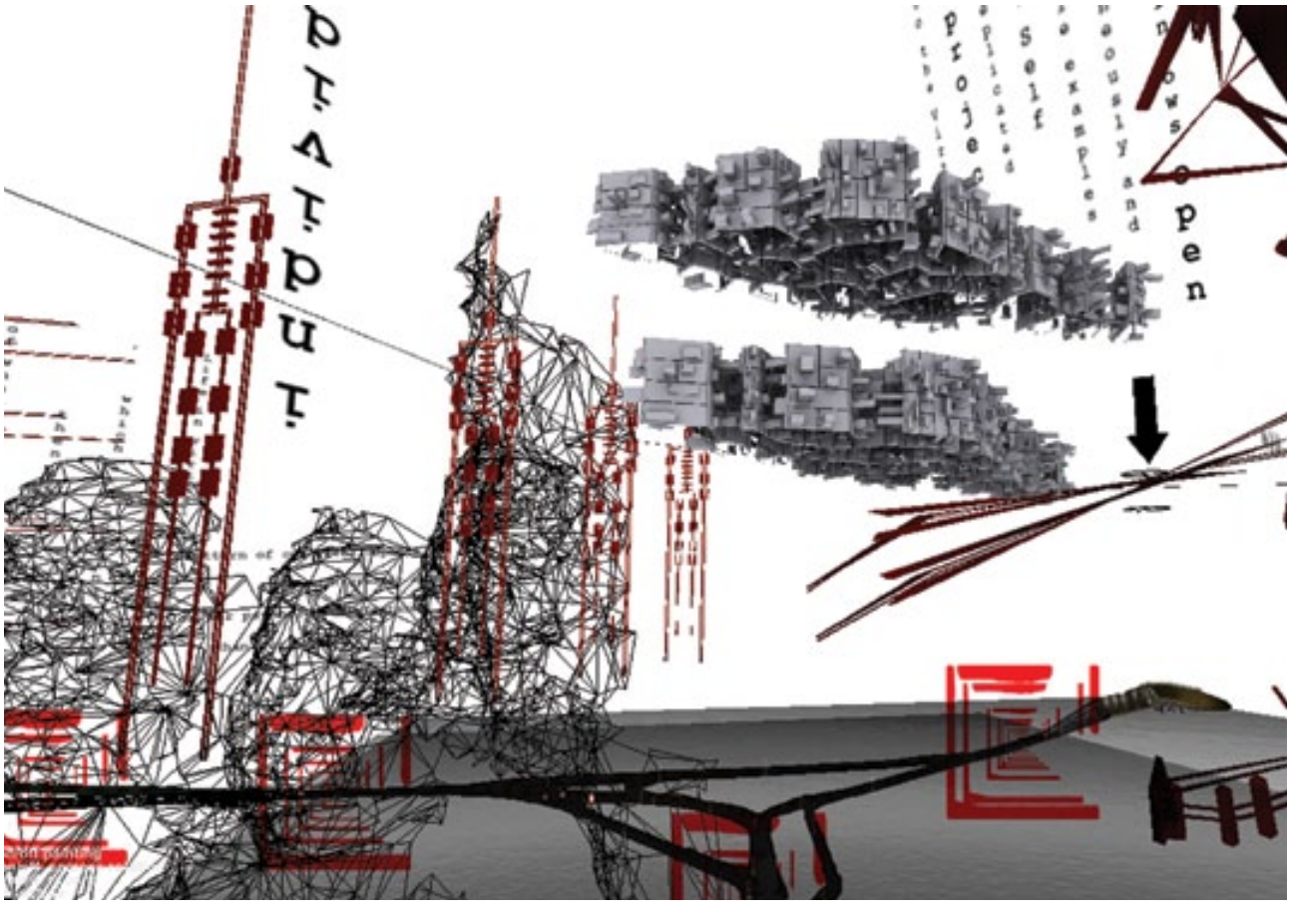
Neuron prototype (2010)
Interactive installation - Real time 3D environment multi-touch interface
by Jakub Grosz (Czech Republic), Peter Marencik (Slovakia), Pascal Silondi (France), Rajmond Berisha (Kosovo).

These artwork prototypes were also presented in the third Prague workshop but in an advanced state. The partner's visualizations were also exhibited during the third Prague workshop and presented other interpretations of how the Underground city could potentially look like such as architectural studies during UCXXI workshop in Labin, Croatia, in May 2010 and animation of architectural sketches .

The interdisciplinary collaboration also involves external entities of Prague College. During the third workshop Jonáš Krýzl (Academy of Arts, Architecture and Design) and Jan Císa (Czech Technical University in Prague, Faculty of Architecture) made a case study of the project interpreted here as an utopian architecture prototype. They worked on the issues of memory and collective memory and the preservation of information connected with the cycles of life and death. They were imagining how there could be a place in the platform as a columbarium where dying "objects" which are about to face extinction could be brought to life again if someone would find them useful or would resurrect them somehow. The columbarium would be then combined with a "natarium" where new things can be brought to life as if the energy of dying objects would be a new essence for new elements. They also imagined it as a database with properties of interacting with visitors and reacting to them according to their feelings. They also got inspired by the interactive installation prototype untitled Neurons and they worked on the idea that tunnel walls would be covered by connected neurons with information flowing between cells. A single information would be then visualized on the cell for a few seconds. The concept is also designed in a way that the visitors would be able to feel the flow of information and control the conditions of the organism. For example, they could slow down the flow to check the single information or just enjoy the feel of the flow around them.

THE NEW PHASE AND UC3D

Since May 2010, Prague College, Libat, Labin Art Express and Nomad Theatre entered the phase of building Underground City 3D environments which aims to establish a specific cultural, artistic and educational virtual community structured as an online collaborative and interdisciplinary 3D platform. Underground City 3D (UC3D) is part of the longer project "Underground City XXI platform" which until now, has been developing workshops/laboratories in order to first define research and experiment what would be the future 3D digital environment and community. UC3D will be developed and implemented on the Internet as a futuristic and utopian 3D City inspired by European industrial history using the potential of contemporary multi-user game technologies to create and present new type of mixed-media art works and performances that interconnect virtual and real environments. UC3D is a transnational agora which will connect interactive media artists, architects, programmers, designers, interdisciplinary researchers and students through a series of workshops, seminars and laboratories to imagine, create and share alternative models for building future European multicultural communities and elaborating new citizenship principles with the public participation. The Underground City 3D (UC3D) purpose is to now use and enhance the potential of the interdisciplinary network developed in the last years to concretely create mixed-media art works, to implement them as part of the platform as a City organization, and to open the digital city to the general public on the Internet. It will also open a public discussion on the issues of building new forms of societies by implying European citizen participative reflexion.



Division of the self, by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, unity3D

The exhibitions proposed a space for the presentation of the project, with explanation texts, documentation and publications produced in the frame of the project. A retrospective of UCXXI/UC3D activities and results was shown through an illustrative slide show, displaying pictures from the mines, photos of the workshops, performances and artworks as well as key words or expressions connected with the project fields.

The public could visit the latest developed 3D environments and experiment the new user functionality enabling a specific interaction with the space, where they could re-size and remodel the paths and participate in public communication where messages were mobile and perceptible in the whole world as part of the whole city flux. Two prototypes of interactive installations which are connecting the virtual UC environments to the real space were presented, Lamparna and Neurons.

The latter is an Interactive installation developed collectively during last Underground City workshops by Libat and students of Prague College. Neurons is a multitouch modular screen displaying 3D environments composed by a network of neurons which can be re-organised, deleted, re-sized and rotated. The screen is made in a stretch textile. In order to interact with the neurons, the "participative viewer", has to place his/her hands in contact with the screen and coordinate his/her movements in order to move the objects by sliding them or to re-size them by placing both hands on the opposite edges of the neuron and bringing them closer or moving them apart.

Agora by P.Silondi, J.Grosz, S.Cavagnetto, R. Berisha, J.Boehringer, M.Silondi, P.Marencik, unity3D

Fractal city and the Sierpinski Pyramid, by P.Silondi, unity3D, video and sound samples, 3dsmax

The connection of neurons reminds us how, from the infinitely small to the infinitely big everything is part of the network and complex systems. Neurons installation is a metaphor of all types of networks, from the network of information with continuous flux of messages to the network of the city. It provides a representation of the world and the conception of it into a system. It evokes, for example, the system of binary codes of the displayed images. It can also refer to the body system which can be defined as a complex organism composed by a flux of information from stimuli to reaction.

The network is here also considered as a rhizome, in the sense defined by Deleuze and Guattari, which is not made from units but from moving directions. The rhizome is a proliferation of multiplicities, and it is always in the middle, between things, inter-being or intermezzo. The installation is interested in presenting the "in-between". It does not aim to focus on the neurons by themselves but on the flux, on what is happening between them, on the in-between. A flux is also present between the image's internal space, its external one and the visitor. The external space corresponds to the actualised surface which is visible in a particular time and space and on a specific visual aid. The internal one is the computer binary coded model. It is then possible for the viewer (we will call him/her participant, since he/she active in the interaction with the installation) to work in the internal space of the digital image through the external space. His/her body is directly connected with the internal space. He/she involves his/her body through the connection between his/her hands and the textile but also through the gesture of his/her whole body. The fluidity of that gesture is intensified by the softness and stretchiness of the textile leading to a certain sensuality in the movement.

Neurons installation is multiplying the sensorial experience, implying the vision connected with sound and touch which are intensifying each other getting close to the point of synesthesy. The artwork screen is like a skin which the participant has to caress and which feeling invites to snuggle down. The connection between the artwork and the participant is highly strengthened by the resort of evocation of comfort and intimacy.

Moreover this contact seems extended by the fact that the screen stretch enables the participant to enter his hands inside the screen. It deals with the old fantasy-idea to "go behind the screen" while the participant is in an other place and doing it a certain way by actually modifying the image content. What used to be inaccessible by the viewer is now within his/her reach. Moreover, by reorganising the neurons system the participant has the illusion to manipulate the living. The artwork is a metaphor of contemporary considerable issues such as the modeling of the living and artificial life, from genetic modification, through the technological devices programmed according to living being cognition to the interconnection between human beings and machines as, for example, the interactive installation.

The artwork is making a call on its meta-communication on what is actually happening while using it. It asks where are the limits and the frontier between artificial and living beings, between the machines and the humans. While some of the last discoveries are highly questionned whether they could be used in our world according to ethical

Fractal city and the Sierpinski Pyramid, by P.Silondi, unity3D, video and sound samples, 3dsmax

issues, we are integrating in our everyday life some technologies of which some are entrelaced with the living and so change our societies, our modes of representation and practices. The point is not to be frightened as soon as we hear about any technological aspect, following the pessimistic science fiction scenarios, but more to continuously wonder why , how and in which contexts these novelties should be implemented and why, how the mutations they engender should happen.

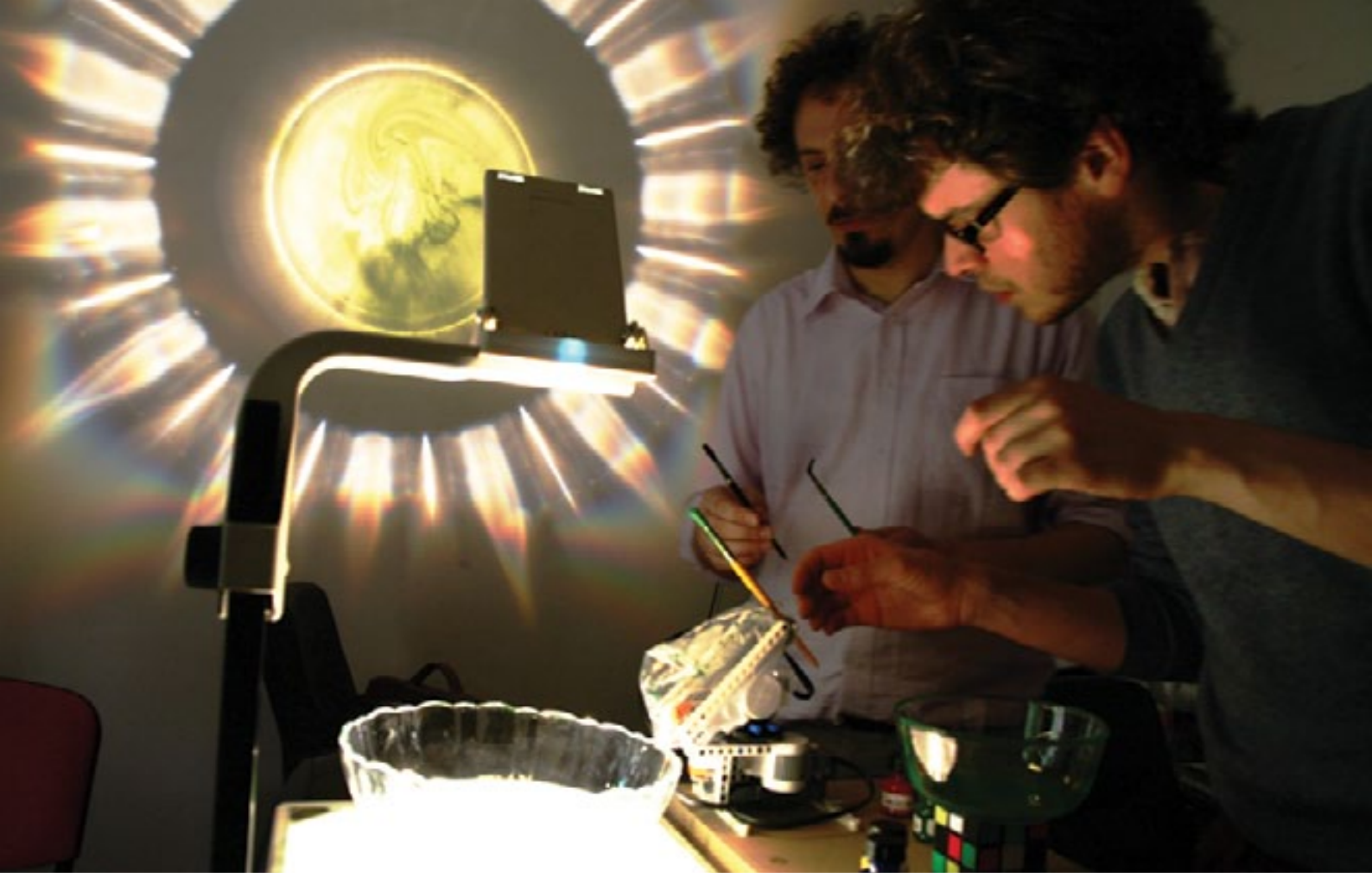
Neurons participates in a really interesting new way of representation which is this connection of image and volume. By interacting with the image through the stretch textile the participant is working in a space like a sculptor where he/she models the screen quitely. It is a truly visionary way to deal with 3D projection, where the screen is also a 3D perspective. The participant mental projection of the virtual 3D space is also accompanied with a movement in the space and in the deepness of the representation. In this type of new interfaces and information architecture this idea is quite pertinent now since it takes the physical 3D movement in real space connected to the 3D virtual world into consideration.

Neurons was presented in Underground City workshop in July 2010 as a prototype but already demonstrates promising research results in terms of human/computer interface and 3D representation.

The mediation of the project was highly discussed during the conception of the exhibitions because of its particularity, its complexity and its interdisciplinarity. Moreover, we know that one part of the public is following the public events of UC3D/XXI very closely, while another part is new to the project. We had to combine a presentation which would explain the whole project but at the same time would not be repetitive to those who are already familiar with it. For this reason the scenography was set up in a progressive way that would offer complementary elements step by step to understand the whole project. It was also really important to imagine a comfortable place where the audience could choose documents free for consultation and where social interactions could happen. Mediators, people active in UC3D/XXI, were exchanging information with the audience and answering questions. Also, the public had the possibility to take part in this collaborative and interdisciplinary European project and to participate in the exhibition by writing or drawing on a piece of paper how the project was inspiring them. This was then hung on the wall. Open doors were really successful since each time we saw more and more people attending the events and participating in the discussions about the project. Around 100 people attended the last exhibition and many expressed their interest and proposed ways how to collaborate.

UNDERGROUNG CITY PROJECT AS INSPIRATION FOR A MULTIDISCIPLINARY COURSE COMBINING ART & COMPUTING

The Underground city project has been a source of inspiration for a class at Prague College since Spring 2009. The main aim of the class is to combine knowledge and skills coming from the Interactive Media and Computing programs. In particular, students should imagine an interactive system, using sensors and programming languages to control behaviors of two robots in reality and to control behaviors of their avatars in the digital environment. The digital environment can be a computer Game and/or a multi-user 3D environment shared on internet based on the Underground city project.



Multimedia Design & Authoring class, Prague College, 2010

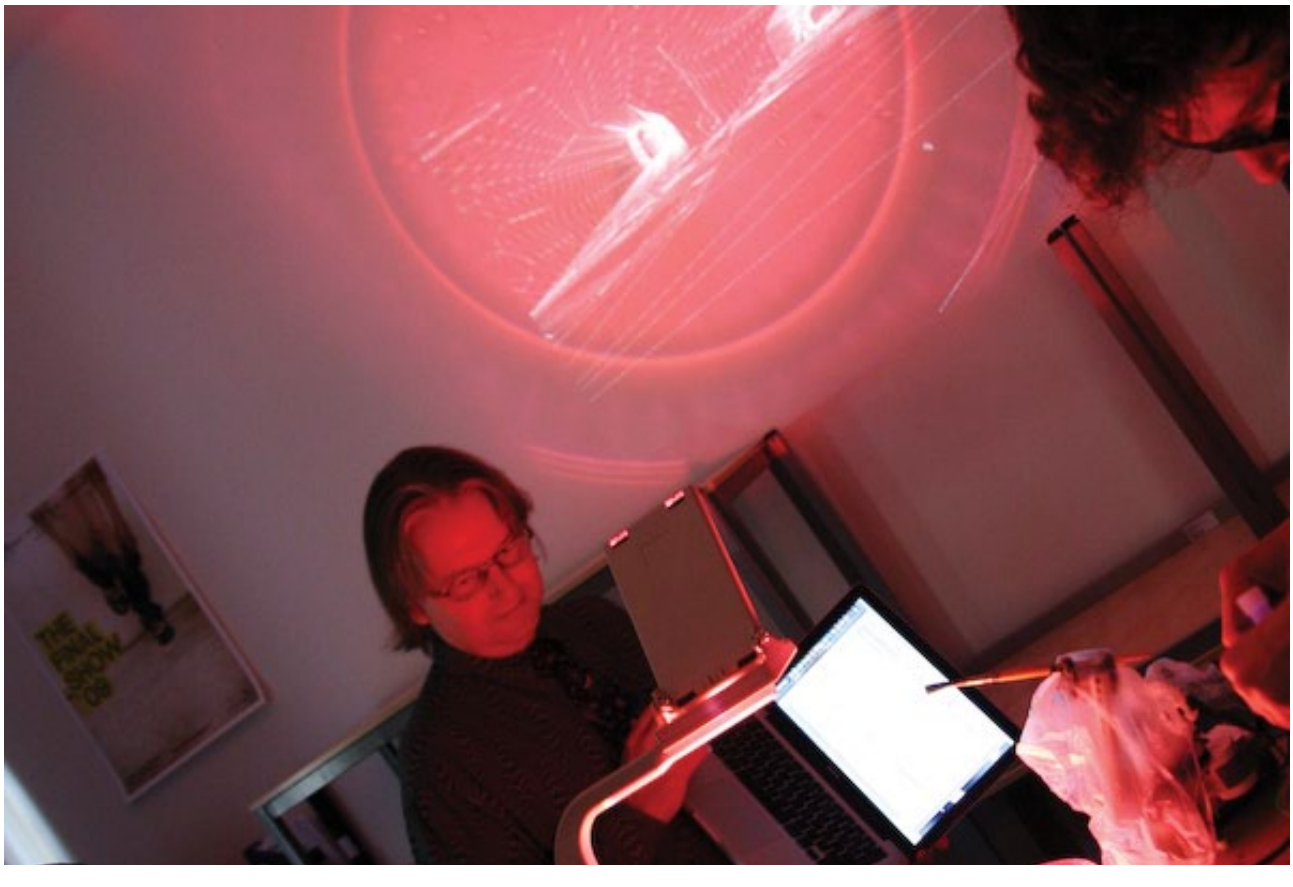
In this class students work with robots and sensors, with a digital environment, possibly a 3D model, and game principles. The final result of the class is a prototype for an interactive installation. Using simple technology such as the NXT Lego students build two robots and experiment in the laboratory the functionalities and the use of sensors. In this phase students experiment with at least two different programming languages. The first is a language coming with the NXT computer, which is a visual programming language in which most of the basic functionalities of regular programming languages are available (control structures, etc.). The second language is a visual language as well, but for a more general purpose, the Visual Programming Language (VPL) by Microsoft. VPL is an application development environment designed on a graphical dataflow-based programming model. Rather than a series of imperative commands sequentially executed, a dataflow program is more like a series of workers on an assembly line, who do their assigned task as the materials arrive.

As a result VPL is well suited to programming a variety of concurrent or distributed processing scenarios. For educational purposes, especially when the class is supposed to work in a team, this type of language is excellent since it is mainly designed for beginner programmers with a basic understanding of concepts like variables and logic. Thus, it is easy to begin the work in teams even when there are elements with very little knowledge about programming. It should be noted that VPL is not limited just to novices. The programming language may appeal to more advanced programmers for rapid prototyping or code development. The language offers the possibility to control and program the NXT computer via Bluetooth communication.

The class is then integrated with a practical part in which students can create self made devices using sensors to control robotic behaviour. The second part of the class moves to the virtual environment and the modelling work. In this part students work with game engines (Unity and 3D Rad mainly) and enter the world of game design. In particular, the formal system and the narrative approach are considered in some detail and the possibility of different approaches to game design are clearly oulined. The aim of this part of the course is that of bulding a bridge between the physical world where we live and the digital world we construct. The bridge is provided by a representation through the idea of avatars for the physical robots. Thus a full correspondence can be built. The class ends with an interactive installation that may be presented to the public in an exhibition or at the studios of the college. In the installation robots meet an interactive digital environment. The interactive system enables the user to control robots by using self made devices integrating different types of analogical sensors and immersive world technology created with 3ds Max and game engines.

The course has a high experimental approach and is a combination of aestetics and computing, mostly programming and human-computer interaction. Aesthetics comes from the Greek aisthitiki, derived from aisthesis (i.e., which means perceived by the senses). In the history of aesthetics, before Kant's Critique and including Baumgarten's introduction of aesthetics, in the 18th century, art and aesthetics have not been well connected. Art was generally not associated with aesthetics, and aesthetics as an area within philosophy was not focused on art. Since Kant's treatise, aesthetics has been expanded to encompass both the logical and the perceptual.

Bruce Sterling in the Multimedia Design & Authoring Class, Prague College, 2010



With the advent of computers and computer graphics, this conjunction between the logical and the perceptual has gone to extremes. The connection allows us talk about the aesthetics of computing as a possible field of research where the interaction is the key-bridge between the logic of a computer system and a perception of its outcomes. In this way an art work is made essentially of two basic dimensions. First, from a philosophical point view, it is defined as an idea, form, or language. Second, psychologically, one can define art with top-down and bottom-up conceptions.

On the subject of computing, it is important to stress the relationship between mathematics and computing. Computer science is founded on core elements of discrete mathematics; thus, we can view aesthetic computing as encompassing a number of mathematical concepts, especially areas involving formal grammar, language notation, geometry, and topology. Discrete mathematics along with the algebraic extension to automata theory is the basic knowledge required for implementing a computing development. Mathematics establishes the formal infrastructure in which mathematical concepts and abstractions can be related to basic computing concepts. Thus, much of aesthetic computing naturally corresponds with mathematical formalism. The benefits of such a definition is mainly that in this perspective we can represent programs and data structures with customized, culturally specific notations. Also we can incorporate artistic methods in typically computing intensive activities, such as scientific visualization and finally we can improve the emotional and cultural level of interaction with the computer. This is the main approach behind the course named Interactive Media Design and Authoring.

Prague College students preparing their installation for Cesky Tucnak, 2010

Bruce Sterling in the Multimedia Design & Authoring Class, Prague College, 2010

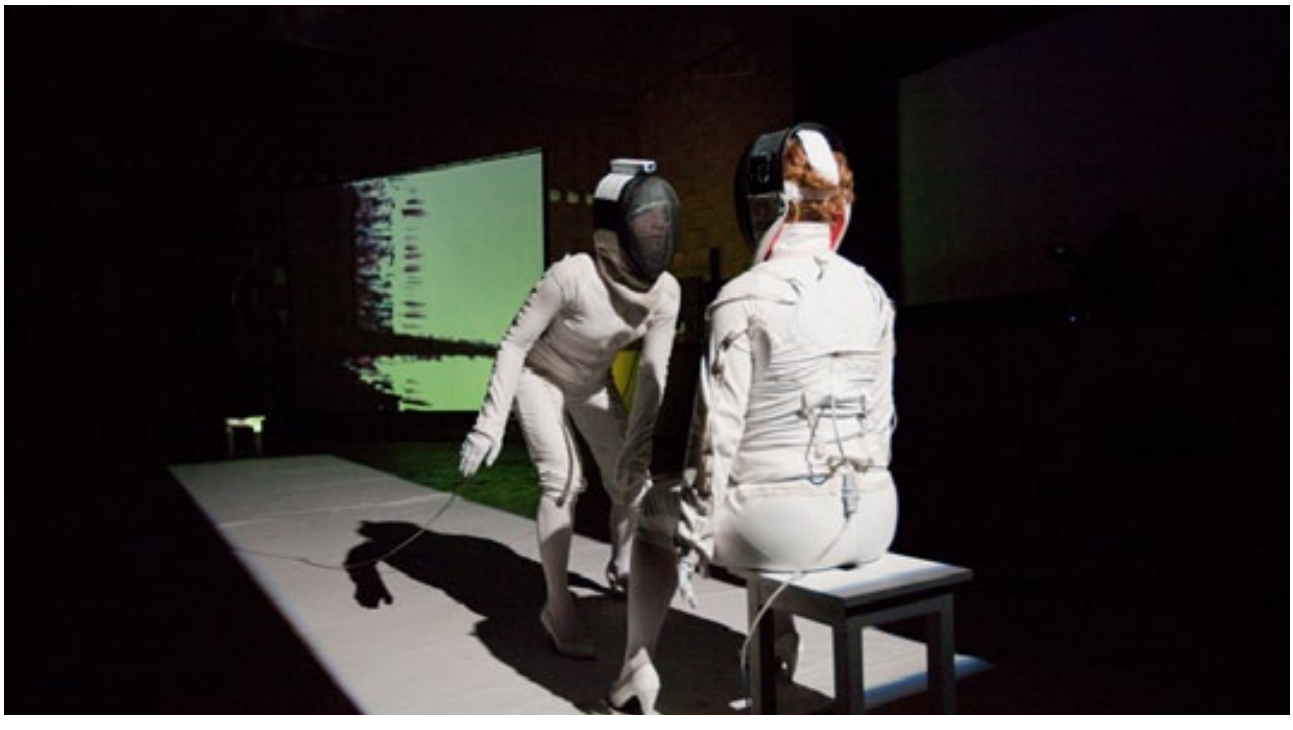
The interesting fact about the course is that it had very positive feedback on the Underground City Project itself. In fact, the mathematical abstraction contained in some part of the development is evident and it deals with discrete mathematics, fractal geometry and cellular automata theory. The following long reflection and analysis, regarding the vision of the fractal city and the city as an organism as well as the concept of spatial justice is the result of this type of synergy between the project and education at the university. ✖

WORKSHOPS, LECTURES & INSTALLATIONS

UNDERGROUND CITY XXI WORKSHOP
"DEFINITION OF THE PLATFORM"
in Labin, Croatia • 21st July - 5th August 2009

PERFORMANCE MULTIMEDIA TRIANGULAR PROPAGANDA FOR THE CITY FESTIVAL

at the Army House of Culture • Legnica, Poland • 14th - 20th September 2009

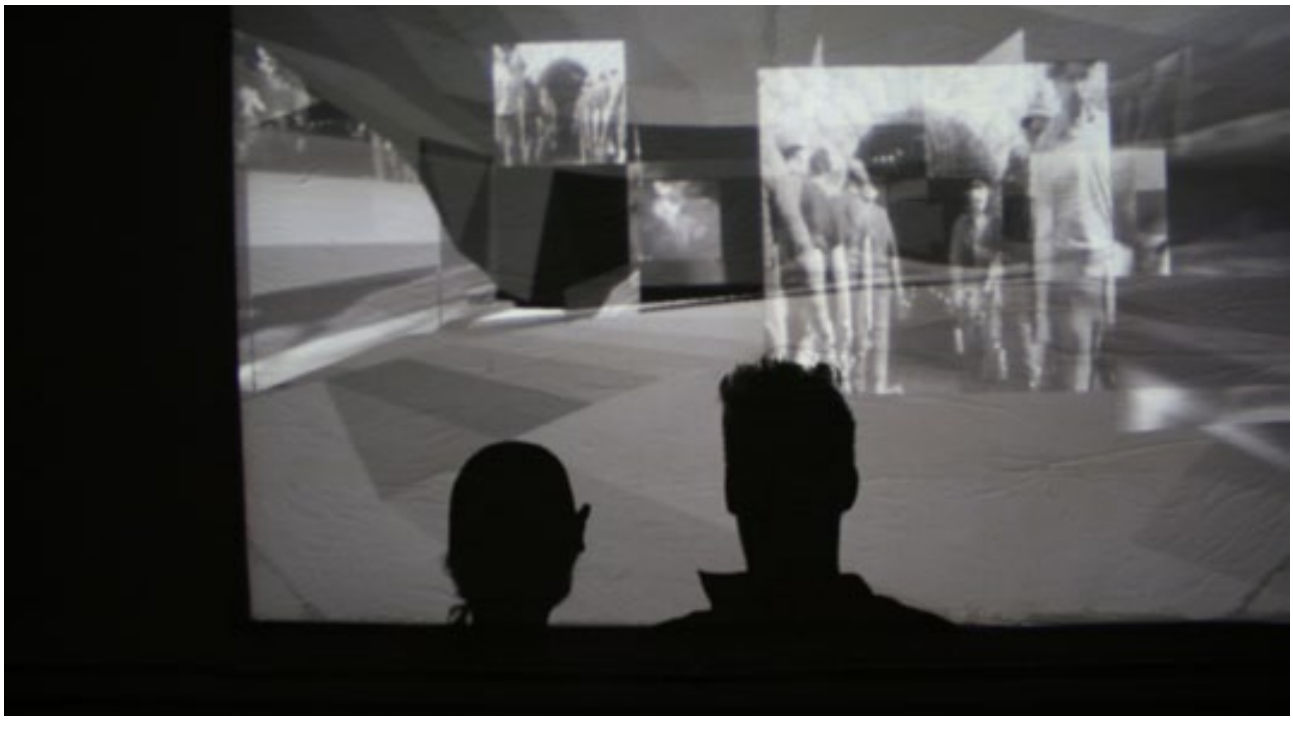


PRESENTATION
"THE CONCEPTION OF THE SELF IN MULTIPLE CYBER WORLD"
at Cyberspace Conference 2009 • Brno, Czech Republic
20th - 21st November 2009

PUBLIC PRESENTATION OF UCXXI AT GAMERZ 05 FESTIVAL

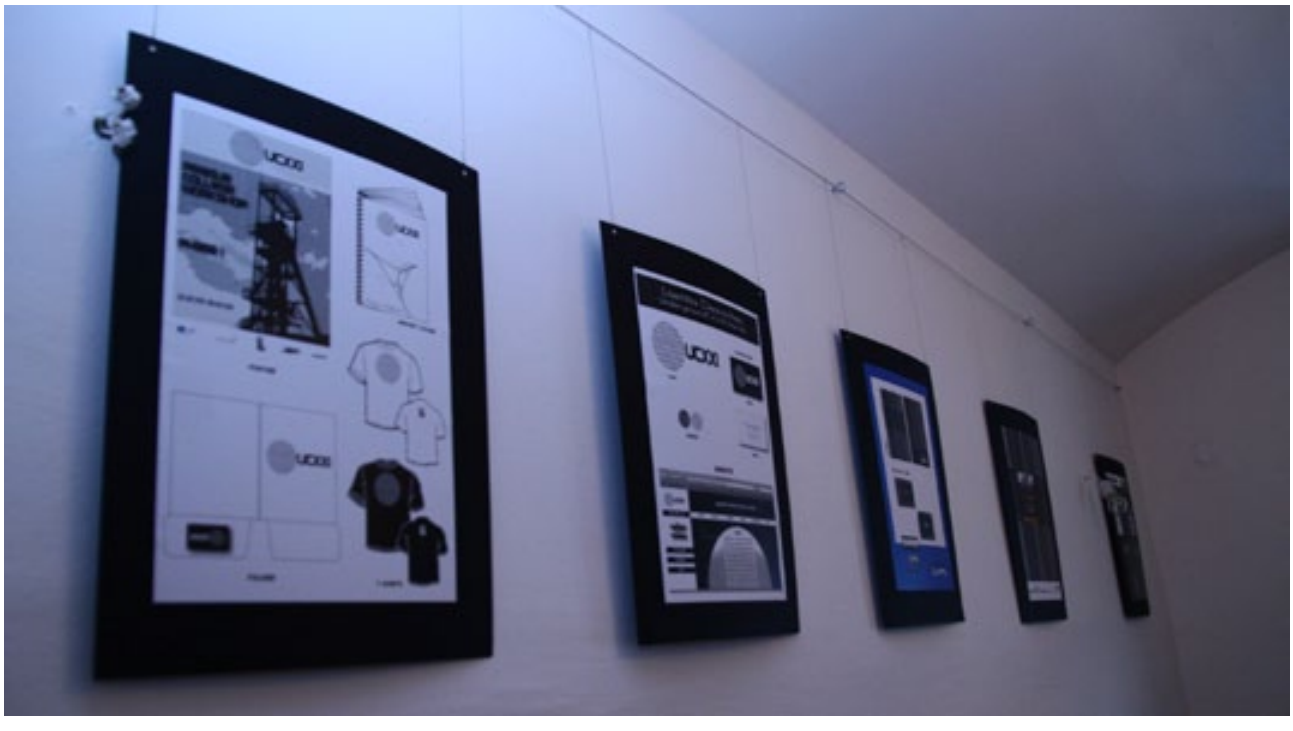
Interactive installation Underground landscapes exhibition in the Ecole Supérieure d'Art

Aix en Provence, France • 26th November - 4th December 2009



UNDERGROUND CITY XXI WORKSHOP, "EVALUATION OF TECHNOLOGIES FOR CYBER WORLDS, COLLABORATIVE EXPERIMENTATIONS AND 2D/3D MULTIMEDIA CREATION IN MIXED 3D MULTIUSER ENVIRONMENTS SHARED ON INTERNET"

Prague, Czech Republic • 12th - 18th December 2009

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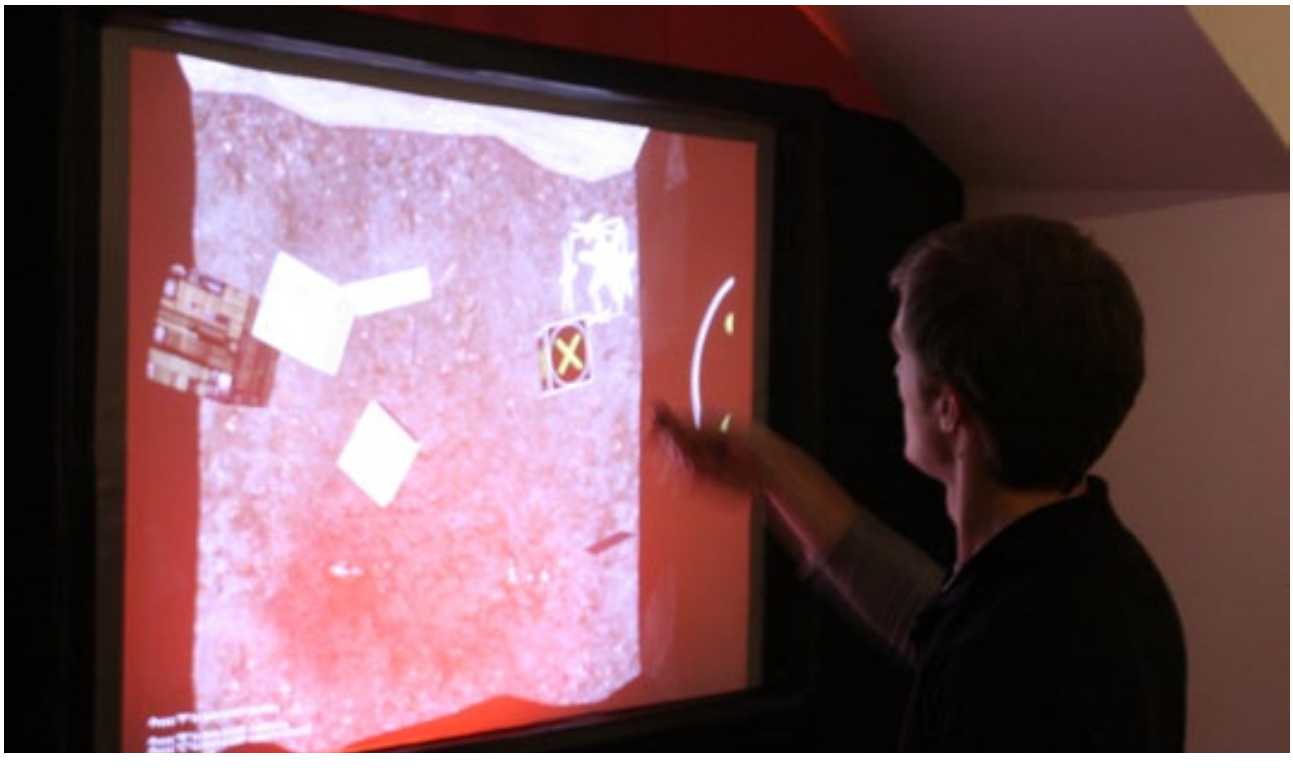
UNDERGROUND CITY XXI WORKSHOP, "CONSTRUCTION OF 3D MODELS FOR 3D GAME ENGINES"

Prague, Czech Republic • 3rd - 10th April 2010



BRUCE STERLING LECTURES: "DESIGN VISION"

at Prague College • Prague, Czech Republic • 26th - 27th May 2010

UNDERGROUND CITY 3D/XXI WORKSHOP, "CREATION AND IMPLEMENTATION OF 3D MODELS AND MULTIMEDIA CONTENT IN UNDERGROUND CITY 3D MULTIUSER ENVIRONMENTS"

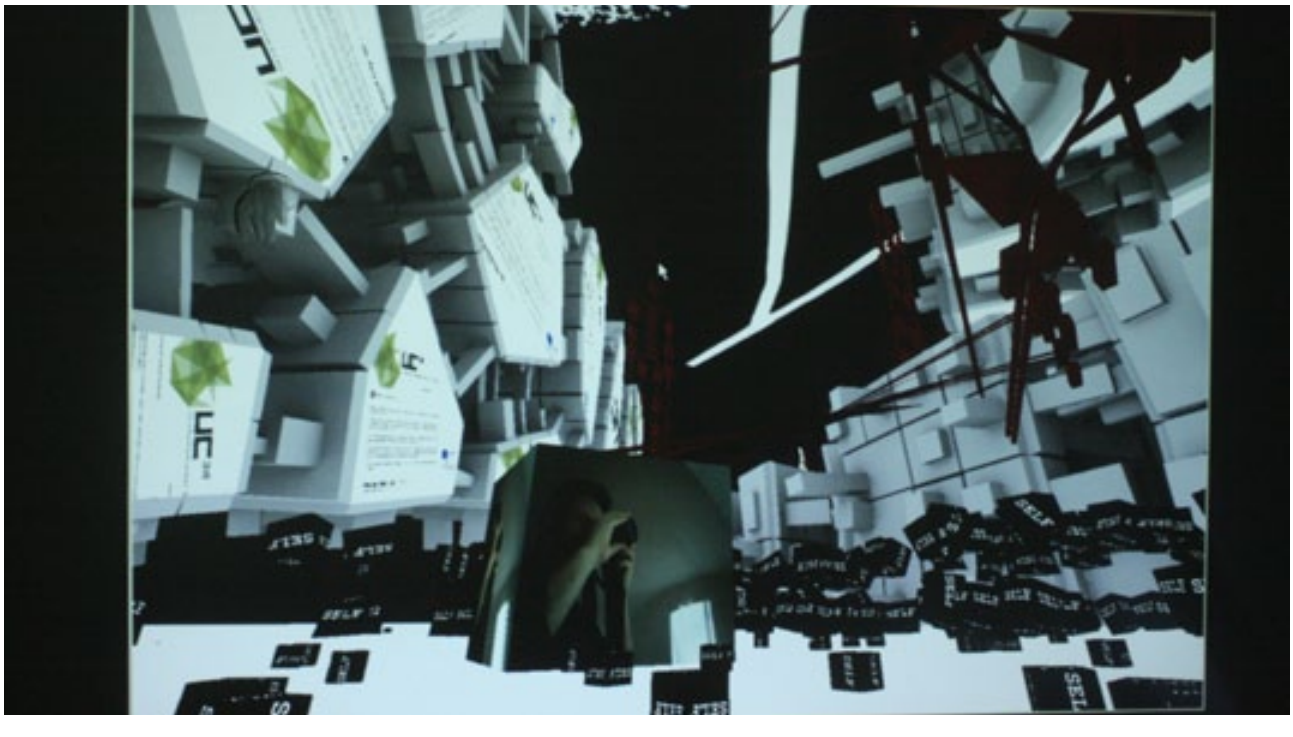
Prague, Czech Republic • 6th - 17th July 2010

UC3D/XXI WORKSHOP OPEN DOORS: INTERACTIVE INSTALLATIONS EXHIBITION AND LECTURE

Prague, Czech Republic • 17th - 19th July 2010

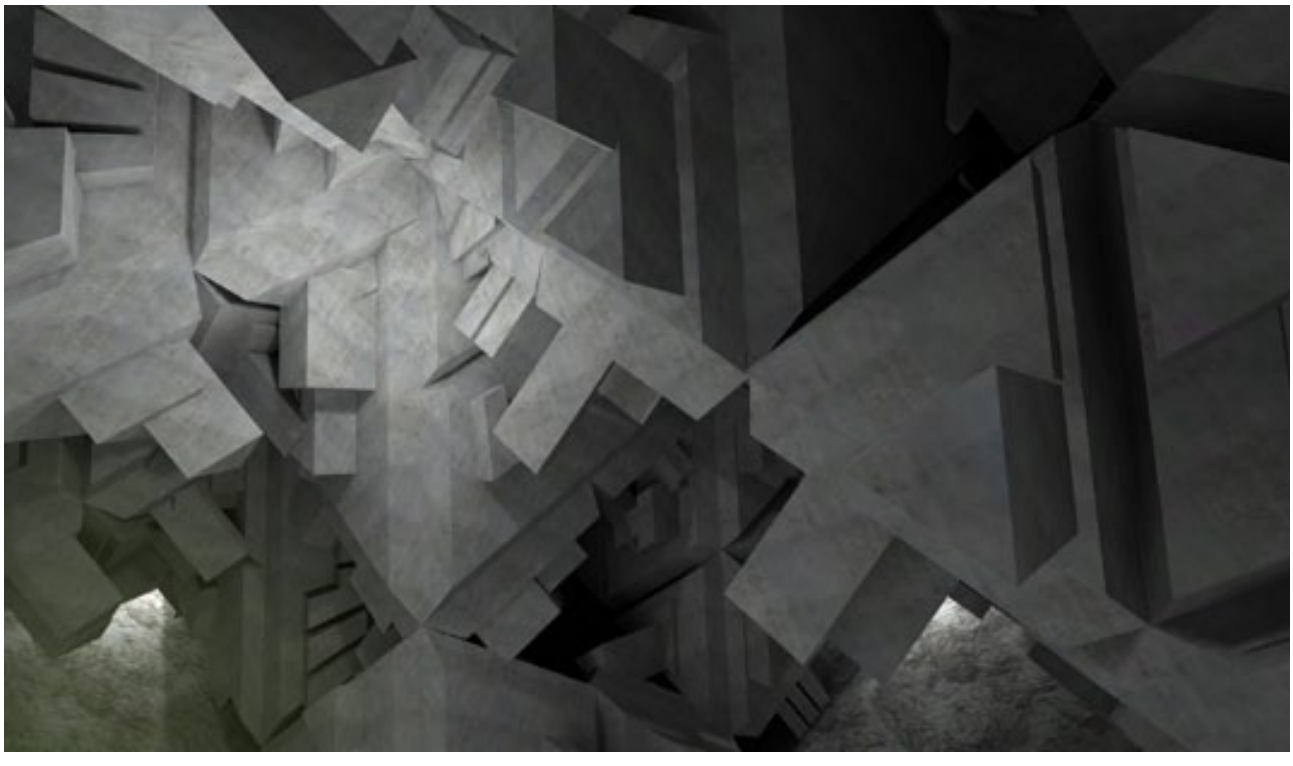
UNDERGROUND CITY 3D/XXI WORKSHOP, "CREATION AND IMPLEMENTATION OF 3D MODELS AND MULTIMEDIA CONTENT IN UNDERGROUND CITY 3D MULTIUSER ENVIRONMENTS & CREATION OF MIXED-MEDIA INSTALLATIONS AND PERFORMANCES"

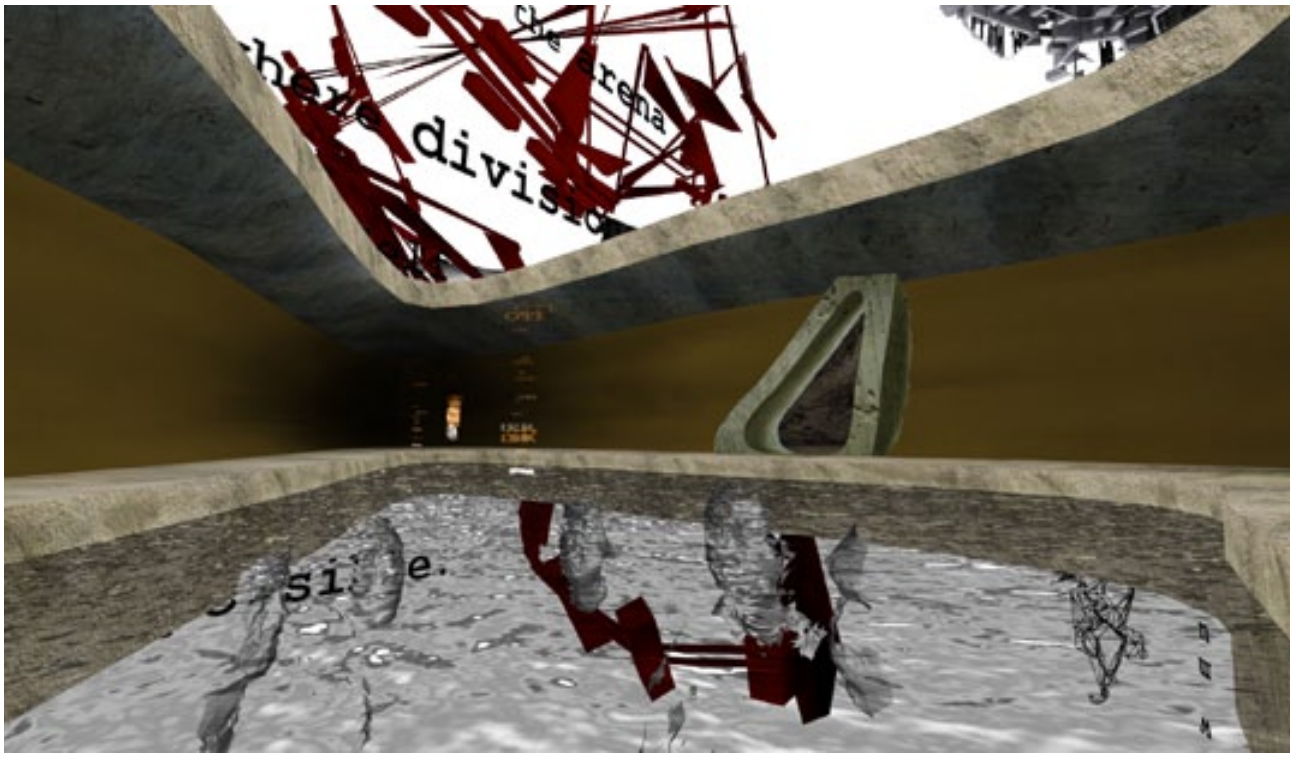
Prague, Czech Republic • 9th - 27th August 2010



EXHIBITION OF UC3D ENVIRONMENTS

at Festival Invaze • Prague, Czech Republic • 21st - 22nd August 2010





UC3D/XXI WORKSHOP, "FINALIZATION OF THE UC3D ENVIRONMENTS AND MULTIMEDIA PRESENTATIONS OF UC3D/ XXI WORK FOR THE TRANSART FESTIVAL"

Labin, Croatia • 31st August - 15th September 2010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TRANSART FESTIVAL 2010

Labin, Croatia • 10th September - 1st October 2010
Vienna, Austria • 4th - 10th October 2010


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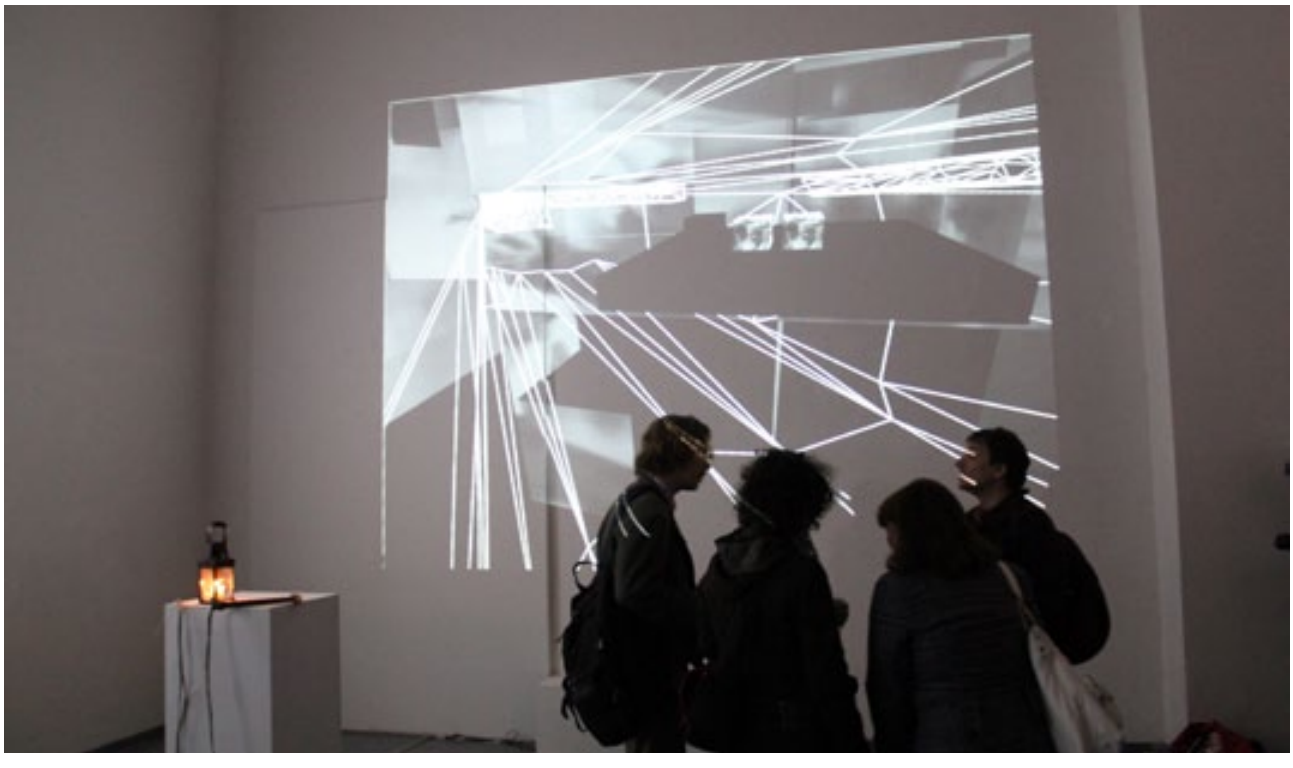
PRESENTATION OF UNDERGROUND CITY 3D/XXI

at Pecha Kucha • Brno, Czech Republic • 27th October 2010

UNDERGROUND CITY 3D/XXI PRESENTATION AND EXHIBITION

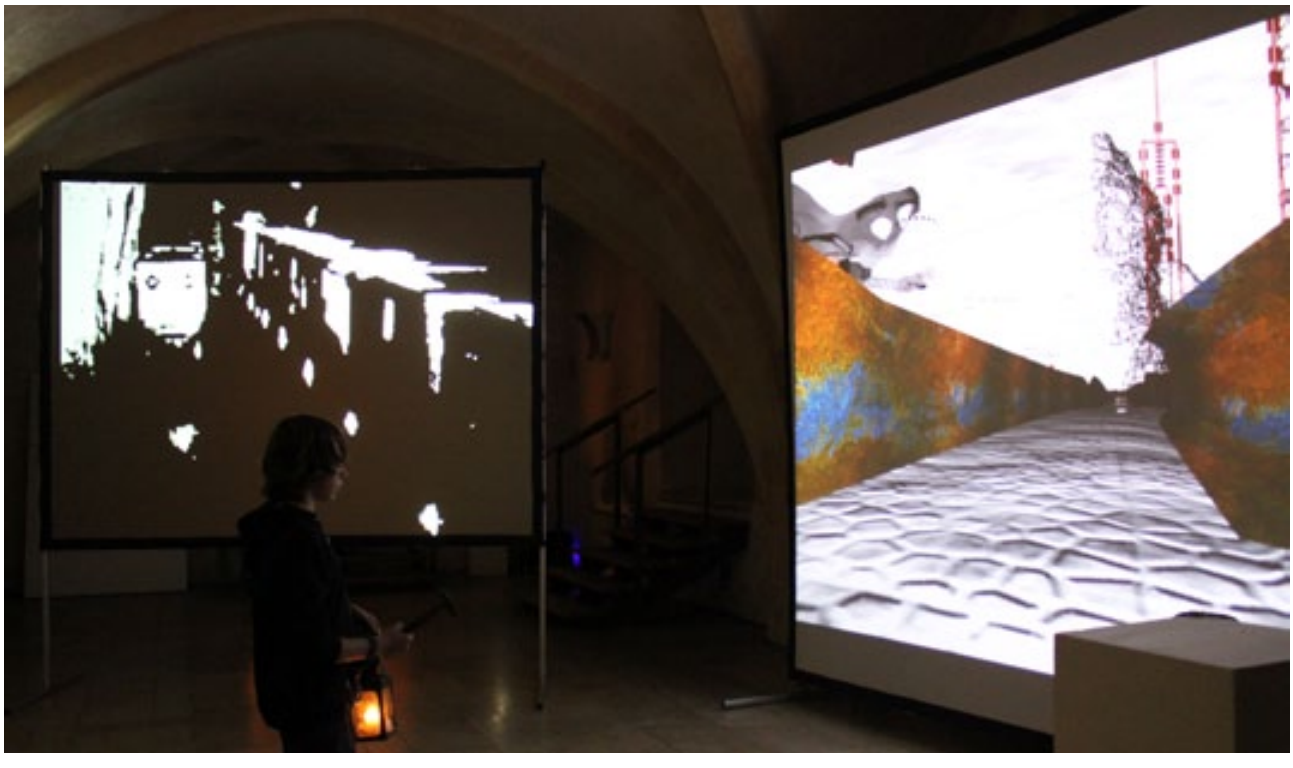
at Anemic festival, the Fine Art Academy gallery • Prague, Czech Republic • 9th - 16th November 2010

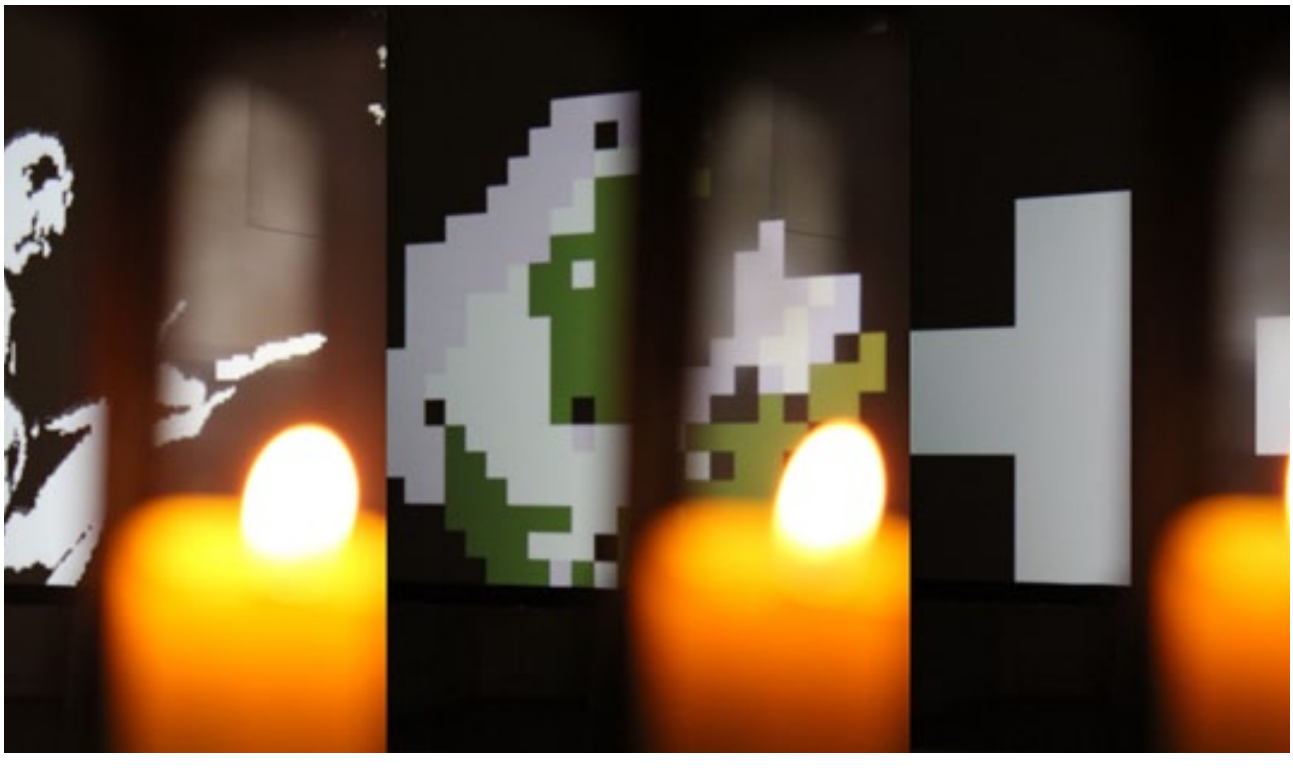


PUBLIC PRESENTATION OF UC3D/XXI IN GAMERZ FESTIVAL

Interactive Installation, "Lamparna in Underground landscapes" exhibition at the Musée des Tapisseries

Aix en Provence, France • 10th - 19th December 2010





PRESENTATION
"MULTIPLE PERSONALITIES AND THE PROTEUS EFFECT IN COLLABORATIVE VIRTUAL ENVIRONMENTS"
at Cyberspace conference 2010 • Brno, Czech Republic
26th - 28th November 2010
(no images available)

SYMPOSIUM
"UNDERGROUND CITY XXI - UTOPIA OR REALITY"
Labin, Croatia • 1st - 2nd March 2011
(no images available)

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