Urban HyperScape: a community game for territorial knowledge.

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Abstract: With considering cooperative and sustainable development of urban and social territories, and dealing with modelling tools and dynamical practices of land (and sound) scape observation, our goal is to experiment a collaborative way in order to observe, fabricate and animate the urban landscape elements, through a cooperative media creation process. From observation phase should emerge mechanisms which will allow prediction of the territorial intelligence processing, through territory global complex behaviour modelling. Territorialized collective representations should be readed within the complex interaction scaling dimensions, which virtual components should interact in order to produce an emergent structure, through a participative hyperstructural game playing.

In that way, Hyperscape should reveal the territorial emergent perceptive hyperstructures related to the concerned populations and their respective teleological assumptions, in order to constitute a support to the "negotiated ideal district" produced through the concerned territory projected vision.

1. INTRODUCTION

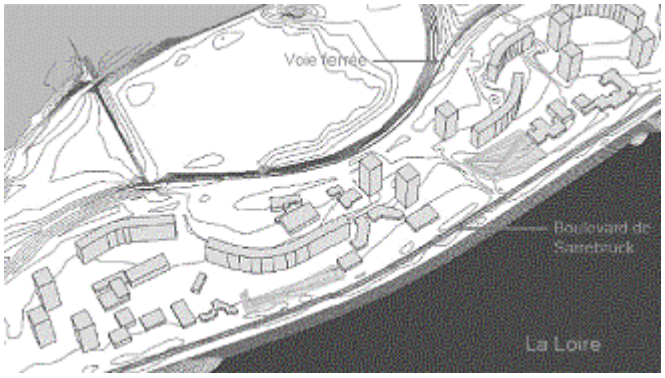
With starting a reflexion about territorial development management within the framework of a study on urban renewal, GPV "Grand Projet Ville", of the Malakoff downtown district in Nantes, we propose here a multidisciplinary approach relying on GIS as a tool to support analysis and assist in decision making. Association LBA "Les Badaux Associés", initially collected testimonies regarding the way in which the territory and these transformations were perceived and understood by the inhabitants. Thus, a study about the concerns of local actors, researchers, political town planners, architects, sociologists and decision makers has associate the inhabitants in the process of knowledge and development of their territory.

2. URBAN DEVELOPMENT AND PARTICIPATORY SOCIAL ISSUE IN THE DISTRICT MALAKOFF

2.1. An out-of-range territory

Enclosed between the "Sarrebruck" high speed boulevard, a railway and a "Natura 2000" area too, "Malakoff Pré Gauchet" is counting about 2000 flats, in an architecture of towers and bars, most of them designed for low-social classes access. Marked with social difficulties, this district is actually supporting deep urban and social transformations, underlining the problems and difficulties which arise for the actors of the project (Dumont, 2005).

Figure 1: The "Malakoff Pré Gauchet" district.



2.2. The LBA district experience

The LBA "Les Badaux Associés" association developed since 2001 a participatory art project involving professional to youth, children and adults Malakoff neighborhood. Therefore, the association proposed to develop a first action program, *Paysages Enchantier* on these issues of accompanying and involvement of local communities and professionals in a dynamic urban and social major change.

Stating that the participation of the people as partners and co-actor of an urban development project can not be decreed unilaterally, the previous associative participatory approach involves the development of complex processes developed endogenously,

touching transversely to both institutions and public and private performances, as well as individuals and cultural groups.

In developing an approach to the topic of landscapes in the district Malakoff, LBA association logically continued his work of study, research and action, which began 13 years on the roles of imaginary, playful and artistics co-exercises as factors essential for the mobilization and involvement of the people as actors and relay of local processes of sustainable development.

2.3. A mitigate state-of-the-art

From the institutional point of view, motivate the asset of the urban and social development of the territory concerning social co-education and economic development is aimed to achieve dialogue in order to assess publicity campaign for equipment and services installation. From the inhabitants point of view, the desire that the district evolve with them leads to blur and often fantasmatic testi- monies regarding the development of the district and the institutional intentions of the urban and so- cial renewal. If, in the district, information actions and consultations with the inhabitants were fre- quent pedagogical processes of involvement referrals were not very many and the quality of resid- ent's participation was not satisfactory. This weak inhabitant implication in the processes of urban dialogues implies a both misunderstanding of the territory representations and of the stakes and real- ities of the urban transformations in progress. Nevertheless, during many meetings with residents and professionals of this neighbourhood, the problematic of urban transformation and especially so- cial seemed to be at the heart of concerns. Consequently, the major feeling that the transformations will be made without them and can be against their concerns (representation and social co-educa- tion), regarding the harmful effects related to the building sites (health, safety, well-being) and the destruction of the urban landscape for this very long period of time. Lack of will and competences to cooperate apart from social and cultural circle leads the professionals and the institutions to react in spite of the sensitization process. This confirms that confusing residents dynamic participation with communications strategy aims to produce counterproductive projects, leading to passivity of the population, consumption benefits, vandalism or urban degradation. (Bourdin, 2007) This atti-tude may also feed a mistrust tenacious about what may emerge in the approach of the project as urban attempted instrumentalisation, breaking traditions or imposing symbolic and societal models.

Difficulties to change the very stigmatized image of the district and to attract new populations is the result of interconnected effects such as the lack of culture and practices of design and participative project management, the institutional shyness, and the difficulties to manage the participative action through multi-media tools and co-operative contents.

2.4. Birth of a research-action program

From this first diagnosis, LBA association proposed to develop a program of research-action, *Pays- ages Enchantier*, bearing on the implementation and the evaluation of

dynamic co-operatives of ac- companiment and implication of populations and professionals in the renewal and the shared and durable urban management of a territory.

Based on the experience of an accompanying structure of territorial actors: the *Grand Projet Ville* (GPV) Malakoff Pré Gauchet co-operative action, our objective here is to exhibit the structure and organisation of the participative global assessment system applied to the specific case of this district (Bourdin et al., 2007).

Therefore, the *Paysages Enchantier* program is structured around 4 poles:

2.4.1. Social and popular education pole:

It proposes to inhabitants and professionals a popular education experiential. It is about making common cause (cooperative play) to create a collective wealth, to be helpful staff and live together. The actors are accompanied throughout the program in a process of workshops led by scientists, artists, engineers, animators and actors expert partners, involved in the project. The dynamic of co- operation is organized by thematic workshops: writing workshops, workshops multimedia, art workshops… The co-actor shares one or more missions and is involved from beginning to end of the workshop. The workshops bring together the co-actors of a cross-cutting and multidisciplinary approach.

At the end of 2007, already more than 1000 inhabitants (of the district but also of town) will be in- volved in the collaborative process of the program for one or more strands (Bourdin, 2007). There have been involved in an individual capacity or as part of schools, associations and institutions in the district.

2.4.2. Scientific pole

Several scientific research disciplines such as environmental psychology, social geography, archi- tecture, acoustics, Ambiance landscapes and virtual reality, are associated with the program of ac- tion - research and constituted under the coordination of Philippe Woloszyn (ESO lab.) and Gaëtan Bourdin (LBA) multidisciplinary scientific team. Goal is to bring new knowledge on participatory urban development, including questions of the mood of the landscape, the terms of representations of the territory, information systems collaborative proximity, immersive multimedia systems, or even governance hyperstructure.

The scientific research program HPU (Hyperscapes for participatory urban development), developed in the present document, has been implemented in the context of an IRSTV global research assess- ment, Linked to a regional “call for research” response. A dedicated Interdisciplinary cooperative working group has been set up for this program, in partnership with scientific institutes: IRSTV (Institut de Recherche en Sciences et Techniques de la Ville, FR CNRS 2488), ESO (Espaces et Sociétés, UMR CNRS 6590), AAU (Ambiances Architecturales et Urbaine UMR CNRS 1563), PSYECCA (Psychologie Environnementale, Conseil et Communication en Aménagement, SC).

2.4.3. Artistic pole

LBA association has asked several artistic researchers, local and national, to implement

urban and social symbolic co-creation games, with associating inhabitants and local actors, in order to revive the contextual and situational art of the city in its symbolic significance through imagination. In that way, landscape is considered as the result of a collective co-creation of a common work.

The key here is the art in the making, the game of drafting a speech, a sensitive and critical relation- ship, a vision of itself, its environment, other, and not only knowledge of art or access to the work. What is important is the work in progress, browsing art acting, experience poetic/symbolic of the collective co-creation.

The program expected results can be listed as follow (Bourdin et al., 2006):

- Experimentation and modeling a dynamic participatory urban development,
- Collaborative tools and multimedia content knowledge Production, included a territorial ap- proach animation education referrals,
- Co-creation and co-achievement artworks urban ephemerals and sustainable, forging urban landscape territorial identity,
- Enhancement of the image of the neighborhood and its inhabitants for themselves and for others,
- Best apprehension by people in urban change issues and social territory (dynamic changes)
- and capacities of the city,
- Acquisition by the inhabitants of skills and many fields of knowledge,
- New links inter-schools, inter-associations and inter-institutionals, inter-generational, inter-cultural, parent-children, generated by the project,
- The emergence of a network of inter-cooperation on the theme of participatory urban development (inhabitants, scientifics, artists, technicians, policy makers).
- Emergence of new and innovative services for the management and animation of the territory with inhabitants.

This participative procedure aims to cross in a transversal and creative manner the differences of status between the categories of the territorial co-actors or users. Crossing those status differences through the corresponding representations assessments can clear the conditions of the dialogue between the actors and clarifies the criteria of integration of the landscape ambience conditions in the urban renewal project.

3. HYPERSCAPE: A MULTIMEDIA SPATIAL PLAY-GROUND MEDIATION: SCIENTIFIC *PLAYERS AND METHODOLOGIES*

HPU's research work General Objective is the observation, analysis and modelisation of an urban territorial cooperative experience, through manufacture and animation of urban landscapes, linking people, actors, experts and policy makers, in order to promote sustainable development common values and goals. To do this, the mentioned research

program also proposes a spatial mediation through on-line medias (Urban-HyperScape) representing the Malakoff district with an inquiry about the inhabitants stories in order to enlighten their territorial representations. (Woloszyn et al., 2007).

3.1. Interdisciplinary cooperation

This co-production approach also implies an immersion into the different educational and social workshops, artistic or scientific ones, for the different "expert actors" of the project (scientists, artists, politics). This identified actors will propose their experience, express their point of view, or develop a specific technical or aesthetical knowledge regarding the specific "district workshops" thematics. To do so, a cooperative platform has been built on, which allows selective access to the different "co-actors families" to exchange data which are relevant to the project.

Scientific methodology itself imply researchers of many various research domains. The project is re- warding for the researchers in the way that the studied neighbourhood is already explored for many years. It therefore provides the study with already marked-out landscapes.

Public participation to those territorial observation data creation provides useful information to characterise:

- Malakoff representations, through discursive contents analysis produced during the district associative workshops, and an inhabitant representative inquiry (Barlet et al., 2006).
- Inhabitant daily mobility, especially concerning kids displacement checking inside the district using GPS modules (Depeau, 2005).
- Artistic retentivity, more or less represented in the district through visible or invisible territorial markers (Veschambre et al., 2005). Social link and landscape appropriation are related to the artistic actions performed in the city: these actions and the corresponding artistic vestiges are stored in a "History notebook" maintained by the inhabitants.
- Hyperscape tool backfire representations studies through a public evaluation process.

3.2. Knowledge and image of Malakoff from the inhabitants and users

GPV is a huge renewal project concerning Malakoff district, which is declining into two parts, urban and social. Regarding its urban part, this project is dealing with all the users urban surroundings, from individual (housing) to collective scale (district-city relationships). Social dimension of the project reveals a double preoccupation: public action optimisation around major thematics (such as employment, prevention, citizenship) and a proximity urban administration management. As noticed by the project manager team, "this project transforms widely the district shape together with its inhabitants life".

Malakoff district renewal project edicts clearly communication and information diffusion needs, with proposing a consultation process between the project management team and the district inhabitants. In this evolutionary context where institutional and action-research

processes are interacting, an experience feedback evaluation seems to be an important step for the participative process understanding. Are those actions influencing the inhabitants district image? Are the district inhabitants more concerned with this renewal project now? Those are few questions which could help to understand the evolutionary situation within the district, through inhabitants urban and social perceptions and representations inquiries. People will be asked about their familiar surroundings at different district evolution key-moments (urban transformations, participative and informative actions,…). To do this, the following three-steps phasing seems to be convenient:

Phase 1 aims to explore Malakoff district inhabitants perceptions and representations between 2001 and today: this phase aims to produce a "snapshot" of the perception and internal representation about the evolution of inhabitants surroundings, with analysing the changes already done and the changes to be applied and the participating actions themselves, as a perspective from the previous study made by a sociological department in 2001 as a first institutional participation and information balance-sheet. A questionnaire inquiry is actually in progress towards a 50-80 persons sample, not only socio-demographically representative, but also taking their district relationship history motivations into account (installation date, housing location and typology…). This inquiry is related to different thematics, as the Malakoff district actual description, its relationships with the downtown district (physical and social environment perception evaluation, uses and practices), the realised changes in the district (changes identification and evaluation), the future evolution of the concerned district (through the future changes knowledge evaluation), the information and communication processes evaluation, and some personal requests, concerning spatial mobility, territory attachment or residential history of the inhabitants. Constructed on the same basis on what have been realised the previous mentioned inquiry, this tool will identify and quantify the environmental elements evolution between 2001 and today.

Phase 2 of the present workpackage will complete the district perceptions and representations inquiry with the collection of spontaneous "words", which will be able to enhance the "guided" previous inquiry data. This phase will lead us to participate to the educational workshops within the Malakoff district, in order to collect individual and collective experiences, and analyse this aimed co-creation process.

The last phase will allow to evaluate the adequation of the various tools for territory with the abilityto take into account one's surrounding, to get an internal representation of the urban space and to generate the corresponding territory knowledge. An evaluation of the modification of the territory perception is necessary to measure the impact of the various participating actions performed. In particular, the multimedia tool has to be refereed with the internal representation of the familiar surroundings, appropriation feelings, and daily involvement in the neighbourhood. This evaluation procedure will focus on the characteristics of such tools, on their goals, on the potential enhancements, throughout an inquiry. It will give informations about the consequences of participating actions onto the local governance, on the decision comity, about the personal matters, in order to let come to the surface a specific knowledge on lasting development of a given territory.

3.3. The exploratory approach of mobility territory

The way to observe mobility has followed the evolution of urban planning, going from motorised mobility to pedestrian mobility and similarly from a focus on road infrastructures and planning to physical and aesthetical ambiences. Thereby, the way to collect data used to be indirect methods (such as diaries, interviews, questionnaires). Moreover in research on children's mobility (Hill- mann, 1997; Prezza et al., 2001; Horelli, 2001), when detailed attributes about ambiences and travel behaviour are required, individuals have to answer a lot of questions and some are based on memory. In this context, few methods, except commented journeys (Thibaud, 2003) allow to get in and observe finely the "here and now" of mobility which is necessary to better qualify the strided and attended spaces. Since the fifth last years, tracking methods with technology such as GPS data- loggers or cellular phones seem to generalise as soon as the aim is to track travel behaviour and the accuracy of geographical positions (Asakura & Hato, 2004). In this project, the method allow to un- derstand not the place of destination but the place of travel itself in order to track ambiences, beha- vioural and social travel-strategies.

In this way, it is possible to go beyond rational logics which usually guide the methodological paradigms in research on spatial mobility and to understand logics of hedonism, of safety and of so- ciability in public spaces. This procedure has also permitted to measure in some contexts, such as Malakoff, how the visibility of tools and techniques which are used and entrusted to children is as much important as the visibility of interviewed persons.

3.4. Immersive tools and virtual contents

Within HyperScape project, a few landscape re-appropriation "experiences" are under development. The project aims at contacting the various cultures existing in the relevant territory and the various generations of inhabitants. It is necessary, in order to be efficient, that the developed tools shouldbe, in somehow, "fun".

Technically, our methodology is based on a feedback between an information system of the town and the associated psycho-physical data, in order to allow an inquiry of the so-constituted database with the immersion techniques relative to Virtual Reality technical process. Hyperscapes uses visual, sonic and textual contents, including trans-media navigation features (Christie et al., 2002) as an on-line "clickable" media navigation process into the territorial representation, in order to constitute an useful tool which facilitates the mediation among the actors of the territory. Therefore, a project specific software library will be designed through many broadcasting ways like CDroms, WAP phone navigation, Internet, using many screen sizes like phones, PDA, Wide digital screen, projector for video. Showing and navigating through various types of data (sound, video, pictures, vectorized data, text) with various constraints for the diffusion implies some difficulties for the development of this software library. This later will be designed in order to easily define new way of navigation through the database. It can be noticed that the uses and the needs are very similar to those of internet navigation. This project will approach a sort of Hyper Text Modelling Language (html) extended for the considered kind of media.

Sound games for territory discovering includes a landscape beat box, and a sound atmosphere generator. The mentioned beat box consists into a computer application that permits the creation of music using sound loops which are recorded within the Malakoff neighbourhood soundscape. This tool should help the inhabitants to read in a new way their sound space through a recognition and an identification of the various sounds that are suitable for the beat box. The goal of the sound atmosphere generator is to allow each inhabitant to reconstruct her/his perception of the Malakoff sound atmosphere, which will be performed thanks to a sound database which can be mixed in order to recompose the global sound.

Immersive 360° picture and sonic tool will allow the user to explore the neighbourhood by viewing 360° pictures (a change of view is performed by mouse scrolling) together with clickable areas which "moves" the user to a new 360° picture corresponding to the clicked area. Developed with an integration of the soundscape recorded on the various locations and played according to the presented view, this tool provide the user with an easy-to-use tool, and really immersive with the need for a small amount of data and a quite low computer. In order to get a sound varying according to the presented view, an innovative 3D sound recording and playback technology has been developed (Woloszyn, 2005).

A lot of multimedia data will be collected by the inhabitants through the associative assessment *Paysages Enchantier*. Those tools aims to provide an non-boring way to explore these data, with using an avatar onto a 2D map of Malakoff. When the avatar is located near designated locations, the corresponding multimedia data are shown to the user. This tool performs a link between vectorized data (the map) and other data (picture, video, sound or text). The multi-criteria data exploration tool profits from the real-time *html* page generator *php* language in order to create web pages showing the multimedia data arranged according to criteria selected by the user. The idea is to design a tool which helps the navigation through the database. The user can select the type of media, the specific area of the neighbourhood, the creation date, the event. A navigation by similarity is permitted as well.

Through this on-line media support designed for interdisciplinary dialogue between inhabitants, professionals and decision-makers, this game-dimensioned research work will also create on-line *Ambient Data Games,* involving territorial actors playing on a dynamic mapping of the media - markers of the territory.

4. HYPERSCAPE AS A TERRITORIAL AMBIENT CO-CREATION GAME

Production of urban well-being, sustainable development and urban ambiences of the territories is relevant to a multi-dimensional and multidisciplinary approach of the concerned territory (Girardot, 2004), both concerning physical phenomenon modelling and environmental psychology inquiry methods.

4.1. Notion of ambients

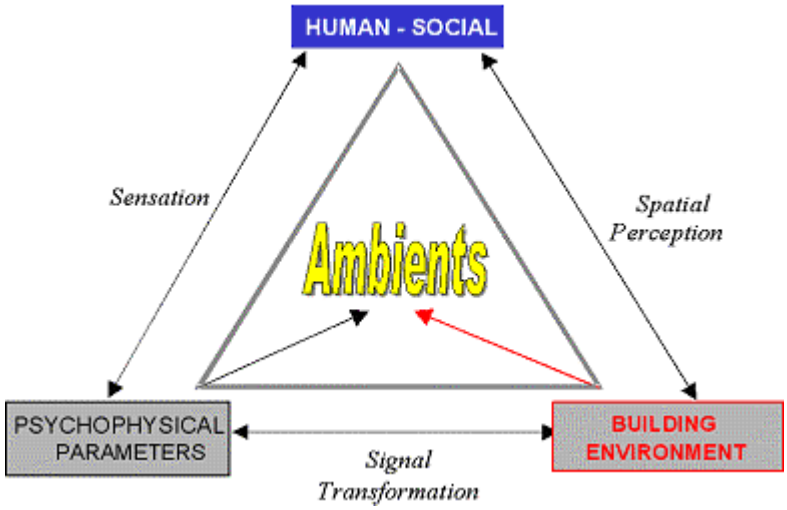
Psycho-physical models allow to describe and to manipulate environmental phenomena in space. Models of suggestive representation allow to place the individual perceiving in

the centre of design process through the use of Virtual Reality tools. Human being, both identified as a modifier actor of the environment, and as an ambience perception subject, is also interacting with the environmental constituents. This leads us to re-formulate the concerned environmental parameters from an anthropocentric point of view, leading to the notion of ambients.

Architectural and urban ambience production is related to the following three main interacting parameters (Figure 2):

- the specified built form, which shape and material characteristics are able to generate an identified physical ambience condition,
- the specific urban physical factors, which cover a large spectrum of environmental phenomenon such as wind, temperature, sun exposure, acoustical propagation or pollution dispersion,
- the human being, both identified as an actor of the environment and as a subject (an ambience perceptor).

Figure 2: Ambience scheme.

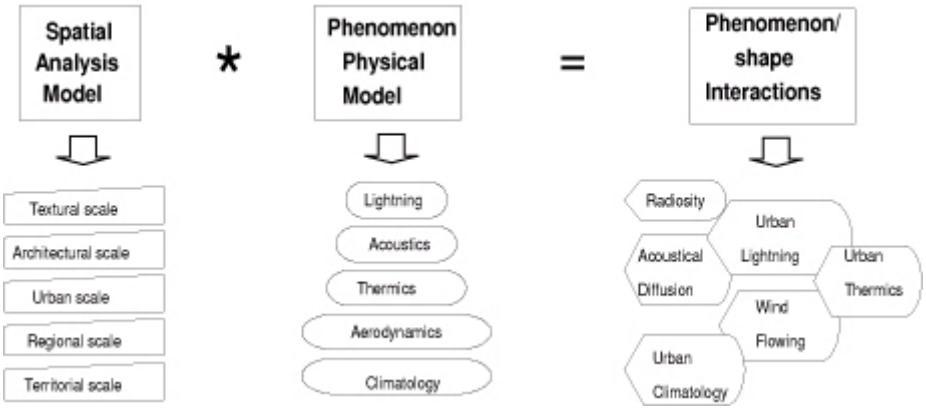


The corresponding method analyses results of psycho-physical simulation through the descriptors linked to the spatial position of the observer, constituting a cartography with GIS use.

4.2. Physical constraints: the rule of phenomenon scaling

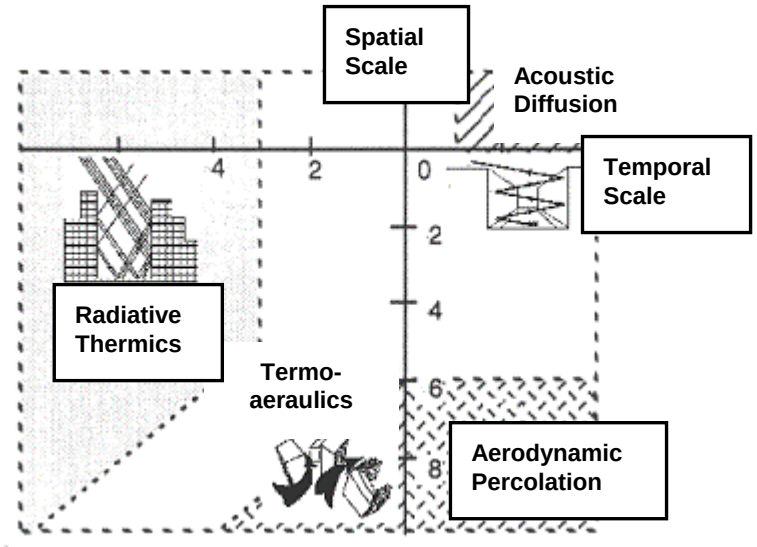
As the main support to analyze the phenomenon of architectural and urban environment is based on particular techniques like modeling and simulation, it is useful, in a first step, to segregate their three main elements into elementary physical manifestations, which involve specific parameters as seen on the following figure 3:

Figure 3: Physical ambiences phenomenon and their associated scales.



For example, the sound wavelength, which corresponds to architectural and urban scales (from millimeter to meter), is very far from the light wavelength (micrometer), and from the microclimatic phenomenon characteristic scale (kilometer). In addition, those spatial characteristic scales are complemented with the phenomenon temporal scales, which have to be taken into account in order to implement the physical parameters into the urban built geometry (Woloszyn, 1997) as seen following figure 4:

Figure 4: Spatial and temporal scales applied to ambiences phenomenon.



Reference to various analyse systems will be necessary, as the most currently used methods, outer the direct phenomenon parameters measuring, imply a physical model for process evaluation. This multiphenomenon characterisation leads us to organise the urban space as a field of data aimed to ambiences physical parameters description. In order to exploit those data for building production process (i.e. the choice of a specified absorption material aiming a sonic quality of an indoor space), we'll focus on *Virtual*

Reality tools reliability for one-scale testing of the corresponding material properties. This physical constraints pre-testing of architectural solutioning of an ambience target constitutes one of the most powerful and flexible in- and outdoor ambience simulation application tools.

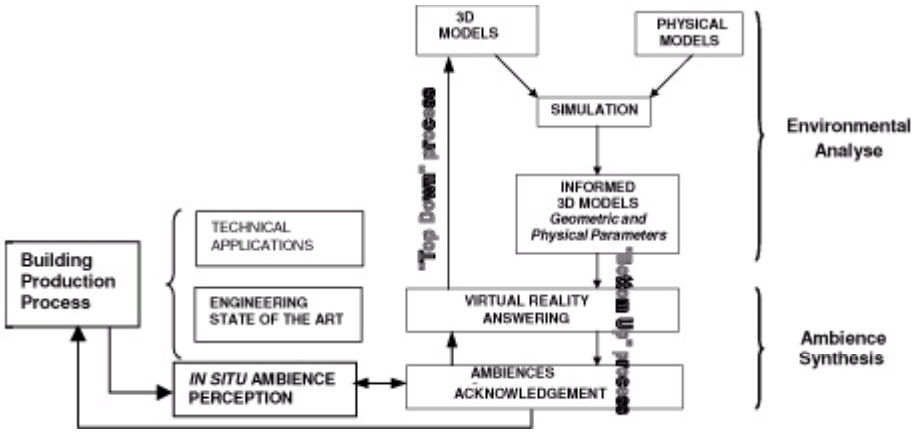
4.3. Virtual Reality instrumentation

This new representation introduces a new vision of the objective environmental conditions of the analysed space, and is to consider as a workshop for the environmental designer, testing *in silico* different spatial hypothesis to the breadth of the psycho-physical ambients filtering.

Environmental simulation is fed between a 3-D geometrical model of the town and the associated physical data, in order to provide a specified ambience perception condition through technical applications. This psychophysical method, consisting to compare engineering solutions with subjective judgements is known as the "Bottom Up" process of sensorial data treatment (Dubois 1993).

Virtual Reality technical applications allows to feedback this methodological approach, with including the human being at the beginning of the process. An interrogation of the pre-constituted engineering database provides an ambience acknowledgement through Virtual Reality immersion process, in order to inform the geometrical model directly with human environmental needs, as seen figure 5:

Figure 5: Ambiences synthesising scheme: "Top Down" and "Bottom Up" processes.



This "Top Down" processing model constitutes a new answer for integrating semio-physical parameters into the built environment engineering, through discursive (verbal) expression of environmental needs. Furthermore, as the "Bottom Up" descriptor is computed from the results of physical simulation of the concerned phenomena, the "Top Down" analysis modality is based on the comparison between objective statements and judgment of interviewed people immerged into the scene. The ambiences 3-D scheme used in immersion process synchronously links "Top Down" and "Bottom Up" physical

dimensions to perception shapes, into a spatio-temporal dynamic, traducing the physical shape of a phenomenon into a technical solution to be integrated through the building engineering process.

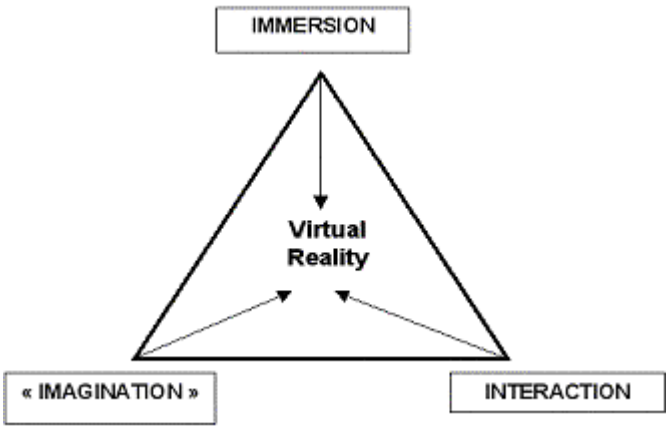
Nevertheless, the use of virtual reality techniques for environmental visualisation can't afford a satisfying ambience representation without integrating the sensitive aspect of phenomenal perception. In that way, we can consider this aspect as a sensation vector from subject (the human being) to the ambience complex. Taking sensorial interaction through the physical simulation process into account leads us to an hybrid ambiences representation model, rooted to our researches in the both domains of spatial analysis and ambiences perception (Woloszyn, 2002). The final model we propose would enable the final user to "re-feel" the ambience parameters at each step of its wandering.

Moreover, the ambience exploration process, combining physical properties and perception actions, will enable the space *producer* (architect, urban planner…) to translate the *space-users* needs and representations of the involved environment into its physical properties to be implemented through engineering solutions.

Those scalar physical phenomenon are perceived with specific *human sensors*, which perception and judgement iteratively act on the building engineering solution choice through ambience simulation. In fact, the laws of human perception, considered as a *sensorial filter* of the reality, are specific for each physical domain relatively to their spatial and temporal characteristic scale. Otherwise, psychological perception studies point out a noticeable difference between individual perceptors, which ambient sensitivity is depending at the same time on the local context of perception situation and on the inner disposition of the human being (Dubois, 1993).

Following those remarks, we can afford to compare these complex interactions with the known Burdea's virtual reality symbolisation (Burdea et al., 1993), based on the three major principles of Imagination, Immersion and Interaction, as illustrated figure 6:

Figure 6: Virtual reality scheme (Burdea et al., 1993).



4.4. Immersion process

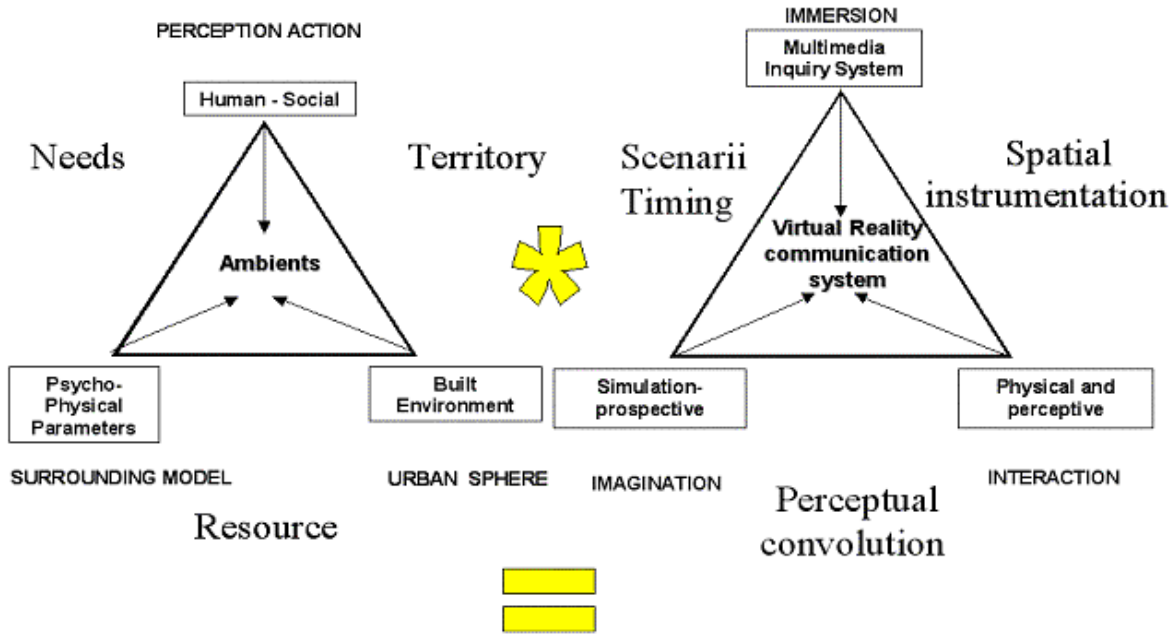
The Immersion process (Slater et al. 1993) places human in an equivalent position of a *classical* urban pedestrian, with rigorous conditions for ambience restitution, involving precise geometrical subject placement in the 3-D town numerical mode and total environmental control, linked to pertinent perceptive descriptors. The effect of this positioning is a simulation of physical phenomenons and spaces interaction very near from the reality. This realistic interaction principle is conditioning the user's freedom degree in the *re-feel* system.

An immersion with a total interaction will allow a free moving and a dynamic parametering, permitting a total independence between each side of the triangle figure 6. This moving and sensing degree of freedom is important for space conditioning, and, consequently, for exploration acknowledgement.

Imagination characterises interpretation of the parameters resulting from the virtual reality experimentation. Those descriptive parameters are related to the physical phenomenon with replacing them in the perceptual context. Several known methods can be applied to this aim, and the results shows a *zoning ratio* for each perceptual characterisation, implemented from the starting point of the perceptor to the rest of its evolution during his walktime along a specified Worldline.

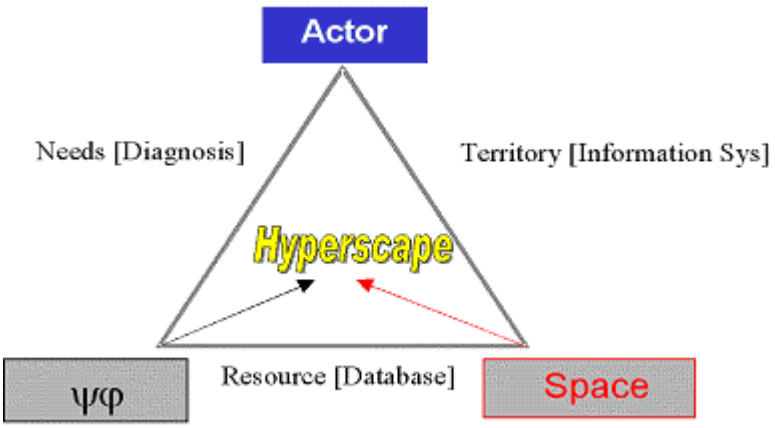
This approach doesn't discriminate the phenomena, but considers perception as a single object. The involved scalar physical phenomena are perceived with specific *human sensors*, which accuse sensorial disparities between environmental phenomena.

Figure 7: Ambients instrumentation.



Considering perception as an action sensation vector from subject (human being) to the ambient complex, the corresponding psychophysical representation space suppose the construction of an homoeomorphism between scenarii timing, perceptual convolution and spatial instrumentation, cognitive transposition of one's population needs, human resource and geographical territory (Girardot, 2004), figures 7 & 8.

Figure 8: Hyperscape territorial scheme.



4.5. Experimental ecological validity

Experimental restitution has to be ecologically valid in the sense of Gibson (1986). In other words, ambience reproduction has to provide a real functioning referential illusion. Physical phenomenon is parameterised through spatial-dimensioned emission, propagation and reception modalities (Woloszyn, 2006). Consequently, stimuli used in this restitution should enforce the initial conditions of the real reference situation, in terms of source physical characterisation, spatial propagation laws and reception conditions. Those *ecological conditions* would be modelled on the background studies concerning relationships between physical characterisation and spatial perception (Hoc, 2001).

Correspondence between physiological organisation and modelled conditions enable an ecologically valid immersion system aimed to test real ambiences *in labo*, without contextual pollution, in order to obtain the twin data types necessary to join physical properties and perceptual effectiveness through ambiences characterisation as follow:

- sensitive data provided trough subjective answering to sound stimuli,
- physico-spatial attributes obtained through signal analysis.

Comparison between space physical characterisation and sensitive exploration leads us to define psychophysical parameters for ambients prototypic categorisation, entered on semantic rendering of the subject's brainwork. In this way, symbolical information treatment involves the subject into the interactional emergence construction process. This cognitive approach means that ambience complexion is no more reduced to environmental

information treatment, but constituted with preliminary representations organising the perception action (Woloszyn, 2005).

4.6. Psychophysical specification of ambients

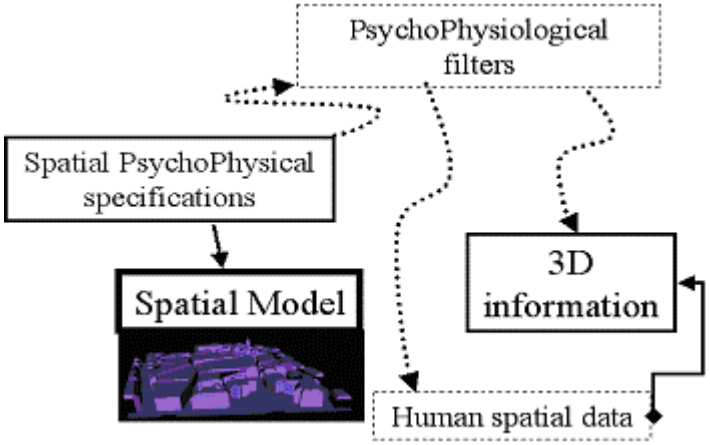
As shown through previous psycho-acoustical experimentations (Woloszyn, 2005), dynamical behaviour of perceived ambient objects confirms the principle of approximation continuity (Carey, 1995): this confirms perceptive experiment as a complexion action, readable through successive instant attempt, which global description formalises a non linear schematisation through Worldline walkthrough. This supervenience principle (Davidson, 1970), stating that mental properties and facts supervene on physical properties and facts, underlines the microstructure of sound information-and more generally for environmental one-. This non-reductive determination principle states on inductive inference between psychological and physical description of the same phenomenon. In our case, the resulting interlevel theory, *psychophysics*, may infer that psychic behaviour of the subject is both determined by the physical properties of his environment and the relationships between their constituents, leading to this global environmental set called *Ambients*.

This ontological dependence states psychophysical laws on general principles of rationality, as mental and physical properties can define an event if and only if mental change in an object's properties-the supervening properties-entails *and* is the consequence of a change in its physical properties. Each step of a psychophysical experiment is empirically supported both by observations of relevant correlation and by the empirical adequacy of psychophysics principles, which unifies the two levels of the observed phenomenon, psychology and physics. Following this principle, sonic shape recognition proceeds to a connectionist approach, treating information as a discontinued process, successively slicing the perceived objects, in order to reference them in an allocentric way during the perception action.

In the aim of environmental prediction, the use of virtual reality immersion techniques enables the identification of pertinent indicators used for urban ambience subjective evaluation, through an adapted representation space.

Moreover, supervenience principle edict totally disconnected laws between individual and collective behaviour processes. Cognitive modelling of behavioural aggregation could be approached through quantitative evaluation of event density probability. In the resulting aggregate, perceptive complexion of an ambient is denoted through the the homeomorphism between the perceived event and its evocation. This should describes both the quality of the identification of all the ambients components, and the capacity for the perceptor to find there a sense, that is to recognise a natural and relevant organisation of its constitutive elements for identification. In that aim, spatialized time/space descriptors will help clearing the stimuli complexity, in order to proceed to its taxonomic description figure 9.

Figure 9: Psychophysical Characterization of Immersive Tools.



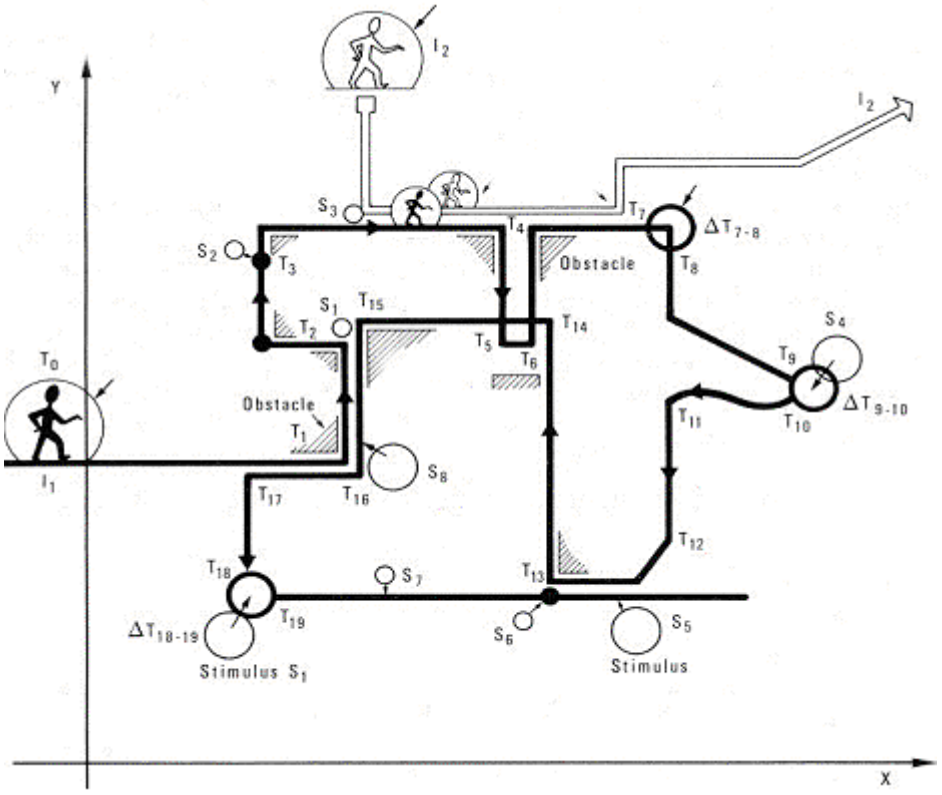
Hyperscape system will associate the different modes of shape/phenomenon relationships we described previously, taking into account the structural organisation of one of the main stimuli which built the perceptual representation of ambients. Those lasts will be described through evaluation of the corresponding psychophysical pertinent indices with coupling cognitive representation, based on the virtual reality scene judgement, to technical characterisation of a specified ambience This method constitutes a step-over for simulation or measure data analysis obtained in the field of environmental studies. In this way, virtual reality allows interaction characterising with use of interlevel indicators in the cross-fields of urban built environment, physical phenomenon and human perception *in virtuo*.

5. A HUMAN INTERACTION DESCRIPTION MODEL

5.1. Universe line: Minkowki theoretical assessments

For the pedestrian that circulates in the urban space, the ambient phenomenon superposed to the urban landscape can be considered as a marker of the totality of phenomenon distributed around a place, creating an atmosphere perceptible for any pedestrian situated in this space. It is revealing a new geometry of the city, modifying its shape during a walk. This ambient landscape reveals its dynamics through the urban wanderer walking through this new ambient city perspective, showing new ambient phenomena that punctuate space along the wander direction, following the so-called *Universe*- or *World-line* of man in the city as illustrated figure 10, from Moles (88):

Figure 10: Universe- or World-line of man in the city (Moles 1988).



The idea of world line originates in physics and was pioneered by Albert Einstein. The term is now most often used in relativity theories, where particles are considered as points moving through space, tracing out a line called the World Line. A world line of an object (approximated as a point in space, e.g., a particle or observer) is the sequence of spacetime events corresponding to the history of the concerned object, spacetime-modelled through a special curvature type. The world line of an object is the unique path of that object as it travels through 4-dimensional spacetime.

However, world lines are a general way of representing the course of events. The use of it is not bound to any specific theory. In this usage, each point of a world line is an event that can be labelled with the time and the spatial position of the object at that time. Thus, a world line is the sequential path of personal human events (with time and place as dimensions) that marks the history of a per- son, perhaps starting at the time and place of one's birth until their death.

At a given event on a world line, spacetime (Minkowski space) is divided into three parts:

- The future of the given event is formed by all events that can be reached through time-like curves lying within the future white cone.

- The past of the given event is formed by all events that can influence the event (that is, which can be connected by world lines within the past vector line to the given event).

The present plane at the given event is formed by all events that can be connected through light cone with the event. When we observe the sky at night, we basically see only the past vector line within the entire spacetime.

Figure 11: Minkowski space representation for one point of the Worldline.

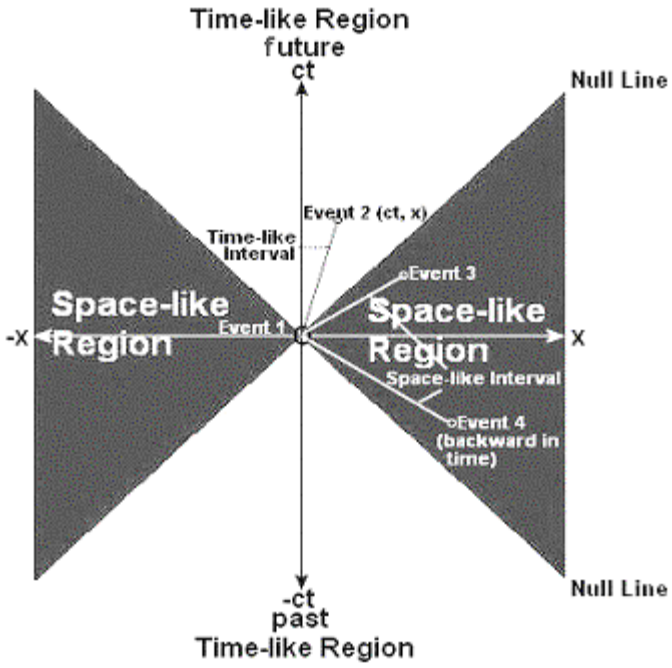


Figure 11 shows the present depth as the region between the two white cones. Points in an observer's present are inaccessible to her/him; only points in the past can send signals to the observer. In ordinary laboratory experience, using common units and methods of measurement, it may seem that we look at the present, "Now you see it, now you don't," but in fact there is always a time delay for light to propagate. Of course: the involved geometry is Minkowskian, not Euclidean.

5.2. Event Interaction entropy dimensioning

Geometrically, Minkowskian measurement operates a *present depth* neighbourhood dimensioning, with the use of the so-called *Minkowski dimension*, describing the structure's entropy through its scale manifestations, or fractal behaviour.

Thus, Minkowskian geometry of event distribution can approach an incertitude evaluation through entropy dimensioning, relative to a territorial problematic. Those lasts indicators should describe an interaction quantity, understood as a teleological tension from past to future action of participative processes. Human information data relative to

those relative interactions from an actual situation toa projected one recover different natures, political, institutional, social, psychophysical, and should be defined through an order spectrum for incertitude measurement and interaction quantification. This order spectrum constitutes the Correlation Dimension probability signal, which can be deduced from the general entropy quantification through its Dimensional Measurement. Entropy probability distribution should then be computed from information dimension of the event data structure, and its measurement momentum will enable entropygeneralization to complexity through multidimensional analysis. Inquiry request as an approach of teleological tension between reality and ideal provide multivariable information for present depth Dimensional Measurement. Recent applications based on inquiries and expressions dimensional analysis are well-adapted to this data treatment, and should define the items dimensional values (Woloszyn et al., 2001).

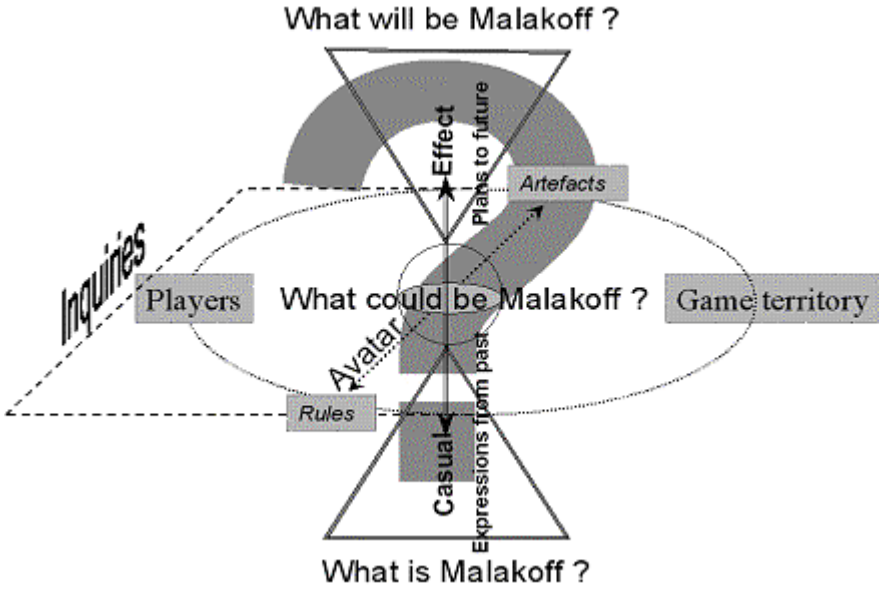
As a particular space/time interaction model, the Worldline Minkowski representation is divided into three parts too:

- The future of the territorial event is readable through political, institutional, social, psychophysical interaction effects quantification, answering to the following question: “What will become our territory, Malakoff, in the future?”
- The past of the territorial event is formed by all events that can be connected by world lines within the past to the given event, as an event memory structure. The relative question states on the actual situation of the territorial event: “What is Malakoff?”
- The order line of the given event is constituting with the territory game map and players inside the present depth. Central position within the casual-effect cone enlighten its present- centred position in ideal construction: “What could be our territory? ”

5.3. Hyperstructural entropy measurement

This teleological construction uses a virtual formalisation of reality, producing artefacts with territorial rules acting into the present depth, so that interactive players would be able to interact through avatars into the game territory, ideal expression between past and future territorial representation as a specified hyperstructure. Virtual environmental modelling reproduce partially some interaction rules, leading to territorial artefact construction (*Present depth* central node) through hypermedia spatial mediation with using Hyperscape play-ground figure 12:

Figure 12: Teleological interaction dimensioning though Hyperscape play-ground.



Hypermedia applications tend to use simple representations for navigation: most commonly, nodes are organized within an unconstrained graph, and users are presented with embedded links or lists of links. Recently, new data structures have emerged which may serve as alternative models for both the organization, and presentation, of hypertextual nodes and links.

The underlying infrastructure of such an information-centered environment is the *network of informations*. This network is a hyperstructure (Richardson, 1999), using Minsky's (1975) *frames* as multidirectional informational connection network. Hyperstructures essential assumption consists into the variation (minimalisation) of the hypergroup emergent properties, concerning associative or commutative natural minimality. This variation could be evaluated through the corresponding entropy calculation.

Thus, considered as multi-level emergent structures as for living organisms or social community structures (anthroposystems), the Hyperscape structure is then formed by information flow dimensioning, and enables information entropy quantification. Measurement space can be also deduced from the main (emergent) characteristics of a number of earlier explanatory inquiries in perception.

6. TOWARDS A TERRITORIAL INFORMATION SYSTEM

From biophysical to sociodynamic sciences, interaction laws (or in general, organizational principles) that emerge from the regularities in collective behaviour are most of time unlinear, as the actors teleological assumptions acts as environmental-dependent non-linear interactions. Those interactions emergent properties are deeply networked to the system observers, in our case, inhabitants involved into the territorial observatory and acknowledgement process.

This is the reason why this research-action approach, constructed from game-information theory, considers complex urban interactional systems as a representative virtual interaction space, a game territory made of land-, sound- or ambient- scapes. This approach should produce specified interaction rules, through environmental scenarii under defined social tradings, relatively to a specified territory hyperstructural system called "HyperScape".

As a collection of interacting systems shows collective behaviour, observed territorial mechanisms of sociophysical ambient observations will allow to constitute a "live" interaction model, feeded with territorial inference rules mechanisms through hypermedia space-time virtual processing.

Within those territorial rules integrations, intelligent system HyperScape should be able to operate an ecologically valid transcription of the representations of a given territory as a collective construction in spatial terms as well as in social ones, aiming at the emergence of a common knowledge of the territory, towards the idea of a community of interest.

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