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A community environment design hypertool. Application to sustainable cities interaction regulation

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Summary: This paper develops an innovative structure of knowledge collaboration forms that allows effective and creative collaboration among the actors along territorial design process.

To contribute to the development of the social dimension of the sustainable development, we investigate a new methodology and computational tools for understanding and facilitating multi-disciplinary, cross-cultural collaboration in sustainable architectural-, urban- land- and ambient-scape design, through evaluating collaboration among project developers, local authorities, architects, engineers, contractors, building inspectors, clients and future users.

Therefore, this proposed integrative tool increases the pool of knowledge and skills available to undertake activities that exceed the capacities of any single person or organization on its own, thus making possible the design and construction of complex skills, especially buildings and ambiences in urban or suburban environment.

Keywords : collaborative environnement, sustainable landscape, urban design, ambient design, hypertool system, territorial intelligence, Participative game, informational dimensioning, entropy evaluation.

A community environment design hypertool

1. LINKING SUSTAINABLE DEVELOPMENT ACTORS

A participative vision is the starting point for a development strategy that fully integrates the economic, social and environmental pillar. To do so, "classical" design workspaces represents a distributed structure of private design workspaces, linked to an overall design workplace, shared by all the participants. Thus, the overall design instance constituted by the merging of all the partial expert instances in the overall workspace will mix them into a composite one. (Ross 2008).

Because the participants, based on their own roles, knowledge, and cultural understandings, can interpret the same data differently, this overall design approach is inadequate, particularly in the fields of territorial applications such as urban, architecture and ambience design. The communication and interaction between the environment process actors, each representing different interests and experiences as basis for evaluation of the proposed design solution, can essentially impact the decisions made and the further development of the design solution. Furthermore, decisions are made based on the decision-makers' or other participants' evaluations of for instance the design solution's quality or its consequences for the design as a whole.

As educational and disciplinary backgrounds heterogeneity usually causes organization troubles into the urban project process, results of the empirical studies have shown three problems emerging in the classical collaborative environments: semantics, synchronisation and communication (Ross 2008, Ross 2008).

Moreover, bearing tension between urban experts and deciders on one side and inhabitants in the other side signs the quasi-ontologic difference between actor's space or territory Cartesian approach and inhabitant's human-centred space. This approach has been well-developed through the various phenomenological trends.

Me, here and now (« Ego Hic et Nunc »), world-centred, can perceive my environment in the double meaning of the surrounding world « Umwelt », and the outstanding world « Merkwelt », offering number of valuable properties, mainly for me. I'm not wandering into a Cartesian, orthogonally referenced world, I'm taking with me my whole reference system (self-centred coordinates).

This two-faced ambigous space conception seems irreducible, even more considering science as a "broadly speaker" (caracteristica universalis). How can a politician or an town planner both work in the ground of science, with taking our singularity (caracteristica singularis) into account, knowing that science of singular remains unthinkable ?

Such a gap is crucial to be solved in cross-disciplinary design in order to allow and improve collaboration. One question remains: How can we overcome this symmetry of ignorance? How can we rely those two conceptions of space, both at a scientifical investigation level, and at the "shapewalk" level, dealing our background, or "life-frame" transformation and production process?

To avoid those interdisciplinary communication handicaps, we develop a virtual environment for collaborative learning with network technology based on simulation games. This will lead to a filtered mediated interaction model, feeded from information theory systemic modelling.

2 DEFINING AN WORKSPACE SYSTEM FOR MULTIDISCIPLINARY COLLABORATION

An overcoming solution should be found through merging psychophysical laws with micro-psycho-social concept rules, in order to model socio-ecologically valid interaction laws (Gibson 1986, Hoc 2001, Moles 1988).

Our main hypothesis lies on supervenience principle (Davidson, 1970), stating that mental properties and facts "supervene" on physical properties and facts. This principle edict totally disconnected laws between individual and collective behaviour processes. It assumes that subject actions are defined, on one side, by the relationships between elementary physical properties and individual representations, and, in the other side, between collective behaviours and global phenomenon manifestation. This leads us to qualify global environmental interaction set as a collection of interacting systems, showing collective behaviour at different scales, that means, for different proxemies. This observed structural organisation of the proxemical mechanisms of interactions laws would define the ambients perceptual representation system, through interaction flow organisation dimensioning (Woloszyn 2000a, 2000b).

To model those interaction mechanisms, we decided to take a systemic approach (Avison-Myers 2001, Le Moigne 1995). The model for the empirical studies is based on four central aspects of the environment design process: the generation of design solutions, the communication, the evaluation of design solutions and decision-making. This model emphasises that a good decision-making is important on several levels in the design process (Morin 1990, Callon1996, Crozier-Friedberg 1977, Kalay, 2004, Schön, 1991). These give a certain dynamic to the process to avoid the sequential understanding of the process from the 1960s. The generation of design solutions is the most important criteria for the decision-making, because a decision can directly impact on both the design process and the product generation, in the form of a new requirement.

3 THE HYPERTOOL COMMUNITY DESIGN : PROJECTS RECIPROCAL CONTRIBUTIONS

General objective of the integrated tool presented here is linking people, actors, experts and policy makers through proposing a spatial mediation with on-line hypermedia supports, through:

- Informational characterisation of representations and judgements disruptions between urban actors and planning advisors
- Application to land- sound- and ambiantscapes environmental design project
- Transdisciplinary epistemological positioning
- Political and economical and political disparities : life designers, social sculpture (Beuys), community assessment

The communitary tool we propose to support collaboration in scape design process is a combination of three methodologies and tools that have been developed in three complementary projects within territorial intelligence network:

- Hyperscape project, developed with The LBA "Les Badaux Associés" organisation within a participatory art project involving professional to youth, children and adults Nantes-Malakoff neighborhood. This project proposes a collaborative way to observe, fabricate and animate the urban landscape elements, through a cooperative hypermedia creation process (Woloszyn-Bourdin, 2007, 2008).
- Colline Project, in Collaboration with the German Center for Artificial Intelligence proposing a common working space within an intelligent interface (table touch) (Ross-Deru 2009).
- Facilitating multi-disciplinary, cross-cultural project in collaboration with the University of Berkeley (Ross 2008, 2009).
- Perlarboration project, which deals with semantic effects perception and representation acknowledgement through ideoscenic-images manipulation procedure (Luckel et al. 2009).

3.1 Hyperscape project

This collaboration between ESO scientific Lab. and LBA "Les Badauds Associés" organisation is a research-action within IRSTV program "Meigeville", approaching participative action through multi-media tools and co-operative contents. Weak inhabitant implication in the processes of urban dialogues within the project was the main reason for developing an approach to the topic of landscapes in the district, through a participatory art project involving professional to youth, children and adults.
This "game-project" consists into collecting and producing territory knowledge and memory data, in order to organize them in a multimedia system for general use. It associates a virtual immersive walkthrough multimedia system realisation. Constituting a "live" representation-game model of the involved territory fed with territorial environmental mechanisms which has been observed in situ, Hyperscape aims to reinforce and blow-up local actors multimedia practices and collaborative production methods (Woloszyn & al. 2007).
To simulate those "scapes", the ambient generator system proposes a multimedia creation interactive hyper navigation tool with an intelligent interface. This last includes integrative trans-media navigation features as an on-line "clickable" and "multitouch" hypermedia navigation process. Panning and zooming into the Audio-Visual landscapes and resizing images and sounds though the use of intuitive gestures allows proper navigation through various types of data (sound, video, pictures, vectorized data, text), in order to facilitate mediation among the actors of the involved territory. As this interactive tool uses visual, sonic and textual contents, a multitouch, multiuser mashup allows the territorial actor such as the urban designer, the researcher, the artist or the citizen to explore landscape ambients. Land- or sound-scape reproduction will therefore use panoramic or framed photographs, as well as ambiophonic sounds.
This is the way our participatory game-model involves the development of complex perception/navigation processes, touching transversely to both public and private institutions as well as individuals and cultural groups, in order to develop territorial politic structures and organisations participation to the Malakoff urban development project.

3.2 Colline project

In the Colline project, we streamline the work of several collaborating journalists, thanks to a user interface that brings together the content from different sources and media, but will also diffuse stories along various outlets. By combining the benefits of a collaborative interface with the power of semantic Web 3.0, it enables a user friendly way to collect information and to produce a newspaper. The journalists can also access or extract information out of their mobile phones and add them in the content production workflow, which will be used by the whole team.
Colline integrates all editing media, synchronizing and intelligent data retrieval features. With providing semantic interaction components, we will adapt this technology within an intelligent interface (table touch) to the urban landscape and ambient data treatment.

The interface will help the actors at the different stages of the development of the virtual territory. It also allows for the integration of different information feeds (RSS Feeds), juridical texts, documents concerning the urban planning, or the use of online pictures databases like Flickr, Panoramio, and also from videos like YouTube or DailyMotion.
The actors can also access or extract information out of their private database or out of their mobile phones and add them in the content of the virtual landscape production workflow. From one interface, several users can work and interact together on the landscape's design within a common working space.

3.3 Perlaboration project

This project proposes a "perlarboration environment" in urban planning context, aiming to manage politics, actors, researchers and inhabitants interactions within many domains. Knowledge sharing and production through adapted activation and representation systems will be processed in a common perspective view of life background transformation.
First phase of this perlaboration environment construction relies on simultaneous analysis of two pictures corpus, first of it produced by territory inhabitants along an urban maze pathway (founded on variable concerns), second one produced by architects-urban planners students, in the frame of a project exercise analyze (constrained with a "sustainable city chart", following the three axes: mobility, density, mixing). Producted pictures will then be mixed, or separately analyzed within two subject families: inhabitants and space producers. Manipulations will consist into classifications, ranking, and pair comparisons.
Multidimensional analysis and tools, as similarity matrixes, ascendent classifications, mobile-centred aggregations, Markov-chained decision making for classification and non-parametric tests on rank correlations are used for data treatment. Scaling used for those difference operations are issued from multidimensional analyses, so that redundancies between scales will be weakened.
Requests on pictures collections, instead of words expressions (thesaurus), will encourage to enrich our perlaboration environment of a picture selection and sorting module, refereed to previously constructed knowledge. This module, based on Shape- and structure-recognition methods will enable the production of new images, inherit from the analyzed images properties under conditions of similarity.

3.4 Facilitating Multi-disciplinary, cross-cultural collaboration project

As illustrated through those three projects, our approach will focus on sharing meaning, not only data. In our sense, meaning is produced by placing the data within the appropriate cultural frame of reference.
As actors who participate in the territory transformations do not share the same educational, professional and cultural backgrounds, the frames of reference they use to construct meaning are different, leading to misunderstandings and conflicts. Our approach overcomes this problem by introducing the notion of discipline- and culture-specific "filters," which will help the actors re-construct the original meaning of the other participants in the collaborative effort, thereby fostering a closer alignment of intents and results. There are 2 filters.

- The first one interface common knowledge with the expert knowledge. Filter mechanism consists here to interface shared information and private information. There is some project-dependent and some project-independent information in each part. Knowledge filter works at the level of concepts (ontologies, properties, relations, values).
- The second filter (instance data filter) works at the level of the individual data. It connects each individual data structure representing a personal instance to the data structure representing the overall instance. It is triggered by the first filter.

The role of the filters is to connect the shared data with the actor's own disciplinary- and culturally-specific frame of reference, thereby helping the actors construct disciplinary- and culturally appropriate meaning from the shared data.
The filters are envisioned as customizable computational tools that 'expand' the shared data by adding to it discipline- and culture-specific information, derived from specific knowledge bases. They work bidirectionally: extracting specific meaning from the shared data, and re-formulating disciplinary- and culturally specific information into shareable information which other filters can interpret according to their own disciplinary and cultural knowledge bases. This will likely involve dictionaries of meaning—translators of common concepts between different frames of reference.
Each entity can have a set of properties (geometric, physical, values) and attributes (function, methods or computing programs), a set of belonging relationships with other entities (part-of / whole-of), a set of inheritance relationships (class-of / is-a), a context (the condition) dependent set of rules of compatibility with other entities (check-list, adjacency-list, etc.), inference engines to activate and manage constraints. The whole is formalized into a syntactically coherent intelligent structure. Ontology provides a valuable support for representing and sharing terminology, concepts and relationships within a given domain. A large number of expert's community can develop ontologies as an underlying base for their collaborative work.

4 DIMENSIONING INFORMATION

To develop those ontologies, informational dimensioning should merge psychophysical laws with micropsycho-social concept rules, in order to model socio-ecologically valid interaction laws.
Information about territorial systems can therefore be filtered, whereas the environmental aesthetic perception of urban legibility is crucially affective as well as cognitive. To do this, analogical mental flow mapping allows a more faithful representation of ordinary reasoning network than langage formalisation. In other words, thinking by pictures instead thinking into words would enhance the quality level of the sustainable development information exchange among the actors of a territorial project.
Therefore, the actors various cultural references will be defined through semantical effects perception and representation acknowledgement with using infra-logical ideoscenic ambiance analysis process. Inquiry methodology will be based on territory ambient re-construction game pad, following the mentioned filtering processes, in order to evaluate the cognitive distance evaluation between real world environments and ideal world projections through the territorial representations.
As classification operations, categorization process often constitutes the firsts steps of the thinking construction process, holistic Audio-Visual world will be proceeded through landscapes « manipulations » to classify them, analyzed with semantic differentials and attribute constellations methodologies, in order to produce “connotative clouds and networks”. Multidimensional analyses of those informations will then enable a robust evaluation of the cultural differences between the collaborative actors of a scape design project.
The resulting back-fed systemic interaction model should provide an interdimensional quantitative evaluation of interaction laws : cognitive modelling of decision-making could be approached through an interaction quantitization with entropy dimensioning, relative to a territorial problematic. Human information data relative to those interactions recovers different natures, as political, institutional, social and psychophysical. They should be defined through an order spectrum, estimated with the interaction flow Correlation Dimension probability signal, as done before in recent applications based on inquiries dimensional analysis (Woloszyn, 2005). The use of entropy levels to quantize interaction between decision actors allow us to structure and organize the different approach by taking into account the different research fields like, individual theories, group theories, organisational theories and societal theories.
Within those territorial hypertools rules integrations, resulting intelligent territorial system should be able to operate an ecologically valid transcription of the main 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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