



**Integrated Project on Interaction and Presence
in Urban Environments**

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Second Prototype of Urban Renewal applications
Deliverable D 6.3



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Abstract

This document describes the two cycles of evaluation-feedback-redesign undertaken in project phase III. It presents the preparations of scenarios and contents, the development of prototypes, and the analysis of fieldwork material, all related to two participatory workshops dealing with a real urban planning project in Cergy-Pontoise, Paris. The first workshop was carried out in Vienna, June 19, 2008, with a student group from UniAK as participants. We used a small setup of urban technologies and experimented with use-cases dealing with urban topics such as time, connectivity and distance. The results of this analysis were used to prepare a second workshop in Cergy-Pontoise in September 2008 in a more elaborate setup of urban renewal technologies, all assembled in the MR-Tent. As participants, we invited different types of stakeholders – urban planners and specialists, members of the municipality and representatives of the local community.

A detailed analysis of the fieldwork material (video observations, photos, and transcripts of discussions and user feedback) is provided.

Our main insights from the participatory workshops with different types of stakeholders, a combination of varieties of mixed realities and forms of representation deal with how these aspects affect the quality of the participants' collaboration and of the collective debate on urban issues at stake.

Intended Audience

This document is intended to all partners of the project, the EC, and to the reviewers for the third project's phase.

1 Workpackage Objectives

Objectives Phase III	<p>The objectives of phase III were to a) further develop the urban renewal prototypes, based on the redesign issues identified in previous field trials; b) plan and carry out a more elaborate participatory workshop with different stakeholders, including citizens, and an extended experimentation protocol; c) implement sound as expressive content as well as part of interaction design on the basis of research done in WP3.</p>
Results Phase III	<ul style="list-style-type: none"> • The urban renewal prototypes were successfully further developed, enriched with additional functionalities as well as re-designed so as to better support collaborative activities and expressive interactions; • A more elaborate workshop scenario addressing more specific urban issues has been prepared. The development was embedded in a participatory process including several types of stakeholders. • The urban renewal prototypes were tested and evaluated in two workshops, one of them on site in the MR-Tent. • The experimentation with spatial sound was successfully integrated in the workshops.
Evaluation Results Phase III	<p>In all two participatory workshops participants related to the urban renewal prototypes in very positive and constructive way, collaborated to compose MR scenes and discussed about urban issues. Major issues dealing with participant's interactions in mixed-reality environments and their debate of urban issues in combination with presence aspects were addressed.</p>
Objectives Phase IV	<p>The objectives of phase IV are to further improve the urban renewal prototypes with a main focus on the stability of the system and the usability of the different interactions. Further research on different forms of representation (visual and auditory) will be done and included in the next field trials. A final participatory workshop including several types of stakeholders and an elaborate scenario will be organized. We will also participate in several small workshops and dissemination activities to assemble a high number of evaluations.</p>

2 State-of-the-Art

This state-of-the-art especially concentrates on design methods used for developing interactive prototypes. During the last development period, an important aspect was the involvement of different stakeholders into the design process and the discussions on urban issues. Therefore it was necessary to make use of different design methods to achieve a most rich set of results.

2.1 Design methods based on user actions

Some groups of researchers look for a higher focus on user actions while designing tangible interaction. Buur et al. (2004) and Jensen et al. (2005) propose design methods to encourage skilled actions in TUI design, such as the Hands-Only Scenario or the Video Action Wall. Larssen et al. (2007) introduce four themes around how our bodies establish relationships with things and discuss which role these themes can play in TUI exploration and design. Fernaeus et al. (2008) claim for a shift from an information centric to an action centric perspective on interaction and propose to consider tangible representations as "resources for action".

2.2 Cultural probes

Working with 'cultural probes' – carefully designed packages of postcards (with images and questions), maps (for identifying relevant places), disposable cameras with listed requests for pictures, photo albums (for a story in pictures), media diaries, and other material (Gaver et al. 1999) – is a method for provoking inspirational responses from large numbers of people. They make sense where the aim is to understand local cultures, bridge distance, identify diversity and differences. This method is inspired by the Situationists and the Fluxus movement who worked with the concept of psycho-geographical maps of cities as representations of the topology of people's longings, fears, isolation, sociality, etc. Although working with cultural probes are a widespread technique by now, there are few discussions of the problems related to developing evocative probes on the one hand and analysing and translating them into meaningful interventions or design ideas on the other.

An example of cultural probes and how they were used for the development process is provided by the students at Vienna University of Technology. They designed as part of their year project, in which they collaborate in small groups with the aim to research a topic and develop a design. One of the student groups¹ had decided to work with non-hearing people. As, in their first naïve approach, the students thought of communication between non-hearing and the hearing as being 'impeded', they designed probes that required written input, such as a diary and a story. The students were disturbed to experience that non-hearing people may have considerable difficulty in expressing themselves in writing (see the returned probe Figure 1). They learned that, up to very recently, BSL (the sign language) was not properly taught in Austrian schools to non-hearing people, and this made it very difficult to learn read and write in German (which from the point of view of non-hearing could be considered a second language).

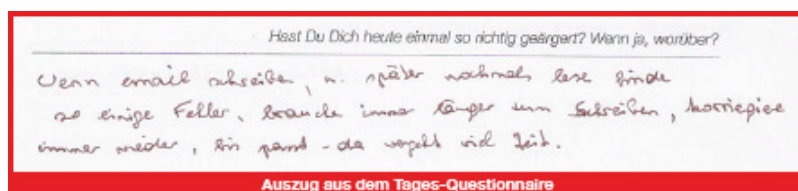


Figure 1: Probe with question: 'Do you remember having been really angry? Why was it so?' - 'When I write an email and read it later I usually find mistakes, writing always takes time, I correct until it fits, and this takes a lot of time.'

¹ Florian Grashäftl, Bernhard Holzer, Albert Kavelar, Peter Smejkal, Criselda Tasico.



Figure 2 Small box with carefully designed constraints

The students also designed a small box that participants were supposed to fill with small relevant objects that told of events of their day (Figure 2). The students cleverly introduced the constraints of box size and small opening so as to limit the input to 'small, ideally foldable objects such as old theatre tickets or notes but also newspaper clippings or wrappings from sweets'. Also important was the impossibility of opening the box, having placed something in it. What they found in the boxes were, for example, an uncooked noodle (for what the person had been cooking), a used pen (reminding of the difficulties of non-hearing students to follow a university course), a turquoise ribbon (standing for the official recognition of BSL, but also for 'deaf power'), and a print-out of an email informing the recipient that a particular course was being translated into sign language. The messages embedded in these boxes were very personal and did not necessarily lend themselves to a straightforward analysis. They rather helped students establish a relationship with the people they worked with, sensitizing them to some aspects of their lives. The content of the boxes could not be turned directly into design materials.

2.3 Drama and Props/Role-Play

One of the methods of participatory design to explore and gain empathy for a context of use/users is drama and props and role-play. The aim is 'Getting a bodily understanding' (Brandt /Grunet 2000) of situations, their work tasks, personalities, life styles and interactions with others. The drama subdivides specific situations into sequences and performs them step-by-step. The actors represent personas with different characters, expectations, knowledge, etc. and play a predefined role. The method is open-ended and flexible. The use of props to foster the performance is optional.

3 Year 3 Prototypes

The toolset for MR-based urban planning on site, was developed in a user-centred design process, in two cycles of development-evaluation-redesign. A main focus of the year 3 prototypes was to develop them in a more intensively cooperation with different stakeholder representatives. We organized two participatory workshops within the context of a same urban planning project: the *Caserne Bossut* in the city of Pontoise. The first workshop was carried out in Vienna, June 19, 2008, with a student group from UniAK as participants. We installed a small setup of urban technologies and experimented with use-cases dealing with urban topics such as time, connectivity and distance. The results of this analysis were used to prepare a second workshop in Cergy-Pontoise in September 2008 in a more elaborate setup of urban renewal technologies, all assembled in the MR-Tent. As participants, we invited different types of stakeholders – urban planners and specialists, members of the municipality and representatives of the local community.

The workshop sessions were video-recorded, and transcripts of significant episodes were produced. In addition we used several digital cameras to capture interesting situations and included saved images of visual scenes in our analysis. Data analysis was carried out collaboratively in the team, with attention to the details of participants' interactions (as revealed in selected video clips) and to the intense discussions that took place during the workshop sessions, where participants addressed questions of the project – which interventions to carry out – but also commented on features of the tools and on their potential role in urban planning. After the workshops we engaged in extensive re-design activities.

3.1 The project

The two participatory workshops in year three were organized within the context of the urban planning project of the *Caserne Bossut* in the city of Pontoise. The site was chosen in relation with the urban issues addressed by the Agglomeration Community of Cergy-Pontoise and the Planning and Urban Design Summer Workshops organized by the Ateliers with Cergy-Pontoise University.

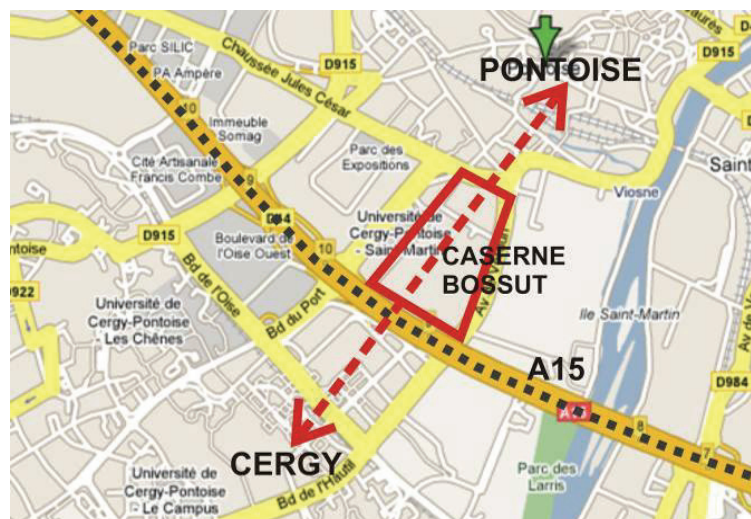


Figure 3: Location of the site in Cergy-Pontoise

The barracks of the *Caserne Bossut* (1914-1916) are nowadays a wasteland situated at the borders of highway A15 that crosses Cergy-Pontoise, one of the new towns created 40km away from Paris in the '60 (Figure 3). Since the facilities were no more used for military functions, the 13-hectare site was sold to the local authorities in the '90s. It is now owned by the Agglomeration Community under the municipal authority of the City of Pontoise. During the period 1999-2004 the site was handed over to the artistic association *Usines Éphémères* that transformed these, architecturally speaking, original military buildings into artists'

studios. Since 2005 the area is hosting a police department and is used as a training field by the fire brigade.

The *Caserne Bossut* corresponds to the big mono-functional entities typical of the New Towns. Nearby there are other facilities with a similar introvert logic: the private school Saint-Martin and Cergy-Pontoise University. However, since the casern was not open to public life, it is perceived as a sort of huge hole in the urban texture. Being owned by military services for almost a century the site was not affected by evolutions, and in particular by the creation of the New Town. This time gap can be taken as an opportunity to reflect on urban issues calling out to artistic creation. This is one of the reasons why the experience with *Usines Éphémères* was particularly interesting. It was also the only period when the site was somehow integrated to the ordinary urban texture and it is nowadays one of the last large land reserves in the city of Pontoise.

A development plan was prepared for the area under the guidance of the Agglomeration Community. It anticipates the construction of 2000 housing units and the development of a commercial zone including a convention and exposition center. The future district *Bossut* will also be equipped with a school and a childcare center. The new constructions will be replacing 90% of the existing buildings but the streets will be conserved. The *Place d'Armes*, the central open space, will become a major public space and a place of animation.

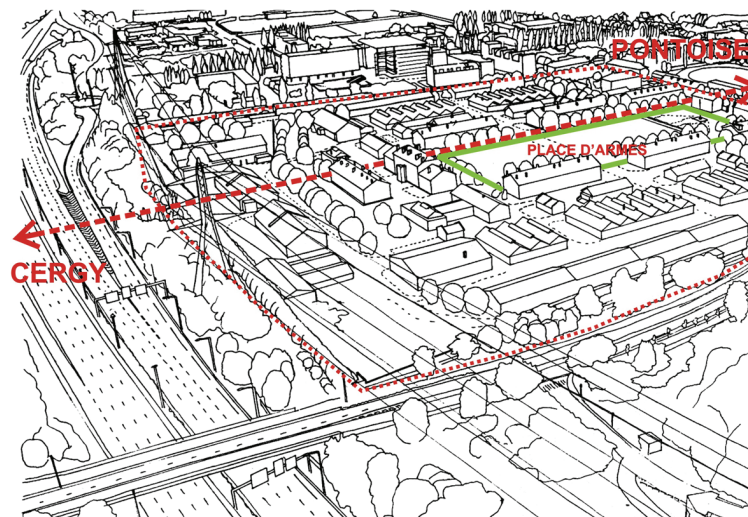


Figure 4: Urban issues for the Bossut district (image from Gueguen (2001), p. 25)

The main urban stakes concern different scales and the point of view of several stakeholders. The City of Pontoise, for instance, is careful about local effects (the nearby residents, the relation of a historic town such as Pontoise to the modern centre of Cergy, etc.), while the Agglomeration Community has both the point of view of the owner, responsible for the site itself, and a larger vision due to its metropolitan competence. In this perspective, an important urban issue concerns the identity and the uses of the site: will it be a transit space with vivid activities or a place for rest and leisure? Therefore connections and public transportation are very important elements: the site is at equal distance from the two main train stations of Cergy-Préfecture and Pontoise (400m), so the possibility of creating a new centrality has to be discussed (Figure 4). Moreover, the highway A15 acts as a border at the moment: another element for the discussion is the possibility and the way of crossing it. Should it be a bridge or an underway path? Where? For pedestrians or also for cars? Technical constraints, such as the levels of the ground on the two sides and the presence of high voltage electricity pillars, must also be taken into consideration.

3.2 Overview of the technologies

The mixed reality tools that are developed in year 3 are based on the prototypes of year two. Extensive work has been done to integrate the different components into a same place and

workflow. The urban renewal prototypes use several of the interaction tools and infrastructure developed in work packages 4 and 5.

Our technical infrastructure (Figure 5) is set up outdoors in the MR Tent on the site of the urban project. The MR Tent becomes the head quarter for a workshop aimed at stakeholder participation, which incorporates MR as well as conventional planning activities. The MR Tent provides shelter for workshop participants and equipment. It offers an interior space of about 5x5x3 meters, suitable for up to 18 workshop participants, and has adjustable openings on the front, back and on the side, which give view to the surrounding site as needed.



Figure 5: The MR Tent is a portable lab for using Mixed Reality in urban planning on location

Inside the MR Tent, two large screens show views of the urban site (Figure 6). The view is alternatively fed by a live video stream from a remote controlled camera, a panorama image prepared previously, a direct view seen through a half transparent screen or a video transmitted by a 'scout' in the periphery of the tent.

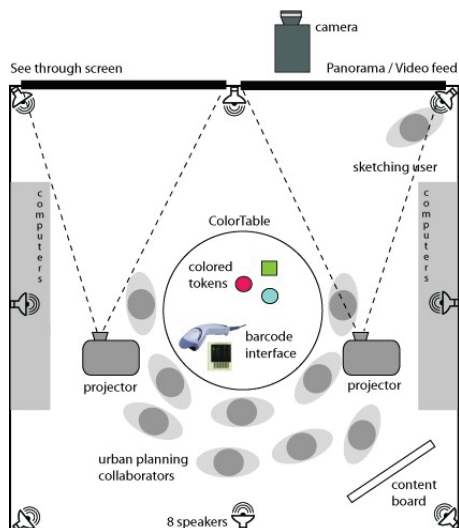


Figure 6: The technical setup inside the MR Tent is centered around the two projection walls and the projection table

The ColorTable is set up in the centre of the MR Tent and provides a top view of the MR scene. It presents a collaborative planning and discussion space – users are motivated to share their ideas and visions by moving colored tokens on the surface of the table. We currently use a set of 56 objects of eight different colors and four different shapes. The tangible user interface uses computer vision based tracking from an overhead camera for untethered interaction (Figure 7). Specifically, the system is able to detect the positions, shapes, colors and sizes of the objects on the table. Users can move and turn existing

objects, while an overhead video projection on the table provides interactive feedback. The table view is composed of several layers combining real and virtual elements forming a common interactive space. A physical map representing the urban site can be placed on the table and is pre-registered to define the coordinate system of the interaction. By choosing a different map or a map on a different scale, this frame of reference can be changed.

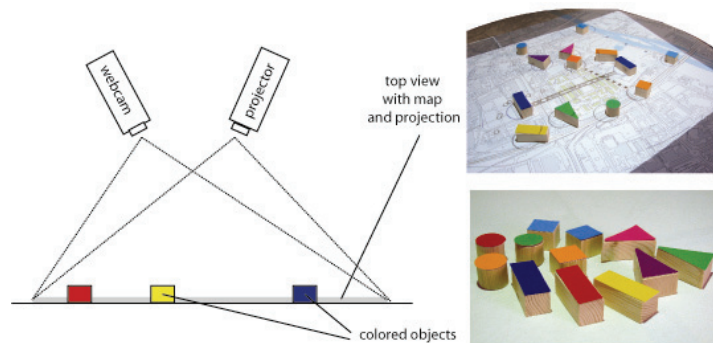


Figure 7: The ColorTable tracks tokens with an overhead camera

The framework relies on multiple interactive views to convey and encourage the urban design process. The vertical screens show egocentric views directed “into the environment”, while the horizontal surface (table) shows an exocentric, top-down view “on the environment”, inspired by maps. Both egocentric and exocentric views are interactive – a sketching tool allows painting “into” the environment (see next section) using the egocentric view, while the table accommodates tangible objects that are intended as proxies for manipulation of artefacts and properties of the environment. Both types of views are connected, so that the effects of changes applied in one view can be perceived in the other.

In order to navigate in the egocentric scene, users can change the orientation of the viewpoint by rotating a rotating disk for rotating the panorama, or by using a wireless gamepad for adjusting the video camera outside the tent which is feeding into the augmented view. The camera is mounted on a pan-tilt unit on top of a tripod stand, and has motorized zoom. Pan, tilt and zoom can be remotely controlled and are pre-calibrated, so that a user can manipulate the camera parameters in real time, while the overlaid graphics stay registered. We also pre-register different panorama viewpoints that can be loaded individually. For each viewpoint, a barcode is fixed on a physical map deployed on the table, representing the corresponding position in the panorama.

A collection of scenario-specific content is stored in advance in the Hypermedia Database (HMDB). We use content provided by architects (e.g. low-polygon CAD models), simple 3D shapes like cubes or polygon strips, objects created from segmented photographs and spatially arranged sound. To make the content available to the users, we use a whiteboard with small, magnetic cards showing thumbnails of the digital assets together with barcodes for accessing the HMDB.

The basic functionalities of the urban renewal prototypes were refined and adapted as part of a participatory process of preparing the workshops. The detailed descriptions of each prototype are included in the following sections.

4 Workshop with Prototype 1

The idea of the first prototype which led to a workshop at TUW in June investigates specific planning tasks on a conceptual level in order to incorporate them into the workshop-scenario of Cergy-Pontoise in September. Within an intense collaboration between TUW, UniAk and its postgraduate program 'Urban Strategies' questions concerning the site in Cergy-Pontoise were addressed and discussed from different angles during the design process. In a first session we defined the purposes for our integrated design approaches as the following:

- Build an Urban Rules application that can be used in conjunction with the Environment Design application
- Create a scenario that can be applied to the Cergy-Pontoise scenario
- Enable people to show their own interests
- Give inspiration by providing possibilities and constraints
- Encourage discussions on modifications of the site
- Make use of the ColorTable as tangible user interface: it's neither a pure simulation/visualisation tool, nor a pure physical planning tool
- Show problems and consequences, but do not solve them
- Get output ideas and preferences that urban planners can use for their project

UniAk set up a program for the new course of 'Urban Strategies'. The group of 15 students then developed individual scenarios based on the given task.

The aim of this two-piece course was to develop urban rules that investigate the notions of time, distance and reachability and their specific influence on urban planning strategies. In the first part the students explored the potentials of various urban parameters and their interdependencies, which mirror restrictions and possibilities of quantifiable and qualifiable data. Secondly the rules were evaluated and applied to the urban context of the forthcoming workshop scenario in Cergy-Pontoise (Paris). The Mixed-Reality application ColorTable provided the conceptual environment as an abstract "world" within which specific urban scenarios can be negotiated.

The workshop started with a demonstration of the ColorTable at TUW, where the students had the possibility to get familiar with the application and comprehend its potentials in an open discussion.

Later during several presentations and meetings the students were supported by UniAK and TUW was invited as external critics and specialist for the versatility of their concepts in accordance with the possibilities of the ColorTable.

Within the discussion about the student's approaches we focused on:

- How can we provoke a discussion on urban topics with the proposed theme? Which are the different stakeholders that are to be addressed?
- How does the chosen task of the student reflect the purposes of the ColorTable?
- How can the proposed rules be further defined in order to match the required preciseness of program language?
- How to visualize the information and functionalities within the different modes of representation offered by the ColorTable; map space (birds eye view on the table), perceptual space (first person perspective, panorama).

The design research questions for the workshop were:

- How can we further optimize interaction for users? How can basic tokens provide visual and tactile guidance?
- Are the users able to fully use the application and understand the relation between importing content (magnetic barcode, barcode trays), the basic tokens and the tracking colour tokens?

In a third step UniAk and TUW selected several concepts out of the student's propositions in order to combine them into a workshop scenario to test the new functionalities for later field trial in Cergy-Pontoise.

4.1 Preparation

4.1.1 Urban topics

Urban Rules II: time - distance - reachability:

Within various disciplines related to the discourse on urban environment and within concrete scenarios of decision-making, usually conceptual models represent the systems of specific investigations (e.g. settlement behaviour in respect to transport and land use; simplified economic models as general equilibrium models of markets; analytic models for visualizing specific phenomena (dynamic or static). These models are simplified representations of reality, which helps to gain knowledge about it. What they have in common is the necessity of an inherent logic that allows understanding the interrelations of the various elements, which constitutes the respective system.

The spatiality of a city within the notions of time, distance and reachability not only relate to its physical body but also to programmatic contexts and individual perception. The condition of the ground, its mere physical constitution or its inscribed rules (economically, politically, culturally etc.) has an effect on its occupation in single moments and over longer periods. The actual movement of people and goods, possibilities of locomotion, individual needs and desires on the one hand reflect the given condition, while at the same time being initiators or catalyst for transformation and change.

Having the urban context of the site in Pontoise and the functionalities of the ColorTable application in mind, the key questions for the student's investigations were:

- What are the elements, influences, indicators, the direct or indirect forces to conceptualize a time-based notion of the city?
- How can one translate these factors into simple parameters and precise numbers, in order to build a system that reflects their mutual relationship?
- What are variables and which are the invariants in the model?

From the very beginning the students adopted the visual appearance of the ColorTable application, by interpreting its interface as an abstract diagram. In order to extract single parameters of the complex urban environment the elements of the ColorTable itself served as an abstract model with two different entities: the tabletop itself was interpreted as a two-dimensional territory whereas the tokens signified mobile objects (programs, buildings, individuals, abstract values) that have impact on the territory or influence each other (Figure 8).

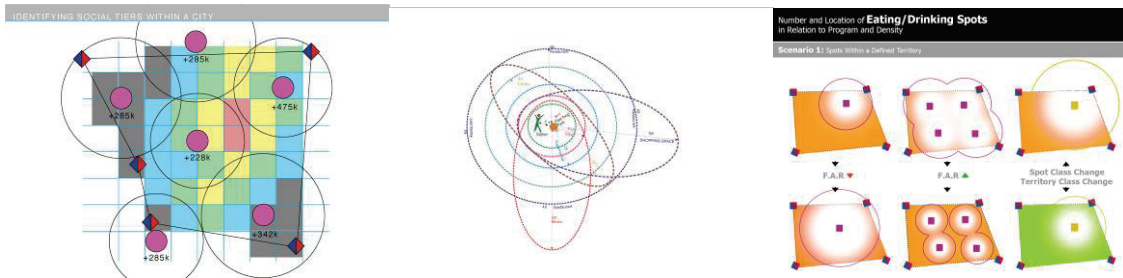


Figure 8: Interpretations of the Elements of the ColorTable: Relationship between Territory and Objects

According to the workshop brief the students chose individual topics, varying from abstract theories, local impacts up to complex conditions in larger contexts, such as the general questions of spatial distance and actual reachability, the influence of noise to a certain territory or the relation of public and private properties depending on land value (Figure 9).

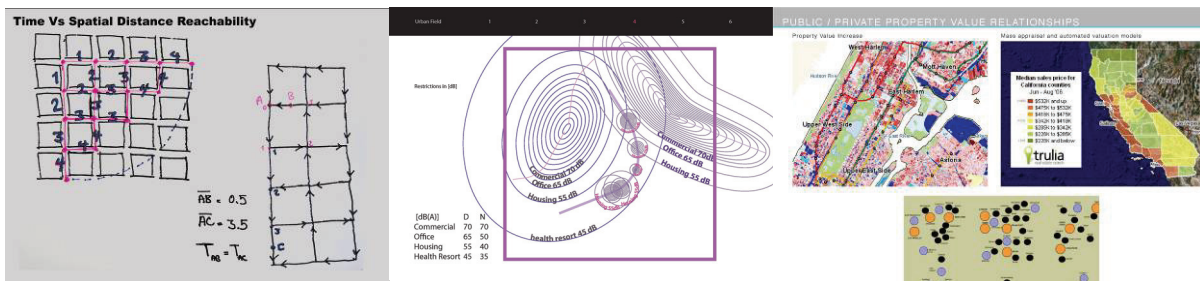


Figure 9: Way-optimization: Measurements of Distance and Time, Impacts of Sound, Dynamics of Land Value

In the second part of the workshop the students were asked to conceptualize a dynamic system based on their chosen topics that can be used in conjunction with the ColorTable application. In order to enhance discussions about the project site in Cergy among different stakeholders, the students focused on specific points of view on the site and its respective representatives, such as:

- different types of individuals at different ages and with different needs and patterns of daily life
- responsibilities, decision makers and users of various types of public and recreational spaces
- economic and ecologic issues: the reciprocal relationship between territory, different uses and the organization of space
- different kinds of locomotion in relation to the layout of street patterns and its connectivity

After defining sets of parameters and their interrelations the students developed possible scenarios for activating the site and reconnecting it to its surrounding, and visualized them in diagrams, which reflect the positioning of tokens on the tabletop (Figure 10).

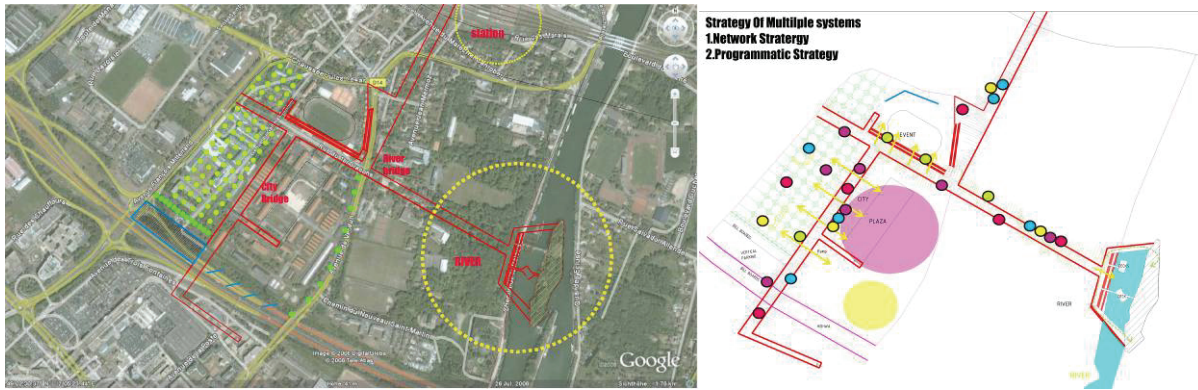


Figure 10: Contextual Diagrams about Network Strategy and Programmatic Strategy

When reviewing the projects at the final presentation it became clear that the degree of complexity directly relates to its feasibility within the ColorTable application. The results offered a large variety of conceptual approaches of possible negotiation scenarios for the site in Cergy and offered many ideas for the use of the colortable application’s elements. Some extended the site of intervention to a larger part of the city, which conflicts with the relation of token size and scale of the territory when mapped onto the tabletop. Other projects precisely described how to use tokens for creating patterns of usage by defining different programs: types elements: punctual functions, laminar elements (roads, paths) and territorial extension (park). According to the uses these distributed functions affects each other. The students also classified the kind of impact and discussed about feedback possibilities if uses are compatible with each other or conflicting (Figure 11).

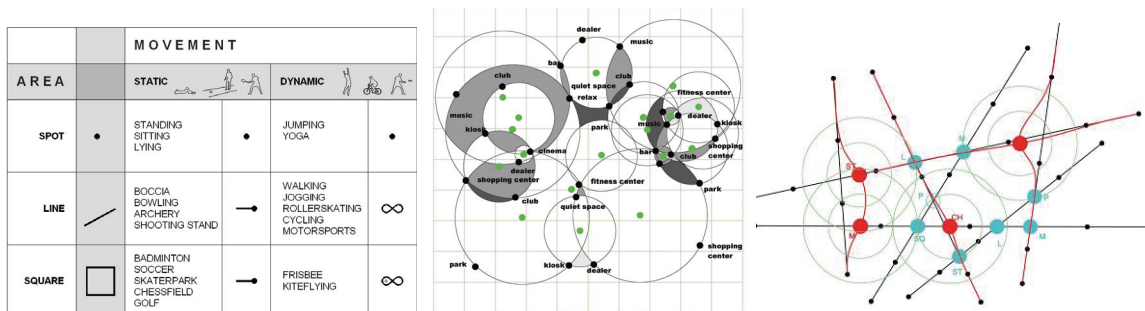


Figure 11: Types of Programs, Individual Desires, Compatibility and Conflicts; Distribution of public Functions

4.1.2 Description of the technologies

Post-graduate students from UniAK developed several theoretical approaches for connectivity-centered applications for the ColorTable. Their ideas were used to completely redesign the functionality of the flows. At the subsequent Urban Rules workshop in June this new implementation was presented for the first time.

Adding and removing connections

Special tokens enable the users to place connections by placing two of them, each one representing an endpoint, on the ColorTable (see

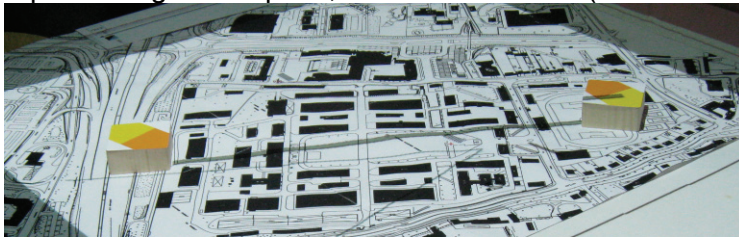


Figure 12). Via bar-code the desired type of the connection can be set. The supported connection-types are *path*, *street* or *highway*, where each of these has different speed limits and constraints regarding the type of flows. (e.g. the cars must not use paths.)

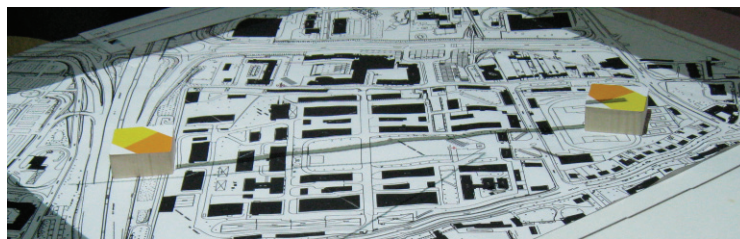


Figure 12: Adding a connection with two special tokens

Once a connection is placed and the according bar-code is read in, the active connection automatically freezes and remains in this state until it is moved or removed. In order to do so, the two tokens need to be put near the both endpoints of the connection and unfrozen again with the appropriate bar-code.

Assigning Programs



Figure 13: Programs are represented on small content cards

Different programs are represented on content cards with images and corresponding barcodes (see Figure 13). They allow the users to assign billboards or 3d-objects to colors of their choice. As usual the content is selected via the bar-code-reader, while the tangible selector is used to choose between the different colors.

Positioning Programs

There are two different classes of programs: punctual (e.g. hospital) and laminar (e.g. park). Punctual programs are positioned with one single token and are defined by a program-dependent radius around this point. To define a laminar program two tokens of the same

color have to be used. They define a line, with a program-dependent width, resulting in a variable rectangular area.

Defining Waypoints

One of the main objectives of this prototype is experimenting with flows, so beside the new definitions of connections (paths, streets, highways) we also added a way-optimizing algorithm that calculates the shortest/cheapest paths between arbitrary points in the networks of our connections. Two special tokens are placed on the map and mark the start and endpoint of the route, while an additional configuration-area allows to add extra waypoints to the path that need to be visited. The colors in the configuration-area correspond to the colors of the programs (assigned by the user).

Monitoring System Feedback

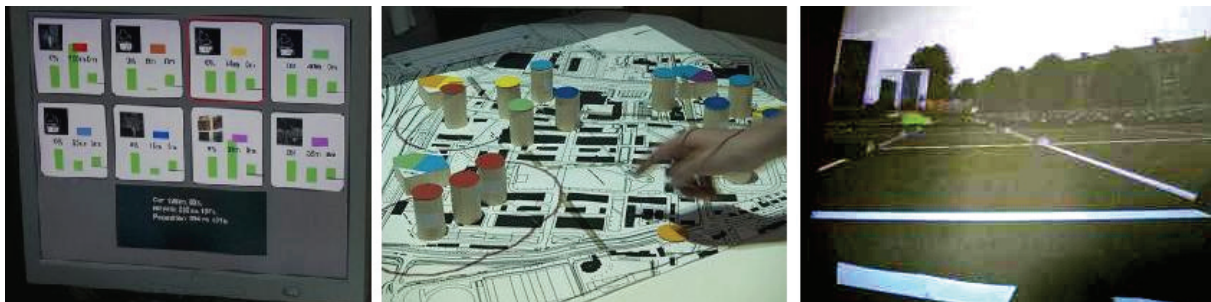


Figure 14: Info screen, foot prints and panorama-projection provide visual feedback and representations

Due the limitations of the different connection-types, the paths are optimized for every kind of flow separately (car, bicycle pedestrian). The Info Screen displays the distance and approximated time for each flow-type to allow more detailed analysis of the designed connection network. The footprints of the programs, the connections and the individual flows are displayed directly on the physical map, while the visual representations of these in 3d-space appear on the panorama-projection, that can be rotated as usual. The three types of feedback are shown in Figure 14.

Setting Fast-Motion

The simulation of the traffic and pedestrians can be followed in real-time or fast-motion. Bar-codes allow to set the time multiplier to single, double, fourfold or even higher simulation speeds.

The redesigned physical objects and tokens/Prototype I

To meet the feedback and the results of the workshop “Urban Rules” from 2007 new colour tokens in form, material and size were designed and built. The tracking colour itself does not longer represent a specific content e.g. the height or volume of a building. This decision was made after the first workshop, as the users called for more content. We met the challenge with a fixed number of 20 basic, cylindrical tokens and 40 tracking colour discs (each colour of the 8 predefined tracking colours has 5 discs).

A white sticker at the side face of the cylinder was giving room for annotations with a pen. The idea was that, users may want to make notes to remember thoughts and important comments in the discussion regarding specific media. (Figure 15)

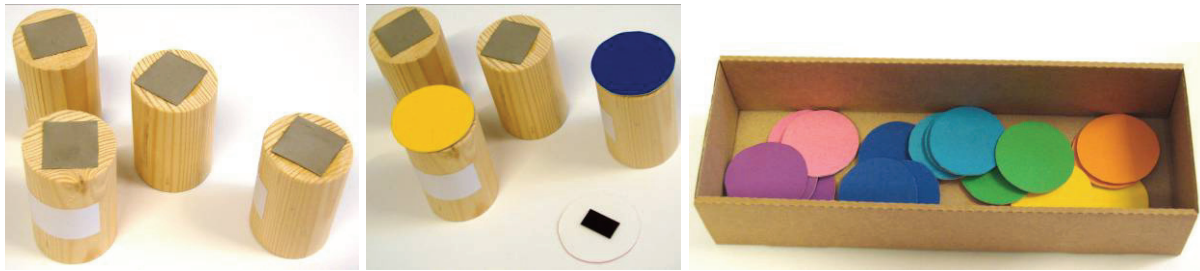


Figure 15: Basic tokens; attached tracking colour tokens, tracking colour tokens

For specific interactions the user needs two square tokens to set the beginning and the end of an connection. A second pair of wooden squares provides a “Trip” shown as flows in the panorama view. The user gets an impression about the placed connections in the scene and gets help to evaluate them (see Figure 16).

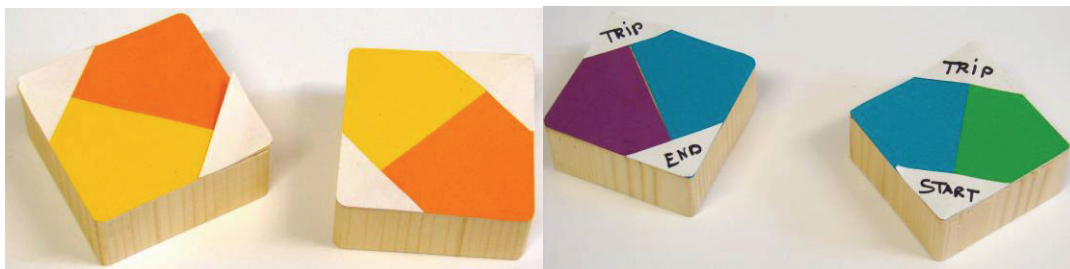


Figure 16: The special tokens: Pair of connection tokens, pair of trip tokens

For this prototype we also improved the barcode trays in adding some little icons next to barcode text for faster understanding what it is for. Together with the appropriate barcode photos of little rectangle cards represent the media content (see Figure 17).

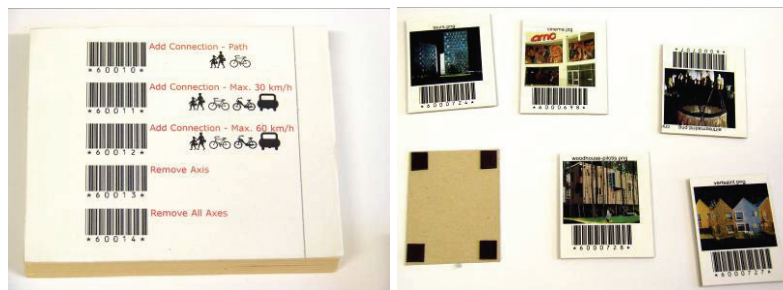


Figure 17: Barcode tray with icons, magnetic content

Specification

Hardware and OS	3x Laptop, Desktop, 2x Projector, Webcam, Flatscreen, Barcode Reader, ColorTable, WinXP
Software	ColorTablef framework, Muddleware, Studierstube, Open Tracker, Tomcat, HMDB
Core Features	Defining connections (streets, paths, highways) & waypoints (different programmes) and observing the resulting traffic (cars, bicycles, pedestrians)
Status	gamma-prototype
Intended users	stakeholders
Showcases	WP6
Relevance beyond project	yes

4.1.3 Workshop planning

Role-Play

In the workshop we were applying a method of participatory design to make the discussion and the interaction from the students with the ColorTable more alive and to awake their sense for the context of use. The idea was to have a set of defined roles and each student has to pick out a role/persona and adapt to its style, interests, argumentations and background. We planned different roles for elderly, businesspersons, family members, youth, urban planners/architects and persons from city council representing the typical stakeholders from our ColorTable.

Preparation step

The first task in the workshop plan was to choose programs from the content board. This can be done alone, or in small groups. The content is then discussed in the whole group to select 8 of them and stick them onto the selection board next to a specific color.

We prepared different types of programs, each one is represented by an expressive billboard and assigned with a default size (Table 1).

Category	Point	Area
Public open spaces	Playground (children) Playground (youth) Look-Out Restaurant Café Pub Hotel Youth hotel	Parc Square Market Camping
Commercial	Shopping center Discotheque	
Culture	Museum Theatre Library Concert hall Cinema Exhibition centre	
Sports	Fitness centre	Swimming pool

Table 1: We prepared different types of programs, represented by expressive billboards.

Discussion step

We prepared three different issues to be discussed and explored on the *ColorTable*. To facilitate the learning of the different interaction possibilities, we planned to sequentially introduce the different discussion steps. Users may however move to and come back to another step at any time.

The three discussions address the issues of setting connections, positioning programs and exploring distances of trips (Table 2).

Set connections

- set or modify connections between main anchor points: each connection can be set as pedestrian way, slow street (30km/h) or fast street (50km/h).



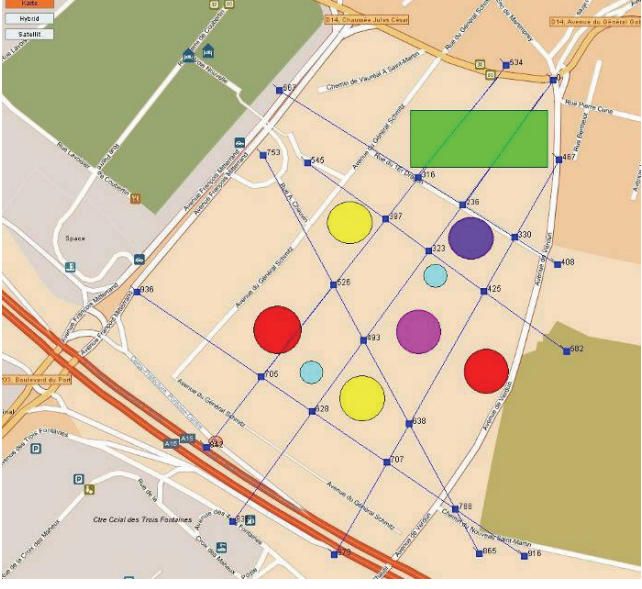
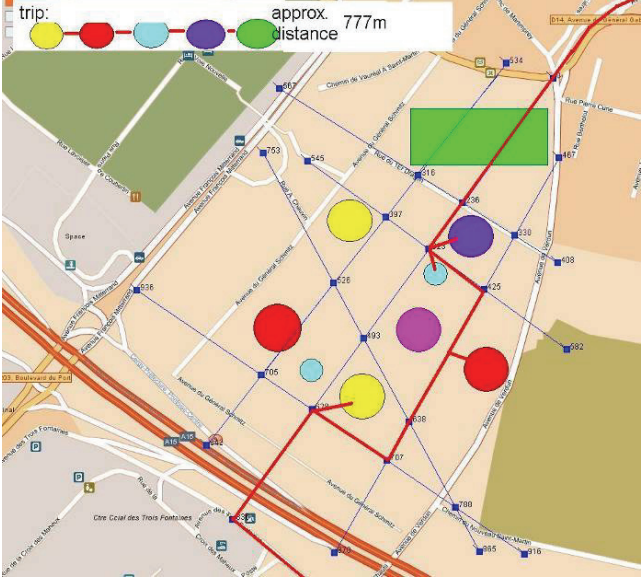
<p>Position program as points or areas</p> <ul style="list-style-type: none"> ▪ assign programs to color objects. Each program is available in 2-3 different sizes ▪ position programs on the map as point or area ▪ see the programs as expressive billboards on the perspective view. The sizes of the programs are reflected in the size of the billboard 	
<p>Distances of trips</p> <ul style="list-style-type: none"> ▪ set a sequence of the programs according to an own interest ▪ as option set a starting point and an ending point different from a program ▪ study distance to accomplish in meter and in time for 3 types of transport (pedestrian, bike, car) ▪ see the flows walking onto that trip, each one having a different speed. The cars may go a different way, as they are not allowed on pedestrian ways. Change the speed of the time passing 	

Table 2: Three different issues to be discussed on the ColorTable

4.2 Testing

The workshop started with an explanation of the different tasks the students were confronted with. These were to discuss topics of time, distance and reachability in the city by negotiating a) the connectivity of the site; b) the distribution of programs and c) individual visions for the public and communal space.

We continued then with the introduction of the role play and following students were adapting to the roles of:

- **Elderly Person:** Sahand, Burcu
- **Family Member:** Vakhtang, Timea
- **Youth:** Stefanie, Sachin
- **Business Person:** Isolde, Pu-Ming
- **Urban Planner/ Architect:** Mohammad, Sophia
- **Person from City Council:** John, Jois, Sevasti

As first step the students assembled around the content board and started to discuss and select the programs. They first arranged the cards on the board and then put their selection onto the content tray: people drinking (orange), place du marche (pink), swimming pool (green), wood houses (light blue), cinema (purple) towers (red), airtree madrid (yellow), row-houses (dark blue).

We then continued with an explanation of the different functionalities of the ColorTable. The students immediately started to define several streets. As the map was too small to show the surroundings of the site, they didn't manage to connect Cergy and Pontoise.

As a next step the group switched to the programs and discussed their location in relation to the surrounding and the streets. To visualize their ideas, they put the content cards directly onto the table and moved them until they agreed on the distribution. One of the students adopted then the role of assigning the programs to the colored tokens. He selected stepwise each color, assigned one of the programs, and placed the card onto the content tray to remember the representations. Some other students prepared the tokens, they placed the wooden objects on the side of the table and equipped them with colored plates. When finished, the group positioned the tokens onto the map and observed the footprints and the visualizations on the panorama. A lot of time is dedicated to the positioning of the towers and the pool. As the tower seemed to small, the participants changed the size. They added and removed constantly some tokens, observe the modifications in the panorama and on the info screen, change the viewpoint, rotate the panorama, modify streets and add flows.

The workshop ends with a debriefing sessions around the table where participants commented on their experience and ideas for redesign.

4.3 Evaluation

In general our decision to split the workshop into a sequence of task which was explained beforehand seemed to be very successful, since the participants were able to concentrate on the recent task.

During a brief description of the functionalities of the prototype the participants were carefully listening for identifying their own concepts, leading into a first discussion about the application. As we did not intervene and skipped explaining the trip-calculation, this functionality was not used in the end.

It was also useful that the students already had worked on the site, so the decision making process was purposeful.

4.3.1 Communication in Role-Play

After a short description of the workshop tasks including the role-play the students were able to enter a discussion about choosing the program, although some of them seemed to be shy about arguing in terms of their given role.

The students used the content board to select a set of programs to be used on the table. They moved and arranged the magnetic cards to discuss which ones are important for which role (Figure 18).



Figure 18: Selecting programs on the content board.

The ColorTable served as medium for communication – we observed intense discussions including placing, removing and exchanging of objects. An important part of the discussion was dedicated to the amount of towers to be placed onto the site, as well as the position of a swimming pool (Figure 19).



Figure 19: Placing, removing and exchanging objects to discuss different possibilities

4.3.2 Level of representations (map vs projection)

Having a broader idea of the site the students complained the scale of the map being too small to connect Cergy to Pontoise, although the panoramas showed distant information about the disconnected part of Pontoise. As we provided a print out of Cergy-Pontoise at a larger scale next to the projection screen, the students used it in order to define the correct angles of the connecting roads and pathways. This was in particular useful information for the preparation of the later workshop at the actual site.

The students placed content cards directly on table-top to discuss the location of functions programs in relation to surrounding and streets. Since they were aware of the Content Card not representing the function in the panorama, this can be explained by the habitual way of firstly sketching a general layout of the urban site to grasp the dimensions before visualizing perspective scenarios. Also the view angle of the panorama did not show all of the placed functions they related to during the discussion (Figure 20).



Figure 20: Placing and Discussing Location Content Card on the Table

They also used the two dimensional visualization of the sizes of program on the table top (projected circles, lines and animated dots, representing the flows) for discussing the compatibility or conflicts of adjacent programs, and adoption of streets. Whereas the sizes of towers or other vertical elements that strongly affects the spatial representation of the scene were observed in the panorama while arguing for increase or decrease and precise spatial allocation (Figure 21). In particular the grid that was visible within in the panorama, while not appearing on the table top seemed to be irritating and was eliminated.

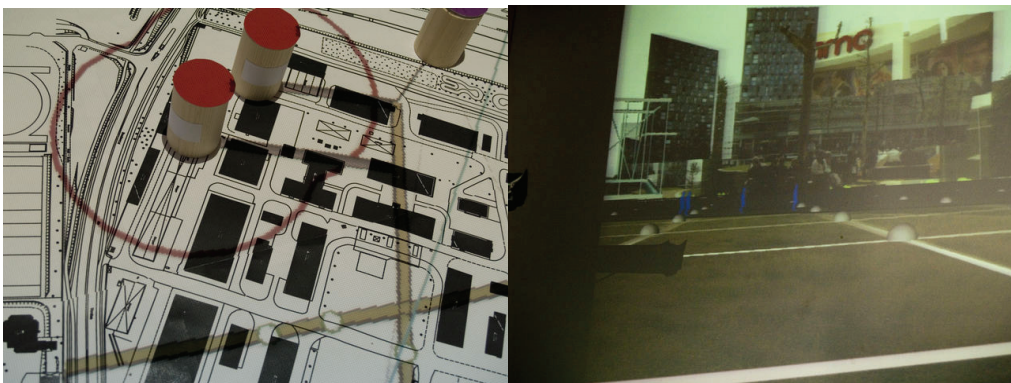


Figure 21: Dimension of Functions: Occupation of Territory on Tabletop; Vertical Objects in Panorama

After agreeing on the general organization of space concerning connectivity and distributing functions the group decided to change the panorama and observe the site from +30 meters from the adjacent University. When observing the scene the students discussed the unexpected but inspiring appearance of a two layered transportation network. Although the spatial representation does not match with initial purpose (roads should be on ground-level), the students agreed that from this distant view the created scene can be better understood (Figure 22). They stated that a close up of such a complex scene was very confusing, since too much overlays of bill boards reduces the depth information of the space and the possibility of orientation of perspective and dimension of the single images.



Figure 22: Panoramic View from +30m

During the de-briefing students discussed about the images that represents the physical tokens in the panorama, especially when the table was very crowded. Since the size of the tokens remains the same whereas the images strongly vary in size, they found it sometimes difficult to identify the right connection between single tokens and the respective bill board. They also mentioned that it was difficult to familiarize with the *scale-jump* of the varying scales of the table top (size of the tokens does not fit to scale of the buildings on the map). Having a diagrammatic representation with additional information on the table (projection of territory occupation, roads and flows etc.) was seen as very helpful for understanding the reorganization of the space and for spatially connecting the two different media (table and panorama). Projections would be better recognizable with less contrast in the map (black hatches of buildings).

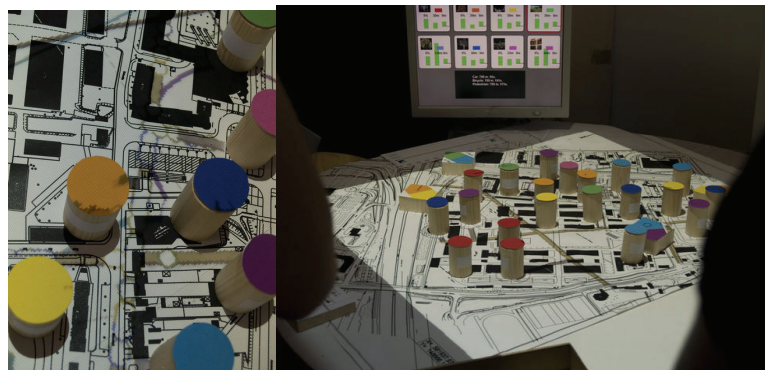


Figure 23: Information on the Tabletop: Tokens, Map of the Site, Projection

According to the students the application contents of too many different devices for handling and feedback (content-tray, tangible selector, rotating panorama) and ask if it would be possible to integrate a touch-screen, that can combine them.

At the same time they regretted that no specific feedback was provided, that reflects the relation between conflicting functions. They also request sound in order to enhance atmosphere of the scene.

4.3.3 Sequence of activities in the workshop

Considering the type and number of different activities that were performed by the students, some insights can be extracted. One main issue is the temporal distribution of learning activities and actual working activities. We planned to explain the interactions of each task right before the participants use it for their discussions. This however resulted in interruptions

of the participant's workflow and discussions and therefore interfered with our idea of supporting negotiations between different stakeholders. To avoid the interruptions not all functionalities have been explained and some of them have not been used, such as the definition of trips. Hence, we identified the need of clearly separating learning activities with working activities and of planning a separate learning session in a workshop.

4.3.4 Interaction design issues

Resembling the role-play of the user group the development group adopted certain roles of observation. One of the main issues was once more detecting the various modes of interaction and the problems of use with the physical objects.

In order to discuss and choose the content, the magnetic content rectangles were displaced on a white board. The users used it to point, move around, arrange, and rearrange their collection of media content (Figure 24).

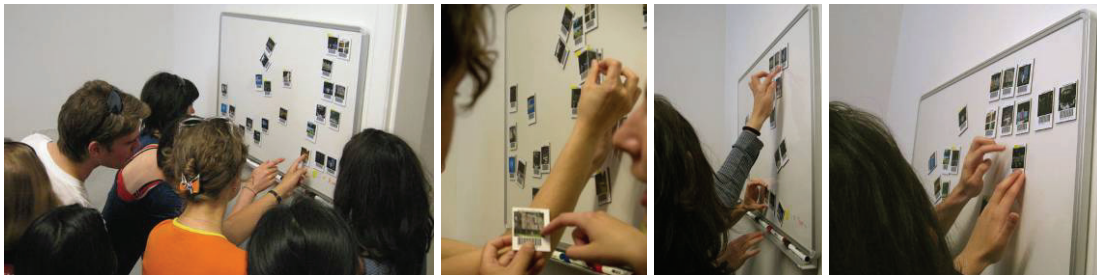


Figure 24: Discussing, pointing and arranging

The usage of the content tray was extended by the users ongoing discussion and arrangement throughout the movement towards the tabletop serving in the intended function to represent the selected content. However, in the later process after importing the barcodes it was blocking the access to the basic tokens (Figure 25).



Figure 25: Displaying content on content tray

For reading barcode and importing content two hands are in use. One user found the only possible way of reading a barcode and at the same time using the tangible selector to define the tracking colour: He placed the content tray with the magnetic content right in front on him on a small table to be able to use both hands (Figure 26).

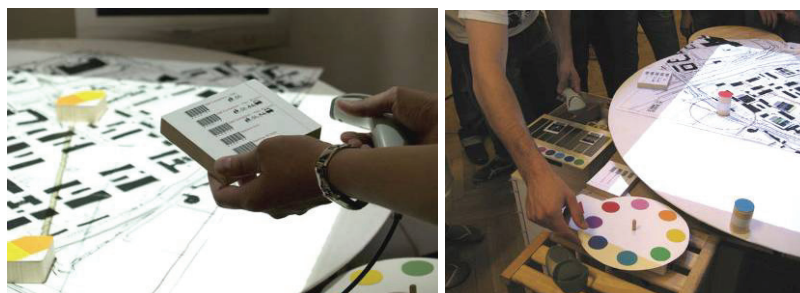


Figure 26: Using barcodes and tangible selector

Equipping basic tokens with more of the same tracking colour tokens – the user wants to place more tokens of the same kind into the scene (represents a tree in the scene). As there is no extra table to work he uses the tabletop (Figure 27).

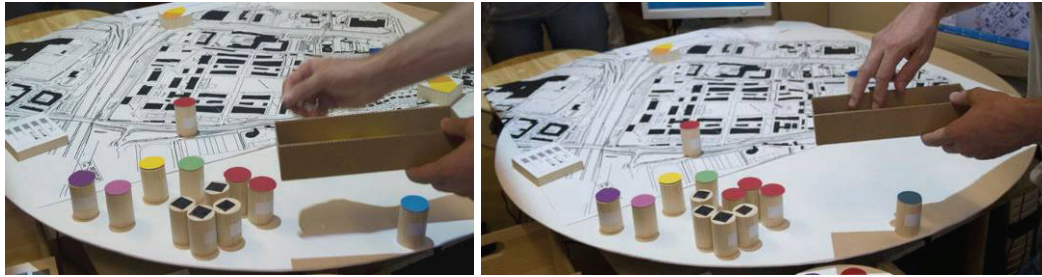


Figure 27: Attaching tracking color plates onto basic tokens

An essential part of making the interaction and the interface usable is the organisation of the workspace. The huge numbers of physical objects around the tabletop is placed at every possible spot around the tabletop and blocking tracking and free interaction (Figure 28).



Figure 28: Numerous objects around the tabletop

Compatible to the researchers aim, the users worked collaboratively while placing tokens and changing connections. The magnetic content rectangles not only served to choose the right content and read the barcode, some of the users used them firsthand for placing media in the tabletop to discuss the content. They defined a new interaction mode and were mixing the magnetic content with the tokens. Due to the fact that the content has to be assigned to a tracked color plate and imported by barcode out of technology reasons, they could not right way see what they have selected (Figure 29).

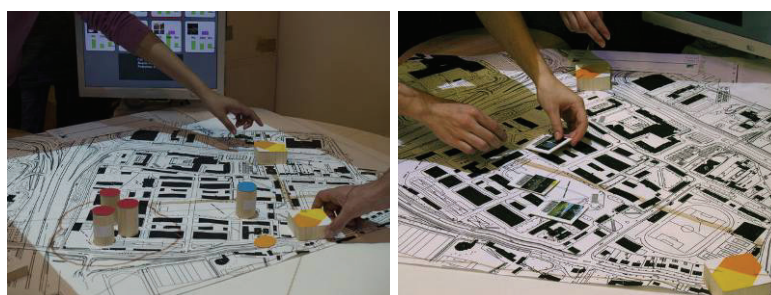


Figure 29: Collaborative working and new modes of interaction

The height the weight and the material of the basic tokens and as well of the special tokens were important to reach the object with a natural grasp. Nevertheless the users gave feedback that the special tokens were oversized and hiding too much of the underlying site map (Figure 30).

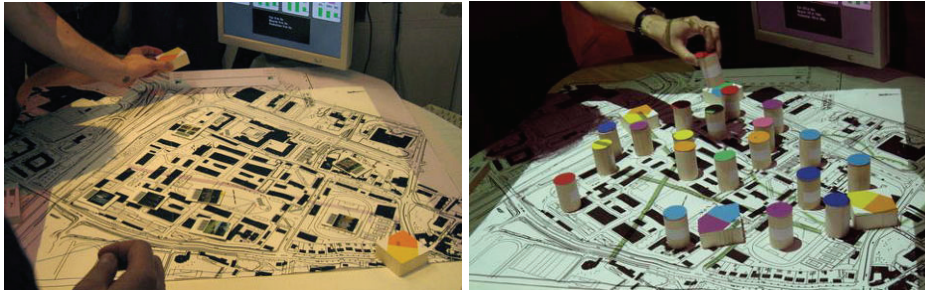


Figure 30: Placing tokens

4.3.5 Implications for re-design

This prototype fosters the visual and haptic revisable difference between basic tokens and tokens referring to the tracking technology. Through the workshop we could observe and see how users understood the basic tokens as just being empty containers for whatever media they want to present with that. Hence, the design has to be specified and intensified further on this matter. The complex issues of collecting and importing content via barcode still seem to be quite a challenge for the users.

Some of the re-design we undertook simplified the use of the objects. However, for this prototype we again implemented additional interaction possibilities. The users, who were participants of the first workshop too, immediately perceived the changes. We detected and learned some main issues through our open feedback rounds with the users. One example is that the possibility of annotations onto the basic tokens did not get used, the information on the info screen got merely ignored and the design of the tabletop is a design of the table and the space and room around.

Important issues for re-design are:

- Continue to investigate the user's chains of action with the various objects and tokens to gain a deeper understanding of interaction.
- Provide other possibilities for the user to make annotations
- Simplify the workspace and provide additional desks for working with the objects
- Experiment with various materials and surfaces.
- Further develop the idea of basic tokens forms to give a visual and haptic guidance and clues for usage.
- Further simplify the interface and the interactive objects, especially reduce the additional devices and objects around – create a clear environment

5 Workshop with prototype 2

Based on the analysis of the workshop with prototype 1, we developed a second, improved prototype to be tested on the site itself. The idea of this workshop was to address the preliminary stages of an urban development scheme. It doesn't focus on design issues, but rather deals with uses, ambiances, problems of daily use, connectivity and accessibility. Participants decide on a number of general principals concerning the site with the outcome to eventually guide the urban design process and the urban design team. The issues to be addressed are interdependent and participants can restructure the scenario as they seem fit.

5.1 Preparation

5.1.1 Description of the technologies

In this section we describe the functionality of the prototype as used during the Cergy-Pontoise Workshop in September 2008. As the tracking technology was improved to support the detection of shapes, we were able to add a more elaborate set of functionalities and provide more guidelines how to use them.

Working with the Physical Map

Physical maps of the site in two scales (1:500 and 1:2000) are available and can be placed on the *ColorTable* surface. Each of these maps provides barcodes at specific positions, to switch between the scales and different viewpoints in the egocentric view. The map is augmented with virtual information, like outlines of defined land uses, the placed connections, the positions of individual flows and feedback from the tracking system (see Figure 31).



Figure 31: Positioning an object on the smaller map

Working with the Egocentric Views



Figure 32: Viewing the scene on two egocentric projections

The MR Tent is equipped with two egocentric projections (see Figure 32). One of the projections either displays a panorama-view with a depth-map so occlusions are handled properly, or a live-video feed from a camera placed outside the tent. Users can switch between this two modes with barcodes. The second projection is the “see-through” on a half-transparent canvas, that combines the real site outside the MR Tent with the virtual scene composed by the users.

Defining Land Use

For the rapid definition of land use we use an automatically computed Voronoi decomposition using circular tokens, put by the users as anchor points. While the top view projection shows the borders of each Voronoi polygon in wireframe, the cells in the egocentric view are textured in an abstract manner to represent the corresponding land use (see Figure 33). Eight colors are reserved for different types of land use, the corresponding texture is illustrated on the side of each token.



Figure 33: Defining land use with circular tokens

Adding Connections and Flows

When thinking about an urban area, its connectivity and transportation to existing locations in the environment play a major role in the discussion. To decide on the types of transport, speed and concurrency, users can define different types of connections and populate them with flows by setting a start and endpoint (see Figure 34). Solid rectangular tokens define the endpoints of the connections with the color determining its type (highways, roads, footpaths and rivers). The start and endpoint of a trip is set by transparent plexiglas tokens. Because of constraints regarding the different connection types as well as speed limits, the shortest/cheapest way is calculated for each flow-type separately. (e.g. boats can not use footpaths, cars drive faster on highways than roads, etc.) In order to animate the moving objects, we store view dependent cyclic flip-frame animations.



Figure 34: Populating roads with moving objects.

Assigning and monitoring content

Seven colors can be associated with content that is selected from content cards, by choosing the desired color on the tangible selector and using the barcode on the content card. This assigns a 3d object or billboard to the specified color as well as a default size and a default set of sounds. Users can change object properties such as transparency or override the default size and associated sounds. The current status of each color can be monitored on the info screen which displays detailed information for every token color.

Positioning content

Having a color associated with content, users can decide if they want one single object of this type or a 3d line. One single object is placed in the scene by simply placing one triangle-token, with the according color, on the physical map. In case of 3d-objects users can also decide about its orientation by rotating the triangle. To facilitate the construction of rows of identical objects (e.g. to build a row of houses) we offer the possibility to define a “3d line” by setting its both end points (see Figure 35). Two square tokens, of the according color, define the end points of such a line and are filled up with identical objects, spaced at adjustable distances.

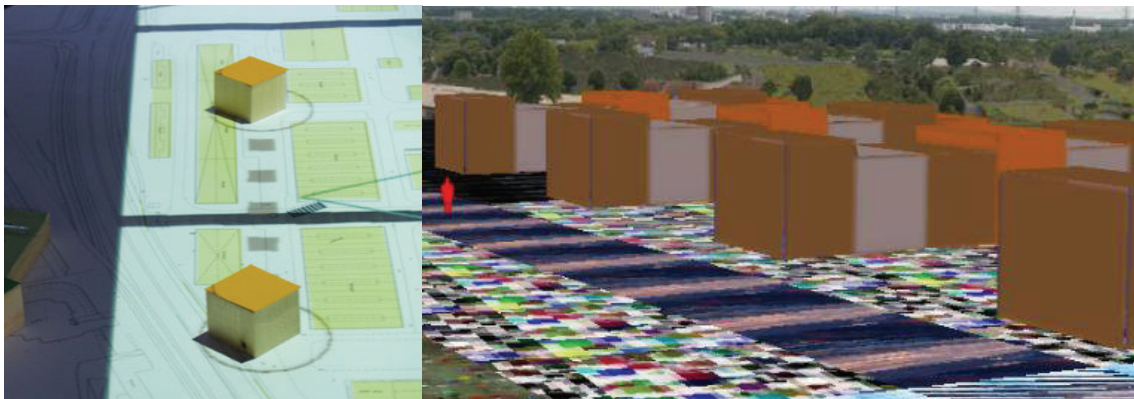


Figure 35: Constructing rows with identical objects

Soundscapes

The MR Tent supports the exploration and manipulation of soundscapes. Each object can be associated with a sound additionally to its visual representation (Most of the content is associated with multiple sounds by default, through which the users can cycle via barcode). The resulting soundscape can then be explored in three different manners by activating a different mode. Users can select the camera position as hearing position and listen to the sound which corresponds to the panorama or video feed. Another possibility is to bound the hearing position to a flow, hence the resulting soundscape corresponds to the path of someone moving with the flows. Finally, the hearing position can be set by placing the red triangular token, defining the virtual listener's position and orientation.

Working with Persistency

The composed scene can be stored anytime by invoking the “freeze” barcode. All color tokens currently placed on the table are permanently added to the scene and saved as a new instance in the history application. Also all the corresponding tokens are freed and available for arbitrary use now. A once frozen object can only be removed with the eraser token (red rectangle). Barcodes allow users to step through the design process and examine or even change all frozen states. The history function does not only allow to go back in time to a previously obtained interesting state, but also allows to use temporality as part of the

inspirational process by looking at the evolving scene over time. Freezing a scene is also a good idea before changing physical maps, because once frozen objects are scaled properly and remain at their absolute spatial positions.

Printing

Users can take snapshots of their compositions at any time. The current exocentric and egocentric views are then saved as images and automatically printed for later reference.

Sketching

Users can sketch directly on top of the projection and also on the 3d objects placed in the scene. This is done with the Urban-Sketcher that supports several painting paradigms. Users can select colors from a palette and choose between different painting-tools (pencil, brush, airbrush).

The physical ColorTable

To simplify the set up of the ColorTable in the MR Tent at the site of Cergy Pontoise we designed a new physical ColorTable. The physical table itself has to sustain the participants using the tokens, maps and technologies and support with a clear structured workplace (see Figure 36).



Figure 36: Physical ColorTable; incl. map and viewpoint, tangible selector and barcode reader

The re-designed physical objects and tokens

To meet additional participant requirements we re-designed the tokens (see Figure 37). To foster tactile guidance we used various materials and forms representing different type of content.

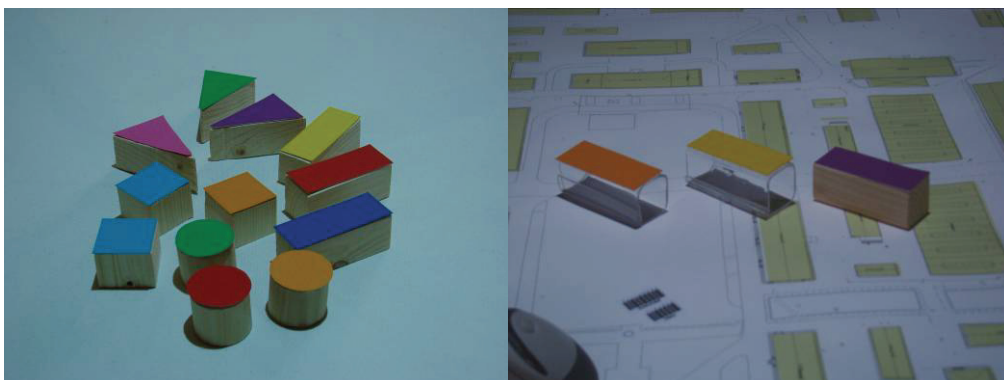


Figure 37: Different material and forms

Specification

Hardware and OS	6x Laptop, Desktop, 3x Projector, Webcam, UrbanSketcher, Flatscreen, Barcode Reader, ColorTable, WinXP
Software	ColorTablef framework, Muddleware, Studierstube, Open Tracker, Tomcat, HMDB
Core Features	Voronoi segmentation, Connections, Flows, 3D Lines, Saving and Loading, Printing, Sketching
Status	gamma-prototype
Intended users	stakeholders
Showcases	WP6
Relevance beyond project	yes

5.1.2 Workshop preparation

Selecting the participants

With respect to the main urban planning issues, it was decided to organize two sessions: the first one focalizing on the issues related to the central public space and the second one focalizing on the issues related to the residential area and the streetscapes. The workshop's participants were grouped in two teams corresponding to the two sessions of the workshop. Every group included 2-3 urban experts implicated in the urban project and 4-7 non experts that are concerned by the future development of the district Bossut. Non experts are those stakeholders that are not coming from the urban planning milieu, that's to say people representing the inhabitants associations, the local economical services, the cultural associations, the people working in the area, etc. However, they are considered experts on the uses, everyday life going on the site, with its positive aspects and its problems. In the case of IP City workshop the urban experts either worked in the local authorities, at Cergy-Pontoise University (Geography Department) or were committed in the Ateliers summer workshop. The non expert were a policeman, 2 students whose office view is on the barracks, 2 theatre people having been hosted in Bossut site, 2 people from a cyclists and pedestrians association, 2 people from the Chamber of Commerce and Industry.

A preparatory session was organized in July 2008. All the participants were invited to join the research team at the Caserne Bossut so as to meet, distribute the cultural probes packages and explain their use as well as the workshop's objectives. This session was followed up by a visit of the abandoned military barracks that are not usually accessible to the public that gave the participants the occasion to discover the place.

Not all the participants to the final workshop were present to the visit, but most of them were, essentially the non expert. The visit was also the occasion to explain more deeply our project, to give the kit for the cultural probes and to answer the first questions. The participants had the opportunity to get to know each other and to feel less uneasy with this unusual approach.

We used the cultural probes method in combination with a narrative interview technique (the interviews were conducted a few days later) for stimulating participants' imagination and to help them prepare for the urban planning workshop. The cultures probes consisted of two maps of the site (and surrounding area) of different scale, three panorama pictures, and a CD with 99 sound files to select from. Participants were asked to think about connectivity, about the central public space, and also about housing types and activities they would like to see at 'Caserne Bossut'; as well as collect and bring objects with which to represent their ideas.

The individual interview with each participant took place in a university office, equipped with a round table and computers in order to be able to look at digital images and listen to sounds. All the interviews were recorded: one person was in charge of the animation, another took pictures and a third one was in charge of voice recording and taking notes.

Participants' visions

Of the twelve participants we have selected five that represent different concerns and perspectives on the one hand, distinctive ways of working with the cultural probes and constructing their vision on the other hand.

Eric - Working with multiple representations

For Eric, an urbanist, the cultural probes initiated his first encounter with the site. He had prepared himself carefully, bringing along a series of high-quality print-outs of Google maps showing the site and its surroundings in different scales but also reference examples from other places, a booklet about a relevant project, notes on some of the probes, as well as a series of pictures (in digital form) to illustrate his concepts. As he did not know the site, he had planned his approach, stepping out of the Pontoise railway station and starting with a walk to and around the site, taking pictures. One of his first steps was to take us on this walk, marking the positions from where he had taken the pictures. The walk had helped him to identify neuralgic points – the highways, the stadium – but also diversities and ambiances.

Remarkable in his performances is the way how he fills the table with all these physical materials, with the computer to his left, explaining and relating through layering, pointing with his hands, using a pen for annotating, pointing, defining areas and distances. Eric uses all the probes as a medium for working out his vision step-by-step (see Figure 38).

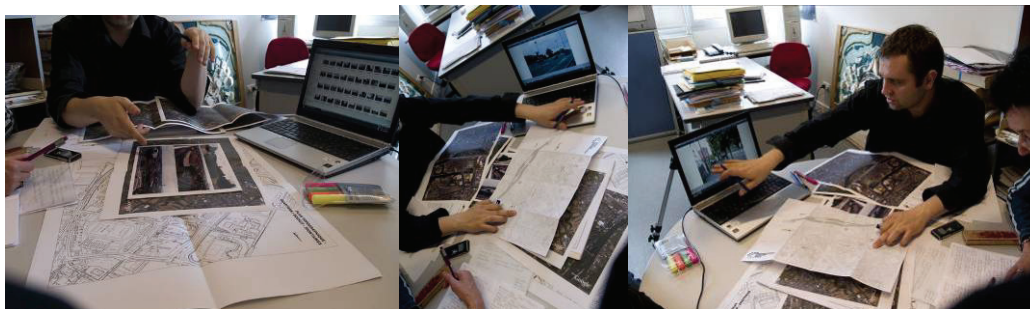


Figure 38: Eric creating layers of material on the table; pointing to a spot on the map and searching for an image on his laptop; connecting a picture with the map

Central to Eric's vision is the relationship with nature, the connection with the river Oise: „ ... this nature space, with its small forest, birds, natural life - I think of a more natural sequence of spaces - the site could benefit from this space“. He also thinks in terms of a multiplicity of ambiances - you may also want to play with the highway, the traffic noise, the noise of landing aircraft – 'I don't see this as something only negative ... You could, for example, have a pedestrian bridge with a belvedere, protect it with some vegetation, do a small 'mise-en-scène'. For the central public space Eric envisions something that can be appropriated by different types of people: young people, couples, families - all of them can meet there, finding their own space: 'I imagine a 'vie de quartier' here and sequences of green spaces. His main idea is to create a 'ville stratifiée', to play with three to four sequences that allow for connectivity across borders and very different uses and ambiances. For each of these ideas

he presents key images on his computer: green spaces, a budge across a boulevard crowded with high trees, boats on the shore of the Seine, and so forth.

Didier – Stories and props

Didier has founded a theatre company some 20 years ago but he has been around the Cergy area for more than 30 years, before the construction of the commercial centre at Cergy-Préfecture, when there was nothing but fields and he went swimming in the wild ponds. He lives in a small village and currently works in Saint Ouen l'Aumone, with small projects all around.

The site for him is an emotional place – it served as a 'friche culturelle' for several years, when it this a little abandoned place was opened to artists. Didier has trouble with the cultural probes – maps seem to be the 'wrong medium' for a theatre artist - and first refuses to work with the maps we provided and to make annotations. He also did not bring any images. The map with which he engages first is a large 'real' map of the area on which he points out places that are important to him and where he has been engaged in various theatre projects. His mode is story-telling and he slowly includes the more abstract A3 map into his stories. At some point he pulls two small objects from his bag: a cricket (a cigarette lighter) and a small bottle with banana scent. He puts the cricket on the bridge across the highway he has marked on the map – to cover the noise. He then opens the bottle and with is finger applies banana scent on the bridge and around – to also cover the bad smell (Figure 39).



Figure 39: Didier intervening with props – grasshopper and banana scent

Didier uses metaphors and tools from the theatre for constructing his vision – props (Grashopper and flacon), a reference to Don Quichotte (which he actually would like to place as a sculpture in the central space) as a memory of the fights they had to maintain the site open for artistic activities. Asked for other objects he might have brought with him, D starts reciting a poem by Rimbaud – 'Ma Bohème', which he cannot remember fully. When we find it on the Internet and print it out D reads the text for us as a 'sound object'. The text represents for him a bit the ambience he envisions for la caserne – 'a place, which invites you to perambulate, with your hands and your pockets'.

Laurence – Involving all senses

Laurence is blind. She lost her eyesight very early but still has 'memories of the main colours', as she says. She works for the city administration and is active in an organization 'Energie Piétons & Co', which takes care of the concerns of pedestrians and cyclists.

Laurence has prepared the A3 map with the help of a colleague who has glued carton on all buildings as well as some Braille (printed out on plastic strips) to mark places, such as the highway, the university, and the entrance. She also has brought two images of fountains (which another colleague found in the Internet for her), colour printouts with, again, a caption in Braille. Laurence stresses that she has worked out the scenario with some people from the association – so this is 'a collective vision'.

One of her main topics is protection: to protect pedestrians and cyclists from the traffic; to have a protected place from where the children cannot move out so easily (she reminds her

own anxieties as a non-seeing person when she was not sure where her young children were running around); a protective wall of trees against the highway that keeps out the noise. For the large central space Laurence wants to have a water basin with a fountain in the middle. Sound plays a large role in her vision and she is the only one to have carefully listened to the sound probes. She prefers natural sound, associated with flowing water, raindrops, birds singing in the trees, footsteps in autumn leaves, young people having fun, children playing at the water side (Figure 40).



Figure 40: Laurence exploring the site with her hands (having added a bus (stop)), introducing ‘her’ fountain and flowers from her garden

Laurence imagines grass, trees, and birds all around. She has brought some flowers from her garden, flowers that have a fine perfume: leaves from an orange tree, geranium, mint, and chives. She would add old roses that have such a lovely smell. All this should be arranged in flowerbeds.

Gilles – Metaphors and complex systems

Gilles is specialized in water and environmental risks. He mentions not having understood the probes well but he is well prepared, with a sheet with notes and a series of digital images. The site is for Gilles is a kind of platform or pivot for connections and the urban ‘composition’. His idea is to construct a kind of eco-village, a new type of urban space.

A ‘chemin de l’eau’ turns out to be a central concept for Gilles, around which he constructs his vision of an ecological village. The other concept is the ‘chemin de l’air’ – a bridge across the highway (Figure 41). His language is full of metaphors. The bridge across the highway he envisages as a large space falling across (‘c’est comme une chute’), slightly pending so as to be comfortable for bikes and handicapped people. He later shows an image of a large waterfall in Canada with a curved pedestrian bridge above. This is about moving across an obstacle. For the center of the site he imagines ‘pulsing life’ (‘la vie palpitante’).



Figure 41: Gilles evokes the quality of the ‘chemin de l’air’ and puts a heart with ‘pulsing life’ into the centre of the site

Gilles evokes complex systems, which he illustrates through images: a waste disposal system with an underground connection to an outside terminal; ‘soft mobility’, where the traffic priorities are inverted (pedestrians before everyone else); an intricate rainwater

collecting system, with the water flowing down the front of the building where it continues as a rivulet along the borders of the small gardens in front of the houses, eventually flowing over in the form of a cascade, arriving in a small canal. Gilles has brought images of houses with on the ground floor a terrace that invites neighbours in for an aperitif. Opening up is an important theme – ‘the walls have to be torn down’.

The scenarios

The scenarios corresponding to the two sessions had to be conceived so as to allow participants to exchange ideas over issues prior to the urban project launch, questions related to the uses, the ambiances, the accessibility, etc. and allow them to indicate collectively options and principles for the development of the future district Bossut by using the MR-Tent. They also had to reflect and make space for the visions participants had developed in the ‘cultural probe interviews’. In this way, they would be able to outline strategies that could possibly lend new points of view to the urban planning team elaborating the development plan. Thus, the scenarios would be structured on the basis of a questioning plot. On one hand, the public space scenario inquiries would concern mostly the importance attributed to this space within the whole area, the desired general ambiance, the spatial configuration, the future uses and circulations, their distribution and their coexistence, the connection between the public space and the convention and exposition center. On the other hand, the residential area and streetscape scenario inquiries would focalize on the future housing types, their distribution within the site, the relation between the built and the open space, the desired ambiance as well as the uses and circulations on the district’s streets. So as to enact the scenarios, the participants would have at their disposition 3D models and images representing uses, ambiances, streets, flows, housing typologies, urban spaces, etc. as well as soundscapes recordings. They would use these elements as well as the areas panoramas taken from different point of views to construct collectively mixed reality urban scenes representing their strategical choices for the district’s development.

Workshop plan

We developed a workshop plan consisting of three parts. The morning session is a learning session where participants playful learn how to use the urban renewal prototypes. Our aim is to explain the relations of the different dimensions: the maps, the perspective views, the see-through, the info screen and the colored tokens.

We prepared 6 different tasks:

1. Creating a scene:

- Each participant selects one object and assigns it to a token
- Takes the token and places it on the Colortable surface (with map)
- Modifies parameters (size, color, transparency, position)
- Change sound (on/off; next/previous; volume)

2. Sketching and painting:

- Participants produce a sketch on the whole scene
- Change one token into a painting object and paint on it.

3. Streets and flows:

- Participants construct a street (selecting also the type of the street)
- Introduce a flow

4. Land use:

- Participants use circular objects to create a textured ground

5. Sound

- Move hearing position and listen to resulting soundscape

6. Use history application:

- Save scene
- Erase something with the eraser

- Undo
- Print

In the afternoon sessions participants work on the actual scenarios we prepared. Each day focuses on a scenario with a different urban topic.

Day 1: Connectivity and Activities

Work with issues of connectivity

- Discuss the site in relation to its surroundings, using the large paper map as well as the Google map (sketch, annotate)
- Create connections – define streets of different types and flows
- Define a ‘sound trip’ (connected with a flow)
- Save and print out important constellations

Work on connection across the highway into the central space

- Place ‘passerelle’
- Define its qualities by sketching and painting, as well as working with billboards
- Discuss allocation of spaces for different uses
- Define areas for different uses
- Save and print out agreed upon solution

Activities and ambiances

- Select and place different activities
- Take account of and eventually modify sound connected with activity
- Switch views (panoramas)

Discuss options

- Annotate with UrbanSketcher
- Change your hearing position and evaluate choice from the point of view of the resulting soundscape
- Save and print out important steps in decision-making process and/or alternative solutions

Day 2: Connectivity, housing types and streetscapes

Work with issues of connectivity

- Discuss the site in relation to its surroundings, using the large paper map as well as the Google map (sketch, annotate)
- Create connections – define streets of different types and flows
- Define a ‘sound trip’ (connected with a flow)
- Save and print out important constellations

Discuss allocation of spaces for different uses

- Define areas for different uses (with special respect to housing)
- Save and print out agreed upon solution

Work with housing typologies

- Select and place different housing units on the site (taking account of already defined streets and flows)
- ‘Customize’ appearance of some housing objects by painting
- Place Congress Center (and other relevant 3D objects)
- Discuss choice by looking at it from different panoramas
- Discuss choice by annotating, sketching
- (Experience choice by taking a video trip (video produced by a scout))
- Save and print out relevant solutions

Work with ambiances – streetscapes

- Add streetscapes to the scene, using billboards and 3D lines
- Take account of and eventually modify sound connected with streetscape

- Change your hearing position and evaluate choice from the point of view of the resulting soundscape
- Discuss and evaluate the resulting ambiences
- Save and print out important scenes

To conclude the day the results are presented to urban planning experts giving feedback on the constructed scenes.

5.2 Testing

The workshop started on Sep 10 with a 2-hour training session with a non-seeing participant for whom we had annotated the map of the site as well as the tokens and 'command tablets' in Braille, as well as a demo session for interested people from the municipality and an architectural summer school. The next two days were spent with two different participant groups, starting in the morning with a tutorial after which the group built their vision of the site, and ending with a feedback and debriefing session.

Participants also filled in a small questionnaire with free comments on a range of key research issues. The workshop ended with an additional demo session on Sep 14. All sessions were moderated by one of the urban specialists of the team and supported by one of the developers. They were videotaped. In addition we took pictures, focusing on participants' interactions both, with the technologies and with each other, and saved relevant scenes.

Constructing a vision of the site

To give a flavor of participants' interactions we here we focus on one of the two key sessions with six participants (architect, specialist for water and environmental risk, policeman, student, representative of commerce). This session includes three of the people that have been described for the cultural probes. During the morning tutorial the group had quickly appropriated the MR technologies. After that they decided on the questions they wanted to focus on: how to connect the site with the two towns, the university and the river Oise; how the centrality of the site should be; and what kinds of habitat and activities to envision.

They quickly assembled around the table to first think about connectivity. For a while they simply discussed which types of connections to plan for, switching between the two maps, to then create three transversal roads and a pedestrian path following the main axes. They started with the map of the site to change to the larger map where they extended the roads. The group 'invented' a way to introduce flows on all of these roads, which added to the depth of the panorama view of the site. In this phase participants focused mainly on the map.

The next step was to introduce objects, so the whiteboard filled with object cards got included in the participants' interactions. Their first move was to place a bus stop next to one of the roads, together with a bus. They immediately reacted to the noise of the bus, replacing it by a tram. Some time was then dedicated to placing different residential buildings. As they felt that the prepared 3D objects were too big, they used the sketching application to reduce their size and changed their appearance. Participants created two rows of two different types of buildings (six-storey building, individual housing), using the rectangular tokens. In this moment they started making more regular use of the different views, switching between the panoramas and the video-augmentation in order to better understand the spatial arrangements they were constructing.

They also went back to the question of connectivity, adjusting the position of one of the roads to the new situation. Satisfied with their result, they started adding other content, such as billboards of a concert hall, a library, a park in between the buildings, and activities - people sitting on terraces, a playground, and so forth. This took time, as placing 2D content in a spatial arrangement is sometimes demanding. In this phase they consulted the info screen for object parameters and checked the panorama views all the time. They also decided to

place one of the land use tokens just to change the ground from grassland to a more abstract pattern. In the end they explored the soundscape, using the token for changing the hearing position and 'following the sound scout' (marked in red in the image) on his way through the site.

The session concluded with one of the urban specialists of our team giving feedback. He used the sketching function on top of the last panorama image for discussing the skyline of the participants' view of the site for making comments. Then followed a debriefing session around the table where participants commented on their experience.

5.3 Evaluation

Our general impression from all the sessions was that the participants organized themselves very well and appropriated the tools and objects they needed for constructing and debating their vision of the site. They also quickly developed their own 'workflow'. In our discussion we focus on the important features of the MR Tent, highlighting some of our observations. The key findings we report here are supported by additional observations in this and previous workshops.

5.3.1 Appropriating the interaction space

The MR Tent creates a particular combination of inside and outside, of views and perspectives. Participants convene and collaborate within the 3D spatial arrangement of table, whiteboard, and projection surfaces. Their interaction with the technologies is constrained to the 2D space of map (on the table) and projection screen (for sketching and painting objects). The egocentric view onto the projected scene invites individual interventions, such as sketching or texturing an object. However, this distinction is not clear-cut. For example, we observed participants walk up to the screen and point to something the others had not noticed. We contend that the affordances of this interaction space are crucial for experiencing the mixed reality configurations participants develop.

Participants assemble around the table with a view onto the map to discuss an intervention; they select content cards from the whiteboard, pick up different types of tokens for enacting their interventions (building roads, activating flows, placing objects or creating rows of them), and they use the barcode reader for activating different views onto the scene. At the same time they orient themselves in the space of the tent towards the two projection screens, one of which provides a direct view of the site through the frame of a window.

5.3.2 Connecting views

The exocentric top view onto the map on the table mainly affords exchanging opinions, constructing interventions and discussing them. It provides the best overview of the site, represented by a map. It also shows the objects placed in the scene, represented by circles (indicating if an object has been recognized by the camera), dots and bars (roads and objects), as well as moving dots/flows. This 'diagrammatic' representation also provides important feedback – participants can check all the elements of the scene even when the tokens have been removed. They also use this view for 'erasing' interventions. We identified a need for even more visual feedback on the map.

The attraction of the 360° (photographic) panorama lies in the possibility of exploring the whole site, turning into different directions and looking at interventions from different viewpoints. It reflects a strong tradition within architecture. The panoramas we produce contain depth information, which supports participants' spatial understanding. Such an understanding is crucial to aligning the virtual with the real scene in a meaningful way. The advantage of the video augmentation is the animation of the video stream, but it currently lacks depth information.

In previous workshops we observed how much being exposed to a lively scene of wind, humidity, smell, background noise, people and cars moving, and so forth, increased the reality element of the mixed reality configuration. The see-through installation comes closest

to the idea of making the site of an urban project present. Even if seen blurred through the transparent screen, it adds an important dimension to participants' understanding of project and site. Although its fixed-viewpoint perspective projection raises well-known problems concerning parallax and focus, it provides a unique augmented view onto the real scene. We are still working on finding the optimal screen material, which is made difficult not only by budget restrictions but also by the fact that an optical see-through installation is extremely sensitive to lighting conditions.

We could not identify any patterns in how participants used the different views available to them but we could observe them frequently switching between panoramas and video, looking around and zooming in and out, eventually but not always commenting on the different views (Figure 42).

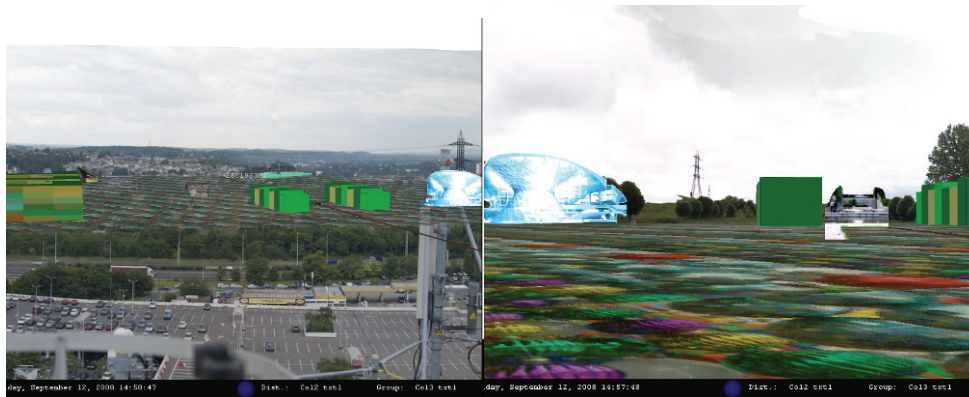


Figure 42: Looking at a scene from two different viewpoints

5.3.3 Sketching application

Working with the sketching application requires stepping out of the circle around the table, moving in front of the screen and changing tools. We identified two typical situations that encourage this step. First, participants are interested in working on the rather abstract 3D objects we provided: to cut out parts, change texture, transparency, add color. Secondly, there is a need to sketch on a composed scene, adding a whole layer onto the scene, making annotations, adding an object 'on the fly', explaining some of the implications of participants' decisions (Figure 43). In a previous workshop we had observed participants creating spatial collages with the sketching application. This had to do with the fact that for each sketch they created a new layer. In this way they discovered the possibility to systematically work with layers and transparencies, thereby lending depth to the scene. These ways of making a comment, of working out design implications, and of discussing design changes, is typical of architectural practice.

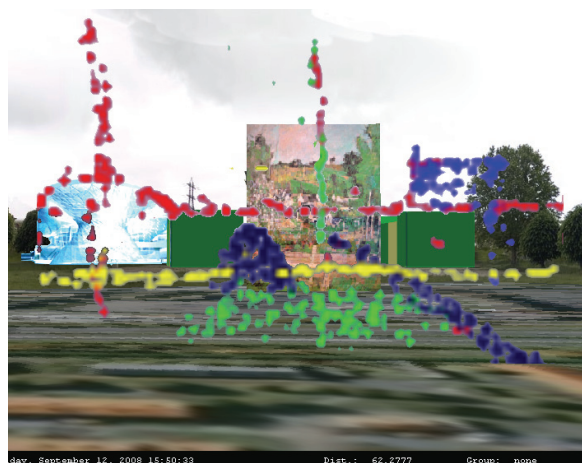


Figure 43: Sketching on a scene using a 'pointilist' style

5.3.4 Participation

All participants appreciated the collaborative aspect of the MR Tent. Our focus on participation had strongly influenced our design decisions, namely to build a tangible user interface in combination with color tracking, to create a 2.5D interaction space, and to support 'immediacy' - the ad-hoc creation of mixed reality scenes as an integral part of participants expressing and experiencing ideas – rather than perfect renderings. However, we came to realize that this is not a tool for 'ad-hoc' participation. Preparing participants for the task (see our 'cultural probes interviews'), as well as preparing the appropriate content is very time consuming and requires special expertise, including artistic skills. Some participants would like to spontaneously evoke their own content but this is still not compatible with the technical and aesthetic requirements of producing suitable content for mixed reality scenes.

One of the main strengths of the MR Tent is that it brings people together around a table and provides them with tools that are easy to learn and handle in an interactive way so that people can quickly develop a good way of working together. The table acts as a mediator insofar as participants do not have to discuss in a confrontational way face-to-face but by means of gesturing, setting interventions, commenting, and modifying. This is an inclusive mode, which does not favor the expert. It leaves space for everybody. The MR Tent provides a space for 'mixing realities' that can be viewed and evaluated together. The diversity of perspectives as well as the presence on the site enlarge this interaction space, hence also the means of expressing and experiencing. People point to the panorama view, they cluster in front of the see-through, they look for content, they zoom into the video-augmentation, they may even step out of the tent to look around.

From an urban planning point of view, the MR Tent lends itself more to develop and discuss a general strategy for a site, discussing main interventions and ambiances. The results of such sessions can be taken back to the design office for specialists to detail the design, eventually returning to the tent for presenting, discussing, and taking up additional comments. (Figure 44)



Figure 44: Co-constructing through gesturing and talking

5.3.5 The role of space and materials

Through activities, such as placing tokens, moving them on the map, changing their parameters, directing flows on the map, and so forth, participants 'perform' a mixed reality configuration. The material artifacts we have designed take a key role in this process. It is argued that 'natural collaboration' is supported when people assemble around a table, reach out and touch with their fingers (Hornecker et al. 2008). To see each other's physical action increases awareness and makes coordination more fluid.

In the MR-Tent participants convene and collaborate within the 3D spatial arrangement of table (on a physical map placed on the table), whiteboard, and projection, content cards, command tablets, barcode reader, and they produce printouts of the scenes they see on the projection (or see-through) screen. Research on the use of tabletops shows how spatiality - size, shape, proportion, location in space and arrangement in relation to other artifacts and people – matters. As Patten and Ishii (2000) and Stanton et al. (2001) observed, a large

working space encourages or even enforces collaboration since there is no way for a single person to manipulate all objects.

The scenes, some of which we briefly described, show patterns of dense cooperation around the table. Participants stay around the table most of the time as a spatially closed group. They use table and map for conducting a debate. They do this quite literally *on* the table, around which they assemble, through gesturing while explaining and setting actions, sometimes simultaneously and in parallel, sometimes cooperatively. There is a rhythm of discussing, using hands and arms to demonstrate on the table by pointing, drawing lines, occasionally reaching over the table. In the foreground is a common goal and the group is directed towards acting/creating. Each step is first discussed, then implemented, and after that participants often remain silent for a little while before getting to the next step. The overview provided by the map, together with the footprints of their interventions, supported conceptual work. From time to time they look at the panorama to then eventually carry out some modifications.

The table/map arrangement draws them into a debate that is mediated by a representation of the site by a map. Interventions are on the one hand represented by the physical tokens. On the other hand interactive feedback is provided, which shows the objects placed in the scene, represented by circles (indicating if an object has been recognized by the camera), dots and bars (roads and objects), as well as moving dots/flows (Figure 45). After a scene has been saved, participants can check all the elements even when the tokens have been removed.

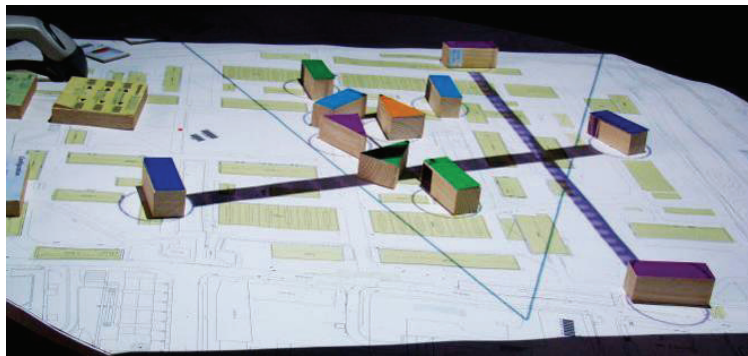


Figure 45: View of scene (and active viewpoint) represented by different tokens and interactive feedback

The tokens themselves, which have undergone several cycles of re-design, are central to participants' interactions. The basic geometric forms and materials are familiar to participants. The different forms – circles, squares, triangles and rectangles – represent different uses while the color refers to a different content. The tokens for connections and ground textures have square printouts of the content mounted onto the side face.

Having a non-seeing participant had spurred our focus on hapticity. Apart from annotations in Braille printed out on transparent material, we made use of different materials (wood, Plexiglas, cork) to distinguish the different types of tokens (in addition to color and shape). To further support the haptic orientation an additional layer of transparent paper was fixed on top of the areas reserved for buildings on the physical map. This enabled our participant to place the tokens accurately while the other hand could feel its way (Figure 46 left).

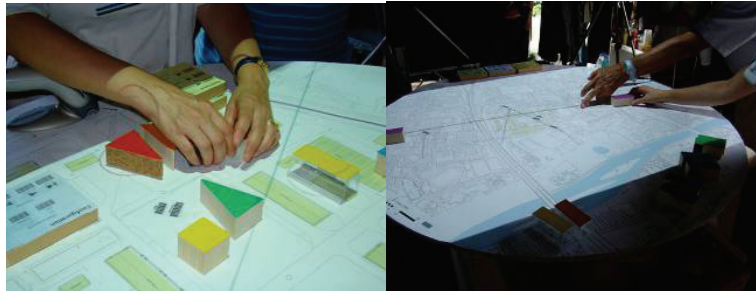


Figure 46: Feeling the difference of material, form and surface (left); inactive tokens in the shadow (right)

Typical patterns of working with the colored tokens emerged during the different discussion and interaction steps. When searching for the right tokens to perform the next interaction step, participants took care not to obstruct the tracking and placed the inactive tokens into the 'shadow' area of the table (Figure 46 right). A quite common observation was that some participants work collaboratively with the tokens on the tabletop, while others wait for their turn with a token and content cards in the hand (Figure 47 left).



Figure 47: Holding tokens and content card (left); two participants selecting content cards (right)

Participants liked working with the small content cards representing content (Figure 47 right). At the beginning they sometimes positioned them directly on the table, but after having understood the need to link them with a token, the cards they had selected remained on the edge of the table, signaling 'this is a pile of our images'. 'Command tablets', with which to manipulate objects, including sound, freeze a scene, print it out, go back to previous scenes, etc. complete the set of tangibles. Participants' interactions with this set consists of selecting and placing objects, as well as 'reading' with the barcode reader.

When comparing the MR-Tent set-up with the currently much discussed multi-touch screens that 'enable fluidity of interaction and switching of roles between co-located users' (Hornecker et al. 2008), we clearly emphasize the hapticity provided by physical objects, building on haptic directness (meaning that there is no 'interface' other than the shape, texture, temperature, and moisture of the object itself; Hornecker and Buur (2006)). What not only touching with one's fingertips but grasping brings is maybe best captured by the notion of 'engaging objects', which Verbeek and Kockelkoren (1998) define as the capacity of objects to absorb people's attention, thereby increasing their engagement with each other and the world.

Hapticity is only one aspect of participants' engagement. Specific to the MR Tent is the mixing of many elements – views onto an urban planning site, a diversity of materials and forms of content – in one application. Participants engage with maps, projections, content cards, they sketch directly on a scene, switch between different panoramas, video view or see-through. For example, although participants often forgot to print out a significant step themselves, they were pleased to receive the printouts, which show the scene together with the table view.

5.3.6 Addressing the urban issues

Many authors suggest that visualization is the key to public participation (see e.g. King et al. 1989) but the question remains how to enrich the available repertoire of representations –

from sketching to 3D renderings - with visualizations that enhance stakeholders' understanding of an urban situation. We provide 2D (billboards) and 3D objects, animated flows, and sound. Our observations of how this material was used permits some conclusions on how to help participants, among them lay people, to express and co-construct their ideas.

3D objects are important elements of the constructed mixed reality scenes. Some content, such as for example buildings, has to be 3D so as to maintain the sense of volume and orientation within space. On the other hand, 2D objects are needed for conveying 'telling detail' and creating ambience. They support the construction of narrative on top of an architectural intervention. The 2D content we provided is based on photographic images, sketches, architectural renderings, and paintings. To lend them a spatial dimension these images had to be cut out and 'abstracted' so that they no longer appear as flat canvasses. As we refrain from applying true 3D techniques such as a virtual model of the site, positioning objects in the panorama is supported by occlusion based on a depth image. We found that the 2D images aligned themselves well with the panorama. Interestingly, the real size of both, 2D and 3D objects, something the urban planners had deemed crucial in an urban composition, did not matter so much to non-expert participants. They often made an object bigger to emphasize an intervention, and they arranged the object optically in relation with other objects and the panorama view, without necessarily focusing on the real size.

Moving objects – pedestrians, cyclists, cars, and boats – connected to the different types of paths not only introduce an additional, human scale in the scene and provide depth information, but also animate it. Participants' gaze drifted between the table view, where the flow was represented as moving dots, and the animated mixed reality scene. They examined the spatial arrangements of 2D and 3D objects they had created in relations to these flows, eventually changing the position of a road and/or of an object that turned out to be too close to it.

Sound proved to be a fascinating but complex medium. Sound adds a dynamic element to a static image. Still, although participants sometimes changed the sound file connected to a visual object, the sound, if not intrusive, mostly stayed in the background. This is partly to do with the fact that they worked a lot with panoramas taken from a distance that provide an overview but also let appear the sound come from far away. Only when actively working with the hearing position participants became more aware of sound as an additional medium for representing and evaluating the site. Changing the hearing position made participants more critical of some their interventions, such as for example the closeness of the road they had introduced to some of the buildings they had planned. They replaced a bus that seemed too noisy by a tram. They also used the 'sound token' to identify an object that emitted an annoying 'casino sound'. We observed how working with sound reactivated the group, motivating it to continue. Exploring the scenario with the hearing position made them enter the scenario in a way that the visual representation in itself cannot achieve. They truly started walking through the scenario and exploring it once more.

We could observe how tools and content together enabled participants to work on the urban issues for the site:

Connectivity: Participants discussed about the different possibilities to set connections through the site and with its environment (the two towns, the river Oise) on the physical map. They defined the types of the connections and used the pair of tokens to add them to the scene. Maps of two scales allowed them first see the grand picture and then focus on the site itself and see how different types of roads affected it.



Figure 48: Bus stop; Bridge across the highway

Circulations: Participants took the flow tokens to set the circulation in each of the transversal streets. Flows, representing circulations, animated not only the scene but also gave a clear understanding of the dynamic of the infrastructure. Content placed close to it added an additional level of animation. For example, the image of the bus stop stimulated thinking about what kind of traffic to invite onto the site; so did the image of the bridge across a cascade, which was also connoted with the noisy stream of cars on the highway (Figure 48). The sound connected with flows heightened participants' sensitivity towards the difficulties of protecting green spaces, living spaces, children and their activities, when opening the *Caserne Bossut* and making it more accessible.

Activities: Participants expressed their ideas about activities to invite onto the site mainly by using 2D images. They used the triangular tokens and positioned them according to the previously defined connections and surroundings. They also positioned buildings connected with specific activities, such as cultural centre or congress centre, creating a collage of activities next to the 3D building blocks they had placed (Figure 49).



Figure 49: Collage of activities and buildings

Housing types: Different housing types were on the one hand represented by highly abstract 3D objects, which once inserted took on the character of massive interventions, eventually blocking the view onto already existing objects, such as the university (Figure 50). Participants discussed the housing types to be placed on the site and used the pair of square tokens to define areas for individual and intermediate housing. They then placed 2D images to denote specific uses on the site, such as social housing, the façade of a movie theatre or a kiosk.



Figure 50: Scene with 3D buildings seen from above (top) and 2D images visualizing use and detail

Centrality: This issue was discussed in terms of paths that frame and/or transverse the central space, in relation to the commercial space and housing units. Specific interventions and uses, such as fountain, playground, green space, as well as paved areas were introduced as 2D objects. Here the points of view offered by the different panoramas helped participants develop a notion of centrality.

5.4 Feedback from participants:

12 participants filled in a questionnaire, which asked for personal comments in free text. Their answers have to be read in connection with the dynamics of the workshop. They provide some interesting and complementary insights.

Spatial aspects of mixed-reality scenes and ease of coordinating the different modes of representation: 9 positive and 2 negative comments – participants stress that coordination was difficult and complex at the beginning, getting more easy with practice; they also point to the problems of placing objects correctly.

Collaborative aspect: 10 positive and 3 negative comments – participants stress the evolution of ideas in the group.

Immediateness of interventions: 8 positive and 4 negative comments – the positive experiences is that the system's reactivity makes the work more lively (it is a pleasure to experience the process) and open up possibilities; negative comments all refer to systems breakdowns on the first day.

The capacity of the tangible objects (tokens, content cards, etc.) of facilitating interaction: 11 positive and 1 critical comment – participants describe the objects as easy to use and playful; one participant thinks of the content cards as being too small.

The abstract and fuzzy character of the scenes: 6 positive and 5 negative comments – It seems that the urban specialists appreciate the fuzziness of representations (they allow to focus on the conceptual level) more than the lay participants who look for more realism.

Animating the scene through flows: 11 positive and 2 negative comment – participants appreciate the reality element added to a scene (a real city is always in movement)

The panorama as form of representation: 10 positive and 2 critical comments – in general participants value the panoramas taken from different viewpoints and the possibility to switch between and rotate

The role of sound for constructing a scene: 7 positive and 4 negative comments – the positive remarks stress the importance of including sound (an often forgotten dimension) for creating ambience, qualify it as surprising; they also think of the connection between image and sound as interesting; the negative comments have either to do with a person relating

more to the visual dimension or (in 2 cases) the sound not being represented 'correctly' (simulated).

5.5 Implications for re-design

The workshop showed that the new prototype with an improved physical ColorTable and working space, as well as with a more elaborate set of functionalities helps participants to discuss different interventions.

We however identified the need to further simplify workflows as some tasks need several, unnecessary intermediate steps. A second issue deals with the interactions themselves – we will develop new possibilities in order to reduce interactions with barcodes since these are quite complicated to use.

In forthcoming scenarios we will further include different forms of representations, including sound, to help participants think about atmospheres and ambiances.

6 Dissemination

Publications related to WP6

Nuojua J., Juustila A., Räisänen T., Kuutti K., Soudunsaari L. (2008) Exploring Web-based Participation Methods for Urban Planning. In: PDC 2008, Bloomington, Indiana, USA, 30 September – 4 October, 2008

Nuojua J. (2008) Communication Based Web Mapping: A New Approach for Acquisition of Local Knowledge. MindTrek 2008, Bonn, February 18 and 21, 2008

Maquil V, Sareika M, Schmalstieg D., Wagner I. (2009) MR Tent: A Place for Co-Constructing Mixed Realities in Urban Planning. GI 2009 (paper submitted).

Wagner I., Basile M., Ehrenstrasser L., Maquil V., Terrin J., Wagner M. (2009) Supporting the Formation of Communities of Practice: Urban Planning in the MR-Tent. In: C&T 2009 (paper submitted).

Boerner A., Maquil V. (2009) Enhancing synergies between computer science and urban disciplines. In: CAAD futures (abstract accepted).

European City of Science Exhibition

European City of Science is the major science exhibition in Europe in the year 2008. The exhibition will take place during 14.-16 November 2008 in the nave and under the great glass dome of the Grand Palais, an exhibition space in the center of Paris. The theme of the exhibition is “Science at the service of Society”, and 80 different projects around Europe related to this theme were selected from about 250 applicants during Spring 2008 to showcase their research in the exhibition. IPCity was one of the selected projects and participated with the urban renewal prototypes (Figure 51).



Figure 51: The MR Tent at the European City of Science in the Grand Palais

A new scenario was developed, dealing with the creation of an exhibition in the Grand Palais. We prepared a panorama from inside the Grand Palais, as well as numerous exhibition content (2D billboards of artistic figures, diverse sounds, 3D objects for children).

We also extended the prototypes as adaptation of the scenario:

- **Flows** automatically start as soon as streets are in the scene.
- A **billboard sketcher** provides means to create new billboards by drawing with conventional pens on sheets of paper. This drawing can then be added to the HMDB

by placing it under a webcam. Drawings can also be framed with a digital frame to represent an art image (Figure 52).

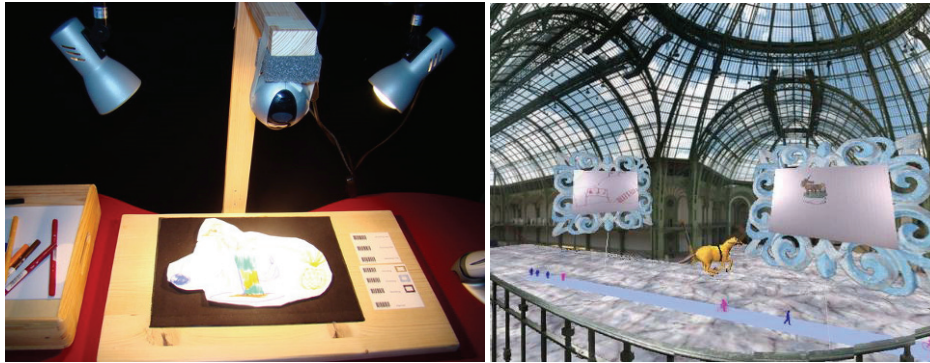


Figure 52: Adding a drawing to the HMDB; viewing an art image in the MR scene

- **Object sets** including a predefined object for each color can be loaded as a set. We prepared 12 different sets with a collection of objects according to three different scenarios. Each set is presented on a magnetic card on the content board and tagged with a barcode.
- **Sound sets** including a collection of topic oriented sounds can be associated to a visual content.
- **Screenshots** of the composed scene are automatically taken in a specific interval of time.
- Screenshot can be **uploaded to Flickr** to be visible on the CityWall

Figure 53 shows how the urban renewal prototypes were used during the exhibition.



Figure 53: Visitors experimenting with the ColorTable; example of a composed scene

Workshops and other dissemination events

The two participatory workshops was also a dissemination events, as we included participants from local authorities and urban planning and other communities, but of course numbers were restricted. On the second workshop, we organised two demonstration sessions that were open for the public. One session was part of the International Workshops of Planning and Urban Design that took place from August 22nd to September 19th 2008.

7 References

Buur J., Jensen M. V., and Djajadiningrat T.. Hands-only scenarios and video action walls: novel methods for tangible user interaction design. In Proc. Of DIS '04, pages 185–192, New York, NY, USA, 2004. ACM.

Fernaesus Y., Tholander J., and Jonsson M.. Towards a new set of ideals: Consequences of the practice turn in tangible interaction. In Proc. of TEI '08, pages 223–230. ACM, 2008.

Gaver, B., Dunne, T., and Pacenti, E. Design: Cultural probes. *interactions* 6, 1 (Jan. 1999), 21-29, 1999.

Gueguen Yannick, La Caserne Bossut sur le plateau Saint-Martin à Cergy-Pontoise. Un paysage de la distance, Ecole Nationale Supérieure du paysage de Versailles, 2001.

Hornecker, E., Buur, J. Getting a Grip on Tangible Interaction: A Framework on Physical Space and Social Interaction. Proc. of CHI 2006. Montreal, Canada (full paper). ACM, 437-446, 2006.

Hornecker E., Marshall, P., Sheep Dalton, N., Rogers, Y. Collaboration and interference: awareness with mice or touch input. In Proceedings of the ACM 2008 conference on Computer supported cooperative work (CSCW 2008), 167-176, 2008.

Jensen M. V., Buur J., and Djajadiningrat T.. Designing the user actions in tangible interaction. In Proc. of CC '05, pages 9–18, New York, NY, USA, ACM, 2005.

King, S., Conley, M., Latimer, B. and Ferrari, D. Co-Design: A Process of Design Participation. Van Nostrand Reinhold, New York, 1989.

Larsen A. T., Robertson T., and Edwards J.. The feel dimension of technology interaction: exploring tangibles through movement and touch. In Proc. of TEI '07, pages 271–278. ACM, 2007.

Patten, J., H. Ishii. A Comparison of Spatial Organization Strategies in Graphical and Tangible User Interfaces. In: Proceedings of Designing Augmented Reality Environments (DARE) 2000, 41-50, 2000.

Stanton D, Bayon V, Neale H, et al. Classroom Collaboration in the Design of Tangible Interfaces for Story Telling. In: 2001 conference on Human factors in computing systems; Seattle, Washington, United States: ACM Press; 2001. p. 482—9, 2001.

Verbeek, P.P. and P. Kockelkoren, 'The Things that Matter', in: *Design Issues* 14 / 3, 28-42, 1998.

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For further information regarding the IPCity project please visit the project web site at:

ipcity.eu