Project: URBAN ('Uitmeten, Reconstrueren, Bekijken, Animeren en Navigeren van stedelijke omgevingen')

Work package: WP4: Visualisation of and User interaction with 3D City Models

Task: 4.4 Embedding user innovation in technology design

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Title:

Final version of report on socio-technological 3D navigation design



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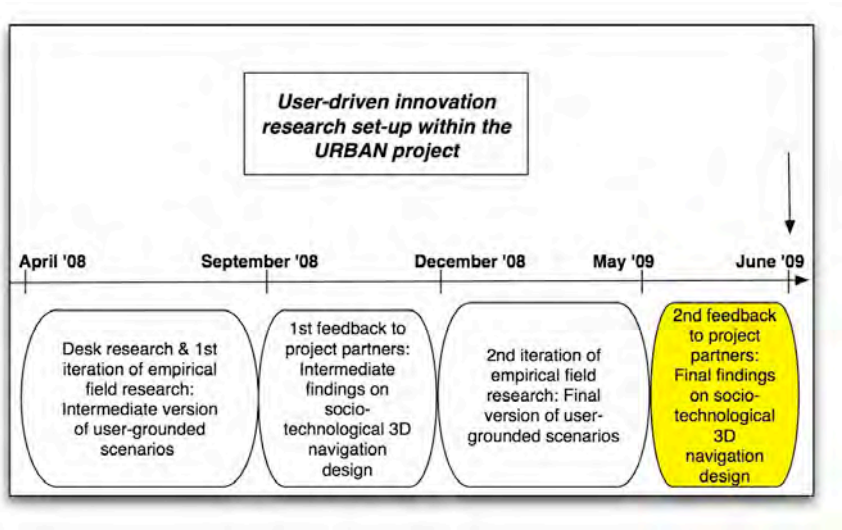
2 Introduction

'Embedding user innovation in technology design', which is the main objective of Task 4.4, implies an 'open innovation' perspective in relation to technology design. Within the URBAN project we aimed at estabilishing a user-driven innovation (UDI) research set-up within which the technical project partners would iteratively implement the user input into their development activities. Our research approach started from the UDI perspective that innovation only has a chance to succeed when user input concerning user practices, needs and expectations is embedded in the design and development process of new products and services (Wise & H∅genhaven, 2008). This can help to mitigate the high risks that accompany the development of new media and technologies. The two key components of UDI are (Wakeford, 2004):

1) A thorough understanding of users for finding new opportunities to create value.
2) A systematic involvement of users in the innovation process.

Picture 1 below illustrates the way in which we have tried to establish a UDI research set-up in practice.



Picture 1: Illustration of the user-driven innovation research set-up within URBAN

In practice the two iterations of the empirical field research are situated on the level of the first key component of UDI. Translated to the URBAN project we tried to identify services and functionalities that could offer a genuine added value for users in a 3D city environment. The two participatory workshops (December 2008 and June 2009) that brought together relevant stakeholders in the URBAN design process and that served as feedback moments, are linked to the second key component of UDI.

The present report first discusses to what extent and how the user-driven findings were embedded in the demonstrator, i.e. the URBAN prototype. The latter is largely based on the user-grounded scenarios and was used as the proxy technology for the user tests in Task 4.3. Next we discuss the outcome of the confrontation between the user test findings with the perspective of the (technological) project partners. In this way we aim to find a fit between the user practices and the (future) development of 3D city models.

3 Embedding user-driven innovation in demonstrator design

3.1 URBAN prototype versus the user-grounded scenarios

In deliverable 4.3.2 we have already elaborated on the affordances, being "a combination of perceived and actual properties of the thing – primarily those fundamental properties that determine just how that thing could possible be used." (Norman, 1988:95) of the URBAN prototype that has been developed by EDM and ANDROME in line with the Task 4.3.1 user-grounded scenarios. The prototype, which is actually a preliminary version of the URBAN demonstrator that will be presented at the end of the project in December 2009, allowed users to have a first more or less truthful (immersive) experience of 3D urban navigation. Yet it is also interesting to map out the affordances that were initially foreseen in the Task 4.3.1 user-grounded scenarios but that have not (yet) been implemented in the URBAN proxy. Time constraints, the technical possibilities at that phase of the URBAN project and the perceived relevance of certain proposed functionalities steered the development of the preliminary URBAN demonstrator.

1) Enlarging or highlighting important sights or buildings

Navigation, "*the process whereby people determine where they are, where everything else is and how to get to particular objects or places*" (Burigat & Chittaro, 2007:945), is a basic task in all virtual environments. To navigate successfully people have to rely on their spatial knowledge that they have gained about the environment and have stored as a mental map. Yet accurate spatial knowledge of virtual environments usually develops very slowly after long periods of navigation or study. The question is whether users are willing to spend this time. Consequently user interfaces of virtual environments need to offer users sufficient navigation support to avoid the users becoming disoriented and getting lost (Burigat & Chittaro, 2007). In this context the user-grounded scenarios involved the enlargement or highlights of important sights and buildings to support the orientation of users in the virtual city model. Since enlarging buildings did not seem technically possible, the developers suggested to let important buildings glow in the 3D model. Though this functionality

was not implemented in the URBAN proxy, but instead the orientation circle/map was implemented. Yet the user tests with the prototype again indicated the importance of extra navigation support within the 3D city model as the respondents were often very disoriented. The orientation circle did not improve the orientation sufficiently and was hardly used. The respondents frequently mentioned their desire for an improved indication of important buildings and sights. During the second participatory workshop a respondent responded that this issue should be solved by designers and that user input on preferable indication ways is unnecessary.

> *"The thing is of course here should be some involvement of designers and people like that to come up with new ways or clear ways of showing limited sets of points or highlighting them or hiding things. (…)" (Deputy managing director, EDM)*

2) (Important) street/square names

Our suggestion to project (at least the important) street and square names on the ground in the 3D model was also driven by the previous concern that users might become disoriented in an (unfamiliar(virtual model. Due to time constraints the developers were not able to implement this functionality. Instead they have chosen to incorporate Google Maps' orientation circle/map. The user tests have again brought up the added value of the addition of street names in the three-dimensional urban environment.

3) Top 10 listings feature

The first iteration of the empirical field research, during which we gained a first insight in the practice of planning and going on a city trip, indicated the popularity of top 10 listings on sights, restaurants, shops, etc. Top 10 listings are very much appreciated since they offer tourists some guidance in the diffuse tourist information. That is why the 4.3.1 user scenarios foresee a top 10 listings feature in the 3D city model. Instead of implementing this particular feature, the developers have chosen to incorporate several POIs (shops, hotels, restaurants & 3D landmarks) that are pre-selected by Tele Atlas in the URBAN proxy. These POIs do not exactly equal the 10 most popular facilities, but there is no concrete information available concerning the applied selection criteria. As extensively described in Deliverable 4.3.2, the offer of POIs need to be extended taking the two key components 'personalisation/categorisation' and 'synopsis' into account.

4) User-generated content and location-based services

We initially aimed at integrating user-generated content and location-based services such as reviews, rankings and pictures of POIs and public transport services in the 3D city model. Yet during the interactive workshop with all the project partners organised on the 15th of December 2008 in the context of Task 4.4.1, these affordances were considered as falling out of the scope of the URBAN project. Only in case the suggested functionalities could be easily implemented in the demonstrator, they should be a part of the demonstrator. For instance the proposed public transport functionality was perceived as too complex and time-consuming to implement as it would require the involvement of external partners such as the Flemish public transport company 'De Lijn' or the Belgian railway association 'NMBS'. To our suggestion to at least incorporate a link from the 3D model to the official websites of these associations EDM & ANDROME responded that this would only entail the automatic opening of a new browser, something users could also do themselves. In addition according to EDM & ANDROME the new public transport feature of Google Maps 'Google Transit', which is not yet available in Belgian but is expanded continuously, will in the future be able to respond to this need for a public transport feature[1]. Consequently the respondents of the user tests were not able to plan a trip using public transportation in the course of their 3D city navigation experience. Furthermore they did not have the opportunity to retrieve reviews of restaurants or hotels either.

In relation to offering users some degree of photorealism of certain important locations, for example hotel pictures for city trippers and property pictures for real estate purchasers, the URBAN project partners argued in the course of the interactive workshop that users only want to know where certain facilities are located and not how these look in reality. Yet the fist iteration of the user research already indicated the importance of pictures and thus photo realistic data in the search for a real estate property and in the selection of tourist accommodations. As a compromise the developers agreed on linking pictures of tourist accommodations and real estate properties to particular locations in the three-dimensional city environment. However, the implementation of such pictures in the URBAN proxy is not yet realised.

[1] This discussion concerning the URBAN prototype took place during a video conferencing with ANDROME, EDM and SMIT on the 16th of January 2009.

"You don't need to model your complete 3D model photo realistic only for the few restaurants and other things that you really want to see photo realistic." (Tele Atlas, workshop, 15th of December 2008)

5) Route simulation

The overview of the implemented affordances of the URBAN prototype already discussed the 'route calculator' functionality that allows users to receive a route description from point A to point B by means of selecting these two points on the 'Top View' map. Since city trippers usually explore a city by means of public transport and on foot, the user-grounded scenarios foresaw the possibility to receive route descriptions for vehicles, pedestrians and public transport. Though eventually the route descriptions of the URBAN prototype were only fitted to vehicles. The route was marked by a blue line in all the three views. Yet as following the marked route in and thus navigating through the 3D model can be demanding and difficult, at least in the beginning, for users, we suggested to implement a play button by means of which users can automatically follow the selected route. This 'route simulation' functionality however is not incorporated in the URBAN proxy. Yet during the user tests the respondents experienced a lot of difficulties, in relation to orientation and the manner of navigating through the 3D model, while following the blue route that is projected on the ground after using the 'route calculator' functionality. A functionality that enables one to automatically folow the calculated route could diminish these difficulties.

6) A mobile 3D city application

The market of mobile digital city guides is still young, but is said to have a large potential. More and more mobile digital applications are being developed for the tourist-recreational sector and are accompanying the city visitor during his visit to the city and to museums (Rubben, 2006). In addition a city tripper who consults a 3D city model during the city trip planning process should also be able to re-consult the model and retrieve tourist-related information on the spot. That is why in one scene of the user-grounded scenarios a persona consults the 3D city model on his mobile during his city trip. The respondents of the user tests however did not have the opportunity to test a mobile version of the URBAN prototype. Currently the developers are experimenting with optimally installing the model on an iPhone. The user tests have indicated the possible added value of a mobile 3D city model in the context of city trips. Yet further research will have to investigate the innovative potential of a mobile urban 3D application for city trippers, first of all by providing

users with a truthful mobile 3D urban navigation experience. During the second participatory workshop one developer of the URBAN prototype agreed with the importance of a mobile URBAN prototype in order to further explore the user needs and expectations towards such devices.

> *"We have to investigate what is important for the users on the spot of course. It is probably not important that they have a 3D view of the whole city." (Junior researcher, EDM)*

7) Omni-directional video

During the user tests the respondents were given a first experience with ODV. After selecting the ODV functionality, an additional window was opened showing an ODV fragment of a popular street in Brussels. Yet the initial user scenarios foresaw the ability to choose between fragments recorded at various times of the day in order to offer the user some degree of transparency. Especially real estate purchasers could be interested in the traffic that passes in the street of a certain property at a particular time of the day. Furthermore during the interactive workshop with all the project partners (15th of December 2008) there was a consensus concerning the possible added value of ODV indoor, for instance inside a hotel from a tourist's perspective or inside a property from a real estate purchaser's perspective. Even though ODV indoor was considered as falling within the scope of the URBAN project and interesting to further investigate, time constraints hindered the implementation of this particular functionality in the URBAN proxy. Yet the user tests definitely indicated the added value of ODV indoor for real estate purchasers as it would overcome a lot of barriers that currently exist, such as contacting the owner to make an appointment to visit the property. Since the respondents of the user tests did not have the chance to test ODV indoor, further research will have to explore the innovative opportunities of this functionality.

Previous part clearly illustrates the importance of involving user input from the early phases of development onwards. The implementation of previous affordances into the URBAN prototype would allow the respondents to have a more truthful and immersive experience of 3D city navigation.

4 Fit between user practices and 3D city models

4.1 Participatory workshop method

The two-hour workshop aimed at embedding the final user findings in the last phase of development. The list with the names, research group or institution and function of all participants can be found in the annex. In order to structure the workshop -we created a step-by-step plan (see annex) that served as the guideline for the moderator. The workshop was composed of **three general parts**: an introductory part that provided the participants with an overview of the research that we conducted in the context of the second iteration of the user research (i.e. phase 3 with deliverable 4.3.2), an interactive part in which the participants had the opportunity to work with the final user findings and finally a group discussion. We will now elaborate on these different parts of the workshop.

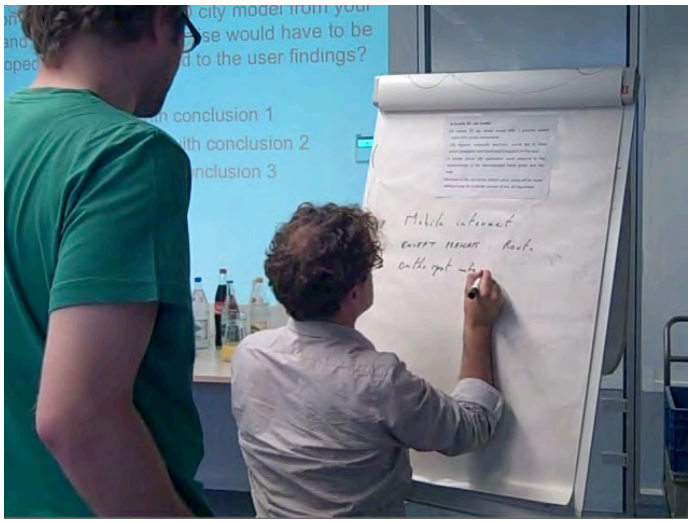
1) Presentation

To frame the final user findings and the objective of the participatory workshop, we first presented our Task 4.3 research set-up to the workshop participants (see annex). We discussed the development of a preliminary model of the URBAN demonstrator by project partners EDM & ANDROME in line with our Task 4.3.1 user-grounded scenarios as well as the set-up of the 12 Task 4.3.2 user tests that we conducted by means of this URBAN prototype. In other words, we first addressed the question: '*What did we do within the previous research phase(s)*'?

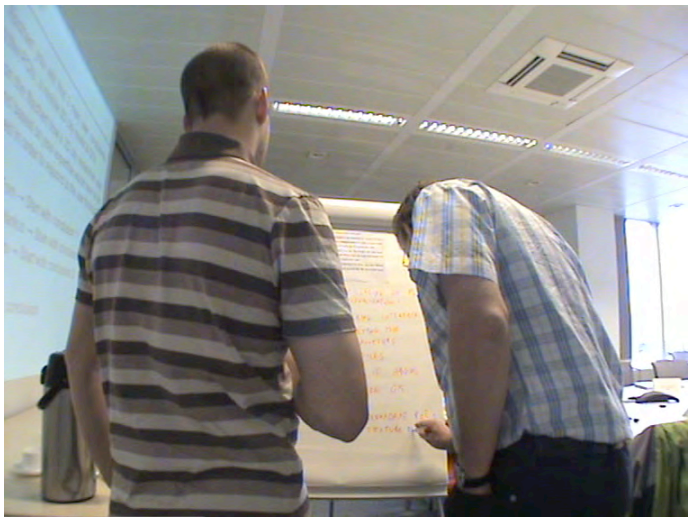
Secondly we elaborated on the final outcome of the user research as described in deliverable 4.3.2. Yet as the workshop aimed at generating multidisciplinary input on the user findings and their possible implications for the development of future 3D city models, we did not yet made the translation of the user findings towards more concrete recommendations. The latter could already indicate a certain direction concerning future 3D city models and hinder an open perspective. Only after the interactive part, during which the project partners had the chance to formulate input on the user findings from their own perspective, we linked our recommendations in with the project partners' input.

2) Hands-on time

The interactive part of the workshop aimed at letting the project partners work with the user findings and hence at giving them hands-on time with the final user outcome. The project partners were asked to think about the future evolution of the 3D city modelling technology from their own perspective and expertise using the user findings as starting point. We divided the seven participants into three groups of two project partners and one moderator who guided the input process by means of the step-by-step plan (see annex). Each pair was assigned a flipchart on which three topics and the corresponding user findings were attached, namely 'Points of Interest', 'A mobile 3D city model' and 'Omni-directional video'. Each pair worked with the same three topics in order to enable comparison between the input of the different pairs afterwards. The user findings that were selected for the interactive part can be found in the step-by-step plan that is added in the annex. The participants had 10-13 minutes for each topic to write down and/or draw how a 3D city model according to them should be further developed in order to respond to the actual user findings. The flipchart input of the participants on the different topics can be found in the annex.



Picture 2: Flipchart session with a junior technical researcher (EDM) & a senior user researcher (SMIT)



Picture 3: Flipchart session with a technical PhD student (VISICS) & a deputy managing director (EDM)

3) Discussion

The final group discussion was composed of two parts, more specifically an evaluation of SMIT's user research approach on the one hand and recommendations on the other hand.



Picture 4: Group discussion during the last part of the participatory workshop

In relation to the evaluative part we probed into the participants' perceptions concerning the workability and concreteness of the user findings. In the context of establishing a user-driven innovation development process, it is required that the user input is actually concrete and understandable enough for developers and engineers to work with and thus to embed in their development activities. Consequently it was essential that the participants gave sufficient input during the

group discussion on how they experienced the hands-on time with the user findings and on the degree in which the user findings actually linked in with the project partners' needs and expectations. Did the project partners perceive the user findings concrete enough to work with and if no, what kind of user information do they further require?

In order to bridge the gap between the user research and the design process, we formulated recommendations as described in deliverable 4.3.2 that can serve as a starting point for future product related choices. During the last part of the participatory workshop we brought together both the participants' flipchart input on the three user topics and SMIT's recommendations concerning these same three topics. By doing so, we tried to find a match between users on the one hand and the technological, research and industrial partners on the other hand from a mutual shaping perspective.

4.2 Main evaluation findings

In the context of the objective of Task 4.4, connecting the user findings on current and future user practices of navigation in a 3D environment to the actual URBAN technology development process, it is important that the user findings are indeed understandable and useful for the developers. Therefore this part 'evaluation' will elaborate on the workshop participants' perceptions of and experiences with the user findings that were presented during the second participatory workshop. Obviously these perceptions and experiences can in the future serve as important lessons that we have learnt based on our experience with UDI in a high-end technological project environment.

The outcome of the first iteration of the empirical field research enabled us to identify and draft two user-grounded scenarios, one related to city trips and one within the domain of real estate. They define the possibilities and constraints of a 3D digital city environment and point out the technological requirements and challenges from a user point of view. The user scenarios have been under constant development based on insights of previous research activities, as 'living' documents, throughout the whole R&D trajectory and fed back into the innovation process. Deliverable 4.4.1 has already elaborated on the way the project partners received these user scenarios and the corresponding storyboards.

However, the final Task 4.3.2 user outcome were presented to the project partners during the second participatory workshop by means of clustering the most important user findings per topic and making a preliminary translation towards more practical recommendations. The presented user findings were overall perceived as being concrete enough from a developer's perspective. For instance in relation to the user finding that identifies the possible added value of a mobile 3D city application in the domain of tourism, the project partners agreed that indicating the added value of a mobile 3D city model with localization and navigation support and functionalities is sufficient for further development activities. User input concerning which mobile device would be most preferable from user perspective is unnecessary. According to one respondent (Deputy managing director, EDM) the choice for a particular mobile device will be guided by the developing possibilities and functionalities of various mobile devices. Currently this **technical perspective** among the technical project partners leads to the iPhone as the most suitable mobile device for a mobile 3D city

model since it is open for development and experiments, it is capable of rendering three-dimensional visuals and it offers practical development tools.

> *"If the user wants to go to the moon and you only have an air balloon then you are in trouble so that's basically it." (Deputy managing director, EDM)*

Yet interestingly the participants also involved a **user perspective** in their argumentation for the iPhone. For example one participant argues that incorporating a mobile 3D city model in current navigation devices, which are still dominantly used in vehicles and not while walking in urban environments, would not be practical for the user as he would have to take an additional device along next to his mobile phone.

> *"(…) also if you look at practical applications if you are walking around then you might. I don't know if people will have their navigation device and their phone with them or will they prefer once we're out of the car let's say, do we still take our little extra device with us to navigate or will we count on our phone?" (URBAN program manager, IBBT)*

In addition during the workshop the participants also reflected from a **market perspective**. Illustratively one respondent states that the final choice for a particular mobile device will be more market-driven than user-driven as one can only develop for a limited number of platforms at the same time. Consequently the developers will be (partly) driven by the platforms that are dominant on the current market and their market potential.

The fact that the user findings mainly focus on the archetypical city tripper and real estate purchaser and not on the city trip and real estate market as a whole is actually perceived as a shortcoming by the project partners. According to them future user research should also involve the perspective of professionals and other stakeholders in the field to gain a better insight in the market potential of different 3D urban services and functionalities.

> *"What I find is missing now is it's only the visitor for the moment as a user but not for example the real estate guy. You know the reason why he uses photos and takes photos and bla bla bla is also because he wants to present the building in the best possible way and if he doesn't like it the whole system then it's never going to get used and for again city trips as well shop holders, museums or cities what do they*

want presented? How would they want to present it? How would they want to fill up that content?" (URBAN program manager, IBBT)

Involving both the user and market perspective next to the technical perspective in the further development differs to some extent with the first feedback moment in Task 4.4.1. Then the project partners where still primarily focussed on experimenting with and fine-tuning the 3D city modelling technology. It was also clear that user research is traditionally perceived as an activity typically taking place in the final phase of technology development. Only once the technology is fine-tuned and becoming 'mature', user input can become relevant to help the technological partners decide on the concrete user-oriented direction of the technology. This does not follow the UDI vision that successful technological development depends on the involvement of users during the whole product development process, including the early stages. By doing so, one can increase the chance that new products and services will actually be in line with the practices, needs and expectations of future end users. The resistance several functionalities in the storyboards evoked during the first participatory workshop in an early phase of the project (Task 4.4.1) and the openess of the project partners towards the user input during the second workshop (Task 4.4.2) again illustrates that it is certainly not self-evident to find an easy match between the user perspective on the one hand and the objectives and expectations of the technological project partners on the other hand in an early phase of the R&D trajectory.

When we interviewed the URBAN project partners for the first time to trace the 'hooks' where user input could guide the development process in the context of the first feedback moment to the project partners, it became clear that the project partners initially expected usability-related user input from our side. Therefore we emphasized throughout the project that our main reseach question within URBAN is: "*Which services could offer a genuine added value for users in a 3D city environment based on their city-related needs and practices?*". Nevertheless we noticed during the second particpatory workshop that some project partners still expected more usability-related user input based on our proxy research, for instance in relation to the viewing directions of the respondents while using the ODV prototype.

"For the omni-directional video it would be interesting to know where the users were actually looking at because now they have tried the ODV application but it is not very clear to me if they actually used the features of ODV. Which direction were they

actually looking at while going through the video? Were they looking forward or aside to the walls?" (Junior research, EDM)

Finally our user research within the URBAN project was explorative and aimed at identifying innovative opportunities of 3D urban environments and sensitizing concepts from a user perspective. For this we conducted qualitative research in which we have invesigated a limited number of responents in depth. This means that if we want to confirm our findings on a larger scale for a certain target population, this research activity would need to be complemented with a quantitative survey approach. The latter would also be needed for some project partners to convince them that the findings are indeed valuable in general sense. For example one of the participants doubted that the finding that ODV is mainly perceived as a nice-to-have by city trippers and thus does not respond to an important need of these users would be also confirmed on a larger scale.

"I think also there it depends a bit on how it evolves (…) I am wondering here with the let's say little demo capabilities we had, with the limited set of people that we are jumping to the right conclusions." (Deputy managing director, EDM)

5 Conclusion

The report describes the final phase in the user research for the URBAN project. The report gives insight in how the final user findings (from Deliverable 4.3.2) are linked back to the project partners, in particular the partners that have been involved in the development of the 3D city demonstrator. We have discussed the concrete approach by way of the participatory workshop, as well as the main outcome.

Looking back at the first phase of embedding preliminary user findings in the technological development (see Deliverable 4.4.1), we notice that not alll social requirements regarding specific functionalities (from Delivareble 4.3.1) were taken into account for the demonstrator to be assessed in the user tests. The report has discussed each of these functionalities in detail. Different reasons where mentioned why specific functionalities were not embedded:

- Lack of time within the project planning for being able to integrate the functionality in the demonstrator
- Technological complexity, requiring radical technological alterations, possibly by different technological partners
- No (or not yet) available (open) API module (e.g. Google) for easily integrating (a proxy to) the intended functionality
- Lack of relevance (for the users) of the functionality according to the developers and/or project partners
- Out of (the technological) scope of the project and therefore no priority according to the developers and/or project partners

The final research findings (see Deliverable 4.3.2) have demonstrated however how the preliminary user findings regarding most of these functionalities were empirically confirmed as being highly relevant, from the everyday life perspectives of the prospective users. Yet if one wants to make these findings statistically representative for the total target population of city trippers and real estate purchasers, this research would need to be complemented with a quantitative survey approach. In addition the research could be extended by linking back the findings with different other stakeholders in the value network (e.g. real estate agents, tourist offices, public authorities,...), in order to better assess regulatory issues and market opportunities.

Our research in the URBAN project has shown the relevance of integrating user input from the early phases of development onwards. It seems to be advisable to take into account already first (preliminary) user findings to some extent. In this way the true value of interdisciplinary research is validated for a more compelling experience of 3D city use and thus more successful ICT that links in with user-driven innovation.

6 References

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7 Annex

7.1 List of participants of participatory workshop

7.2 Step-by-step plan of participatory workshop (in Dutch)

7.3 Input of the participants on the user findings during the hands-on session

7.4 Presentation for participatory workshop

7.1 List of participants of participatory workshop

- **Date of workshop: the 16th of June 2009 at IBBT-SMIT, Brussels 10 a.m.– 12 a.m.**

Research group/ insitution	Function	Name participant
ANDROME	Research developer	Tom Jehaes
EDM	Deputy Managing Director	Prof. Dr. Frank Van Reeth
EDM	Junior researcher	Jeroen Dierckx
IBBT	Program Manager	Nico Verplancke
VISICS	PhD student	Markus Mathias
IBBT-SMIT	Senior researcher	Prof. Dr. Jo Pierson
IBBT-SMIT	Researcher	Marinka Vangenck

7.2 Step-by-step plan of participatory workshop

Participanten:

Nico Verplancke (IBBT)

Frank Van Reeth (EDM)

Jeroen Dierckx (EDM)

Tom Jehaes (ANDROME)

Markus Mathis (VISICS)

Jo Pierson (SMIT)

Marinka Vangenck (SMIT)

Overzicht:

Start: 10u

1. **Presentatie** (30 minuten)
   1.1. What did we do? (10 minuten) Uitleg totstandkoming van demo met EDM/ANDROME en uitvoering gebruikerstesten.
   1.2. Resultaten gebruikersonderzoek D4.3.2 (20 minuten) (nog geen vertaling naar product recommendations)

2. **Interactief deel** (40 minuten)

- De participanten worden in 3 groepjes verdeeld.

Groep 1: Nico & Tom

Groep 2: Frank Van Reeth & Markus

Groep 3: Jeroen & Jo

Ieder groepje gaat naar een flipchart waarop 3 conclusiekaders van het rapport staan. Op iedere flipchart staan dezelfde 3 kaders zodat achteraf de uitwerking van ieder kader door de verschillende groepjes met elkaar kan vergeleken worden.

- **Opdracht**: Kunnen jullie met behulp van de gebruikersresultaten vanuit jullie eigen (technologisch of markt-) perspectief en expertise aan de slag om de toekomstige evolutie van de 3D stadsmodelleringstechnologie verder uit te werken? Werk voor ieder conclusiekader op de flipchart uit hoe een 3D stadsmodel volgens u verder zou moeten ontwikkeld worden om tegemoet te komen aan de gebruikersresultaten. Belangrijk: De 3 groepjes beginnen elk met een ander kader zodoende dat alle kaders minstens door 1 groepje behandeld

zijn binnen de opgegeven tijdspanne (slechts 10-13 minuten per kader: moderator houdt de tijd bij).

- **Kaders:**

1. Points of Interest: Everyone's interest?

- The offer of POIs needs to be extended by means of more **personalisation** and **categorisation** in order to link in with the personal needs and interests of a particular city tripper or real estate purchaser.
- POIs that are implemented in a 3D city model can only have added value for the user when they are selected based on their usefulness for the user in question, in this context the city tripper or real estate purchaser.
- In the context of the expansion of POIs and the offered information one should assure that the 3D city model stays **synoptic**.

2. A mobile 3D city model

- A mobile 3D city model would offer a genuine added value from a user perspective:
  - City trippers, especially explorers, would like to have some (navigation and localization) support on the spot.
  - A mobile virtual city application could respond to the shortcomings of the domesticated travel guide and city map.
- Because of the perceived added value, users will be more willing to pay for a mobile version of the 3D city model.

3. Omni-directional video: Real estate

- In comparison to online property pictures, ODV is perceived as more '**real**' and '**authentic**'.
- ODV enables users to see more features (i.e. traffic, parking space, trees, etc.) of the neighbourhood of a property, which is particularly interesting for properties that are distant from the current place of residence.
- Referring to the need to receive a better view of the interior of a property, the respondents suggest the added value that **ODV indoor** can have for them.

Omni-directional video: City trips

- The hyper realistic **ODV** is clearly situated on the **border** of getting a prior vague idea of the vacation destination on the one hand and keeping a city trip spontaneous on the other hand.

- Particularly planners like to have a kind of **pre-experience** of a city, but there always has to be the opportunity to **discover** (new things of) a city on the spot.
- **Omni-directional video** is mainly a **nice-to-have** functionality to virtually explore the neighbourhood of an accommodation.

3. **Discussie** (40 minuten)
   3.1. Evaluatie (10 minuten): Jullie hebben zelf een aantal dingen uitgewerkt op basis van onze gebruikersresultaten. Waren de findings concreet genoeg om er mee aan de slag te kunnen gaan? Indien nee: welke gebruikersinzichten hebben jullie nog nodig? Voorbeeld: mobiele applicatie voor toeristen kan een meerwaarde zijn, ook input nodig over welk soort toestel dit best zou zijn?
   3.2. Recommendations (20 minuten): SMIT's recommendations worden aangevuld met de input op de flipcharts.
   3.3. Next steps (10 minuten): Wat kan er verder gedaan worden met (delen) van deze data?

7.3 Input of the participants on the user findings during the hands-on session

Points of Interest: Everyone's interest?

- The offer of POIs needs to be extended by means of more **personalisation** and **categorisation** in order to link in with the personal needs and interests of a particular user.
- POIs that implemented in a 3D city model can only have added value for the user when they are selected based on their **usefulness** for the particular user.
- In the context of the expansion of POIs and the offered information one should assure that the 3D city model stays **synoptic**.

Input group 1: Nico Verplancke & Tom Jehaes

→ Entry point determines fist view (detail, POI)

→ Show highlights → shops

→ musea (based on previous search results)

→ ...

→ 3D building as interaction point → "show similar shops'

Input group 2: Frank Van Reeth & Markus Mathis

- Improved - filtering of POI's
  - visualisation of POI's

  Remove or hide: * Redundant POI's?
  * Texture detail?
  * …

  Highlight important POI's
- Improved filtering interface

  For setting the
  - Parameters
  - Profiles
- Automatic implication if above points are ok

Input group 3: Jeroen Dierckx & Jo Pierson

Filtering

Not everyone wants the same

Many databases available

- Schools; child case; Retail
- Geo tags (UGC)

Position = Where = OK

How = Photo

Business …

Rating system → Unuseful info OUT

Referal – Tripadvisor

→ Position-linked

A mobile 3D city model:

- A mobile 3D city model would offer a genuine added value from a user perspective:
- City trippers, especially explorers, would like to have some (navigation and localization) support on the spot.
- A mobile virtual city application could respond to the shortcomings of the domesticated travel guide and city map.
- Because of the perceived added value, users will be more willing to pay for a mobile version of the 3D city model.

Input group 1: Nico Verplancke & Tom Jehaes

* localisation → in function of finding stuff

(it doesn't matter where you are, but where you're going)

→ preview before walking there

→ photorealistic

Input group 2: Frank Van Reeth & Markus Mathis

- Develop a mobile viewer:
  - Increased level of detail
  - Incluse localisation (GPS, …)
  - Overlay directions
  - Issue: rendering capabilities on most mobile devices
    - ? Remote rendering?

Input group 3: Jeroen Dierckx & Jo Pierson

Mobile internet → Will become ubiquitous

Except perhaps: Route planning

On the spot info: Markets etc.

BUT research

Context sensitive information

e.g. iPhone app.

Omni-directional video: Real Estate

- In comparison to online property pictures, ODV is perceived as more '**real**' and '**authentic**'.
- ODV enables users to see more features (i.e. traffic, parking space, trees, etc.) of the neighbourhood of a property, which is particularly interesting for properties that are distant from the current place of residence.
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Omni-directional video: City trips

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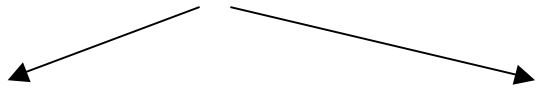
- Particularly planners like to have a kind of **pre-experience** of a city**,** but there always has to be the opportunity to **discover** (new things of) a city on the spot.
- **Omni-directional video** is mainly a **nice-to-have** functionality to virtually explore the neighbourhood of an accommodation.

Input group 1: Nico Verplancke & Tom Jehaes



ODV ⇔ 2D layout
- Vlot switchen tussen views
(of 2 views simultaan tonen)

<u>ODV als basis mock-up</u>
bijv.: dubbel glas

Input group 2: Frank Van Reeth & Markus Mathis

- **Omni-directional video** is mainly a **nice-to-have** functionality to virtually explore the neighbourhood of an accommodation.

→ Why not important-to-have?

→ Indoor also interesting?

- Referring to the need to receive a better view of the interior of a property, the respondents suggest the added value that **ODV indoor** can have for them.

Now technically possible!

? Interaction with ODV?

- Improved navigation
  - ⇔ "predefined" path
- Cliching on ODV stream

  Images for getting additional info / …

→ Link 3D – ODV important?

Input group 3: Jeroen Dierckx & Jo Pierson

<u>City trip</u>

Afstand → Te voet

Efficiency

Structure = ok

Not through houses (collision detection)

<u>Real estate</u>

Structure → More reality

Limited to specific interest

Real estate agent: Buiten ODV

- Uitbesteden

Indoor also → completely

7.4 Presentation for participatory workshop

IBBT

URBAN

WP4 - Visualization of and user interaction with 3D city models

Task 4.4 - Embedding user innovation in technology design

Interactive workshop: Final user findings

Marinka Vangenck & Jo Pierson

Brussels, 16 June 2009

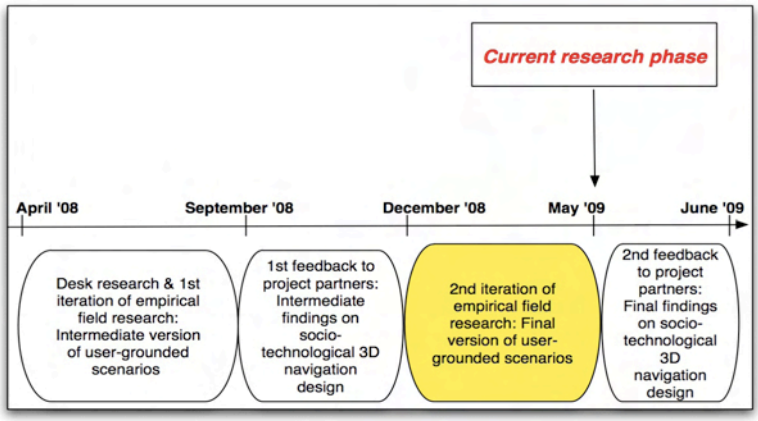
Vrije Universiteit Brussel

Studies on Media, Information & Telecommunication smit

Overview workshop

1) Presenting the final user findings
   1. What did we do?
   2. Conclusions
2) '*Hands-on-time*'
3) Discussion
   1. Evaluation
   2. Recommendations
   3. Next steps

What did we do?



- Second iteration of the empirical field research: confront users with the first URBAN prototype.
- URBAN proxy is developed by EDM & ANDROME more or less in line with the D4.3.1 user-grounded scenarios.
- Objective of workshop: embedding the user research outcome in the last phase of development.

What did we do?

- The 'user tests' (≠ usability testing)
- 6 user tests with city trippers:

	< 40 years	40 to 60 years
The (mainly) online planner	Annelies	Rob
The (mainly) offline planner	Thomas	Els
Explorer	Evelien	Noëlla

- 6 user tests with real estate purchasers:

	< 40 years	40 to 60 years
Non-inhabitant of Brussels	Wouter	Ludo, Lucia
New inhabitant of Brussels	Michèle	
Inhabitant of Brussels	Pauline	Ronald

What did we do?

- The course of the user tests: not solely testing of URBAN prototype.
  1. Establish a profile sketch
  2. Conducting an online search
  3. Interview on current domesticated practices
  4. Presenting the URBAN prototype
  5. A first acquaintance with the URBAN prototype
  6. Gauging the respondents' first impression of the URBAN prototype
  7. Scenario-based task performance
  8. Evaluative interview concerning the URBAN prototype

Presenting the final user findings

- Presenting the final user findings: Conclusions

'City trips'



Conclusions

'The practice of planning and going on a city trip: The dominant tourist information tools'

- The main advantage of a travel guide is its **mobility** and thus its ability to provide some (navigation) guidance on the spot.
- The tourist information that is offered by a **travel guide** is perceived as more **synoptic** and **well organised** in comparison to the **diffuse online** tourist information.
- Tourists prefer to decide which restaurants, bars and shops they will visit on the spot in order to keep the city trip more or less **spontaneous**. Future mobile tourist applications should be able to respond to this need to not plan everything in advance.
- City trippers are interested in **up-to-date information** such as opening hours, events, exhibitions and the schedules of public transport. Three-dimensional city models should therefore play a part in this particular need of tourists that a traditional guidebook cannot fulfil.

Conclusions

'Wayfinding and localization as primary affordance'

- All city trippers regularly struggle with **wayfinding** issues. From this perspective navigation support is perceived as the primary service of 3D city models. Consequently navigation should be a basic function on all urban tourist applications.
- **Three-dimensional visualisation** of urban environments provides a clear insight in a city, a better orientation and allows users to better link particular places to each other.
- Tourist applications should enable users to **localize** traditional tourist facilities, such as hotels, restaurants and tourists centres.

Conclusions

‘A mobile 3D city model’

- A mobile 3D city model would offer a genuine added value from a user perspective:
  - City trippers, especially explorers, would like to have some (navigation and localization) support on the spot.
  - A mobile virtual city application could respond to the shortcomings of the domesticated travel guide and city map.
- Because of the perceived added value, users will be more willing to pay for a mobile version of the 3D city model.

Conclusions

‘Virtual reality: How real?’

- People prefer a generalised 3D model of a city to a hyper photorealistic representation as the latter would leave little room to still get “**overwhelmed**” during the city visit.
- Things that are relevant for tourists, which are generally part of the **public space** (e.g. parks, squares, historical buildings), require a higher level of detail than things that are not of interest to tourists (e.g. private houses).

Conclusions

‘Omni-directional video: As real as it gets?’

- The hyper realistic **ODV** is clearly situated on the **border** of getting a prior vague idea of the vacation destination on the one hand and keeping a city trip spontaneous on the other hand.
- Particularly planners like to have a kind of **pre-experience** of a city, but there always has to be the opportunity to discover (new things of) a city on the spot.
- Omni-directional video is mainly a **nice-to-have** functionality to virtually explore the neighbourhood of an accommodation.

Conclusions

‘Points of Interest: Everyone’s interest?’

- The offer of POIs needs to be extended by means of more **personalisation** and **categorisation** in order to link in with the personal needs and interests of a particular city tripper.
- In the context of the expansion of POIs one should assure that the 3D city model stays **synoptic**.

Conclusions

‘Willingness-to-pay’

- People are more willing to pay far a **mobile** 3D city model rather than for a static application as the latter cannot approach the requirements of a traditional guidebook.
- The price people are willing to pay for a (mobile) 3D city model is limited by the price of a paper travel guide on the one hand an by the existing (free) **alternatives**, i.e. tourist brochures, online tourist information, city map, etc., on the other hand.
- In order for a 3D city model to be able to offer a genuine added value from a user perspective, it has to create a **unique city trip experience** that is tailored to the interests of the city tripper in question.

Presenting the final user findings

- Presenting the final user findings: Conclusions

‘Real estate’



Conclusions

‘The practice of searching for a home: Online real estate information’

- Real estate purchasers like to **self-select** potential properties that could be worth a visit in the comfort of the own home setting by means of real estate websites and hence avoid the intermediation of a broker.
- Online property **pictures** are of great importance in this self-selecting process of possibly interesting properties.
- Current **real estate websites** have some **shortcomings** that can hinder an efficient online self-selection of properties and that are situated on the level of the offered information on the neighbourhood, the interior and the street of the property and on the level of the search functionalities.

Conclusions

‘Virtual reality: How real?’

- A generalized 3D representation of a city can have **added value** for real estate purchasers who are **unfamiliar** with that particular city in the sense that it provides them with a spatial insight in the city and with an overview of the available facilities.
- A generalized 3D representation of a city does **not** have **added value** for real estate purchasers who are **familiar** with that particular city since they already have a general view of their own town. For these users only an up-to-date **photorealistic** virtual city model with relevant real estate services can be able to create added value.

Conclusions

‘Omni-directional video: As real as it gets?’

- In comparison to online property pictures, ODV is perceived as more ‘**real**’ and ‘**authentic**’.
- ODV enables users to see more features (i.e. traffic, parking space, trees, etc.) of the neighbourhood of a property, which is particularly interesting for properties that are distant from the current place of residence.
- Referring to the need to receive a better view of the interior of a property, the respondents suggest the added value that **ODV indoor** can have for them.

Conclusions

‘Points of Interest: Everyone’s interest?’

- POIs that are implemented in a 3D city model can only have added value for real estate purchasers when they are selected based on their **usefulness** for future inhabitants.
- POIs and the offered information need to stay **synoptic**.

Conclusions

'Willingness-to-pay'

- As a generalized 3D model can only have added value for real estate purchasers who are unfamiliar with the neighbourhood where they are looking for a property, only these people might be willing to pay for a 3D visualisation of that neighbourhood.
- There is more willingness-to-pay for **ODV inside** than for ODV outside as the former would overcome a lot of barriers that currently exist in the self-selecting process of interesting premises: contacting a broker or owner to make an appointment to visit the property.
- The existence of **free alternatives** to self-select possibly interesting properties from the comfort of the own home setting, more specifically traditional real estate websites, lowers the willingness-to-pay.

'Hands-on-time'

- On each flipchart you will find 3 main user conclusions, concerning the POIs, a mobile 3D city model & ODV.
- Task: Draw on the flipchart how a 3D city model from your perspective and based on your expertise would have to be further developed in order to respond to the user findings?

- Group 1: Nico & Tom → Start with conclusion 1
- Group 2: Frank & Markus → Start with conclusion 2
- Group 3: Jeroen & Jo → Start with conclusion 3

- +/- 10-13 minutes per conclusion

Discussion

- Discussion: Evaluation



Evaluation

- Did you find the user findings concrete enough to work with?
  - If no: What kind of additional user findings to you require?
  - For example: A mobile 3D city model can have added value from a city tripper's perspective. Do you need user input on what kind of mobile device would be desirable?

Discussion

- Discussion: Recommendations



Recommendations

- To bridge the gap between the user research and the design process we formulated **recommendations**.
- Recommendations map out the several opportunities for product change and serve as starting point for the eventual product related choices that need to be made.
- (SMIT's) recommendations:
  1. Points of Interest
  2. A mobile 3D city model
  3. Omni-directional video

Recommendations

1. **Points of interest**:

- The POIs that are offered by future 3D city applications need to vary based on the user profiles: user profile needs to be determined immediately after logging in to the 3D city model.
- The presented information on useful facilities should be layered in order to maintain synopsis, e.g. pop-ups: selecting from an optional list of facilities in which facilities one is interested (cfr. Realtor.com on next slide)
- Results hands-on-time?



Recommendations

2. A mobile 3D city model

- The best suited environment to use a virtual city model for city trippers is actually on the spot.
- Integrate more navigation and localization tools on the spot: e.g. route calculation for pedestrians & public transport, project street names on the ground, highlight important sights/buildings, put emblems on important shops, etc.
- Results hands-on-time?

Recommendations

3. Omni-directional video

- Since ODV outdoor is only a nice-to-have for city trippers and real estate purchasers are mainly interested in ODV indoor: Implement outdoor pictures in the 3D city model.
- Make ODV fragments transparent: Mention time and date of recordings.
- Results hands-on-time?

Discussion

- Discussion: Next steps?

