Exploring the World of Children and Teenagers in a 360° Virtual Environment

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Abstract: Within the multidisciplinary research project 'BLOK' we have been researching the meaningfulness, liveability and opportunities of self-development for children and teenagers in vertical housing environments. This paper discusses the value of a virtual (360°) environment in the presentation of participatory research data within this research project, and its potentials for the collection of new participatory data and as a (research by) design tool. After an introduction, the first part of the paper focuses on the reasons why we created the 360° environment and the goals we aim to achieve with it, the second part shortly explains the more technical aspects of how the environment was built, in the third part we further define different uses of the tool and finally we reflect on the difficulties and potentials we see in the (future) use of the environment.

Keywords: Youth friendly, immersive environments, virtual reality, 360° panoramas

1 Introduction: Child-friendly Vertical Housing in Europark?

A significant number of children and teenagers grow up in vertical housing environments in Flanders, especially in the cities[1]. Despite this being the reality, it is often portrayed as a question: "do we want them to?" The housing environment is an important factor in the socialisation of children and teenagers, and vertical housing has specific characteristics that influence the meaningfulness, liveability, opportunities and the quality in general of these environments. However, very little is known about the perception that children and teenagers have of these environments (HORELLI 1998, DE VISSCHER & SACRÉ 2015). Furthermore, as urban policy in Flanders is prioritising urban infill and densification, the amount of vertical housing (and so children and teenagers growing up here) is likely to increase in the future.

Our multidisciplinary research team of social workers and landscape architects explores children and teenagers' perspective on vertical housing and is interested in finding out how children and teenagers give meaning to (semi-)public spaces within, but mainly outside of the buildings. The spatial focus within the research project is on the (semi-)public spaces. This is because housings itself usually falls outside of the technical knowledge of landscape architects. However we do realise that in vertical housing environments the interior and exterior of the buildings are connected in many ways and cannot be seen as completely separate. Eventually our ambition is to come to practical advice for policy makers and social and spatial professionals who work in vertical housing environments so they can increase the liveability, meaningfulness and opportunities in these environments for children and teenagers. This being our research goal, actively including children and teenagers in the research process was a logical consequence. One of the cases where we conducted participatory research is Europark, Antwerp. A diverse, modernist high rise neighbourhood built mainly in the 1970's. In total, 44 children and teenagers between the ages of 6 and 18 years have been

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involved in different ways: from intensive, individual interviews and mental mapping exercises to short discussions around a model of the area, guided walks and photo-essays. The research data, consisting of mostly verbal or written information, was subsequently coded in NVivo software for qualitative data analysis. One way of coding was through specific places, linking physical spaces to the statements and stories that were being told about the neighbourhood.

2 Exploring the Opportunities of a 360° VR Environment

After collecting and analysing the participatory research data we reflected on useful ways to translate and report the data that go beyond the possibilities of a common research report. The first goal was to look for a way to visually represent the space as it is experienced and lived by the inhabiting children and teenagers. This representation needed to be readable both for the inhabitants as for a broad spectrum of professionals who, not necessarily know the neighbourhood very well. Moreover, there was an explicit intention to make the visualisation readable across disciplinary borders. The second goal was to present the results in such a way that it enables discussion and facilitates the exchange of different meanings given to the same space. It would therefore be an advantage if the visualisation could be consulted individually as well as for group discussions. Finally we looked for an interactive communication form, since this makes it possible for a person or group to navigate through the results of the research for this person or group in the most relevant way. Taking all of this into consideration, the idea to experiment with virtual reality (V. R.) arose.

Within the research team, who had worked with participatory research before in a previous research project (KIDS), some experiments had already been done with virtual environments (3D C.A.V.E., Figure 1) (JOYE, SACRÉ & DE VISSCHER 2016), and the translation of research results in what were called ‘experience maps’ (Figure 2). The experiences with both these methods had been positive, so they inspired us to create what finally became the 360° tool of the Europark neighbourhood.

The 3D C.A.V.E. (Figure 1) proved successful in facilitating all the participants to be present in the same virtual environment, making it a shared experience which was greatly valued and was an engaging way to discuss urban living environments. However it must be noted that setting up the 3D C.A.V.E. on location required finding a suitable (big enough) space and moving and fine tuning screens, projectors and computer was very time demanding. The use of VR-goggles in combination with a simultaneous projection would require significantly less setup time. In addition, making a detailed virtual 3D-model also takes a lot of effort and might make sense when you are discussing design proposals, but for already existing environments, like our case study, using 360° panoramas seemed like a more rational choice. Furthermore, using real-life images gives the advantage of being able to see certain important details or traces of use of the environment (e. g. littering, graffiti etc.) that might not be included in 3D modeling and can play a major role in displaying the place as a lived space.

Fig. 1:
The 3D C.A.V.E. setup from the previous research project (KIDS) showing an ongoing design-oriented workshop with teenagers

The 'experience map' (Figure 2) that was created was interesting as it showed urban places by the nicknames children and teenagers use and featured their own small drawings that quickly give insight in features or landmarks children connect with their living environment. Using a map as a base has the advantage that it helps to spatially organize this information. Nevertheless you don't get to have a visual feel of the places that are annotated on the map, which can be a disadvantage for people that are not familiar with the area. A 360° tool meets this shortcoming because it offers several options for inserting types of (raw) information like audio and images, being more immersive in comparison to a more classic map.

Fig. 2:
Fragment of an 'experience map' from the previous research project (KIDS) showing how children experience and perceive their living environment

By merging the individual or shared experiences and perceptions of children and teenagers about their living environment through adding quotes, including audio and providing some background information about the environment, the 360° tool becomes a lively representation of the space from children and teenager's perspectives, similar to the collective 2D 'experience map'. This is a unique way of exploring the environment, as you get to see an enriched version of the actual physical environment. This is important since we believe that space consists not only of a physical layer, but also comprises the (often non-visual) individual experiences and opinions, socially shared values and standards, opportunities for activities etc. that the space holds (JACOBS 2004). We hope that creating an environment where both physical and social realities are connected in a readable way creates awareness for the multi-layered character of space and increases clarity and effectiveness in striving for spatial quality by multidisciplinary teams (MARREL, BOONEN, DE VISSCHER & FORÉ 2018).

In essence, the 360° environment seemed like an interactive and flexible way of presenting the research information while at the same time offering many opportunities of connecting the 'experienced space' within a virtual representation of the physical space. In its own way it combines the benefits of the 3D C.A.V.E. and the experience map. A final, important reason for choosing the 360° environment is that it speaks to the imagination of children and teenagers, and they clearly enjoy exploring it, which is essential considering the potential for using the environment as a research tool (Figure 3).

Fig. 3:
Children from the neighbourhood Europark, where we did participatory research, on a visit of our school campus. Together with them we explored the 360° environment, which was a work in progress at that point in time.

3 Building the (Virtual) Environment of Children and Teenagers

To build the 360° environment we used a NTech Iris360 camera (NCTECH 2015) to make the 360° images, which were then processed to .jpg images. In total, the environment consists of 89 panorama images (quality: 300 dpi; 8000 × 4000 px). All of the images were made on the same day to ensure the coherence of the lighting in the 360° environment. In retrospect, we would have made the images on a fixed height, preferably the eye-level of children in order to simulate the environment as perceived by them. In the current environment, eye-heights are variable between approximately 1.2m and 1.5m.

Some of the images were then edited in Adobe Photoshop to further improve lighting and colouring. Subsequently, all of the panorama's were uploaded into the virtual tour software. For this we used 3D Vista Virtual Tour Pro (3dVista, n.d.). In this software, we connected all panoramas to make navigation between them easy and clear, which is a time-consuming process. Thereafter, quotes and images have been selected from the database of coded interviews in NVivo and inserted in the environment. By doing this, the environment becomes not merely a virtual representation of the physical space, but a readable form of children and teenagers' perspective on their living environment.

In addition to the data collected through participatory research, we experimented with adding some extra features. For example, the software allows for external content to be included like a survey using Google Forms. Throughout the environment, hotspots have been created that include images, facts about the environment and stimulating statements. We also hid several treasures as a playful element for children. By adding elements like these, the tool becomes more useable as a participatory research tool (see part 4 of the paper). In the *skin* of the environment, a users' guide has been included which explains how the environment can be

used. To increase the immersiveness of the environment, audio recordings of ambient noise (1min in length) have been attached to several of the panoramas. Finally, it is possible to navigate through the environment by following a 'guided tour', which is incorporated with a colour scheme. This will lead the spectator following a specific path set out by the researchers, following a certain theme (e. g. physical and mental borders of the environment).

The environment has been made accessible through the website: www.europark360.cf (Figure 4)**.** It can be navigated through a browser on different hardware (pc, laptop, tablet, smartphone). It is possible to navigate through the environment using a V.R.-headset, and the browser version allows for the use of a game controller (this requires additional supporting software). When working in groups, we recommend linking the hardware to a projector in order to make the navigation through the virtual environment a more shared experience. Based on our experience with the technology so far, we believe the V.R. experience (using the goggles) has limited added value considering our main goals of presenting and exchanging research results. It is, however, a completely different (more individual and immersive) way of experiencing the 360° environment, which is especially interesting when working with children and teenagers as they clearly enjoy and master this type of technology quickly. This in itself is positive, since teenagers can be a more challenging group to involve in and enthuse for research projects. The downside of using the V.R.-headset for navigation is that it limits the possible applications) that can be linked to the environment (e. g. online questionnaires can only be opened in the browser version).

After discussing the usefulness and possible improvements to the tool during a workshop with a group of professional workers in the Europark neighbourhood (Figure 5), we formulated some possibilities which could be implemented in future versions of the environment. To give some examples: we have received the feedback about adding panoramas of the inside of buildings or spaces further away from the environment (e. g. Watersides, much used parks, the centre of Antwerp etc.). A second remark was that the environment only gives a snapshot of reality so it could soon be outdated and has very little links with how the environment was a few years ago. People commented on the possibility to include information about certain activities, provisions and key figures in the environment, making it more of a 'social map'. All in all, everybody agreed to the quality of the environment as a presentation tool, and some were enthusiastic about it as a participatory research tool as well.

Fig. 4:
Print screen of the tool opened in a browser. You can see the navigation buttons in the lower left and right corners, some image buttons and two quotes about this specific place in the environment, linked to our theoretical concepts of spatial quality.

4 Different (Potential) Uses of the Tool

When building the 360° environment of Europark, our main goal has always been to create a visual representation of the research data collected through participatory research with children and teenagers. However, we soon started thinking about several other opportunities for using the tool. In broad terms, we see three potential uses: (1) as a presentation and dialogue tool, (2) as a participatory research tool and (3) as a research by design tool. Since the construction of the tool for presenting results and setting up dialogue about the research data has been our main focus, subsequent decisions had to be made about the type of information that was to be included in the environment, as different potential uses ask for different types of information of features. However, we believe it is interesting to explain all three of the uses we saw, as we still believe all of them could be valuable in different types of processes. Due to limited time, we have only been able to test the tool as a presentation and dialogue tool.

(1) As a presentation and dialogue tool. The tool as it exists now, with the 360° images and incorporated statements and information about the liveability, opportunities and meaningfulness of the neighbourhood for children and teenagers, can already be seen as an interesting source of information about the neighbourhood. We have had three different opportunities to test the tool in this way, the first one being with children from the neighbourhood, secondly with colleagues from our university college as a test, and thirdly with people working in local neighbourhood organisations. We quickly noticed that young people have an easier time working with the technology and have less problems using the navigation tools of the website and the V.R.-hardware. Logical but worth mentioning was the finding that people who are familiar with the area have a much easier time exploring the tool.

Fig. 5:
Presentation of the tool and its content for a varied group of professionals working in the environment of Europark, Antwerp. For this interactive workshop we linked the computer to our VR-goggles and a projector, which made the tour through the environment a shared experience.

We were pleased to notice that it was easy to start a discussion about the environment when walking through the virtual environment. These discussions seemed to cross the borders of physical and social themes very easily. We regard this as an especially good finding because we are convinced that, when talking about the quality of a space, these different *aspects* of space need to be combined. Another positive finding was that the focus of the discussions remained on children and teenagers for the most part. We believe this is due to the quotes that constantly brought them into focus. Since the statements are all made by children and teenagers, the current 360° environment inherently has a focus on this specific age group. People immediately saw the tool useful for discussions with policy makers, but also for people living or working in the neighbourhood themselves, specifically newcomers or teachers from local schools that live elsewhere, so they can easily get an idea of what the area is like, especially from a child's point of view.

(2) As a participatory research tool. We strongly believe the environment could be useful for collecting new information about the use and experience of the neighbourhood by children and teenagers. First of all we experience the technology is very appealing for this age group. Secondly, we believe walking around in the virtual reality holds some extra advantages in addition to walking around in the actual environment. Because the virtual environment already contains information about the way the space is experienced, you can let children react to the statements of others. By doing this, you can broaden the perspective of the navigator with other people's point of view and thus go more into depth about some topics and issues. Thirdly, there are some practical considerations: walking around virtually is quicker, not dependent on weather conditions and you can easily bring the environment to the children rather than having to bring all the children to the environment. However, as we did not get to test them in practice, we can only describe how we see this possibility work.

While doing participatory research in Europark, we saw several interesting opportunities or possibilities for using the 360° tool. These ideas have taken shape by incorporating certain elements or features in the virtual environment. Working with these features, the environment allows for plenty of different ways of researching the environment with children and teenagers. To give some examples: children can map out guided walks through the environment, steered by certain themes or questions. Children can go look for treasures, which are strategically hidden in spots we do not know a lot about yet. Children can look for flags in the environment and respond to the statements, information and images attached to them. All of these could be both individual and group methodologies, as the projection of the tool on a larger screen makes the exploration a shared experience. When used in a group, we would suggest linking the exploration of the tool to group discussions. When used individually, we would recommend a more interview oriented approach.

(3) As a (research by) design tool. By analogy of the 3D C.A.V.E. we could make projections of the environment on a screen and for instance have children and teenagers draw their ideas for improvements on the projection. It is also a possibility to have suggestions of changes incorporated in the environment (sketches / 3D renders) and have people virtually experience and respond to these suggestions. The software we used allows for uploading 3D renders which can then be experienced in a V.R.-environment, making it fully immersive. We have not further experimented with this opportunity because the case of *Europark* was meant as a participatory research case and not a design-oriented case within the research project.

5 Reflections and Conclusion

Although we believe the 360° environment is an interesting way of visualising the meanings and opportunities spaces hold according to children and teenagers, there are also a few critical reflections to make. While the environment is very comprehensible, for some, the use of V.R.-glasses can be confusing and difficult to use. A note should also be made about the individualistic nature of the V.R.-glasses, however this can be overcome by projecting what the user sees, to make it a shared experience. Additionally, attention needs to be paid to the amount of information incorporated in the environment, as there is a risk of becoming overwhelming and confusing to navigate. Another remark would be that as the images give a very time-specific overview of the environment, it's possible when the neighbourhood is changing

over time, the virtual environment too needs constant updating to remain up-to-date. This would mean that maintaining the environment *could* be very work intensive.

We have already used the virtual environment as a presentation and dialogue tool, but we have not had the opportunity to test it as a participatory research tool or as a research by design tool with children and teenagers. Therefore it is difficult to assess and discuss the effectivity of it for these uses. However, we can confirm the enthusiasm with which children received the environment, and our belief that it would be easy to recruit children for participatory research with the tool. For now, the tool remains mostly exploratory rather than solution-driven, and does not directly answer the question of what one actually can or should do with the information it contains. We have linked the quotes with *building blocks or themes of spatial quality* (to get to know more on this toppic we suggest reading MARREL et al. 2018), but specific design proposals are not (yet) part of the virtual environment. After all, we believe a thorough knowledge of the meanings a space holds, should be the starting point for a good design process. We see possibilities for future research in testing the 360° environment as a participatory design tool and as a research by design tool.

Finally, we hope the tool will prove useful in creating and supporting a dialogue about spatial quality. We believe this way of analysing, mapping and presenting socio-spatial analysis of an environment can create a more in depth discussion of spatial quality as it makes it very tangible that space is certainly not only physical space, but has many invisible, social layers which have an influence on the use and appreciation of the environment.

References

3dVista (n. d.), Virtual Tour Pro. https://www.3dvista.com/en/products/virtualtour (22.11.2018).

DE VISSCHER, S. & SACRÉ, H. (2015), Die Sozialpädagogik des Urban Design. In: Stadtbaustein Bildung, COELEN, T. et al. (Eds.), Springer, Heidelberg, 233-242.

HORELLI, L. (1998), Creating child-friendly environments. Case studies on children's participation in three European countries. Childhood 5, No. 2, 225-239.

JCOBS, M. (2004), Metropolitan matterscape, powerscape and mindscape. Planning Metropolitan Landscapes, 26-38.

JOYE, R., SACRE, H. & DE VISSCHE, S. (2016), Immersive Environment: Discussing Child Friendly Urban Spaces with Teenagers. Journal of Digital Landscape Architecture, 1-2016, 109-117.

MARREEL, M., BOONEN, J., DE VISSCHER, S. & FORÉ, P. (2018), An interdisciplinary framework for spatial quality – a vertical living kids' perspective. In Landscapes of Conflict, Routledge, Ghent, 709-718.

NCTECH (2015), iris360 – Technical Specifications. https://www.nctechimaging.com/new/wp-content/uploads/NCTech-iris360-specs.pdf.

Footnote text

[1] In Flanders, the percentage of families with children growing up in vertical housing typologies varies between 8,8 % and 17,3 %, according to different surveys. It must be noted that this percentage is significantly higher in cities and shows a great correlation with the income status of the families. Lower income families have a greater chance of living in vertical housing.