Tools for Planning, Design and Communication in Landscape Architecture: From Conventional Approaches to Virtual Reality

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Abstract: The tools used in landscape architecture vary according to the requirements of each project development setup, which occurs over multiple stages, ranging from planning to detailed design. The relationships between project development setups, participants and tools involved in different project stages are rarely discussed. This qualitative study aims at describing and exploring the motivations behind the chosen tools. Representatives of ten landscape architecture companies based in Norway were interviewed. Nine project development setups, their participants and tools were identified. Throughout this paper, we present a range of tools used for designing, discussing and communicating landscape projects with multiple groups of participants involved in the process.

Keywords: Landscape design process, project development, design tools, communication tools

1   Introduction

As with any other design discipline, landscape architecture aims to provide satisfactory solutions to the users' needs. Improving existing environments and creating new ones are its main purposes. The landscape design process goes through different stages that range from planning to detailed design. This process demands varied skills and abilities, which require the involvement of different participants, such as landscape architects, planners, project owners, governmental authorities and the public in general (HASSAN 2002). Communication among specialised groups, e. g. landscape architects, architects, planners, engineers, and communication with the public – lay people who are not part of the core group for the project development, but will benefit from the design solution – are key factors to achieve a successful result. In spite of the multiple participants involved in a landscape project development, they all have a background – whether technical or not – within the subject, which gives them a different comprehension of the project.

As key contributors to the landscape design process, landscape architects have access to a wide variety of tools, from conventional solutions (e. g. hand sketching, two-dimensional drawings, physical scale models) to computer-assisted techniques (e. g. computer-aided sketching, three-dimensional modelling and Virtual Reality (VR)). Methods and tools for collaborative landscape design and planning processes have evolved in order to enable all participants to take part and actively contribute to them. Studies on collaborative workshops point to combined tools (i. e. 2D drawings, hand drawings, scale models, and 3D visualisations) as the more efficient way to involve the public in the project discussion (GILL & LANGE 2013). However, visualisations have been mentioned as the main way to involve different participants, due to their capacity to affect decisions (KING et al. 1989, SHEPPARD 2005). Technology progress seems to drive design and planning through a digitally-oriented way of working and presenting results. Considerable number of studies highlight the added value of

using interactive 3D visualisations as the most effective way of facilitating the discussion among participants and improving the ability of the public to understand, analyse and criticise the content (APPLETON & LOVETT 2005, BISHOP 2005, SCHROTH 2007, HOUCK et al. 2013, HASSAN et al. 2016).

In Norway, involving different groups of participants in landscape planning and design has been left far behind what is described as good practice (FALLETH & HANSEN 2011). Based on interviews with landscape architects from companies of varying sizes in Norway, this paper presents tools and challenges they face when designing, discussing and communicating design solutions with different participants. Additionally, it explores the motivations behind the chosen tools and their capacity to affect the different stages of planning and design.

2   Methods

We conducted interviews with a limited number of Norwegian landscape architects from companies located in Oslo and Bergen. We limited the study to those two cities based on the considerably high number of landscape architecture offices based in each of them. In the first stage, the list of all landscape architecture companies was accessed through the Norske Landskapsarkitekters Forening (Norwegian Landscape Architects Association) website. To begin with, only landscape architecture companies in Oslo were considered – 25 in total. They were sub-divided and classified according to the number of employees, which was considered as a measure of the scale of the projects they work with and their availability to participate in this study. All companies were contacted via e-mail, in order to introduce the study and inquire about their availability to take part in an interview. In the second stage, the study was expanded to the second-largest city of Norway – Bergen – in order to enlarge the scope of the study within the Norwegian context. A similar process of selection occurred, which resulted in a list of ten available companies in Bergen. In total, ten interviews were conducted – eight in Oslo and two in Bergen. The group of participants was composed of employees from companies of varying sizes: two small (1-10 employees), two medium-sized (11-20 employees) and six large (20+ employees). Being currently involved in landscape design and/or planning projects was a pre-established requirement for participating in the interviews.

Data were collected through semi-structured interviews conducted between August and October, 2017. The interviews with companies based in Oslo took place in their own facilities, but some degree of uncertainty was faced regarding the need for being physically present in Bergen to conduct face-to-face interviews with two participants. Later on, there was a chance to interview one of them in Oslo, and the other one via a web meeting. In those situations, quiet environments and good internet connections were aspects that were taken into account in order to prevent the conversation from being affected by external factors. During the interviewing process, we tried to keep a self-critical awareness of our previous assumptions about methods and tools used within this context. Additionally, the researcher – who conducted the interviews – has limited personal experience of public participation in the Norwegian context. This was viewed as an advantage that would avoid potential bias from being introduced by the researcher during the interview. All the interviews were done in English.

All interviews were recorded and transcribed along with the interviewing process. The transcript was analysed by following the stepwise process described by KVALE & BRINKMANN (2009) and MALTERUD (2012). To begin with, two of the authors read through the whole

transcript to get an overview of the material. Thereafter, text fragments containing information responding to the aim were identified as main themes and marked out with a coloured pen. This process led to the list of codes grouped by themes. The information on each group was written up in order to condense the meaning of the topics beyond each theme. This process ended up in a descriptive statement in which all themes are tied together (KVALE & BRINKMANN 2009, MALTERUD 2012). A few quotations were chosen to exemplify the themes. Each quote is marked with an ID number (from ID1 to ID10).

3   Results

Relationships between project development setups, participants and tools are strongly linked to the choices made by the landscape architects in our study based on the purpose of each particular situation. These include project development meetings, two-way communication setups and one-way communication setups. It is also relevant to note that each setup may take place multiple times throughout the project development process.

3.1   Project Development Meetings: Collaboration between Participants with a Technical Background

a)   Project Development Meetings between Landscape Architects

The common background shared among participants facilitates the work and communication in these project meetings. These meetings take place several times during the project development process. Informants described that multidisciplinary readings, combined with hand sketching and physical scale models, are used mostly in the early stages. Even though some can easily see the value of scale models, most of them mentioned 3D modelling as the most complete tool to expose a design: "I don't see anything in a physical scale model that I don't see in a 3D model" – ID8. Only big companies, with available human or technological resources (e. g. 3D printers and laser cutters) referred to scale models as a work tool.

In general, the informants referred to both 2D computer-aided drawings and 3D models as suitable tools for the design stage, due to their accuracy. Most of the informants mentioned 3D modelling as the most valuable tool to visualise and understand the terrain from the very beginning. Only the large companies, with human and economic resources available, provide different teams with the opportunity of choosing their own work tools: "It (3D modelling) is just a normal way of working for most of us. Not everyone works in 3D, but most of us do" – ID1 – and: "We don't use them (physical scale models) a lot. It's free to use if teams want to" – ID3. Early stages often require flexible tools and work methods that allow for quick changes, while the project concept is evolving quickly. For that reason, rendering of 3D models is frequently left for the later stages. Informants working for big or medium-sized companies mentioned that BIM (Building Information Modelling) software, such as Revit or ArchiCAD, is used later in the process in order to establish a precise model for cross-disciplinary work. 2D computer-aided drawings are still used in the later stages as they are considered the most accurate tool for detailed elements, even considering the general propensity for 3D modelling-oriented work.

b) Project Development Meetings Involving Landscape Architects, other Professionals, Project Owners and Governmental Authorities

The choice of common tools was mentioned as one of the main challenges for cross-disciplinary teams: "We work together with architects, urban designers, landscape architects, so we look for the best platform across the three disciplines" – ID2. In some cases, only later in the process do all contributors come together to discuss common issues. In these meetings, several changes can potentially take place along with the discussion: "All those (different professionals mentioned before) can be in the meeting together (…) then you can do a lot of work in just a few hours because you get all input at once" – ID8.

3D modelling is considered a key tool within the process, even taking into consideration the participants' ability to interpret 2D drawings. ID8 mentioned: "Even professionals have a lot to learn from it. They see a lot more in a 3D model that they don't see in 2D drawings", whereas: "It's hard sometimes to understand the full scope of plans and their relations" – ID7. Moreover, 3D models can also give an incorrect impression of the project as it is hard to convey the scale of the site based only on a model. ID7 mentioned a specific project where: "The politicians haven't really understood the shape of the terrain by looking at the plans before the terrain has been built (…) We had some challenges in order to communicate that the design we had made was not extreme at all but the scale of it was really hard to glance". Additionally, illustrations are rarely used in these meetings, as they are usually linked to the final result: "Traditional tools are very useful. The discussion is more open. It's not that fixed as it is when you see a 3D model" – ID7.

ID10 presented an alternative intellectual process to kick-start the conceptualising stage. The participants are presented with some images of the existing site and invited to discuss a future medium/long term scenario. No additional elements are provided, but: "It's also dependent on who attends these meetings. It could be creative people who have a lot of ideas (…) It's not for everybody to walk into these discussions" – ID10.

3.2   Two-way Communication: Discussions between Landscape Architects and Technical and/or Non-technical Participants

a) Open Public Meeting

Most informants mentioned previous experience in participating or leading open public meetings. These meetings are open to everyone interested in the progress of a particular project with impact over the public space. The landscape architects usually present the design suggestion so it can go into open discussion afterwards. The combination between different tools is the key factor in such a meeting where a wide range of people with different backgrounds may be present. As mentioned by ID10: "It always comes down to how you present it. The more information you can give them, the better they will understand. But if you do very simple stuff, then it's difficult and it could be misused".

In general, the informants mentioned that interactive tools are rarely used in such meetings. These meetings usually expose the forthcoming changes and collect feedback on a concrete design solution presented mostly through written information, rendering, 2D drawings and sketching. In the planning stages, ID10 mentioned that it is important to show some vague ideas through: "Images from similar projects or ideas you had. It could be also hand sketches (…) I do it myself very often because it's not so specific as a 3D picture", whereas ID9 said that: "It's really important to give them concrete information when talking about a hypothesis

of programming". Nevertheless, they all referred to 2D drawings as legal requirements for such meetings. Regardless of the project and the participants, rendering was mentioned as the most fruitful way of ensuring a common understanding.

b) Workshop with Landscape Architect and Project Owner

The landscape architects, who have held a preliminary presentation on the project, usually run these workshops. Some informants mentioned physical elements, such as sticky notes and puzzles, used by facilitators to get the participants into the discussion. At the very early stages, the workshop discusses preliminary ideas and requirements. Sketches were also widely mentioned as a tool for such meetings due to their flexibility in testing different possibilities, while getting feedback from the project owner. 2D drawings and 3D modelling are also widely used to keep the participants tied to the project. In spite of the fact that most of the informants mentioned 3D modelling as an important tool for this setup, some referred to 3D modelling software as too complex a tool to make live changes. Instead: "We use a *cartoon-ish* tool where you can put it in as a section of a street and you just add in like a bicycle lane (…) So we had a brainstorm session with some sections (…) on how it could be" – ID1. The informants who have been involved in these setups still referred to pens, pencils and paper as must-haves for involving the participants in the discussion.

c) Workshop with Landscape Architect and General Public

Few informants mentioned workshops where the general public is invited to participate in early stage discussions or even to provide feedback on design solutions. 3D models were mentioned as the main tool to give the public the best overview of the projects, although the public is often invited to preliminary discussions when the project is not yet under development. People are invited to talk about their own experiences and suggestions for the space: "They work on the ideas and come back with important information for us, like how they want to use the space" – ID6.

Other informants described the later stage workshops that occur when the project has already taken shape in drawings, 3D models and physical scale models. Once this has happened, the architects come up with 3D models in two different ways: by showing static 3D images, and also by exploring the 3D model live in the workshop. 2D drawings are kept in addition to the models – it is not expected that the users will be able to use them on their own. Some small companies build physical scale models of the terrain: "Nothing is better than a physical model to tell a story and how it is (…) My opinion is that it's easier with a physical scale model to get an initial impression and go on through the process" – ID6.

3.3 One-way Communication: Final Presentation of the Design Solution

a) Open Public Meeting

ID5 mentioned a private owned public space where an open public meeting was arranged to present the project to the general public. The project was closely related to environmental issues that had triggered the interest of the media and the public. The owner chose to turn it into a public presentation, rather than a public discussion. The landscape architects ran the meeting by showing a video rendered from the 3D model, but also decided to use the model live in order to answer additional questions. Although: "The 3D model can be (…) a bit misguiding. (…) This is a big open area with not that much on it, except grass. It's difficult to see in a 3D model how steep it is" – ID5. When it occurred, 2D drawings were of great

help in providing additional data on inclination and distances. Only one informant mentioned that particular setup, whilst making clear that was not a representative case.

b) Exhibition and Dissemination

These setups represent a dissemination requirement in the latest stage of the design process, when the project goes into the public domain. Depending on the purpose, the main tools used by landscape architects in order to present the final result are illustrations, videos and 3D live models. In this sense, those tools are used in order to give the public the best understanding of the project, by facilitating the simulation of the human scale perspective. Such an impression is given through hand sketching, rendering, videos (taken from either 3D modelling software or scale models) and physical scale models at different scales.

While physical scale models and illustrations are considered key elements to expose the final result, some of the companies are very strict about the resources allocated to visualisation work, and their significant impact on the final results. The small and medium companies in our study tend to outsource the work, whereas big companies working with a satisfactory budget, on public or private projects with a huge impact on the community, tend to put extra effort into that stage. ID2 mentioned: "We have a 3D printer, it's usually quite expensive (…) sometimes we get such a low budget on the project that we can't use it. If the budget allows, then we usually work with that (the 3D printer) because it's so fast".

3.4   Virtual Reality: From Vague Impressions to Concrete Experiences

Virtual reality (VR) has been kept separate from the previous sections due to its particularities as a new tool for landscape architects. Some informants revealed previous experience using this technology in landscape design, whereas others could only speak about their general impression of it. The informants also shared a preliminary impression on how they envisage the progress of VR within the field. In order to ensure that all participants had a clear idea of the topic that was brought into the discussion, a VR model for a park scenario in Malmö (Fig. 1) was shown to the participants by using a VR mobile headset (Fig. 2). The chosen model was easy to use, in order to prevent long discussions on that particular experience – it included a limited number and pre-defined sequence of scenarios. After going through the experience, even the most cautious reconsidered their initial hesitant thoughts. Adaptability to different environments and easy use and navigation were the advantages that were mentioned most often: "If I can have different choices to be built in this, then it could be interesting" – ID10.

Fig. 1:
VR model for a park scenario in Malmö, Sweden. 3D model by Ramzi Hassan, Helena Nordh & Caroline Hägerhäll (2015).
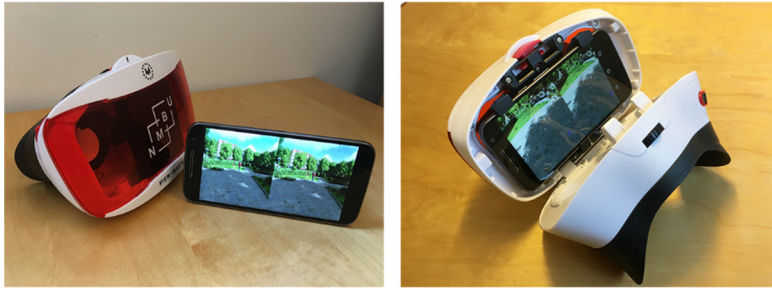
Fig. 2:
Mobile
VR headset

Both mobile VR solutions (smartphone-based) and desktop VR solutions (computer-based, requiring a desktop and wired headsets) were mentioned in the context of workshops with project owners and the public, project development meetings and exhibitions. Due to its portability, mobile VR was mentioned as the most useful for meetings outside of the office: "It's easier to create some renders and just show some pre-defined points (…) we can also go somewhere else and show our presentation" – ID5. The main issue addressed by the participants regarding desktop VR was that it is time consuming. Despite its value, the time needed in order to get a 3D model into a desktop VR environment represents a heavy disadvantage. Informants mentioned that: "It's not that bad to see the model on the screen either. Hopefully, we'll get there, but we don't have that tool yet (…) now it is too much of a hassle"– ID1 – and: "With the tools we have now, we are not able to put a pair of VR goggles and walk around. It's too much work to be able to use that" – ID5. VR has also been used by some informants for visualisation of specific projects with impact in public spaces and extensive areas where the scale is hard to convey through 3D models or illustrations. ID1 mentioned a very particular project: "It was a shooting range and the terrain forms were really high for avoiding the bullets to go anywhere (…) then we used Oculus Rift and put them on the people who were involved so they really got the feeling on it".

Interestingly, the informants with previous experience of VR were the most critical of its value for landscape architecture. Their experiences enable them to raise questions about its value to the landscape architect's work: "Whether your projects are going to be better because you can see them in stereoscopic 3D, then I'm not convinced that's going to happen (…) it may have some effect, but not a revolutionary one" – ID8. Additionally, landscape architects more in favour of traditional tools appeared to be reluctant about its value. In this context, VR was mentioned as a way of creating a gap in communication: "I believe in dialogue, in communication where you can see the people you are talking to" – ID10. They referred to VR as a tool that may be about to come in the near future. The exclusion of the other senses present in the real world was also criticised: "The sense of space, hearing, smelling… we don't have that in VR" – ID7. Additionally, two participants mentioned that VR might shift the focus of the design discussion: "Everyone would be impressed with the technology. Maybe even more than it happens with renders" – ID7. In terms of using VR to show the final design product, no one hesitated on its value. Actually, one informant referred to it as a powerful tool to manipulate people: "It's quite effective in terms of selling projects because you can really convey certain atmosphere or a certain *wowness* (…) suddenly it looks so real and so concrete that you just believe straight away" – ID2.

4   Outlook

The study's findings show that participants and tools involved in the landscape design process vary according to the purposes of each project development setup, although project development setups are not exclusively related to any particular project stage, as they might occur more than once throughout the process.

Project development meetings exclusively involve participants with a technical background. They are arranged in order to discuss design solutions by combining perspectives from multiple disciplines. Due to their recurrence, they require interactive tools that allow for continuous iteration over the design. Landscape architects have developed tools to facilitate the work among similar professionals, but they face challenges when meeting others. Project owners and governmental authorities have different interests and understandings of the design solution, which represent additional efforts for the landscape architects when presenting, discussing and collecting feedback. Virtual reality has been used under very specific circumstances in order to afford a better understanding of the scale of the project.

Discussions between landscape architects and other technical and/or non-technical participants take place at the very beginning or at different stages of the process. The scope of these meetings is usually broad, but they attempt to establish a two-way communication platform where varied perspectives can meet. In these meetings the architects expose, discuss and get feedback on the design, so it can be considered further. Nevertheless, workshop situations require active discussions between landscape architects and project owners or the public, whereas open public meetings provide an arena for questions and answers. The tools used in workshops (e. g. sketching, non-technical software, puzzles and virtual reality) act as facilitators of discussion. On the other hand, those used in open public meetings (e. g. rendering, 2D computer-aided drawings, pictures and written information) expose a design suggestion or final result which bounds the scope of the meeting.

Presentations of the final design are often required for projects with a strong impact on the public opinion. The landscape architects in our study make all efforts in order to provide the public with a good understanding of the project. At this stage, there is no invitation for further discussion, but a deliberate attitude towards the public's acceptance. Visualisation tools (e. g. 3D modelling, videos, virtual reality) are the most common tools in this context.

In general, 3D modelling and rendering are common tools across all setups. In spite of the project development stage, the adaptability of those tools is open for multiple possibilities. 2D drawings take part in all the various project development setups, although they remain as unnecessary elements for the purposes of the final presentation. As we understood trough the interviews, VR is taking the first steps as a tool for landscape architecture. It has been used in very specific situations, in which other tools do not provide a proper answer to the architects' visualisation needs. Moreover, it has been seen as an innovative, but time-consuming, tool. In this way, mobile VR is more likely to be taken up as a planning, design and communication tool, due to its easy use and versatility.

It is considered relevant to mention that all interviews were conducted in English with non-native English speakers, which might represent a limitation for the study as the informants attempted to make sense of their own thoughts in a foreign language. Due to this reason, some quotations include grammatical mistakes.

Finally, this is a qualitative study that involves a limited number of Norwegian landscape architects. In this sense, the aim was not to achieve representativeness, nor to generalise the findings. It rather presents the motivations behind the chosen tools and methods of a group composed of varied landscape architecture companies with a relevant contribution to make to the Norwegian context. The methodology presented was able to provide qualitative data that can be used as a basis for coming studies on tools for landscape architecture. It will be of interest to explore virtual reality further in the context of some of the described setups.

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