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Research Paper

What you see is not always what you get: A qualitative, comparative analysis of ex ante visualizations with ex post photography of landscape and architectural projects

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ABSTRACT

This study presents a qualitative, comparative analysis of ex ante visualizations, created during planning and design phases, with ex post photography of landscape and architectural projects. Visualizations play an increasingly important role as decision-making tools in the planning process and are expected to successfully communicate proposals to both experts and laypersons. Outside of the wind farm industry there is a lack of detailed guidance for those creating landscape visualizations and currently no method of analyzing the accuracy of visualizations exists. In a world where we increasingly rely on information communicated in a visual manner it is imperative that potential viewers are provided with clues to enable them to distinguish between what is real and what is not. This study analyses a selection of visualizations from a cross section of landscape and architectural projects and reveals reoccurring patterns of inconsistencies in the depiction of content elements. The control of production through agreed guidelines proposed by previously published research could have both positive and negative effects for the future of visualization production. This research proposes that the starting point for honest communication lies in transparency, in both production techniques and presentation to clients, stakeholders and the public. There is scope for more in depth image analysis of a larger body of projects that may reveal more detailed findings that could contribute to future guideline discussions.

1. Introduction

The use of diverse forms of visualization as a communication tool in the planning process of landscape and architecture projects is growing in popularity (e.g. Gill, Lange, Morgan, & Romano, 2013). In recent years, this is driven by the need to find more effective means of public participation (e.g. Lange & Hehl-Lange, 2005). Developments in the use of visualizations are aided by continuing advances in computer processing power and readily available software.

The effectiveness of visualizations as a communication tool and issues which arise with their use has been subject of previous research which has focused on response equivalence and audience (Sheppard, 2001; Wergles & Muhar, 2009), realism and viewer perception (Lange, 2001) as well as on a lack of standard production methodology and assessment criteria (MacFarlane, Stagg, Turner, & Lievesley, 2005; Sheppard, 2001).

Generally, methods for the assessment of existing landscapes and proposed futures using landscape visualizations (see e.g. Daniel, 2001; Lange & Legwaila, 2012; Ribe, Armstrong, & Gobster, 2002; Zube, Sell, & Taylor, 1982) can be grouped into quantitative perceptual (asking people about 'judgments'), qualitative perceptual (asking people to describe differences between the presented stimuli), quantitative analytical (developing metrics to estimate the degree of differences e.g. in before/after images) and qualitative analytical (describing objective differences between images) approaches.

Little conclusive research has been carried out to compare ex ante visualizations introduced during the planning phase of landscape and architectural projects with ex post photography of the finished site. This paper outlines a purposive critique of visualizations produced for specific landscape and architectural projects.

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This was achieved through qualitative analysis of the ex ante visualizations (*Before*) compared to ex post photographs of the completed sites (*After*).

1.1. The use of images to communicate proposed landscape changes

Visualizations which aim to show proposed designs as they will appear in reality were pioneered in the landscape profession by Englishman Humphry Repton (1752–1818). He is the first practitioner who systematically created images which depicted 'before and after' scenarios in his famous 'Red Books'.

Repton (1840) postulated that the human eye finds it difficult to judge distance and scale unless there is some known standard by which it can be measured. He was concerned that "trees are of such various sizes that it is impossible to use them as a measure of distance; but the size of a horse, a sheep or a cow varies so little that we immediately judge of their distance from their apparent diminution, according to the distance at which they are placed" (pp. 348–349).

This role of communicating proposals to clients and site users remains one of vital importance in the field of landscape architecture today. Presenting a visual representation of ideas and designs for the future makes it possible to convey complex information to a wide variety of viewers. This is particularly important for projects that require public consultation. Often, in such cases visualizations are prepared to facilitate discussion between experts from planning and design disciplines and non-experts, or stakeholders in general.

2. Areas of research: standards, perception, accuracy, realism and bias

Landscape visualizations provide a way of translating ideas behind design and planning concepts and data depicted in plan into a more accessible visual form for the purpose of communication. Visualization is a method of computing with the ability to transform the symbolic into the geometric for the purposes of observation and evaluation. Thus, "visualization offers a method for seeing the unseen" (McCormick, DeFanti, & Brown, 1987, p. 3).

The potential of landscape visualizations and their role of conveying information for planning decisions is concisely described by Sheppard (2001, p. 194) as "specifically to provide the means for both an emotional (affective) response to proposed future environments and an analytical assessment of expected aesthetic changes".

2.1. Production standards

Current production standards of visualizations vary greatly across the landscape planning and design disciplines, to the extent that the lack of a framework or guidelines for their creation leaves landscape professionals open to criticism. Consistency in production standards is of increasing importance in the light of EU regulation requirements for public consultation and participation in the planning process (e.g. European Commission, 2003). Sheppard (2001, p. 192) believes the use of visualizations becoming more commonplace in public decision-making will lead to "an increasing likelihood of debate over their veracity, and of litigation resulting from differences between the visualizations and the built designs".

Detailed landscape visualization guidelines for projects that require an Environmental Impact Assessment (EIA, see European Commission, 1985), and projects which do not, are limited in the UK. The current EIA and Visual Impact Assessment (VIA) guidelines compiled by the Landscape Institute with the Institute of Environmental Management and Assessment (2013) do not include specific production guidelines for visualizations. They do however reinforce the importance of transparency and ease of access to information agreeing with the aims of the *Environmental impact assessment: guide to procedures* (Department for Communities and Local Government, 2006) to ensure that "the importance of the predicted effects, and the scope for reducing them, are properly understood by the public and the relevant competent authority before it makes its decision" (p. 7). It has been noted that current practice requires the text content and performance standards of Environmental Impact Statements to be regulated, however there are generally no set standards for visual simulations (Sheppard, 2001, p. 191). Rare exceptions include guidelines by the Landscape Institute (2011) and good practice guidance on the visual representation of windfarms (SNH, 2006).

2.2. Perception, vision and our experience of the environment

Our sensory perception of the environment varies greatly depending on whether we are experiencing it physically or through photography or visualization. The visual aspect of landscape plays a key role in our perception of the environment. Bruce, Green, & Georgeson (1996) estimate that 80% of man's perception is based on sight, however other sensory, physiological and psychological factors also influence our perception of place.

There are key differences in visually experiencing an environment on site compared to viewing a visualization. When experiencing an environment on site the dynamic boundaries of the human visual field are not limited. A combination of head and saccadic eye movement provide vital clues to the brain informing important calculations about scale, distance and speed. Gibson (1950) points out that the eyes function as both a very wide photographic lens and a telephoto lens. In contrast, when viewing an environment by looking at a visualization or photograph we are limited by the fixed physical boundaries of the printed or projected format.

Partial views of objects or lack of contrast can lead people to "see" an object and still fail to perceive the object (University of Newcastle, 2002). On the other hand, characteristics such as scale, brightness and contrast can draw attention to an object. The link between these elements leaves potential for perception being enhanced or suppressed.

2.3. Accuracy and realism

The effect of accuracy on the viewer has been investigated by Watzek & Ellsworth (1994). It has been argued that it is not clear what level of accuracy is necessary for people to accept visual simulations and that for many situations exact accuracy may not be required (Watzek & Ellsworth, 1994). Sheppard (2001) argues that although accuracy in itself may not be enough to ensure validity, the practice of permitting inaccuracies in landscape visualizations poses a danger. The danger is made apparent for example by allegations regarding the misrepresentation of turbines in a number of Scottish wind farms (Macaskill, 2010). Research has indicated that turbines depicted in visualizations that use panoramic, wide angle views of the landscape can have the effect of making the turbines appear smaller than they actually are (Macdonald, 2007).

Discussion in research is ongoing as to the level of realism and detail regarding response equivalence. Response equivalence refers to the ability to stimulate responses that are similar to those that would be produced by the real environment (cf. Appleyard, 1977). Wergles & Muhar (2009) have carried out a detailed study of response equivalence through a comparison of viewer responses to visualizations versus on-site visits. They point to the importance of discovering a way of empirically determining an acceptable image and adequate levels of realism while maintaining an economical approach to producing the visualizations (p. 172). Lange

(2005) raises concerns that current hard- and software for visualization provide the opportunity to produce visualizations that can look highly realistic – even with inaccurate data (p. 6). Daniel & Meitner (2001) maintain that despite an accurate projection and portrayal of biophysical conditions, it is possible that visualizations may produce perceptions that are not consistent with live experiences of the environments represented. As Gibson (1974, cited in Sanoff, 1991) reminds us "pictures record data not sensory information".

Solutions to these problems are particularly relevant to commercial practices producing landscape visualizations that seek to balance high quality production values with finite resources and tight time deadlines. Clearly, there is still important work to be done to identify thresholds of acceptability for adequate levels of realism and accuracy (see Sheppard, 2001).

2.4. Bias

Bias in the selection of content for landscape visualizations is a potentially contentious issue and remains an inherent danger in their production (cf. Watzek & Ellsworth, 1994). Appleyard (1977, p. 48) states that there is growing pressure in the various phases of communicating a design project "to persuade the public of its value". This could potentially lead to biased intentions of the simulator. MacFarlane et al. (2005) also allude to the problem of bias in cases where the developer is commissioning client for landscape visualizations produced as part of an EIA, e.g. in the case of alleged misrepresentation of wind turbines in Scottish wind farm developments where developers were the commissioners of visualizations of the proposals (Macaskill, 2010). Furthermore, the selection of viewpoints, either deliberately or accidentally, could lead to bias if the viewpoints do not show a project from a typical viewpoint or in typical conditions (see e.g. Lange, 1994; Sheppard, 1989). Daniel & Meitner (2001, p. 64) mention the potential power of specific features in visualizations "to affect attention, to alter interpretations of complex concepts and differentially to arouse positive and/or negative emotions".

3. Methods

The method for comparative analysis of visualizations with post construction photography aims to highlight reoccurring issues that arise in relation to accuracy and realism and to examine how these issues have the potential to impact on a viewer's perception of the proposed design.

3.1. Project selection criteria

Twelve landscape and architectural projects that have all been completed since 2005 and within a two-year timeframe were selected for analysis. The projects did not undergo any major design changes between the publicly available visualizations and their completion as built projects. They are mainly situated in the public realm and include a suburban park, urban play space, university buildings with related open space and a waterside plaza. The projects were designed and funded by both local authorities and/or private practice and used both public and private funding in their construction. For reasons of proximity, time and funding all sites analyzed were located within the cities of Sheffield, UK, and Dublin, Ireland.

The visualizations selected for analysis were readily available and they were all used for communicating the project with the public.

3.2. Data collection

Initial searches were carried out for *Before* and *After* visualizations and photographs published in the public domain on the Internet. The search encompassed websites of landscape architecture practices, architectural and urban design practices, planning practices, city councils and project developers. During the initial stages of the research it became apparent that the photographs of the finished sites that were available did not match the same viewpoints as the visualizations produced during planning and design phases of the projects.

In order to carry out as accurate a comparison as possible between *Before* visualizations and *After* photographs, the *After* on-site photographs were taken specifically for this study. These photographs were taken from viewpoints corresponding as closely as possible to those used for the visualizations. In some cases this was hampered by restrictions to public access or by the positions of subsequent developments.

3.2.1. Visualization collection

Before images acquired from online sources varied in file size and were predominantly available in JPEG format. In cases where the resolution of a visualization was so low that pictorial elements became difficult to distinguish higher resolution digital files were requested from the original producers or clients.

A representative selection of visualizations was chosen for each project. Birdseye views were not used. Although these visualizations can provide a useful overview of the project site the viewpoints they represent are generally not publicly accessible and therefore make poor candidates as comparative subjects.

3.2.2. Post construction photography collection

The collection of site photographic data was undertaken in a systematic manner during a series of site visits. Photos were shot between 6th and 12th August 2010. Technical information and shooting criteria are shown in Table 1.

3.2.3. Limitations relating to photographic data collection

The analysis acknowledges a certain degree of distortion to vertical perspective due to the use of a wide angle fixed lens as opposed to a specialist tilt and shift lens, as used e.g. in professional architectural photography. It was deemed unnecessary to carry out any lens distortion correction in post-production as this was not a key comparison factor in the analysis. Image processing (e.g. Mitchell, 1992) was kept to a minimum, but in some cases it was necessary to carry out basic levels correction using Adobe Photoshop, which was recorded in the Photo Image Data section of the text analysis. In rare cases the viewpoint was inaccessible due to buildings constructed since the production of the visualization.

3.3. Ex ante visualizations and ex post photography – comparison methodology

Image pairs consisting of one '*Before*' visualization and one '*After*' site photograph were selected for each project. The number of visualizations analyzed was determined by the range of visualizations available (varied by project between one and six).

3.3.1. Photo selection

Photos for comparison were selected based on the closest match. This was determined by overlaying a digitally produced transparency of the photograph with the visualization (using Adobe Photoshop). To aid this matching process, key perspective cues were in some cases highlighted by marking their position with

Table 1
Photographic technical information and shooting criteria.

Photography equipment and shooting criteria	Technical detail	Additional notes
Camera	EOS 5D Mark II, 21.1 megapixel full frame 36 × 24 m CMOS sensor.	
Aspect ratio	3:2	
Lens	Canon EF 24–70 mm f/2.8 L USM	This fixed 24–70 mm 2.8 lens was the most suitable available lens which enabled a selection of focal lengths to be recorded.
Focal lengths		A range of fixed focal lengths were used for each composition, 70 mm, 50 mm, 35 mm and 24 mm.
	70 mm	70–80 mm lens is the current lens advised by specialists in the field of visualization for the wind energy industry, considered to give the closest match to the human eye.
	50 mm	'Standard' lens traditionally considered the most appropriate lens for portrait photography as it produces minimal distortion and its field of coverage is considered roughly equivalent to that of the human eye.
	35 mm/24 mm	Wide angle options – 24 mm widest available (and closest match to the wide angle views in many of the selected visualizations).
Lens height	1.6 m (approximately – see note)	The decision was made to hand hold the camera which was particularly important for ease of access in cases involving viewpoints located on or crossing streets.
Image quality settings	Medium quality jpeg 4080 × 2720 pixels	This setting, considered in relation to available processing power, was deemed to provide sufficient quality for the purposes of this analysis.
Depth of field	f 22/20 (daylight only – see note)	The F stop was set to the highest setting 22/20 in order to reflect the predominantly large depth of field portrayed in the visualizations. In order to maintain as large a depth of field as possible shutter speed and ISO settings were altered accordingly. For night-time photography the F-stop had to be set lower to work with available light to enable shooting with available light.
Viewpoint matching		The initial step was to attempt to match as closely as possible photographic framing to the visualization framing making allowances for differences in aspect ratio [available visualizations had a variety of aspect ratios]. Visually dominant elements and their positioning in the visualization were used as markers/visual cues [e.g. Main building position, road alignment, traffic light or light post positioning] in addition perspective cues such as footpaths or roof line of a key building were used to aid camera alignment.

coloured lines – for example the line of a footpath or the roof line of a key building.

3.3.2. Presentation of image analysis

A set of criteria was established for presentation. It was important to see the visualization and photo on the same page. Visualizations would always be shown at their original aspect ratio. Where the visualization was larger than the photograph both were shown at their original aspect ratios. To aid viewing for comparative purposes a dotted line showing the framing of the photograph is superimposed onto the visualization (Fig. 2).

3.4. Object mapping

This method was developed to provide a visual representation of the comparative image analysis. Mapping of individual key content elements is intended to provide the viewer with a quick overview. Fig. 1 shows initial work involved using basic symbols and a variety of line types in one colour to mark the location of key built and vegetative elements in both the *Before* Visualization and *After* Site Photograph. Subsequently, the object mapping concept was refined to make the results more easily readable. For example, each content element's outline shape should be represented by a single line. Different content element types (structural elements, vegetation, etc.) were represented by different coloured lines. This means of representation gives a better indication of scale and mass in addition to location information.

3.5. Image analysis

A total of twenty-eight visualizations were analyzed to extract the key content elements:

- Key proposed structures: Visible areas of proposed building/landscape constructed elements.
- Structural elements: Key existing and proposed built structures which are dominant in the scene and/or do not match in scale or position.
- Street furniture: Seating, railings, rubbish bins, street signage, bike racks.
- Lighting: Street lighting structures and traffic lights.
- Vegetation: Street trees, herbaceous planting and mown grass.

The results were recorded in visual format using the Object Mapping method (see also Fig. 2). Additional text analysis notes were recorded in table format (Tables 2 and 3) under the following categories: style of production, viewpoint, perspective, vegetation, built structures, street furniture, materials, people, traffic, weather, time of day/year and photo image data.

4. Results

A selection of visualizations encompassing a range of landscape types is presented. These visualizations illustrate a number of important points highlighting a lack of consistency relating in particular to the inclusion and omission of various design components, choice of camera angles and framing.

Suburban park visualizations (Fig. 3) reveal discrepancies in depiction of vegetation maturity, while the compositing of building imagery in some urban settings has impacted on perspective, resulting in angles which do not match the actual location (Fig. 4).

Selective 'decluttering' through the omission of existing built structures (such as tramlines and street furniture, e.g. Fig. 5), and carefully considered camera angles and framing have helped to reduce the visual impact of distracting structures. Partial (Fig. 5) or complete omission (Fig. 6) of vehicular traffic has been noted in busy urban contexts, painting a misleading picture of proposed development – a particularly pertinent point when it relates to a child's play space such as Chimney Park (Fig. 6).

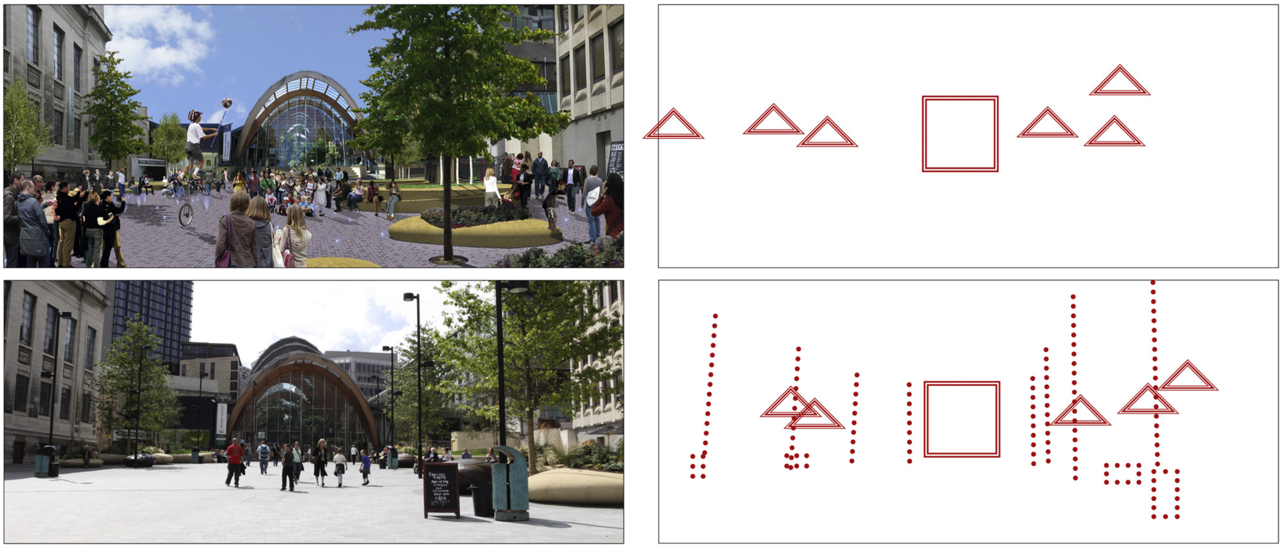

Fig. 1. Tudor Square/Open Space, Sheffield, UK. Example of initial object mapping experimentation using basic symbols to represent key content elements including trees, key built structures, lighting and litter bins. Visualization produced and provided by Sheffield City Council, photograph by Melanie Downes.

4.1. *Style of production*

The production style of visualizations analyzed can be broadly fitted to the following categories:

- Computer generated elements only.
- Predominantly computer generated elements with the addition of some photographic elements such as vegetation and trees.
- Computer generated models super-imposed onto a photograph of the existing site.
- Hand drawn style, illustrated as line drawing with basic colour fill.

There was no direct relationship drawn between the style of production and levels of accuracy and realism in the visualizations analyzed.

4.2. *Viewpoint*

Elevated viewpoints as used in many visualizations were deemed to produce the following positive and negative effects:

- Allows for the inclusion of more detail as it reduces the likelihood of background objects becoming obscured by foreground objects.
- Can lead to a distorted sense of scale.
- Reduces the visual impact of foreground items.
- Viewpoints are sometimes located in inaccessible places, e.g. in water bodies, amidst vegetation or in places people would not normally stop to observe the view such as the middle of a busy road or a tram line. These are clearly not as representative (see Sheppard, 1989) as those located along well-used routes. Projects that provide at least some eye level, or close to eye level, perspectives provide the most representative or realistic impressions of the finished design.

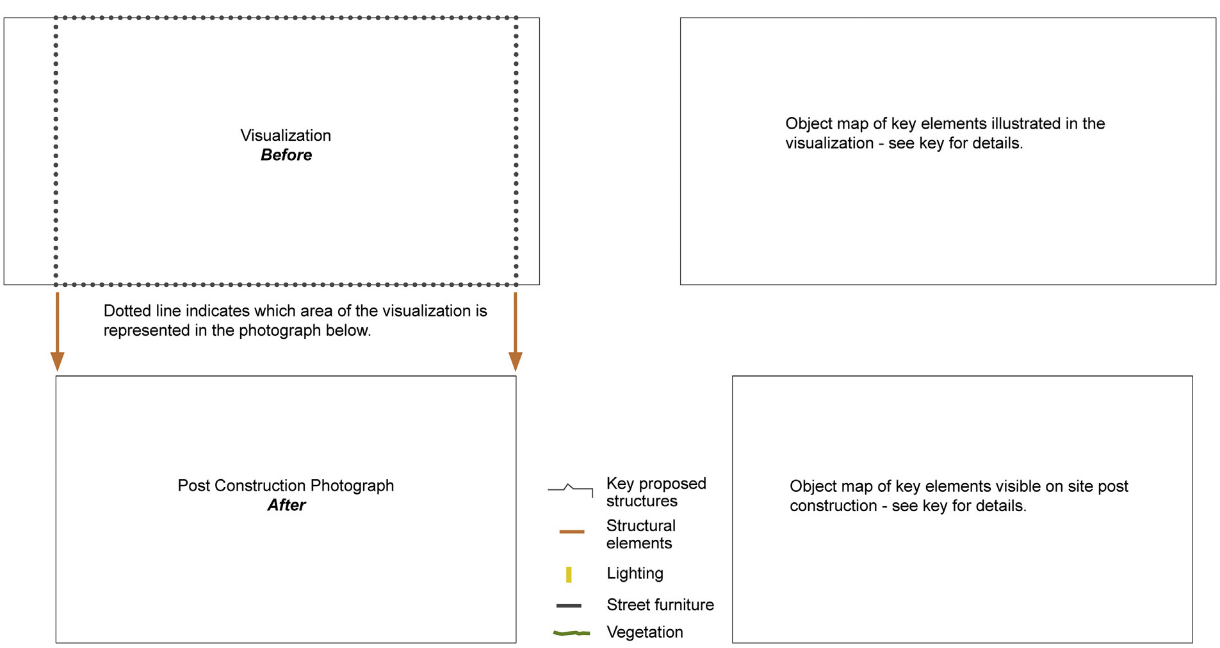

Fig. 2. Image analysis object mapping; sample format.

Table 2
Image analysis: text notes table sample.

X PROJECT NUMBER	Name and purpose. Designer. Client. Completed date. Visualization production date. Time-scale visualized year.
STYLE OF PRODUCTION	Computer generated elements only/Predominantly computer generated elements with the addition of some photographic elements such as vegetation and trees/Computer generated models super-imposed onto a photograph of the existing site/Hand drawn style illustrated as line drawing with basic colour fill.
VIEWPOINT	Direction – North South East West/Height and Location of viewpoint.
PERSPECTIVE	Correct and Distorted perspective noted.
VEGETATION	Trees, herbaceous vegetation, climbing vegetation, reeds and mown grass.
BUILT STRUCTURES	Key proposed built structures and dominant existing built structures.
STREET FURNITURE	Seating, railings, street lights, traffic lights, street signage, litter bins, bollards, cycle racks.
MATERIALS	Texture and colour/level of detail.
PEOPLE	Numbers and positioning of people.
TRAFFIC	Vehicular traffic inclusion and omission.
WEATHER TIME OF DAY/YEAR	Sky condition, Shadows, Seasonal cues in vegetation or clothing worn.
COMMENTS	Comments on key issues noted
PHOTO IMAGE DATA	Image number. Date of photograph. Time of photograph. Lens type. Shutter speed. F-stop. ISO setting.

4.3. Perspective

Visualizations using computer-generated elements that are super-imposed onto a photograph of the existing site indicated the best representation of true perspective. The existing buildings provided an anchor for the image elements of the design proposals.

Perspective distortion was evident in the following cases:

- When photographic background elements have been inserted as separate image elements; this can result in inconsistent viewing angles.
- When the visualization foreground and background appears to have been created from two different viewpoints; this can have the effect of drawing the foreground closer to the viewpoint and results in the misrepresentation of scale in background elements.

4.4. Vegetation

An inconsistent approach to the depiction of vegetation was noticeable even within specific projects. Existing trees and background shrubs were often omitted. These omissions may be explained as a method to improve views of proposed buildings. More subtle approaches are also evident, for instance the seasonal depiction of vegetation, the use of bare winter trees to allow an unhindered view of proposed building development, or trees showing vibrant autumnal colours for added visual effect.

Proposed trees were usually depicted in full foliage, and it was noted that where photographic representations of trees have been used there is often little effort made to introduce noticeable variances in the tree colour or form. Copy and paste techniques, i.e. multiple use of a single cut-out element, is sometimes evident, which undermines the work of achieving a realistic scene.

The proposed tree species sometimes differ in type to those planted on site. In some cases this may be explained by design reviews that occurred after the production of the visualizations.

The maturity of proposed planting is sometimes inconsistent even within the same visualization. In the Father Collins Park visualization (Fig. 3) trees and climbing plants have been illustrated as semi-mature while the background reed planting is only indicated as a very sparsely planted mass (the opposite to its current onsite form). The variation and inconsistencies in the depiction of vegetation can be attributed to a number of factors. The most common driving factors being that detailed planting design happens at a later stage than the production of the visualizations and planting is often the element in schemes which is reduced or cut when budgets are under pressure.

Table 3
Father Collins Park, Dublin: image analysis text notes.

21 PROJECT	Father Collins Park, Donaghmede, Dublin 13, Ireland. Designed by: Abelleyro + Romero Architects with MCO Architects. Commissioned by: Dublin City Council. Completed: 2009. Visualization produced: 24.04.06. Time-scale visualized: not available.
STYLE OF PRODUCTION	Computer generated modelling combined with photographic texture elements. Use of saturated colours in particular in the sky area. The light source to the left of frame could be considered distracting.
VIEWPOINT	Direction – North. Inaccessible to the public – situated in the water.
PERSPECTIVE	Good match to the photograph of site.
VEGETATION	Reed planting in along the walkway waters edge in the foreground has been omitted and only barely represented with thin distribution in the background. Trees represented at a stage of semi maturity.
BUILT STRUCTURES	Wind turbine illustration not representative of the scale on site, there is a large discrepancy between the sizes.
STREET FURNITURE	Lighting, bins and electrical service boxes have been omitted. Seating form and positioning different from what was constructed on site.
MATERIALS	Ground surface materials illustrated as two different types however on site this distinction is very minimal. Dark ground surface material illustrated as reflective – no reflective properties in the surfacing installed on site.
PEOPLE	Foreground figure's action and eye line distracting.
TRAFFIC	No vehicular traffic illustrated. Public park – vehicular traffic other than service and emergency vehicles not permitted.
WEATHER TIME OF DAY/YEAR	Unrealistically cloudless blue sky. Shadows cast by the shelter would suggest mid morning. Foliage and clothing suggest summer.
COMMENTS	The reed planting on site has the effect of softening the hard concrete edges of the promenade, only minimal reed planting limited to small areas is illustrated in the visualization.
PHOTO IMAGE DATA	IMG_0519 06.08.2010 11.44 70 mm 1/320 f22 ISO 1600

4.5. Built structures

Existing built structures have been used to positive effect as an anchor for perspective in a number of projects. This approach is only successful if the existing buildings are treated as one entire element. In the case of the Tudor Square project in Sheffield, buildings have been inserted as separate image objects (Fig. 4). This has resulted in angles that do not match those on site.

Some projects are located in areas where development on neighbouring sites is happening concurrently. In these cases it is inevitable that some of the buildings indicated in the visualizations will not appear on site in the same form. It must also be acknowledged that development of background buildings may have occurred after the production of the visualization. In some visualizations existing built structures, such as infrastructure

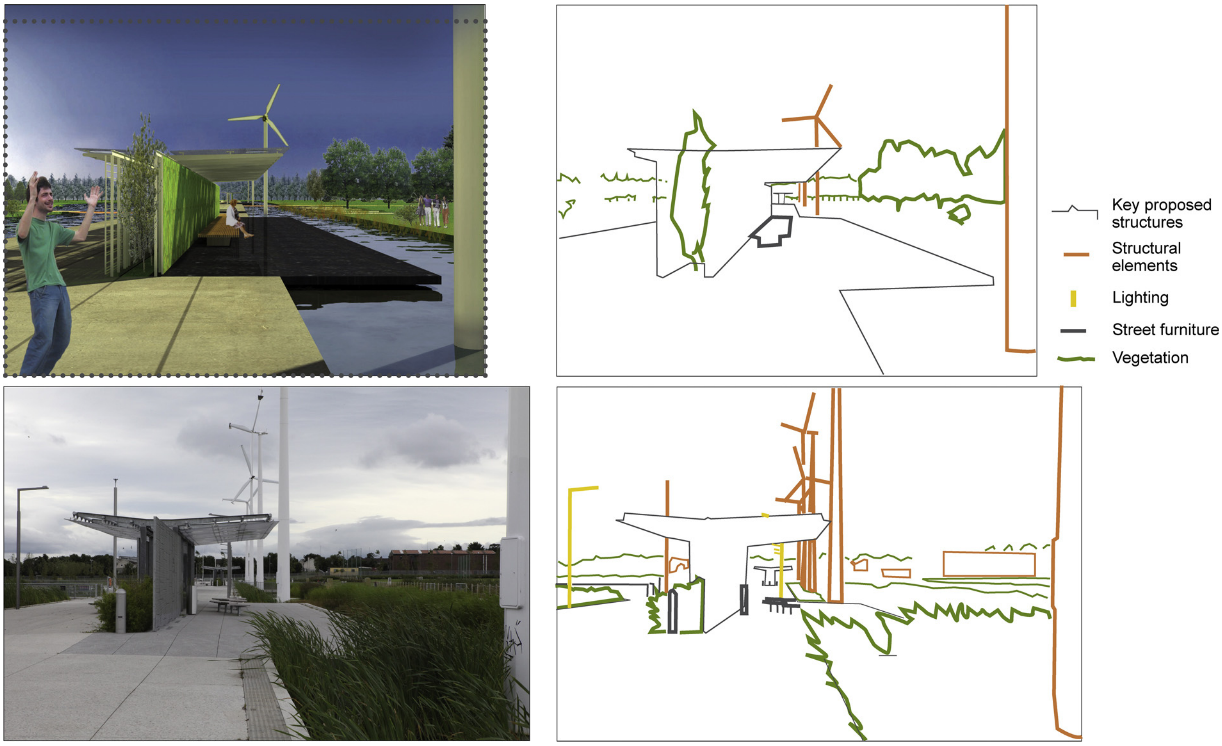

Fig. 3. Father Collins Park, Dublin, Ireland. Discrepancies in depiction of vegetation maturity. Visualization produced and provided by ArArq Ireland/MCO Projects, photograph by Melanie Downes.

relating to transport (tram power lines, street-side railings, etc.), have been completely omitted (Figs. 5 and 6) or their visual impact reduced by careful angle and framing. This 'de-cluttering' can result in a rather clinical finish to sections of the visualization, which often appears contradictory to the detailed finish in other sections.

The importance of depicting site context in visualizations should not be overlooked. The area surrounding any proposed development has a great effect on how it looks and feels. Accurate but not necessarily detailed depiction of the surrounding environment helps orientate the viewer. Also, as a landscape or architectural project will never be experienced out of context, omitting contextual detail, e.g. in the interest of aesthetics, could influence the representational validity.

The level of detail illustrated in existing buildings is a factor that also warrants consideration, e.g. simple wire-line depiction of background buildings can appear less distracting. It could be argued that in specific cases the concept of 'less is more' may have a positive effect on the overall composition.

4.6. Street furniture and Lighting

Lighting and street furniture were mapped as separate categories in the visual analysis. The depiction of lighting elements has been treated in a similar manner to other street furniture elements in the majority of visualizations. Specific street furniture elements including railings, lights, traffic lights, traffic signage, litter bins, bollards and security cameras are the components most likely to be omitted from any visualization. These omissions appear to be a case of selective 'de-cluttering' and are most noticeable in projects where the visualization viewpoint is from a street side.

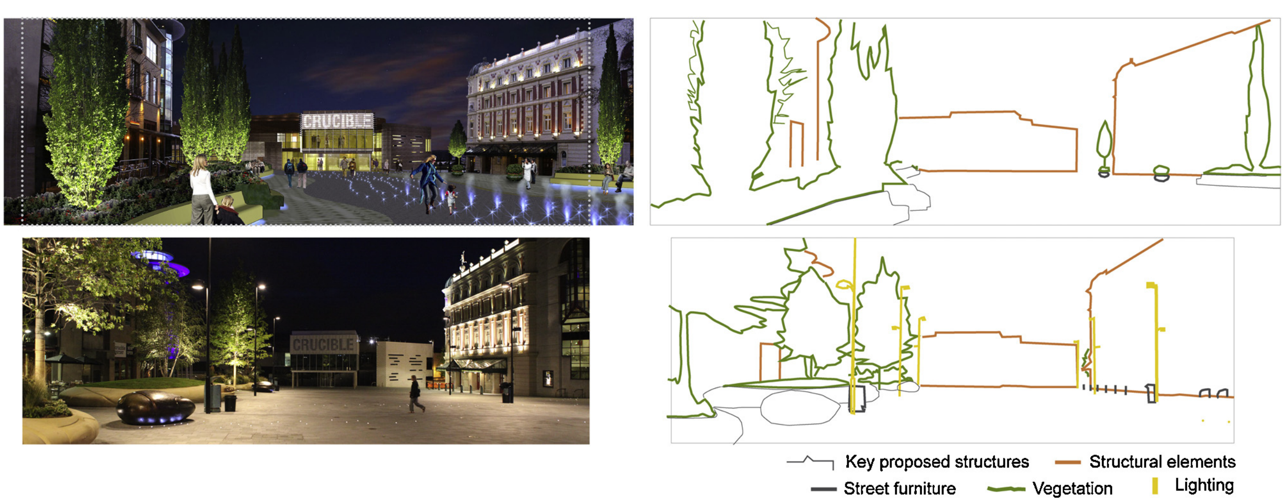

Fig. 4. Tudor Square/Open Space, Sheffield, UK. Visualization produced and provided by Sheffield City Council, photograph by Melanie Downes.

Fig. 5. Jessop West, The University of Sheffield. Evidence of foreground 'decluttering' through the removal of built structure relating to transport infrastructure (tram power lines, street-side railings, etc.) Visualization produced and provided by Sauerbruch Hutton, photograph by Melanie Downes.

De-cluttered visualizations contain fewer objects and are therefore faster to produce. In addition, they are possibly considered more aesthetically pleasing and therefore a more effective sales tool.

4.7. Materials

The level of detail used to illustrate materials is highly variable. Attention to detail of materials ranges from the inclusion of

Fig. 6. Chimney Park, Dublin Docklands, Ireland. Street-side playspace where the illustration of traffic has been omitted. Visualization produced and provided by Snug & Outdoor, photograph by Melanie Downes.

reflections, and use of subtle texture mapping, to the more basic use of flat colour to indicate changes in materials.

Exact material specifications for proposed structures are unlikely to be determined at the time of visualization which calls into question what level of detail is appropriate (cf. Kingery-Page & Hahn, 2012; Lange, 2001). In the interests of accuracy and transparency it may be more appropriate to only indicate material where specifications have been agreed, rather than present visualizations to a public who will never get to experience them as illustrated.

4.8. People

People have been included in the majority of visualizations analyzed. This is interesting, as until some years ago the presence of people in visualizations was the exception (see e.g. Ervin, 2001). The careful positioning of people or silhouette figures can be used as a tool to engage the viewer. For example the use of people in the foreground is particularly effective at drawing the viewer in. The opposite effect occurs where an absence of people in the foreground can have the negative effect of leaving the viewer feeling disconnected from the scene.

The number of people included in a visualization tells a story as to the potential use of the space. With visualizations used for public consultation this should be a key consideration. Depicting a busy pedestrian street as an empty space does not create an accurate impression of the site. The opposite practice of over populating a space has the potential to raise expectations too high.

4.9. Traffic

The illustration of traffic elements varies from project to project. In a number of projects traffic is shown at a lesser volume than would be expected to be passing through or parked in the area. This is particularly noteworthy in the Chimney Park visualizations (Fig. 6) where a play space shares a boundary with the street and no traffic was illustrated. Depicting very busy streets with minimal traffic, possibly in the interests of aesthetics as the uncluttered scene shows the proposed development in a positive light, and creates a false impression of the context.

4.10. Weather, time of day/year

All visualizations show dry weather and most depict sunshine through the casting of shadows. The time of year illustrated is predominantly late spring or summer as depicted by the foliage on the trees and clothes the people are wearing. Some inconsistencies were noted with the representation of shadows, where in some cases the built structures were depicted as casting shadows but the people were not.

Weather as a tool to create atmospheric effect and to add depth is underused. Projects, such as public parks and busy pedestrian zones, could benefit from being shown as a series of visualizations throughout the seasons. Especially projects in an urban context would benefit from being shown at night time, as these spaces potentially will have an intense use at night too. The production costs for the visualizations would rise but such representations would give a more holistic sense of the proposed spaces for potential users.

5. Discussion

5.1. What you see is not always what you get: now what?

Communication is the fundamental purpose of producing visualizations throughout the planning and design phases of any landscape, urban design or architectural project. Communication is achieved to differing degrees in all the visualizations analyzed, but is it honest communication? Visualizations help to communicate proposed developments to planners, clients and the public. Given the cost and permanency involved in such projects, it is imperative that a transparent communication of design proposals remains the focus of all visualizations.

A key point that requires addressing is the need for increased levels of transparency in production and presentation methods of all visualizations to be used for communicating proposals with the public, stakeholders, and planners. Presentation methods could incorporate a way of informing viewers of the limitations of the visualization, while also suggesting optimal viewing format and viewing distance. The introduction of "Best Practice Guidelines" could function as a mechanism of achieving more transparent communication through visualizations. Regarding the viewing position, which is a key criterion, it could be e.g. requested that visualizations should be produced with a fixed height representing average eye level for every project. The reoccurring issue of omission of street furniture elements could also be addressed. Excluding a myriad of what could be considered visual interruptions is a temptation but it may result in a representation of a proposal that differs greatly from the final delivered project.

The indication of site context in addition to design proposals not only provides visual anchors, but also communicates important information about 'sense of place'. Furthermore, the combination of a low level of rendered detail of the site context with a more detailed rendering of the design proposal does not detract from the overall impact of the visualization.

Considering the diverse nature of the spaces being proposed in landscape and architecture practice it is important to acknowledge the need to protect the variety of creative approaches possible in the production of visualization. Solutions that help increase transparency in production and presentation methods should seek to allow this creativity to remain.

The iterative nature of design means that not every design detail may have been resolved at the time of visualization or at initial planning stages. Changes to designs may occur through the process up to and sometimes during construction, which means there will be differences between the visualization and the finished site. E.g. a smooth and shiny granite surface that could potentially be very slippery in the rain, would need to get sanded for safety reasons, thus resulting in a difference between visualization and built project.

5.2. Production standards: how it could be in the future

Most projects in the public realm require evidence of public consultation. Often, in such cases, visualizations are used. Therefore, standardizing the quality of visualizations is a matter of growing importance.

According to Sheppard (1989) landscape visualizations need to achieve three fundamental objectives:

- Convey understanding of the proposed project.
- Demonstrate credibility of the visualization itself.
- Avoid bias in responses to the proposed project.

Sheppard (2001) encourages the creation of a professional support infrastructure for those preparing landscape visualizations and proposes an interim code of ethics (p. 196) including the following principles: accuracy, representativeness, visual clarity, interest, legitimacy and access to visual information. Sheppard also attempted to identify different levels of precision and accuracy linked to the stage of project development. This approach, linking production criteria to different stages of project development, could be associated with existing work stages as recognized by industry and could provide a positive introduction to the application of best practice guidelines.

5.3. Production guidelines, a double-edged sword?

The creation and adoption of a set of landscape visualization production guidelines could be interpreted in both positive and negative ways. Recognized procedures enabling transparent documentation of production methods could serve to protect the designer. This might apply in cases where the design changes after the use of visualizations in the project approval process or where a visualization is legally challenged. Professionally agreed procedures would also serve to protect the designer from client pressure.

If landscape visualization guidelines are to be adopted, accuracy of content must be clearly defined. Misleading guidelines have the potential to produce an equally negative effect as the absence of guidelines. The problems arising from the application of potentially inaccurate guidelines is evident in some recent examples of visualizations relating to the siting of windfarm developments where methods of production and presentation have been subject to a certain level of scrutiny (see e.g. Macaskill, 2010).

The adoption of 'Best Practice Guidelines' could potentially limit creative representation and lead to a certain level of uniformity. Although this may be helpful at decision making level in the planning process it may result in all visualizations looking very similar (cf. Kingery-Page & Hahn, 2012). This may result in the production of two kinds of visualization in the future – one lead by guidelines for transparent communication of design proposals, which could be accompanied by another more creative 'mood board' type which invokes artistic license to communicate more ephemeral aspects such as atmosphere and sense of place.

6. Conclusions

Visualizations play an important role in planning decisions affecting the landscape and form part of the Landscape Visual Impact Assessment for any project requiring an Environmental Impact Assessment. The EIA is intended to help ensure "the predicted effects, and the scope for reducing them, are properly understood by the public and the relevant competent authority before it makes its decision" (DCLG, 2006, p. 7).

Visualizations play an equally important role in projects situated in the public realm where public consultation is required. In these cases accurate visual communication of project objectives could be considered even more crucial as they involve non-expert viewers.

This research has revealed inconsistencies of production values and accuracy applied in the creation of visualizations depicting designed landscapes and the public realm. Although questions relating to appropriate levels of realism remain to be answered, the scope for accurate visual communication remains. Issues such as the omission of existing structural content, unrealistic camera angles and inaccurate depiction of scale are factors that could be addressed presently. However, this might not be in the interest of developers (or clients in the wider sense) for which visualizations often function as the 'pretty picture' to sell a particular product.

The visualizations discussed here are static and typically produced for printing or for on-screen viewing. It is the norm that they will be viewed disconnected from the actual environment, e.g. in an office. Recently, mobile device augmented reality applications have been developed (Lange, 2011). Although an augmented reality model can still be deceptive, vague and inaccurate it provides the user with an augmented on-site experience showing a project proposal overlaid on the image of the real-world as captured through the camera of a mobile device.

This study provides a qualitative, comparative analysis of ex ante visualizations with ex post photography of landscape and architectural projects. In future research, alternative analytical or perceptual approaches, e.g. following an experimental research design (cf. Lewis, 2012) could be pursued to explore how community residents, planners and decision-makers respond to differences in visualizations of proposed projects and post-construction photography and what effect those differences have on their judgments.

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