Review of the

SNH Visual Representation of Wind Farms 2014

and where we are today

Alan Macdonald RIBA

This document should be read in conjunction with the following Scottish Natural Heritage documents which can be downloaded from the following links;

Visual Representation of Wind Farms 2014 - Version 2.1, December 2014
Visual Representation of Wind Farms - Summary of changes, December 2014
Summary for members of the public and decision makers
Background and changes from previous version
Background and Context

Alternatively, the documents can be downloaded directly from the following SNH website;

http://www.snh.gov.uk/planning-and-development/renewable-energy/visual-representation/

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For convenience, this document contains embedded web links which are highlighted in blue.

INTRODUCTION

The visualisations presented in windfarm applications have been a contentious issue for almost two decades: to the public, the images are misleading and do not give a realistic impression of how big and how near the turbines will appear. On the other hand, Scottish Natural Heritage (SNH) and the landscape professionals who work for the windfarm industry stated that the visualisations conform to 'Best Practice' so the images are viewed in correct geometric perspective. In the context of visualisations to date, the term 'Best Practice' means the SNH Visualisation Guidance.

Anyone who has attended a public local inquiry will be aware that the question of the viewing distance had become an increasingly important issue over many years. Following widespread complaints from the public about misleading visualisations and the marked difference between the original planning visualisations and the emerging built reality, The Highland Council drew up their own standards in written form in 2009, followed by illustrated versions in 2010, 2013 and 2015. In addition to the existing panoramic format to show the wider landscape context, they require the submission of additional single frame photomontages to provide the public, including their own council members, with a more realistic impression of turbine scale and distance. Since its initial publication in 2009, the standards have received the full approval and support from both the public and their members alike.

Following instructions from the Scottish Government to review their 2006 guidance, the new *Visualisation of Wind Farms* was finally released by SNH in July 2014 and further updated in December 2014 and represents a considerable departure from their previous guidance. I have therefore taken some time before reviewing the contents and their implications for a number of sound reasons. I wanted to give the whole matter considered thought, attend SNH's workshop, examine and assess the technical content of what was presented for scientific accuracy, test actual planning applications on site, and monitor the visualisations now appearing on developer's websites and ePlanning portals since the six month changeover period expired in January 2015.

I have also looked hard at the package of visualisations SNH now propose to find some logical form which addresses the needs of all users and audiences as they claim. Instead I have found a fragmented structure of elements which have become more impractical to use, more expensive to produce and less accessible to the public in their correct printed form. What is proposed may suit the small element of 'desk-top' assessors which may include SNH themselves, but it fails to inform other equally important and much larger audiences. They include a wide selection of statutory consultees, decision making councillors and the general public, all of whom will in reality struggle to access prints of the correct scale. To understand the problem, it is necessary to review the background of where we are today.

THE BACKGROUND

During the early development of windfarm visualisations in the mid to late nineties, the images were easily understood although the quality of photography was generally poor; a single frame 50mm photomontage at A4 size, along with a fold-out A3 page showing the wider context made up of overlapping photographs, butt-jointed together with visible joints, so it was obvious to the observer that they were looking at a wide-angle view.

The problems first emerged with the development of computer software which could seamlessly join photographs together to create what now appeared to be a single frame photograph which had been cropped top and bottom. The single frame 50mm image was dropped and replaced by a 'viewing distance' applied to the panorama.

For developers and their consultants it achieved two things to their advantage; it limited the focal length of a camera lens to 50mm in direct contradiction to SNH's own recommendations in 2001* that a single frame telephoto image of 'up to 80mm' was more appropriate. This became the first step in the diminishing process.

By now maintaining the status quo and shrinking the 50mm single frame image to form the centre of a much wider panorama, a 'viewing distance' was introduced which claimed to use the principles of Leonardo's window, a technique based on the science of linear or geometric perspective originally used by fine artists before camera film was invented to create the illusion of depth in a two dimensional painting. To achieve this, the panorama had to be viewed at a much closer distance so the single frame photograph in the centre was viewed in correct perspective with additional peripheral vision. Because the panoramas were naturally viewed from a greater distance, the viewer was instead looking at a much wider field of view which diminished landscape scale. The second and most significant step in the diminishing process. This 'subtle but powerful under-representation of the visual effect' was also observed by Professor Benson in the University of Newcastle Report.**

The windfarm industry were aware of this potential deception for many years, yet nothing was done about it until The Highland Council published their own standards, a move which attracted much criticism from landscape consultants who worked for the windfarm industry. Both Architech and the Council had carried out extensive research and field tests over several years which revealed that the viewing methodology in the 2006 SNH guidance was technically and scientifically flawed and was the main cause of the problem.

To fully understand why, it is necessary to go back to the original recommendations of the University of Newcastle Report (2002) which was commissioned by SNH to address the inconsistencies in EIA presentation. Under the leadership of Professor John Benson, the University found considerable discrepancies between the original planning visualisations and the built reality of eight first generation windfarms in Scotland. It is worth noting that the turbines in question were half the size of the current generation of turbines.

As a result, he made several recommendations and observations: that Visual Impact Assessment (VIA) was an integral but distinct part of Landscape and Visual Impact Assessment (LVIA,) and although Landscape Assessment (LA) was mainly a matter for professionals, VIA was also a matter for the public. Because of their different visual requirements, he recommended that images for LA should be clearly distinguished from images for VIA. He also found that a single frame, full page photograph gave the best representation of reality, but noted the tendency of the standard 50mm lens to under-represent landscape scale.

Of even greater significance, he stated that what is natural and comfortable for the viewer should dictate the technical detail and not 'vice versa'; a direct reference to the problems with the panoramic format favoured by the windfarm industry where images had to be held at unnaturally close viewing distances. He also noted that, even in 2002, important research was being ignored and concluded that the ''the increasing development pressures for windfarms require that VIA is approached in a comprehensive, explicit and systematic way and that the inherent complexity, controversy and uncertainty are addressed''.

**Guidelines on the Environmental Impacts of Windfarms and Small Scale Hydroelectric Schemes* (2001)

***Visual Assessment of Windfarms: Best Practice,* University of Newcastle (2002)

Regrettably, Professor Benson died in 2004 before he could complete the draft of the SNH Visual Representation of Windfarms Guidance and the University withdrew from the project. Instead of maintaining the independence of academia, SNH appointed two members of their original Steering Group who had worked as consultants for the windfarm industry. When the 2006 SNH guidance was eventually made public in 2007, most of the University of Newcastle's recommendations were ignored. When I asked SNH why Professor Benson's recommendation for single frame images had been omitted, I was informed that these changes had been agreed with Professor Benson in two meetings prior to his death although SNH could not provide any evidence to support the context under which this was discussed as no minutes were taken or any correspondence exchanged.

This statement also contradicted the conclusions of Professor Benson around the same time. In the book *Visualization in Landscape and Environmental Planning* to which he contributed just prior to, and published after his death, he only strengthened his criticism of the visualisation techniques promoted by the industry.

Although the viewing distance had become an important issue from the late-1990s onwards, it did not make its 'official' entrance until the publication of the 2006 Guidance by SNH. However, during its formulation, the Steering Group were presented with this complex viewing methodology as a *fait accompli* from the outset. During the public consultation period which followed, no explanation was provided on how this viewing distance was calculated or even its scientific source. When I queried this with the co-authors, I was informed that this would only be made known in the publication of the final guidance. In other words, the viewing distance methodology was never made available for public scrutiny.

THE REVIEW PROCESS

In view of the fact that The Highland Council had developed their own standards, in October 2011, the Minister for Energy and Tourism for Scotland 'challenged Scottish Natural Heritage, with Scottish Government assistance, to come up with an objective, verifiable, single approach to windfarm visualisation involving The Highland Council and Architech.'

From the outset, both The Highland Council and Architech advised SNH of their problems with the visualisations presented in Environmental Statements and how they had been overcome based on several years of extensive research and empirical testing. An internal investigation by The Highland Council into 18 windfarm applications also revealed that none of the applications conformed to SNH's 2006 guidance and contained incorrect and misleading technical information. As part of their ongoing research, in 2011 the Council commissioned the University of Stirling to undertake a detailed study on the effects of focal length in landscapes involving over 500 members of the public. When the document was published in 2012, it confirmed what SNH had found in 2001; that a single frame image of around 80mm printed full page gave a reliable impression of scale and distance and concluded that the Council's requirement for 75mm single frame images was therefore considered fair.

The main issues raised by The Highland Council and Architech were as follows:

- To start with the original recommendations by the University of Newcastle Study in 2002.
- Fixed, but flexible Standards were required, not Guidance.
- To completely remove any use or reference to a 'viewing distance'.
- Submission of 50mm single frame images with camera metadata for verification purposes.
- Submission of additional 75mm single frame images for Visual Impact Assessment.
- Images for Landscape Assessment and Visual Impact Assessment to be clearly distinguished.
- Single frame viewer for cumulative assessment.
- Images limited to a practical A3 size.

Following several meetings with SNH and much correspondence over a period of several months it was clear that SNH was consistently ignoring this advice which became increasingly mired in counter-argument and needless

technical detail. At a meeting held in Inverness in September 2012 with The Highland Council's representative and myself in attendance, we were somewhat alarmed to be informed by SNH that the guidance was 90% completed which raised the question as to why we were only being consulted at such a late stage. It was also clear that they had no real understanding of the problem or wish to understand the problem. What they presented was not acceptable to either The Highland Council or myself because they had retained the A1 wide panoramic format with visualisations which still involved a viewing distance, only now, it was called a 'principal' distance. The requirement for single frame images for the public remained ignored.

At that meeting I also raised my concern about the involvement of the co-author of the 2006 guidance whose company Envision had produced the visualisation material presented at the meeting. My concerns were further raised to find that SNH had not carried out any preliminary research work into the fundamental problem: they had not consulted any of the community councils, community groups, or members of the public who, for many years, have raised concerns about misleading visualisations. This was not considered necessary by SNH as they claimed that they had never received any complaints, a fact which was further reflected by the Energy Consents Unit (via teleconference link for part of the meeting).

Following their failure to reach an agreement with The Highland Council and Architech, SNH then referred the matter to a steering group comprising seven members including one representative of The Highland Council. SNH's representative on the Steering Group who led the Review previously worked for a firm of environmental consultants who used the same visualisation techniques that were criticised by Professor Benson. Independent visualisation consultants with experience in the problems with windfarm visualisations were excluded because of 'possible bias', yet SNH appointed Ian McAuley, a director of Envision and co-author of the now widely criticised 2006 guidance as their Technical Advisor.

Mark Turnbull, the representative of the Landscape Institute's Scotland Branch on the Steering Group is also a director of Envision and Chairman of the Technical Committee who advise the national body, the Landscape Institute on such matters. Mr Turnbull is also a member of the Landscape Institute's working group who drew up the Institute's response to SNH's draft consultation document for the 2014 guidance where again, Mr McAulay was appointed as Technical Advisor, but this time representing the Landscape Institute. [Both Mark Turnbull and Ian McAulay were also originally involved in the preparation of the Landscape Institute Advice Note 01/11 which endorsed the 2006 Guidance their own company had co-authored '**in preference to any other guidance or methodology**'. (The LI's emphasis, not mine).]

It would have been a logical first step for the Group to have visited the Highlands to test out actual planning applications on site, but this was not considered and despite the fact that there was no clear consensus within the Steering Group, the draft guidance went out to public consultation between May and July 2013. The document was confusing, contradictory, technically inaccurate (where they even had their principal distance wrong) and contained structured questions which were clearly designed to steer the respondent towards a pre-conceived methodology.

Because of irreconcilable differences, in September 2013, The Highland Council informed SNH that they could not support their proposals. Based on the public consultation feedback, the final revised guidance was to be presented to a final meeting of the Steering Group before publication, however no such meeting took place; instead, SNH had one-to-one meetings with each individual member of the group where the representative from The Highland Council was excluded from the process.

The reference to the research work undertaken by The Highland Council and myself in the introduction of *Background and changes from previous version* should therefore not be construed as an endorsement. Although the same paper also implies that the guidance had the full agreement of SNH's Steering Group, it clearly did not. As a result, contrary to the understanding of the original instruction from the Minister for Energy, no agreement was reached and neither The Highland Council nor I had sight of the final document before it was published. Although the paper also implies that it has the full approval of the Heads of Planning Scotland (HoPS), it is my understanding that it was never formally presented to, or debated by the body.

REVIEW OF THE SNH 2014 GUIDANCE

For the wider audience, realistic visualisations are very important. Unlike conventional planning applications where scaled architect's or engineer's drawings can also be assessed, the photomontages are the only means by which the wider audience can make an informed judgment. We have to create, in effect, a two-dimensional scaled drawing of a three-dimensional landscape, so when the image is viewed as shown in the diagram below, the vertical scale of the landscape appears about the same proportion.

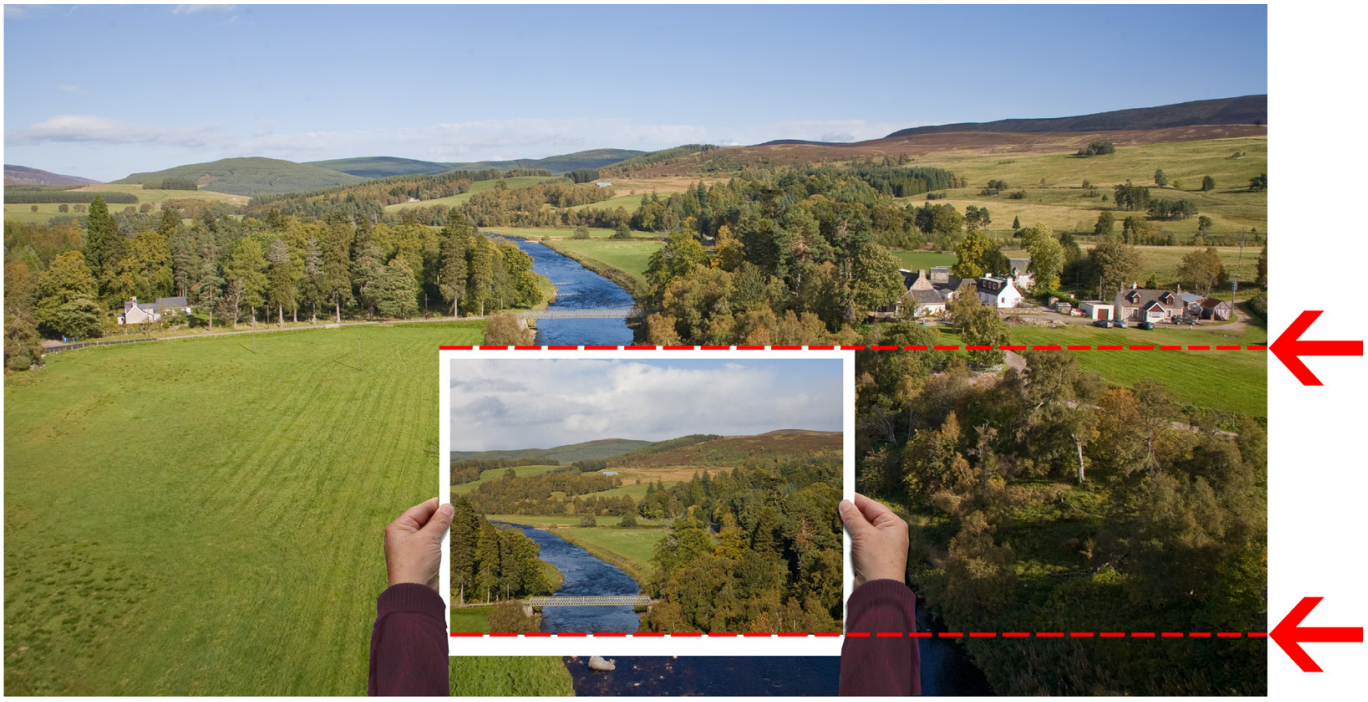


Fig. 1.

The new guidance will therefore be welcomed as a step in the right direction; SNH now accept the findings of The Highland Council that a 75mm single frame printed image gives a realistic representation, and that the use of their complex viewing methodology is no longer required. At their workshop at Battleby in October 2014, SNH finally announced that the 'viewing distance is dead', and that images should instead be viewed 'at a comfortable arm's length'. This statement will have considerable implications for the many windfarm applications presently within the planning system throughout the UK which are based on SNH's 2006 Guidance.

In her decision document for a planning appeal in 2014, the planning inspector stated that "when generally assessing photomontages local communities across the country find them unrepresentative and lacking credibility. Unfortunately the Louth Canal photomontages are no exception to this rule''. She went on to state that ''Photomontages are produced, during the various stages through which planning applications proceed, to inform all parties and consultees, this includes planning officers, statutory consultees, including District and Parish Councillors, residents (receptors) within local communities. It was with great surprise that the appellant's landscape witness appeared to down play this key tool as being of little relevance, asserting that they are part of a suite of information to assess impacts, and that he prefers just to rely on wire frames."

It is my considered opinion that while the new guidance may have improved the visualisation standards for landscape professionals, little has changed for the wider audience because SNH have failed to identify the fundamental problem in the first place by continuing to ignore the advice of their spatial data analyst in 2005 that any future guidance should take into account how the images will be viewed in the 21st century (i.e. on a computer screen). This prediction has proved to be correct as most people now view the visualisations through their council's ePlanning portal which is also the easiest and most accessible route for members of the public.

It is recognised that landscape assessment and visual impact assessment are an integral part of LVIA, but they have different audiences and different visual requirements as identified by Professor Benson in 2002. It is only by considering two different sets of images that a properly informed judgement can be made, so while SNH now recognise the use of additional 75mm single frame visualisations, **they do not form part of the Environmental Statement**, nor do they appear to be taken into consideration as part of the EIA process by professional assessors although this is not made clear.

Images for the much wider audience are restricted to **selected viewpoints only** and have been relegated to a separate printed 'viewpoint pack' of single frame images which should only be viewed on site. However, it is not clear if these images should also be available on ePlanning portals. If this is the intention, then what should be a direct visual comparison between two consecutive images is completely fragmented.

In contrast, the images in the ES are all presented in panoramic format. Now that the 'viewing distance' is officially dead, the emphasis is on 'context' which creates exactly the same problem for the wider audience when viewed through ePlanning portals as illustrated in the graphic below.

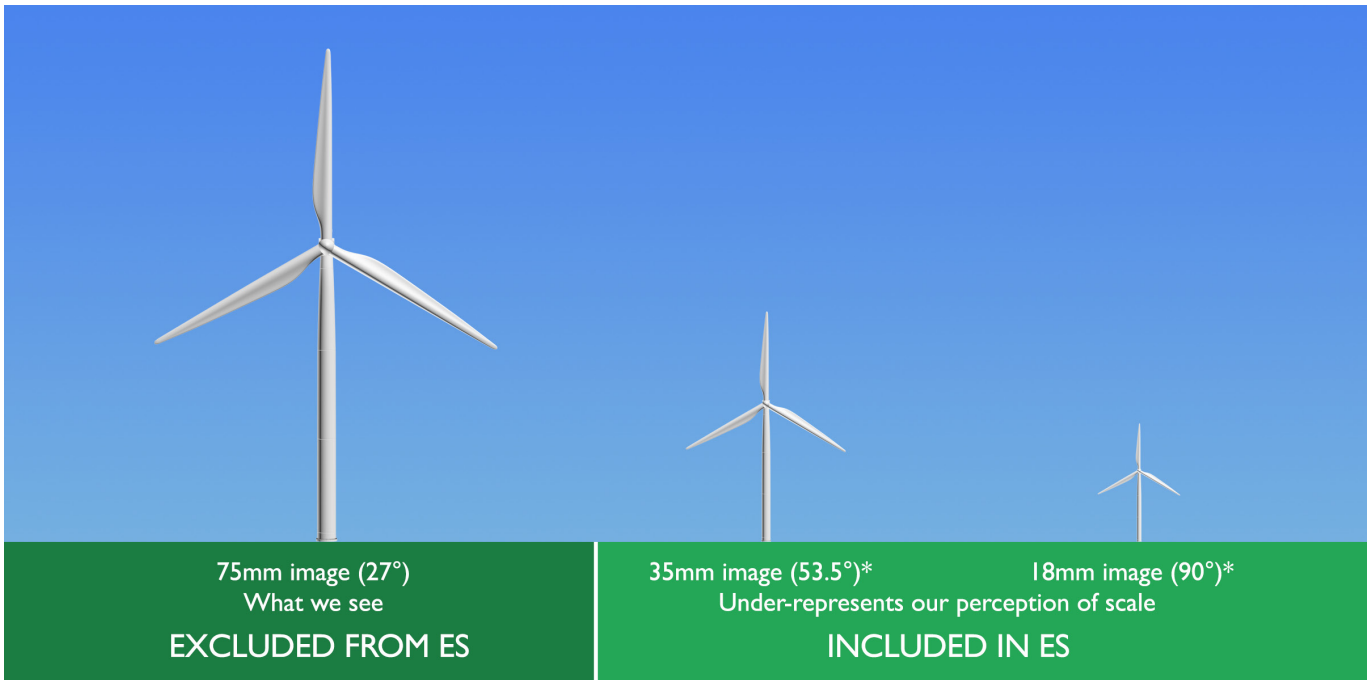


Fig. 2.

*The vertical scale will change slightly depending on the aspect ratio of the computer screen.

The reason this different perception in scale occurs is because all the visualisation pages, regardless of their widths, appear more or less the same width on a computer screen or projected to a planning committee, so the observer is simply looking at angles of view which diminish landscape scale.

The term 35mm

There is a lot of confusion about the terms 35mm camera format and 35mm lens. The 35mm camera format is so-called because it was developed in 1914 to take advantage of cheap black and white movie film which was 35mm wide including the sprocket holes on either side of the film frame. Its inventor Oscar Barnack found by turning the movie film sideways he could double the frame size to 36mm x 24mm which could be conveniently housed in a light-proof spool inserted into a specially designed camera body.

The 35mm lens refers to focal length: the distance between the optical centre of the camera lens and the film plate or digital sensor when the focus is set to infinity. The standard or normal lens for the 35mm camera format is a 50mm focal length which in photographic terms is similar to the image projected onto the retina of the eye. Lenses above this are known as telephoto lenses and lenses below this are referred to as wide-angle lenses. The 35mm lens therefore comes into the latter category. Commonly used fixed lenses are 24mm, 28mm, 35mm, 50mm, 85mm and 100mm.

THE PRINCIPAL DISTANCE

Although SNH have now stated that the 'viewing distance is dead', It has simply been renamed 'principal distance'. Scientifically, they are exactly the same thing. In all the recent applications I have assessed, the principal distance of 812.5mm is stated on the 53.5° view, and a principal distance of 522mm is now starting to appear on the 90° views, although this is not a requirement of the 2014 SNH Guidance which states in paragraph 139 that the image should be used as a reference only.

For non-landscape professionals in particular who read the technical data, this is somewhat confusing. On the one hand, they are told to view the printed images at a comfortable arm's length, yet the image page also specifies a 'principal distance' of 812.5mm which is well beyond arm's length. This, we are informed, is the correct viewing distance for the 'professional landscape assessor' should they wish to assess the image in 'correct perspective'.

The application of a fixed distance at which an image should be viewed for correct perspective may be regarded by many as not an issue that merits the degree of discussion it generates. It is however responsible for what is in my opinion the biggest visual deception ever perpetrated on the British public and the planning system, invented by a small group of landscape consultants who devised a complex viewing 'science' to justify the use of wide panoramas where two entirely different images can be interpreted depending how the image is viewed. It has been conveniently used as a vehicle for many years to mislead the public, consultees and more importantly, councils who are the decision makers. It also explains why the degree of impact or harm predicted by the developer's consultants is consistently under-estimated in their LVIAs.

In contrast to the SNH's 2006 guidance where the importance of viewing a photograph in correct perspective is continually stressed throughout many of its 198 pages, much is now made in the 2014 guidance of the fact that a photograph cannot replicate what we see, but we all know that. We know from experience that a photograph is a flat image and does not represent reality. In his book *Eye and Brain** the late Professor Gregory stated that had we not learned the rules of linear or geometrical perspective, we would just regard photographs as weird distortions of reality.

Whether we realise it or not, we learn the rules from an early age; a small child learns to distinguish between a picture book and the real world, and as we get more experience, we can even tell when the perspective appears wrong in a badly drawn picture. We also know that if we use the zoom on the camera lens which automatically captures correct perspective for us, we can make objects appear nearer or further away depending on the focal length of the lens. The wider the field of view, the further away an object appears, and the narrower the field of view, the nearer an object appears. The basic science of photography.

Although SNH now state at paragraph 104 that viewing distances applied to geometrically correct images "do not necessarily portray the view as experienced by people in reality", it should be stressed that a printed photograph will *always* under-represent reality.

In *Eye and Brain*, Professor Gregory stated "when an artist employs strict geometrical perspective he does not draw what he sees – he represents his retinal image. As we know, these are very different; for what is seen is affected by constancy scaling" which is our ability to perceive objects maintaining the same size relative to their distance. Our retinal image of a person walking away from us for example gets progressively smaller while a person walking towards us gets progressively larger, yet we perceive the person as the same size regardless of their distance.

In geometrical perspective, the size of an object halves as the distance doubles whereas in the real world, it does not appear to shrink as much because the brain automatically takes into account the distance to an object to re-calibrate the size of the retinal image by size-constancy scaling. When we focus on near objects, more distant objects are out of focus and when we focus on more distant objects, nearer objects are out of focus. This 'blur' sends vital distance information to the brain.

**Eye and Brain, The Psychology of Seeing,* Fifth Edition. Richard L. Gregory. Oxford University Press.

Fig. 3. In the photograph above, we can see that the two people are approximately the same height because we take into account the many familiar perspective cues in the photograph.

Fig. 4. If we now compare the size of the same two people standing side by side in the foreground, the person in red appears smaller. This is their relative scale projected onto the retina of the eye before size-constancy scaling. If you measure the heights of the person in red, you will find they are exactly the same.

The problem with viewing photographs in correct perspective involving considerable distances where everything is in sharp focus is that our perception of depth is invariably shrunk because there is no distance information. Our eyes tell our brain that we are looking at a flat image a fixed distance from our eyes regardless of what is depicted in the image itself. According to the Centre for Visual Science in Rochester USA, this is 'informationally encapsulated' in our visual system and cannot be over-ridden by the intellect. Mountains will therefore appear smaller in a photograph than they do in real life and the use of large foreground objects also serves to further diminish the size of distant objects.

So while a 50mm lens may be similar to what is seen by the human eye (it actually slightly magnifies)*, it does not reflect what we see in the real world once constancy scaling is processed by the brain. Photographically, the only way we can compensate for this is to increase the focal length of the lens so that the vertical scale of the landscape appears similar to what we see as shown in fig.1 on page 5. It has been suggested that this will depend on whether or not the observer wears spectacles, but there is no evidence to support this as the University of Stirling Study revealed because the brain readjusts its perception of distance.

I would like to explain this more clearly by using two single frame images of identical size to illustrate the difference in perceived scale between a photograph based on linear perspective compared to one which takes into account the effect of size-constancy scaling. Based on a printed image size of 390 x 260mm which is viewed at a comfortable arm's length (around 500mm), the right hand image has a focal length of 75mm while the focal length for the left hand image is based on the image size and the viewing distance for correct geometric perspective.**

Fig. 5. PERSPECTIVE

Fig. 6. PERCEPTION

The 75mm image on the right provides us with a reliable perception of turbine and landscape scale while the left hand image recreates correct geometric perspective based on a 'principal distance' where our perception of scale and distance is somewhat different. However, the left hand image is also the one the industry's landscape consultants would use to assist in their assessments of impacts (see Section 5 of the *Landscape Institute's Advice Note 01/11*), a claim further confirmed in a *Briefing Note**** posted on the internet by one of the consultants who state that ''when making professional judgements about landscape and visual effects of a development with reference to a visualisation, it is still essential to know the correct viewing distance''. Given the degree of under-representation, the reliability of any assessment by landscape professionals working for the windfarm industry which are based on geometric perspective has therefore to be seriously questioned.

A typical recent example relates to a proposed windfarm in an area of Dorset containing many heritage assets, where an assessment made by English Heritage, now Historic England, using 75mm single-frame images (which they considered to be the most reliable representation available of potential impact on the landscape setting of the monument), classed the degree of harm as 'substantial', while the developer's landscape assessor, who made their assessment based on correct perspective, classed the harm as 'moderate'. As someone who has researched this subject for 18 years, I fail to see how anyone can make an informed prediction of visual impact unless they are provided with images which replicate the vertical scale of what we actually see.

*See note 1 in Appendix A **See note 2 in Appendix A ***Visual Representation of Wind Farms, Version 2 - Briefing Note (2014) Pegasus Group.

Panoramic images showing the wider landscape context *can only* be used as a reference because even if a principal distance is applied, it will make more distant objects appear smaller than they are in the real world. It therefore defies logic why the wider audience can now simply view the single frame 75mm images at a normal arm's length, while landscape assessors view the panoramic images at a distance of 812.5mm which is beyond arm's length for correct perspective viewing when it is a perception of scale we do not experience, nor can it be correctly viewed. According to the Center for Visual Science, the application of a viewing distance or principal distance is subject to two very important caveats; the centre of the image must be perpendicular to our line of sight, and viewed with one eye only.

Contrary to a viewing science which was established many centuries ago, SNH imply that there is no discernible difference between viewing a printed image with one eye or two eyes. While there may appear to be no difference other than an increase of peripheral vision when a print is viewed with two eyes, there is a considerable difference which can be easily tested by anyone using a transparency applying the principles of Leonardo's window on which the principal distance is based. When viewed at the correct distance with one eye, the transparency will accurately fit the real landscape cues, but if viewed with both eyes, it is out of alignment. Because the requirement for one eye is not stated anywhere in the viewing instructions, it is not possible for the observer to view the image in correct geometric perspective*, so its application is meaningless.

As the panoramas can only be used as a reference, it is therefore unnecessary to have such large impractical prints when the A3 format traditionally used by the windfarm industry showing a panorama with a matching wireframe on one page is sufficient because regardless of the size of the original print, they all appear the same size on a computer screen.

The viewing distance or principal distance

In photographic terms, the viewing distance is simply based on an enlargement of the focal length of the camera lens relative to the printed image size. An image taken with a 35mm format camera fitted with a 50mm lens captures a 3 x 2 image on a 36mm x 24mm sensor, so to view correct perspective for that focal length, the image would have to be viewed with one eye at a distance of 50mm which is too small for anyone to focus on, so it is necessary to enlarge the size. If enlarged ten times for example, a print 360mm x 240mm would have to be viewed from a distance of 500mm. A 50mm print 390mm x 260mm would therefore have to be viewed from a distance of 541.7mm which can be worked out by using the following formula regardless of whether the image is a single frame image or a panoramic image:

Viewing distance = printed image height ÷ original frame height (24mm) x focal length.

By the same method of calculation, an image 390mm x 260mm with a focal length of 75mm would have to be viewed at a distance of 812.5mm which is beyond arm's length.

FOCAL LENGTH

Since the publication of the 2014 guidance I have been contacted by many members of the public, independent landscape architects, consultees and members of the legal profession who cannot find any reference to a 75mm focal length in the 2014 guidance. The reason for this is given in the *Background and Changes* document which states that ''the consultation version of this guidance (and some other publications) referred to '75mm focal length' and this caused significant confusion''. However, that confusion was caused by SNH themselves in their consultation document where it was referred to as a '75mm equivalent' because there is no conventional fixed 75mm lens produced by the major manufacturers such as Canon and Nikon. Any increase in focal length simply crops the field of view of a wider lens which SNH clearly illustrate in their 2006 guidance.**

*See definition of principal distance in the glossary on page 7 of the SNH Visualisation of Wind Farms (2014). **Figure 21 in the printed version and page 188 of the downloadable version of the 2006 SNH guidance.

Because we live in a digital age, we can accurately recalibrate focal lengths using professional 3D software which contains a computer camera which can be matched to the exact profile of the actual camera and lens which took the original photograph. Based on a 50mm lens which is the standard or normal lens for the 35mm camera format, any increase in focal length can therefore be recalibrated from the original photograph. The result is not a 75mm 'equivalent' as SNH imply, it is a technically accurate focal length of 75mm.

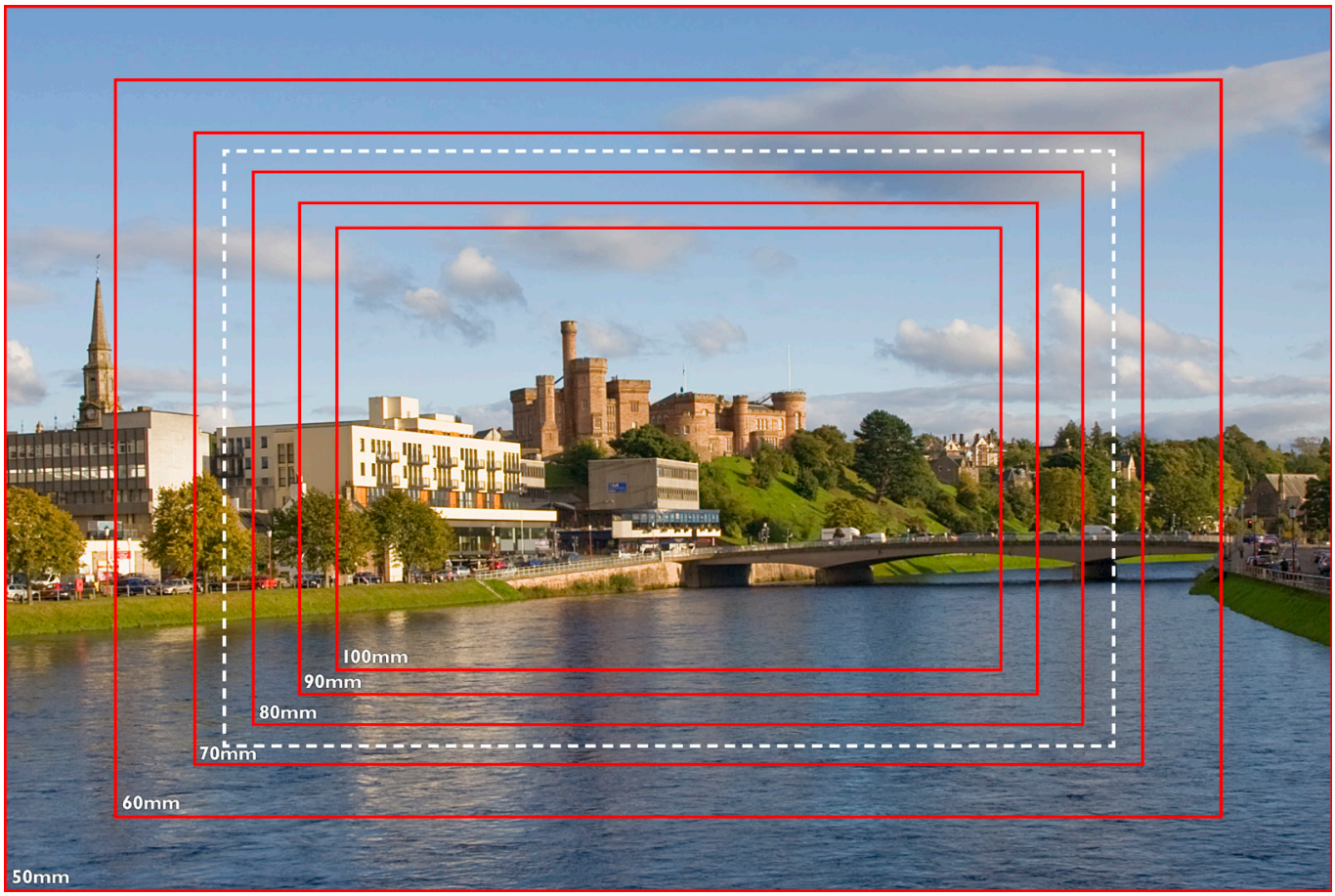


Fig. 7. Based on an image taken with a 50mm standard lens, any increase in focal length can be accurately recalibrated using 3D computer software. The 75mm focal length is shown by the dotted white line.

Images of different focal lengths however do not reduce in size relative to the printed page as shown above and our perception of distance only becomes fully apparent if all the images are printed at the same size. In the images below, you can now see that our perception of distance varies according to the focal length of the lens. The more the image is cropped, the nearer the Castle appears.

Fig. 8.

50mm standard lens

75mm focal length

100mm focal length

Because of this claimed 'confusion', SNH now only specify horizontal and vertical fields of view instead of focal length which is meaningless to most people. Even an experienced photographer would have some homework to do if he was asked to produce a photograph with a horizontal field of view of 27°, 53.5° or 90° because it is not how photography is specified or understood. This obfuscation of terms only adds further to the confusion.

In assessments of recent planning applications which claim to conform to the 2014 guidance, the technical data on the full page height panoramas for example states that the camera lens is 50mm while also stating that the horizontal field of view is 53.5° with a vertical field of view of 18.2°. This has nothing whatsoever to do with the characteristics of a 50mm lens which has a horizontal field of view of 39.6° and a vertical field of view of 27°.

During my dealings with SNH before I was eventually excluded from the process, focal length was always referred to. For panoramas, it was SNH's original intention to use the horizontal field of view of a 28mm fixed lens (65.5°) for landscape context until I pointed out to them that given their proposed image height, the width was too long to print on an A1 wide sheet which was a rather fundamental and unacceptable mistake for SNH to make. Given their strong emphasis on the need for wider context, it defies logic as to why they would then reduce the horizontal field of view from 65.5° to 53.5°.

In my opinion, the main reason for the change from focal length to field of view is because the guidance is designed around certain proprietary software packages designed for the windfarm industry which contain visualisation modules based on angles of view only. Guidance for such an important part of the planning process should not be based on the limitations of certain software; The Highland Council require all panoramic images for landscape assessment to specify the focal lengths in addition to the vertical and horizontal fields of view to accommodate all current software.

When we are viewing a hand-held photograph, unless we are viewing a very small print or examining detail, our natural viewing convention is to hold the image at a distance where our eyes can comfortably focus on the overall scene which is approximately the diagonal measurement of the page. For a hand-held A3 print the image will be held at a distance of around 500mm which is a comfortable arm's length. For Environmental Statements which are presented in A3 format, The Highland Council specify a single frame image size of 390 x 260mm because it is the maximum image size which can be accommodated on the page allowing space for a technical information bar. When viewed in the real landscape, it also reduces the degree of eye convergence making it easier to focus over a huge range of distances for comparison purposes.

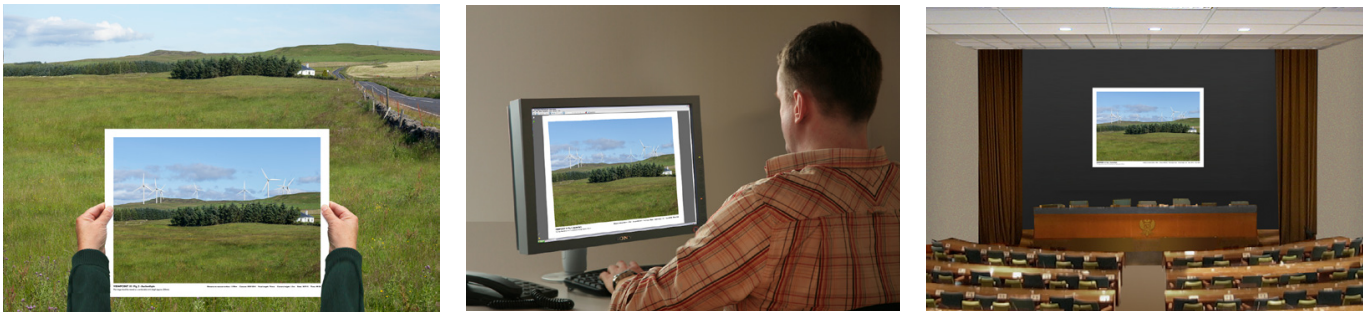


Fig. 9. Regardless of whether a single frame image is viewed on site, on an ePlanning portal or projected to a planning committee, our perception of scale and distance remains the same because the three fields of view within the image frame remain constant.

However we can view and understand the same single frame images at any size from a variety of different angles and distances because of a phenomenon known as 'Zeeman's Paradox', the brain's remarkable ability to compensate for our viewing position. We do it every day when we look at images in a newspaper, watch TV or even view paintings in an art gallery, so regardless of how the image is viewed, our perception of scale within the image frame remains the same because the three fields of view which define the focal length do not change, so the image is therefore not open to misinterpretation.

This is not the case with a panorama where the distance between the eye and the page determines the focal length (as shown on the next page). Theoretically, a photograph will appear in 'correct perspective' anywhere along the line between the eye and the centre of the image, so if the distance is reduced, the focal length increases, and if the distance is increased, the focal length decreases. Compared to a camera lens, it is unreliable, open to misinterpretation and has been the main cause of the problem with visualisations presented in windfarm applications as The Highland Council and Architech found in their research over many years.

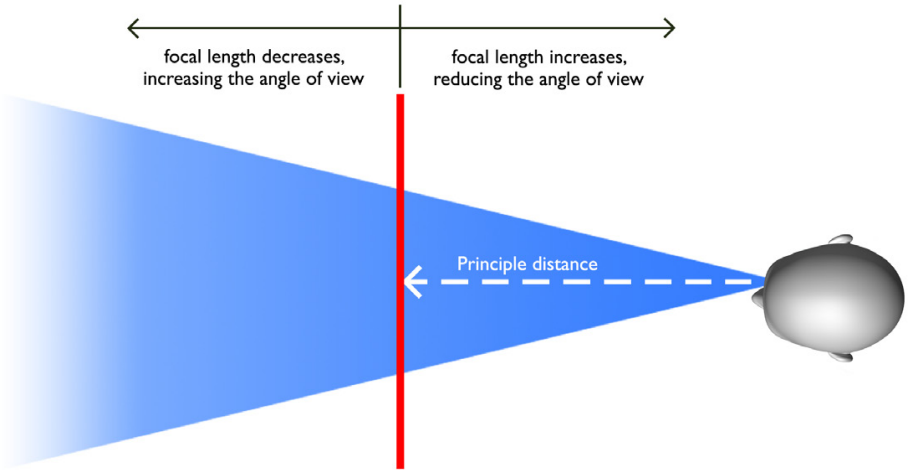


Fig. 10. Because the focal length in a panorama is determined by the geometrical relationship between the eye and the image, any increase or decrease in the principal distance will change the focal length.

If this A1 width panorama is now reduced in size and viewed on a computer screen, the horizontal field of view within our clear central vision becomes much wider making the landscape appear further away, so for the public who view the visualisations on their council's ePlanning system, they are not viewing a 75mm image.

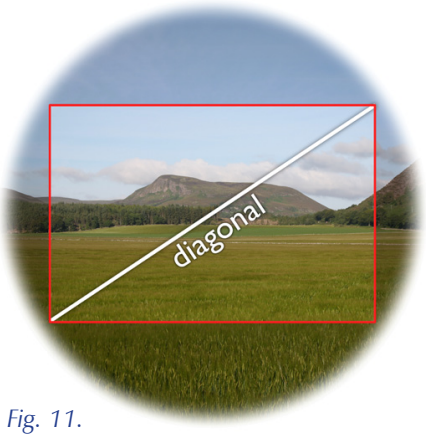


Fig. 11.

The focal length of any camera lens is defined by its diagonal field of view because it is the diameter of the circle projected onto the 35mm sensor so **the term can only apply to a single frame photograph**. As the field of view decreases, the focal length increases.

Because the image ratio is 3 x 2, the diagonal also dictates the horizontal and vertical fields of view, so while the panoramas may have a vertical field of view of 75mm focal length, on a computer screen the observer is simply viewing an image with a horizontal field of view of a 35mm wide-angle lens (53.5°) and the field of view of an 18mm ultra-wide angle lens (90°) which diminishes landscape scale by up to a factor of two and four respectively as shown on page 6.

Given SNH's emphasis on context, I am surprised that they have specified a vertical focal length of 75mm for their 53.5° panoramas rather than the 50mm traditionally used by the industry because the latter shows more foreground context as shown in the two graphics below. If viewed on a computer screen, our perception of turbine scale is no different because the horizontal field of view remains the same, only the image height changes. The Highland Council have retained the 50mm focal length in their panoramas for this reason.

Fig. 12. When viewed on a computer screen, there is no difference in our perception of turbine scale between a 50mm panorama and a 75mm panorama because their horizontal fields of view of 53.5° remain the same. Only their image heights are different.

PHOTOGRAPHY

The section on photography in the SNH Guidance is particularly poor, ill-informed and does not take into account the huge advances in digital photography. To state there ''should be minimum of post-processing image enhancement'' and that the ''extent of enhancement must be limited to that which would conventionally occur in a darkroom'' is completely outdated thinking and meaningless to anyone under the age of thirty.

Anyone who has a digital camera which can capture both RAW and JPEG file formats of the same image will notice that there is a difference between the two. The JPEG image appears more dynamic and colourful with deeper shadows compared to the RAW image which appears somewhat lifeless by comparison. The reason for this is because the JPEG image has been enhanced by the camera co-processor over which the photographer has no control and due to file compression, detail is also lost, particularly in the shadows.

The RAW image on the other hand can capture data in an uncompressed format designed for post-processing where, with careful adjustment, images can be created which reflect what was experienced by the eye when the photograph was taken. The white balance for example can be finely tuned if necessary and the black level in shadows can be adjusted to reveal the fine detail, a factor particularly important in landscape photography.

One of the main problems with the visualisations presented in Environmental Statements is the quality of the photography which ranges from acceptable to very poor, often taken on overcast days where the landscape can appear dank and dark in a photograph because of the camera exposure differences between the sky and the land. One of the reasons for this is because many environmental consultants sub-contract the photography which I do not consider good practice. Unless there are exceptional reasons, photography should always be taken in bright, clear, sunny conditions when the turbines will appear at their most prominent, i.e. the 'worst case scenario'.

It is therefore a matter of concern that in the *Summary of changes* dated December 2014, SNH now state that "cloudy skies can be acceptable in some circumstances, as long as the visibility is sufficiently clear and the turbines are rendered with sufficient contrast, for example where the turbines are backclothed, noting the preference is still for clear skies'. This is explained in more detail in paragraph 113 of the Guidance.

Resolution: The camera vs. the eye

The camera is similar to the human eye in many ways: their lenses for example project an inverted image and reversed image onto a 'sensor', but in terms of resolution, the camera is a poor relation to what we actually see.

The resolution in a camera remains the same over the whole image but although the eye is a camera, it operates in a very different way because it is also a neural organ which sends electrical impulses to the brain. As can be seen on the next page, our visual acuity reflects the distribution of cones in the macula which lie within a circle less than 5mm in diameter at the centre of the retina. The density of cones in the fovea in the centre of the macula which gives us pin sharp vision is in excess of 100,000 receptors per square millimetre, a resolution which far exceeds that of a camera. Although the fovea accounts for only 1 degree of our vision, most of our 'seeing' is dependent on it rapidly scanning our environment, focusing on things which interest us to build up a detailed 3D image of our surroundings. Over half of the visual cortex in our brain is taken up with processing the information from this small area alone.

This has a significant effect on the way more distant turbines appear in a photograph compared to what we see because their presence lacks resolution, contrast and depth, but a correctly executed remontage can compensate for this and appear more realistic when viewed in the real landscape.

HUMAN VISION

LEFT VISUAL FIELD

Processed by the right visual cortex

RIGHT VISUAL FIELD

Processed by the left visual cortex

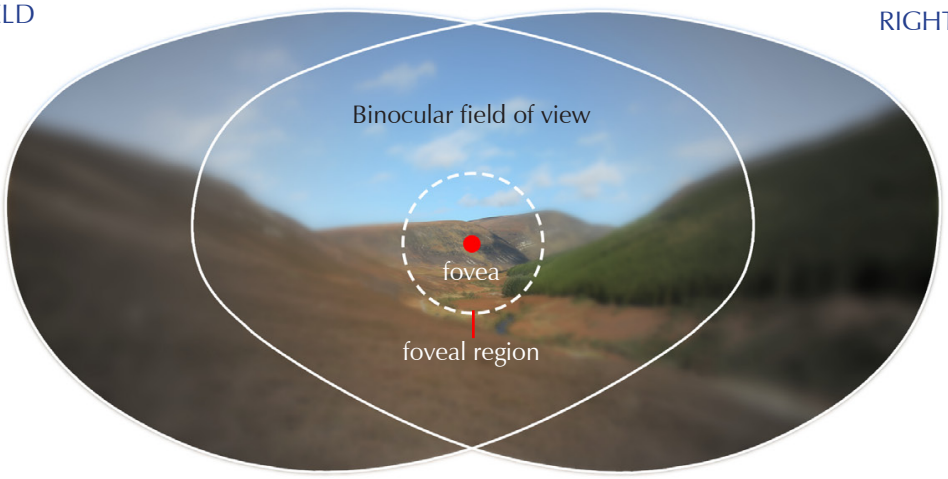
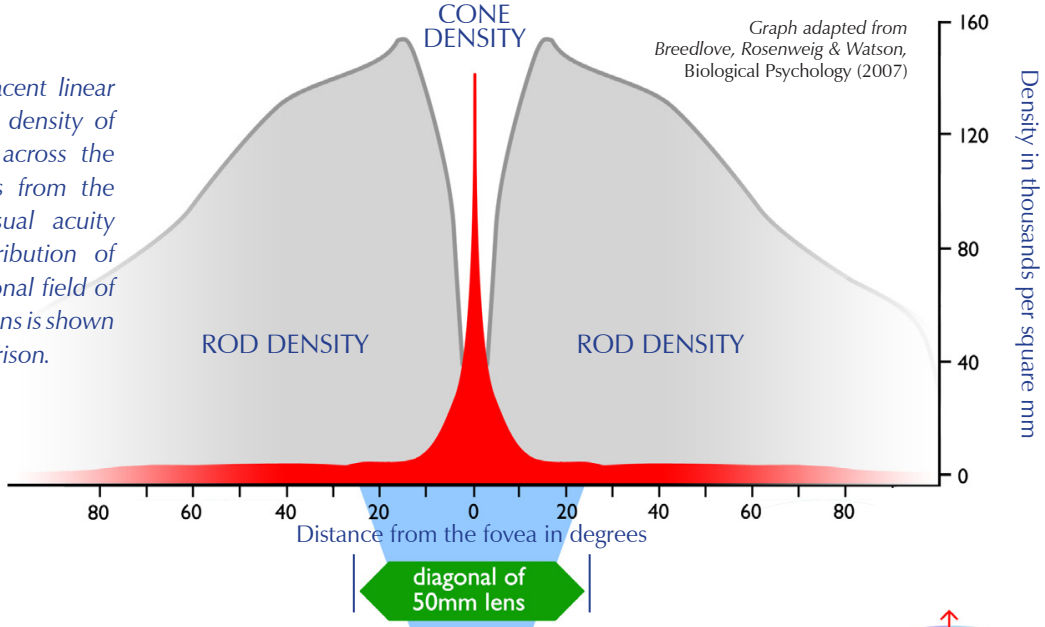


Fig 29. Depending on bone structure, we can see up to 200º horizontally and up to 135º vertically although we only see objects in detail within the central area of the visual field. Our binocular field of view is around 120º.

Fig 30. The adjacent linear graph shows the density of cones and rods across the retina in degrees from the fovea. Our visual acuity reflects the distribution of cones. The diagonal field of view of a 50mm lens is shown below for comparison.



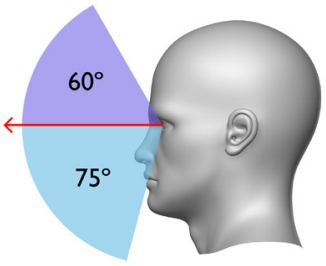


Fig. 31

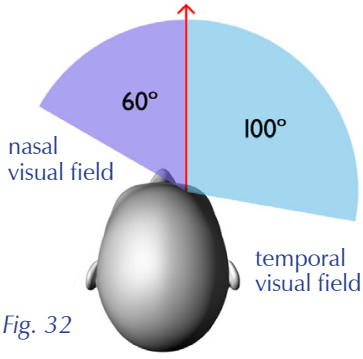


Fig. 32

*Figs. 31 and 32 above. The safety publication,'*Pilot Vision*', issued by the Federal Aviation Administration in America states that while the normal field of vision for each eye is about 135º vertically and about 160º horizontally, only the fovea has the ability to perceive and send clear, sharply focused visual images to the brain. The foveal field of vision represents a small conical area of about 1º. Outside a narrow 10º cone, we only see about one-tenth the resolution of our sharpest vision.*

PHOTOMONTAGE

In paragraph 160 of the SNH Guidance, it states that "**photomontages are used to illustrate the likely view of a proposed development as it would be seen in a photograph (not as it would appear to the human eye in the field)**" and goes on to state in paragraph 164 that "where a project involves an extension to an existing windfarm, existing turbines have sometimes been 'painted out' in the photograph of existing conditions and remontaged back in so the images of both existing and proposed turbines match. This effectively changes the record of baseline conditions and is not recommended".

Such statements simply defeat the whole purpose of producing photomontages. Anyone who has taken a photograph of existing turbines with any camera device that can produce an instant image will see that the actual presence of the turbines is greatly reduced for the reasons I explained on page 14. This is particularly the case where considerable distances are involved where the turbines are barely visible in a photograph but still clearly visible to the naked eye.

They are peculiar statements for SNH to make, particularly as the image of the existing Drumderg windfarm on the front cover of their Guidance is an actual remontaged photograph which gives a much more realistic impression of the wind turbines when viewed on site under similar lighting conditions. The smaller and much nearer single turbine in the photograph (which faces a different direction) has not been remontaged and lacks definition and presence by comparison. As any existing turbines have to rendered in cumulative wirelines, it is a simple matter to remontage them on their photomontages along with the application windfarm.

VERIFICATION

The main problem in the past for planning officers has been the verification and accuracy of the images presented in windfarm planning applications because of the considerable limitations imposed on the software they can use on their Council's computer network. As a result, they generally had no alternative but to accept the word of the developer that the images conform to 'Best Practice'.

Although the change from conventional film to digital imaging has revolutionised photography, it has also brought considerable confusion because there is a wide range of different camera formats with different size sensors which require conversion factors. Any visualisation page which states the focal length is a '50mm equivalent' for example will not be a technically correct 50mm because the images were not taken with full-frame sensor, so the standardisation of the 35mm camera format with a fixed 50mm lens by SNH is therefore welcomed.

When the 35mm SLR camera was developed in the sixties, it had two major advantages: the development of a moving mirror and a pentaprism which enables the photographer to view the real scene the right way up and the right way round through the lens. The second advantage is the fact that lenses are easily inter-changeable, so if we use a 50mm fixed lens which can be verified by metadata, we can accurately re-calibrate the single frame 75mm image using professional computer software. Similarly, if a 53.5° field of view is required, a 35mm wide-angle lens which has a similar horizontal field of view can be used which again, can be verified by metadata. However, while this is a straightforward matter for any professional photographer, according to SNH this will somehow cause confusion.

The SNH guidance has however, made the whole process unnecessarily complicated causing even greater confusion. To create the single frame 75mm photomontage*, the photographer first of all has to take a 360° view using a panoramic head involving 12 or 18 photographs taken with a 50mm lens depending on the overlap setting. The photographs are then formed into a cylinder using stitching software and the section of landscape containing the windfarm is identified and cropped to a 53.5° panorama with a vertical field of view of 18.2°. Because we still have a curved image, this image now has to be 'flattened', again using computer software where the template provided by SNH (which is a direct copy of the one developed by The Highland Council in 2013) is applied to then crop the 75mm photomontage. However, such a process is prone to inaccuracies and perspective distortions, nor can the base 53.5° image be verified by metadata because such data is removed in the stitching process.

*See footnote on page 41 of the SNH guidance which is also referred to in Summary of changes.

There has always been a reluctance by SNH and windfarm consultants to make the submission of camera metadata a requirement so that the accuracy can be verified in accordance with the Landscape Institute Advice Note 01/11 because many of the visualisations presently in the planning system are technically incorrect. Of the hundreds of applications I have assessed and analysed throughout the UK since 2006 which claim to conform to the SNH guidance, only a few had the correct technical data.

In digital photography every image records technical data such as make of camera, lens type and focal length which can be read in a wide variety of software. The Highland Council for example require submission of the original base photographs which can be easily verified by metadata and then visually checked using acetate or digital templates to quickly ensure the accuracy of any re-calibration. It is a straightforward process which has been successfully used for several years.

This is not the case in the SNH guidance where the submission of metadata is not a requirement and will only be made available on request. Using the method of verification shown on page 51 of their Guidance which has been made needlessly complicated, it again defies logic why the 75mm image should be extracted from a composite image with a 53.5° field of view which is unverifiable and prone to inaccuracies when it can simply be recalibrated from the verifiable 50mm single frame image as described on page 52. I am also at a complete loss as to how any planning officer or member of the public can accurately check that the angle of view is 53.5° or effectively use SNH's focal length template without being supplied with a correctly dimensioned and verifiable 50mm print for each viewpoint in the first place.

ON-SITE TESTING

During their research before they published their first illustrated standards in 2010, The Highland Council found that the A1 wide panoramic images were totally impractical for use in the field and were highly misleading when projected to their own planning committee. As a result, the Council limited the visualisations to the practical A3 page size which was the format used by the windfarm industry before the publication of SNH's 2006 Guidance.

In their feedback to SNH's Draft consultation document for the 2014 Guidance, one of the leading independent Landscape Architects who responded also commented that "A1 is too large, expensive to print, impossible to copy, an inconvenient size to hold and can be difficult to manipulate out of doors."

Fig.13. The Highland Council who undertook extensive research and empirical testing of windfarm visualisations before the publication of their own standards in 2009 found the A1 wide images were impractical to use in the field.

Despite this advice based on practical experience and field testing, the A1 wide panoramic format is maintained and in January 2015, the Landscape Institute endorsed SNH's 2014 Guidance as the preferred standard for England and Wales. Over the last few months I have therefore been monitoring and assessing the latest windfarm planning applications posted on ePlanning portals and testing printed planning visualisations on site.

A summary of the ES visualisations are shown in *Annex C - Summary of visualisation requirements* on page 49 of the SNH Guidance. All visualisations are presented at A1 width and comprise a 90° baseline panorama with a matching wireline along with a 53.5° panoramic photomontage with a separate wireline which are folded into an A3 size document as shown on the next page.

On site, the visualisations which were bound in a heavy A3 document were difficult to view and virtually impossible to use even in a moderate breeze producing the same problems that The Highland Council had encountered with wide A1 panoramas before 2009; the only difference was the images have to be viewed flat instead of as a curved arc.

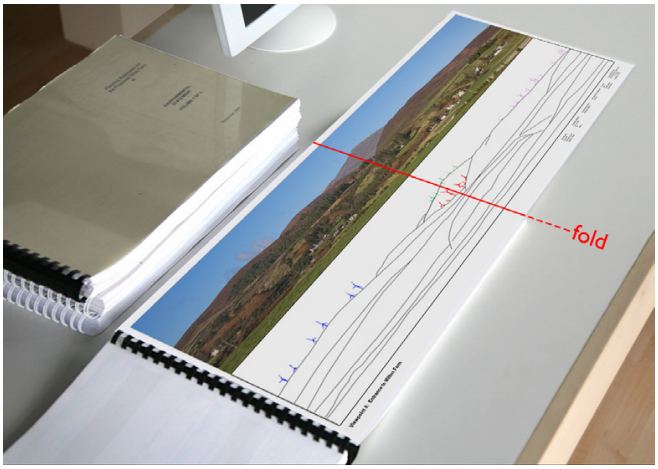


Fig. 14. 90° baseline panorama with matching wireline on a single page.

Fig. 15. 53.5° panoramic photomontage which has a matching wireframe on a separate page.

90° PHOTOMONTAGES WITH MATCHING WIRELINE

The 90° view made the landscape appear further away because the features in the panorama appeared more compressed horizontally when compared to the real scene. The image could only be used as a reference as stated in paragraph 139 of the SNH Guidance because the observer is viewing a curved image as a flat plane which compresses the 90° field of view into an actual field of view of 76° as shown in fig 16 below.

The vertical scale of the image is progressively compressed vertically and horizontally towards the outer edges of the image distorting the landscape which becomes more obvious when viewed on a much smaller computer screen which is the reason why straight roads curve downwards and power lines curve upwards. Because of the diminishing effect when an A1 wide panorama is reduced in size when viewed through ePlanning portals, our perception of turbine scale is under-represented by up to a factor of four* as shown on page 6.

In other words, we would have to be four times further away from the actual viewpoint to perceive the landscape and turbines at this scale. As this format is also the *only* practical means for the wider audience to assess cumulative impact (see paragraph 143 of the SNH Guidance), the images are particularly misleading.

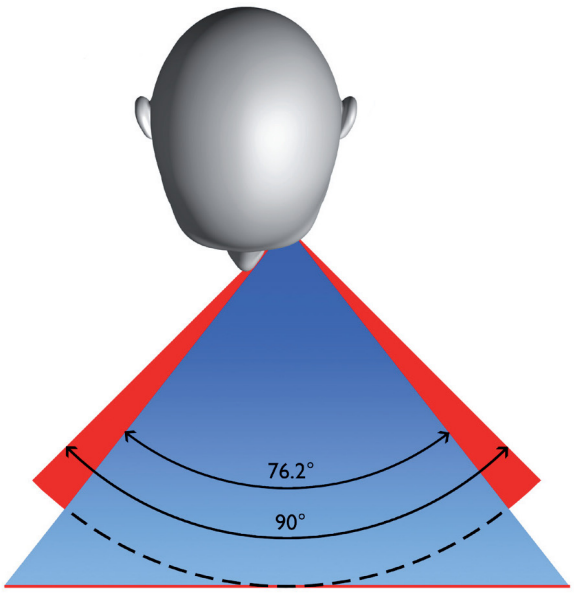


Fig. 16. Because the 90° curved image is viewed as a flat print, the actual field of view is reduced to 76° distorting the landscape profile.

Fig. 17. When the 820mm wide A1 panorama is viewed through an ePlanning portal where it is reduced down to the width of a computer screen, our perception of turbine scale is under-represented by up to a factor of four.*

*This will vary slightly depending on the aspect ratio of the computer screen.

53.5° PANORAMAS

When the folded 53.5° panoramas were opened up to A1 width while trying to hold the document with one hand and stretching the other end of the print, our arms are moved much further apart, so the image is held nearer the eye. This effectively increases the focal length because, unlike a single frame, in a panorama the focal length is dictated by the geometrical relationship between the eye and the image as shown on page 13.

Horizontally, none of the features in the 53.5° images could be aligned with the real landscape (an essential requirement in SNH's 2006 Guidance) and appeared somewhat wider giving the overall impression that the photomontages made the landscape appear 'too near'. This also applied to the matching A1 wireline image which is only available on a separate A1 wide page. Because wirelines are devoid of any recognisable landscape features, it was also impossible to orientate the image accurately on site, particularly in a flat landscape.

With further investigation however, I found that if the images are viewed at a comfortable arm's length which could only be achieved with assistance from another person holding the other end of the image, when the eye was focused on the centre of the panorama the vertical scale of the real landscape appeared to be similar which made the remainder of the image within our peripheral vision superfluous. By comparison, the single frame images which were supplied in the viewpoint pack for certain viewpoints gave a more realistic impression of the vertical scale and were easy to hold at a comfortable arm's length, even in a strong breeze.

If this A1 image is now viewed in the field at its 'principal distance' of 812.5mm for correct perspective viewing which is beyond arm's length, it requires the help from two additional people to hold each side of the panorama who then have to somehow align it correctly with the viewer's eye to view a perception of scale we do not experience as explained on pages 9 and 10. The whole process is in fact somewhat ridiculous and totally impractical.

Fig.18. When the 53.5° panorama or wireline is viewed through an ePlanning portal where it is reduced down to the width of a computer screen, the viewer is not looking at a 75mm image. They are viewing an image with the horizontal field of view of a 35mm wide-angle lens where our perception of scale is under-represented by up to a factor of two.*

We would have to be about twice the distance from the actual viewpoint to perceive the landscape and turbines at this scale.

To complicate matters even further, when the A1 wide panoramic images are viewed through ePlanning portals, our perception of turbine scale is under-represented by up to a factor of two* as shown on page 6, **so a strange anomaly exists here**; when the 53.5° panoramas are viewed as an A1 document in the field, the landscape appears too near, but if viewed on the local Council's ePlanning system, it appears much further away.

Although SNH have made some allowances for this by stating that the single frame images in the viewpoint pack may be more convenient for on-site assessment in poor weather conditions, it only applies to selected viewpoints which introduces the next set of problems.

*This will vary slightly depending on the aspect ratio of the computer screen.

IMPLICATIONS FOR THE PUBLIC AND DEVELOPERS

The implications for the public are considerable. They can only view single frame images of selected viewpoints in a 'Viewpoint Pack' which they have to obtain from their community or parish council as a set of A3 printed images with a location plan printed on the back. No mention however is made on how the images should be viewed on-site in the real landscape, a point considered to be very important by the University of Stirling during their study so that a correct scale comparison could be made. These images must only be used on-site because SNH claim that they do not show enough context and are therefore excluded from the visualisations presented in Environmental Statements (ES).

This implies that our perception of scale and distance in a photograph viewed on-site is different to that when viewed off-site. I consider this to be misleading because our perception of scale within the image frame remains the same regardless of how it is viewed as shown on page 12, so if the public are provided with reliable images of their landscape, there is no need for them to visit the site.

I have found over many years of research that residents of communities who could potentially be affected by a windfarm development are not interested in viewing the wider context because their cognitive map of the landscape which surrounds them is highly developed. They live with it every day. All they want to know is how big and how near the turbines are likely to appear which we know can be reliably achieved with a 75mm single frame image.

The best way to illustrate the problem for the public is to view the images on page 41 of the *Background and Context* document on SNH's website which shows the SNH requirement on the left hand side and The Highland Council requirement on the right.

To the observer, it will be seen that SNH requirements appear much more flexible in terms of image size compared to the images on the right, but it is not the way the images are viewed by the public. The reality is that most people make their judgements from the visualisations posted on their Council's ePlanning site which they view on a computer screen where all the images are the same width. The large A1 panoramas are now the width of the computer screen where they are highly misleading.

The Highland Council recognised this problem several years ago which is why all the images on the right hand side of the SNH graphic are the same width, but now give different perceptions of scale. The single frame images give the observer a reliable impression of scale and distance, while the panoramic images showing the wider context are useful reference for professional assessment. The different visual requirements are clearly identified as images for Visual Impact Assessment and Landscape Assessment respectively.

The next problem is practicality. If the viewpoint in question does not form part of the selected single frame images in the 'Viewpoint Pack', but is included in the ES, how does a member of the public acquire the panoramic image printed to the correct size?

Because of the limited file sizes for images posted on ePlanning portals, most large panoramic images are not suitable for printing at A1 size, so it is necessary to purchase a DVD of high-resolution images from the developer. This then has to be taken to an output centre capable of printing large-format images which tend to be located in towns or cities (Jessops for example, charge £20 per A1 print). For urban dwellers, this may not be such an obstacle, but for someone living in the country where the windfarms are more prevalent, it is an unnecessary and expensive inconvenience. This is clearly not making images more accessible to the public.

One of the greatest problems for the public has always been accessibility to suitable images. Environmental Statements conforming to SNH's 2006 Guidance for most windfarm applications were in the range of £400 to £600 per document. Although SNH claim that there should not be any significant increase in printing costs, in practice they will be considerable as the cost of printed documents in some recent applications have been in excess of £1,000 (one windfarm applicant quoted £1,400 for the full ES).

There are also implications for windfarm applicants. As SNH state that all images must be viewed at their correct printed size, every member of the local authority's planning committee will have to be provided with a full set of printed visualisations as emphasised in paragraph 195 of the SNH Guidance. This should equally apply to all consultees and every affected community council/parish council. As the printing of such a large number of documents is the responsibility of the applicant, the increase in overall costs will be substantial which introduces a further problem.

To reduce printing costs, some recent applications I have assessed have been printed on poor quality paper which is not acceptable. It is also now evident that certain consultees who have no direct access to large scale printing are only being supplied with the images on DVD which continue to be highly misleading if viewed on a computer screen. All consultees should therefore *insist* on a full set of visualisation documents printed to the correct size before making any assessment.

One of the long-standing issues for the wider audience has been the difficulty in navigating the visualisations presented in many Environmental Statements when they are made available digitally from developers on DVDs or downloaded from ePlanning portals. No attempt has been made by SNH to provide any guidance to either windfarm applicants or local councils on the standardisation of viewpoint titling and image file sizes.

SNH GUIDANCE Version 2.1 dated December 2014

The changes in Version 2.1 listed in the *Summary of changes* in response to "queries from some practitioners" is a further retrograde step because they appear to be based on feedback from visualisation consultants working for windfarm applicants. It is my understanding that the changes did not have the full agreement of the SNH steering group.

Some of the amendments are already discussed in this paper. However, one of the other significant changes is in *Annex C - Summary of visualisation requirements* on page 49 where the footnote at the bottom of the page states that 'it is not necessary to produce all 5 images. In some cases, a wireline may suffice, for example, if agreed by the determining authority and consultees".

In her conclusion, the Inspector for the Louth Canal Inquiry referred to on page 5 of this paper concluded that "The question that is left is how in a technical and professional world are consultees, and lay people, to assess impacts on the natural landscape in a format that is at least broadly understandable, if we do not have access to photomontages and are only presented with technical wire frame drawings."

As wirelines are increasingly used for Residential Impact Assessment (RIA), apart from the fact that they can be highly misleading, they are not understood by the public because they do not contain any familiar landscape references. One member of the public who appeared at a Local Public Inquiry in the Highlands of Scotland several years ago described them as 'insects stuck in a spider's web'.

Residents who will be directly affected by windfarm developments are not interested in images which show the wider context; all they require are understandable images which will give them a realistic prediction of turbine scale as seen from their property.

Panoramic wirelines or wireline overlays on a photographic backgrounds are now being submitted digitally for RIA with an angle of view of 53.5° where the turbines appear around half of their true perceived scale if viewed on a computer screen, so the public continue to be misled. For accurate RIA, only 75mm single frame images should be provided. Where the angle of view of the windfarm exceeds the single frame, a wider view showing the whole windfarm should also be submitted for reference. In such cases, the 75mm single frame image should contain the nearest turbine.

Fig. 19.

SINGLE FRAME VIEWER

Because cumulative issues are becoming an important factor, in 2012 The Highland Council, in conjunction with Architech developed a single frame viewing system for panoramic images where the 75mm focal length is controlled by computer. It is in effect, similar to turning our head to scan landscape detail as we would do in the real world.

Although it has been argued by landscape professionals representing the windfarm industry that a single frame image can over-emphasise visual impact, it actually under-represents because of the structure of human vision which is illustrated on page 15. Although we have a very wide field of view up to 200°, our sharp detailed vision is restricted to a very small area in the centre of our visual field which is tightly packed with 'cone' receptors which enable us to see detail and colour.

Outside this region, the distribution of cones is considerably reduced where the major part of our visual field is taken up with our peripheral vision which is made up of 'rods'. The rods only see in black and white and have a much poorer resolution of colour, shape and pattern, but they are many hundreds of times more sensitive to movement, so if we view a landscape involving several windfarms or a very large windfarm over a wide area, we would be aware of turbine movement beyond our clear area of vision to the edge of our peripheral field which would considerably increase their visual presence. While our peripheral vision alerts us to movement, our central vision is used for object recognition which is also the reason why windfarms attract our attention in an otherwise still landscape.

The use of a single frame viewer similar to the one developed by The Highland Council in 2013 which is strongly supported by the Scottish Government was originally incorporated into SNH's Guidance issued in July 2014. In what circumstances it will be applied is not made clear except that it purports in SNH's terms to provide better access for the public and to facilitate more accurate on screen viewing. The more obvious applications which The Highland Council system currently successfully addresses; accurate cumulative assessment, very large or lateral schemes and viewpoints close to a development are not clearly stated.

On page 49 of the SNH Guidance dated December 2014, practitioners have now been informed that they ''do not need to prepare jpeg images for insertion into the digital viewer until further notice''. Inexplicably it has since been delayed further. Although it is difficult to understand why the introduction of a viewer needs to be phased, according to SNH, the first phase which will only apply to Section 36 applications was to have been made available this summer. Nothing has appeared to date. The second phase, to make the viewer available for all applications, apparently will not be introduced until late 2015/early 2016.

THE LANDSCAPE INSTITUTE

In January 2015, the Landscape Institute (LI) issued a notice stating that the SNH Guidance 2014 is now the preferred guidance for all windfarm applications throughout the whole of the UK. The Guidance was approved by the Institute's Technical Committee which is again chaired by Mark Turnbull, a member of SNH's Steering Group for the 2014 Guidance and a director of Envision who were co-authors of SNH's 2006 guidance.

It is now also evident that consultants working for the windfarm industry were fully informed of this intention six months in advance, yet the public, councils and consultees in England and Wales were not informed or even consulted on this matter. They have simply been faced with another *fait accompli*, a move which is undemocratic and unacceptable because I am aware of many individuals, community groups and even consultees in England and Wales who either knew nothing about SNH's original consultation document or did not respond because it clearly stated that it only applied to Scotland.

The LI's endorsement of the SNH guidance 2014 is also subject to two caveats. The first states that ''different landscapes, types of windfarms and conditions in other countries may require different approaches'' which in my opinion is purely a let-out clause for visualisations outside Scotland which do not conform to the new Guidance. Our perception of scale and distance does not change depending on the type of landscape or types of windfarms.

The second caveat states that "it is recognised that smaller scale wind farm proposals (up to 3 turbines) and single turbine applications do not usually require the same level of visual representation". In addition to the cumulative issues of larger windfarms, the emergence of single or small clusters of turbines in the landscape is also becoming a matter of public concern because regardless of their height, they are presently not subject to the same visualisation requirements.

Most visualisations for single or small clusters of turbines I have assessed outside Highland are so seriously misleading that they should never have been accepted by the local authority in the first place. The Highland Council now require all turbines with a hub height of 15 metres or over to conform to their visualisation standards, even if they are not subject to a full EIA. Unlike larger windfarms which tend to be placed on higher ridges, many single turbines are built on lower valley farmland where the light coloured structures are often back-clothed against the darker landscape which makes them more visually prominent even in overcast conditions, so turbine colour is important.

CONCLUSION

For the last thirteen years SNH have strongly resisted, and continue to resist, the use of single frame images as part of the ES or part of the LVIA. It is simply time that this ended and common sense prevailed.

Although the delay in publication of revised SNH Guidance has had no impact in the Highlands, it has had serious and unacceptable consequences for applications across the rest of Scotland, England and Wales. A projected six-month process was extended to three years because self-interest has again been allowed to overrule science, logic and simple practicality resulting in an unnecessarily complicated and confusing document. The 'inherent complexity' which concerned Professor Benson in 2002 still continues by simply replacing one layer of needless complexity with another to justify images which are misleading when viewed on a computer screen.

Despite SNH's claims that suitable images are now also more accessible to the wider audience, in practice they are not. The single frame images and single frame panoramic viewer developed by The Highland Council have simply been tagged on to the A1 panoramic image format which SNH have promoted from the outset and are excluded from the Environmental Statement and LVIA assessment. If they had wanted to achieve more accessibility, then the single frame images could have been included sequentially with the panoramas for landscape context in the Environmental Statements so a direct comparison could have been made. This should have been prescribed for every viewpoint so they can be correctly viewed through ePlanning portals.

The continuing absence of the SNH single frame viewer to aid better access for the public and more accurate screen viewing is not acceptable. A similar system is currently in operation in Highland which raises serious questions over the delays in implementing the use of the system in other parts of Scotland and the rest of the UK.

The stark reality is that virtually none of the planning visualisations presently within the national planning system can be relied on for an informed assessment of visual impact because the majority of applications are based on the SNH 2006 Guidance which is scientifically and technically flawed, despite claims by SNH that it remained fit for purpose until January 2015. It is now clear, as the built reality appears throughout the UK, that the visual impact and scale of such structures are much greater than the public and decision makers were led to believe.

We have once again ended up in a situation where the tail is wagging the dog; the planning system is being dictated to by a small group of landscape consultants working in conjunction with SNH and the windfarm industry who clearly have got things seriously wrong in the past and continue to be involved directly or indirectly in the process. **They have simply developed another way of misleading the wider audience through Local Authority ePlanning portals.**

Apart from inaccuracies in the 2014 guidance and associated documents which are too numerous to list in this review, there appears to be an inability by SNH and the Landscape Institute to recognise the scientific implications of linear perspective in a photograph; if we show context, we do so at the expense of a realistic impression of scale, and if we show a realistic impression of scale, we do so at the expense of context. It is only by considering both together can an informed judgement be made as Professor Benson and the University of Newcastle originally identified thirteen years ago; that although they are both an integral part of LVIA, the visual requirements for the two are very different and should be clearly distinguished because they serve different audiences.

Since that time, a huge amount of research work has been undertaken on this subject which continues to be largely ignored and although SNH claim to have carried out extensive research within their Steering Group review process, no reports (other than the responses to the consultation document) have ever been released for public scrutiny. The result of the site visit at the second SNH 'workshop' in May 2012 for example where SNH once again had their principal distances wrong was never even made available to members of the groups who participated.

It is a very simple matter to provide images for an Environmental Statement which can be understood by all audiences and can be achieved using two image formats; a panorama showing the wider context along with a single frame image which gives us a realistic impression of scale and distance. The panoramas will be of particular interest to the landscape assessor, while the single frame images will be of particular interest to the public. Non-landscape professionals such as planning officers and consultees will assess both.

When our planning laws were established, the widespread development of moving structures with heights of 45 stories or more across our landscape throughout the UK were never envisaged. There are now also certain local authorities who cannot cope with the amount of windfarm applications in the planning system and are faced with considerable costs and staff resources involved in windfarm inquiries where the ultimate decision is made by one person who has to take Government policy into account. If we are to have any control of our planning system and our landscape, the final decision must lie with the local authorities. Although this now appears to be the intention in England and Wales, it will not apply in the Scottish planning system.

No-one can accurately predict the visual impact on our landscape of the applications presently in the planning system. The Town Planning Institute must therefore take a much more pro-active stance as a matter of urgency so that the control of visualisations for the wider audience is given to planning authorities so that properly informed judgments can be made based on easily verifiable images which are clearly understood and not open to misinterpretation. Our landscape does not stop at local authority borders; it is a continuous flow of space where there appears to be little or no co-ordination between adjoining councils which can only lead to reckless planning.

Cumulative issues are now a major consideration as more and more windfarms appear on our landscape. In many areas, small single turbines are now infilling the areas between the larger windfarm developments, so the landscape is becoming a turbine landscape rather than a landscape with turbines in it. Single turbines often tend to appear on the landscape without any proper impact assessment because they generally do not require an LVIA, nor do they have to conform to any visualisation standards. This must be urgently addressed.

As there is now overwhelming evidence that a 75mm single frame image gives a reliable impression of scale and distance, they should be incorporated into Environmental Statements to inform both professional judgement and the much larger wider audience. Many thousands of hours of expensive legal time have already been wasted at Public Local Inquiries since 2007 discussing the importance of viewing distances and the problems of 75mm 'zoomed-in' images. The question of whether or not a 75mm single frame image is acceptable for the assessment of visual impact should no longer be an issue.

A panorama will always be open to misinterpretation and examples of images which continue to mislead the public are already appearing on ePlanning portals and developer's project websites. The images, which claim to conform to the 2014 SNH Guidance, are shown as panoramas with a horizontal field of view of 53.5°. However, if viewed as a panorama on a computer screen, our perception of turbine scale will appear about half their true scale as shown in the two images below. In my opinion, the public would be perfectly justified in reporting developers to the Advertising Standards Authority (ASA) for visual misrepresentation. It should no longer be possible for developers to continue to hide under the guise of 'Best Practice' as they have done in the past with the ASA.

Fig. 20.

SNH 75mm image (53.5° angle of view)

Fig. 21.

Technically correct 75mm image

Unlike SNH who take no responsibility whatsoever for policing applications or even commenting on the accuracy of submitted visual materials, The Highland Council has continued their research and monitoring of visualisations for the last six years. With the largest number of individual windfarms and in-coming applications in the UK, covering an area larger than Belgium, the region is the ideally placed to undertake this programme. Their Standards which are now widely quoted throughout England and Wales and have proved to be well founded, easily verifiable, designed for all audiences and restrict the image sizes to the practical and economic A3 format. However, if consultants wish to submit additional A1 wide panoramas in accordance with SNH's 2014 Guidance, they are free to do so providing the document is clearly labelled 'For Landscape Assessment only'.

Lancashire County Council and Leeds City Council for example now require all windfarm applicants to use *The Highland Council Standards* and a growing number of councils and consultees throughout the UK are now asking for 75mm single frame images to be included in the Environmental Statements in addition any wider panoramic images showing context. The Standards are reviewed and re-issued on a regular basis in response to continuing

research and feedback from applicants and the latest update was issued in March 2015. There is also no evidence that the existence of the Standards has negatively affected the rate of approvals in Highland or impeded the planning process, if anything, the result is entirely positive and the Government's 2020 target for approvals in the region has already been reached.

An Environmental Statement should be an objective assessment to enable the Local Authority to make an informed judgement of likely impact. Under their interpretation of the EC Directive, the Landscape Institute's GLVIA 2* published in 2002 stated that ''this helps 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'', although this was somewhat watered down in GLVIA 3** published in 2013.

While the large A1 wide images may be a considerable improvement for desktop assessment when viewed on a flat surface at a 'comfortable arm's length', the consequent increase in cost makes these documents beyond the means of members of the public. SNH have stubbornly disregarded the importance of ePlanning as the future means of communicating planning information, not just for the public, but also increasingly for statutory consultees and council members. The Scottish Inquiry Unit (DPEA) is now experimenting with digital submissions for inquiries which indicates the general future direction of travel which will have implications for the screen viewing of all visual material. Yet, the fact remains that SNH's proposed presentation formats are still potentially misleading when viewed on a computer screen.

It is also worth noting that when the Scottish ePlanning service was established it was intended to modernise and streamline the planning system across the country which in turn would provide a more accessible and consistent level of service. One of the specific aims was to provide "a mechanism to consult electronically with statutory consultees". The revised guidance is out of step with these aims and does not take forward the modernisation which digital visual output now requires.

Since 2011, SNH have just 'steered' another steering group into a preconceived methodology to suit their organisation and certain landscape consultants with vested interests, resorting to questionable practices where necessary in order to gain consensus despite being informed from the outset by both Architech and the Highland Council that their proposals could not work for the wider audience or the on-going computerisation of the planning system.

In the same way they made reference in their 2006 Guidance to Professor Gregory's *Eye and Brain* without mentioning the importance of constancy scaling, and the application of Leonardo's Window without mentioning its important caveats, they have selectively incorporated aspects of The Highland Council Standards but removed them from the context for which they were originally designed.

In an article in the Press and Journal in March 2007, Fergus Ewing MSP, now the Scottish Minister for Business, Energy and Tourism accused SNH of collusion with the windfarm industry. Regrettably, nothing has changed.

Alan Macdonald RIBA
October 2015

**Guidelines for Landscape and Visual Impact Assessment - Second Edition.* The Landscape Institute and Institute of Environmental Management & Assessment (2002). ***Guidelines for Landscape and Visual Impact Assessment - Third Edition.* The Landscape Institute and Institute of Environmental Management & Assessment (2013).

Appendix A

Note 1 Page 9

A 50mm 'normal' lens slightly magnifies external space. A 35mm camera produces an image size of 36mm x 24mm with a diagonal measurement of 43.3mm which is the diameter of the circle projected onto the sensor. A focal length of 43.3mm will therefore produce an image that neither magnifies nor reduces. However, when the 50mm lens was first developed in the 1920s, it was a compromise between minimising distortion and the optical quality available at that time. Although lens optics has advanced considerably since then, it has remained the 'normal' lens for the 35mm format.

Note 2 Page 9

As explained on page 10, based on an enlargement factor of 10, the viewing distance or principal distance for an image 360mm x 240mm with a focal length of 50mm will be 500mm which is a comfortable arm's length. If the image size is increased to 390mm x 260mm, the viewing distance will be increased to 541.7mm. However, if the viewing distance is to remain at 500mm, it is necessary to change the focal length for correct perspective viewing which can be calculated as follows:

Viewing distance ÷ printed image height x original image height (24mm) = focal length.
500mm ÷ 260mm x 24mm = 46.15mm focal length.