Unreal Engine in the Theater: New Challenges for the Lighting Designer

Victor Inisan

Abstract *While visualisation software has transformed the profession of lighting designer, these tools are neither complete nor photorealistic. So why not turn to video game engines, which provide better capacities? Unreal Engine has recently taken this step by creating a plugin that allows control of lights from the game engine: What potentials do such programs offer to reshape the work of the lighting designer?*

Introduction

The last four decades have seen considerable changes in the field of stage lighting. First of all, this period has witnessed the popularization of motorized projectors: If 'it seems that the idea of using remote control of the pan, tilt and the focus (PTF) of a spotlight came into the collective consciousness of the lighting industry in the early 1960s' (Cadena 2010, 12), they have become dominant since the 1980s and 90s. More recently, luminescent sources (discharge lamps at first, then light-emitting diodes) have become dominant in the marketplace at the expense of incandescent lamps: In a way, 'we're at the start of a revolution in home, commercial, and public lighting that will be the biggest shift in the sector since the development of the tungsten filament over 100 years ago', as Sal Cangeloso wrote ten years ago (Cangeloso 2012, 6–7). Indeed, LED lighting is beginning to change the way we understand light and is part of a much larger transformation: 'the digital age seems to have taken hold and become a permanent fixture in our civilization, and LED technology is part of that logic' (Massol 2012, 1). In fact, it is becoming obvious that 'light is more and more electronic and less and less physical' in the words of the light designer and collaborator of Claude Régy, Rémi Godfroy (interview with the author, 14 December 2017).[1] This is true equally of the way designers use light and of the kind of light emitted, which is flatter and smoother than the light of incandescent bulbs.

1 Unless otherwise indicated, this and all further translations from non-English-language sources are by the author.

The new techniques logically require new means of control: LEDs and motorised lights require more powerful and capable lighting desks to exploit all the features inherent to them (colour changers, zoom, pan & tilt, etc.) in an intuitive and efficient way. In this regard, if we were to draw inspiration from the field of video, we could say that lighting consoles have progressively gone from analogue to digital. Moreover, the digital revolution has also allowed visualisation software to play a major role in the creation of light shows. Indeed, in the event industry, which mobilizes large budgets (high number of projectors; advanced equipment) in a short period of time, lighting designers model their lights in 3D before the show, both to help to conceive them and to facilitate the flow of information to the teams during the tour. Consequently, the software is now at the heart of both the logistical and the artistic aspects of a light show. This is the case of software such as VectorWorks or wysiwyg,[2] whose name is based on the acronym 'What you see is what you get'. It is only in a second step that digital consoles connected to visualisation software, such as Eos[3] or GrandMa,[4] allow the running of live light plots that perform what the designer had previously modelled.

In live performance, however, the spread of new lighting technologies is much more limited than in the case of events, for at least three related reasons: first, it is a smaller industry, which attracts less interest from the international lighting companies. Second, live performance lighting designers are often wary of these new technologies and still use a lot of incandescent halogen lamps. In fact, they often perceive these transformations as a 'takeover of the industry' to the detriment of the artistic, as Marie-Christine Soma, a great French lighting designer put it (interview with the author, 9 December 2017). Third, there are also artistic reasons why new technologies may not be taken up, relating to the quality of luminescent light, which is inferior to the rendering of incandescent colours (Inisan 2021, 95–108). For these reasons, the need to replace the tools used for lighting design and control is not felt so strongly. Moreover, since the time available for light creation on set is far longer than in the event industry, with lighting designers on live shows often having the opportunity to work for several weeks in the theatre, this further reduces interest in computer modelling. Thus, most of the entry-level consoles for live shows integrate fairly basic software (e.g., Cobalt) which makes handling some new technologies awkward while favouring the control of older sources.

2 VectorWorks (www.vectorworks.net) and wysiwyg (www.cast-soft.com/wysiwyg-lighting-design) are complex 3D design software suites that can be used in a range of fields, such as live events and architecture.

3 Eos (www.etcconnect.com/Products/Consoles/Eos-Consoles/) is a series of lighting desks designed by ETC that became very popular among the lighting designers, especially for live performances that don't require GrandMa.

4 GrandMa lighting desks (www.malighting.com) are the most popular devices used to control lights in major live events (concerts, TV shows, conferences, etc).

Some lighting designers have also ventured into the field of simple virtual consoles (e.g., DLight,[5] QLC +[6]). With an ENTTEC box, for example, they can transmit a single DMX[7] universe via a USB cable. A yet smaller number are starting to be interested in software with integrated visualisation functions. The simplest are virtual consoles with 2D schematics (Lightkey, Millumin, Sunlite, and DasLight 4), or even with basic 3D (Chamsys[8]): In fact, these are not even lighting plans but merely contain sets of reference points. But as Yragaël Gervais, lighting and video designer, notes, the very tension that currently exists around control tools in live performance is perhaps a sign of a transformation to come:

> The new generations are completely different. In theatres, we live with people who still have classic consoles, classic programming, and who are stuck in this. Afterwards, they will be very good at adjusting a projector, making a beautiful front light. These people can place and adjust everything well, and then I can program the way I want, but they can't, because they are stuck with their tools. There is really a difference between two schools of lighting; the teams in theatres seeing us arriving can be a bit lost: the first thing we tell them is to put away the console… (interview with the author, 10 January 2018).

As for Marie-Christine Soma, she explains:

> There are people who think it's great, like any novelty, the geeks in fact. As soon as there's something new, they think it's great. And others who have a form of reticence: There are technical directors who find it very bad, while some are very enthusiastic (interview with the author, 9 December 2017).

In this regard, Christine Richier, director of the lighting section of the École Nationale Supérieure des Arts et Techniques du Théâtre (ENSATT) distinguishes two types of lighting designers among her students: the traditionalists and the geeks,

5 DLight (www.getdlight.com) was been the most popular simple virtual console at the beginning of the 'digital era' of lighting. It is not really used anymore at this time.

6 QLC+ (www.qlcplus.org) is an open-source virtual console that looks a lot like DLight. Even if it has more or less the same specifications, it remained less popular. As with DLight, it now looks quite outdated.

7 DMX is the principal computer protocol used for lighting since the end of the 1980s that allows the transmission of various kinds of light information from the console. Thus, the operation of the lights differs according to the variation of the DMX signal. DMX contains 512 channels – 512 different pieces of information are possible: The whole is referred to as a 'universe', and it is possible to multiply universes when more information is needed.

8 Though all the lighting controllers named here are more complex than DLight and QLC+, they remain very accessible options for the beginner.

the latter whose favourite control protocol is computers (interview with the author, 28 February 2018).

3D visualisation in live performance

It is not surprising that some lighting designers are starting to use 3D visualisers from the event industry to design their theatre lights – even if these software packages require the use of digital consoles that are often still lacking theatres. In fact, we anticipate that, alongside the generational shift, another factor that will boost the uptake of visualisation software is its ability to compensate for the lack of access to theatres or rehearsal spaces. Many productions are confronted with this problem, especially emerging productions which struggle to obtain stage time. Indeed, the use of 3D software allows for significant progress on the visual design of a show outside of a theatre, much better than with schematic or 2D lighting design software. Moreover, since it is possible to experiment with proposals and effects in a virtual environment that also integrates movement, the use of a video game engine can lead to savings in the number of necessary technical purchases.

That said, this kind of usage can also be found in larger theatre productions: In this case, it is rather that they allow the exploitation of certain lighting technologies to the fullest. This is for example the case of Antoine Travert, lighting designer for Thomas Jolly, user of wysiwyg and GrandMa consoles. As he attests:

> I'm a geek. Afterwards, I have the console between my legs. Philippe Berthomé, for example, with whom I work on *Thyeste*, he must know how to manage a console, but he always has someone with him, he doesn't climb either. My job is mostly encoding machines. The more I have, the better (interview with the author, 4 April 2018).

However, it must be recognized that while most of these software programs are of excellent quality for the visualisation of light, they remain rather basic when it comes to designing materials and spaces: They model the scenes of shows, certainly, but not really detailed sets. In fact, in live shows, the modelling is very often done by the scenographer using different software (such as Sketchup[9]), and the stage design file is then imported into the lighting software. Wysiwyg and VectorWorks, which are also used in architecture, are more complex, but they struggle to be photorealistic. Moreover, it goes without saying that none of the software is capable of rendering the movement of the sets and actors, though it is possible to build different scenes,

9 Sketchup (www.sketchup.com) is a very popular software for 3D visualisation and modelling.

i.e., different placements, without seeing the movement itself. In short, light visualisation, even where it has been adopted, is still usually unable to model what a show will look like as a whole. It is an advanced technical tool, sometimes useful for artistic purposes, but it remains mostly alien to the staging process.

Where some more or less successful attempts have been made to create visualisation and control tools that are as artistic as they are technical (Bardiot 2016, 431), it seems that video game engines have been particularly interesting for live performance teams: Indeed, they are the only tools capable of creating integrated environments that aggregate movement (sets, characters) – so that it is possible for a designer to obtain a more or less complete visualisation of a performance in advance. Of course, the use of game engines for theatre design does not seem to be inevitable: First, visualising an entire show in advance is almost fundamentally opposed to the definition of a live performance, which occurs in the moment and depends on actions that may occur spontaneously. Second, these game engines are made for … producing games: In other words, they are not optimised for this kind of visualisation. Very often, they require training in coding, which almost no director or lighting designer has.

The case of Unreal Engine

In this context, Unreal Engine, developed by the American studio and video game distributor Epic Games, seems particularly interesting. Unreal Engine, which has gone through five versions since its release in 1991, makes it possible, like most other game engines, to create photorealistic environments of great quality that are incomparably superior to those made using any classic visualisation software. Furthermore, unlike all the visualisation software mentioned above, Unreal Engine is totally free, since it works on a system of royalties that must only be paid to the license holder when profits exceed a million euros – something that remains very rare in live shows. By way of comparison, wisywyg costs 3,000 euros per year, and while Capture[10] offers a free student version, to access the full range of features, you'll need to pay between 400 and 2,000 euros, depending on which DMX universes are to be unlocked. In addition, Unreal probably has two advantages over its competitors in the live performance field:

- Entirely coded in C++, Unreal has long been inaccessible for artists, and even sometimes for programmers compared, for example, to Unity. However, thanks to a system of associating nodes called Blueprint, it is now possible to create

10 Capture (www.capture.se) is a 3D visualisation software that has been optimized for live performance. Contrary to VectorWorks for instance, it is not dedicated to architecture.

scenarios without coding, making the design of environments quite accessible for someone who does not know how to code.
- Officially released in April 2022, the latest version of the software, Unreal Engine 5, has greatly improved photorealism. It immediately became the default system for creating triple-A games, i.e., video game blockbusters. This improvement comes in particular from the processing of lights via Lumen, a tool that allows much more detail in the environments and greatly accelerates design work.

This is why Unreal, perhaps more than any other engine, seems appropriate to accommodate live performance visualisation. A first DMX plugin was released in Unreal Engine 4 in early 2022: It allows live show visualisation with theatre projectors and the electronic patching of the projectors. However, the virtual console function is still very limited, and is only useful for testing lights. As is often the case in visualisation, it is necessary to use an external console (virtual or real) to create sequential effects. So, what does this plugin actually offer lighting designers, and more generally to a live performance team? Since it is recent and has been designed more for events, asking what the plugin will achieve, both in terms of work organization and transformation of show aesthetics, remains a matter for speculation. I have tried to put forward two sets of assumptions – the first concerning changes in the division of responsibilities in theatrical projects that use Unreal; the second about the interest of the use of Unreal itself.

First set of assumptions

1. Certain software tools are already successfully unifying the sequencing of light, sound, and video (e.g., QLab[11]): 'a more stable relationship between the control of light and the control of the other elements of the show – music, midi elements, video – becomes possible' (Toeplitz 2010, 27), writes composer and musician Kasper T. Toeplitz about the modernisation of technologies. Nevertheless, this is still rare in the field of visualisation: It is therefore safe to say that Unreal brings greater unity not only to control, but also to the design of the aesthetics of a performance. Unreal, which is quite easy to use, would even allow a director to be involved in the construction of the 3D visualisation. If the lighting visualisation belongs to the lighting designer, the visualisation of materials and spaces to the set designer, then, for instance, the director can intervene in the file by determining in advance what the movements of the actors are. The director is thus encouraged to be the technician-creator of his or her own work. Thus, a team

11 QLab is a multimedia control software that allows light, sound, and video to be controlled from the same interface (https://qlab.app).

gathered around the same Unreal environment could create a show whose set would be the artistic result of a virtual design.

2. Since the lighting designer can start the visualisation before the rehearsals and continue the design outside of the work sessions in the theatre, it seems that he or she could more easily be invited to participate in dramaturgical considerations. In a way, integrating lighting visualisation into the creative process of a show solidifies the role of the lighting designer as an artist in his or her own right.[12] In fact, as the DMX plugin is prepared by programmers who have no real affinity with live performance, we can distinguish between the lighting designer – who until recently was considered a pure technician – and pure programmers, who can access the source code and prepare the interfaces without knowing the works they allow to be produced.
3. As the director can intervene in the file and the lighting designer himself becomes an artist, one could imagine a convergence between the two professions. Frédéric Poullain, former assistant of François-Éric Valentin, even imagines, in the long term:

   F.P.: A computer scientist will create a network with a small team and then the lighting designer, who will not be entirely unfamiliar with the technology – but who will primarily be a representative of artistic and literary culture – will make visuals.

   V.I : So you think that there will be a valorisation of the work of conception ?

   F.P: Yes. It could even become a training course for directors, we could almost make the lighting designer's job disappear (interview with the author, 1 February 2018).

Second set of assumptions

4. In his book *L'Éclairage des spectacles* published in 1982, Yves Bonnat imagined a lighting system where 'all the modular elements of information processing will be grouped together in a room and will receive orders by radio or telephone cable from a removable console barely larger than a pocket calculator'! (Bonnat 1982, 69) In fact, control by smartphone, although still rather unreliable, is not far from realizing this dream. In this context, one can speculate about the nature of a lighting plot: At what point does the lighting concept stop being technical and

12 The term 'lighting designer' only arrived in France in the 1950s: it was Pierre Saveron who, along with Jean Vilar, was the first to be named as such – and no longer 'chief electrician".

start being artistic? It is no longer 'the set and sequence of indications of effect and directives for change consigned in a transmissible document […] to ensure the proper unfolding of a performance and the service of a staging' (Freydefont 1995, 212), to use Marcel Freydefont's definition: the technical plan becomes almost the performance itself in germ, encapsulating all the aesthetic aspects of a production. The use of Unreal cements this direction: What is the nature of the file that contains all the potentialities of visualisation of a spectacle? The software, which was considered a simple technical tool, becomes not only the vector of the work that it foresees, but perhaps even a part of the work itself, or even an alternative version of it. In a way, the artistic nature of Unreal – since it is first and foremost a video game creation tool – can be considered to have deeply infused the field of live performance.

5. If we give artistic credit to the Unreal visualisation, we could consider that in a way a visualisation file – just like a recording – can act as a memory of a performance, since it is a virtual version of what happened. This would make it possible to preserve valuable traces of performances, especially when the theatricality does not place the text at the centre, and it is therefore more difficult to archive. In this case, could we imagine that the document that comes closest to the performance is a visualisation file? Would it be possible to study these visualisation files in the same way as we do with a musical score or even a theatrical text?

The limitations of Unreal

If the use of Unreal augurs a transformation of the organization and the nature of artistic work, it must be recognised that it is for the moment only a thought projected on the future. Indeed, Unreal currently has a series of central drawbacks that still block the possible realization of these assumptions – namely:

1. Up to now, the plugin's DMX addressing system is rather rudimentary: It doesn't yet rival that of most of the software developed specifically for events and live shows. Moreover, some elements of the plugin, which is inspired more by video games than by live shows, still show a lack of porosity between the two domains.
2. Live control of the projectors is almost non-existent and the coupling with the consoles is less evident than with other software and consoles: It would therefore be necessary to pair Unreal and consoles and/or to develop a virtual console within Unreal (as is the case with software such as L8 for example).
3. The fact that USB-DMX boxes are excluded from the plugin is quite contrary to Unreal's interests, since these are the cheapest hardware devices and therefore precisely the ones that emerging companies are more likely to have available. Indeed, like many other modern systems, the DMX signal is not transported

by an XLR cable but by an RJ45, via two specific protocols, ArtNet and sACN,[13] which, if they are gradually taking the place of DMX as modernisation of technologies proceeds, remain marginal in precarious economies and often absent from small theatres. Thus, the need to acquire ArtNet and sACN nodes makes it slightly more complex to use for a simple installation.

4. Unreal does not have a projector library, which is the key to visualisation. As a result, it is often necessary to manually create the machine you want to control. In the case of complex projectors, this wastes precious time.

In other words, perhaps the most significant aspect of the use of Unreal is the application of the virtual environment itself to live performance. This establishes a kind of paradoxical digitalization of live performance through a medium whose origins are found in videogames and architecture and which is completely alien to the traditional working protocols of most theatre teams. Anticipating the movements of the actors in a performance, Unreal appears to be a delicate matter, as these are far more random than those in a virtual file. One can also ask the question of the influence of Unreal on a theatrical work: Can one detect that a show has relied on a visualisation software to exist? Is it worth noting this or not? If questioning theatrical lighting 'allows us to question the very imaginary of the theatre' (Chaouche, Vialleton 2017, 6–7), as Sabine Chaouche and Jean-Yves Vialleton explain in the introduction to the 273rd issue of the *Revue d'histoire du théâtre*, which was devoted to performance lighting, maybe we could extend the interrogation to the various lighting tools that the lighting designer tends to use. At this point, one could reasonably say that Unreal is appropriate in some artistic proposals, and that it is not so much relevant in itself as in accordance with dramaturgies where visualisation is a determining tool for the realization of a work that justifies taking the necessary time. To date, it is still too difficult to know if it remains a niche tool or if it will really impose itself in the sector by radically transforming the way theatrical creation works.

13 Artnet and sACN are network protocols allowing to send DMX data over ethernet. Artnet allows sending 32,768 universes down a single network cable. sACN (streaming architecture for control networks), allows to run 63,999 universes of DMX data down a single network cable.

References

Bardiot, Clarisse. 2016. 'Les partitions numériques des digital performances', In *Partition(s), Objet et concept des pratiques scéniques (20e-21e siècles)*, edited by Julie Sermon and Yvane Chapuis. Dijon: Les Presses du réel, Manufacture – Haute école des arts de la scène de Suisse romande, 429–441.

Bonnat, Yves. 1982. *L'Éclairage des spectacles.* Paris: Librairie Théâtrale.

Cadena, Richard. 2002. *Focus on lighting technology.* Cambridge: Entertainment Technology Press.

Cadena, Richard. 2010. *Automated Lighting, The Art and science of moving light in theatre, live performance and entertainment.* Waltham: Focal Press.

Cangeloso, Sal. 2012. *LED Lighting. A Primer to Lighting the Future.* Sebastopol: O'Reilly.

Chaouche Sabine, Vialleton Jean-Yves (*et al.*). 2017. *L'Éclairage au théâtre, XVII^e^-XXI^e^ siècle, Revue d'histoire du théâtre* n°273.

Freydefont, Marcel. 1995. 'Conduite', edited by Corvin, Michel, *Dictionnaire encyclopédique du théâtre.* Paris: Bordas.

Guinebault-Szlamowicz, Chantal, et al. 2007. *Faire la lumière, Théâtre Public,* n°185.

Inisan, Victor. 2021. *L'Adieu au soleil. Imaginaires de la luminescence dans le spectacle contemporain,* PhD diss. University of Lille.

Keller, Max. 2010. *Light fantastic. The Art and Design of Stage Lighting*. Bonn: Prestel.

Massol, Laurent. 2012. *Les LED pour l'éclairage. Fonctionnement et performances, critères de choix et mise en œuvre.* Paris: Dunod.

Reid, Francis. 2001 [1976]. *Lighting Stage Handbook*. New York: Routledge,

Toeplitz. Kaspar T. 2010. 'LEDS et contrôleurs DMX : à la croisée de la lumière et de la musique', *in Patch* n°11. Paris: Centre des Écritures Contemporaines et Numériques.

Biography

Victor Inisan has a PhD in theatre studies and is currently employed as an ATER (non-tenured teaching and research associate) at the University of Rennes 2. He graduated from the ENS of Lyon and the University of Lille and has spoken at several events in France and abroad (University of Padova, Fondazione Cini, University of Tartu) about the dramaturgy of light and the cinema of David Lynch. He has also written for specialized magazines (*Supernatural Studies, Horizon/Théâtre, Opium Philosophie*) and intervenes regularly as a critic of live performance in various media (France Culture, *I/O Gazette, AOC, Détectives Sauvages*).

At the same time, Victor Inisan is a playwright, director, and lighting designer. Author of *C'est moi Guy* and *Papa congèle*, and director of two shows with the Groupe Le Sycomore (*Au revoir mon amour, Éclairage Public*), he founded his art company, UltraComète, in 2021. As a lighting designer, he assists Emmanuel Sauldubois and Jérémie Papin, and creates lights for the shows of Lawrence Williams, Julien Avril, and Louise Dupuis.