

Lighting and color design in the live music show between new technologies and practice

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ABSTRACT

The choice of light and color to complete the performance of a singer or performer in a live music show is an important and critical issue that can contribute to the success of the event. As part of the show, whether it's a concert, a musical, or a fashion show, the lighting designer's design choices can make an event unforgettable or sink its quality invalidating the efforts of all the production. In this paper we introduce the evolution of this sector from a technological, methodological and research point of view, comparing it with today's reality of the professional practice of the stage lighting designer.

KEYWORDS: live show, lighting, color, performance, LED.

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1. Introduction

There are many factors that affect the choice of color for each single song of a show; for example, the personal interpretation given by the sensibility of the designer who can "feel" a specific color and its shades, more appropriate for the staging of the song. You can also make choices related to the different stages of the show, in order to create a sort of "color narration", bringing dominant colors to the stage for more consecutive songs, giving the perception of "monochromatic" periods within a more vast scheme of interpretation, which will evolve later, recalling an imaginary and transmitting different sensations to the viewer so as to accompany him emotionally through the path of the show.



Fig. 1. Albert Sperr Lighting at Zeppelinfeld stadium in Nuremberg 1934. Courtesy German Federal Archive.

The use of artificial lighting as a stage tool began to spread in the 20s of the last century when cinema, from the first experiences of theatrical shooting in plen-air, started production in indoor film studios. The masters of photography discovered the importance of scenographic light as a communication tool. A turning point in this area was Fritz Lang's 1927 film *Metropolis*. In this film, the luminous coding assumes a semiotic value, in the management of light and shadow, in the dynamic projections, in the use of electric discharges and luminous objects, as scenographic communication tools, able to amplify the effect of the scenes on human emotions (Roth, 1978). Lang drew his inspirations from Art Deco, Bauhaus and Futurism (Rutsky, 1993; Wolfe, 2020) applying them to light, which from a scientific and technological subject became a communicative, scenographic and design tool (Pooky, 2016).

In the following years it was not only cinema that drew inspiration from the scenographic and communicative use

of light. In 1933 Albert Speer, the Nazi architect, aware that he would not have had time to build the Zeppelinfeld stadium in time for the 1934 annual party meeting, decided to use light as a building material. He used 152 anti-aircraft floodlights loaned by the Luftwaffe to delineate the boundaries of the stadium in a space in Nuremberg that could hold up to 340,000 people. The British ambassador Henderson, described it as "sacred and beautiful cathedral of ice", while the French ambassador Francois-Poncet defined it as "a mystical ecstasy, an holy illusion" (Speer, 1970). The communicative effect was such that even in the following years the same set-up was used. In the documentary *Triumph of the Will* (by Leni Riefenstahl), about the 1934 Nuremberg Party Rally, music was also used: as part of the soundtrack she used Wagner's *Die Meistersinger* (Moller, 1980). The aim was to emotionally involve the viewer through a synaesthetic interweaving of the two senses, sight and hearing, which are the basis of remote communication.

Light, music and, with the end of the era of black and white, color arrived on the stage. As evidenced by (Applebee, 1950), the introduction of color through lighting was already beginning in post-war British theaters. Even decades before the advent of LEDs (Strange and Hewitt, 1956) cite the example of the theatrical experience as a possible model of experimentation to determine the quantity and chromaticity of general lighting to try to make it more pleasant for users.

The issue of color also affects television stages, posing serious problems with regards to color rendering as a function of different lighting setups. One of the first television stages was created at the BBC with the possibility of remotely controlling up to 100 different intensity configurations of the installed system. It arose also the problem of obtaining the first color filters capable of withstanding high temperatures for a long time (Ackerman, 1969).

The relationship of light with the subject of the representation was defined by (Reid, 1970) as the art and science of the stage lighting. In his description, this is an activity that must manage three fundamental variables of light: intensity, color and direction, which are the syntactic elements on which to design selective, atmospheric and dimensional lighting that should be suitable for the context of the representation.

After the color, a further innovation took place in the 1980s by Vari-Lite with the introduction on the market of moving lights. These light projectors are able to rotate the emission of the light beam on two axes and to control the color thanks to the use of dichroic filters. From those

years onwards, stage lighting has become dynamic in live music shows, theater and television stages. A turning point in the live music show came with Pink Floyd's *The Wall* concerts, whose lighting design marked a difference from previous live music shows (Williams, 1988). And from those years, even in theatrical (Taylor, 1989) and television stages, dynamic lighting began to become a new expressive variable, used to amplify the communicative power of light in representation, which was also celebrated in the *Showlight'89* conference, made in collaboration with the CIE (Ackerman, 1990).

In the following years, the professional approach to the design of the live music show events was the subject of further researches at the marketing level where light and color always played a role of primary importance (Minor *et al.*, 2004; Moody and Dexter, 2009). Since this is a business, mathematical models have been defined to evaluate the level of satisfaction of the participants in live music shows (Hausman, 2011). Some scientific and applied research has also been done on the relationship between color and music (Pridmore, 1992; Caivano, 1994; Lindborg and Friberg, 2015; Whiteford *et al.*, 2018), and this is a research topic still open worldwide.

Some preliminary research has recently been developed aimed at investigating the psychological response of users to the variation of the luminous patterns of a concert (Lo and Steemers, 2020) and the environmental colors of the concert halls (Chen and Cabrera, 2021). This area of research on stage lighting and color is anyway in an initial phase and, in order to be developed in the future, the degrees of freedom of the variables that come into play must be determined, which in the context of the live music show must be clearly determined.

Taste, interpretation and the experience of the lighting designer are always dominant in the dynamics of lights and chromatic choices, however, there are many factors that are inevitable and can affect the choices of the designers. As an example, an element certainly important is the will of the artist himself, who could have a clear chromatic vision of his songs and, consequently, pass it on to the lighting designer.

The live stage field allows considerable freedom of intervention; greater than in other fields, such as fashion and television, where there are many more constraints. In live shows, there is no univocal approach regulated by standards. In this paper starting from world research in this sector and moving along the line of technological innovation, we have analyzed the experiential aspect of a famous Italian lighting designer: Giovanni Pinna, active since 1986, who has worked with some of the major Italian and international artists such as Fabrizio De Andre, Pino Daniele, Adriano Celentano, Eros

Ramazzotti, Luciano Ligabue, Vasco Rossi, James Taylor, Ryuichi Sakamoto, and many others.



Fig. 2, 3 - Two different moments of the building of the stage of the concert of Vasco Rossi in Modena (2017). Courtesy Giovanni Pinna.

2. Project variables

The design of lighting for a live stage show is not a simple task. Thinking of it as a series of operations that lead to a result, it could be possible to compare it to an artistic or architectural activity. Despite the freedom granted to the designer, there are numerous factors that make the preparation of the lights for a live show, a real

race against time; many steps and checks in a very short amount of time.

First, the show venues are available just few days before the show itself, so it is not possible to "play ahead" (not much at least). This is also due to the high rental costs of the structures. The productions concentrate the dates of employment near the shows and of course, the lighting is only a part of the things to be done. Designers are therefore faced with the need to carry out preparation and testing in just a few days, some more if the production is a major international event.

Working experience certainly helps in these cases; beyond the ability to find optimal solutions to possible unforeseen events, the knowledge of the various structures in which the shows are usually held (strengths and problems) for the artists with whom you work, is a very useful know-how for the lighting designer.

In recent years, some software has also been developed that make it possible to prefigure the luminous and chromatic set-up of the live show, also considering the music and the dynamic temporal dimension of the lighting. Software tools such as Wysiwyg (CAST, 2020), Depence² (Synchronorm, 2020), L8-Software (L8, 2019), Spotlight (Vectorworks, 2020), and others that can help, simulating an installation; but as regards their use, there are different points of view on the part of professionals. Some completely avoid these systems, others use them for a very early phase, while others use them more widely.

It is mostly software that allow the professional to virtually rebuild the stage, even starting from the CAD drawings of the set designers, and to go and install actual moving light projectors, simulating the control consoles. It is also possible to export files that allow a certain level of automatism during the real show. The algorithms used by these digital tools, however, are not always very refined and the show simulated often does not have enough visual correspondence with the result, to the point that some designers do so easily without them.

Everything is then decided in the last days, and the lighting designer's artistic sensibility remains the essential tool; knowing how to read the various nuisance of the show and visually transpose them, improving their emotional charge.

In addition to the timing and the geometrical characteristics of the venue, there are other external variables to be taken into consideration. When you are outdoors the concert usually begins while the sun has not yet completely set. The luminous envelope therefore evolves over the course of the show and it is necessary to adjust to adapt to the change. These changes in the

color of the natural light atmosphere depend on numerous factors; place, season, time, weather conditions and these are almost always variables that can be evaluated only at the last moment, due to their very nature.

Another element that can significantly influence the color choices of the Lighting Designer is the presence of light deriving from other new technical equipment. The now constant presence of elements such as LED-walls, which put in scene digital content which is not produced directly by the lighting designer.

In addition to external factors and production variables, typical elements of the actual Production of the show must also be taken into consideration. Even just the type of engagement of the lighting designer, a contract with the Production or directly with the artist, can affect the freedom of choice of the professional. Then there are the other figures in the show; the most important is certainly the artist himself, who can have a personal vision of the show by making requests to the designer. As an example: Vasco Rossi, on the last tour asked for white and blue key colors for the song "Gli Angeli". These requests are not very frequent, but they can happen; in this case the designer must be able to mediate them with his own vision of the show.

Another very important actor is the Set Designer. The physical construction of space involving, geometries, materials and choice of surface colors, is extremely important for the choices of lighting and the maximum synergy between the two teams is desirable.

3. Design degrees of freedom

The project starts to form in the mind of the designer early, trying to build a "painting without colors", giving more importance to those that are the compartments of the scene, the orientation of the spot beams, of the wash-type fillings, and so on. In this phase the color is only a vague anticipation; you can get an idea of what color could be used, but the information available is still not enough and the risk is to waste your work. It is at the time of staging, when everything goes into production, that it is possible to really give a color to the songs; work upwards, observing the "substance" of the light beams. Very often the initial ideas had during the programming phase are rejected because they do not fit the rest of the scenic machine. The choice of colors is almost always the result of a personal interpretation. Beyond the sporadic performer requests that might happen, it is the designer who chooses, through his musicality. The lighting designer can almost be considered an added musician who participates using time, measurements and

musical writing as a track to work on. It is essential to know perfectly the programmed repertoire to build its chromaticity, passing from framework to framework.



Fig. 4, 5, 6: White is the unifying color in the songs - performer: Vasco Rossi. Courtesy Giovanni Pinna.

The freedom to be able to do all this then depends on the factors seen before, but also on the products available and on the designer's knowledge of them, which is mostly acquired through experience. Entering into the heart of

the choice of colors, in the specific case of Giovanni Pinna, color combinations are very contained. You can play on warm tones on warm, cold on cold, complementary colors and (but only rarely) in contrast unless it is necessary for a change of narrative.



Fig. 7, 8, 9. Shift colors along the concert - performer: Vasco Rossi. Courtesy Giovanni Pinna.

The chromatic shift marks the passage from one module of the show to another. Often authors like to create narrative compartments composed of multiple songs and

a good choice is to keep the same colors within these segments, introducing different colors to move to the next compartment.

The presence of natural light in the initial moments of the concert can be an issue, partly because of its intensity and partly because of the variability of its appearance. A possible approach to this condition is the use of neutral white light, adjuvated by a good quantity of artificial smoke, which gives an impression of diffuse glow, "naturally" luminous. This can be done while waiting for the sun to set completely and then to introduce the first color. This creates a very clear perceptive detachment with respect to the initial part of the concert which allows the public to immerse themselves even more in the programmed narrative contexts.

4. New technologies

In addition to natural light, as already mentioned there are digital contents that are usually presented through LED-walls or projections. The amount of light emitted by these devices is by no means negligible and their presence is now a must in major productions.

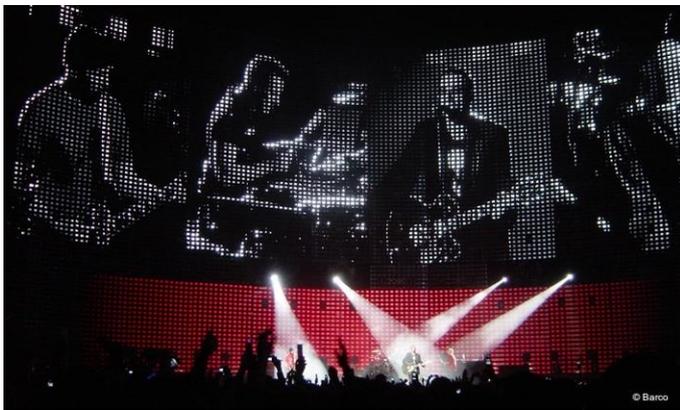


Fig. 10. LED wall A created with BARCO Creative LEDs (MiSPHERE) - performers: U2.

Spanning from simple vertical elements able to change the perception of depth on the set, to actual modules scattered all over the stage; the amount of light and its coloring must be absolutely kept in consideration when designing light. It's a good thing in fact that the lighting designer coordinate his work with the designer of digital content to create synergy and manageable choices. This can be greatly improved using media servers, which allow the integration of video content in the control consoles operated by the lighting staff, ensuring a good level of integration. Usually, however, it is the lighting designer who, when he cannot make suggestions about

the colors of the videos, must adapt to digital content in order to make harmonious light choices.



Fig. 11. A projection that overlaps the stage created with Backtraxx and Acronn screens - performer: Fedez.

Technology continues to improve in years, providing more possibilities every day: higher powers, more control and bright full saturated LED colors. However, the flip side of these innovations is that as the possibilities increase, so does complexity. If we think of the shows of just some decades ago, everything was about using fixed beacons, colored gel filter; flexibility was less, but the preparation time was consequently very low compared to today.

Moving lights allow a very wide range of colors to be obtained, gobos to be implemented, light to be profiled, and multiplied with prisms, as each luminaire is potentially able to carry out the work of many. And then video projections, sets in transparency, special materials, platforms. A flexibility that was unthinkable until not long ago, but kind of overwhelming for the designer. The possibility of obtaining unlimited colors does not necessarily mean that this should be done. At times, using a fixed spotlight with a colored gel filter is still the most effective and economical choice, even if less elegant. The available budget is always the primary constraint of each project. This does not mean that technology should be avoided, on the contrary, today more than ever it is essential that professionals are prepared for the possibilities that products and systems have to offer, always keeping up to date in order to evaluate the best choices.

Regarding color, LED light sources can produce more saturated colors with greater efficiency than using filters; obviously, we are not talking about the rendition of illuminated colors, but about the appearance of the light beam projected into the environment where artificial

smoke is dispersed. In terms of entertainment, the white remains a weak point of LEDs, making it less brilliant than the one created with metal halide lamps. Some LED sources are offered in RGBW format (Red, Green, Blue and White) in order to give greater chromatic flexibility, but the result, from a white chromatic point of view, is still not comparable with that of discharge lamps. The same is true for sources that must provide a portion of UV for fluorescence, such as Congo-blue, for which traditional lamps are still more appropriate. Obviously, the digital sources are more flexible from a control point of view, but as mentioned above, too much flexibility, can extend the preparation time of the show.

power implied has led manufacturers to develop many devices that mount this type of lamps. From a chromatic point of view, however, the LED sources still encounters resistances; some purists of gas discharge light sources prefer to avoid LEDs, opting for classic lamps, assisted by dichroic or gel filters. In the approach of Giovanni Pinna, the LED sources find a wide space, mainly in the "wash" type headlights, the wide and adjustable beam with soft and indefinite contours that increase the brightness diffused in the space, while for the "spot" headlights, the beams with well-defined contours that are easily identifiable and create hard clear lines in the atmospheres of the show, still prefer discharge sources.



Fig. 12, 13. LED lamp moving lights with Wash type projection - Clay Paky A.leda B-EYE K20

Fig. 14, 15: ARC lamp moving lights with Spot type projection - Clay Paky Supersharp

5. Conclusions

To conclude a last consideration regarding the LED light sources. Even in the entertainment industry now, solid-state lighting sources have conquered their position. Although their dominance is not as established as in the architectural lighting field, the possibility to contain the

The future evolution of this sector will be influenced by technological innovation, but also by the methodological and marketing aspects presented in the introduction. At the end of the innovation, in a research (Hsiao, Chen and Lee, 2017) (Hsiao, Chen and Lee, 2017) proposed an automatic lighting control method, based on emotions due to music, through algorithms based on neural networks, whose application in the practice of lighting design is however very complex and far from the pretext of the lighting designer. To date and for many years the creative activity of the designer in the live music show

cannot be replaced by mathematical models or computer algorithms. Years of experience are needed to be able to grasp every nuance of a performance and be able to act accordingly, making the best choice would it be technical or stylistic that is able to emphasize, dull down or even correct what is happening on stage.

6. Conflict of interest declaration

The author wish to state that no financial or personal interests have affected the objectivity of this study, and that no conflicts of interest exist.

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9. Short biography of the author(s)

Andrea Siniscalco - MSc in Design in 2002 and PhD in 2007 in the field of lighting fixture design. Since 2003, he has been collaborating with the Lab Luce - Dip. Design - Politecnico di Milano. Since 2008, he has been teaching lighting (design theory and CAD methods) as adjunct professor at the School of Design - Politecnico di Milano. Deputy Director of the Master's in Lighting Design & Technology. Vice President of the GdC-Associazione Italiana Colore.

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