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.

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.](image-url)
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 Wysiwgg (CAST, 2020), Depence² (Syncronorm, 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 automatisms 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.

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.

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.

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) 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

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 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.
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.

7. Funding source declaration

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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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