Soleil de minuit – the Spectral Design of 14 Glass Panels for the Montréal Metro

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ABSTRACT

Soleil de minuit is an artwork made of artificial light and colored glass, which exists due to a combination of elements from different backgrounds: the natural light of Brussels, CIE colorimetry, computing and the expertise of German and Belgian glassmakers.

Fourteen laminated glass panels – each 205 × 150 cm – were permanently installed in the 1960's architecture of the Montréal metro station Place-d'Armes in May 2017. Soleil de minuit ("Midnight sun" in English), refers to the colored lights emitted by the rising sun in Brussels on June 21st, 2015, around 6AM, when the first day of summer started in Belgium while it was midnight in Montréal. This project was the first opportunity for me to transfer to the medium of glass a working methodology involving colorimetric characterization of colored materials and algorithmic design, that I had developed on a small scale over several years, using spectrophotometry, pigments, light sources and digital printing techniques.

KEYWORDS: Art, Glass, Colorimetry

INTRODUCTION

In July 2015, I won a competition organized by Brussels Mobility and the Société de Transport de Montréal. During the project's design phase, I was looking for a "relaxing" and "warm" image for the public space that would refer to transport and to both cities. After I stumbled upon images of the "midnight sun" – a constant sunset-sunrise during the Arctic summer where the sun never passes beneath the horizon – I had the idea of producing images from the sun's light as it rose in Brussels. The images would be constructed using a bespoke computer program and from actual measurements of the Brussels sunlight, in a high-grade and durable material: blown Antique glass.

I usually work with light and color. I invent forms by drawing on a variety of artistic techniques and materials, on elements that come to me from the industrial world and on scientific instruments, methods and ideas. An equation, an algorithm, a brush, a jar of pigment or a spectrophotometer are simply tools that I use opportunistically with a visual goal, like a physicist would use them to construct an experiment to test a theory. As an artist, I would like this mix of disciplines and the specific visual results it produces to be the lever through which my work stands out.

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THEORY

Before becoming monumental glass panels, the type of images that I generated for *Soleil de minuit* existed in the form of digital prints. Each of the fourteen images are that of white disks on grey backgrounds, virtually lit by the light of Brussels rising sun on June 21st, 2015. This basic scene is seen through a water droplet or a lens, which creates a strong chromatic aberration around the circular shape. As for the colors of a sunset, those of embers, molten lava, red hot steel, etc. the colors appearing in this phenomenon are often impossible to reproduce exactly: they exceed the limits of the gamut of most artistic media.

However, glass is one of the most colorful materials there is. Glass colors are deemed to be impossible to reproduce by classical photographic means or by using common pictorial techniques such as painting, printing or screen display. The most intense glass colors such as the cobalt blue, the selenium red, orange or yellow, are quite simply extraordinary. The red light passing through a piece of selenium red glass illuminated by daylight is so red that its color reaches colorimetric purity levels above 99%, as high as that of a laser[1].

Regardless of the media in which the artwork will eventually exist, the colorimetric characteristics of this media are always an integral part of the algorithms from which I build images. Therefore, an image calculated at source to become a digital print was, in my view, easy to migrate to glass. To do so would simply require capturing the color characteristics of the glass and repeat all the calculation steps of the algorithm. The new images should also make the most of the extraordinary colors of the glass.

EXPERIMENTAL

In August 2015, I spent 3 days at the mouthblown glass factory Glasshütte Lamberts in Waldsassen, Germany. With a spectrophotometer, I measured the spectral transmittance of about 350 small glass samples, fragments of larger sheets: the entire “standard catalogue” plus about 100 extra colors selected subjectively among a few thousand available. I was particularly attracted to selenium red, orange, and gold pink – which are the most beautiful and the most expensive colors of all. Simultaneously, I was rewriting and tuning the parameters of my picture-generating algorithm, discovering the complexity that I would have to contend with.

There were two problems to cope with. On one hand, I had to find a good balance between financial constraints and the variety of the colors available. At Lamberts, ½ m² is the minimal amount that can be ordered for single glass references. It was out of the question to order ½ m² in order to use just a small piece of a few cm². Conversely, the result would not have been beautiful if I had chosen too few shades. On the other hand, blown glass is not regular like the colours from a printer. In the same sheet of glass, there are often several shades of a variable thickness. For flashed glass, which is often the type that presents the most beautiful colours, this can be up to three glass layers of different composition and thickness. Could I rely on measurements made on samples of a few centimetres squared to represent the colour of whole glass sheets?

To be honest, I had to accept the uncertainty of the glass measurements as a fait accompli and find some way to limit their visual impact. Because of their extreme values, the colours of some samples were incorrectly reproduced in sRGB. To select the colours that I would choose to use, I worked blind from objective criteria. I designed optimization strategies to minimize the variety of glass references while maximizing the overall chroma of the pictures, without affecting the beauty of the borders and edges that would require maximum softness in the shades.

Being used to deal with synthetic pigment colors, I was amazed by the nearly two times larger size of the antique glass gamut. The range of reds, orange and yellow having a colorimetric purity of almost 100% was exactly what was needed in order to reproduce the colors of the rising sun and of the chromatic aberrations.

The Belgian glassmakers Debongnie developed a technique to assemble the largest panels of glass tiles that they had produced to date. My job was now to provide the scale plans upon which the glass references to be assembled were indicated. We ordered 80 glass references and as I feared, the difference between the measurements made during the trip to Germany and the actual glass colors that we received a month later was sometimes significant. It was generally possible to hide the differences by combining the tiles randomly. Before creating a panel, a certain number of tiles were cut in each reference. These then had to be cleaned with acetone in a tray in order to remove dirt and finger marks. These tiles would finally end up in a sealed plastic box. The pieces of glass would not be resorted, the cleaning process had mixed them up. They had to be taken out in their order of appearance and we had to refrain from choosing them before placing them on the printed plan.

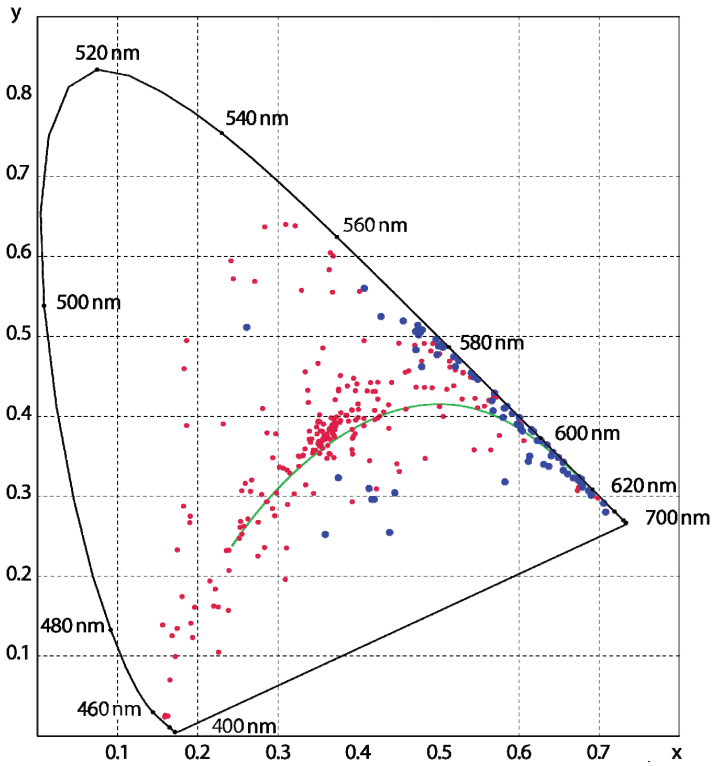

Figure 1: antique glass samples plotted in the CIE xy diagram.

Red: standard catalogue. Blue: extra colors. Green: Planckian locus

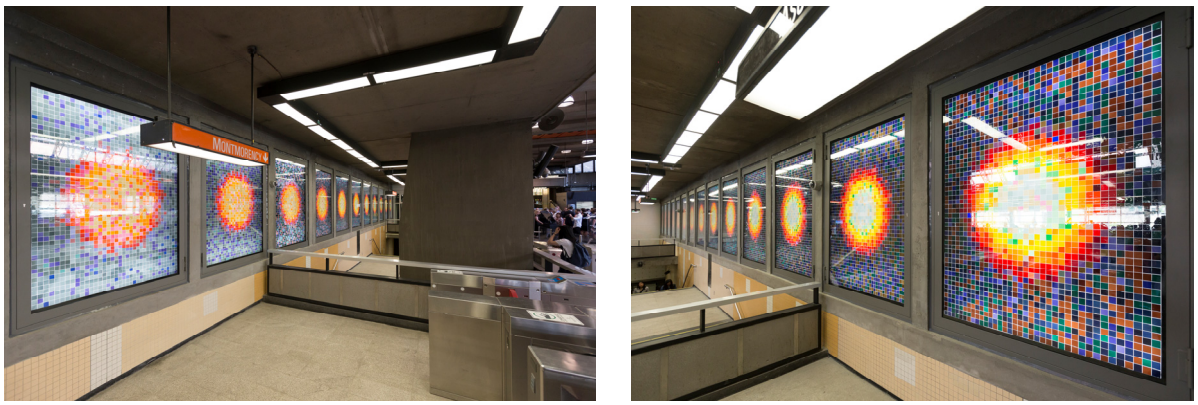

Figure 2: Soleil de minuit *installed in the metro station Place-d'Armes in 2017.*

RESULTS AND DISCUSSION

The studio production of 14 panels took 8 months during which we had to be very attentive. In a collective work, human errors increase: classification errors of the references at the factory or the individual choices of those involved that are not communicated and are not therefore discussed, a bug in the computer code I had written. It is impossible to control everything and it is not easy to plan in advance which variables from the work in the workshop will have a visual impact, *even more so* in a collaborative work where each person has their own methods.

An algorithm far exceeds the framework of computing. To cope with the reality of such a project, it must take account of each of the stages of the work in the workshops and question each gesture in light of its possible influence on the result. Any dark area involves a risk; if something has not been planned, it shows.

CONCLUSION

Soleil de minuit, an artwork made of artificial light and colored glass, wouldn't exist without the combination of several elements from different origins: the natural light of Brussels, CIE colorimetry, computing, and the expertise of German and Belgian glassmakers. It was my first attempt at introducing color-management methods within the somewhat traditional world of contemporary glass art or "stained glass" and it is also the only example I know of CIE-colorimetry based artwork in the field of glass.

The reader is invited to watch the following videoclip: https://youtu.be/HYv37HJERQY

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REFERENCES

[1] Lucca, A. 2017. *Soleil de minuit – Bruxelles Montréal*, Bruxelles Mobilité pp. 38-39.