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Media Façade and the design identity of buildings based on visual density

Abstract

This article proposes a low visual density design for media façade using a quantitative technique that combines a visibility range and PPI (Pixel per inch) approach with an iterative method. Furthermore, we address not only display pixel design, but also concern about the company identity conveyed using media contents called 'Dandelights'. Thus, designers have investigated optimum low visual density levels between structure and media contents that have several constraints for efficient communication. With realistic boundary conditions, the media façade design was adapted to low PPI that is under 30% of standard display. These quantitative results have shown that the low visual density method is applicable to the media façade design for visual communication. The final goal of this research is to use digital media as a façade to achieve more efficient and harmonized communication while maintaining the identity of the physical building structure. Therefore, we adapted the human figure and body gestures in media content to solve the inefficient resolution of low-density media façade. As a result, we address not only display pixel design, but also digital media contents to create efficient visual communication for buildings.

Keywords: Media façade, Visual density, PPI, Visual communication

1 Introduction

In recent years, the media façade has tended towards design that transmits a lot of information to citizens. The media façade, which was installed downtown, was too short term to communicate information to pedestrians. This issue is particularly important because even if the media façade displays several contents with diverse purposes, pedestrians cannot sympathize with the designer's theme. Therefore, standard concept design methods and installation of media façades are not appropriate in mega cities.

The media façade installed in a company building is not only used to display information such as weather, temperature and time, but is also related to the company's identity. If the media façade was not only for public interest, it could deliver a lot of messages from the company to people. With the sluggish graphic delivery, the media façade needs a solution to make people understand the company's brand identity efficiently by high-definition display methods. However, designing a high-definition media façade is a double-edged sword for the company. In spite of having a distinct image, the media façade can raise realistic problems such as overinvestment, light pollution, durability, energy and economic maintenance, and so on [1]. Limits on the high-definition display of the media façade significantly affect

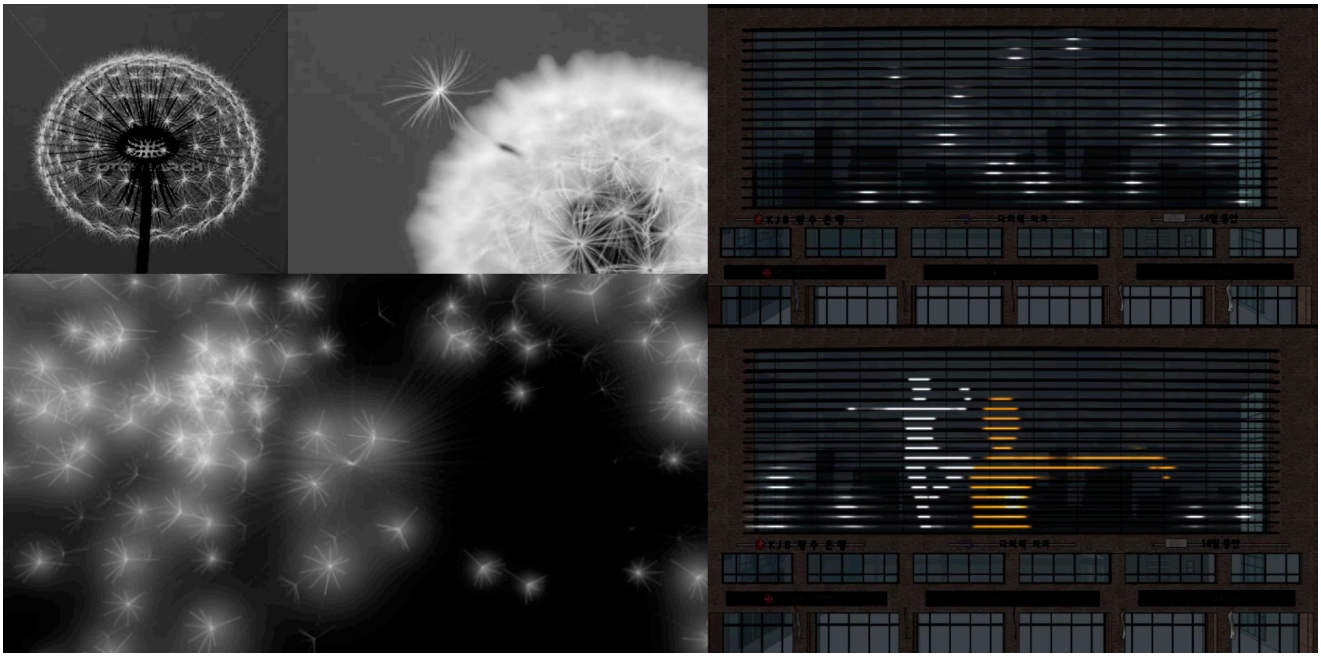

Figure 1: Media Contents- Dandelights (The convergence of nature and technology)

creative design in a wide range of art forms, but the image quality has limits in order to transmit information efficiently.

Reportedly, humans have the ability to acquire and maintain meaningful perceptions in an apparently chaotic image [2]. This principle means that when the human mind recognizes incomplete or fuzzy images, they tend to understand them by collecting information from the surrounding area in a manner similar to crawling data from big data. In other words, there is a possibility of solving the problem above by controlling the resolution of the display. Therefore, we present this paper, an idea to control the visual features of the media façade display

2 Theoretical study

2.1 Media contents-Dandelights

For visual communication between a company and people walking on the street, we defined two types of identity characteristics as 'Static' and 'Dynamic' elements. The static elements of company's identity assume that a building structure is designed based on significant identity of the company. The company building had existed for a long time in same place and was visible to people who were working or living in Guro. Therefore, we assumed that whether the people living in Guro wanted to be or not, they had been naturally introduced to the identity of the target company.

The dynamic elements are the media contents that are displayed on the media façade. The media façade also includes a message from the company. This media façade intends to express a message about a new paradigm of dynamic infrastructure, IT digital industry and the culture and art of the young generation in Guro, Seoul. Above all things, we intend to design a site that communicates identity and management philosophy. The dynamic identity elements are media contents called 'Dandelights'. Dandelights was inspired by William Gibson. William Gibson said 'The future is already here. It's just unevenly distributed'. Based on what he said, we took media content that used modern dance and dandelion spores to represent dreams, hope and a future that could bloom slowly and spread widely.

2.2 Visual density

With advanced technology and diversity of architecture, media façade has tended toward high-resolution display design. Particularly in mega cities, based on a trend of building skyscrapers, media façade installation size has become bigger and bigger. Spontaneously, the visual density of media façade has become denser than before. The higher visual density corresponds to an image definition and an amount of information. However, high density of visual content can raise several problems such as energy efficiency, economic maintenance and balance of structure. A higher visual density of display can encroach on or block the existing identity of a building and be constantly visible. As for the communication role of media façade, the designer must establish a clear strategy that converges naturally. Here, we resolve this controversy by a visual density quantitative technique. First of all, we defined correlation between visual density and transinformation. In low-resolution conditions, a human requires far more visual effort to search for information [3]. In other words, low visual density lets people collect data from non-media façade sites like structures and signs to establish meaningful perceptions. In order to converge static and dynamic company identity elements, reducing the visual density can be an efficient way to bypass limitations.

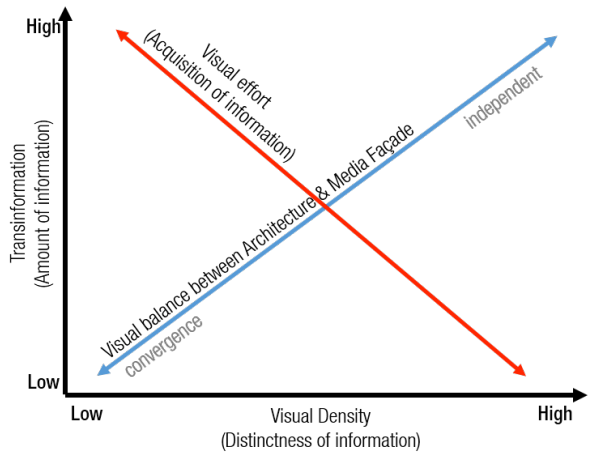

Figure 2: correlation between visual density and transinformation

Based on the above mentioned, we designed media façade using a low visual density technique for harmonious blending. To clearly define the density of visual contents, quantitative technique was applied to media façade design strategy. We used a visual density equation derived from PPI (Pixels per inch). The derivation of the visual density is given in Figure 3.

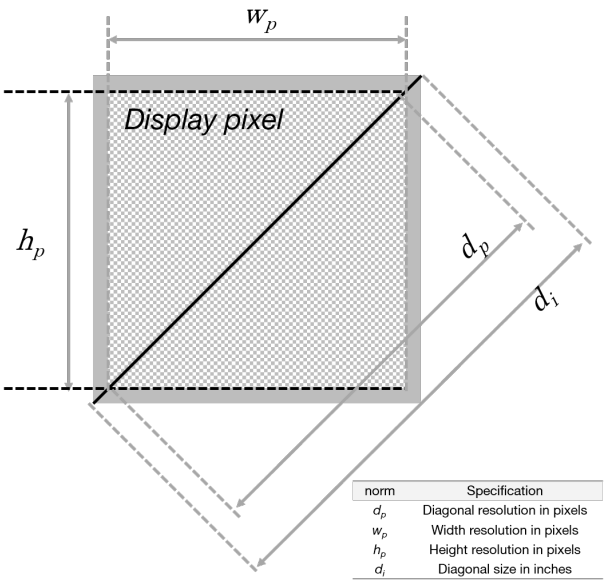

Figure 3: Equation of PPI (Pixel per inch)

The media façade PPI variables and visibility range are important factors in this design. Most people near the installation site walk on the sidewalk. Thus, identifying maximum and minimum visibility range is a necessity to designing a compatible size for the media façade.

$$d_p = \sqrt{w_p^2 + h_p^2} \qquad \text{Eq.(1)}$$

$$PPI = \frac{d_p}{d_i} \qquad \text{Eq.(2)}$$

Figure 4: Visibility range of media façade

In our strategy, multiple viewers are tracked based on sidewalks of 31 Digital Street and Digital Ave. The characteristics of a human's natural viewing angle can be assumed to be correlated with distance from the media façade. We assumed a viewing angle of 60 degrees and calculated optimum distance [4]. After that, the variables were compared with a 1024 x 768 pixel display condition, which is the normally used pixel size in media façade design.

The iterative optimization was applied to the target media façade design to maximize the possibility of visual communication. It suggested a visual density level of less than 30% of standard pixel PPI. Therefore, the target media façade defined two core design factors: optimum distance and pixel size. The optimum distance is 50 meters from media façade and optimum pixel size is 750 x 19 pixel. The optimum pixel size of media façade has resulted in a constraint of structure that only permits façade installation from the 3rd to 5th floor.

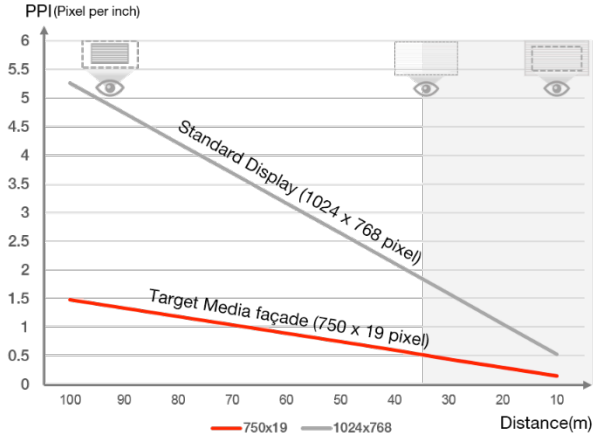

Figure 5: Relation of Distance and Visual density

Table 1. Media façade design specification

Object	Specification
LED pitch	50mm(width) x 700mm(height)
Installation Size	37.5m x 13.3m(19 lines)
LED Type	Bar Type Image-LED 14.4W (1000x22x35mm)
Resolution	740Pixel x 19Pixel

Table 2. Comparison of visual density

Distance (m)	Media façade (750 x19 pixel)	Standard Display (1024 x 768 pixel)
100	1.48	5.27
90	1.33	4.74
80	1.18	4.21
70	1.03	3.69
60	0.89	3.16
50	0.74	2.63
40	0.59	2.11
30	0.44	1.58
20	0.30	1.05
10	0.15	0.53

Table 2 summarizes the results of comparison of visual density through distance, which is the visibility range. It can be seen that the target media façade has a reduced density of about 28.1% of the standard display.

Table 3 The average of luminance

	Around building	Installation building	Advertise -ment structure
Average of luminance (cd/m^2)	20.2	38.64	130.6

3. Engineering installation for media façade

3.1 Luminance analysis and design

For efficient convergent design between the company identity of the building and the media façade, we need to evaluate street properties. Analysis of the luminance environment is a key factor for the convergent design of media façade. Media façade is a medium that sends information using light displays to pedestrians. Because of the above mentioned, we measured the luminance environment of the street by Topcon BM-9.

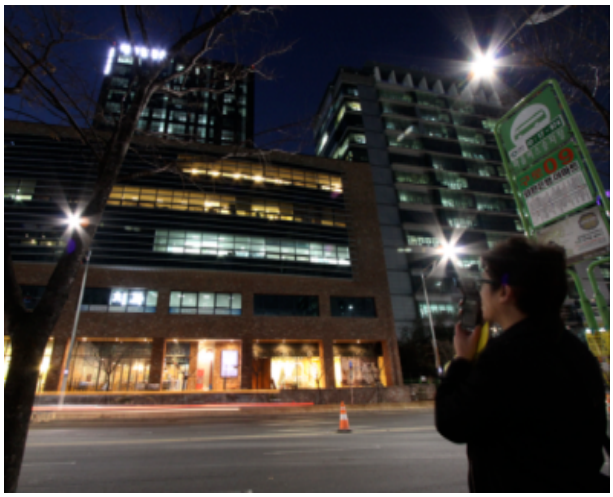

Figure 6: Building luminance measurement

To set the luminance measurements in relation to media façade design, we also categorized measured values with 3 standards concerning place and design purposes. The light source categories are composed of the advertising structure, the installation's building site and around the building. The media façade began with convergence between the design identity of the installation's building and the media façade. For this purpose, we systematically calculated a range of media façade luminance. The range of media façade luminance has 2 essential conditions. The first condition is that the luminance of the media façade needs to be higher than the around the building conditions for the media façade to be eye-catching. It should also be designed lower than the installation building's luminance. The second condition is legal protocol. According to the act on the prevention of light pollution by artificial lighting in Seoul, media façade luminance performance must be designed under 25.0 cd/m^2 on average.

Returning to design converging media façade, we derived a safe and adequate luminance design range that fell between 20.2 cd/m^2 and 25 cd/m^2. A minimum (20.2 cd/m^2) and maximum (25.0 cd/m^2) set of conditions were derived from the average luminance around the building, the installation's building and the legal protocol. Based on above conditions, LED light modules were set to 23.0 cd/m^2.

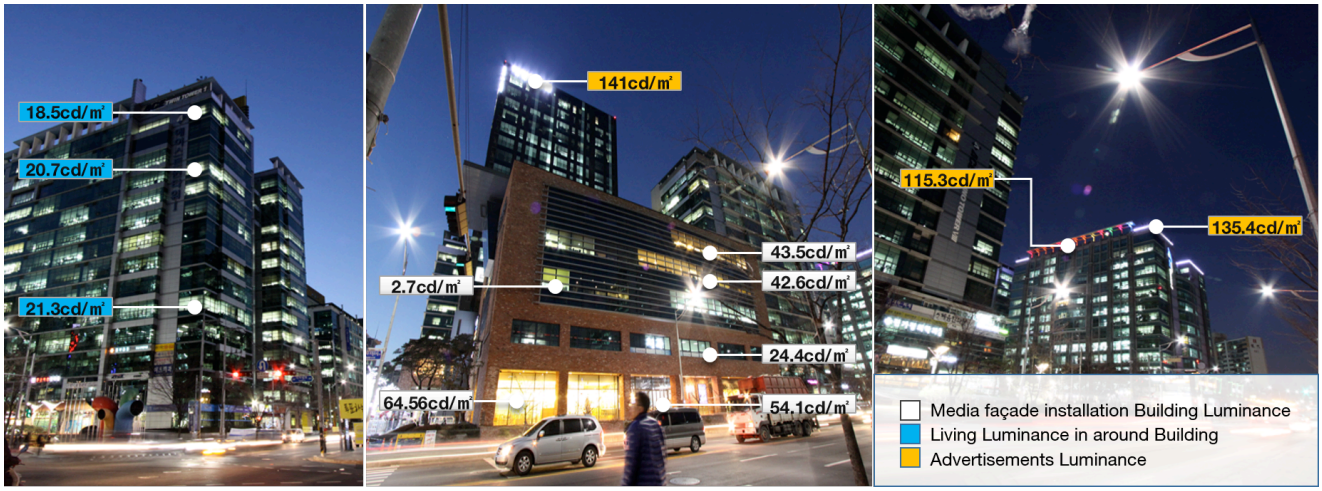

Figure 7: luminance of environment

Figure 8: Designing LED light module luminance

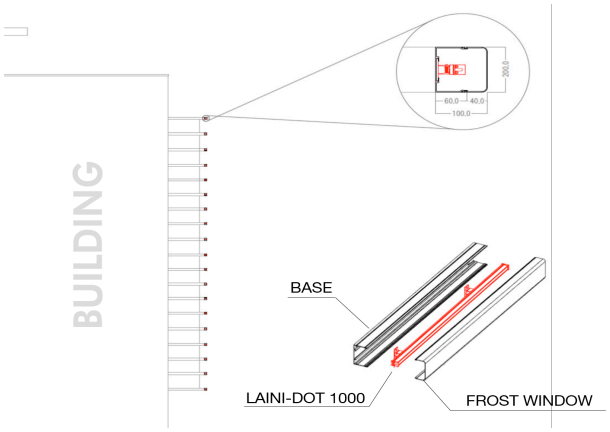

Figure 9: LED Module design

3.2 Media façade system installation

For the convergent media façade installation, we installed Image-LED systems in the building. The Image-LED lighting system is able to display various shapes and scale images using LED pixels that are based on full color. It can also be installed in a multiple line style for atypical sites. This system was composed of a display device and a control system.

LAINI-DOT1000 was selected as the display device because it is an outdoor display and therefore has different requirements from an indoor display. It also was designed with a pixel interval distance of 50mm to avoid image distortion. This distance was selected after testing in order to avoid having to use a high resolution. For light-scattering effects in our luminance design range, a frost window was adapted on the display device. The scattering effect by the frost window bridges the LED device gap and makes the pedestrian feel like they are seeing a higher visual density on the media façade.

Preliminary research on the media façade control device provides detailed specifications for designing a new device. The existing control device is not sufficient to control a low-density media façade system. In order to properly control the system, we designed a new control system and devices. The control system is organized into 3 customized devices called B-Sub control, B-processor and B-Works.

(1) B-Sub control

For manipulating the low-density media façade, the B-Sub controller was designed to focus on three main specifications. The first one is that the device can control and data process the signal into a display. The second specification is converting RGB data to an LED board drive format. The last one is compensating the data signal by using an anti-noise circuit.

(2) B-processor

The B-processor was designed to convert a DVI signal to an LED display signal. It can also avoid the flicker phenomenon by using an automatic luminance controller.

Figure 100: Media contents composition

(3) B-works

The B-works technology is a customized software that can better display the media façade contents visualization on low-density. This software can control the whole system of the media façade, which includes scheduling, synchronizing video and sound, automatic luminance control settings and remote media façade power management.

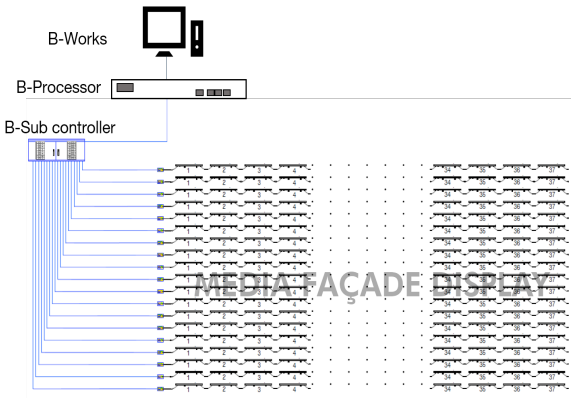

Figure 111: Media façade system

3.3 Pixel installation and media façade display design

As shown in figure 9, the media façade display module was designed based on the new system. The total display area is 498.75m^2 (37.5m x 13.3m) and it was composed of 703 LED modules that were lined up in 19 rows. Every row was made up of 37 Bar-type image LEDs covered by a frost window. The installed LED modules were set on a 50mm horizontal pitch and a 700mm vertical pitch. This media façade reached from the 3rd to the 5th floors of the building.

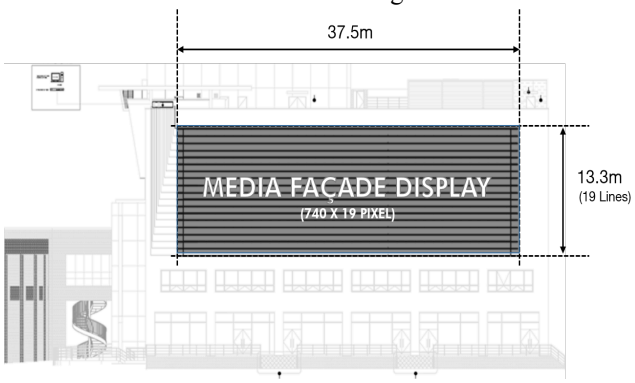

Figure 122: Media façade display area design

4 Art installation for building identity

4.1 Adopting modern dancing

Low-density media façade is not a sufficient resolution to display small numbers and text information. For the simple cognitive processes of human beings, we focused on a primary form of language ignoring text and verbal. Given Collingwood's theory of language, a bodily gesture has a relation to all different kinds of language [5]. In that context, every kind of language is a specialized form of a body gesture. Based on the above mentioned, we adopted modern dance to express the identity of a company in the media façade. The modern dance movement of an organic human figure is freely expressive and easily recognizable. This type of figure

can be shown in a low-density resolution display.

4.2 Media contents composition

The media content on the façade was composed using 3 steps to convey the iconic Pan-Pacific Company's building and corporate motto about a growing global network and an expansion of business worldwide. The 3 steps include: the bloom of dandelion as an introduction, the seeds start to spread as they develop and finally, they spread out all around as the conclusion. The first step, the introduction, is shown through messy soft light particles which are shown by symbolic dandelion seeds slowly fluttering in the wind. Simultaneously, a crouched dancer appears in the center of display and slowly stretches out to show the full bloom.

In the second step, the development, two new dancers (orange and cyan) appear at different times to express softly floating dandelion seeds. The three dancers appear on different layers, expressing depth, and perform together to show the spreading seeds reach all around the world. The last step, the conclusion, is a dance finale that shows the fulfillment of the dandelion seeds. In this step, all dancers fade out one by one while they stretch their body completely to symbolize the expansion of the seeds and the display is gradually filled with CG images of soft white particles in the media façade.

5. Conclusion

As this study indicates, we approached the design of media façade differently from existing methods. In media façade trends, we investigated display devices that tended towards higher quality resolutions that might cause issues with installation's building. Our findings derived a new method that balanced the original design identity of the building and the media façade. For an efficient method of visual communication, we had developed a convergent design method of art and engineering that adopted a low-density resolution method. Our work not only calculated pedestrian sight range and distance from media façade, but also considered the appropriate language form (i.e. dancing and shape metaphor) for a low-density display.

Therefore, our media façade showed that the low-density method convergences between art and engineering and will eventually be an alternative method in visual communication.

References

[1] Portella, A., *Visual pollution: advertising, signage and environmental quality.* Routledge, 2016.

[2] Mcluhan, M. *Understanding media: The extensions of man*. MIT press, 1994.

[3] Ziefle, M., *Effects of display resolution on visual performance.* Human Factors: The Journal of the Human Factors and Ergonomics Society, Vol 40, No.5, pp. 554-568, 1998

[4] Alfano, Patricia L.; MICHEL, George F., *Restricting the field of view: Perceptual and performance effects*. Perceptual and motor skills, Vol70, No.1, pp.35-45, 1990

[5] Copeland, Roger, and Marshall Cohen. What is dance?: readings in theory and criticism. Vol. 720. Oxford [Oxfordshire]; New York: Oxford University Press, 1983