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A web of pixelated textures and intricate behaviors

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The materiality of the pixel between real and virtual

In her seminal essay *The Myth of Immateriality: Presenting and Preserving New Media* Christiane Paul, curator at the Whitney Museum of American Art, focuses on the materiality of the media and of the processes that support artworks on digital media platforms loosely considered as being immaterial.

The myth of the immateriality of digital media has generated a new media artistic practice that is focused on the concept of the immateriality of the digital and that is not aware of the materiality of contemporary digital media that are strictly linked to artistic and curatorial practices that require knowledge of and support for hardware tools, software components and algorithmic processes. All these elements combined with a conceptual aesthetic of the digital and the modalities of the viewers' interaction are at the basis of the final manifestation of the artwork in a physical digital form - be it that of the computer screen, of a pixelated image projected on a wall or of a digital print.

These supporting hardware and software platforms are not the only material elements that compose historical and contemporary digital artworks in new media. At the basis of contemporary new media approaches is the pixel, with its own characteristics, material support and specific aesthetic.

There is a mythology of immateriality that also surrounds the concept of the pixel as something that has no texture, that is made of an immaterial electric substance and that by laying behind a screen is untouchable, unreachable and therefore immaterial and devoid of substance.

The perception of the immateriality of the pixel and contemporary digital media is based on the conflicting nature and representation of real and virtual¹, whereby the

¹ F. P. Brooks, « What's Real About Virtual Reality? », *IEEE Computer Graphics and Applications* 19, n°6, November/December, 1999, pp. 16-27.

real is something that can be touched and the virtual is something that is illusory, untouchable and immaterial.

The discussions about this relationship have been complex and multilayered but after years of debate the concept of the virtual as representation of an illusory world that is immaterial and distanced and unrelated to reality is no longer valid.

The relationship between the real and the virtual and its aesthetic conceptualization underpins the methodologies of perception, interaction and engagement². This relationship can no longer be considered one of isolation and separation since virtual worlds affect the real and the real affects the virtual.

Once an exchange between the two worlds is established the transformation of both real and virtual is unavoidable with one becoming more of the other and vice versa. The relationship cannot be considered as mutually exclusive of real or virtual. It is a matrix within which the virtual with all of its components, including that of telepresence, is no longer isolated but a part of a reality based on a necessary intermingling of real and virtual.

Telepresence based activities and interactions with images displayed on screens across continents³ are no longer a futuristic vision, but the reality of the 21st century that sees the « immateriality » of the pixel's image and its related information as part of the real while the real is being pixelated in to reality to be analyzed and processed in virtual environments.

What is the pixel made of?

If there is a materiality to the pixel, what is the pixel made of and what are its characteristics? There are different possible interpretations but all can be reduced to the fact that a pixel is a manipulation of light.

« Now back to the display of pixels on a screen. Here's roughly what happens. The value of a pixel is converted, for each primary color, to a voltage level. This stepped voltage is passed through electronics which, by its very nature, rounds off the edges of the level steps. The shaped voltage modulates an electron beam that is being deflected in raster fashion across the face of your display. This beam has shape – again think of it as Gaussian (although it can get highly distorted toward the edges of the display). The shaped beam passes through a shadow mask that ensures that only the red gun will illuminate the red phosphors and so forth. Then the appropriate phosphors are excited and they emit patterns of light. Your eye then

² O. Grau, *Virtual Art: From Illusion to Immersion*, Cambridge, MA, ed. MIT Press, 2003, p. 10.

³ K. Goldberg, « Introduction: The Unique Phenomenon of a Distance », in *The Robot in the Garden: Telerobotics and Telepresence in the Age of the Internet*, Cambridge, MA, ed. MIT Press, 2000, p. 3.

integrates the light pattern from a group of triads into a color. This is a complex process that I have presented only sketchily⁴. »

To say that a pixel is made of light provides a focus in this article on the materiality of the complex hardware that produces the light as well as on the aesthetic nature of light that has its own rules, fundamentals and materiality. If in previous centuries the painting and sculptural tradition for the materiality of light was that of being captured, simulated and reflected, in contemporary digital media the manipulation of light through the liquid crystals of the screen is not limited to the visual image but extended to engineering behaviors through disembodied visual representations and interactions.

The idea of immateriality of the pixel contrasts with the reality of traditional conceptual aesthetic underpinnings that used the textures created by brushes in painting or chisels on marble to capture and reflect light and to generate the aesthetic reality of the artwork. The materiality of which the pixel is composed is no longer restricted to light and to the inorganic hardware but is a mixture of organic and inorganic.

These mixtures of organic and inorganic hardware to transform light in a visually controlled form re-present the painterly conceptual approaches of Paul Klee for the production of the artwork conceived as a functioning organism or that of Kasimir Malevich's approach to the art products as autonomous organic machines.

The pixel can no longer be considered an immaterial reality, an expression of virtuality, when its existence, embedded and part of increasingly autonomous artworks, blurs the lines between a-life art⁵ and real life, recomposing this new hybridized reality in abstractions that, eradicated from nature and rendered artificial, are transformed into creative organic/artificial artworks embedded both in the real and virtual.

« It is clear that a-life art is engaged, in a very general way, with the underlying forms of living things; however, it is also engaged in the translation of those dynamic forms into technological media, into structures of code and engineering, into explicit and formal rules and processes. The clearest predecessors for a-life art practice, then, are those that combine these organic ideals with a tendency toward rigor and systematization, where creative organisms arise not through the transfer of an ineffable vital essence but from the interactions of formal elements in a medium deliberately abstracted from nature⁶. »

It is this abstraction from nature together with the artificiality and the illusory representation of nature – as a trompe l'oeil to trick the eyes – that ironically has created the mythology of a world of the virtual represented and characterized by

⁴ A. Ray Smith, « A Pixel Is Not A Little Square, A Pixel Is Not A Little Square, A Pixel Is Not A Little Square! (And a Voxel is Not a Little Cube) », *Tech Memo 6*, Microsoft, July 17, 1995, http://www.alvyray.com/memos/6_pixel.pdf [accessed November 10, 2009].

⁵ G. Dyson, *Darwin Among the Machines: The Evolution of Global Intelligence*, Reading, MA, ed. Perseus Books, 1998, p. 125.

⁶ M. Whitelaw, *Metacreation: Art and Artificial*, Cambridge, MA, ed. MIT Press, 2004, p. 14.

the immaterial nature of the pixel as an illusory construct that discards the materiality of the pixel.

The pixel, although microscopic and continually shrinking, is nevertheless a material element that has characterized, through its fragmentation and microscopic existence, the reality of fragmentation, disembodiment and teletransmission as aesthetic characteristics of the end of the 20th century.

« To achieve the number of pixels required in numerous experiments, we have already begun the design of a new chip XPAD3. It will use radiation-hard submicronic technology (0.25 μ m), which will allow the pixel size to be reduced to 100 – 150 μ m with similar or enhanced performance⁷. »

The materiality of the pixel and its existence cannot be simply denied on the assumption that the pixel exists and resides solely in the virtual realm.

The cultural relationship established between invisibility, illusory, virtual and immaterial is one that has created the mythology of the immateriality of the pixel. If a pixel is invisible and is related to illusory representations it is an element of the virtual world and therefore immaterial, since all virtual worlds are immaterial, despite the large amounts of hardware and software they require to operate.

« This paper describes an algorithm, based on biological vision, which overcomes many of these problems. The algorithm reduces the redundancy of visual information and compresses the data observed in the real world into a significantly lower bandwidth signal, better suited for traditional 8-bit image processing and display. However, most importantly, no potentially useful information is lost and the contrast of the scene is enhanced in areas of high informational content (where there are changes) and reduced in areas containing low information content (where there are no changes). Thus making higher-order tasks, such as object identification and tracking, easier as redundant information has already been removed⁸. »

The problem to be faced is that of a pixel existence that disregards redundant information as non-efficient and dysfunctional. Increasingly this information does not relate solely to an image relegated to the world of the virtual as a world that has no consequences on the real. The relationship has become one of representation, through the pixel, of complex sets of financial, cultural and socio-political interactions that are automatically presented with reduced redundancy and « superfluous » information removed.

The conflict between the pixel's materiality or immateriality is one that is a reflection of the conflict between real and virtual representations. This conflict has

⁷ S. Basolo et al., « A Multi Elements Assembly for X-ray Synchrotron Radiation XPAD: Pixels Detector for Material Sciences », *IEEE: NSS/MIC/SNPS and RTSD 2004 International Conference*, Rome, October 16-22, 2004, http://www.ccp14.ac.uk/ccp/ccp14/ftp-mirror/xnd/pub/xnd/XPAD/xpad_ieee04.pdf [accessed November 12, 2009].

⁸ R. S. A. Brinkworth, E.-L. Mah and D. C. O'Carroll, « Bioinspired Pixel-wise Adaptive Imaging », in *Proceedings of SPIE, the International Society for Optical Engineering*, ed. Said F. Al-Sarawi, January 4, 2007, <http://hdl.handle.net/2440/44710> (accessed November 20, 2009).

characterized the birth of contemporary digital media, which were construed as old media versus new media, analog versus digital.

If perhaps there is a tyranny of the pixel⁹ in its attempt to homogenize all structures, the relevance of the interaction between real and virtual in shaping contemporary realities can no longer be denied, when telepresence or immediate pixel existence across multiple spaces become the reality of contemporary virtual lives and artworks.

The textures and aesthetics of the pixel beyond digital determinism

In his description of the aesthetic of classic artworks Debney Townsend speaks of objects such as paintings that are concrete and separate and of artworks that have a secondary existence as « digital code on a magnetic disk; so aesthetic objects are intentional objects in a fundamental way¹⁰. »

The intentionality element of the artwork, in Townsend's analysis, becomes a characterizing factor that defines the art object as being for « someone » and not solely defined by its natural physical existence. This is not the only characteristic of the aesthetic experience since with intentionality two other elements become part of the aesthetic equation: perception and participation.

There is a relational process of participation in the aesthetic texture of the pixel – presented and perceived as a square – that is an illusory representation of reality that continues to shape the fine art representations of the digital.

The aesthetic world of contemporary reality is represented by the virtual imagining of the pixel that is not a reflection of its material structure as a deterministic element of reality. Contemporary digital society, within which its utopia and dystopia representations are offered to the audience as pixilated images, is not a deterministic byproduct of the materiality of the pixel but of its mythological visual construction.

It is in this context that the reality of the pixel becomes no longer that of an aesthetic object, but that of a relational and participatory object that virtually offers an illusory image as representation of any data at any point in time. The correspondence between the reality of the material and that of the image is no longer a fundamental part that determines reality: what is important is the relation between the viewer and the image as generator and creator of behavioral responses based on perception and participation.

The texture of the pixel is not the square but the behavior that the pixel solicits in the audience, even if this behavior is part of an increasingly unconscious aesthetic of unaware participation.

⁹ A. V. Moere, « Beyond the Tyranny of the Pixel: Exploring the Physicality of Information Visualization », in *Information Visualisation, 12th International Conference*, July 9-11 2008, pp. 469-474.

¹⁰ D. Townsend, *An Introduction to Aesthetics*, Oxford, ed. Blackwell, 1997, p. 137.

The physical definition of the pixel – and its relational nexus between the viewer and the visual image – forms a relationship within which the representation of data is the representation of audience behaviors. The behavioral interactions are expressed and condensed in an image based upon data collected and transformed in an artwork with its aesthetic that relays the link between pixel and viewer.

The audience, with its behavioral interactions, becomes a virtual set of data embedded in the artwork thereby creating an equation between the pixel, the viewer and the interaction. The pixel becomes the expression of an individual that, « cleaned » from the redundancy of information and visualized as a square, represents the texture and the aesthetic of the artwork. This aesthetic frames the role of the viewer as a representation of the single individual interacting with the system as a square, a dot, an infinitesimal part that can be resumed in a pixel. The viewer is reduced to this participatory function, while all the rest is redundant and not functional to the behavior required for the achievement of the pixel aesthetic.

The aesthetic of the pixel is that of a use of digital technology as an everyday *modus vivendi* (way of life) that is characterized by a process of constant mutability and updating of personal and collective behaviors. « The aesthetics of technologically inflected, augmented and managed modes of perception is also about relations to others in the *socius*, to the ways in which these relations are themselves reorganized by the globalization of technologies¹¹ ... »

It is in this landscape of pixelated behaviors that the distinction between engagement and connection takes place, creating different textures and aesthetics that are based on the perception and function attributed to the pixel as engagement or connectivity. « To be engaged is not the same as to be connected. Engagement is an active and ongoing confrontation with others, whereas connection, as Steven Shaviro has suggested, is to the network and away from sociality¹². »

In this context, the texture of the pixel and its aesthetics are based on the harvesting of human behavior and on the discarding of « superfluous » data. The behavior based aesthetic of the pixel questions the ethological modalities of sociability as presented by Gilles Deleuze. The connection to the network can no longer be a socially strengthening process for those who have access. It is instead a locus of increased dematerialization where the individual, devoid of non-usable data, becomes the bearer of a connected behavior represented as a single pixel amongst trillions of other pixels.

¹¹ A. Munster, *Materializing New Media: Embodiment in Information Aesthetics*, Lebanon, NH, University Press of New England, 2006, p. 151.

¹² *Ibid.*, p. 152.

Conclusions: digital human behaviors as operating digital pixels

In conclusion, the operating framework of contemporary human connectivities is that of an increased assimilation between humanity and the pixel with a transfer of aesthetic from the pixel's materiality of the immaterial to the reality of contemporary interactions. Humanity moves away from the process of commodification and objectification into a world of dematerializations and analyses of behaviors in complex metavisualizations and abstractions based on open data sources.

Humanity is increasingly immaterial – construed as and assimilated into a series of pixels that generate a texture, a visual construct or a behavioral map.

« A fundamental shift in the way we view the world is underway: the abandonment of discrete objects, and objecthood itself. The world is now plural, and the distinction between real and virtual is becoming increasingly blurred, with troubling consequences within the geopolitical register. This shift is related to a cultural change that emphasizes digital deconstruction over analog construction: a photograph for example can be accessed and transformed, pixel by pixel, cities can be taken apart by gerrymandering or eminent domain, and our social networks are replete with names and images that problematize friendship, sexuality, and culture itself. One issue that emerges here: Are we networking or are we networked? Are we networks ourselves¹³ ? »

The above call for a special issue of the Leonardo Electronic Almanac on Dispersive Anatomies offers some clues on the function of the network and the role played by human behaviors in it.

As humanity is represented by networks, visualized and materialized as pixel connections, the distance between real and virtual is blurred and the aesthetic of the pixel, pictured as being immaterial, becomes the aesthetic of a pixelated humanity. Taken apart, pixel by pixel, human being by human being, the textures and the materials become those of the behavior in meta constructs and mega bodies – increasingly less related to what is the material underpinning the networks, the bodies and their visualizations.

¹³ « Dispersive Anatomies », guest edited by S. Baldwin and A. Sondheim, *LEA: Leonardo Electronic Almanac* 16, n° 4-5, May 20, 2009, <http://www.leonardo.info/LEA/DispersiveAnatomies/DispersiveAnatomies.html> [accessed November 25, 2009].

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