The Symbolism and Iconography of Noise in Digital Media

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VISUAL NOISE GLOSSARY

Artifacts
Unpredictable forms which appear in an image as a result of a digital process, such as sharpening.

Chance Process

A process which is in part determined by random procedures. A process which has an unknown outcome, but which is part of a known set of possible outcomes, e.g., throwing dice.

Chaos

The interaction of random and structured elements within a system. The level and nature of structure within a real-world system.

Desynchronization

When an event or structure actively suppresses a similar event within surrounding areas or periods of time. Transitions in motion pictures are desynchronous–they tend to be followed by a period of activity before another transition can occur.

Fracticality

The repetition or reoccurrence of a chaotic structure at various quantum scales within a system. Growing organic or active physical systems have this quality.

Leveling Filter

An electronic, perceptual, intellectual, or mathematical structure which removes information that does not conform to a standard or pattern. The modulated work of Mondrian is an example of the use of perceptual and intellectual leveling filters.

Noise
Those aspects of nature, messages, images or signals, which are not predictable and do not adhere to any perceivable pattern.

Non-Deterministic Process

A process which relies on chance procedures to generate outcomes from an unknown set of possible solutions, e.g., throwing paint.

Pink or Other Colored Noise
Visual, auditory or intellectual noise which fills the available range of bandwidth, but with an emphasis on a narrow range of frequencies. Many sounds in nature and acoustic musical instruments are colored noise.

Randomness

Those elements of a system which appear to be impossible to predict.

Sharpening Filter

An electronic, perceptual, intellectual, or mathematical structure which exaggerates or emphasizes differences among bits of information.

Strange Attractor

A set of chaotic events or possibilities with an indefinite, but limited, boundary.

Structure

Those aspects of a system which are predictable.

Synchronization

When an event or structure increases the likelihood of a similar event within adjacent areas or periods of time. Blurring is a synchronous process.

White Noise
Visual, auditory or intellectual noise which fills the available range of bandwidth or media without discernible pattern. White light is a form of white noise.

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ABSTRACT

Digital media offers unique opportunities for the electronic creation and manipulation of noise as a component of fine art. This ongoing manipulation of noise in the arts and popular media has taken on specific denotations and connotations of science, symbol and icon. Noise can be defined by widely used, well developed concepts in acoustics, music and information theory. While those concepts can be applied to the visual arts, their formal application is not as widespread among artists as among musicians. The conceptual framework for defining and manipulating visual noise can be modeled on existing pedagogics of design and the fine arts. A formal study of noise augments the artist in these activities: (1) The use of noise to reflect nature in design, illustration, film and expression. (2) The use of noise as a connotative and denotative element in electronic media. (3) The use of chaos theory and noise to optimize the search for art and design solutions. Just as the artist must master the positive and negative, he or she can also master the dialectical concepts of structure and noise. So we teach noise, not just to explain noise, but to augment our explanations of structure. A pdf of this paper is available at http://e3motion.com/noise/noise7N.pdf

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INTRODUCTION

When examining structure and pattern, artists must also contend with information which is neither structure, form, pattern or void. In electronic media, we can speak of non-structured information as *noise*.

> "Wherever we are, what we hear is mostly noise.
> When we ignore it, it disturbs us. When we listen to it,
> we find it fascinating. The sound of a truck at 50 mph.
> Static between the stations. Rain. We want to capture and
> control these sounds, to use them, not as sound effects,
> but as musical instruments."
>
> —Richard Kostelanetz, *John Cage*, 1970, page 54 [3]

The use of noise has been common in non-western traditions of art and music, but much of second millennium formal western tradition focused on visual structure and ignored noise. Two major events are changing western art in regard to noise: (1) The advent of world wide, multi-cultural artforms which incorporate the use of noise and non-deterministic methodologies, and (2) The speed and control with which one can manipulate noise in electronic and digital media. The manipulation of noise has become a mature part of the popular and refined artistic vernacular of our time.

I. DEFINING NOISE

1) Auditory/Signal/Spoken Noise

Some synonyms for noise: sound, gossip, blab, rumor, talk, tattle, clamor, din, hubbub, pandemonium, racket, cacophony, clatter, caterwauling, babel, blare, hullabaloo, hurly-burly, tumult, hue and cry, uproar, quarrel, scream.

Definitions of noise always begin with the perception of sounds and vibrations, senses more primal than vision. Quoting from the *American Heritage Talking Dictionary:*

1. a. ...a sound that is loud, unpleasant, unexpected, or undesired. b. ...a sound of any kind... 2. A loud outcry or commotion...

We can infer that noise stands out from the background, either by its volume, its unpleasantness or by its unexpectedness—all useful qualities to the artist. Paradoxically, in the natural world, noise comprises the background itself.

Acoustics and Information Theory generally treat noise as a problem to be eliminated, dampened or filtered.[5] More dictionary entries reveal a prejudice in the sciences towards noise:

3. Physics: ...a random and persistent disturbance, that obscures or reduces the clarity of a signal. 4. Computer Science: Irrelevant or meaningless data generated by a computer along with desired data.

In noise's defense, studies are revealing that noise is a necessary component of neurological transmissions, that noise is desirable in complex transmissions, and that humans may choose to notice noise based forms over simple geometric forms.[7]

Noise implies an effect on a variety of senses, often disagreeable sensations, and the ability to attract or repulse. Words which share the same root as noise are: navy, nausea, navigate, and astronaut. So noise also has some connotations of movement, travel and time.

2) Noise as a Function of Structure

Levels of visual noise can be defined as a dialectic from the predictable, flat graphic plane to structure to noisy, unpredictable chaos. Begin with the graphic plane: featureless, without limit or texture. When this plane exists with boundaries upon a field it has shape and structure. Natural visual structures are revealed to be composed of noise fields with structural boundaries. Only imaginary and virtual structures can be composed of truly flat graphic units.

3) Noise as a Function of Scale

It is difficult to gauge the distance of a cloud because a smaller, closer portion of a cloud looks almost identical to the entire cloud. This phenomenon of self similarity in nature can also be seen in rocks/mountains, atoms/galaxies, cells/communities, plant structures, or

the human figure. A visual noise often demonstrates these properties of self-similarity as it is examined at various scales.

4) Graphic/Cognitive/Ideational Noise

Finally noise can be defined within a nonphysical, intellectual space. It can exist as a component in the rational and irrational relationships established in a graphic or temporal space. The Dadaists used intellectual noise as a component in their graphic structures combining non-relational or contrasting visual concepts into a single structure. Intellectual noise exists in the post-modern mode of surfing television or the Internet.

II. NOISE AND STRUCTURE AS DIALECTIC PRINCIPLES

1) Scale as a Defining Variable of the Noise/Structure Dialectic

Noise is an innate visual cue for the scale of a structure: the more prevalent and obvious the level of noise, the farther away one is from viewing the overarching structure. For example, the static noise on a monitor may move towards a monochromatic gray as one moves some distance away from the screen, revealing a structure in the mean value of the pixels. The drip work of Pollack shows consistency across the field, but does not replicate itself across scales. Pollack's art shows structure, even as the lay person describes it as 'random'. There are many exceptions, but we generalize about noise-structure relationships from our experiences with nature and the man-made environment.

2) Noise as a Function of Movement

Noise is not only an indicator of relative scale, but also a measure of relative speeds. We see this in video where the figures move at hurkey-jerky speeds, or in the pattern of 2 subway cars passing. As blurring is a reduction of perceived detail, it may obliterate both structure and noise into flat or modulated color fields.

3) Alignment, Proximity, and Density as Variables of the Noise/Structure Dialectic

The compositional principles of 2D art can be applied to the noise/structure dialectic: A lack of discernible alignments designates the elements of a composition which can be defined as noise. Single elements, unattached to any grid or gestalt, can be defined as noise. Elements which are crowded into dense overlapping masses can also be characterized as noise.

4) Abstraction as a Defining Variable of the Noise/Structure Dialectic

The removal of detail from an image moves that image towards structure in our dialectic. Blurring, tiling, pixilation, or mosaic making are all forms of leveling filters. The act of adding noise and detail, or depicting ultra-realism without regard to depth of field moves our image more to the noise end of the dialectic.

5) Teaching Noise as a Counterpart to Structure

The basis of human perception is the recognition of differences: "Is it on or off? Positive or negative? Yes or no? Sound or silence? Light or shadow?" From these most basic questions, we discern patterns and structure. In training students to create the positive image, teachers speak of being aware of the negative space, of the inverted complement of their creativity.

Noise can be used to explain transitions along several dialectical continuums:

Mechanical—Organic Contour—Gestural Drawing

Idealism—Naturalism

Symbolism—Virtual—Actual

Noise can also show chaotic patterns and properties. Digital artists use fractal dimensions (and software such as Bryce) to create the illusion of rocks, clouds, forests, water, fire, smoke, vapors, scales and hair. Imaging engineers manipulate levels of noise to enhance or compress images. Even the ragged edge of a column of typography is noise.

Chaos theorists have given us a quantifiable, objective unit for the measurement and description of form on the noise–structure continuum. A unit of varied repetition is a fractal. Engineers assign a numeric coefficient to describe the amount of fracticality. A straight line has a coefficient of zero, a truly random line would have a coefficient of 1.0. Lightning would be assigned a coefficient of about 0.87, athletic shoes and auto tires a coefficient of 0.2. [2]

It is no more necessary that the artist be able to do fractal calculations than it is necessary for an artist to be able to calculate the velocity of a falling body. The knowledge that such a principle exists is enough to influence and inform the artist. The popular attention given to noise and chaos echoes the effect of Newton's ideas about gravity on perceptions of asymmetrical balance in 2-D composition. The popularization of an Einsteinian/Hawkings universe is having an effect on our expectations for temporal arts and motion picture conventions.

III. OBSERVING NOISE

The artist should develop a sensitivity for observing the noise–structure dialectic in the real environment.

1) Noise in Nature

> The function of Art is to imitate Nature in her manner of operation. Our understanding of "her manner of operation" changes according to advances in the sciences
>
> —John Cage, *A Year from Monday,* 1980, page 31 [1]

Visual noise is the primary feature of the natural environment. Atmosphere, soil, rock, fire, water, plants, ecosystems and organisms all have qualities and properties of fracticality. In nature, we find an endless interplay between noise and structure. To mimic almost any natural phenomena requires the use of and inclusion of noise.

2) Noise in Technology

When we speak of noise in the technological world, we are generally referring to extra, perhaps unwanted, information in the transmission of a message or signal. In the broadcast world this is called snow or interference. In the audio world, static. In the digital world, this unwanted information is called an artifact. In digital media we can create objects and images of pure structure or pure noise.

3) Noise in Traditional Media

The artist does not precisely control the mix of colors from the palette to the brush or the knife to the canvas. The canvas of every 'realistic' or 'representational' painter, like the real world, is filled mostly with noise. Every sculpture, however smooth, has some expression of noise. The naturalistic or non-objective artist controls patterns and structures, while allowing the non-deterministic aspects of the work to be controlled by process and intent rather than exact plan.

IV. NOISE IN DIGITAL MEDIA AS A DENOTATIVE COMMUNICATION

Just as physics has had a profound effect on the arts, so too an understanding of noise and chaos theory can have an effect on the arts and design. Media carries a number of messages which reflect our direct experience with noise:

1) Source/media Denotations

White and pink noise denote the use of analog electronic media, even as a symbol in nonelectronic media or digital media.

2) The Empty Channel

Noise is often a precept of a message, it says that a communications device is at least receiving power, though perhaps not in perfect working order. We search through the channels for a signal. Noise can be the literary equivalent of a silent tension when people are connected through an electronic device:

"....I'm not interested in talking to you:"
"I think you will be, when you hear what I have to say."
The hiss of the open line continued for some time.
"Let's hear it."
—Greg Iles, *Sleep No More*, 2002, added boldface

The empty channel also carries a sense of a place that was suddenly abandoned: the noise of a teapot boiling and whistling in an empty house is among the more tension-filled devices of film-making. The television left on after station sign-off is a channel for demons in many contemporary films (*Poltergeist, The Ring*) and is now a part of the popular vernacular.

3) Kinesthetic

Artifacts from an artist's process reflect the motion of its creator. Noise reflects and records movement and process in Nature. Noise can define the path left by an object in motion and can exhibit the rhythmic properties of the object's passage. Noise can be an expression of the afterimage left behind on film, video, or x-rays.

4) Destruction

Noise is almost always a by-product of the destruction of form and structure. When an object is blown to smitherines, it moves from structure to noise and debris. Flames, dust clouds, and smoke are all forms of noise. The erosion of structure by rust, wind or organisms move it towards noise on our dialectic model.

6) Power

Noise depicts power, especially electricity and radiation. Science fiction and Godzilla movies inform the artist of death rays and, less frequently, healing beams.

V. NOISE IN DIGITAL MEDIA AS A CONNOTATIVE COMMUNICATION

Noise can carry indirect, referential messages. Commercial media has given noise additional layers of meanings beyond the empty channel or a reflection of nature. Noise has been codified and iconified in products, interiors and media since the appropriation of Jackson Pollack's nonrepresentational paintings into Formica.

1) Scene/temporal Transitions

Noise is used as a transition device from one time, place or mood to another.

2) Historical Connotations

Static refers to pre-digital, analog devices such as early radios and television. The use of digital scratches to mimic old film has become a popular technique in digital imaging. Noise also speaks to post-modern aesthetic—noise is manipulated and used to add warmth that was perhaps missing in the modern, international style.

3) Cultural Connotations

Noise means different things to different groups and it may reflect struggles within those groups. Rural folk art is often prized for it's attempt to remove noise, to impose order with mechanical or graphic pattern, or conversely we may see folk art which embraces Nature and chaos by the use of unaltered objects and patterns from nature.

We see the same struggle in electronic media as some artists work toward the most noise-less electronic transmissions, while others use electronic noise as object and ornament. Noise may signify the rebel; the rave culture uses noise in their electronic designs on the web and in print.

Noise also seems to be part of the television watching class.
Noise can signify kitsch and Wal-Mart.

Noise is associated with the wave of Japanese animation now so popular in the U.S.

Noise carries no single perception or message–it's message is dependent upon context.

Noise is perhaps considered most appealing when it is accessible, but does not interfere with the perception of structure. We are comfortable when we can turn it off and on as the locus of our visual perception.

VI. EXPLOITING NOISE AS AN ARTISTIC TOOL

As suggested as an outline by *Design Basics*.[4]

The computer possesses some characteristics which make it uniquely suited for carrying out chance procedures. It is possible to replicate and modify in an unstructured mode, and to allow random changes within very precise parameters.

1) Controlling the Parameters of Noise as a Form of Expression and Exploration

These procedures may be as simple as the use of dice or as complex as the use of a non-periodic, non-repeating system in an imaging or video program. For the artist, noise may become a resource for imagery or an organic part of their physical or electronic process. Intuition can be seen as the random noise of intellectual activity. Meditation is the empty communication channel, searching for a station or a solution to a problem. We can teach our students to tap into scientific knowledge in both rational and irrational or emotional modes through the use of the noise–structure dialectic.

> "When the logician has resolved each demonstration into a host of elementary operations, all of them correct, he will not yet be in possession of the whole reality, that indefinable something that constitutes the unity... Now pure logic cannot give us this view of the whole; it is to intuition that we must look for it."
>
> —Henri Poincaré, *Science and Method*, 1914, page 127 [6]

Poincaré, the pioneer of modern quantum mechanics, suggests that intuition offers a wider range of possible solutions to a problem than pure logic. A non-structured, noisy process can offer an even broader range of possible solutions than simple rationality. Random process and its consequent noise may be entirely necessary to create a product which reflects the indeterminacies of nature. For example, the ceramicist calculates that a certain chemical combination, applied and fired in a specific manner, will result in an appearance which is only somewhat predictable. Some glazes will result in spectacular failures and successes, others will be more predictable. (The range of variation in the patterns for a certain glaze is the measure of its *fracticality*.) Digital artists can be informed by non-digital art's inherently noisy processes.

2) Noise as a Unifying or Contrasting Element

Graphic fields of different colors, values or textures can be unified by the application of filters which add gaussian noise and other forms of noise. Noise can be used to heighten the differences between flat and textural surfaces or to add a unifying quality to unlike surfaces. Sharpening and noise filters can be employed for this purpose. We recognize the work of the master artists, not only by what elements of their work are consistently controlled, but also by what aspects are not controlled and allowed to evolve.

3) Noise as Surface Treatment/Texture

Noise describes the transitions of hazy to sharp, continuous tone to pointillism, smooth to rough. Noise informs the perception of tactile qualities in an electronic image, giving them an additional layer of meaning and resonation.

Focus–Blur Continuum

Noise and Chroma/Vibration

Pointillism/Visual Mixings

Discord–Harmony Continuum

4) Noise as an Eroding Element

By the fracticality of a line, we are informed as to whether a line is contour or gestural, whether it is a rendering of the subject or an active expression of the artist's process. Noise can also be used to erode a form, to move from the predictable graphic to the unpredictable image of nature.

5) Noise as a Dimensional Cue

The use of warm and cool color to convey atmospheric distance is complemented by the use of noise to convey intimacy and detail.

6) Noise as a Method for Crystallographic Balance

The addition of noise can function as deletion of form and structure, much as blurring can eliminate unnecessary details and allow the viewer to focus on the structure.

7) Noise as a Temporal/Animation Element

Directionality: when noise is evenly distributed across a structure, we tend to see that structure as stationary and immobile. When noise shifts across a structure we perceive some force acting on that structure.

Velocity: Noise can be used to mark something in motion or to designate where something has been. We see this effect as disturbed air, dust particles or the blurred afterimage trailing a figure in motion. We also see the path of motion in the flattened, disturbed grasses in a meadow or the scattered belongings of a ransacked room.

Blurring/Sharpening: Noise can be used to 'blur' an image in the sense of obscuring some of the information with a layer of noise. True blurring is the leveling of information, not it's removal. Noise artifacts can be a by-product of sharpening, but they obscure the structural details from which they were derived.

8) Emotional–intellectual Noise and Problem Solving

The desire to go in new directions is not enough, intelligence and insight are not enough to create breakthrough art and designs; one must eventually look for new directions in some place other than our own limited intellects and instincts. The three fundamental systems for creative problem-solving are logic, intuition, and chance. To rely entirely on logic is to accept a limited number of solutions to a problem. The range of acceptable possibilities is always larger than the set produced by deductive or analytical reasoning. Chance processes should not be confused with intuitive processes. They have different, though not necessarily conflicting, philosophical assumptions. The use of chance process assumes that the logical mind is not powerful enough to encompass all possibilities. The use of intuitive process assumes that the mind has certain abilities that cannot be defined by logical constructs. Noise can introduce that element of chance so necessary to explore a full range of possible artistic solutions. The noise–structure dialectic is a good metaphor for teaching the logic–intuition–non-deterministic problem-solving dialectic.

CONCLUSIONS

Noise is an inherent component of digital and electronic media, carrying both direct and symbolic messages. The use of visual noise not only denotes the absence of structure, but it also connotes a variety of cultural values, symbols and icons.

The addition of terms and language describing noise to the lexicon of artists and art teachers opens (intellectual) doors. Our visual perceptions require the interpretation and filtering of noise. Chaos Theory and noise theorists are part of a new wave of scientific thought which informs the artist. If this paper were to be perceived only as a noisy sequence of gibberish upon which we map our own expectations and constructs, it would perhaps be paradoxical proof of its underlying rationale.

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