What is an image - Overview

What is an Image – What are the metrics?

- By what criteria do we measure the interest level of an image?
- What are the key components in the image itself, and what do we bring to give meaning to the image?
- What are the standards by which we create our images?
- How can we increase our competence in evaluating our own images?

What is an Image – an artist's point of view

Image-making, and more particularly art-making, are considered as *rule-based activities* in which certain fundamental rule-sets are bound to *low-level automatic cognitive processes* (Harold Cohen)

What is an Image – Harold Cohen

What is an Image?

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Image-making, and more particularly art-making, are considered as rule-based activities in which certain fundamental rule-sets are bound to low-level cognitive processes. AARON, a computer-program, models some aspects of image-making behavior through the action of these rules, and generates, in consequence, an extremely large set of highly evocative "freehand" drawings. The program is described, and examples of its output given. The theoretical basis for the formulation of the program is discussed in terms of cultural considerations, particularly with respect to our relationship to the images of remote cultures. An art-museum environment implementation involving a special-purpose drawing device is discussed. Some speculation is offered concerning the function of randomizing in creative behavior, and an account given of the use of randomness in the program. The conclusions offered bear upon the nature of meaning as a function of an image-mediated transaction rather than as a function of intentionality. They propose also that the structure of all drawn images, derives from the nature of visual, cognition.

1. INTRODUCTION

AARON is a computer program designed to model some aspects of human art-making behavior, and to produce as a result "freehand" drawings of a highly evocative kind (figs 1,2). This paper describes the program, and offers in its conclusions a number of propositions concerning the nature of evocation and the nature of the transaction — the making and reading of images - in which evocation occurs. Perhaps unexpectedly — for the program has no access to visual data — some of these conclusions

bear upon the nature of visual representation. This may suggest a view of image-making as a broadly referential activity in which various differentiable modes, including what we call visual representation (note 1), share a significant body of common characteristics.

in some respects the methodology used in this work relates to the modeling of "expert systems" (note 2), and it does in fact rely heavily upon my own "expert" knowledge of image-making. But in its motivations it cones closer to research in the computer simulation of cognition. This is one area, I believe, in which the investigator has no choice but to model the human prototype. Art is valuable to human beings by virtue of being made by other human beings, and the question of finding more efficient modes than those which characterize human performance simply does not arise.

My expertise in the area of image-making rests upon many years of professional activity as an artist — a painter, to be precise (note 3) — and it will be clear that my activities as an artist have continued through my last ten years of work in computer-modeling. The motivation for this work has been the desire to understand more about the nature of art-making processes than the making of art itself allows, for under normal circumstances the artist provides a near-perfect example of an obviously-present, but virtually inaccessible body of knowledge. The work has been informal, and qua psychology lacks methodological rigor. It is to be hoped, however, that the body of highly specialized knowledge brought to bear on an elusive problem will be some compensation.

AARON is a knowledge-based program, in which knowledge of image-making is represented in rule form. As I have indicated I have been my own source of specialized knowledge, and I have served also as my own knowledge-engineer. before embarking on a detailed account of the program's workings, I will describe in general terms what sort of program it is, and what it purports to do.

First, what it is 'not. It is not an "artists' tool". I mean that it is not interactive, it is not designed to implement key decisions made by the user, and it does not do transformations upon input data. in short, it is not an instrument, in the sense that most computer applications in the arts, and in music particularly, have identified the machine in essentially instrument-like terms.

AARON is not a transformation device. There is no input, no data, upon which transformations could be done: in fact it has no data at all which it does not generate for itself in making its drawings. There is no lexicon of shapes, or parts of shapes, to be put together, assembly line fashion, into a complete drawing.

It is a complete and functionally independent entity, capable of generating autonomously an endless succession of different drawings (note 4). The program starts each drawing with a clean sheet of paper — no data — and generates everything it needs as it goes along, building up as it proceeds an internal representation of what it is doing, which is then used in determining subsequent developments. It is event driven, but in the special sense that the program itself generates the events which drive it.

It is not a learning program, has no archival memory, is quite simple and not particularly clever. It is able to knock off a pretty good drawing — thousands, in fact — but has no critical judgment that would enable it to declare that one of its drawings was "better" than another. That has never been part of the aim. Whether or not it might be possible to demonstrate that the artist moves towards higher goals, and however he might do so through his work, art-making in general lacks clear internal goal-seeking structures. There is no rational way of determining whether a "move" is good or bad the way one might judge a move in a game of chess, and thus no immediately apparent way to exercise critical judgment in a simulation.

This lack of internal goal-orientation carries with it a number of difficulties for anyone attempting to model art-making processes: for one thing, evaluation of the model must necessarily be informal. In the case of AARON, however, there has been extensive testing. Before describing the testing procedure it will be necessary to say with more care distinguishing here between the program's goals and my own — what AARON is supposed to do.

Task Definition.

It is not the intent of the AARON model to turn out drawings which are, in some ill-defined and loosely-understood sense, aesthetically pleasing, though it does in practice turn out pleasing drawings. It is to permit the examination of a particular property of freehand drawing which I will call, in a deliberately general fashion, standing-for-ness.

The Photographic "Norm"

One of the aims of this paper is to give clearer definition to what may seem intuitively obvious about standing-for-ness, but even at the outset the "intuitively obvious" will need to be treated with some caution, in particular, we should recognize that unguarded assumptions about the nature of "visual" imagery are almost certain to be colored by the XXth century's deep preoccupation with photography as the "normal" image-making mode. The view that a drawn image is either:

1. representational (concerned with the appearance of things) , or

2. an abstraction (i.e. fundamentally appearance-oriented, but transformed in the interest of other aims) or,

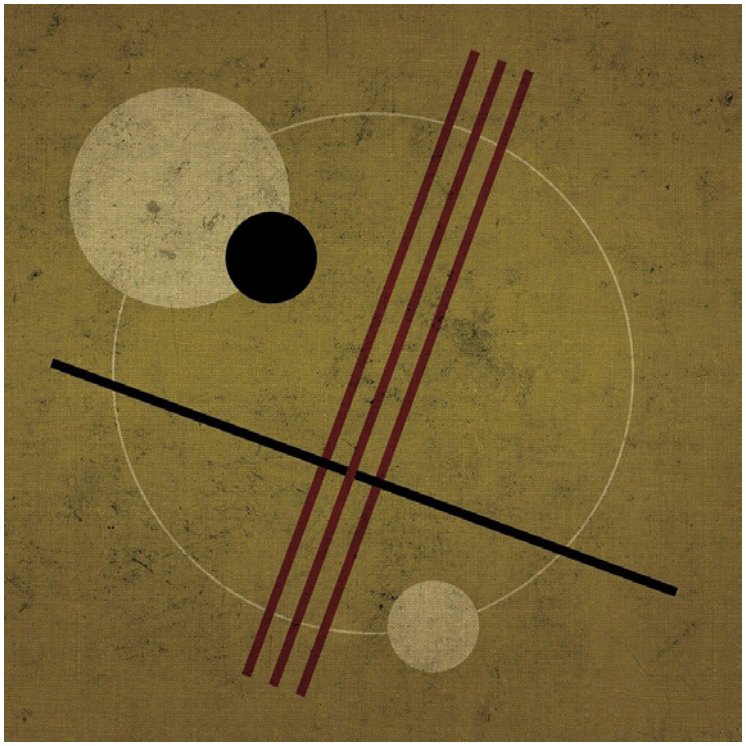
3. abstract (i.e. it doesn't stand for anything at all),

betrays just this pro-photographic filtering, and is a long way from the historical truth. There is a great wealth of imagistic material which fits none of these paradigms, and it is by no means clear even that a photograph carries its load of standing-for-ness by virtue of recording the varying light intensities of a particular view at a particular moment in time.

It is for this reason that image-making will be discussed here as the set of modes which contains visual representation as one of its members. It is also why I used the word "evocative" in the first paragraph rather than "meaningful". My domain of enquiry here is not the way in which particular meanings are transmitted through images and how they are changed in the process, but more generally the nature of image-mediated transactions. What would be the minimum condition under which a set of marks may function as an image? This question characterizes economically the scope of the enquiry, and it also says a good deal about how the word "image" is to be used in this paper, though a more complete definition must wait until the end.

What is an Image – most fundamental state

- A visual representation: graphs, maps, doodles, paintings, photos, anything visual
- Its elements are the relationship of forms, colors, marks, etc.
- It can represent something about the world, or just consist of abstract forms, or just patterns



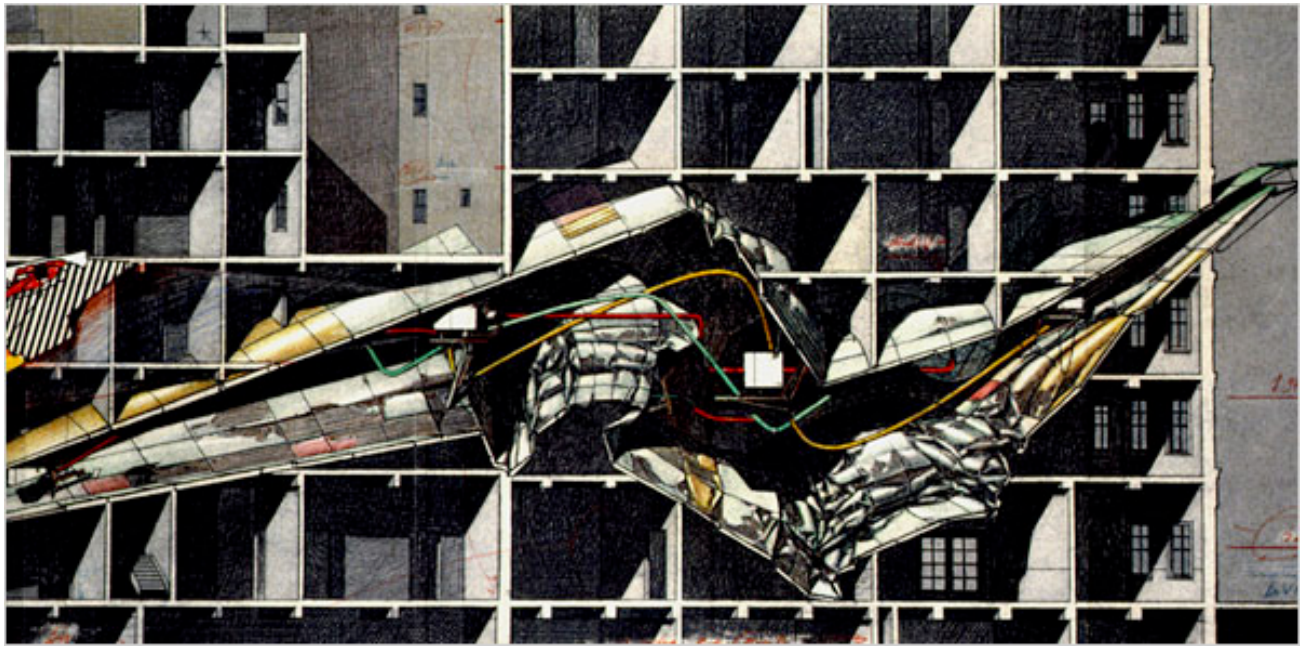
What is an Image – in relation to Notation

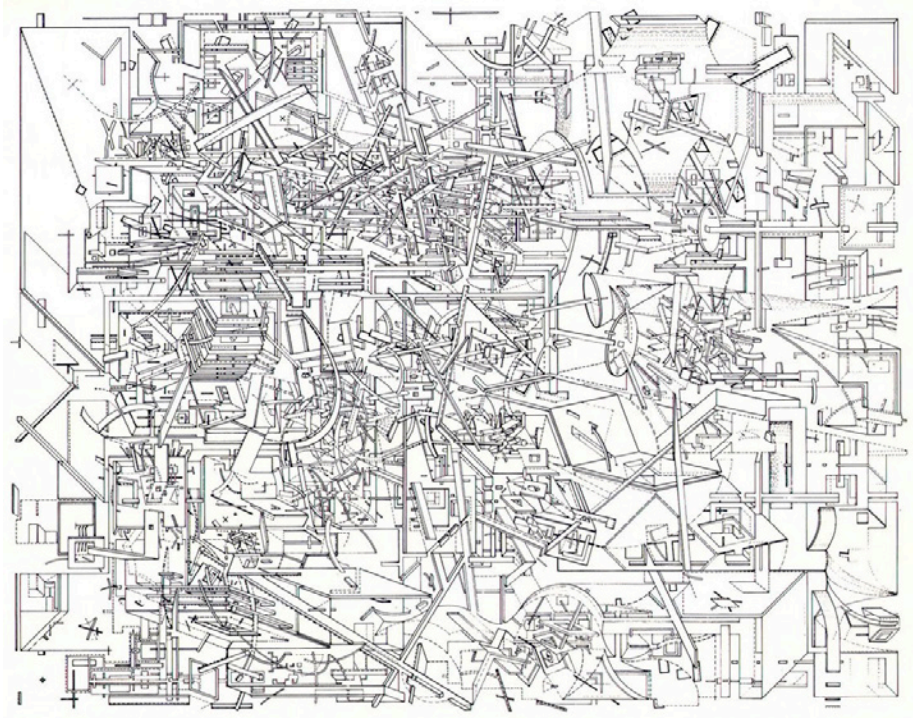
A **notation** is a system of graphics or symbols, characters and abbreviated expressions, used (for example) in artistic and scientific disciplines to represent technical facts

- **Notation**: Visual articulation of a concept suggesting further action
- **Musical Notation**: Representation of aurally experienced music through written symbols
- **Sketch**: Rapidly executed freehand drawing to convey an idea
- **Scripts**: Instructions for a performance work | computer, cooking, etc. sequence of actions
- **Computer Code**: Human readable statements executable by a computer
- **Schematic**: Diagram that represents the elements of a system using abstract, graphic symbols
- **Mathematical Notation**: Symbolic expressions with precise semantic meaning

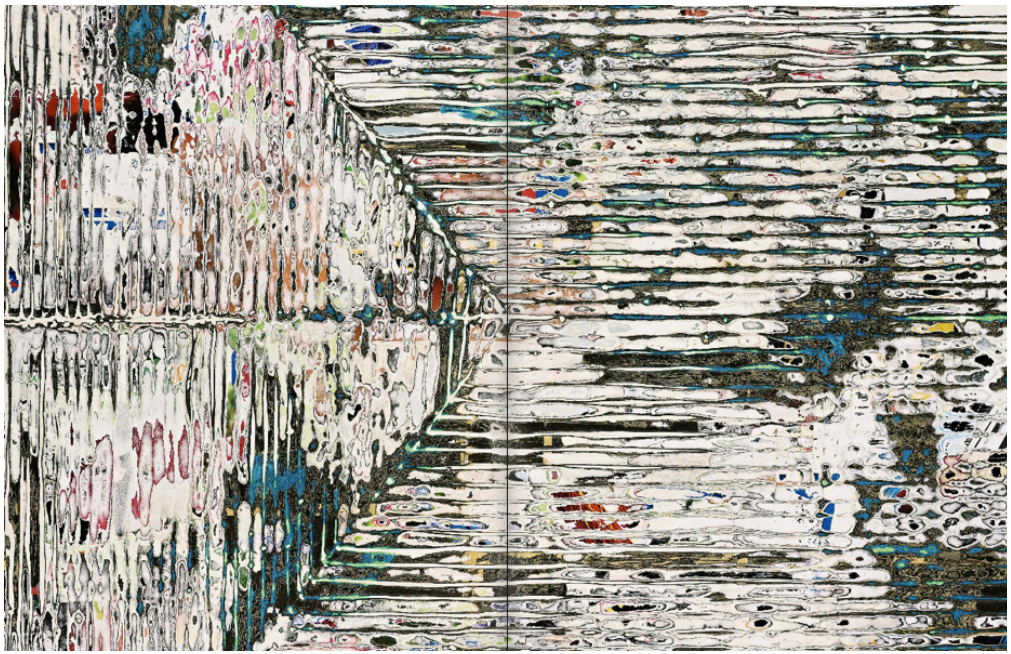
What is an Image – Frank Gehry Disney Hall, LA - Architect sketch

What is an Image – Lebbeus Woods

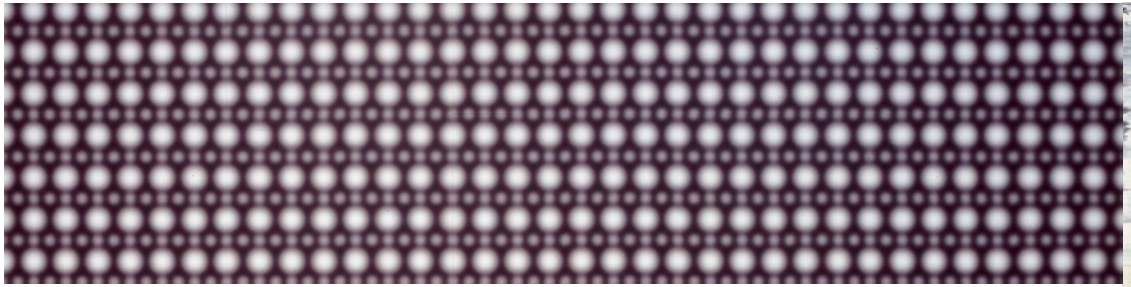


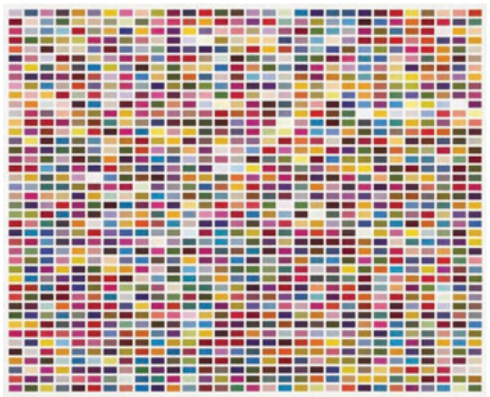


What is an Image – Contemporary painting – Mark Bradford

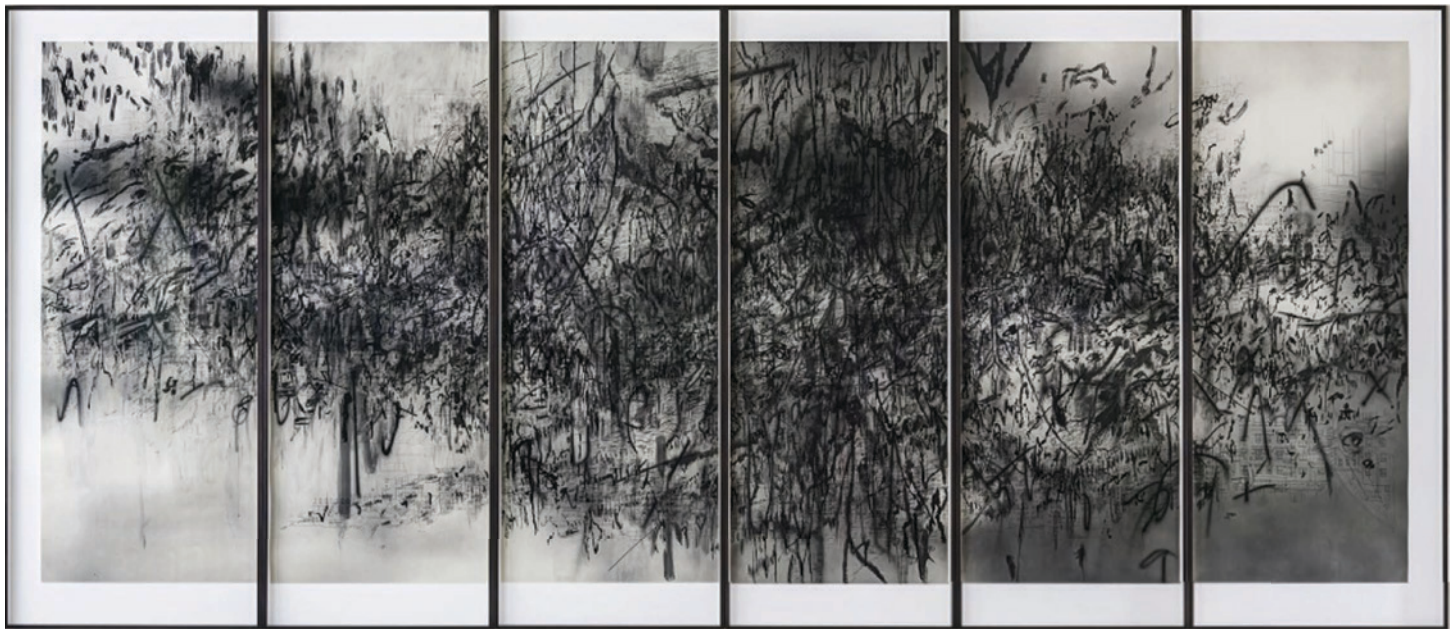


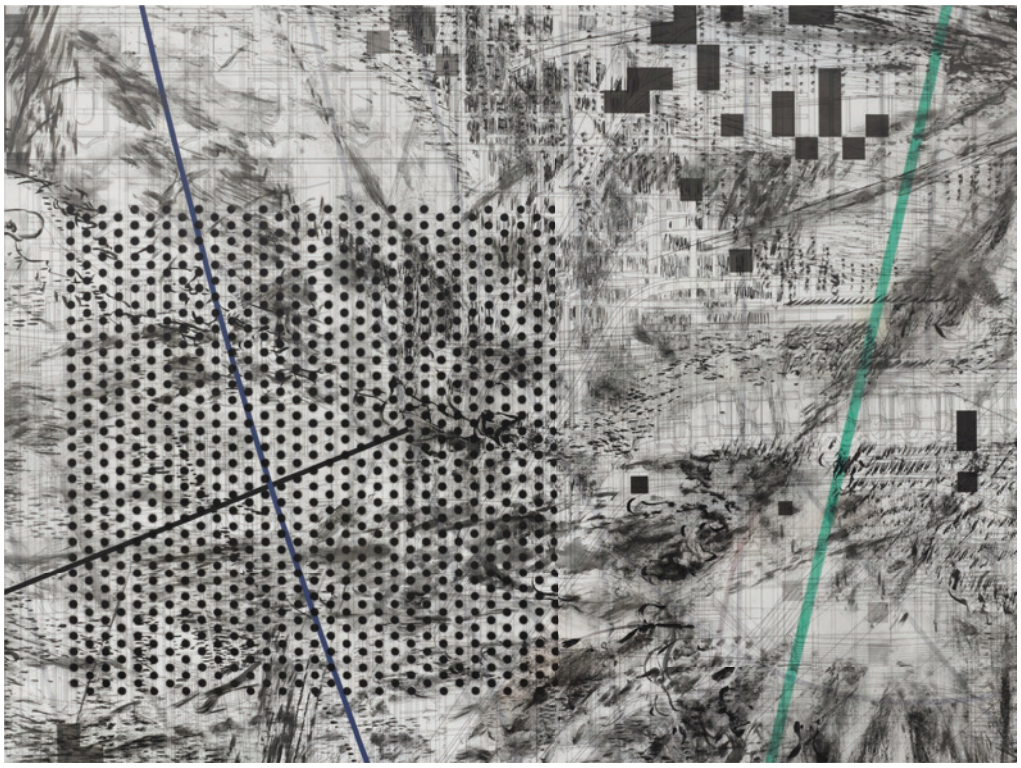
What is an Image – Contemporary painting – Gerhardt Richter



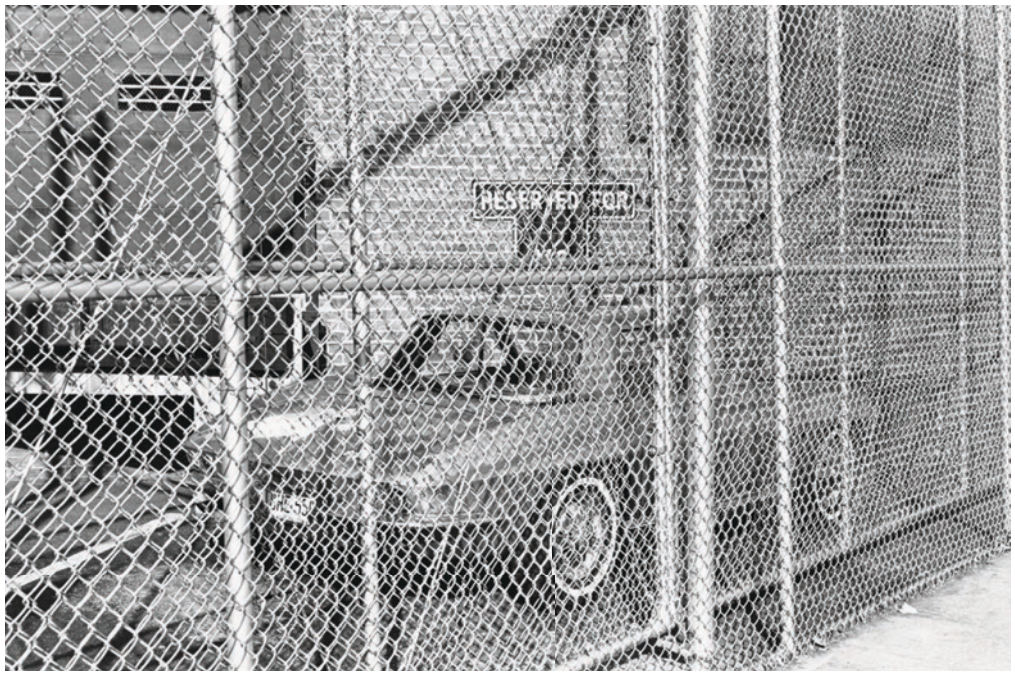


What is an Image – Contemporary painting – Julie Mehretu





What is an Image – Lee Friedlander



Urban Nature
1975-1980

Gelatin silver prints 24"x30"

Canadian Museum of Contemporary Photography, Ottawa and others

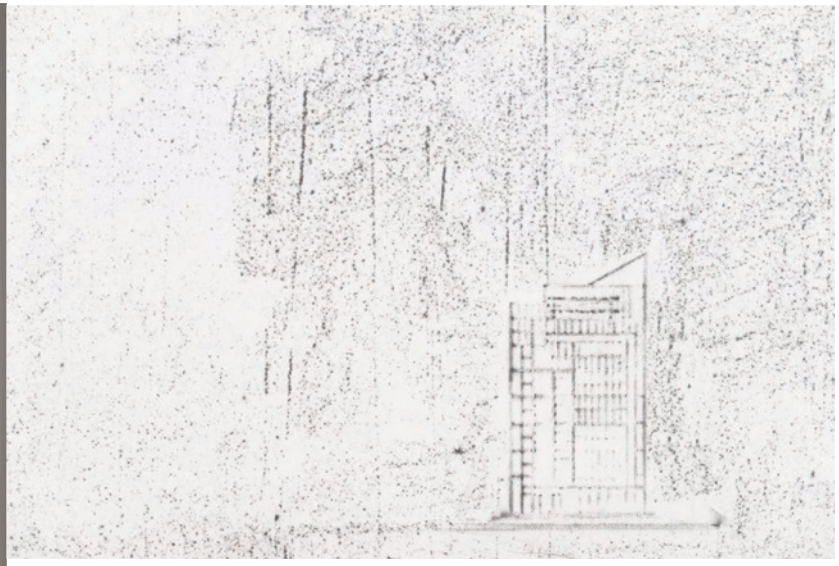
http://www.mat.ucsb.edu/~g.legrady/glWeb/Projects/lp/Urban.html

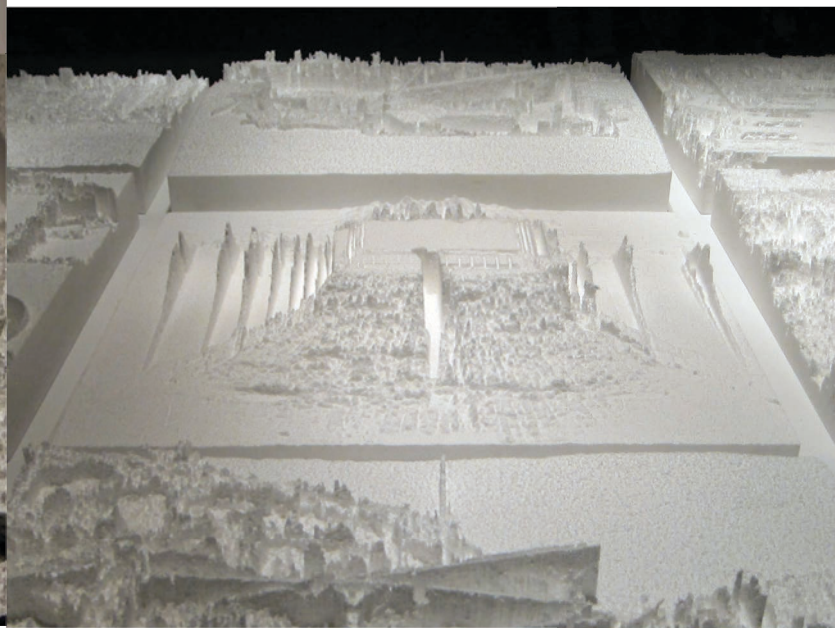
Beginning in 1969 to around 1980, my photographic projects fit into a genre of image making heavily influenced by the documentary tradition. This mode of fine arts photography concentrated on documentation in the journalistic sense of photographing scenes, cultural events and environments one came across by chance or circumstance. The focus was on a balance between the chance encounters of interesting or banal subject matter and its visual orchestration according to a lexicon of formal compositional strategies. The game lay in a contrast between the veracity of the photographic image and the shift in meaning that occurs when the photographer conscientiously explores how real-time and real space are reduced and transformed through the freezing of a moment into a two-dimensional image.

The activity of walking around looking for visually interesting studies and chance events in urban and suburban environments was replaced by visits to construction yards at night, which further shifted the emphasis towards formal resolution of visual elements. 20th Century technical, and evidential photographs that were done for reasons other than aesthetic, were guiding models. The prioritization of the photograph's formal orchestration over its subject matter addressed the historical and ongoing dialogue between photography and painting, where the gesture based construction process of painting was challenged by the mechanical recording process of the photograph.

From 1974 onwards, I began to explore the balance between order and chaos in visual compositions, a precursor to my later interest in Claude Shannon's Information Theory. The approach consisted of studying the visual relationship of cluttered, banal and uneventful subject matter (a form of noise) in real space and to orchestrate the subject matter defined by the rectangular frame of the image to achieve a formal balance. The emphasis was on the act of formal structuring and the image's success resided in the degree of difference between the image's order in contrast to the subject matter's chaos. The use of strobe lighting in daylight and darkness, further distanced the photographic

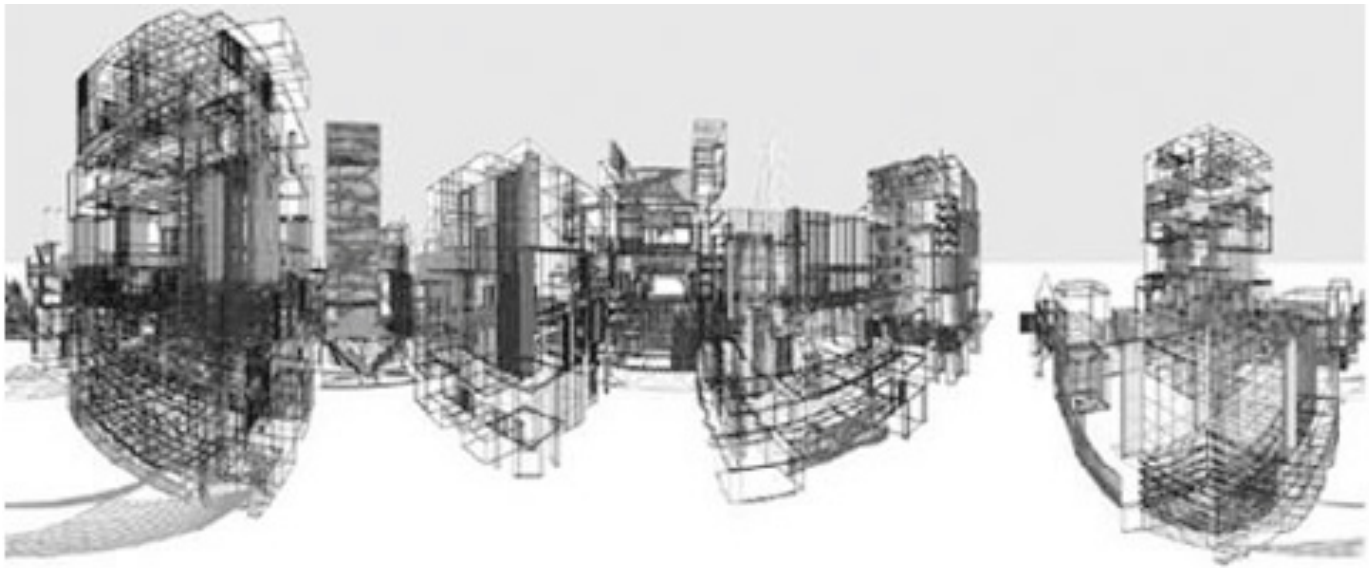
What is an Image – From 2D to 3D Carlos Garaicoa





What is an Image – Perspective, Point of View

- Bruneschelli
- Anamorphic
- Holbein's Ambassadors
- Asian perspective
- VR perspective



What is an Image – Anamorph Transformation

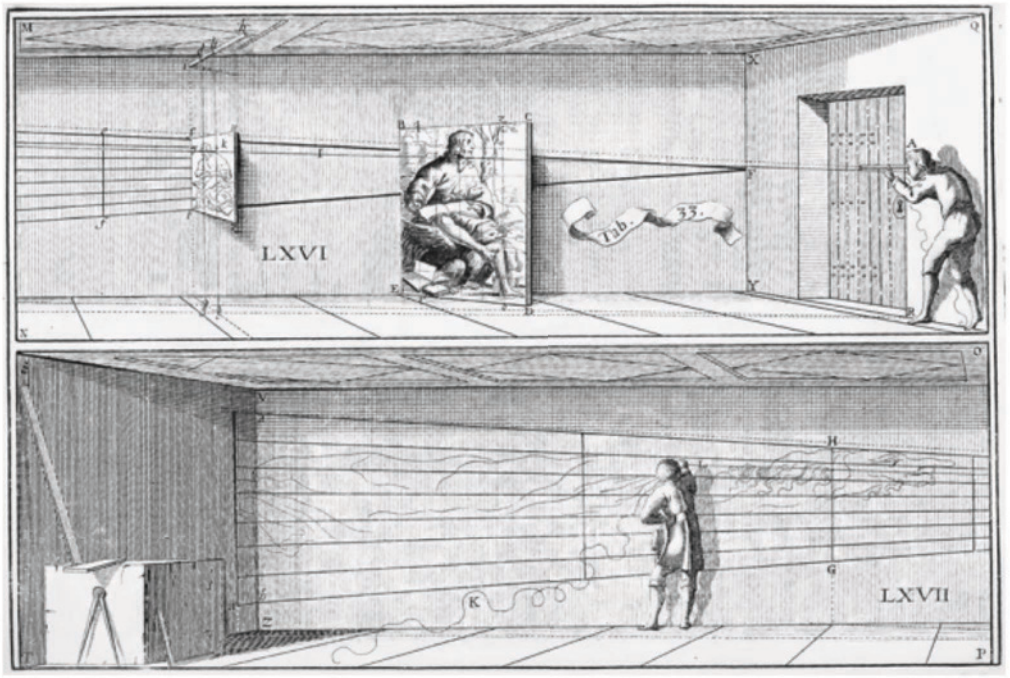


FIG. 5 – Anamorphic structure by J.F. Niceron, Thaumaturgus Opticus (Tab. 33, Fig. LXVI and LXVII), Paris, 1646.

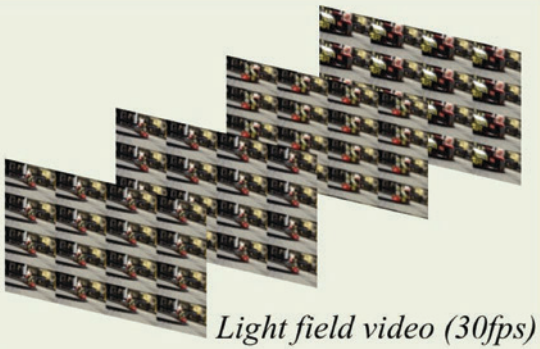
Fig. 3. Hans Holbein, 1533, The Ambassadors, oil on panel with an anamorphic image of a skull in the bottom of the image

Fig. 4. The Skull – visualisation of the **flat surface** anamorph from *The Ambassadors*

What is an Image – Point of View in Real and Virtual Space

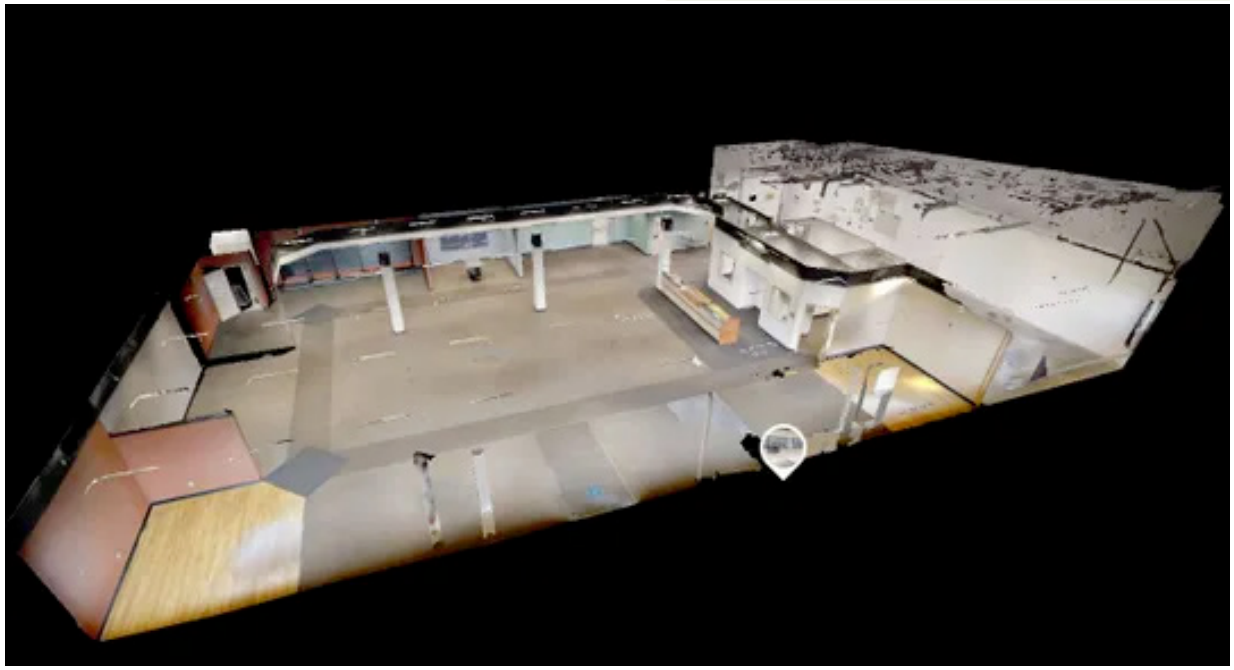
DSLR: 2D video (30fps)

Lytro: light field video (3fps)

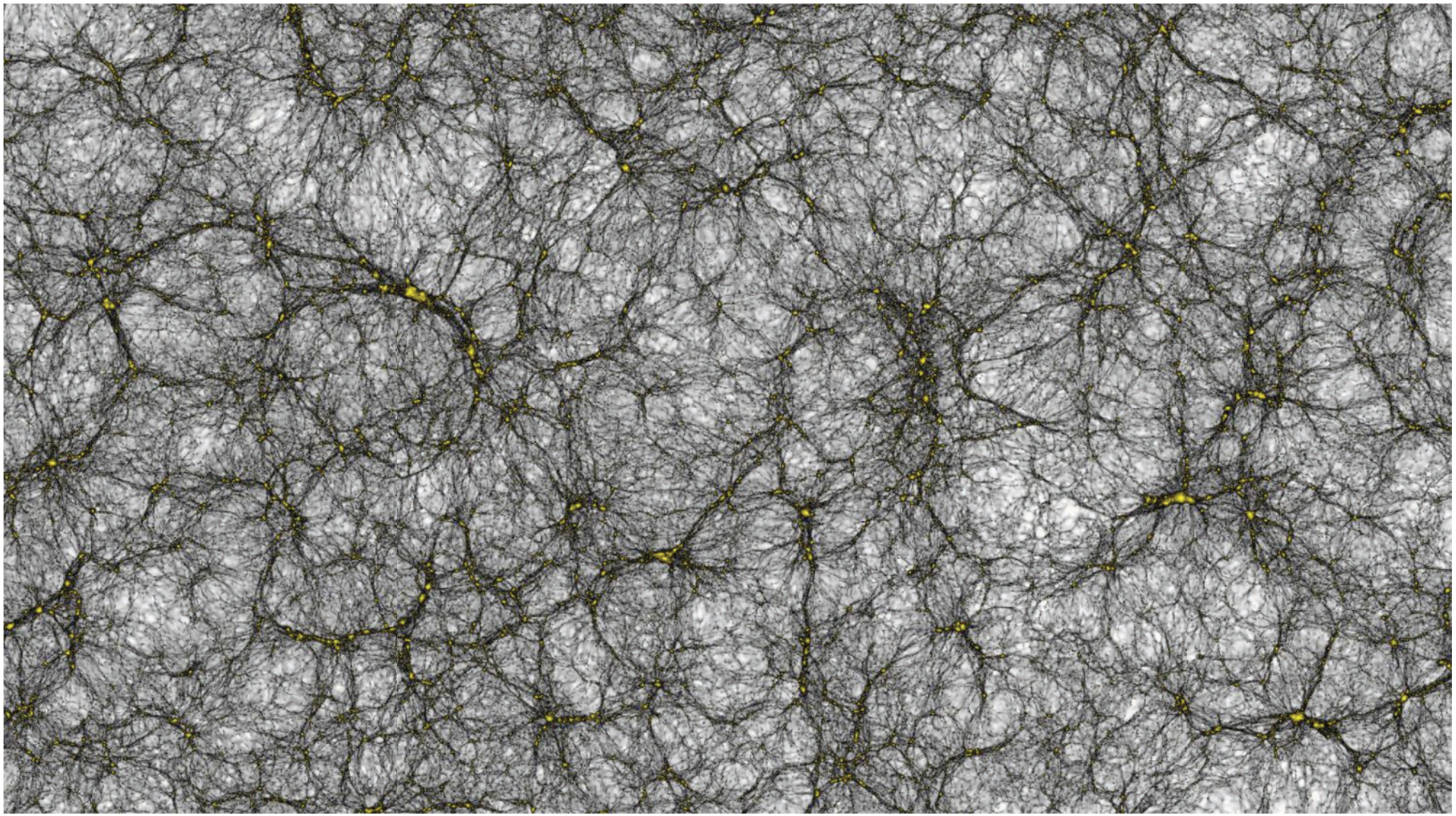


Light field video (30fps)

Interactively refocused



What is an Image – Visual Simulation



The Cosmic Web: A section of the virtual universe, a billion light years across, showing how dark matter is distributed in space, with dark matter halos the yellow clumps, interconnected by dark filaments. Cosmic void, shown as the white areas, are the lowest density regions in the universe. Credit: Joachim Stadel, UZH

What is an Image – Aesthetic Primitives, Gabriele Peters

Aesthetic Primitives of Images for Visualization

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Abstract

Images play an important role in visualization. As users are more willing to adopt a product if it evokes pleasurable feelings the aesthetic appeal of interfaces becomes more important. Thus, there is a growing need to generate also images which appear aesthetically to the user. Starting with the modularities of the human visual system, we derive six dimensions of visual aesthetics. For each dimension we explore, inspired by principles of the visual arts and insights of cognitive neuroscience, which pecularities of the dimensions are particularly adequate for an aesthetic impression. Accompanied by a fair number of image examples, these considerations result in an easy to understand guideline for computer scientists and interface designers how to deal with images in terms of aesthetics.

1. Introduction

The roles of images[1] in visualization are manifold. Stone et al. [1] name four main benefits. Images motivate and attract the attention of the user and have the function to persuade her. They communicate information, which is often exploited in computer-based learning. Furthermore, they have the great power to overcome language barriers, and they support interaction. Images are especially powerful whenever it is difficult to describe the depicted information by words or numbers. This is the paradigm for most human-computer interaction applications. For example, in web design images are utilized mainly for two different purposes. They can have the function to attract the user and may be used as anticipation of the overall topic of the website. On the other hand, small thumbnails promote interaction. In e-learning images usually are the support of the information, that should be conveyed by the course. Other examples of interfaces from several applications of augmented reality (geovisualization, navigation, maintenance and repair, and a museum guide) where images are the key components of the visualization, are shown in figures 1 and 2. The left picture of figure 1 shows an image of the environment which is augmented by data indicating a possible path for a vehicle. One could be of the opinion that such a real-time navigation system has to show "just the image the camera captures". But the interface designer has to decide for the specification of numerous variables that determine how the captured image is presented in the user interface. To name but a few, she has to choose color space, contrast, dynamic range, spatial arrangement of the image components (e.g., the position of the horizon), depth of field, and focal length. The right part of figure 1 shows an example for maintenance instructions for an engine. The previous statements hold true for this example, as well. The last example is given in figure 2. A virtual guide for the Guggenheim Museum Bilbao refers the visitor to architectural features of the building or gives explanations of exhibits. Two screenshots from the user interface are shown. In the context of information visualization and human-computer interaction topics such as the importance of aesthetic qualities of graphical elements of user interfaces [2] or the aesthetics of interaction [3] have frequently been addressed. Also the relation between visual and verbal information in presentations has been dealt with [4]. What is underrepresented in the literature is the role of image aesthetics in visualization. This paper is an attempt to fill this gap. To identify aesthetic dimensions that, on the one hand, allow for the evaluation of the aesthetic qualities of an image and, on the other hand, enable an interface designer to adapt her tools to the needs of the

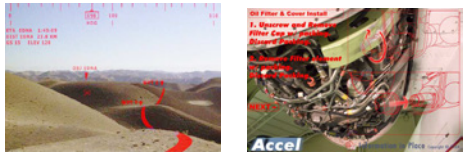

Figure 1. Images as key components of visualization: navigation and maintenance.

[1]The term "images" is used here in the sense of pictures, i.e., photographs or drawings. It does not denote diagrams or charts.

nternational Conference Information Visualization (IV'07)
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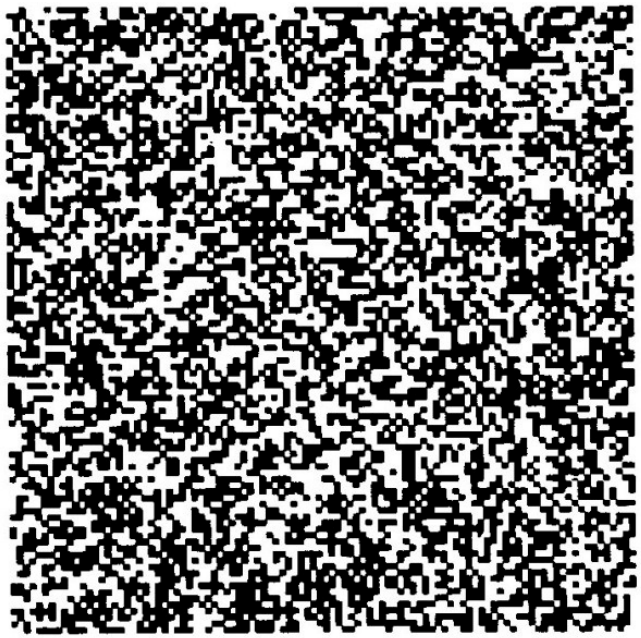
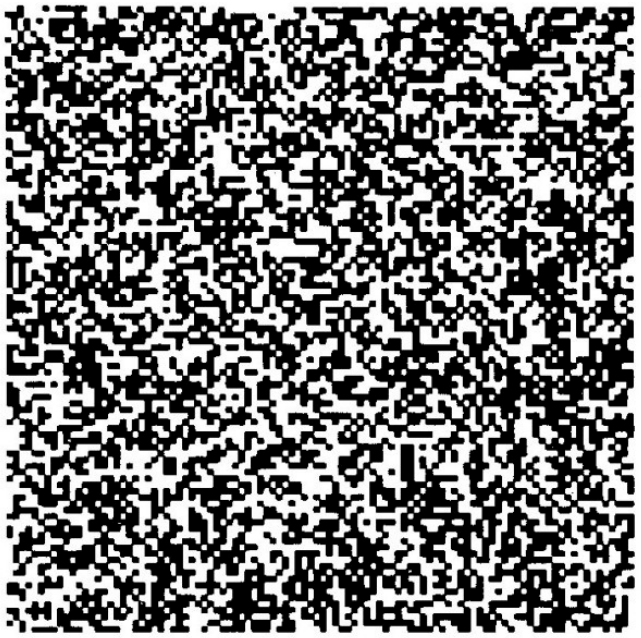
What is an Image – Perception, Neuroscience

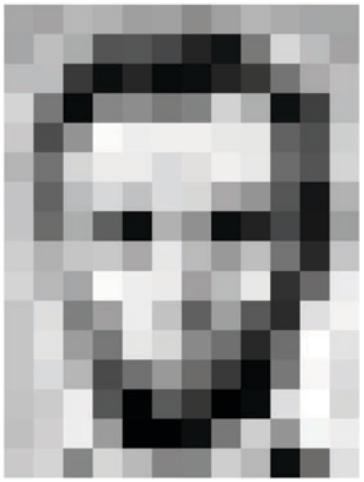
- Images are analogous to visually perceived scenes in the world [Archigram]
- But the observer's psychological [Mark Cohen], physiological [Jonathan Crary]
- perceptual [Eckstein] and mental operations [Julesz] [random dot] all impact on meaning

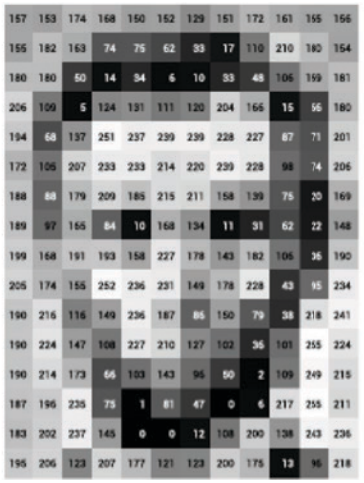


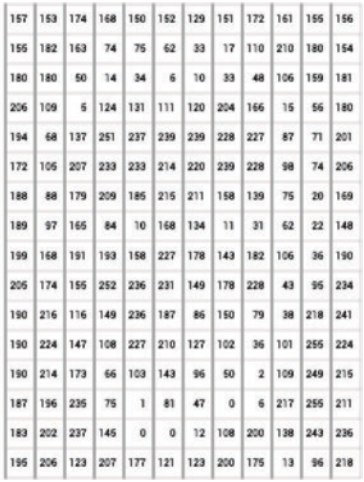


What is an Image – 2D convolution

- Pixel as data sample in 3D x,y,z (image depth)

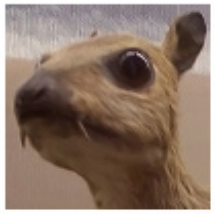






- 4D digital video pixel value change over time
- 2D convolution – manipulation of individual pixels in relation to surrounding pixels using a kernel

Input image



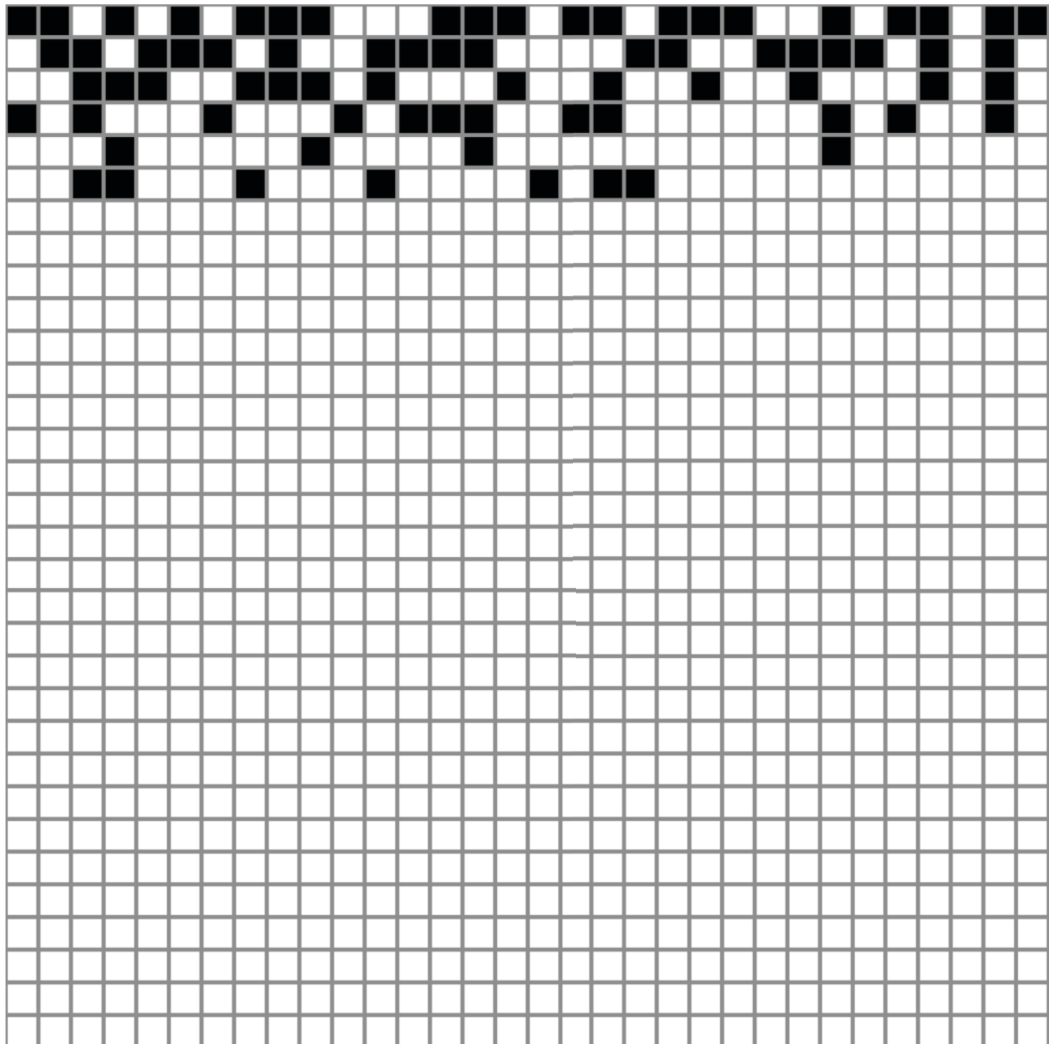
Convolution Kernel

$$\begin{bmatrix} -1 & -1 & -1 \\ -1 & 8 & -1 \\ -1 & -1 & -1 \end{bmatrix}$$

Feature map

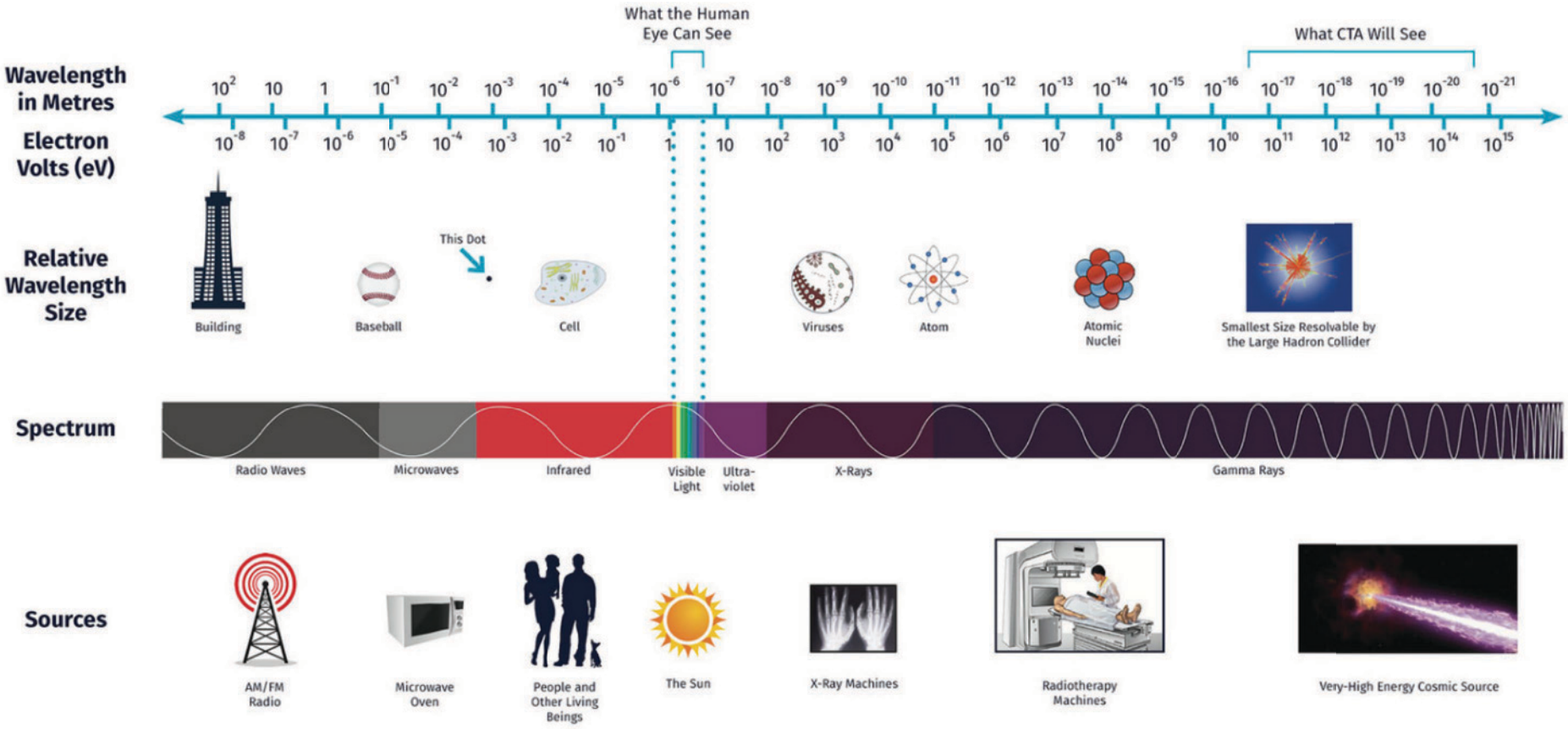
What is an Image – The digital image is finite

- http://numeral.com/appletsoftware/eicon.html



What is an Image – Vision as Sensing System

- Electro-magnetic spectrum



What is an Image – Machine Vision as a Sensing System

- Machine vision as an extension of human vision

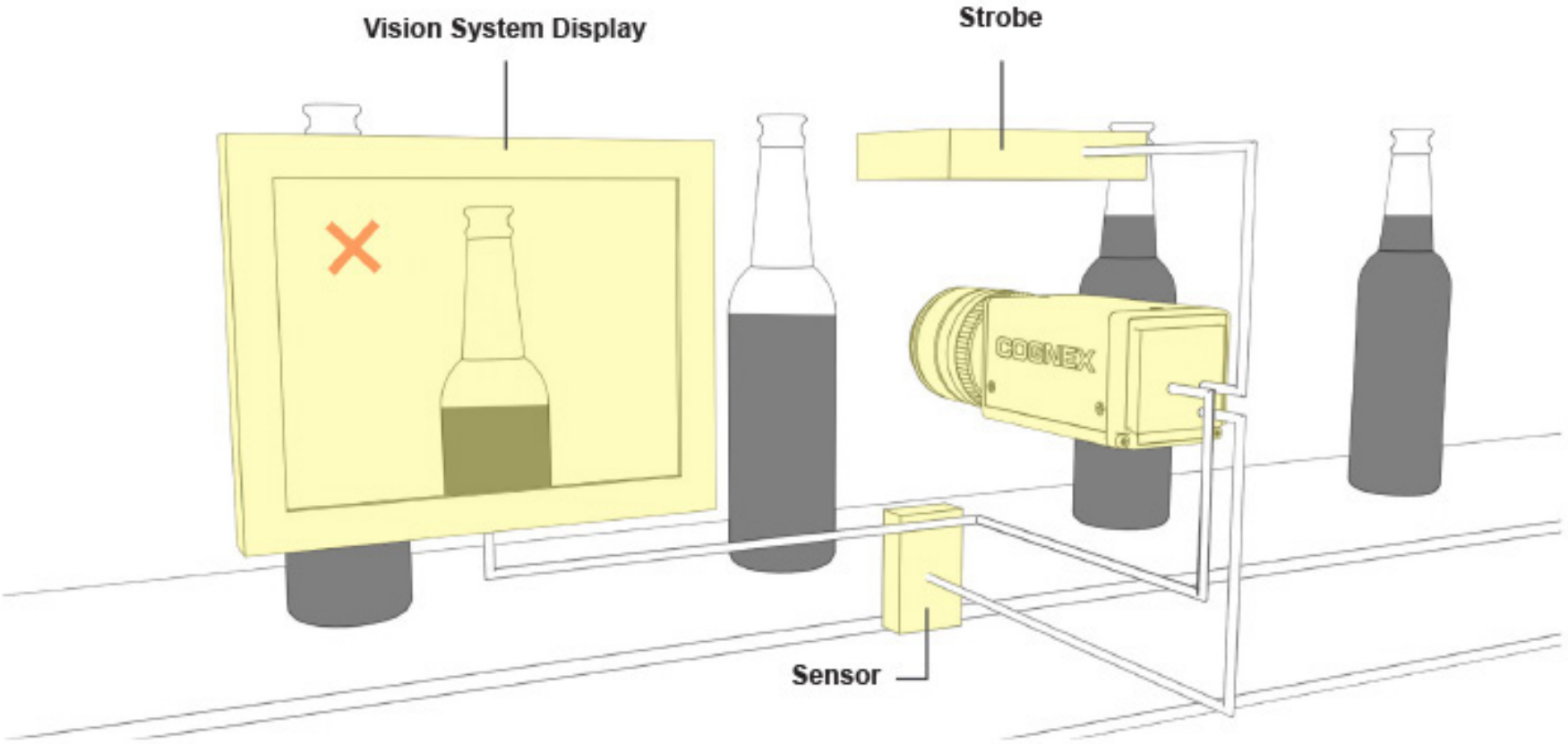


Figure 1. Bottle fill-level inspection example
The fill-level inspection system in this example permits only two possible responses, which characterizes it as a binary system:

1. Pass if the product is good
2. Fail if the product is bad.

What is an Image – Syntax of the Image

- Peirces' sign – signifier to signified
  - Symbol = Rose is a symbolic, culture defined relationship
  - Index = points to as in smoke is an index of fire
  - Icon = analogous representation, where the sign looks like the ..

What is an Image – Syntax of the Image

- Rhetoric of the Image, Roland Barthes
  - Coded iconic
  - Non-coded iconic
  - Text label as anchorage

What is an Image – Time, Motion, Space

- Etienne Jules Marey
- Eadweard Muybridge
- Harold Edgerton / Berenice Abbott
- Fluid Dynamics – visualize how data moves in space
- Blade Runner Esper Machine
- Ramesh Raskar Camera Culture

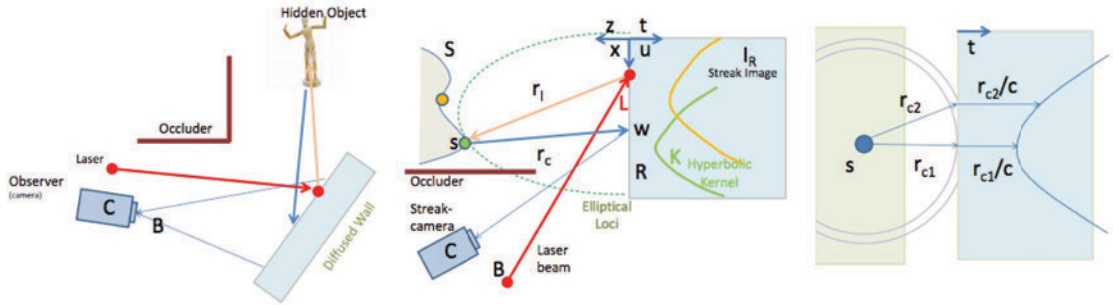


Fig. 1. Forward Model. (Left) The laser illuminates the surface S and each point $s \in S$ generates a energy front. The spherical energy front contributes to a hyperbola in the space-time streak photo, I_R. (Right) Spherical energy fronts propagating from a point create a hyperbolic space-time curve in streak photo.

To be continued…