

COGNITIVE THEORY IN RELATION TO THE ACT OF DRAWING IN ELECTRONICALLY GENERATED PROGRAMS

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ABSTRACT: Visual perception processes in sequential samples or fixated forms. Therefore, if we are to achieve unified perceptions there must be an integration of visual input over time. These sensations are not rich enough to mediate perception, we as perceivers must add to them.

The elaboration of sensations involve inferential processes, semantic, semiotic and metaphorical associations, utilizing memory, habit, etc.

This paper forms a basis for looking at these inputs as abstractions and how this enables a better understanding of:

Cognition, visual and computational perception

Computational descriptive rules

Constructivist machine vision programs

uses of Cognitive and visual theories within the mechanics of drawing.

The examination expands towards exploring issues of presence and absence and the confusion of boundaries between inside and outside, hybridity, infiltration and dispersion, non-grounds and objects within.

KEYWORDS: Cognition, computers, perception, drawing.

1. INTRODUCTION

Unless otherwise stated the software used to illustrate and elucidate this paper is Adobe Photoshop 5.0

Perceptual images come direct from the environment. Optical neurones in our retina are stimulated by the physical environment which in turn generate complex electrical signals to our brain. Our visual perception processes in sequential samples or fixated forms. If we are to achieve unified perceptions there must be an integration of visual input over time. As these sensations are not rich enough to the mediate perception, we as perceivers must add to them. In order to make sense of the physical world the perceiver makes many assumptions, particularly those concerning speed, object identification, orientation and locomotion. *Mental images* are representations of the physical world, memorised and processed. Both perceptual and mental images can be imbibed in computational images and involve inferential processes, semantic, semiotic and metaphorical associations, utilizing memory and habit. This paper forms a basis for looking at these *inputs as abstractions* and how this enables a better understanding of:

Cognitive, visual and computational perception;

Computational descriptive rules and machine vision programs



uses of Cognitive and visual theories within the mechanics of drawing.

The focus of the investigation will be:

- * how, that which is *abstract, i.e. the theoretical consideration of something*, is able to become concrete with examples. McCullough sees abstraction not just as a token by which one thing, image, or symbol represents others, but as a higher level *schematization*. He defines visual thinking as the use of images to generate ideas and knowledge plus the use of abstractive grasp to detect patterns and identities in images. (McCullough, 1996 p.37). The important point here is that process of abstraction in itself greatly increases the range of options investigated.
- * the continuous operation in digital media of *Parametric* modelling¹. The factors that form the operation and that define the conditions of the act of drawing in electronically generated programs. It will outline the aspects and scope of particular processes.

1.1 Parameters: Visual semiotics

“Visual modality is expressed by configurations of degrees to which specific image parameters are articulated.

Degrees of the *articulation of detail* form a scale which ranges from the simplest line drawing to the sharpest and most finely grained photograph.

Degrees of *articulation of the background* range from zero articulation, as when something is shown against a white or black background, via lightly sketched in backgrounds, to backgrounds shown in maximally sharp detail with many degrees of background articulation in between.

Degrees of *colour saturation* range from the absence of saturation (black and white) to the use of maximally saturated colours.

Degrees of *colour modulation* range from the use of flat, unmodulated colour to the representation of all the fine nuances and modulations of any given colour.

Degrees of *colour differentiation* range from monochrome to use of a full palette of diverse colours.

Degrees of *depth articulation* range from the absence of any representation of a depth to a maximally deep (‘fish eye’) perspective, with other options, such a simple overlapping or isometric perspective (perspective without vanishing points in between).

¹ Parametric modelling is an operation in digital media .Other continuous operations are:

Image processing: tonal corrections, layered compositions

Paint: finely controlled brushstrokes

Illustration: drawing curves

Page layout: placing elements

2D animation: placing elements and transitions

Mapping: rapid iterative(repetition) queries

Geometric modelling: position scale, alignment

Sketch modelling: geometric transformations

Parametric:(a factor that determines a range of options/variations) modelling

Rapid prototyping: iterative fabrications

3D object language: navigating generic form

Rendering: adjusting lights and cameras

3d animation: path and transition control

Digital video: cueing elements, editing orchestrations

Hypermedia; following associative trails

from *Abstracting Craft* p. 297.

Degrees of the *articulation of light and shade* range from zero to the articulation of the maximum number of degrees of 'depth' of shade, with options such as simple hatching in between.

Degrees of the *articulation of tone* range from the absence of any tonal gradation to just two shades of tonal gradation, black and white (or a light and a dark version of another colour)' (Van Leeuwen, 1999: p.2).

By applying these qualities of semiotic investigation to the image parameters within the operations, tools and conditions of Photoshop 5.0 the range of modality variances and options are greatly increased.

Degrees of the *articulation of detail*: vector and raster images: *vector* :mathematically defined lines and curves. *raster* : pixel squares in grids, groups of pixels are edited. (resolution dependent).

Degrees of *articulation of the background*: *layers*: masks-applying filters, blending modes, blending images, definitions, duplicating.

Degrees of *colour saturation*: adjusting with Hue/Saturation, sponge tool, adjusting with Variations decreasing, definition

Degrees of *colour modulation*: *gradient tool*, filters.

Degrees of *colour differentiation*: *mathematically defined*: *models*: hue, saturation and brightness (HSB); red, green, and blue (RGB); cyan, magenta, yellow and black (CMYK); and CIE Lab (device dependant).

Degrees of *depth articulation*: *layers* ; adding mask, backgrounds, applying filters, blending modes and ranges, converting backgrounds, flattening, target, layers and floating selections.

Degrees of the *articulation of light and shade*: *Filters*; lighting effects.

Degrees of the *articulation of tone*: *image adjust*; brightness/contrast.

2. COGNITION, VISUAL AND COMPUTATIONAL PERCEPTION

It is generally accepted that with the appropriate software it is possible for the computer to replicate realism with convincingly accurate images. Unfortunately, because of the overuse of few programs most realistic images in computer programs appear to be of much a sameness (Van Leeuwen, 2000).

In the act of looking the low level visual mechanism searches and scans the visual scene for regions of interest. Indicators from within an image can then be taken and used by other mental processes. These include mental processes such as verbal thought and commands for hand drawing manipulations. 'Ulric Neisser used the term 'focal attention' to distinguish such limited capacity sequential inspection processes from other 'preattentive' processes'.²

2.1 Symbolic descriptions

Marr's theory involves a number of distinct representations each of which is a *symbolic description* of some aspects of information carried within the retinal image. The psychologist Marr proposed that this marked the beginning of a series of processing stages, which measure the intensity of light as it is perceived from each object point. Although operating independently, each of the stages is dependant on input from the previous stage. *Grey Level Description*: Only monochromatic images are considered here, with each pixel representing the intensity of light from black through to white. The simple cells are not feature-detectors,

²Fish and Scrivener,(1998) Amplifying the Mind's Eye: Sketching and Visual Cognition .p 120.

but are measuring devices. The amalgamation of multiple blurred images (zero crossings) within and between the channels leads to the generation of the segment's terminations and little blobs and bars. Once a zero crossing segment is located in each channel they can be crossed referenced with other channels using the 'spatial coincidence assumption'. *Raw primal sketch*: The edge segments sketch can, in very general terms, be grouped together to reveal the contours such as those formed where one of the edges occludes another object and the contours of internal in a raw primal regions. *Full primal sketch*: groups some of these outline structures of objects into images primitives. Algorithms give more importance to grouping's which lead to smooth or closed contours which are significant in terms of describing objects This is reminiscent of the Gestalt principles of proximity, similarity and continuity This set of prescribed laws can describe what types of perceptual structures can be systematically evoked particular types of pattern. The use of these principles is not a single unified stage but a series of repeated sub stages. "However there is ample evidence that the visual nerve fibres are arranged in patterns that constrain their function"(Gregory, 1996). Notwithstanding this, the principal of explicit naming in order to manipulate described or reason about an object enabling the computer to give 'it' a name is one the foundations of computational psychology theories. The value of explicit naming, regions lines etc., is that once a label has named an entity it can be used repeatedly in application. *Recognising Objects as coherent independent structures* The 2.5D sketch may contain information about the layout of an object in it's space: identifying the object's distance from surrounding objects and the observer. Processing modules via stereopsis, shape from shading etc. is contrary to proving that the representation of the visible surfaces which are coded from the current viewpoint. It is the analysis of certain properties of visual stimuli, such as the detection and grouping, stereopsis, shapes and shading that operate a relatively independent processing module. The 2.5D sketch also holds products of earlier visual processing from one instant to the next. The recognition of an object may also depend on it's surrounding environment, and its sensory context.(Wade,1991).

3. MACHINE VISION PROGRAMS

The *interpretation of pictures using three-dimensional objects* was first attempted by Guzman in 1969. His computer program SEE takes its input from line drawings of the simple surfaces of *planar* polyhedra that have been pre-processed into a symbolic or schematic form. The programme begins by searching for common joint types within the pictures. The local cues concentrate on picture junctions which belong to the same physical object. There are eight different classes of junctions. Each separate junction provides one bit of evidence that makes the adjoining planes a part of the same, and then it uses these local hypotheses as a basis for computing a globally consistent perception.

Minsky and Papert suggested that: the development and uses of such computational description rules are a possible basis for proposing that human perception might be descriptive or symbolic. Minsky envisioned the Frames theory as "complex data structures with propositional and procedural components"¹ Frames hold the typical structure of a class of objects. These can be applied to pictorial examples of objects and make perceptual descriptions of them. The hierarchical structure of a Frame represents, for example, the prototype room which holds prototypic walls, these in turn hold knowledge of expected windows or doors (Mc Arthur,1982).

4. COGNITIVE AND VISUAL THEORIES WITHIN THE MECHANICS OF DRAWING

Sketches and drawing.

A sketch has different attributes to a drawing. Sketches are often accompanied by written additional information whereas drawings are complete as visual statements. Sketched lines are deliberately drawn hazy and obscure allowing for much more serendipity of interpretation and conscious and subconscious, play of our imagination. Fish and Scrivener 'postulate that sketches are records of a sequence of attentive acts combining information from our eyes with images generated from our memory.'³ Drawings are definitive precision statements, following the precepts laid out in predetermined, but are often re-evaluated as an on-going schema. The drawing schema is a representation of a plan or theory, an outline or model, that will determine which aspects we take into consideration during the act of drawing. It is a system of expression that is adaptable to different thought processes, ideas, ideals and modes. The quality of communication of these *abstractions* is dependent on the clarity of aims within the *schema* itself.

4.1 Schema:

Perceptual image: drawing model

A legal transformation system for a *Serpentination* drawing *schema* is:

a fixed-viewpoint;

there is spiral rotational motion which articulates the front and back;

the front and back are seen simultaneously;

the presumed integrity of the anatomical figure is maintained.

4.2 Cannonic:

Mental image: drawing model

Cannonic drawings are mental representations which are universal. They are invariably simple outline drawings drawn from a flat-on or 45 degree angle view point. Most drawings are culturally influenced. The amount of detail included is a personal, subjective embellishment. There are many similarities between cannonic images and modern iconic signs, cross-referrals and influences can be seen in international road signs, airport information and computer software icons, etc.

4.1 Propositional representational drawings:

Mental image: drawing model

Propositional representational drawings represent nouns and verbs as sequential narrative actions taking place over a time. These drawings are complicated, possibly, because of the need for specific naming of objects and the actions to or of these objects in an event. They often rely on simple directional drawn lines and highly illustrative images.

Examples:

A curtain blowing in the wind;

A rapid flowing stream;

Closing doors.

³ Fish and Scrivener, (1998) *Amplifying the Mind's Eye: Sketching and Visual Cognition*

5. CONCLUSION

In his description of drawing David Tomas says: ‘The sensuality of a practice---a certain primitive ‘know-how (de Certeau, 72)---that unites eye, hand and pencil in a common activity as a personal, private and tactile experience: the contact and pressure between the graphite and paper whereby friction and texture engender the quality and status of a particular mark. In exceptional circumstances (one thinks of Michelangelo’s drawings of the crucifixion) these marks become ‘grainy’ with a certain ‘materiality of the body speaking its mother tongue’ (Barthes, 1970). This sense and lack of materiality on the computer screen is very problematical in digital images. Given the haptic and heuristic processes of using a mouse or stylus can the inevitable gaps of memory and loss of continuity of thought ever compete with the immediacy of a pencil drawing ? Deanna Petherbridge succinctly comments: “...benighted students ... who have trundled a computer into the drawing studio and thought they were making a break-through in learning to draw directly from the body with a mouse or pad on to the screen”⁴.

Maybe drawing with the computer requires a different approach. “If no existing mode of thinking provides a model... There may be modes of thinking to which no known realisation has so far been found to approximate” (Bion, 1973). This examination now expands towards exploring issues of presence and absence and the confusion of boundaries between inside and outside, hybridity, infiltration and dispersion, non-grounds and objects within.

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⁴ Computers and Art (1999) mailbase