THE DIGITAL SKETCH WORKSHOP:
A CORE COURSE IN DESIGN WITH COMPUTATION

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ABSTRACT
This paper summarizes DIGITAL SKETCH, a workshop that took place over the course of two weeks in September 1998 at Designskolen Kolding, Denmark. DIGITAL SKETCH was an attempt to create a foundation course in design for the digital medium for students with strong visual design skills, but little to no computer experience. Teaching design on computers is commonly thought of as detailing the current version of the latest commercial software. As long as this is the case, design on computers will (quite rightfully) continue to get little respect from those designers using more traditional design methods. How can we find the "core" of this medium when faced with the constant onslaught of operating system upgrades and version 11.2 of software Y83? For DIGITAL SKETCH, we tried to demystify the process of controlling the computer. In this workshop we examined the meanings of the term "sketch" as it applies to the design process on the computer. Our hope was that by revealing some of the unique characteristics of the digital medium, we might develop new design processes in tune with this medium.
INTRODUCTION: TOOL OR MEDIUM
Is the computer a tool for making design or a medium for design? Recently a number of researchers have proposed that the computer may be considered a medium for design [Bermudez 1998: 11]. If this is the case, what are the defining characteristics of this medium?

It is interesting that despite the ever-prevalent monitor display, the computer medium is not limited to the cathode ray tube. Computation is a separate realm that may or may not be connected to a monitor. Its aesthetic may or may not be visual.

It matters not that a computer be binary or even electrical. If a computer were made entirely of analog mechanical parts, it would still add, subtract, multiply, divide. Amazing the power, mythology, and complexity born of such mind-numbingly simple building blocks.

What is a computer? A process perhaps, a connection of communicating elements. Given this definition, then static schematics, flow charts, or a recipe for pasta may be more connected to the digital design than an AutoCAD animation.

History has shown that work in emerging media first adopts the concepts and content of preexisting mediums before entirely new work based in and of the new medium arise. MIT's David Thorburn calls this phenomenon the "horseless buggy principle." In essence, the horseless buggy principle reminds us that there was no reason that the first motorized vehicles should look like horse-drawn carriages. The engineers of these early cars adopted forms from transportation that had come before as opposed to designing entirely new vehicles based around the design constraints of the new technology.

Thorburn points out that time and again as media arise, the first step in their acceptance is this assimilation of previous techniques. The first book printed on Gutenburg's printing press was a bible. Cervantes' Don Quixote defined a new literary tradition, the novel, which existed only because of the printing press and could not have come before it. The first films were essentially theatre plays shot as though one were a spectator in the audience. The computational medium is still in the early, adoptive phase of evolution. [Thorburn, 1998]

Thus far, design on computers has sought to mimic existing form-making techniques. We present text on a computer monitor as if it were paper. We present movies on a monitor as if it were a television. We design buildings on a computer as if it were a drafting table: plan, elevation, perspective, etc.

Teaching design on computers is commonly thought of as detailing the current version of the latest commercial software. As long as this is the case, design
on computers will (quite rightfully) continue to get little respect from those designers using more traditional design methods. How can we find the "core" of this medium when faced with the constant onslaught of operating system upgrades and version 11.2 of software Y83?

If a new digital design is to arise, we must develop teaching techniques in tune with the basic qualities of the medium. The new digital design is a simultaneous experience of vision, hearing and communication. We now have the ability to communicate interactively with constantly shifting pixels and audio speakers. However, to fully control these devices and create a new understanding of light, space and motion on the computer one must depart from pre-existing tools and preset interactions. This requires new methods to evolve to explain and express the new design process. This paper proposes one such method.

OVERVIEW
DIGITAL SKETCH was an attempt to create a foundation course in basic form-making for the digital medium for students with little to no computer experience. The workshop took place over the course of two weeks in September, 1998 at Designskolen Kolding, Denmark. Designskolen Kolding is a five-year college of design with departments in graphic design, illustration, fashion design, industrial design, ceramics, textile design, and interactive multimedia. Of the 14 students participating in the workshop, 10 were second-year design students and 4 were in the fourth year.

The goal of this workshop was to examine the design process on the computer: how the computer thinks and how, by understanding the computer's processes, we can teach the computer to do our bidding. We engaged in the core issues of the computer design process itself and tried to steer clear of interface fashion.

Our hope was that by revealing some of the unique characteristics of the digital medium, we might develop new design processes in tune with this medium.

For DIGITAL SKETCH, we tried to demystify the process of controlling the computer. We took as our underlying principle the idea that the computer medium may be thought of as a very stupid person.

If we tell another person what to do, we are in fact programming them. The computer works in a similar manner. It merely functions much faster. To use the computer as a means of interactive expression, we must learn how to phrase our desires very explicitly so that it does just what we want.

The master of design for the digital medium is able to clearly explain his or her design as process. Just as people remain the same through human generations, in all likelihood this method will hold true through computer generations (though the semantics may change).
“To sketch” means to draw, to plan, to play. Sketching occupies such a central place in the process of design that it has become almost sacred: sketching as the first artifact of an idea, sketching as the continuing refinement of an original concept, sketchbook as the artist’s constant companion, emotional repository, and biographer’s documentation. In the context of design, sketching is almost always assumed to take place with a pencil and paper or at least some physical process.

In the DIGITAL SKETCH workshop we studied the meanings of the term "sketch" as it applies to the design process on the computer:
1. We examined the transformation of the line as it leaves the physical medium and enters the digital medium
2. We analyzed the digital computer as a method for planning, testing, and playing with aesthetic concepts

WORK
Physical Process
For the first assignment, the students were asked to make a free sketch on paper. The students were required to use black ink and the primary visual element of the drawing should be the line. The main concerns of the sketch should be motion, interactivity, and process. If the sketch could spring to life on the page, how would one play with it? The students were asked to examine their own process in making the sketch.
Figure 1: First sketches with pen and paper by Espen Moe.
Figure 2: First sketches with pen and paper by Tania Hjorting.
Digital as Physical Process
For the second assignment, we enacted our hypothesis that the computer medium may be thought of as a very stupid person. The students were again asked to make a sketch on paper. However, this sketch must also include a text "recipe." The recipe should allow another person to redraw the sketch accurately. The recipe should assume that the reader knows nothing about drawing and has no knowledge beyond that which he or she is explicitly directed to do. In other words, “pick up the pen,” “put down the pen in the far lower right-hand corner of the paper,” or “draw a straight vertical line 2.5 centimeters long upwards” would be considered within the grasp of the reader of the text recipe. “Draw tiger” would not. In other words, the students were required to not only come up with a composition, but to invent a semantic system for reconstructing the drawing.

As a means of presenting the finished assignments during the following class, we handed each completed recipe to a student unfamiliar with the final drawing. This student was then asked to go to a whiteboard and make a drawing by following the directions detailed in the recipe (without looking at the expected result).

The students expressed that this was a very challenging assignment. In many cases the constraints imposed by creating the text recipe led to a simplification of the final drawing when compared to the first free, physical sketches.

It is interesting to note that many of the text solutions used the same techniques as low-level computer code, such as memory, repetition, iteration, and mathematical operations. This occurred in spite of the fact that none of the students had any previous knowledge of computer programming. They reached these results out of necessity to explain their desires explicitly to another person. This may be seen as a type of validation of our original hypothesis concerning the nature of the computer medium.
Figure 3: Second sketch including text "recipe" by Espen Moe.

Figure 4: Second sketch including text "recipe" by Tania Hjorting
Digital Process
As a logical continuation of the previous assignment, we set about to create our own language for working with the computer. We used the commands developed in the previous exercise for describing a drawing to another person as the basis for the language. We first adopted a grid such as the one arranged by Tania (Figure 4). As several students had the command "draw line ..." of some kind in their recipes in the previous assignment, we chose this as our first command. A Macintosh application was constructed that could interpret our language.

The students entered their digital recipe in a text window in the DIGITAL SKETCH application environment. By clicking on the bar at the base of the text window, they could see the result of their recipe in the square, “drawing” window at the center of the screen. The “drawline” command takes four parameters corresponding to the horizontal and vertical positions of the beginning and end points of the line on the grid. In addition, our interpreter could understand the simple algebraic operations: addition, subtraction, multiplication, and division. Finally, by typing in an “x” or “y” as one of the parameters of the “drawline” command, the current horizontal or vertical position of the mouse would be substituted. In this way, by moving around the mouse the students could see the direct result of changing parameters on their drawing; the drawings then have the potential to bend and transform based upon a user's movements.

Figure 5: The DIGITAL SKETCH digital process application environment.

The students were asked to present a free expression on the computer using our language for the following day's class. Surprisingly, the students reported little apprehension typing in text as a method for sketching out their designs. When compared with the previous assignment, this process seemed much easier.

Over the course of the next three days, we appended several additional commands to our language, all of which were pulled from the text recipes from assignment 2: "draw circle," "fill circle," and "draw thick line." Aside from these
additions, the language remained fundamentally unchanged through the end of the workshop.

For the final assignment the students were asked to create a completed composition using our DIGITAL SKETCH language. The purpose of the two previous sketches was free exploration in the digital medium. In contrast, for this final sketch the students should demonstrate complete control over the set of commands they employ. Several students noted that the digital design process then began to feel like “math” when they were asked to understand the mathematical techniques they used. Prior to this stage, many of the students had inserted +, -, *, or / signs through trial and error, not caring about the numerical result but focussing instead on the affect these symbols had on their composition.

For their final presentations, the students crafted elegant, interactive compositions.

Figure 6: Snapshots from Espen Moe's final interactive composition.

Figure 7: Snapshots from Tania Hjorting's final interactive composition.

Figure 8: Snapshots from Claus Kristensen's final interactive composition.
TALKS
To frame the subject matter of the course and outline a conceptual base to the assigned projects, a series of talks were given:

Talk 1: Why Computer?
In this talk we introduce the fundamental question concerning creation for the digital medium: Why should one endeavor to create on the computer? Other, more traditional mediums for expression seem to work so well and have established theory, techniques and methodologies. What should we really concern ourselves with? Should we trust terms such as "interactivity," "multimedia," "new media," "virtual reality," etc.? Where can we find our joy in making for the digital medium?

Talk 2: Computer Construction
In this talk we concern ourselves with the physical construction of the computer medium. What is a computer in terms of its physical structure? We live in a physical world. How does the computer medium exist in our world? How can we communicate to it and how can it affect our senses?

Talk 3: Performing Machines
Interactive art was around long before the computer. Here we review some of the many artistic experiments in which machines communicate with one another and/or with an audience. In this way we might understand some of the basic possibilities and limitations of building performing machines.

Talk 4: Metaphysical Digital Medium
Biological signals are received, transmitted, amplified, or reduced by each species according to its senses. Man has both wide and limited facilities for accepting and transmitting signals and can learn a great number of signs by which he manages his day-to-day business. Man uses these signs to regulate his functioning and conduct. In addition, man has the unique ability to transform and reinterpret symbols into pictures, sounds, sculptures, and retransmit these symbols for further recognition by other humans. This may be thought of as "information processing," a capacity also shared by the man-made creation of computers. In this talk we review the history of information processing. [Kepes, 1966]

Talk 5: Processing Art
Since the dawn of the modern movement in the 1920's, artists have transformed information and processes into form. Many of these same artists sought to create works that could be mass-produced and still remain true to the original artist, clearly a task of utmost importance for creations on computers. In this talk we review a limited selection of these great works.

Talk 6: History of Computer Expression
It often seems that expression on computers is without a history. It appears to be so new. Yet the modern computer has been around for 30 years and artists and designers have attempted to make works on and for this machine for at least as long. How did we get to where we are today?
FUTURE EXTENSIONS
The DIGITAL SKETCH workshop is the foundation for a design methodology in tune with computation. From this beginning point we must explore all possible branches of expression related to the digital. We must develop a complete curriculum for understanding design in the digital medium.

One of the most challenging fields in the computational medium is the three-dimensional digital sketch. Here we make an initial attempt to surmount traditional approaches by transforming the two-dimensional sketches from the DIGITAL SKETCH workshop into three dimensions. This was accomplished by creating custom software in OpenGL that reads in the text files created during the course of the original, two-dimensional workshop and reconstructs these creations as interactive three-dimensional sculptures. The first of the images in Figure 9 is a snapshot from Espen Moe's final project. The other three are snapshots from the live, three-dimensional version of Espen's creation.

As with Espen's spider, in Figure 10 we have transformed Claus Kristensen's final project, 'Ping,' into a three-dimensional interactive construction.

In January 1999 a new workshop at Designskolen Kolding was held entitled "the digital/physical border." In this course we employed the same straightforward methodology as the DIGITAL SKETCH workshop, though in this case the medium was the interactive physical and sensory as opposed to purely interactive graphics. We built a series of "reactive spaces," full-scale, real spaces that reacted to a person or people mediated by a computer. Here we examined the input and output and attempted to develop a greater connection to the participant’s whole body, not just their eyes.
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REFERENCES