Sketching tablet built for industrial designers and their ideation workflow

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How will designers work in the future?

What tools will be available?

How do their tools influence the way they work?
Gesture based interfaces

Touch and surface display technology

Source: Corning Glass “A Day Made of Glass” (2012)
Predicted growth of mobile devices

Source: BI Intelligence, via www.businessinsider.com/the-future-of-mobile-deck-2012-3
Haptics market predicted to reach $13.8 billion by 2025

Source: Lux Research, Inc.
Ideation and sketch rendering

Source: dschool.stanford.edu
Sketch ideation is in a transitional phase

Wacom Cintiq 12wx

Paper app by 53 for Apple iPad
Industry context of sketching

**Client Demands**
- speed of delivery
- level of refinement
- interim presentations of renderings

**Ideation**

**Technology**
- growth (ubiquitous)
- speed
- new feature race
- style of rendering influenced by digital medium

**Design Process**
- convergence of analog and digital tools
- capabilities of one person
- tool accessibility
How are companies attempting to enhance the sketching experience?
Adobe DX Projects Mighty & Napoleon

Source: xd.adobe.com/mighty/notify.html
Autodesk Sketchbook Express Palm Rest

Positionable "dead area" to avoid unwanted palm drawing

Source: www.sketchbook.com
Wacom’s ExpressKeys

Source: wacom.com
What does it mean for an interface to be natural?
Digital Drawing Tape

Source: www.billbuxton.com/tapeDrawing.htm
How do people study Human Computer Interaction (HCI)?

How will I study the user experience of digital sketching?
Studies in HCI and NUI

Bimanual Activities

Body Mechanics

Gesture / Touch Input

Sensory Based

Stylus + Touch + Task

Mechanics, Sensory and Interface

Current Study

Task Centered Approach

Program Interface
AUTOS: A framework to rationalize human computer design and show how the four entities relate

The AUTOS tetrahedron

In my case...

**Industrial Designer**
(User)

- Duration
- Efficiency
- Immersion

**ID Agency, School, Firm**
(Organization)

- Industry Demands
- New Market Opportunities

**Wacom Tablet**
(Artifact)

**Sketch ideation, Rendering**
(Task)

- New Knowledge
- Skills / Techniques

**In my case...**
Grounded Theory Approach

Within HCI, the real issues are often not known before we start research, making it hard to define the variables necessary to do quantitative research.

Technology is rapidly changing—making it harder to abstract it from the context of use in order to study it.

How to best capture and understand the sketching experience?
Research methods in HCI

**Contextual Inquiry**
- Examining the act of sketching
- Contrasting interfaces between analog and digital methods

**Think aloud Protocol**
- Can provide a detailed view of the what the user is thinking
- Sufficient without having to use eye tracking

**Eye Tracking**
- Tracking gaze is not the focus of this study
- Used when a very fine level of detail is needed
- Used for timed task-to-task events
- Eye tracking alone can reveal the WHAT but cannot reveal the WHY
True point of view

GoPro Camera with head-mount
Role of a designer for Wacom

CINTIQ®

22HD touch Creative Pen Display

Wacom’s most advanced, pressure-sensitive pen combined with intuitive, multi-touch capabilities deliver an on-screen creation experience that’s so natural and seamless, it feels like an extension of your senses.

$2,499

☐ 22HD touch   ☐ 24HD touch

Buy Now
Study Participants

5 Expert Users
3 times a week, over 2+ years

5 Novice Users
Once a week, 1-2 years

Raleigh, NC
Charlotte, NC
Charlotte, NC
Raleigh, NC
Example Images

Sample sketches used in the 30 minute sketching session

30 minutes on paper...
30 minutes digitally...
Software of Choice

- Adobe Photoshop
- Autodesk Sketchbook Pro
- Autodesk Sketchbook Designer
- Corel Painter
ExpressKeys vs. Keyboard
(Tool Shortcuts)

Wacom built-in ExpressKeys

Keyboard
ANALOG CODES

**Sketching Actions**
100 Sketching
101 Erasing
102 Ghosting
103 Smudging
104 New Color
105 Setting Tool

**Tools**
200 Hard Pencil / Light Pen
201 Soft Pencil / Heavy Pen
202 Eraser
203 Straight Edge
204 French Curve
205 Ellipse Template
207 Marker

**View**
300 Lean In/Out
301 Moves/Rotate Page

**Non-Sketching Behavior**
600 Pausing
601 Looking for tools/switching tool
602 Flow Disruption
603 Answering Question/Commenting

DIGITAL CODES

**Sketching Actions**
110 Sketching/Applying to Can
111 Erasing/Deleting
112 Ghosting
113 Smudging
114 Adjust Color / Opacity
115 Adjust Tool Size / Softness / Angle (PS)
116 Copy/Paste
117 Adjusting Work / Selecting Work
118 Layer Select
119 Setting Tool

**Tools**
210 Pencil / Light Pen / Small Brush
211 Soft Pencil / Heavy Pen
212 Eraser
213 Airbrush / Soft Brush
214 Straight Edge
215 French Curve
216 Ellipse Tool
217 Shape Tool
218 Selection Tool / Lasso (PS) / Vector (SBD)
219 Paint Fill
220 Marker / Hard Brush

**View**
310 Zoom In/Out
311 Pan/Rotate Canvas
302 Rotate/Adjust Device

**Layer Management**
400 New Layer
401 Layer Management
402 Layer Opacity Adjustment

**Edits**
500 Undo
501 Redo

**Non-Sketching Behavior**
600 Pausing
601 Looking for tools/switching tool
602 Flow Disruption
603 Answering Question/Commenting
1 Minute of Sketching / 15 Distinct Tasks

= 1 Task every 4 seconds
Analog Count
Frequency of Occurring Activities
Analog Sum
Duration of Occurring Activities
Digital Count

Frequency of Occurring Activities

- Expert
- Novice
Digital Sum
Duration of Occurring Activities
Novice and experts equally value many of the same tools.

(In order of most used)

Pen/Pencil
Rotate/Move
Eraser
Layers
Undo
Zoom
The Timid Beginner

**Age:** 20

**Occupation:** ID Undergraduate Student

**Experience Level:** 1 year of ID sketching, 50 hours with Cintiq

**Software:** Sketchbook Designer

“Sketching digitally takes a little bit of the fear out of ideation.”
The “Do Everything” Designer

Age: 28
Occupation: Mid Level ID, hard and soft good products
Experience Level: 8 year of ID sketching, 200+ hours with Cintiq
Software: Photoshop

“I sketch on paper and use a Cintiq for layout, adding color and textures.”
Sketch Render Veteran

Age: 35  
Occupation: Senior ID, Consumer Product Corporation  
Experience Level: 12 year of ID sketching, 2000+ hours with Cintiq  
Software: Sketchbook Pro

“In the concept phase, I’ll spend 70% of my week sketching digitally.”
The application interface should enable users to...

- Practice efficient sketching workflow
- Easily access tools and functions
- Maximise productivity and control of the medium
Perception of software and hardware integration
Designers have quirks, hacks and workarounds.
Small clickable areas

Sketching Aid Controls

Pan, Zoom, Rotate

Tool Sliders
Poor Layer Feedback
SBD: Infinite Editability

Paper Sketch (Top)

vs.

Sketchbook Designer (Bottom)
“Look at that screen!”
Wacom Demo Day

Georgia Powers
Wacom representative

13” Cintiq Companion
• Android OS
• Touch Screen
• Portable Stand
It's touchscreen, but so what?

- Small interface buttons are better for pen input
- One handed pinch-zoom and rotate position is awkward and not precise
- Fixed Stand (No rotation)
“Now, let’s take a minute to talk about your problems. Please, take your time, I want all the juicy details.”
**SKETCH RESEARCH SLOW MUNCH**

2/22/14

- **Button Uierarchy**
  - No physical difference in keys

- **Secondary Hand Input Device**
  - Zoom switch
  - Hand tool setting
  - Connected with grip
  - Potential solutions
    - Multi-touch screen
    - Palm drawing

- **Collaboration Stand**

- **Sketching Software**
  - EXPRESS: Zoom/Max
  - As smart small also realized to the device & user interacting
  - In the office environment & multi-userization
  - Palette or tools that make the input possible (Pencil, pen + erasing)
  - Other devices & software

- **Usable Tool setting off**
  - Flip Ring adaptive control

- **Click and Drag tools & Tool Surfaces**
  - Could be "iPencase" tool with custom settings
  - Second device, digital sketchbook

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- **Changing to settings on the fly**
- Tool settings: Round, Square

- **Rotation/Pan**
  - Just like touch screen / Paper
  - Pen lock out

- **Pinterest-type tool bubble**

- **Do designers still want physically express keys?**
  - How should they switch tools

- **Layer Management**
  - Hot keys to use current tool settings

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2/18/14

- **Constraint/Universe**
  - Multichannel: Volume
  - Multichannel: Volume

- **Sketching Tools**
  - Taper vs. Roundpoint tool

- **Sketching Tools**
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2/21/14

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Current Wacom Buttons

2010 Cintiq 22HD

2014 Cintiq on 22HD
Eleven (airplane) knob shapes distinguishable by touch alone.

Manipulating the position with the pen is quite natural and it works well. But what if we style it as a physical button? Sketchbook does digital pan/zoom/rotate and physical spin analogy. Maybe too much intuitively. Customizable color labels (LED lights). Move/pin = zoom, flip to = normal view (rotate). Move not so natural.

Button + Physical Stylus Design

Zoom In/Out

Rotate

Pan/Move
Hardware interface should compliment the software interface:

- Unique button feel
- Pre-programmed to the interface
- Limited to most frequent tools
- Allow the hands to work together
Final Design Criteria

**Software Interface**
- Simple
- Efficient
- Pen Gestural

**Hardware Interface**
- Unique Buttons
- Localized
- Essentials

**Form**
- Wireless
- Semi-portable
- Thinner, Lighter

**Stylus**
- Low Profile Button
- Pen and Chisel Tip
Low Profile Buttons

4-Way Button
View, Move Canvas

5-Way Button
Tools, Colors, Layers, Aids, Undo

22" Display

Marker Tip

Low Profile Buttons

Pen Tip
Sketching Aids
Sketching Aids
Sketching Aids
Introducing the new

CINTIQ

ID sketch

The Cintiq® IDsketch is the first graphics tablet designed for industrial designers’ ideation workflow and sketching style. Featuring Wacom’s new innovative sketching application, finally, true compatibility of hardware and software can be experienced in one complete design tool.
Thank you.

Committee Chair
Dr. Sharon Joines

Committee Member
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The Design Firms
Laut Design
Husqvarna
Bolt Group

Student Participants