Connecting the Dots – Balancing Humans and Computers

Shengdong Zhao
http://www.shengdongzhao.com
**How to achieve balance?**

- Who is good at what?
- How to design?
- How to combine?

…”
What do humans do well?

• Sense low level stimuli
• Pattern recognition
• Inductive reasoning
• Multiple strategies
• Adapting
• “Hard and fuzzy things”, paraphrasing George Miller
What do computers do well?

- Counting and measuring
- Accurate storage and recall
- Rapid and consistent responses
- Data processing/calculation
- Repetitive actions
- “Simple and sharply defined things” again paraphrasing George Miller
How to achieve balance?

At a high level, let humans do what humans do well and let computers do what computers do well.
Current Status

Unoptimized

Solution(s)

Computer tasks

Interaction

Human tasks

Unoptimized

Imbalanced
Vignette

Kazi Rubaiat, Takeo Igarashi, Shengdong Zhao, Richard Davis

CHI2012
Motivation
Pen and Ink Illustration Workflow

Step 1

Step 2

Step 3

Step 4

Step 5
Current Processes

Physical drawing with pencil

Digital drawing with software
Texture synthesis in Illustrator
Rebalanced Vignette System

- An interactive system for pen-and-ink illustrations
  - Accelerating the creation of textures from user defined example strokes
  - Preserves traditional pen-and-ink illustration workflow
  - Preserve the original style and signature of individual artists
Vignette Video

• http://www.youtube.com/watch?v=R4NnYNsOcio
Draco

Kazi Rubaiat, Fanny Chevalier, Tovi Grossman, Shengdong Zhao, George Fitzmaurice
CHI2014
Draco Video

• http://www.youtube.com/watch?v=l84YK1_ytks
SandCanvas

Rubaiat Habib, Chris Chua, Shengdong Zhao  Richard Davis, Low Kok Lim

ACM CHI 2011, Honorable Mentioned Award
An Emerging Art Form

About 2.7 million views
-snapshot on Jan 2nd, 2011

Over 17 million views
-snapshot on Jan 2nd, 2011

About 2.5 million views
-snapshot on Jan 2nd, 2011
Sand Animation History

Early sand drawing
• Sand drawing at ni-Vanuatu

Modern sand animation
• Stop motion animation
  – Caroline Leaf (1968)
• Live performance
  – Ferenc Cako (1982)
Unique Advantages

• Unique drawing material (sand)
  – Transient, fluid, yet still controllable
  – Economical to correct
  – Seamless transition between foreground/background
  – Uniformed sandy texture

• Unique interaction method (hand)
  – Convenient
  – Versatile
  – Quick to perform
Unique Art Medium

Sand animation produces “alive” drawings with the composing particles “settle by chance around the features” in a single texture (a sandy feel).

The sand animation drawing process is “fluid”, with “high speed execution”, using “sets of transparencies” and “superposition”, which “forms spectacular drawings in transformation which excite imagination, surprise, allow abrupt changes of tone and images unforeseen.”

By David Myriam
Challenges of Sand Animation

• Setup and maintenance cost (space, special sand)
• The drawback of being transient
• The drawback of having only a single texture
• The drawback of fluidity
Phoenix Tears
Stop Animation Sand Animation
by Alec Ace
Quotes from the Artist

• “Anyone who has done animation can tell you what a long and tedious process it is. However, stop motion with sand takes it to a whole new level”

• “Don't get me wrong, there were times when the sand made it easier and more fluid.. but the majority of it was going over an edge again and again to get it right. ”

• “Generally I would spend about an hour composing each scene before I started animating. Each frame would take anywhere between 5 mins to 1 hour depending on the complexity of the scene.”

• To get any decent amount of work done, I stayed in the studio working for 12 hours straight, usually two or three nights per week in succession.

• “140 hours”

http://alecaceill.blogspot.com/2010_07_01_archive.html
Current Processes

Physical animation on sand
Rebalanced SandCanvas System

• An interactive system for Sand Animation
  – Maintain the look and workflow of traditional Sand Animation
    • However, we lost the haptic feel of manipulating the sand
  – Provide enhanced digital capabilities to make Sand Animation a more powerful media
SandCanvas Video

- http://www.youtube.com/watch?v=NQ9FERXWWs
Magic Cards

Shengdong Zhao, Koichi Nakamura, Kentaro Ishii, Takeo Igarashi
ACM CHI 2009
### Average Time on Housework Per Week

<table>
<thead>
<tr>
<th></th>
<th>Married</th>
<th>Divorced</th>
<th>Separated</th>
<th>Widowed</th>
<th>Never Married</th>
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</thead>
<tbody>
<tr>
<td><strong>Women</strong></td>
<td>29.83 hrs</td>
<td>27.80 hrs</td>
<td></td>
<td>21.17 hrs</td>
<td></td>
</tr>
<tr>
<td><strong>Men</strong></td>
<td>17.67 hrs</td>
<td>21.53 hrs</td>
<td></td>
<td>17.83 hrs</td>
<td></td>
</tr>
</tbody>
</table>

*Source: National Survey of Families and Households*
Domestic Robots can Help, but ...

Technology:

Robots technologies are not well defined, and may change often.
Current Processes

Human users

Interface

Housework tasks

Robot technology
Rebalancing

Principle of Information Hiding
– Hiding "difficult design decisions or design decisions which are likely to change" (David Parnas, 1972)

Human users

Interface

Housework tasks
(Long history relatively stable)

Robot technology
(Change frequently)
Rebalancing

Principle of Information Hiding
- Hiding "difficult design decisions or design decisions which are likely to change" (David Parnas, 1972)

Solution: Only expose “tasks” to users
Magic Cards Video

Guest Star: C3PO

http://www.youtube.com/watch?v=tMeGjo5anbA
Looking into the future

- **Tasks division optimized**
  - Optimize performance with computer tasks \((CS \text{ minus } HCl)\)
  - Optimize performance with human tasks \((HCI)\)

- **Tasks division unoptimized**
  - Shifting tasks from one side to another & re-define the interaction in between
Looking into the future
How to achieve balance?

At a high level,
let humans do what humans do well
and let computers do
what computers do well

+ transform more human tasks to
computer tasks
Concluding Notes

The Good News

• HCI has a bright future!
• However, it requires deep knowledge of both human & computer + holistic thinking

Research opportunities: look for domains that are most imbalanced

• Creativity
• Design
• Programming
Acknowledgement

The credit goes to

• Students

• NUS School of Computing
Thank You!