Design Everything by Yourself

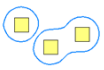
User interfaces for
graphics, CAD modeling, and robots

Takeo Igarashi
The University of Tokyo
JST Erato Igarashi Design Interface Project

Self Introduction

Computer Graphics
Enrich visual communication

User Interface
Making computers easier to use



Design Everything by Yourself

User interfaces for
graphics, CAD modeling, and robots

JST ERATO
Igarashi Design Interface Project
2008-2013

Research Goal

"Help people **design** things by themselves"

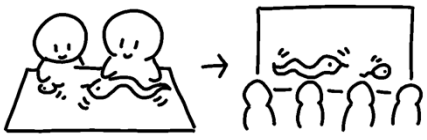
Graphics (3D and animation)
Physical Objects (bags, furniture)
Robot behaviors

Develop **Interaction Techniques** to achieve this.

Research Areas

1. Designing Digital Media
2. Designing Real World Objects
3. Designing Robot Behaviors

1. Designing Digital Media

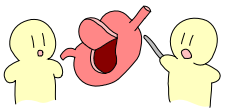


Help people to create
3D Graphics and 2D Animation.

Goal

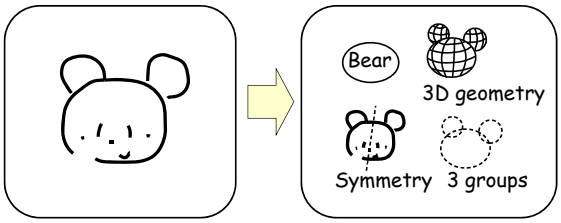
Dedicated construction by experts for later presentation

Instant construction by novices for live communication



Our Approach

Implementing Visual Intelligence



Graphical Representations

Semantics / Structure

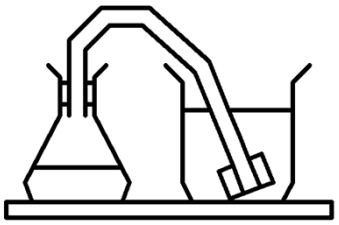
Pegasus:

a Drawing Editor for Rapid Geometric Design

Appeared at UIST'97 & CHI'98

Takeo Igarashi, Sachiko Kawachiya, Satoshi Matusoka, Hidehiko Tanaka

Problem

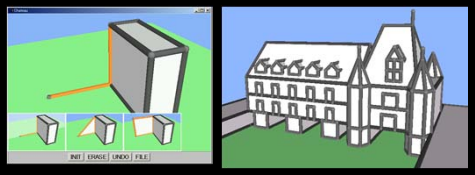


How do you draw this?

pegasus

UIST 01

Chateau: a suggestive interface for 3D modeling

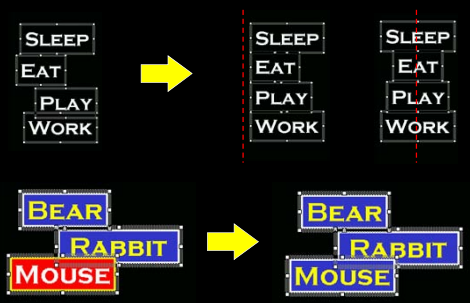


User interface using hints and suggestions

Chateau

Future Work

Other applications (e.g. PowerPoint)

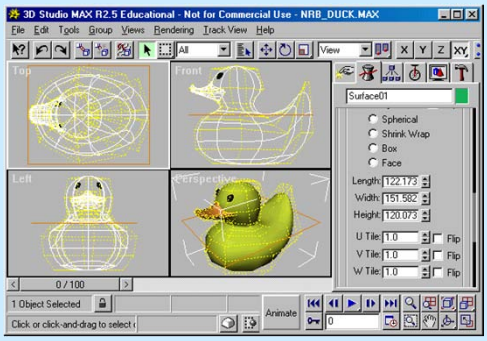


SIGGRAPH 99
Impact paper

Teddy:
A Sketching Interface for 3D Freeform Design

Takeo Igarashi
Satoshi Matsuoka
Hidehiko Tanaka

3D modeling is difficult

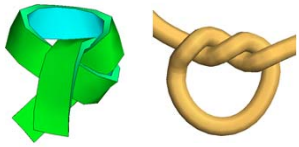


Sketching is easy!

teddy

SIGGRAPH 2010

Apparent Layer Operations for the Manipulation of Deformable Objects

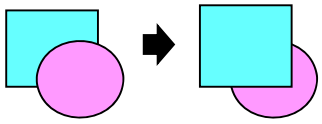


Takeo Igarashi Jun Mitani

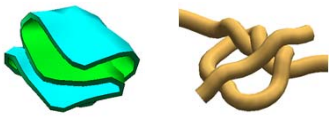
JST ERATO Igarashi Design Interface Project

In this work, we introduce

layer operations



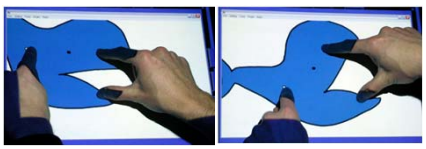
for 3D modeling



mesh

SIGGRAPH2005

As-Rigid-As-Possible Shape Manipulation



Takeo Igarashi, Tomer Moscovich, John F. Hughes

The University of Tokyo / Brown University

Goal

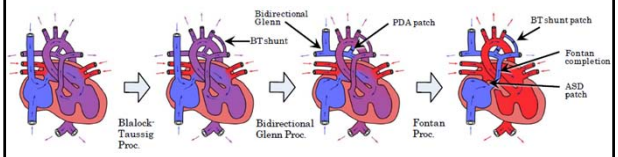
Move and deform 2D shapes as if manipulating real objects

rigid

SIGGRAPH Asia 2011

Sketch-based Procedural Illustration of Fluid Systems

B. Zhu, N. Umetani, T. Igarashi,
M. Iwata, R. Haraguchi, K. Nakazawa



Describe complicated flow using fluid simulation.
Mainly designed for infant heart disease.

fluid

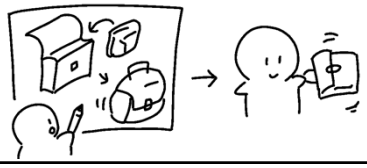
Research Areas

1. Designing Digital Media
2. Designing Real World Objects
3. Designing Robot Behaviors

2.Designing Realworld Object

Farewell to Mass Production and Consumption

"Design Your Own Artifacts by Yourself"



Enabling Technologies

- Fast computers (real time simulation)
- The internet
- Personal fabrication machines

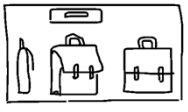
3D printer

Milling machine

Laser cutter

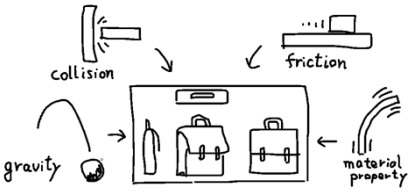
Our Approach

Integrate physical simulation into geometric modeling (CAD)



Our Approach

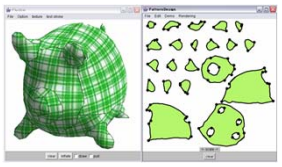
Integrate physical simulation into geometric modeling (CAD)



SIGGRAPH 2007

Plushie: An Interactive Design System for Plush Toys

Yuki Mori, Takeo Igarashi



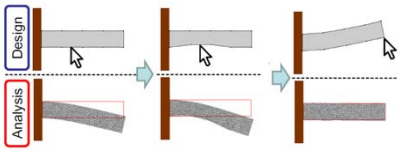
Sketch → 2D pattern → Simulation → Real Toy

plushie.mp4

CG&A 2010

Responsive FEM for Interactive Design

With N. Umetani, K. Takayama, J. Mitani



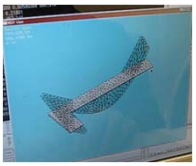
- The system continuously runs FEM analysis.
- The user can edit geometry while seeing the simulation result.

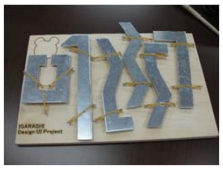
.delfem.mp4

NIME 2010

Metallophone Design with FEM

With N. Umetani, K. Takayama, J. Mitani



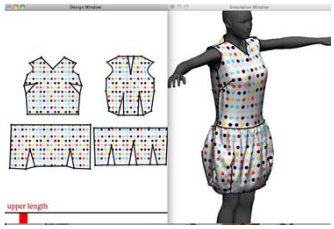


- The user designs a metallophone
- The system computes the tone in real time.

.delfem.mp4

Garment Design with Real-time Cloth Simulation

with N. Umetani, E. Grinspun



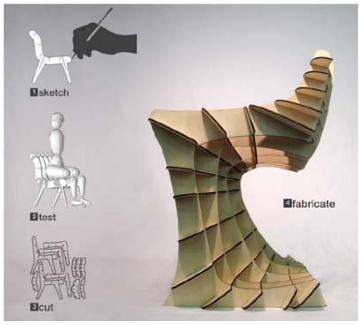
- 3D simulation results changes as the user edits the 2D pattern.

cloth

TEI 2011

Sketch Chair

with Greg Saul

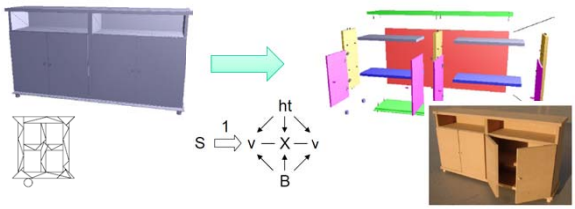


chair
chair.mov

SIGGRAPH 2011

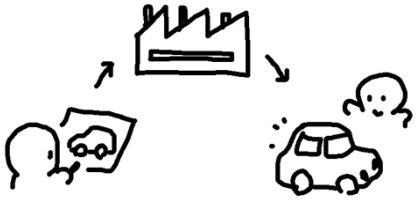
Converting 3D Furniture Models to Fabricatable Parts and Connectors

with M. Lau, A. Ohgawara, J. Mitani



Analyze 3D surface model with a grammar and obtain structure necessary for fabrication

Future Vision



Design Everything !
Furniture, Clothing, Car, House…

Research Areas

1. Designing Digital Media
2. Designing Real World Objects
3. Designing Robot Behaviors

3. Designing Robot Behaviors

User Interface for Robots (embodied Computer)

Control and program real world activities

3. Designing Robot Behaviors

User Interface for Robots (embodied Computer)

Control and program real world activities

Our Approach

Introducing visual interaction

Typical Approach
- Speech or gesture (too abstract)
- Gamepad (too detailed)

Our Approach

Introducing visual interaction

Typical Approach
- Speech or gesture (too abstract)
- Gamepad (too detailed)

Our Approach
- GUI
- Sketch
- Augmented Reality
- Tangible User Interface

SIGGRAPH e-tech 2009

CRISTAL

Table-top Augmented Reality for Living Space

(collaboration with Michael Haller's group)

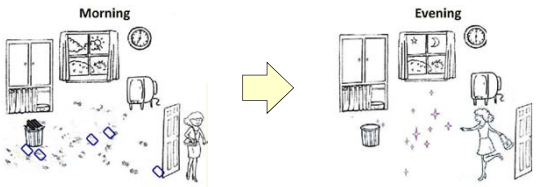
- Ceiling camera view appear on table top.
- The user controls by touching target appliances.

cristal.mp4

ACM CHI 2009

Magic Card

With Shengdong Zhao



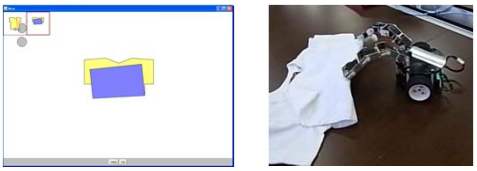
- The user puts instruction cards in the house
- The robot does the job while the user is out.

magiccard

SIGGRAPH e-tech 2009

Graphical Instruction for Robots

Yuta Sugiura, Daisuke Sakamoto



- The user folds a garment on the computer by dragging.
- The robot folds the garment accordingly.

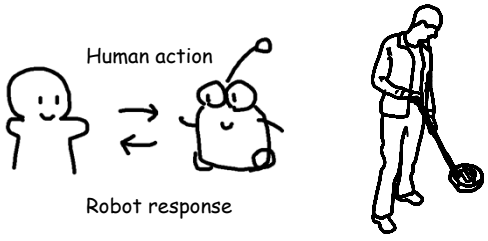
foldy video

IUI2012

Style by Demonstration:

Teaching Interactive Movement Style to Robots

James E Young, Kentaro Ishii, Takeo Igarashi, Ehud Sharlin



Problem: how to teach interactive, analog behavior?

Summary

We develop interaction techniques to help people create their own;

Graphics (3D and animation)

Physical Objects (bags, furniture)

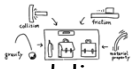
Robot behaviors

Key Insights

Graphics

Implementing visual intelligence

Physical Objects



Integrating physics into modeling

Robot behaviors

Visual and spatial interaction

Thank you

We are hiring!

- Interns (few months)
- Post-docs (few years)

If you want to work in Tokyo, please come and join us.

www.designinterface.jp/en/