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Mapping, Meaning and Motion: Designing Abstract Visualization of Movement Qualities

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Digital Resources for Humanities and the Arts

Presentation Outline

- What are we doing?
- Overview of Laban Effort: significance
- Laban Effort visualization: rationale, challenges, and approaches
- Machine-based recognition, eight Basic Efforts
- LabanEffortDetect: a system for generating real-time Laban Effort profile stream from a moving subject
- Two visualization systems: description, results, initial results
- Future work

What are we doing?

- We created a visualization of movement qualities (Laban Effort qualities).
- Visualization: (Pat Subyen)
A prototype of real-time interactive visualization system.
- LabanEffortDetect: (Diego Maranan, Thecla Schiphorst, Philippe Pasquier)
A prototype machine-learning based system which was created by the Institute for Advanced Computing Applications and Technologies at the University of Illinois and the University of Illinois Dance Department in collaboration with Thecla Schiphorst.
- This Project is funded by the Canada Council for the Arts - NSERC New Media Initiative Grant, for the research project entitled "Meaning from Motion for Interaction and Visualization".

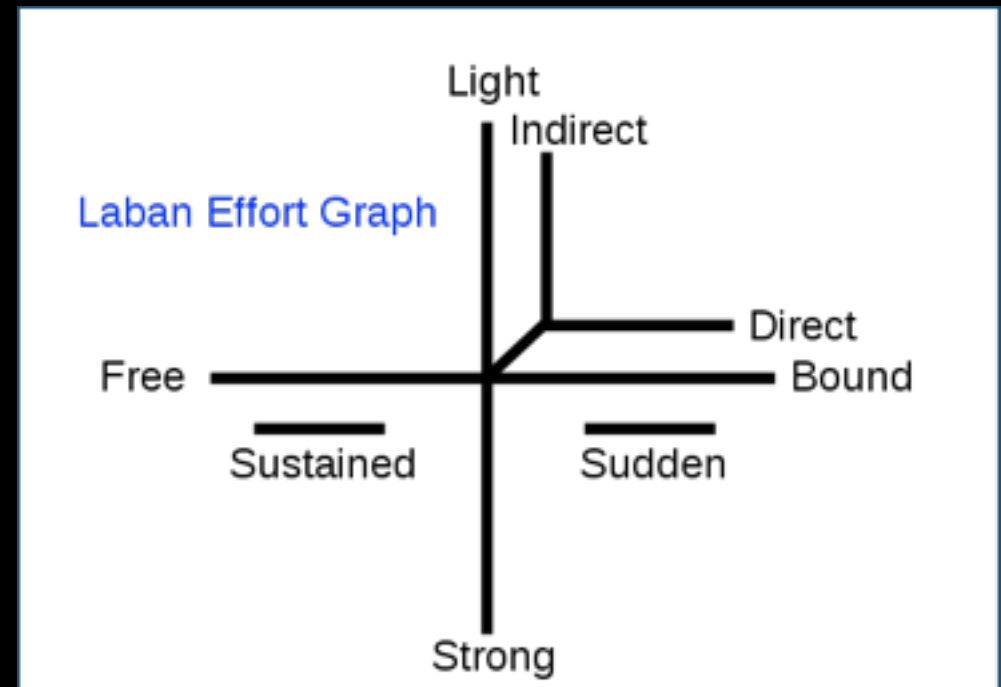
Human movement



Human movement is an outer manifestation of an inner state. It is that part of our self that extends to and interacts with the physical world (Moore & Yamamoto, 1998).

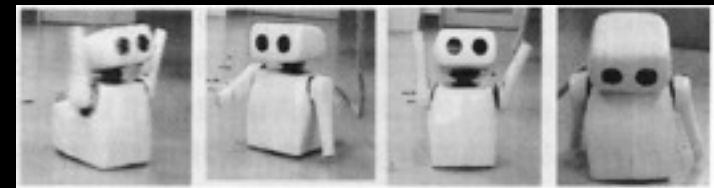
Laban-based analysis of movement qualities

- Laban Effort: part of Laban Movement Analysis
- Laban Effort analysis looks at
 - Weight
 - Time
 - Space
 - Flow
- Weight: Strong - Light
- Time: Sudden - Sustained
- Space: Direct - Indirect
- Flow: Bound - Free



Laban Effort: a few applications

- Enhancing factory worker efficiency and experience (Laban & Laurence, 1974; Bradley 2009)
- Enhancing movement-based practices (e.g., dance, theatre, sports)
- Designing interactive interfaces (e.g., Schiphorst, 2007; Pietrowicz et al, 2010)
- Animating robots (Nakata et al, 2002; Matsumaru 2009) and virtual characters (Chi et al, 2000)



Narrowing our focus: The Eight "Basic Efforts"

- Laban's Eight Basic Efforts use three parameters, Space, Weight and Time. (Flow is absent in the Action Drive).
- The Action Drive is immediately recognizable in everyday actions.

Effort Space value	Effort Time value	Effort Weight value	Corresponding Basic Effort
Direct	Sustained	Strong	<i>Press</i>
Direct	Sustained	Light	<i>Glide</i>
Direct	Sudden	Strong	<i>Punch</i>
Direct	Sudden	Light	<i>Dab</i>
Indirect	Sustained	Strong	<i>Wring</i>
Indirect	Sustained	Light	<i>Float</i>
Indirect	Sudden	Strong	<i>Slash</i>
Indirect	Sudden	Light	<i>Flick</i>

The Eight Basic Efforts

Laban Effort Visualization: Rationale and challenges

- How can the visualization communicate a “feeling” of movement across modalities?
- How can Laban Effort Qualities be designed and transformed into a visualization that make sense?
- How can the visualization be interactive, real-time and computationally efficient?
- How can it complement performance/dance?

LabanEffortDetect: A system for recognize of Laban Effort qualities

- Part of a larger research project (Thecla Schiphorst, UIUC NCSA+Department of Dance, Diego Maranan)
- The prototype, machine learning-based system we use for obtaining a real-time, continuous Laban Effort profile stream
- Expands on previous research in machine-based Laban Effort recognition (e.g., Santos et al, 2009; Zhao & Badler, 2005; Zhao, 2001; Swaminathan et al, 2009)



Laban Effort Recognition + Visualization

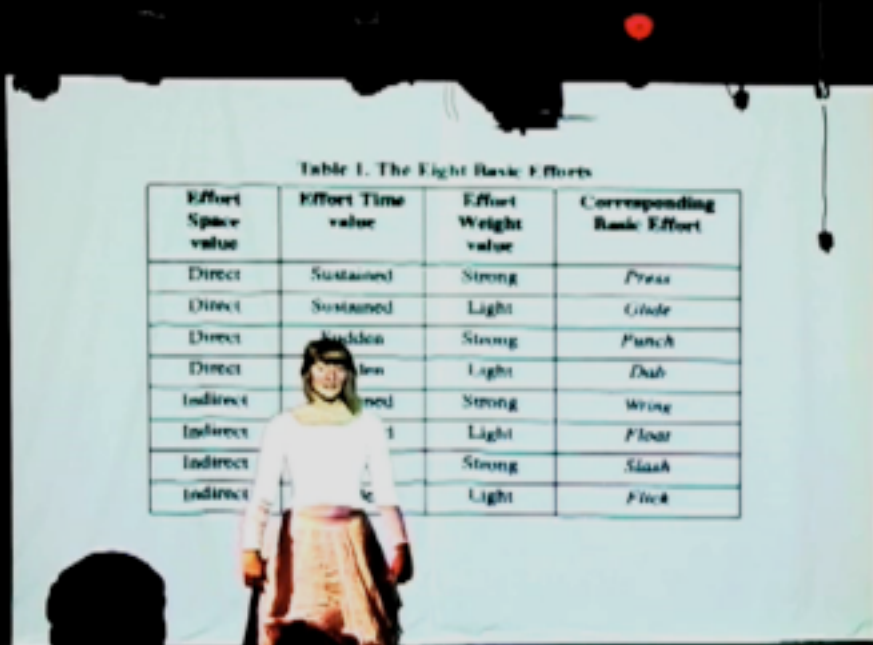
We are designing a real-time interactive system that visualizes the eight Basic Efforts



We exploring what are the criteria expressing Laban Effort Qualities?

Laban Effort Recognition + Visualization

We are designing a real-time interactive system that visualizes the eight Basic Efforts



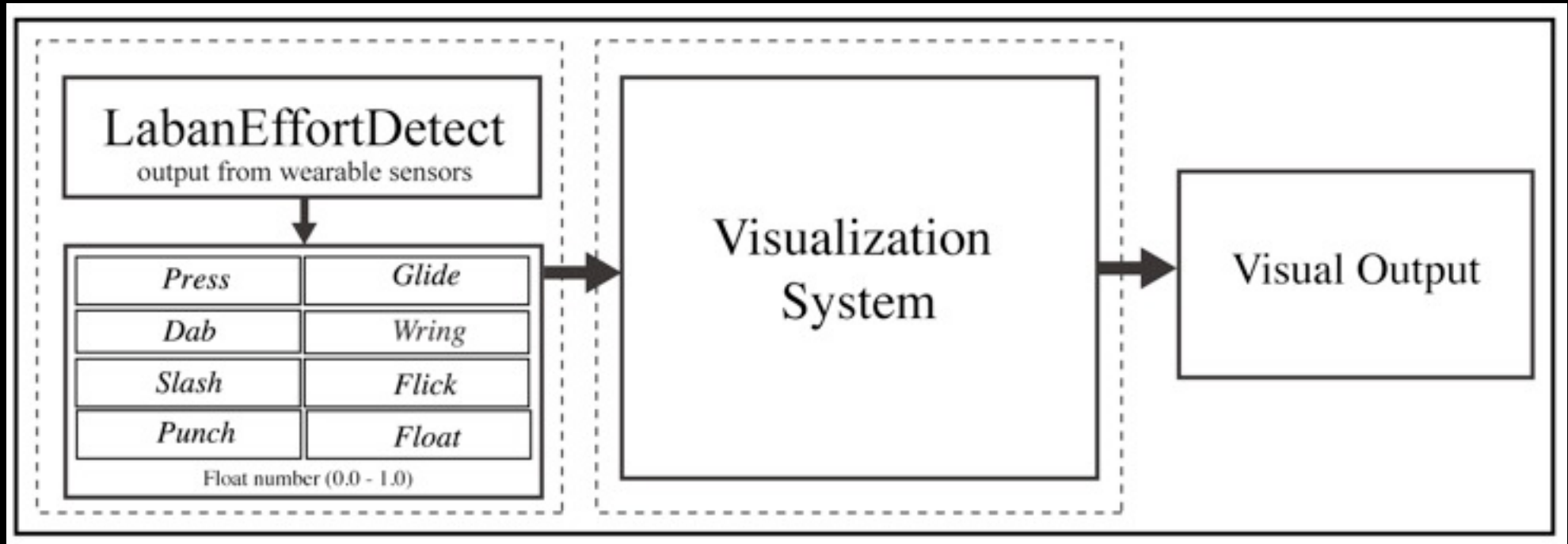
Effort Space value	Effort Time value	Effort Weight value	Corresponding Basic Effort
Direct	Sustained	Strong	<i>Press</i>
Direct	Sustained	Light	<i>Slide</i>
Direct	Sudden	Strong	<i>Punch</i>
Direct	Sudden	Light	<i>Dab</i>
Indirect	Sustained	Strong	<i>Wring</i>
Indirect	Sustained	Light	<i>Float</i>
Indirect	Sudden	Strong	<i>Slash</i>
Indirect	Sudden	Light	<i>Flick</i>



?

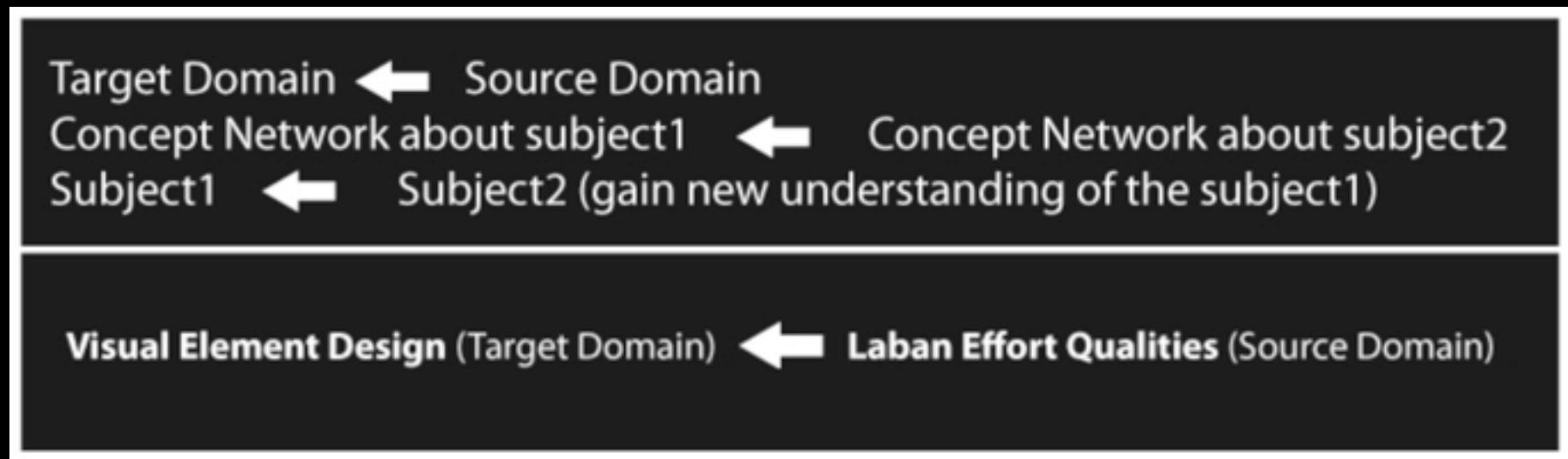
We exploring what are the criteria expressing Laban Effort Qualities?

Visualization System+ LabanEffortDetect: System Diagram

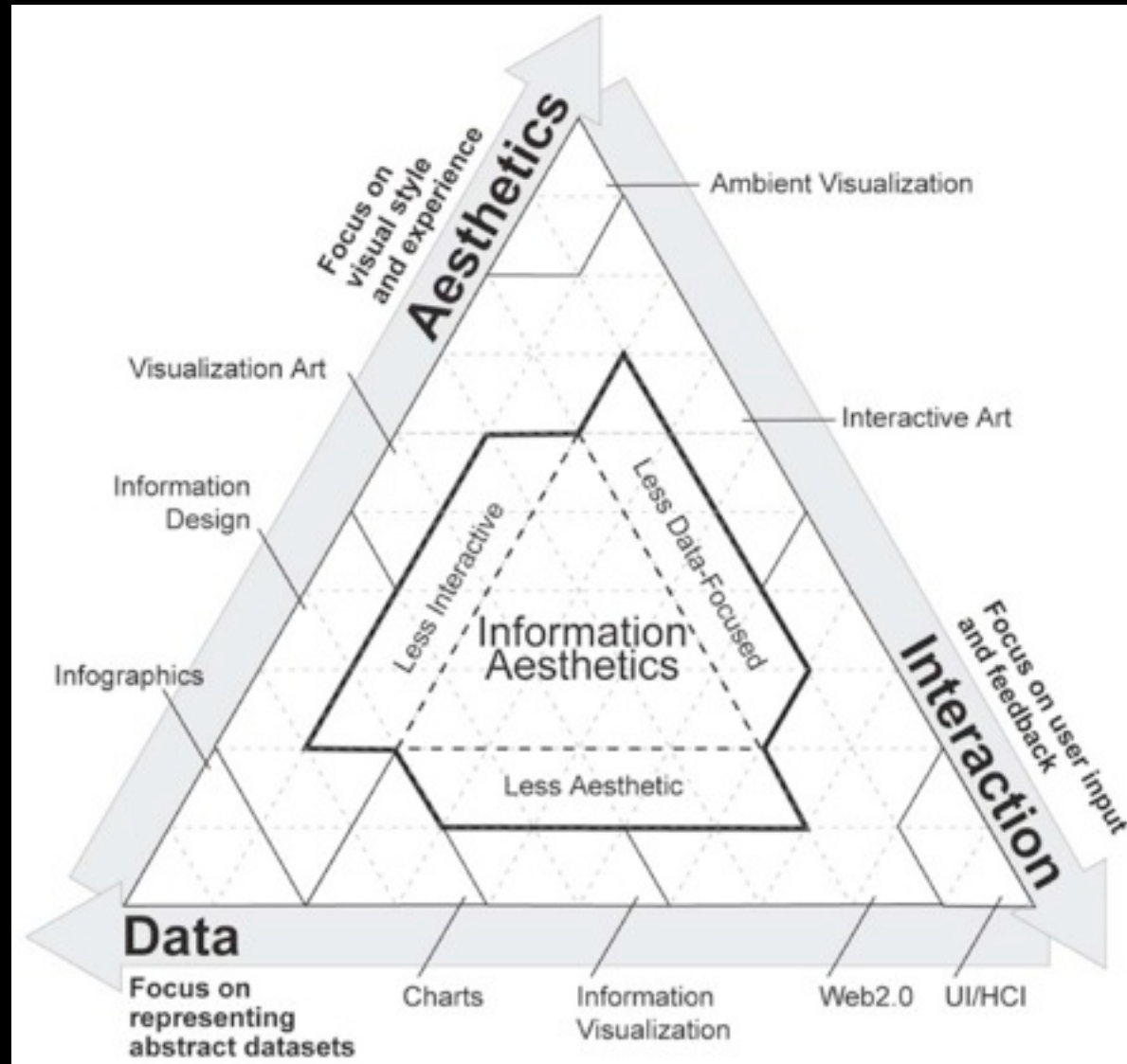


Visualization: Experimental Methods

- I use metaphor framework (Cox 2008) to create a mapping from one domain of information (the source) into another domain (the target).
- Each domain constitutes a system of beliefs, also called a concept network (Indurkha 1992).

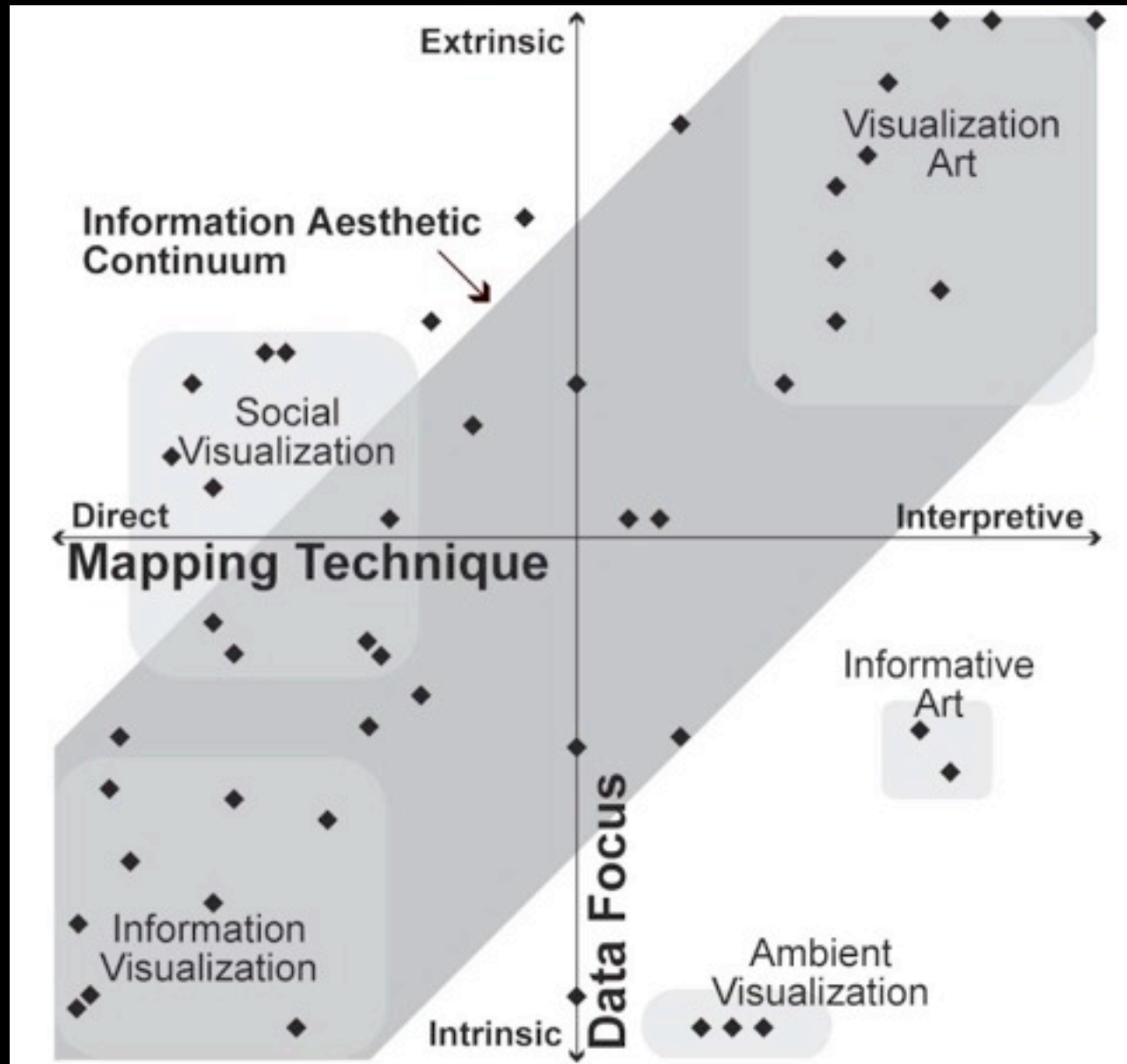


I use a model of information aesthetics (Lau and Moere 2004) to analyze from a visualization art perspective, in terms of artistic influence and meaningfulness.



Domain model for information aesthetics (Lau and Moere 2004)

The creation of “art” is often synonymous with a focus on extrinsic data meaning(Boehner. et al 2005).



Categories within the model of information aesthetics(Lau and Moere 2004)

Design Process for Visualization

- used exploratory methods to create a series of prototypes.
- experimented with two different designs (to date).
- compared
 1. mapping strategy
 2. visual communicative properties
 3. aesthetic of visualization
 4. computational efficiency
- Design1 uses an artificial life technique, L-Systems to generate visualization.
- Design2 uses metaphors within communication design to generate visualization.

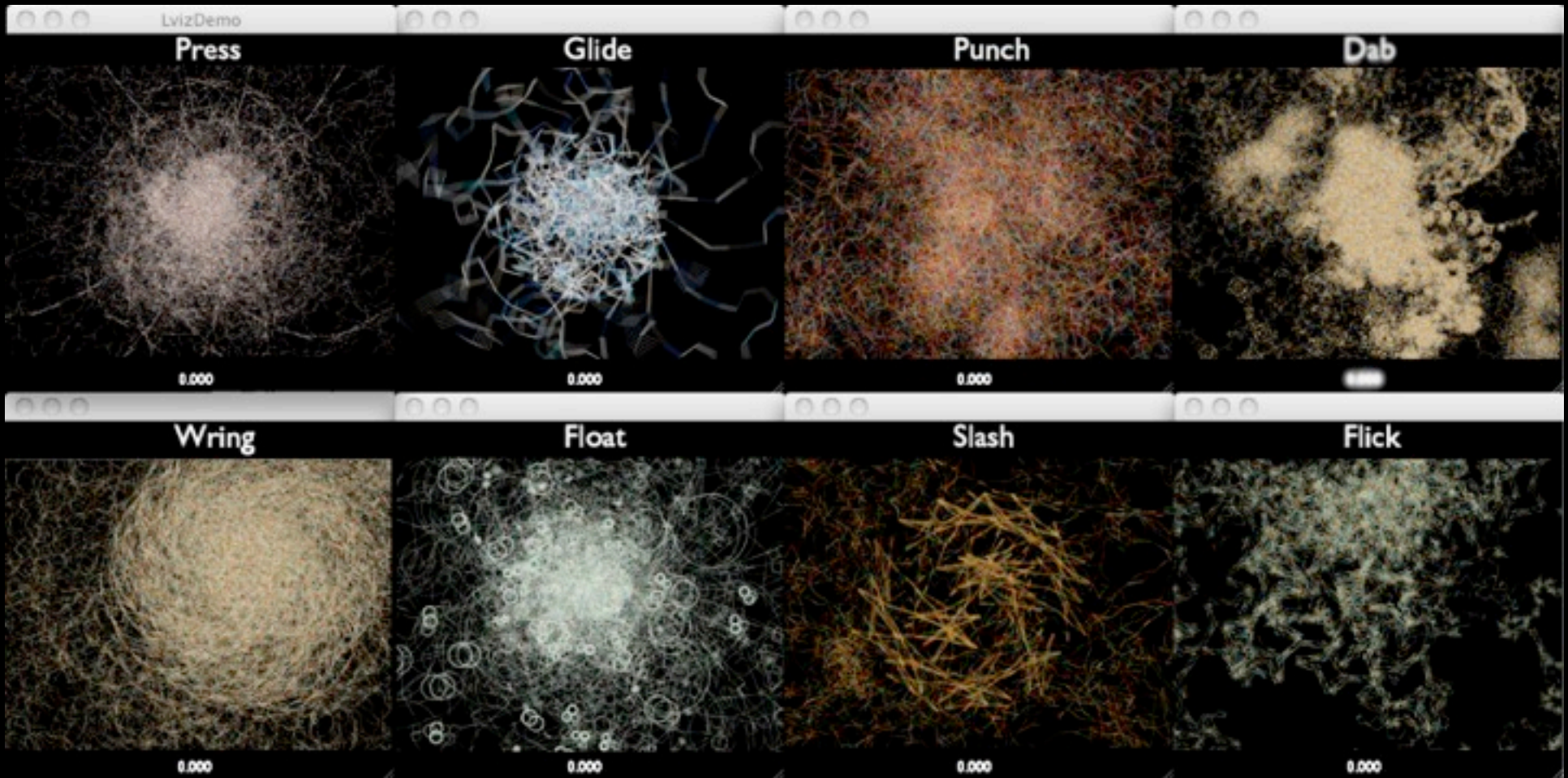
Design1: L-VIZ System

- L-VIZ uses an L-system as a generative process to create visualization.
- L-system is a formal process to simulate the growth of plants; it was first described by Aristid Lindenmayer in 1968.
- an L-system is a grammar composed of a set of procedural drawing rules. Different rules produce different results

Laban Effort	Space		Weight		Time		
	Direct	Indirect	Strong	Light	Sustained	Sudden	
Laban Effort Definition	Straight, Single, Focus	Spiraling, Deviating, Flexible	Forceful, Vigorous	Buoyant, Weightless	Leisurely, Lingering, Indulging in time	Hurried, Ergent, Quick	
Kandinsky Color Definition	Peaceful, Light Blue	Green, Peace, Stillness, Quiet	Green, Red, Yellow Orange, Hidden -Strength, Strength, Energy	White, Harmony of Silence, Not a dead silence	White, "Harmony of silence", "pause that breaks temporarily the melody"	Red, Yellow Orange, Loud, Sharp, Harsh, Radiant	
Color Scheme Mapping from Color Theory according to Wassily Kandinsky: "Concerning the Spiritual in Art"							
<i>Press</i>	<i>Glide</i>	<i>Punch</i>	<i>Dab</i>	<i>Wring</i>	<i>Float</i>	<i>Slash</i>	<i>Flick</i>

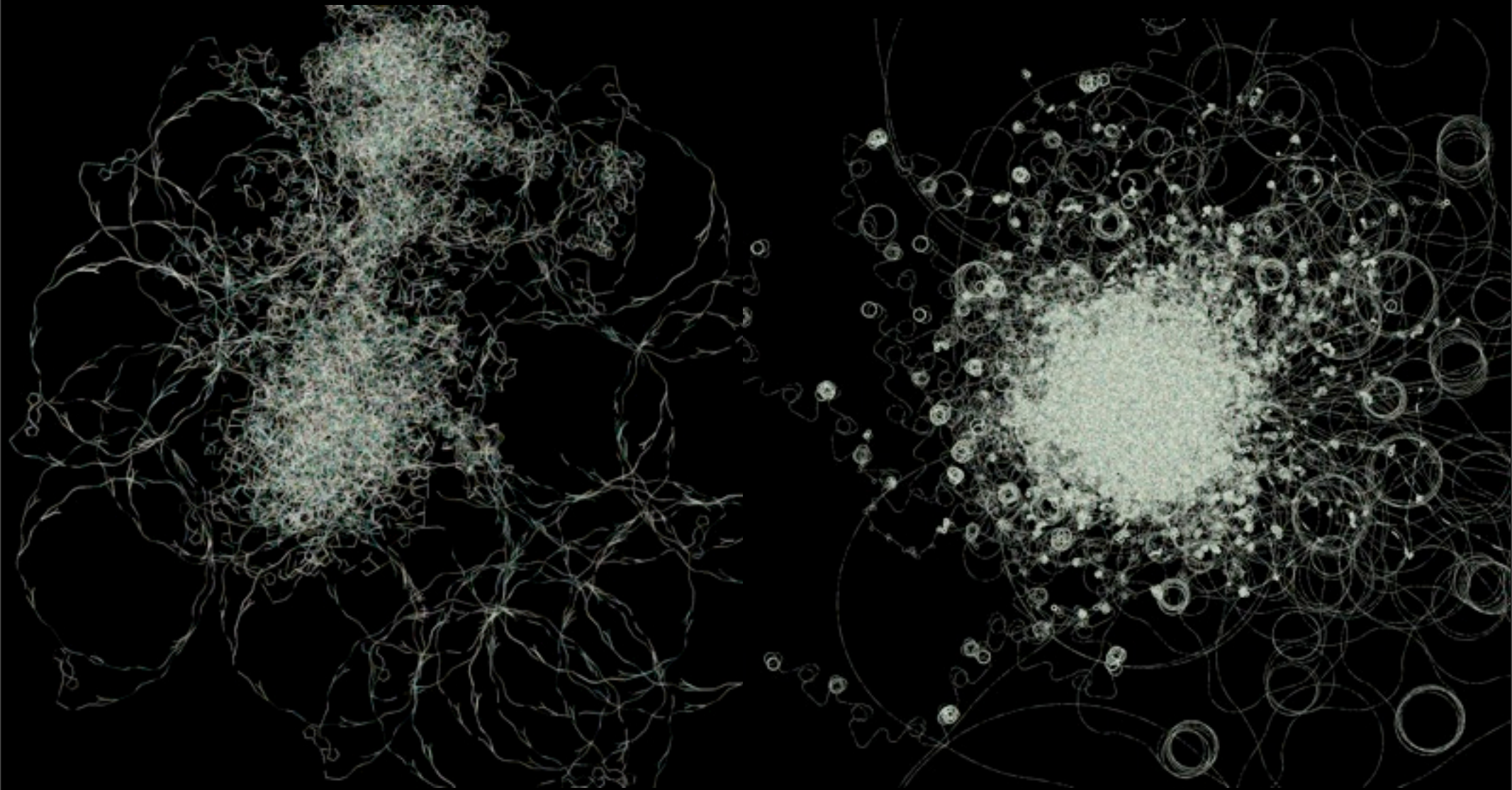
Kandinsky Color Theory and Laban Effort qualities Color Mapping

Result: Output from the L-VIZ System



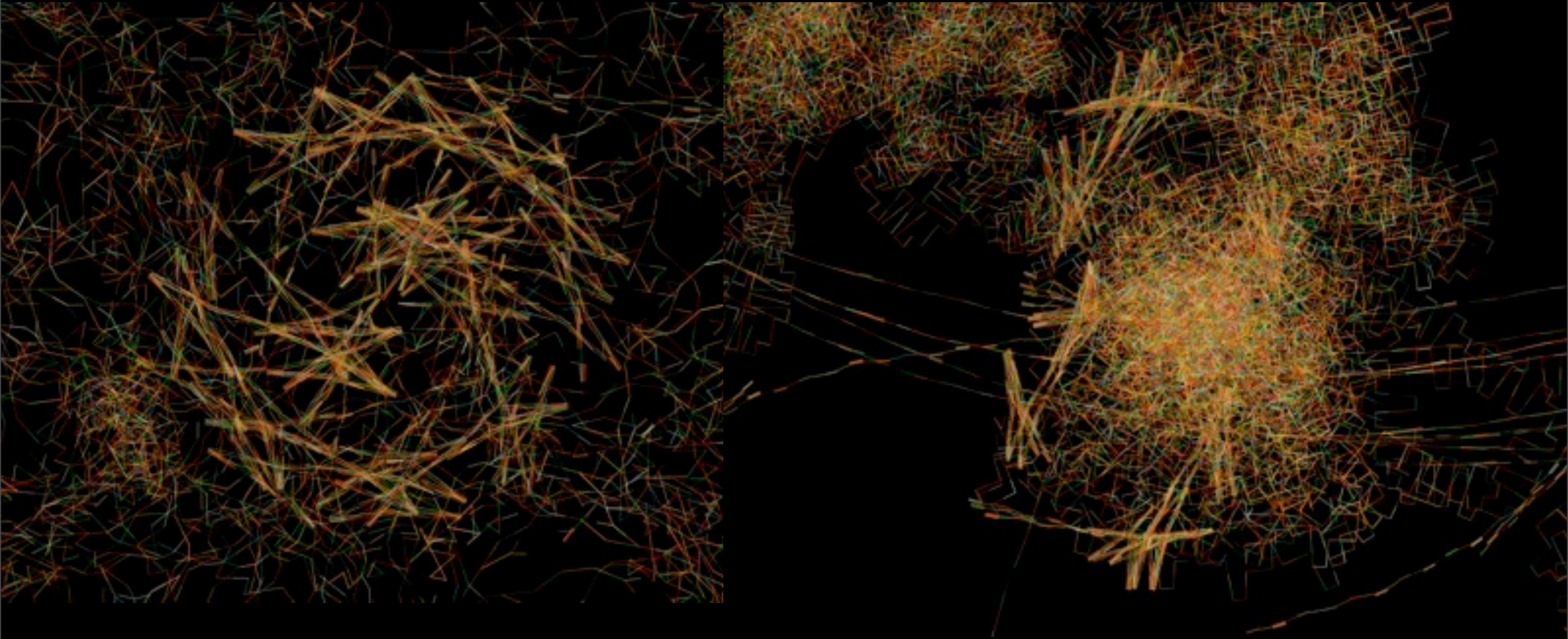
Still images from real-time visualization interactive system; L-VIZ System

Result: Output from the L-VIZ System



Visualization of Float Effort

Result: Output from the L-VIZ System



Visualization of Slash Effort

Output from L-VIZ: Punch Basic Effort (Video)



Output from L-VIZ: Punch Basic Effort (Video)

Design2: Motion Sketch

- uses visual communication design metaphors (two-dimensional design theory) to explore the expression of Laban Basic Efforts.
- explore visualization that expresses the “feeling” of movement quality.

- Motion Sketch uses sketching, based on composition design, and then translates it to motion.

Sketch Effect like a ball - make it look act

Sketch particle - obj - move - speed - weight - flick

Sketch - can follow path display transition

Press
Direct + Sustained + Strong

Glide
Vast + Sustained + Light

Float
Indirect + Sustained + Light

Wring
Direct + Sudden + Strong

Punch / Thrust
Direct + Sudden + Strong

Slash
Indirect + Sudden + Strong

Flick
Indirect + Sudden + Light

Translate → Computation.

Weight	Space	Time	Corresponding Basic Effort
Strong	Direct	Sustained	Press ✓
Light	Direct	Sustained	Glide ✓
Strong	Direct	Sudden	Punch ✓
Light	Direct	Sudden	Dab ✓
Strong	Indirect	Sustained	Wring ✓
Light	Indirect	Sustained	Float ✓
Strong	Indirect	Sudden	Slash ✓
Light	Indirect	Sudden	Flick ✓

- see also L10 (chain focusing)
- map design to visual parameter
= parameter (ellip, feet)
- diameter, movement, speed
- number of particles
- direction of the obj.
= discrete vs-velocity

- translating the motion sketches into computationally defined motion graphics.



```

startTime = millis();
link.declareInlet("lfloat");
link.declareInlet("lpunch");
link.declareInlet("lglide");
link.declareInlet("lslash");
link.declareInlet("lflick");
link.declareInlet("learing");
link.declareInlet("lpress");
link.declareInlet("ledab");
link.declareInlet("lstill");

font = loadFont("GillSans-12.vlw");
font = loadFont("GillSans-16.vlw");
font = loadFont("GillSans-24.vlw");
font = loadFont("GillSans-36.vlw"); //load font for text display
// MaxLink: declare the variable name and the setter function name
link.declareInlet("message");
link.declareInlet("message2");
link.declareInlet("h");
link.declareInlet("m");
link.declareInlet("s");
link.declareInlet("px");
link.declareInlet("py");
frame.setLocation(0,0);
PFrame1 fglide = new PFrame1();
PFrame2 fpunch = new PFrame2();
PFrame3 ftab = new PFrame3();
PFrame4 fwring = new PFrame4();
PFrame5 ffloat = new PFrame5();
PFrame6 fslash = new PFrame6();
PFrame7 flick = new PFrame7();
PFrame8 primary = new PFrame8();
PFrame9 still = new PFrame9();
PFrame10 ttext = new PFrame10();

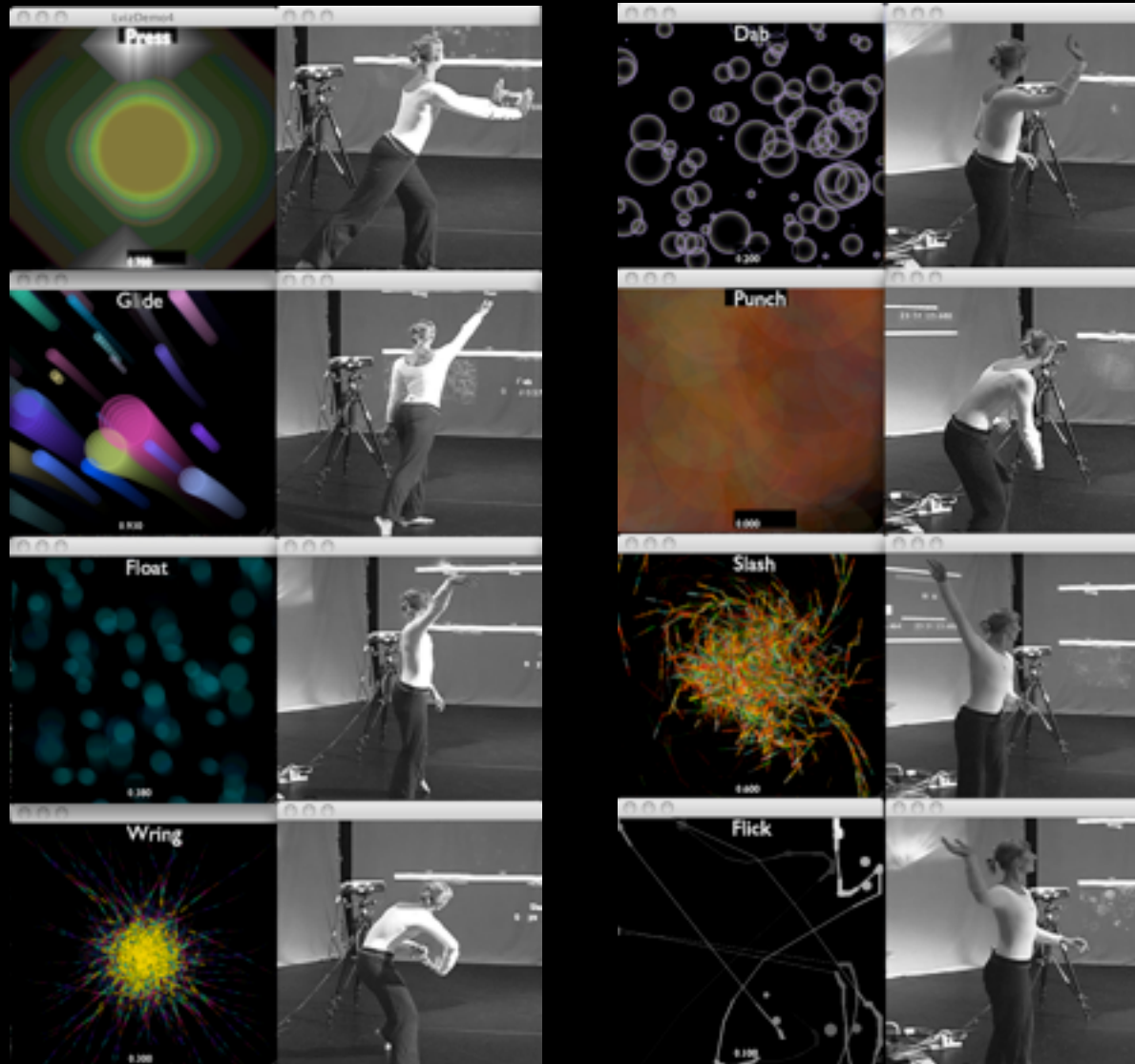
grammarPrimary2 = new StochasticGrammar(this, "A,B,C");
grammarPrimary2.addRule("w", "A+B+C"); // This is the starting rule
grammarPrimary2.addRule("A", "A", 0.6);
grammarPrimary2.addRule("B", "B+B+BB+BB+BB+BB+BB+BB", 0.3);
grammarPrimary2.addRule("C", "C-C+C+CCC-C-CCC+C+CCC-C-CCC+C+C-C", 0.2);
float startLengthPrimary2 = 0.1;
productionPrimary2 = grammarPrimary2.createGrammar(depthPrimary2);
distancePrimary2 = startLengthPrimary2*pow(0.1, depthPrimary2);

for(int i = int((z.length-1000)*k/n); i < int((z.length-1000)*(k+1)/n); i++) {
  v = sqrt(random(sqrt(m)));
  theta = random(TWO_PI);
}

//frames
dashColorPrimary2(0)=00000; dashColorPrimary2(1)=00000; dashColorPrimary2(2)=00000; dashColorPrimary2(3)=00000; dashColorPrimary2(4)=00000;
dashColorPrimary2(5)=00000; dashColorPrimary2(6)=00000; dashColorPrimary2(7)=00000; dashColorPrimary2(8)=00000; dashColorPrimary2(9)=00000;
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```

Result: Output from Motion Sketch: eight Basic Effort



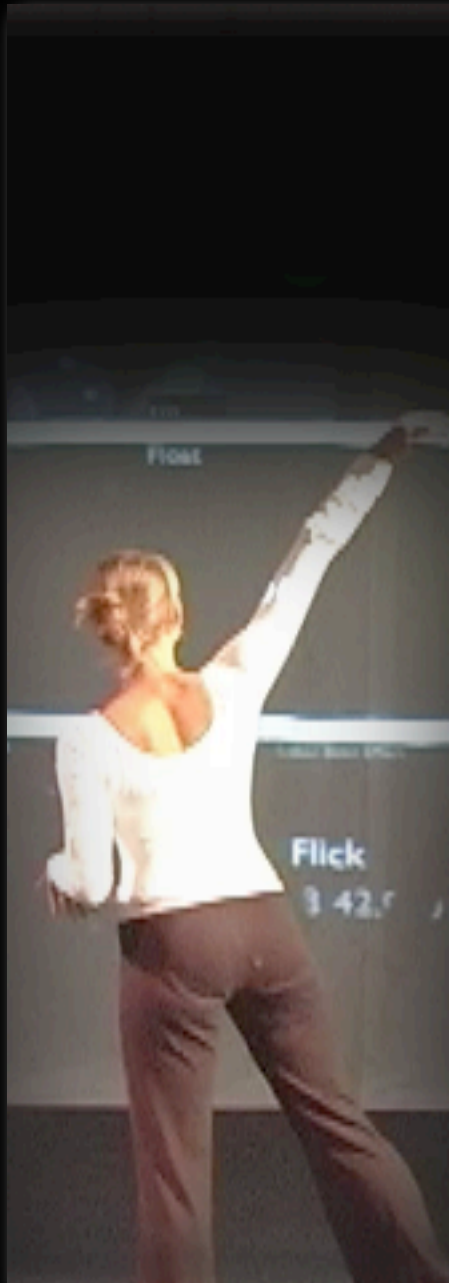
Still images from real-time visualization interactive system; Motion Sketch

Result: Output from Motion Sketch: eight Basic Effort (Video)

Result: Output from Motion Sketch: eight Basic Effort (Video)





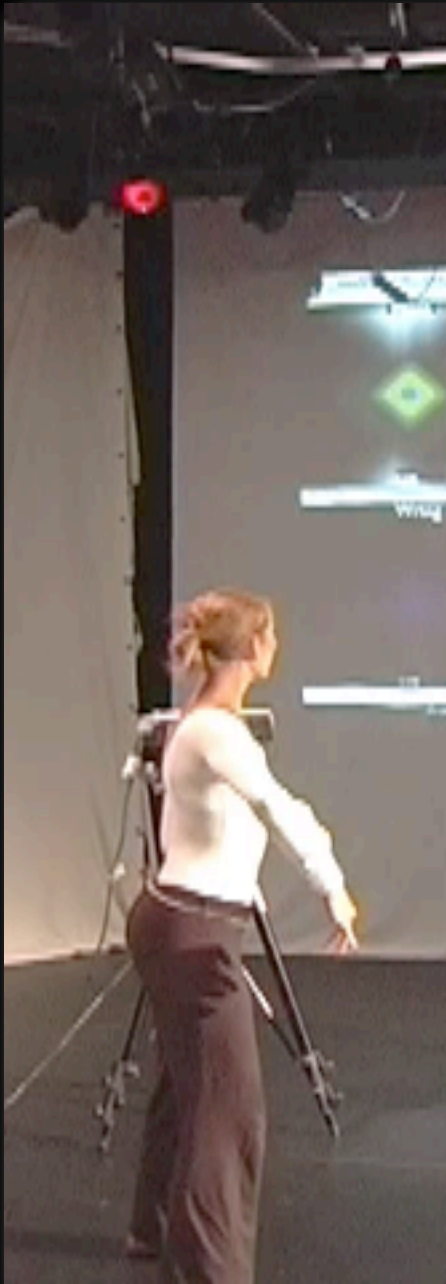


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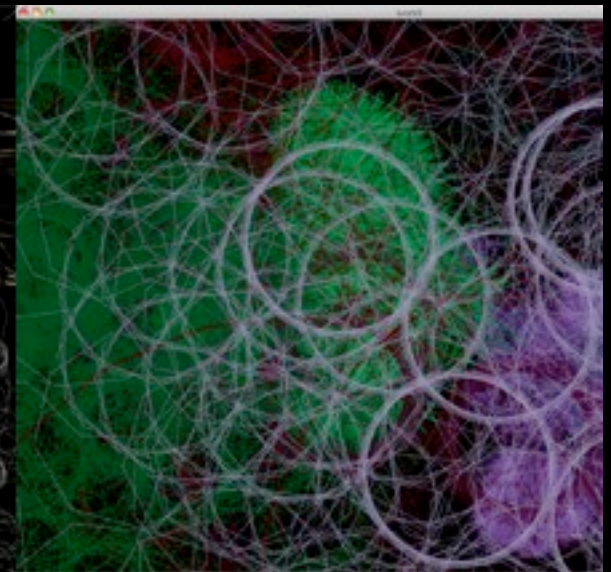


Initial Results

- L-VIZ (L-systems) has some computational aspect specific issues. For instance,
 - the visualization tend towards dense layering
 - the visualization did not accurately represent Time, Space Efforts (Sustained or Indirect).
 - etc.
- Motion Sketch is successful for communicates Eight Basic Efforts from performer and audience perspectives in initial pilot study user feedback tests. (mention by Laban certified specialist).

Laban Effort Recognition + Visualization: Possible Future Applications

- Teaching tool for movement classes (mention by Laban certified specialist)
- Integrated into live performance
- Visual/installation art



Future Work

- Visualization: develop prototypes with four main criteria
 - Visual aesthetic
 - Visual communication
 - Mapping strategy
 - Interactivity (real-time and computational efficiency)
- We are interested in visualizing
 - human movement
 - movement textures (from a 'still' scene)mapped to moving elements that exhibit Laban Effort qualities.

Acknowledgments

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