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UNIVERSITY OF CALIFORNIA, SAN DIEGO

A Pattern Language

A thesis submitted in partial satisfaction of the
requirements for the degree Master of Fine Arts

in

Visual Arts

by

Stephanie Feng Lie

Committee in charge:

Professor Kyong Park, Chair
Professor Amy Alexander
Professor Nathan Delson
Professor Jennifer Pastor

2012

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The Thesis of Stephanie Feng Lie is approved, and it is acceptable
in quality and form for publication on microfilm and electronically:

Chair

University of California, San Diego

2012

For my mother, father and brother

“To imitate the Chinese...” Matisse says.

“I have shown you, haven't I, the drawings I have been doing lately, learning to represent a tree, or trees? As if I'd never seen or drawn a tree. I can see one from my window. I have to learn, patiently, how the mass of the tree is made, then the tree itself, the trunk, the branches, the leaves. First the symmetrical way the branches are disposed on a single plane. Then the way they turn and cross in front of the trunk...Don't misunderstand me: I don't mean that, seeing the tree through my window, I work at copying it....I have to create an object which resembles the tree. The sign for the tree, and not the sign that other artists may have found for the tree: those painters, for instance, who learned to represent foliage by drawing 33, 33, 33, just as a doctor who's sounding you makes you repeat 99...This is only the residuum of the expression of other artists. These others have invented their own sign...to reproduce that means reproducing something dead, the last stage of their own emotion...”

“...and the residuum of another's expression can never be related to one's own feeling. For instance, Claude Lorrain and Poussin have ways of their own of drawing the leaves of a tree, they have invented their own way of expressing those leaves. So cleverly that people say they have drawn their trees leaf by leaf. It's just a manner of speaking: in fact they may have represented fifty leaves out of a total two thousand. But the way they place the sign that represents a leaf multiplies the leaves in the spectator's mind so that he sees two thousand of them...They had their personal language. Other people have learned that language since then, so that I have to find signs that are related to the quality of my own invention. These will be new plastic signs which in their turn will be absorbed into the common language, if what I say by their means has any importance for other people...”

“The importance of an artist is to be measured by the number of new signs he has introduced into the language of art...”

- Henri Matisse, 1943

“If we study Japanese art, we see a man who is undoubtedly wise, philosophical and intelligent, who spends his time how? In studying the distance between the earth and the moon? No. In studying the policy of Bismarck? No. He studies a single blade of grass.

“But this blade of grass leads him to draw every plant and then the seasons, the wide aspects of the countryside, then animals, then the human figure. So he passes his life, and life is too short to do the whole.”

- Vincent van Gogh, 1887

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Audio, 19 min 39 sec

Sequence of nine leaf clusters from The Mustard Seed Garden Manual of Painting

File 2: APatternLanguage-DrawingHead.MOV

Video, 49 sec

Close-up of drawing head (facing the front of the gallery)

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ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to my collaborator John Trevor Benson. This project would not have been possible without his love and support.

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I would also like to acknowledge Nathan Delson and several students from the Mechanical and Aerospace Engineering Department for their unfailing dedication to curiosity-based research. In 2010, Joshua Wu was an invaluable assistant in the production of *Fundamental Frequencies*. My 2011 team members William (Duke) Degen, Monique Goeders, Hiram Jacobo and Joshua Muñoz developed the first XY plotter which became the central figure in *A Pattern Language*. My 2012 team members Jonathan Bruns, Gregory Jimmie, Eric Tom, Kent Wong, and Junzhe Wu extended the initial design to create a second XY plotter for future work.

My sincere thanks goes to Vahid Fozi for his keen editorial oversight.

The installation was informed by conversations with John Benson, Liz Chaney, Rob Duarte, Tom Erbe, Eun Jung Park, and Jeffrey Treviño.

To my many collaborators and confidants, your playful enthusiasm and quality of invention are a continual inspiration to me.

ABSTRACT OF THESIS

A Pattern Language

by

Stephanie Feng Lie

Master of Fine Arts in Visual Arts

University of California, San Diego, 2012

Professor Kyong Park, Chair

In *A Pattern Language*, a mechatronic device draws leaves based on the early Qing dynasty tome The Chinese Mustard Seed Garden Manual of Painting. The drawing machine's noisy movements produce a conflation of image, sense and sound, suggesting an ideographic approach to language championed by Ernest Fenollosa and Ezra Pound. By revisiting the modernist impulse to mine classical Chinese culture, the thesis considers the difficulties of translation, the transference of agency between actor and object, drawing as performance, and embodied cognition. *A Pattern Language* reflects upon the codification of landscape representation vis-à-vis the language of computation, enacting a meditation on language and mind, nature and artifice.

The machine was designed at the University of California San Diego in 2011. *A Pattern Language* is the installation based thereon held at the Visual Arts Facility Gallery in 2012.

A PATTERN LANGUAGE

“The importance of an artist is to be measured by the number of new signs he has introduced into the language of art...”

- Henri Matisse, 1943¹

“It is only when the difficulty of placing some odd term arises or when we are forced to translate into some very different language, that we attain for a moment the inner heat of thought, a heat which melts down the parts of speech to recast them at will.”

- Ernest Fenollosa, 1910²

Towards the autumn of his career, as he was abandoning the practice of drawing nature from direct observation, Matisse confessed “I have been working at my craft for a long time, and it’s just as if till now I had only been learning things, elaborating my means of expression.”³ In discussing the problem of drawing trees with their many leaves, he emphasizes the need to create his own signs for leaves. The invention of such a personal, symbolic language would allow him to “tackle large-scale compositions.” As early as 1907 his conversations with the poet Louis Aragon reveal a search for a plastic language of art that elides the distinction between figuration and abstraction.⁴ Matisse was not alone in his fascination with the Other and the ideographic promise of new plastic languages. European artists and scholars in the first decades of the twentieth century mined everything from “the folk songs and folk tales of European peasants, African and Inuit masks, Japanese haiku, Celtic rituals, Navajo blankets, Etruscan funerary sculpture, the unreconstructed fragments of classical Greek poetry, Oceanic

shields and tapa cloths, alchemical drawings...” China, with its unbroken chain of history dating back 4,000 years, held a particular allure for artists of the early avant-garde seeking a return to origins.⁵

Just one year earlier in 1906, Ernest Fenollosa died before he was able to complete a draft “study of the fundamentals of all aesthetics” titled “The Chinese Written Character as a Medium for Poetry.” During the Meiji restoration, Fenollosa had studied Chinese poetry as a professor at the Imperial University at Tokyo. At the request of his widow, his notes were translated and edited by Imagist poet Ezra Pound, becoming a fertile primary text in the development of modernist poetry.⁶ In the essay, the Chinese written language is deemed inherently poetic because each character, or ideogram, originates from “natural suggestion” rather than abstraction. For example:



Illustration 1: Sun Rises (in the) East.

Fenollosa explains the sign for East is the sun sign entangled in the branches of the tree sign. The sign for rise is the sun sign above the horizon; plus “the single upright line is like the growing trunk-line of the tree sign.” Thus, the characters in this sentence are a “vivid shorthand picture of the actions and processes in nature.”⁷

According to Fenollosa and Pound, reading these characters reveals the text in image, sound and meaning all at once, producing an embodied experience of language in *time*, much like listening to music or reading poetry. The essay has been alternately dismissed by linguists as a “complete misunderstanding” of the language or defended as a

radical manifesto on aesthetics.⁸ In either case, the search for meaningful signs in a natural language anticipates some of the issues tackled in the 1950s in the subfield of artificial intelligence and computational linguistics called natural language processing. My thesis works to recuperate the ideas in “The Chinese Written Character as a Medium for Poetry” by exploring the issues of translation, codification, and subjectivity that are raised by the mediating role of machines in the exhibition *A Pattern Language*.

COPYING PRIMITIVES

According to Matisse, “the importance of an artist is to be measured by the number of new signs he has introduced into the language of art.” The artist is recast as an inventor of signs. Instead of painting a portrait of each leaf, the artist paints the sign for a leaf. An amateur artist simply copies signs from other artists, blindly scrawling “33, 33, 33”. But a great artist places signs in a way that “multiplies the leaves in the spectator’s mind so that he sees two thousand of them.”⁹ At the center of *A Pattern Language*, a drawing machine “learns” to draw “primitive” trees from the Mustard Seed Garden Manual of Painting, an instructional text from the early Qing dynasty (1679-1701), in an effort to reproduce landscape painting in the Chinese tradition. The manual aggregates and distills an exhaustive number of examples from the long tradition of landscape painting, presenting a systematized view on the representation of natural forms. The machine is like a poor student who can hardly learn the ABC’s of landscape painting. In its usage here, “primitive” connotes both an early stage of development as well as the simplest possible element in a computer programming language. In copying primitives, the machine strives like a modernist artist to reclaim the ancient past or “childhood of

man.”¹⁰ To be clear, the machine does not attempt to model an early stage of human cognition. Rather, it addresses how cultures define learning and produce knowledge through particular aesthetic traditions.

For its debut in *A Pattern Language*, the machine was programmed to draw leaves, the most primitive forms in the first volume of the Mustard Seed Manual called The Book of Trees. As the project continues, the vocabulary of the machine will grow to include branches and other tree elements, as well as rocks, mountains, streams and fog from the second volume of the manual called The Book of Rocks. At first glance, the manual appears overly prescriptive in its methodological approach to landscape painting. However, this clear outline lends itself to the language of computing. The authors of the manual cite 63 methods of dotting leaves¹¹. These clusters of foliage are the atomic units which the machine deploys to render landscape imagery via a pseudo-random generative algorithm.

In the tradition of Chinese landscape painting, copying ancient master works is considered an essential part of the learning process. Instead of carrying a negative connotation, copying ensures the transmission of painterly knowledge from an old master each time an artist communes with his work. In *A Pattern Language*, copying is folded into the production of the exhibition through the quotation of materials and techniques from my mentor Jane Rosen and the sculptor Judy Pfaff. In addition, designating the machine as producer troubles the notion of individual authorship. The machine is characterized by superhuman patience, at times running at 18-minute intervals for 24 hours. The duration of the exhibition is evident in the tangle of leaves left on the scroll, revealing the futility and humor in copying without improvement.

Each sequence of leaf clusters resembles a sentence; as if in reply, Fenollosa wrote “We cannot exhibit the wealth of nature by summation, by the piling of sentences.”¹² The Chinese written language appears to enact the forces of nature in part due to the three traditions of art practice, or the “three perfections”: painting, poetry and calligraphy. All three would have been practiced by the Chinese scholar or *literati*.¹³ Contrast the machine’s piling of sentences with the practice of calligraphy, wherein the artist’s spirit or *qi* enters the brush, enlivening each character with both meaning and interpretation from the poet’s hand. In this respect, the machine in its current state will always fall short of this gesture. This more distanced and less personal view of the creative act brings to the fore the primary interests of *A Pattern Language*: the difficulties of translation, the transference of agency between actor and object, drawing as performance, and embodied cognition. By positioning the codification of landscape representation vis-à-vis the language of computation, the installation enacts a meditation on language and mind, nature and artifice.

SCHOLARLY REFLECTION

The space of the gallery in *A Pattern Language* is presented as a classical Chinese garden. Typically in such a garden, a scholar’s pavilion faces a pond in the center, around which lie meandering paths. As one walks along the path, you would encounter a framed view of a natural feature, which acts as a subject for contemplation. To enter the gallery, a visitor must pass through floor-to-ceiling black curtains into a dimly lit room. A steel maze stands at the front, directing the entering visitor towards the right before jogging them left. The primary actor of the exhibition, a drawing machine, sits on an elevated

platform. Puddles made of plaster and resin lie between the zig-zag path and the pavilion, behind which a window frames a “Zen view” onto a scholar’s rock. A classical garden presents a tranquil microcosm, wherein a scholar contemplates their place in the universe through the practice of calligraphy, painting, poetry and music.

The steel maze is a manifestation of the labyrinth in Jorge Luis Borges’ short story “The Garden of Forking Paths”. As Dr. Yu Tsun, the main character in “The Garden of Forking Paths”, recalls before searching for a stranger’s house: “you won’t get lost if you take this road to the left and at every crossroads turn again to your left”. Dr. Tsun is a professor of English whose ancestor Ts’ui Pên constructed a riddle in the form of a labyrinth that is both a novel and a garden. The keeper of the garden and text who unlocks this secret is Dr. Stephen Albert, an Englishman who is a professor of the Chinese language.¹⁴

In the paradoxical tale, Borges presents a hypertextual novel in which he embeds a reflexive relationship between the two main characters, both translators and scholars of each other’s language. The two characters complement and complete each other, if only for a moment, before their commingled existence is annihilated. Similarly, in *A Pattern Language*, the role of the machine and the artist are mirrored. The artist teaches the machine the language of drawing, and the machine teaches the artist the language of the machine — or is it the reverse? In programming the machine to draw in the manner of Chinese landscape painting, the techniques and stratagems of drawing must be reconfigured, and the artist is compelled to think more like a computing machine. The absence of human intervention in the gallery is notable given the scale of the architectural elements in the room.

MINDS AND MACHINES

A small window behind the pavilion opens onto a framed “Zen view” of a scholar’s rock, a view “so restrained that it stays alive forever.”¹⁵ The silver-leafed window mimics the décor of a 1970s Chinese-American restaurant and repeats the zig-zag pattern of the steel maze. The window frames a Torrey Pine tree trunk in a dark space illuminated from below. The tree is the rarest species of native pine in the United States and can be found only in coastal North County San Diego. Its placement gives the machine a native artifact to contemplate.

The term “Zen view” is one of Christopher Alexander’s design patterns in the book A Pattern Language: Towns, Buildings, Construction. Published in 1977, the book identifies 253 timeless patterns or solutions to problems in the fields of architecture and urban design. The book was highly influential in the then-emerging field of computer science, where Alexander’s ideas were applied to software design. Design patterns in software could be classified as creational, structural and behavioral designs, and could be identified and reused in object-oriented programming practices. The architectural metaphor runs through much of computer science jargon.

Compared to a natural language like English or Chinese, which can be spoken, written or signed, a computer programming language is considered a formal language. The concept of formal languages is often attributed to the Enlightenment philosopher and mathematician Gottfried Wilhelm Leibniz, who believed symbols were a key to understanding human thought. In a formal language, simple ideas could be represented by simple symbols, while combinations of these characters could represent complex thoughts. In 1679, Leibniz described a binary computing machine which used marbles to

represent numbers. The machine could then perform mathematical operations by opening and closing small gates to control the movement of these marbles.¹⁶ Leibniz' binary machine anticipated by a few centuries Alan Turing's concept in 1936 of a Turing machine, where symbols are read and altered by a stylus over a strip of paper tape. Both of these theoretical machines are examples of the simulation of logical operations using a symbolic language. *A Pattern Language* obliquely addresses Turing's 1950 question: 'Can machines think?' by questioning whether the exhibition of intelligent behavior through machine simulation is enough to constitute artificial intelligence.¹⁷

John Searle first proposed "The Chinese Room Argument," a riddle designed in 1980 to dispute the claim that computers could have intelligence. Searle, a professor of philosophy who does not speak "Chinese", is put in a closed room and passes back slips of paper to a person in another room. Using a Chinese-English translating dictionary, Searle decodes the Chinese writing and then uses the dictionary to return Chinese characters. Searle's argument is that even if he is able to imitate the signs and follow the rules of the language, it does not mean he understands the squiggles or can speak Chinese.¹⁸ The drawing machine in *A Pattern Language* takes the place of Searle in the Chinese Room. It cannot be said to necessarily understand nature, the human need to represent it or the process by which it represents a simulation of nature to its human audience.

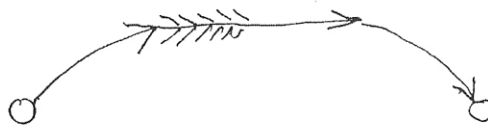
The "Chinese Room Argument" has been hugely influential in the fields of philosophy of mind and cognitive linguistics. In the field of cognitive linguistics, thought and language are believed to be embodied, since our conceptual structures arise from sensorimotor experience. If thought and language are embodied, the classic mind/body

dualism is rejected.¹⁹ Searle’s Chinese Room stresses this view by creating a false binary between the physical mind (the Chinese Room) and cognition (Searle’s role as translator).

METAPHOR AND ACTION

George Lakoff and Mark Johnson’s research on metaphor significantly contributed to the current theory of embodied cognition. In their 1980 book Metaphors We Live By, they state that “most of our ordinary conceptual system is metaphorical in nature” and that metaphors “can have the power to define reality.” As an example, the metaphor of ideas as plants underlies the phrase “an idea has come to fruition.”²⁰

In his analysis of particular Chinese written characters, Fenollosa shows their basis in metaphoric thought, particularly on “natural suggestion.” To Fenollosa, Chinese characters are a picture of “the operations of nature;” the written language is inherently active because nature is in constant flux. How are the operations of nature reflected in the Chinese written language? He identifies the major parts of speech as verbs and nouns; other parts of speech (adverbs, adjectives) are simply derivatives of these, or terms which connect these together (conjunctions, prepositions). A sentence expresses the transference of power between two terms, an actor and an object. For example, the sentence “Farmer pounds rice” can be mapped to this diagram:



term *from* which—transference of force—term *to* which

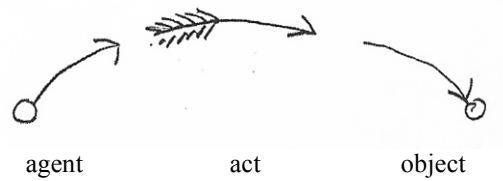


Illustration 2: Transference of force.

The Chinese character is thus an image of natural action, and the language grows as an accumulation of metaphors that poets and scholars keep alive. However, Haun Saussy identifies an incongruence in Fenollosa's essay. If the sentence expresses the transfer of energy, what becomes of the ideograph? Which is more important, the action or sign?²¹ This tension is reflected in *A Pattern Language*. Does the art work exist as the drawing produced by the machine (painting), or is it given in the machine's movements (performance)? Just as a natural language can be both written and spoken, both qualities are integral to the art work.

UTTERANCE

As the machine steps through definitions of leaf patterns, pen strokes produce clusters of foliage that proliferate on the paper scroll. The variance of form enacted is distinct and audible, reverberating in the cavernous space of the gallery. The machine itself and its platform act as a double resonant body, like the body of a giant wooden guitar. Two stepper motors control XY motion, generating overtones or "haloes of secondary meaning."²² A solenoid controls the pen motion up and down, producing an irregular tapping sound each time the pen is slammed onto the paper. A single leaf form consists of one to six pen strokes; a cluster is composed of 12 to 24 leaves. Hence, the

rhythmic score is inextricably linked to the composition of landscape imagery.

A single pen stroke corresponds to a phoneme, the smallest distinct unit in a spoken language. Each leaf is like a simple character; a cluster of leaves is a compound character. A sequence of leaf clusters produces a phrase or sentence. In *A Pattern Language*, the machine speaks as it writes, at times slurring word-forms. Fenollosa states that “acts are successive, even continuous; one causes or passes into another. And though we may string never so many clauses into a single, compound sentence, motion leaks everywhere, like electricity from an exposed wire.”²³ The machine’s forceful utterance blends one sentence into another, pronouncing a seemingly interminable run-on sentence.

ZEN KOAN

During his tenure in Japan, Fenollosa studied at the Tendai monastery, eventually converting to Buddhism. One element of Tendai teaching takes the form of the koan. A koan is a question, statement or story that is often paradoxical in nature. It may be given to a novice to meditate upon. For example, “Two hands clap and there is a sound; what is the sound of one hand?” A koan cannot be solved by the rational mind; instead it requires a flash of intuitive insight.

A Pattern Language emulates the form of a koan. The machine represents a scholar studying nature, and the riddle posed is whether the machine can learn to imitate nature; is its program inherently human in its aspirations to do so? The installation attempts to mimic Searle’s riddle by reconfiguring the space as Chinese Room and enlisting the machine as translator and performer. The machine appears to go on drawing forever, because its study is never done. In this case, practice does not make perfect. Searle wrote

“The point is not that the computer gets only to the 40-yard line and not all the way to the goal line. The computer doesn't even get started. It is not playing that game.”²⁴

Searle would argue that sense and experience — both of which this drawing machine lacks — form our conception of the world and are fundamental to our cognition. Allowing the machine to stand in as producer for the artist allows both the artist and the audience to consider the activity of expression from a distance. For observers of the drawing machine, the experience is similar to a Fluxus work, which according to David Doris is “like the koan, is the exposition of the path itself, the restructuring and presentation of a process of meaning-production. The form a work takes is the demonstration of the unfolding processes of its own presentation and reception.”²⁵ The riddles of *A Pattern Language* — whether cognition is produced in the Searle’s Chinese Room and whether expression is produced by the drawing machine — recede infinitely, as in a koan, into a reflection on meaning-production that is itself the subject of the work.

INTERACTIONISM

In new media art, the term interaction often describes a stimulus-response model in an installation environment. In *A Pattern Language*, my model of interaction is unresponsive in this way; the interaction I try to produce is a state of reflection in the audience through the repetitive actions of the machine, and the dualities presented between nature and machine, artist and object, and the mutual otherness between the modernist artist and the classical Chinese scholar.

Saussy notes the appearance of the word interaction in Fenollosa’s draft of his

essay. The term was used in “1830s North America to describe theological or social questions,” before emerging in the discourse of the sciences, linguistics and sociology. “‘Interactionism’ proposes...to follow the causal relations between the mind and body in both directions.”²⁶ The desire to achieve synthesis, or a more full quality of experience, is also expressed in the installation. Though the primary feature of the exhibition is the drawing machine, the various sculptural elements in *A Pattern Language* are placed like signs in the space to give the audience a fuller sense of the questions at hand, especially the binary relationship between nature and machine. Doris summarizes the teaching of Daisetsu T. Suzuki (an acquaintance of Fenollosa and a teacher to John Cage) as follows: “Nature is thus revealed through direct engagement in its processes. Further, the operations of the individual are themselves revealed through engagement in this unfolding; one becomes an actively perceiving, infinitely mutable organ of response, not differentiated from nature.” By repeating cultural and natural forms, the machine assimilates what is foreign unto itself. In accepting the irrationality of nature, we transcend ourselves. The work is designed to “relinquish artistic control in favor of participation in, assimilation of, and identification with the processes of nature.”

CONCLUSION

In the design of my practice, I pursue multiple avenues of research simultaneously. At times it can be challenging to shift modalities, but I find that the difficulties of translation produce “the inner heat of thought, a heat which melts down the parts of

speech to recast them at will.”²⁷ As for the work itself, like the koan, the unfolding process of reflection resonates precisely because of its undecidability. In 1928, David Hilbert posed a challenge that became a defining moment in the history of computation. Alan Turing and Alonzo Church proved that “with finite means and an enumerable infinity of steps, one can create an ‘unsolvable problem.’”²⁸ Some processes appear to be unknowable. This was determined centuries after Leibniz dreamt of a machine that, through its manipulation of a symbolic language, could settle disputes about the truth values of statements.

As the machine goes through its ABC’s, it produces a sonorous rhythm, speaking while it writes. The scroll unfurls over the duration of the exhibition, revealing piles of leaves and holes worn through the paper from bleeding ink. *A Pattern Language* presents the “quasi-geological” accretion of leaves, signs, and metaphors, in the exposition of a koan about the nature of ultimate reality. The machine writes its response, but as Fenollosa suggests, this sentence “could be no complete sentence but one which it would require all time to pronounce.”²⁹

¹ Flam (1973), pp. 93-95

² Fenollosa (1918, 1936), p. 50

³ Flam (1973), p. 94

⁴ Flam (1973), pp. 47-49

⁵ Weinberger (2005)

⁶ Saussy (2008), p. 3, 11

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- ⁷ Fenollosa (1918, 1936), p. 53, 60
⁸ Saussy (2008), p. 1
⁹ Flam (1973), pp. 93-95
¹⁰ Weinberger (2005)
¹¹ Sze (1957), pp. 65-71
¹² Fenollosa (1918, 1936), pp. 57-58
¹³ Cotter (2000)
¹⁴ Borges (1962)
¹⁵ Alexander (1977), pp. 641-643
¹⁶ Dyson (2000)
¹⁷ Turing (1950)
¹⁸ Searle (1980)
¹⁹ Fauconnier (2003), p. 3
²⁰ Lakoff (1980)
²¹ Saussy (2008), p. 37
²² Saussy (2008), p. 18
²³ Fenollosa (1918, 1936), p. 47
²⁴ Searle (1990)
²⁵ Doris (1998), p. 101
²⁶ Saussy (2008), p. 31
²⁷ Fenollosa (1918, 1936), p. 50
²⁸ Sack (1996), p. 8
²⁹ Fenollosa (1918, 1936), p. 47

ILLUSTRATIONS



Illustration 2: *A Pattern Language*. April 2012. Visual Arts Facility Gallery, University of California, San Diego.



Illustration 3: *A Pattern Language*. April 2012. Visual Arts Facility Gallery, University of California, San Diego.

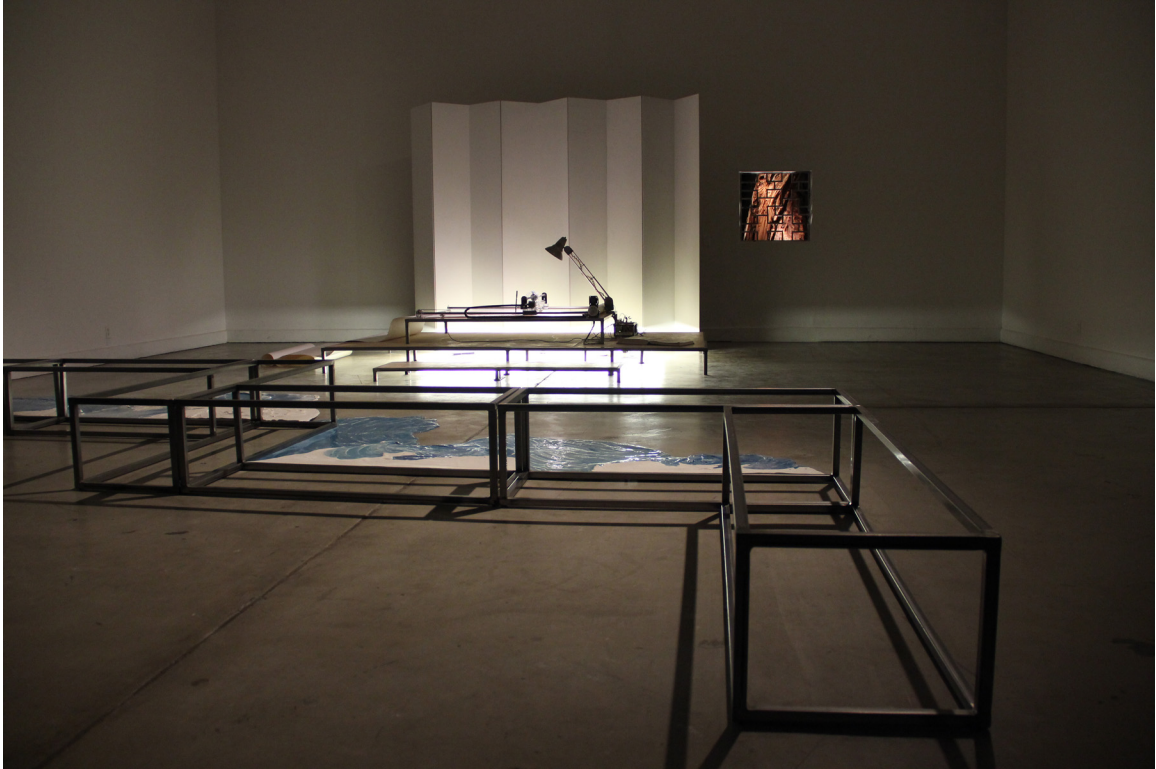


Illustration 4: *A Pattern Language*. April 2012. Visual Arts Facility Gallery, University of California, San Diego.

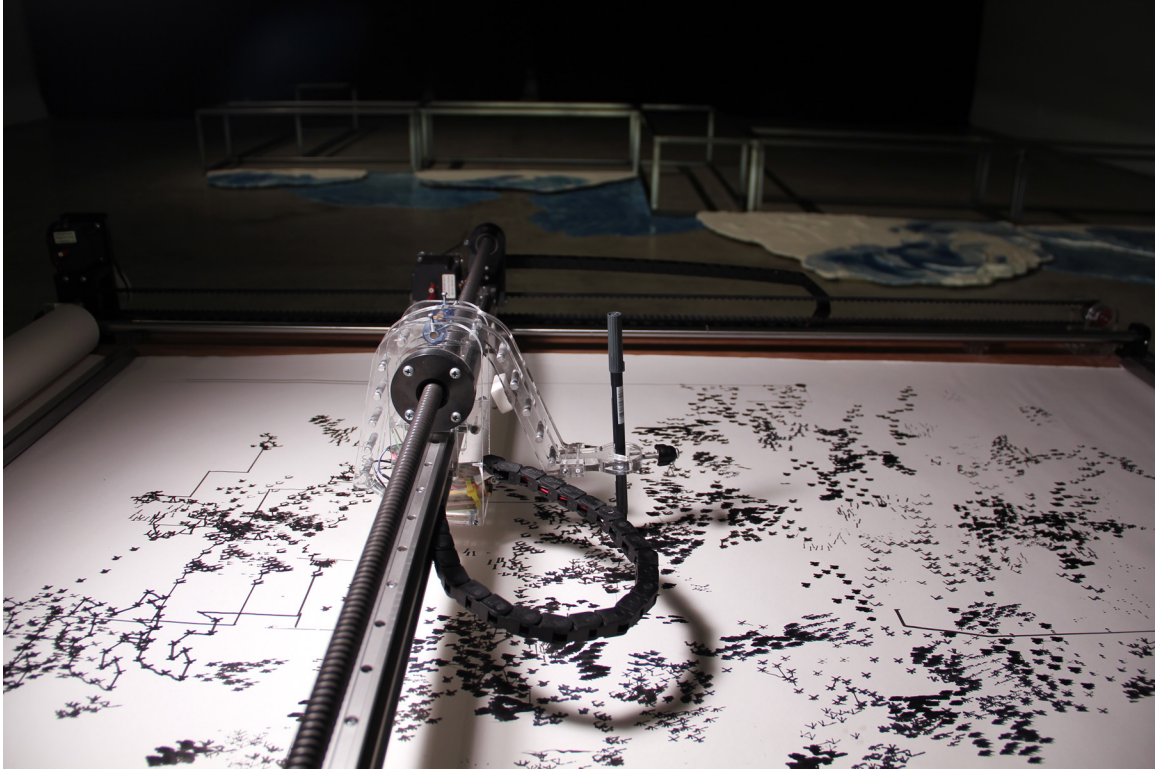


Illustration 5: *A Pattern Language*. April 2012. Visual Arts Facility Gallery, University of California, San Diego.



Illustration 6: *A Pattern Language*. April 2012. Visual Arts
Facility Gallery, University of California, San Diego.



Illustration 7: *Vibrating Milk*. 2008. San Francisco.



Illustration 8: *There Goes the Neighborhood!* June 2010. San Diego Museum of Art.

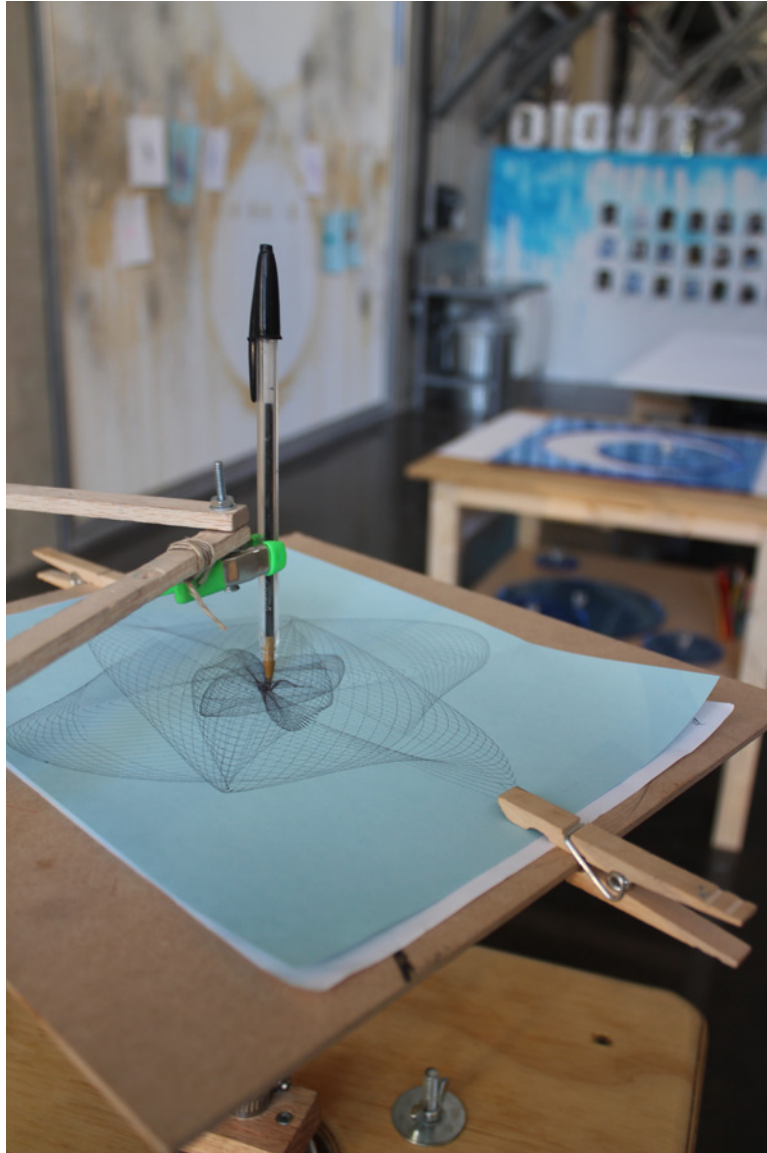


Illustration 9: *Fundamental Frequencies*. October 2010.

New Children's Museum, San Diego.



Illustration 10: *Scylla serrata*. February 2011. University Art Gallery, University of California, San Diego.

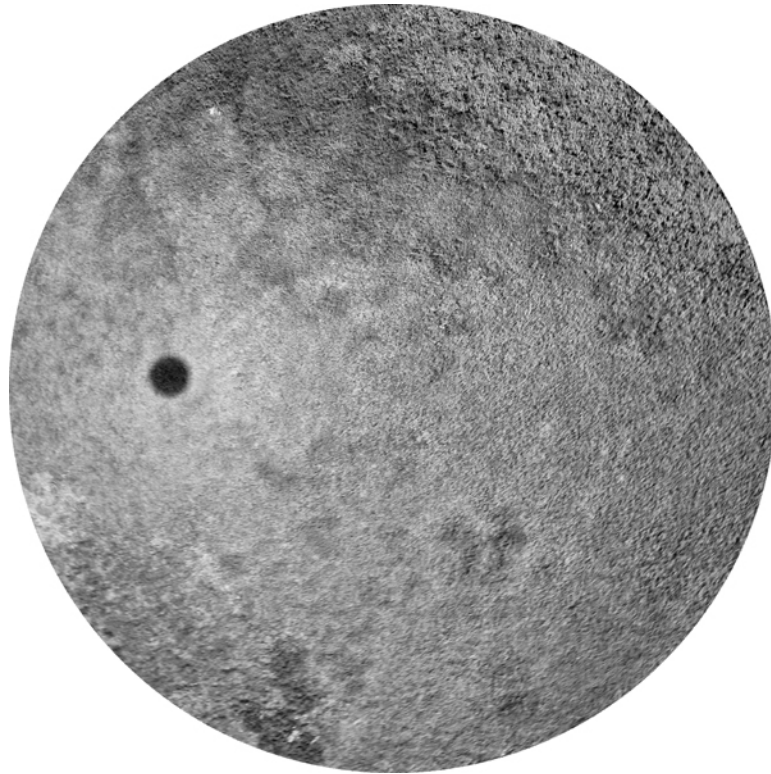


Illustration 11: *Lagoon Project*. 2011. San Diego.

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