Oiko-nomic Threads

Marinos Koutsomichalis
P.O. Box 1901, E. Antistaseos
Heraklion, 71004 Greece
me@marinoskoutsomichalis.com

Afroditi Psarra
17, El. Venizelou
Athens, 15561 Greece
stereochic@gmail.com

Maria Varela
5, Korai
Athens, 15233 Greece
m.mivon@gmail.com

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the Owner/Author. Copyright is held by the authors.
ISWC'14 Adjunct, Sep 13 - September 17 2014, Seattle, USA
ACM 978-1-4503-3048-0/14/09.
http://dx.doi.org/10.1145/2641248.2641281

Abstract
Oiko-nomic Threads is a collective art project for an algorithmically controlled knitting machine and open data. The installation represents a system commenting on the notion of work through the production of a textile in real-time. By means of rethinking, modifying and redefining the functionality of an obsolete knitting machine and employing financial data from the databases of the Greek National Manpower Employment Offices as well as selected patterns inspired by Greek folk art, a textile is generated algorithmically. This way, the woven textile is to be understood as both a document of its own making as well as a dynamic base of archival resources which presents a computer-generated interpretation of the original financial data.

Author Keywords
Physical Computing; Hacking; Knitting; Tinkering; Embroidery; Micro-Controller; Image Processing; Generative Design; Open Data; Labour; Art; Craftmanship; Media Art;

ACM Classification Keywords
J.5 [ARTS AND HUMANITIES]: Fine Arts.; H.5.1 [MULTIMEDIA INFORMATION SYSTEMS]: Animations.; H.5.m [INPUT/OUTPUT AND DATA COMMUNICATIONS]: Miscellaneous.; I.4.m [IMAGE

PROCESSING AND COMPUTER VISION]:
Miscellaneous.

Background

Weaving has played a key role in international economy during both the pre-industrial and the industrial era, as well as during the domestic revolution of the 1980s when knitting machines became a popular domestic appliance. Accordingly, it has always been associated with wealth and prosperity, as well as with corporeal labor. In Greek tradition, weaving held a prominent place, especially during the 18th and 19th centuries, when woven textiles were typically produced from women to satisfy their the household needs. Such was the importance of weaving in the social fabric that in certain Greek regions the word 'weaver' denoted a good wife and housekeeper and was used as a compliment.

Oiko-nomic Threads is a collective installation art project that resolves around the idea of labor. It explores weaving in both symbolic and phenomenological terms and employing both outdated and present-day technology. The work is structured around the real-time production of a textile through an obsolete knitting machine which has been tinkered with to be algorithmically controlled by a computer running custom software. The decoration of the woven textile emerges from the computer's interpretation of contemporary financial data, that are encoded and processed using patterns inspired by Greek folk art and according to a complex automaton. This way, the installation Oiko-nomic Threads enacts a mythology around the very methodology of fabrication and creates the conditions to keep the weaving process contemporary and accessible. The produced woven fabric may, then, be understood as a dynamic archive that represents the computer's interpretation of the original data.

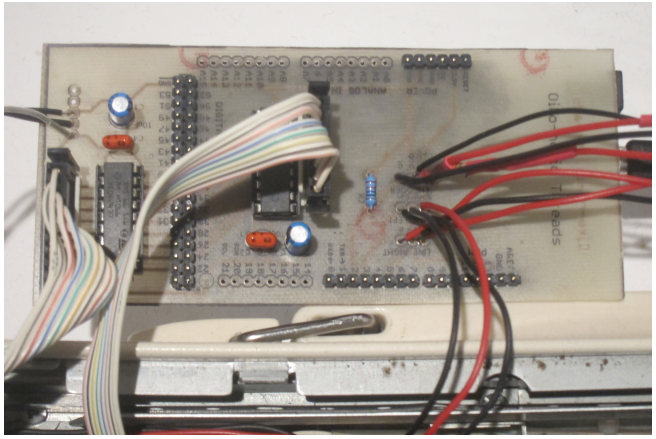


Figure 1: Brain for the knitting machine.

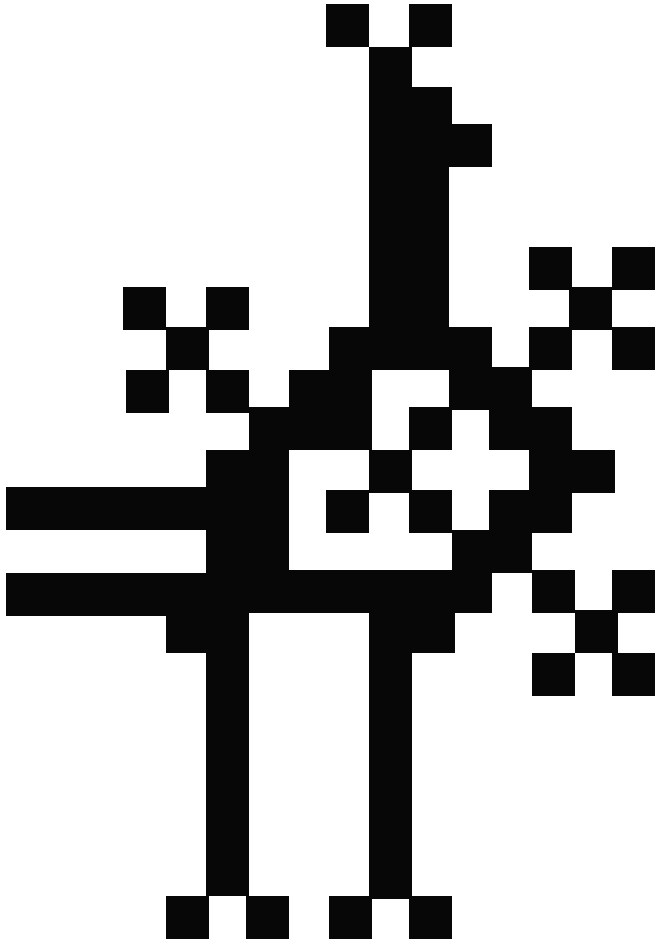
Technically speaking, the installation is structured around a Brother KH-950i knitting machine. The machine has been hacked, its main processor has been replaced with custom electronics (also employing an arduino DUE micro-processor) and additional sensors and electronic components have been used so that the machine may be controlled from a computer sending messages through a serial port. This way, it is possible to interface the mechanical parts that control the movement of the needles. Image 1 demonstrates the custom 'brain' interconnected to the machine. On the computer side, a custom algorithm has been coded using C++ programming language and the openCV framework for image processing and computer vision. The algorithm relies on hard-coded rules and on a very minimal stochastic process to interpret numerical financial data through binary raster-graphics patterns (digitized version of original Greek traditional motifs). The graphics are generated algorithmically line by line with respect to the original financial data and in a way that patterns may be

layered and scaled according to the computers interpretation to result into a generative design subsequently knitted on pattern. Detailed hardware and software documentation and the progress of the project is published in the projects GITHUB page[1].

Conceptual Axis

The installation Oiko-nomic Threads represents a system that through the production of a textile is commenting on the very notion of labour in its historical transfigurations. This is achieved through the juxtaposition of elements that represent different historical incarnations of the very same technologies, symbols and social functions.

Indeed, the knitting machine and the computer encountered in the installation are both historical artifacts of the very first looms, since Babbages analytical engine—unarguably a predecessor of contemporary computers—is based on loom's architecture. More, much alike contemporary computers, weaving has always been dependent on some sort of 'programming', originally carried out by the operator of the machine and later by some electronic circuitry, so that the desired pattern is knitted. Then, the knitting machine used in Oiko-nomic Threads, like most domestic knitting machines, exemplifies a binary paradigm, since at every given moment the state of the machine may be described as a binary (each digit representing which of the two available threads should be used for each stitch). Therefore, the knitting machine and the computer may be understood as different incarnations of the very same technology, which has been always dependent on labour as well as on computation. It has to be highlighted, too, that this very same technology in its various incarnations has resulted in breakthroughs and reorganization of the entire social and financial structure. Consider, for example, the industrial loom as the motor behind industrial revolution, the domestic knitting machine as the driving force towards a domestic economy in the 1980s and personal computer as the carrier of the contemporary information era.



[1] https://github.com/MarinosK/oiko-nomic-threads

Figure 2: Example of digitized pattern.

In the same vein, Oiko-nomic Threads' input and output may be understood as just different representations of the very same notion, i.e. economic data. The original financial data have been retrieved from the databases of the Greek Manpower Employment Offices and are ostensibly a measure of employment and wealth in contemporary society. In the same fashion, the digitized folk patterns used also relate with these two concepts—in older societies weaving was considered as one of the primary means of production and therefore textiles and relevant artifacts as 'wealth and 'capital.

Oiko-nomic Threads is, this way, situated in the intersection of labor and technology and constantly revolves around these two constituents and through their historical incarnations to demonstrate the ways in which a society depends upon them. More importantly, it suggests a new economical model founded on a constructive discourse between the past and the present and suggesting a new way of production based on creativity, on openness and on tradition.

Design

Even though in Greek tradition woven textiles were used as everyday objects, they had been decorated as unique creations. Women used to decorate them not merely for aesthetic reasons but also to indicate their use. Thematically, such patterns can be classified in broader categories such as geometric shapes, plants/animals, religious themes, themes from everyday life, historical themes, etc. After a relevant research in the archives of the Hellenic Folklore Research Center, a pattern-pool was created for Oiko-nomic Threads, consisted of a selection of design patterns from the Greek mainland and islands, edited and digitized to account for their use with available technology. This pool constituted the 'alphabet' the computer would rely on to interpret the financial data fed to it. Example of such digitized patterns are shown in images 2 and 3.

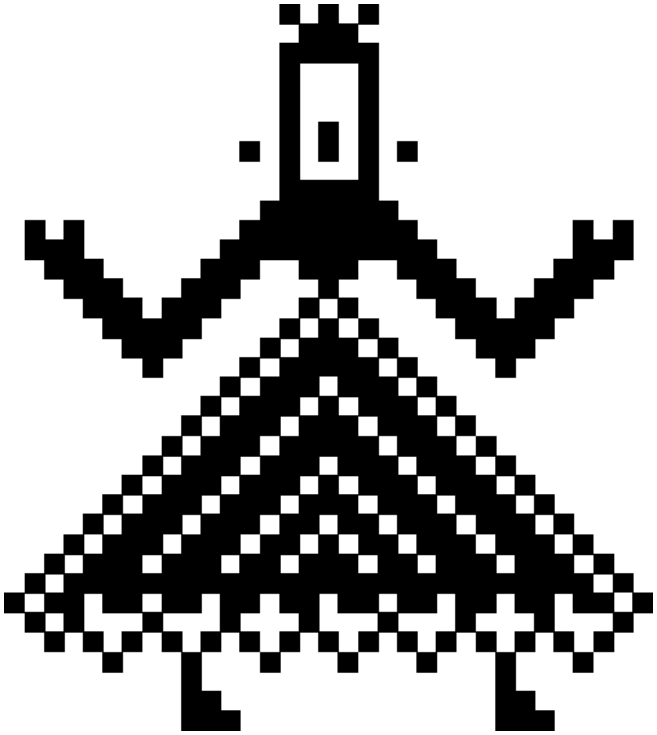


Figure 3: Example of digitized pattern.

From a technical point of view, Oiko-nomic Threads can be understood in terms of an I/O system where a dataset is re-interpreted through another that acts as an 'alphabet'. The original dataset used in the project is a numerical record of the financial activities of the Greek

National Manpower Organization since 2008 which, according to the Greek legislations, are supposed to be open to the public and accessible online. Oiko-nomic Threads relies on a complex automaton that encodes these data into sequences of design patterns and further manipulates the latter to generate computer graphics that are subsequently materialized (woven) as textiles. Since every number in decimal format may be described using a combination of 10 possible symbols, only 10 different patterns have been used, each assigned to a digit from 0 to 9. A simplified version of the automaton may be describe like this:

Figure 4: Generative design visualized on the screen.

1. Retrieve next numerical entry.
2. Deterministically map each number to a sequence of the corresponding patterns.
3. Stochastically decide the width of each pattern, so they all have different width and their total width is exactly 160 pixels.
4. Scale patterns according to the desired width so that their proportions are kept intact.
5. Calculate a single line of 160 pixels width taking the bottom row of each pattern and them moving to the next sequentially.
6. Move to the next row and proceed until no more rows exist in the shortest (in height) scaled pattern.
7. Repeat steps 1, 2, 3, 4.
8. Calculate a single line of 160 pixels width from the scaled patterns, but this time also layer all the remaining rows of each scaled pattern left from previous iterations of the algorithm and using Boolean logical operations on the binary pixels.
9. Proceed until the process is terminated. If the entire database has been encoded, repeat from its start.

This is an over-simplified version of the automaton that does not include a series of complex operations and tasks related with file I/O operations and with hardware communication, nevertheless it exemplifies the computer's logic when operating on the original financial data. The computer, this way, generates a continuous and never-ending design, which is subsequently visualized in the computers screen line by line—see image 4. The idea is that a simple stochastic operation (which is to be understood as an inherent minimal element of computer logic—the computers own and only contribution to the whole process) will (through layering the remaining parts) result in infinite eventualities and contingent transfigurations. This leads to all sorts of computer-generated designs that, nevertheless, in their very essence are nothing but the machines own way to

interpret the numerical data with respect to a fixed set of patterns. These patterns are, therefore, the only available 'alphabet' and they define the only available 'grammar' in terms of which the computer may 'think'. It has to be stretched, nevertheless, that in reality the automaton is even more complex since it is non-deterministically biased by occasional errors in communication between the hardware and the software, various mechanical glitches and miscellaneous errors congenital to the hardware itself, and, finally, the human factor as the operator of everything who will most-likely err at some point.

Figure 5: Oiko-nomic Threads in Bozar Center for Fine Arts, Brussels 2014.

Outcomes and conclusion

Oiko-nomic Threads has been conceptualized as a piece of installation art where the entire system of fabrication is exhibited (and occasionally operated in front of some audience). E.g. image 5 demonstrates the installation set up at Bozar Center for Fine Arts in Brussels.

Figure 6: Example textiles

Still, Oiko-nomic Threads remains a system that employs computational and digital fabrication methods to produce woven textiles—consider image 6 for examples. Such artifacts constitute imprints of the computer's understanding of financial data as well as a contemporary approach to Greek folk art and, hence, they do represent and exemplify the main attributes and the thematically focus of the entire project (labor, technology, tradition, economy). Because of the contingent nature of the automaton used as well as of the different kinds of threads used, each produced piece of textile is a unique 'archive'—a record of a machine-realized interpretation of the original dataset.