International Journal of Current Engineering and Technology
ISSN 2277 - 4106

Available at http://inpressco.com/category/ijcet

Research Article

Study on Designing and Development of Ornamental Products with Special Reference to the Role of CAD in it

Sudeep Sharma[a*], Yadvinder Singh[a] and Gurpreet Singh Virk[a]

[a]L.R. Institute of Engineering and Technology, Solan H.P (INDIA)

Accepted 4 Nov.2012, Available online 27Dec. 2012, **Vol.2, No.4(Dec. 2012)**

Abstract

This paper studies the design and introduction of relevant computer-based design tools for ornamental design industry in India. To this end, a programmable environment for combining motifs into patterns was developed named Estampa (Environment for Stamping Patterns). Estampa is a visual programming language environment for applying transformations to primitive motifs to create ornamental patterns. The design and implementation of Estampa seeks to fulfill the economic, cultural and artisanal requirements of this specific location. The evaluation of Estampa, through initial user trials in the community, presents other possible approaches for introducing programming in a relevant way to non-industrial locations in developing countries. Drawing from this example, a series of guidelines are presented for designing and introducing relevant computer-based applications for these communities.

Keywords: *Ornamental Products, CAD, Estampa*

1. Introduction

Computer aided design is evolving as one of the most advanced technology invention of this fastest and ever growing modern age due to minimization of design time and for this reason the amount of money it can save on a project. In manufacturing industries, architectural, mechanical and production industries, CAD drafting takes a great role in reducing the design cost which leads to cost saving for designers, manufacturers and product inventors. Computer Aided Design is closely related to creativity and logical thinking. Nowadays every product designers, manufacturers and inventors designed their products by using the modern technologies of computer aided drafting and design. AutoCAD is the most popular and common platform for CAD drafting and design services among all other platforms. Due to the emerging form of CAD, the architects are becoming more sophisticated by lessening their dependency upon excessive paper drawings. This is resulting in enough time saving to concentrate on their core activity and business.

CAD is not only important in the field of architecture or mechanical engineering sector, but also very crucial in the area of graphic design, fashion design, toy design, packaging, computer gaming and movies. In most of the above highly sophisticated and fashionable sector, CAD has been proven its vitality as an integrated part of digitization with high clarity as well as output. CAD is a true asset for architects who are interested to have a robust career in any domain. The CAD systems capable of making your work easier and faster by removing the repetitive works, which not only fastens the speed of the work, but also mitigate the stress upon the designer to lot, extend due to repetitive works. Furthermore CAD system is the effective way for reducing the errors in designing and drawing with high accuracy and quick turnaround time. Nowadays, many CAD design and drafting companies are providing complete project management to serve the entire residential and commercial design need of the architects and engineers. Advantages of CAD ages after struggling with the limitations of manual drafting engineers invented an advanced, cost effective and efficient process of drafting with the help of computer technology which is known as Computer Aided Design and Drafting (CADD). With the invention of CAD, the advantages become multi-folded. The overall drawing creation time was reduced by a huge margin. Standards were maintained by advanced CAD software. Modification and multi copy preparation become easy like a child's play. The issue of safe custody of the designs and data literally vanished. Being digital in nature, transfer of the prepared drawing/design became extremely easy through internet. Publishing the design/drawing on the web became possible allowing an unlimited number of viewers assessing it at the same time.

The research in this thesis combines three topics:

• The description of a successful introduction of a computer aided design (CAD) tool in a non-industrial, non- developed location such as ornamental design.

Sudeep Sharma is working as Associate Professor; **Yadvinder Singh** and **Gurpreet Singh Virk** are working as Assistant Professor

• The design and implementation, based on the above-mentioned study, of a programmable drawing tool called Estampa (Environment for Stamping Patterns. The programmability of the environment allows the artisan to explore the design of patterns in new ways, not possible existing CAD tools.
• The evaluation of Estampa through user trials with artisans of Goldsmiths of various parts of India and then developed a set of design guidelines for the creation of specialized applications relevant for non-industrialized settings.

2. Motivation

The use of the computer as a digital design tool might seem too sophisticated for non-industrialized settings, in India, CAD/CAM tools are currently being used to conceive and manufacture copper crafts. I aim to provide these artisans with an environment where they can use the computer as a programming tool. I believe that if the artisan is presented with an appropriate tool, he will use the power of computer languages to create new designs for his crafts. In the short term, artisans could program these new designs using Estampa. Furthermore, learning to program can teach debugging skills to the artisan, useful for solving daily computer problems such as configuring hardware, installing software, or locating a malfunction.
I hope that in the long term, artisans will be sufficiently acquainted with the programming skills required to design and implement their own custom environments. I see no reason why they could not create their own software in the future, given the necessary training.

3. Approach

Patterns can be drawn with Estampa by programming "stamping rows" in an iconic visual language. These "stamping rows" apply transforms (translation, rotation and scaling) to pre-selected motifs (spiral, circle, half-circle, s-form, line, zigzag, and wavy-line) or groups of motifs.

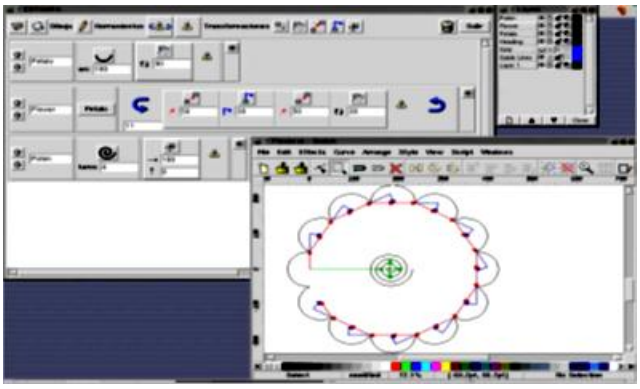

Figure.1. Estampa: Environment for Stamping Patterns.

The skill to draw a perfect hand-drawn circle takes years to develop, while a child can create a "perfect circle" in a CAD with a few clicks. The utility of CAD tools for drawing lies in the constraints they pose to the artisan or the elementary student. The CAD user is only allowed to make flawless straight lines or perfectly round circles. This does not mean that the computer is necessarily a superior medium to learn drawing; the computer can never replace hand drawing, but it can serve to explore drawing in different ways than hand drawing can. Computers and software never evolved in non-industrial environments in developing countries, they just materialized. In developed countries, the creation of crafting software has been following the advent of digital technologies. This is illustrated by the variety of crafting software and hardware that is available in the USA to create traditional crafts such as quilting, embroidery and stained glass. However, in non-industrialized settings, computers are appearing without any previous history. Consequently, no software has specifically been developed for these environments, and even less with them. If the computer is to find its place in a non-industrial society in non-developed locations, it is important to develop applications that are specifically suited for their culture and infrastructure. In order to create adequate tools for the intended audience, the programmer must go, on site, to understand the design criteria. The involvement of potential end-users for the design of a system stretches across a wide range of perspectives, backgrounds, and areas of concern but is formalized in several design approaches. Participatory design in particular, encourages the designers to work with users to better understand the implications of prototypes and scenarios for new designs.

4. ETCH

Etch is a vector based graphic design environment, in which one can create objects not only by direct manipulation tools, but also parametrically through an object oriented version of the programming language Logo. Etch outputs in a variety of file formats supported by many fabrication tools both modern -- like laser cutters, Water jet cutters, and 3D printers -- and traditional -- like computer numerically controlled lathe, milling, and sewing machines. In Etch, the graphical turtle serves as a concrete model for the machining tool tip (drill bits, laser, or needle), and Logo is a formal way of understanding and

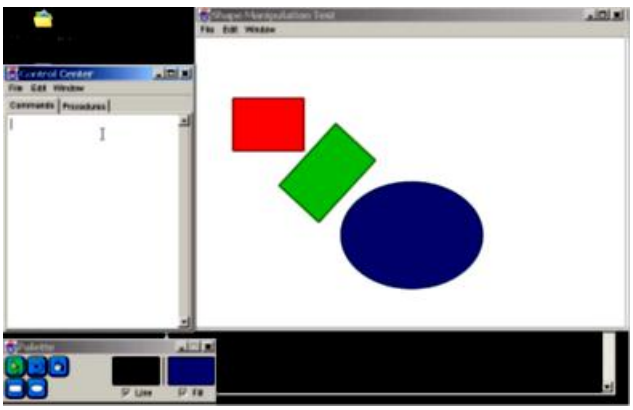

Figure 2 ETCH.

creating representations of tool paths underlying common file formats used in describing project files for common fabrication applications. As new technologies bring these types of tools to a new community of users, new design applications are required. ETCH expands the realm of creation of a Logo environment by providing an platform for the creation of concrete objects through computer aided manufacturing tools. One of the goals is to create unique programmable entry points to the world of machining and fabrication.

5. DBN

DBN is both a programming environment and language. The environment provides a unified space for writing and running programs and the language introduces the basic ideas of computer programming within the context of drawing. Visual elements such as dot, line, and field are combined with the computational ideas of variables and conditional statements to generate images. The Design by Numbers language was "designed specifically for visual people – artists, designers or anyone who can pick up a pencil and doodle". It is composed of simple and concrete metaphors such as paper, line, point and basic control structures as repeat. As an extremely constrained drawing environment, design by numbers presents an excellent example in how well chosen constraints can support powerful scaffolding. Maeda transforms the drawing space, composed by a grid of 100 by 100 points into scenes, reactive graphics and a remarkable variety of graphics.

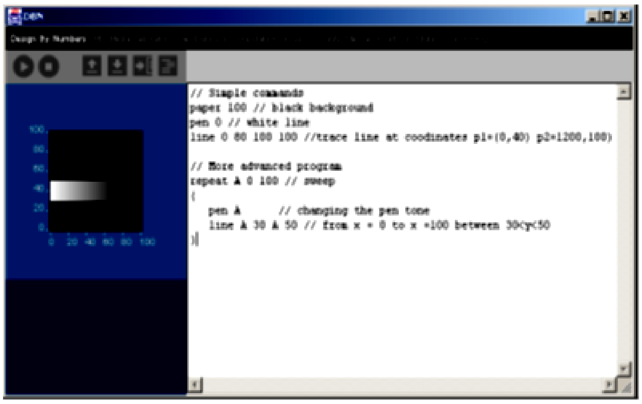

Figure 3 Design by numbers.

6. Shaper 2D

"Shape grammars are visual, spatial algorithms for creating, or computing, and understanding designs. Presently, the preferred approach to the development of shape grammar interpreters is to design special tools for special functions, rather than "universal tools". The program presented in this thesis, Shaper 2D, was developed by the author as a dynamic, visual interpreter for exploring basic, two-dimensional shape grammars. Shaper 2D is a constructionist environment for the learning and practice of shapes grammar. It is directed towards the designer who wishes to experiment with shape grammar without having to learn and understand all the theory behind it. The most remarkable part of the Shaper 2D is the constrained and graphical programming environment which allows the designer to easily explore a wide space of design, by controlling a few parameters. Moreover, its visual programming metaphors allow for a direct and interactive for the manipulation of simple shape grammars.

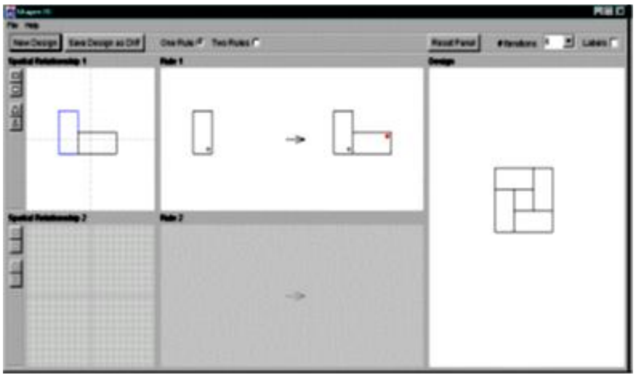

Figure 4 Shaper 2D.

7. Pattern

Pattern reads in a shape description, builds a tree of shapes and renders the pattern. Pattern is meant for incorporation into design software that can be used by persons having minimal artistic skills. Pattern is a promising environment for programming traditional patterns of India. It renders beautiful artisan drawings programmed in a Shape Grammars Descriptions Format into postscript files. The scripts use metaphors Shapes, Compound Shapes and Pattern Trees to describe ornamental patterns. This Compound Shapes and Patterns Trees could be good metaphors for programming arrangements of flowers as show below.

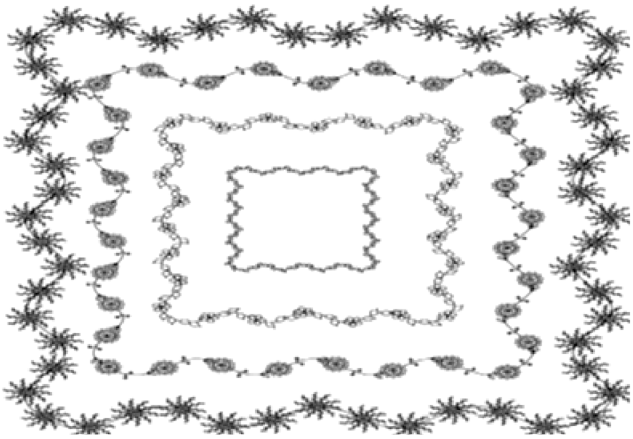

Figure 5 Border Patterns produced using pattern.

8. Computer as an Artisan Rule

To understand the role that the computer should play in the artisan's life, one must first understand the artisan-machine relationship. The artisan started to use machines when they began to appear, in the 16th century, before industry was born. Artisans have long used mechanical machines such as the ornamental turning lathe and other tools. The ornamental lathe was designed to produce extremely intricate work, since it allowed new ways to creatively conceive a handcraft while exploring the material. The machine was not primarily used for raising productivity and lowering costs, as in industry, but rather to discover new creative pathways; for tools can mold matter where the hand doesn't have the shape or strength to do so. The defining characteristic of the end product was the intention of the artisan, unrestrained by fashion or price. But in the 18th and 19th centuries, the machine became the artisan's worst enemy, in the hands of industry. The artisan couldn't compete against the efficiency of mass production powered by mechanism, steam and electricity. This decimation of artisans gave root to many movements, such as the "The Arts and Crafts Movement" in England in the 1860s. Some proponents, such as Ruskin, argued that the machine dehumanized the worker since it detached him from the artistic process, that, "all cast from the machine is bad, as work it is dishonest." But other proponents of the "The Arts and Crafts Movement", such as William Morris, were not totally opposed to machines, although "he was deeply critical of the consequences of machine production in a capitalist society" (Harvey Charles, 1996). William Morris understood instead that the machine did have a place in the world of the artisan, Thus the apparent conflict between the artisan and the machine did not rise from the machine itself but from the displacement that the artisan was forced to endure by industry. The artisan is helpless when confronting the efficiency of mass-production in the industry. Thus for an artist to survive, he must find a product niche, which has and shall remain untouched by industry: the creation of original and unique pieces.

Just as the ornamental lathe was useful for exploring new pathways for crafting, the computer can allow the artisan to seamlessly manipulate preconceived shapes (such as motifs). Thus, the computer should not be used for its labor saving cost for easy mass production, such allowing the unskilled drawing technician to create perfect blue prints, on the contrary, the computer should be used by the skilled artisan for experimenting with different motifs and patterns. This is the main difference between the use of the computer by an unskilled technician and by a skilled artisan - the unskilled technician uses the machine only to reach a preconceived goal, whereas the artisan can use the machine in novel ways. Hopefully Estampa will add yet a new way, such as experimenting with the visualization of a pattern with different motifs and allowing for the creation of novel patterns that can only be created by programming, using the iterative power and the versatility of a computer language. In the professional field, crafting software has existed for a long time. The more common software crafting such as CorelDraw or Illustrator, are intended for designers. However more specialized software does exist directed at specific craft such as quilting and stained glass. But specialized crafting applications remain scarce in non-industrial settings in the developing world, which have an important tradition in craft making. Thus, it is worthwhile to study and create computer assisted crafting applications because of their relevance in these communities. A craft-computing tool is useless without the necessary technique to produce an authentic tangible craft. Thus, a craft computing tools must have a direct relationship with concrete activities the artisans perform.

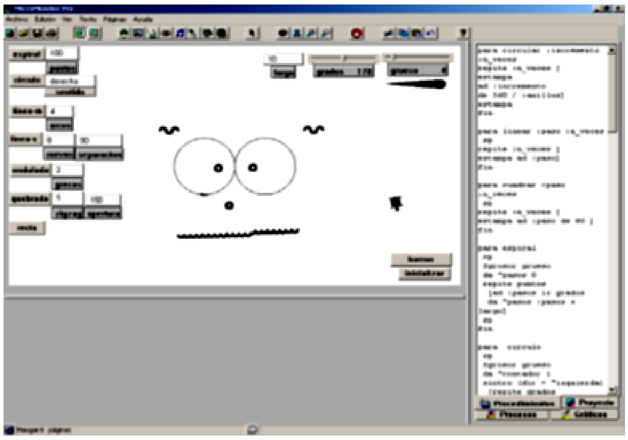

Figure 6 First Estampa prototype.

9. Design & Implementation

Estampa provides programming constructs and commands for generating patterns of primitive motifs based on the Best Maugard drawing method. Ideally, Estampa should expand the range of what people design and create, by providing a programmable environment where motifs can be arranged by applying transformations. Estampa aims to provide an environment where the artisan and young artisans in the elementary school get an understanding of what the word "programming", means, by doing it. Many properties, such as length, are not parameters since they can be modified with the transformations. The motifs share these common properties:

- They are all the same size.
- They all grow out from the middle outwards.
- The center of rotation is the symmetric center

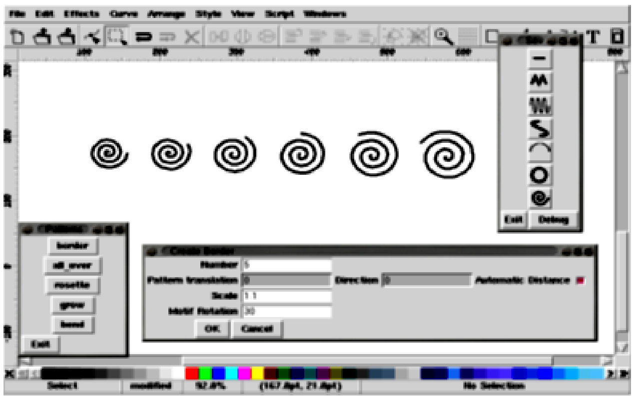

Figure 7 Second Estampa prototype.

Technically, Estampa is subdivided into six modules, estampa, interpreter_ui, motif_ui, pattern_maker, pattern generator and motif modules. The estampa module is the main module, controlling all the objects that compose Estampa. It first instances the interpreter_ui, which contains all the graphic user interface definitions for the rows that make up a program. The rows contain graphic blocks defined in the motif_ui module.

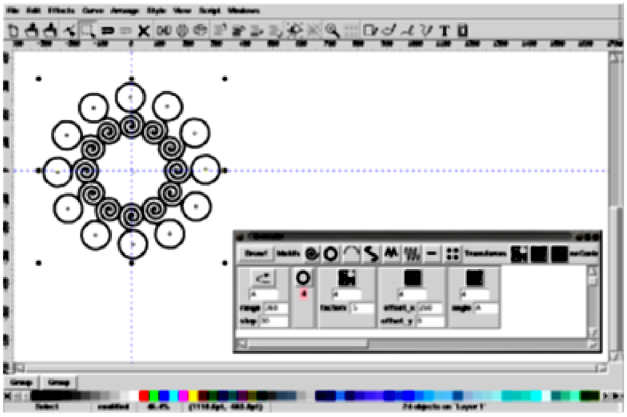

Figure 8 Third Estampa prototype.

When a program is executed, the graphic user interface is parsed by the pattern_maker module to create a python file that gets compile and interpreted by python in the pattern generator, using the motifs predefined in the motif module

Conclusion

This research presents the design and implementation of a craft computing environment for non-industrial settings. The goal of software's development was to provide a drawing-centered digital design space for artisans and students of an elementary school. I feel that the economical and the technical requirements were fulfilled but the research and artistic requirements were only partly satisfied. For the elementary school students, Estampa should be redesigned to constrain the drawing themes to figurative subjects composed by patterns that children are naturally inclined to draw. This will prevent children from drawing subjects that do not incorporate patterns and thus a problematical or tedious to programming (such as Pancho's car). A plausible avenue for finding programmable drawing subjects based on patterns would be to take a subset of those described in best Maugard's book, such as flowers and customize an Estampa specifically for creating them. The language would directly address the creation of a petal row by defining the shape, size, number and orientation of petals. Another essential requirement for using digital design is that quality technical training is provided to the network administrator. A CAD system is rendered unusable if the computer where it is hosted is out of service. Furthermore, the network administrator should become more of a network facilitator. After the initial setup of the computer infrastructure, the network administrator should take the professional role of an advisor for the user, ready to guide and explain the tool and how it could be useful to him. The utility of Estampa for the artisan remains inconclusive though the programming metaphor clearly understood by the artisan, the method for introducing the tool must be refined by conducting a long term introduction. The introduction should focus on strategies for introducing the tool to the artisan in such a way that he is directly convinced to the distinct value it brings to his work as explained to me by Metcalf- it is naive to think that an artisan will adopt a tool because it is new or better than his present tools. The artisan will only adopt a tool if he is convinced that it raises the uniqueness or quality of his work or decreases his manufacturing time with maintaining the uniqueness and quality of his work.

References

Cooley, M & Noble, D. (1982). Architect or Bee, *South End Press.*

Eisenberg, M. & Eisenberg, A. (2000). The Developing Scientist As Craftsperson, *Springer-Verlag*,

Greenbaum, J. & Kyng, M. (1991). Design at work. Hillsdale, NJ: Laurence Erlbaum & Associates.

Harvey, C. (May 1996). William Morris - art and idealism.(Victorian Values). *History Today*

Herzog, B. (2001). Sketch: Homepage http://sketch.sourceforge.net

Maeda, J. (2001). Design By Numbers. *MIT. MA.*

Mihich, O. (1993). The Weaving Turtle: African Textiles. The Logo foundations papers. http://www.Logofoundation.org

McGill, M. (2001). A Visual Approach for Exploring Computational Design. M.A. Thesis. *MIT. MA*

Metcalf, J. (2002). The drawing method of Adolfo Best Maugard adapted by James Metcalf. –Video-. Instituto Latino-americano de Comunicación Educativa ILCE.

Papert S. (1980). Mindstorms. Basic *Books. NY.*

Patil, S. Kedar. (2002). Geometric Modelling of Patterns. M.A. Thesis from the *Indian Institute of Technology*. Kanpur.

Prarkash, M. Low cost printing device for a chikan craftsman , MIT Media Laboratory, *Indian Institute of Technology*, Kanpur, India, 2002

Pellicer, A., and Metcalf, J. (1997). PEFIPA Proyecto Experimental de formación integral para la producción artesanal. Unpublished, can be found in the *CECATI Library*.

Skodnick, R. (1996). James Metcalf Joins the Smoky Smiths Deya-Paris-Santa Clara del Cobre, GRAVESIANA The Journal of the Robert Graves Volume I Number II, *Society.Buffalo, NY*

Skodnick R (1998). James Metcalf of Santa Clara del Cobre, Metalsmith Volume 18.

Stamati, V, Fudos, I. A Parametric feature based CAD System for reproducing traditional pierced jewelry, Computer Aided Design & Application, 2(1-6) 2005, 1-9.

William J.C. and Patrick J.F.E., 2007, Injection streach blow molded container *U.S Patent 20070048473*.

Tam K.W. and Chan K.W., 2005. A novel surface scanning system, Journal of robotics system, *Willey inter science,* 22, 7,359-366.