STRUCTURE SHARING IN LOGO DESIGN

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Structure Sharing means fulfillment of several functions by the same physical structure, and is an important concept in product design. The aim of this paper is to translate and expand the concept of structure sharing to the field of visual design, in particular, to the design of logos. The objectives of this work are to: identify if structure sharing can be applied to logo design, develop a set of guidelines to enhance the degree of structure sharing and resource effectiveness in logo design, and evaluate effectiveness of these guidelines.

1. INTRODUCTION

Structure Sharing (SS) means fulfillment of several functions by the same physical structure [1]. Structure sharing is an important concept in product design and is often referred to using different terms such as combination of functions or integrated structures. They have been used consciously or unconsciously in making products more innovative as well as more efficient in terms of resources used [2].

Resource Effectiveness (RE) is necessary to keep product cost down and reduce time to market; both are essential to keep a product competitive [3]. In earlier work that focused on engineering designs [4], it has been found that enhanced structure sharing leads to greater resource effectiveness, leading to more cost effective designs. This leads to the questions as to what structure sharing would mean in the context of aesthetic designs, and to what extent it would lead to resource effectiveness in these designs.

The aim of this paper is to translate and expand the concept of structure sharing to the field of visual design, in particular, to the design of logos. The objectives of this work are to: identify if structure sharing can be applied to logo design; develop a set of guidelines to enhance the degree of structure sharing and resource effectiveness in logo design, and to evaluate effectiveness of these guidelines.

2. RESEARCH METHODOLOGY

The following is the research approach used with respect to each objective:

1. Understand the concepts: What is function, structure, structure sharing, and resource effectiveness in the field of logo design? To clarify these concepts, a literature review has been carried out on logo design. Around 200 logos were collected and among these the ones that appear to involve structure sharing have been selected for further analysis. By analyzing these logos, definitions of a set of structure sharing parameters to be applicable to logo design have been developed.
2. Develop methods for enhancing structure sharing in logo designs: How can we translate into logo design the methods for measuring SS and RE? What steps must be adopted for enhancing structure sharing and resource effectiveness in logo designs? Using the definitions developed in the previous
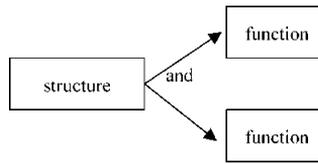
Figure 1. Structure Sharing (Source [3])

step, methods to measure SS and RE have been evaluated for selected logos. A literature study was done to identify guidelines to design good logos, following which a new set of guidelines were arrived at as a check list for designers to enhance SS and RE in their designs.
3. Evaluate the effectiveness of these methods: How can we verify whether or not the methods are effective? A comparative study of the effectiveness of logos designed with and without using the guidelines has been carried out for validating the guidelines.

3. DEVELOPING UNDERSTANDING AND MEASURES

A logo is a visual representation of a company or organization, which forms the foundation of its corporate identity. It is a name, symbol, monogram, emblem, trademark, or other graphic device designed for easy and definitive recognition by the company's audience [5]. Structure sharing (SS), by definition, relates to the number of functions and structures in a given design solution, see Figure 1. The phenomenon of SS is said to exist where there is more than one function fulfilled by the same structure at the same time [4]. SS is calculated by Chakrabarti and Singh [4] as the ratio of the number of functions at the lowest level of abstraction to the number of structures in a product:

$$\text{Degree of } SS = \text{no. of functions at the lowest level of abstraction/no. of structures} \qquad (1)$$

In order to redefine the concepts of function and structure with respect to logo design, around 200 logos were collected, and among these 36 logos which showed signs of structure sharing have been selected for further analysis. The work of Chakrabarti [6] has been used as the basis for defining function and structure, and to represent these, five constructs have been used namely: variables, properties, constraints, effects and components.

- A *function* of a logo is the depiction of an event/company/organisation/non-commercial entity by visual and/or tactical means with an intent to convey the most important or primary information about its activities, services or brand.
- *Main functions* are the intended effects from the logo design at its highest level.
- *Means* are the principles, laws or phenomena that are responsible for the occurrence of the function [4].
- An *effect* is the implementation of the basic concept (Means) through which is the function of the logo depicted or expressed.
- A *component* is the element in the logo chosen to depict the effect. Components are formed by ideograms (sign, icon), emblem (symbol), typography (fonts) or images either independently or a combination of these.
- A *constraint* is the geometrical/ spatial/ proportional relationships between components to bring in the desired effect.
- *Properties* are the basic characteristics of the components. (E.g. colour, size, texture).
- *Variables* are quantities associated with a logo that can vary when a particular effect is applied to a logo. Variables are some times values of properties which may undergo a change due to an effect, like for example, a change in tone or hue value, change in size etc. Other quantities which can vary are orientation, shape, typography or font, ideograms etc.
- A *structure* is a positive or negative entity capable of being identified independently by means of its properties.
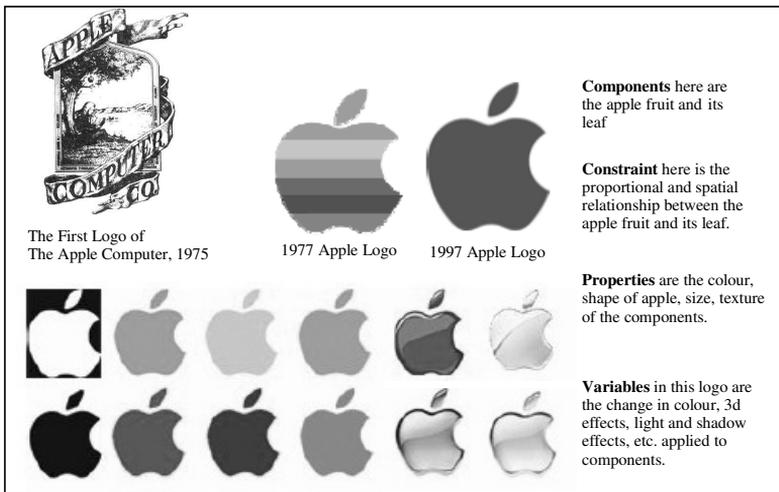
Figure 2. The Apple logo and constructs Source...' to 'The Apple logo and constructs, Source... [7, 16].

The logo of Apple Inc., an American multinational that designs and manufactures consumer electronics and computer software products, is being taken here to illustrate the above mentioned constructs. Figure 2 shows the Apple logos of 1975, 1977 and 1997.

The main function of this logo is to depict its brand name 'Apple'. The *means* used in the 1975 logo, designed by Ron Wayne, is by the depiction of Newton under his apple tree.. The *effect* here is the graphic of a seventeenth-century man, in the countryside, reading a book, under a tree with an apple on one of its branches. The *means* used in the 1977 logo, designed by Rob Janoff, is by the depiction of a rainbow-coloured silhouette of an apple with a bite taken out of it. The apple depicts the brand name and the rainbow colour is to represent the fact that a computer monitor could reproduce images in colour. The *effect* here is the shape of a bitten apple fruit and a leaf over it with horizontal stripes on the fruit shape in multiple colours. The *means* used in the 1997 logo is the same but replaced by a monochromatic theme. The logo becomes the "apple" symbol itself instead of the rainbow apple graphic. It appears in various colours in various products. The *effect* here is the apple fruit and leaf in a single solid or glossy colour. See Figure 2 for explanations of other constructs.

Resource Effectiveness (RE) is approached with the view to achieve efficiency in terms of the number of structures used in attaining the desired functions.

$$\text{RE} = \text{number of main functions (MFs)/number of structures} \qquad (2)$$

According to this definition, RE should become, in general, higher as a design gets more simplified. This means that for the same MF, a design with the least branching of its FM tree should have more RE. A design with lesser number of SFs and structures should be more efficient.

A function means (FM) tree was developed for each of the 36 logos using the above mentioned constructs in order to develop an understanding of the solution principle or the logo design for its functionality. The steps for generating an FM tree is taken from the previous study by Chakrabarti and Singh in 2007 [4] for product design and to verify if the same method can be followed for logo design.
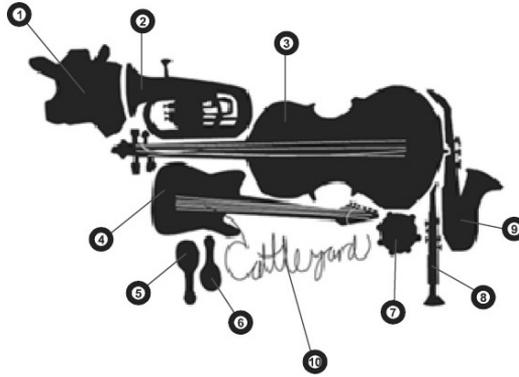
3.1. Steps for generating an FM tree

The steps for generating an FM tree are the following (Figure 3):

1. Identify the main functions (MFs). For the cases where there is more than one MF, each will have a separate FM tree. Each FM tree starts with a MF.
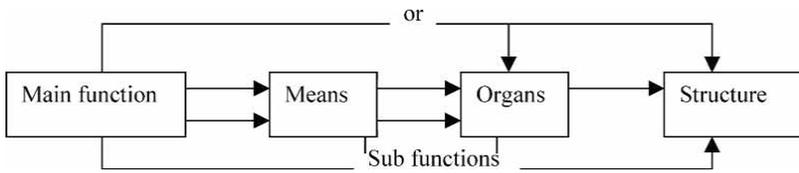
Figure 3. The process of generating a function means tree, Source [4].

Figure 4. Logo for Cattleyard Promotions.

2. Identify the immediate next link, which can be a sub-function, means, an organ or a process. Asking question 'HOW' leads to the next level.
3. At each stage look for further branching until a structure is reached.
4. The total number of end points in an FM tree gives the total number of structures for the purpose of computing the degree of SS and RE.
5. All functions evolving in a branch for the fulfilment of some other function at an immediately higher level of abstraction are called sub-functions (SFs).

3.1.1. Example 1

For instance, the logo of Cattleyard Promotions (see Figure 4), a music related business, is taken for the analysis. The main functions are,

1. to depict that it is a music related business (MF1)
2. to promote the name — Cattleyard (MF2)

An FM tree is generated for each of the two main functions of the logo.

Figure 5 shows the FM tree for the main function 1, 'to depict that it is a music related business'. The *means* (M) which the designer uses to depict the MF1 is by the use of musical instruments, represented in the FM tree as, Musical Instruments (M). The musical instruments cello, guitar, tuba, clarinet, tenor saxophone, ball and castanets are being used for this purpose. The structures numbered 2,3,4,5,6,7,8 and 9 represent these musical instruments itself which is its sub-function. The total number of sub-functions (SFs) in this FM tree is 8.

Figure 6 shows the FM tree for the main function 2, 'to promote the name — Cattleyard'. The means (M) which the designer uses to depict MF2 are,

1. by the use of a cattle/ cow figure
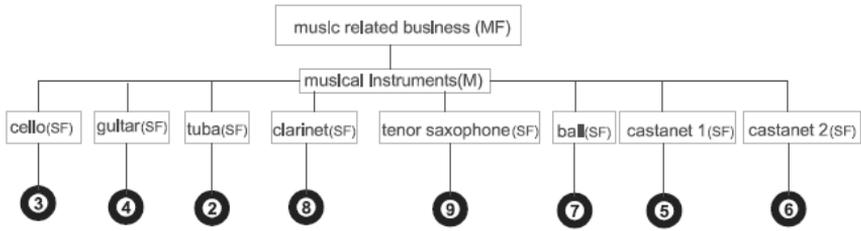2. through use of typography 'Cattleyard'

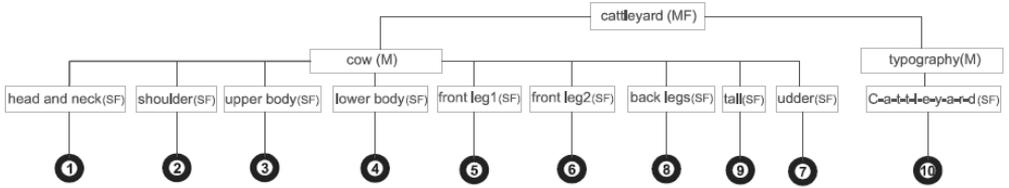**Figure 5.** FM tree for MF1. MF=main function, M=means, SF=sub-function.

Figure 6. FM tree for MF2. MF=main function, M=means, SF= sub-function.

The structures used for each of these means are,

1. Shapes numbered 1,2,3,4,5,6,7,8,9 which meets the SFs head and neck, shoulder, upper body, lower body, front leg1, front leg2, udder, back legs and tail respectively.
2. Lettering 'C-a-t-t-l-e-y-a-r-d' numbered 10, which meets the SF, the text cattleyard itself.

3.1.2. Example 2

Another example is the logo for talkmore, a telephone service from Kingston Communications (see Figure 7). The main functions are to: promote the brand name talkmore (MF1), represent that it is a telephone service that is used for the function talking (MF2).

An FM tree is generated for each of the two main functions of the logo.

Figure 8 shows the FM tree for MF1, 'to promote the brand name talkmore'. The *means* which the designer uses to depict the MF1 is by the use of typography/text talkmore. The structures 1,2,3,4,5,6,7 and 8 represents the SFs 't', 'a', 'l', 'k', 'm', 'o', 'r' and 'e'. The total number of sub-functions (SFs) in this FM tree is 8. Figure 9 shows the FM tree for MF2, 'to represent that it is a telephone service which is used for the function talking'. The *means* used to depict the MF2 is by showing quotes which is used to denote speech. The structures numbered 2 and 8 depict the quote 1 and quote 2 respectively. The total number of sub-functions here is 2.
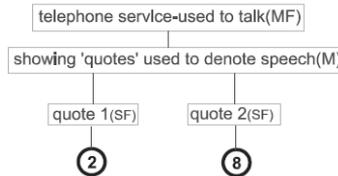
The total number of subfunctions from both the FM trees is 10. The total number of structures is 8. Therefore, from Eq. 1, the degree of SS for this logo is 10/8, and from Eq. 2, Resource Effectiveness, RE is 2/8.

Figure 7. The talkmore logo.
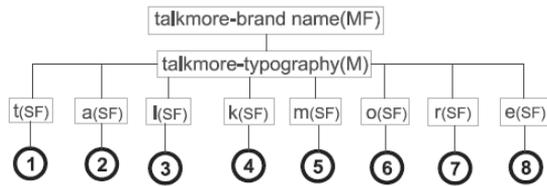
Figure 8. FM tree for MF1 of the 'talkmore' logo. MF=main function, M=means, SF= sub-function.

Figure 9. FM tree for MF2 of the 'talkmore' logo. MF=main function, M=means, SF= sub-function.

4. SS GUIDELINES FOR LOGO DESIGN

The guidelines proposed here are in the form of a checklist for designers, to ensure that the problem has been approached from different directions towards achieving the goal of increasing SS and thereby increasing RE.

1. Identify what kind of product the logo is for.
2. Identify the competitors, project budget for the logo.
3. Identify the most important thing the potential customers should think of while looking at the logo.
4. Find out from the client which colours, symbols, or images could be used for the logo.
5. Find out from the client which colours, symbols, images should not be used for the logo.
6. Make a list of all the details which is to be included in the logo, the exact name or abbreviation etc. of the company/organisation for whom the logo is to be made.
7. Find out all potential implementations of the logo design (letterhead design, business card design, envelope design, t-shirt, signages etc.)
8. Once all the details are available, identify the main functions and make an FM tree for each of those MFs.
9. Apply the following to generate more structure-shared solutions.

   a. Look for the most abstract commonalities between images, symbols, texts between structures under the same FM tree.
   b. Try eliminating the structures by merging the above.
   c. Reduce the number of repeating structures for the same function.

10. Repeat Step 9 for all FM trees.
11. Look for commonalities between FM trees too.
12. If the logo is for implementation in more than one medium, try to make it compatible in all the media to avoid unnecessary variations in the design.

5. EXPERIMENTAL EVALUATION

To validate the effect of SS and RE in logo design, a logo design experiment has been conducted using designers with bachelor's level degree in engineering or architecture undergoing a Master's level course in design. The subjects are first introduced to the basics of logo design and to the type of logos designed. Two logo design problems have then been framed and each subject has been asked to design a logo for each of these problems, one to be solved without using any guidelines for SS and the other

after introducing the concept of structure sharing and the guidelines — with these to be used. In order to reduce the influence on the result due to the inherent difference in the creative ability of the subjects, the problems were swapped as shown in Table 1.

   Problem # involved designing a logo for the music band for Indian Institute of Science named 'Rhythmica'. The problem given was that the logo should reflect the attributes: classy, professionalism, and that it may also have images of musical instruments. The letter 'R' was asked to be emphasized and a tag line 'Music in IISc' was also asked to be included. No restrictions were given on the positioning of the tag line. Problem $ involved designing a logo for a computer technology company named 'icon'. The details given were: the logo should have the complete name, should reflect their premium position in the market and should have images of a laptop or any computer accessory.

5.1.   Findings from the experiment

The designs from all the experiments have been evaluated using FM trees, by calculating the values of SS and RE. The findings from the experiments are as follows:

- The degree of SS of the designs increased in 29 out of the 40 subjects after the concept of structure sharing and the guidelines were introduced (See Figure 10). For 3 subjects the value remained the same. The increase of degree of SS is 21.9%. (See Figure 12).
- RE values increased in 17 out of the 40 cases that used the guidelines (Figure 11).

Table 1.   Matrix showing the problems and the set of designers involved.

	Before introduction to SS	After introduction to SS
Set 1	Problem #	Problem $
Set 2	Problem $	Problem #
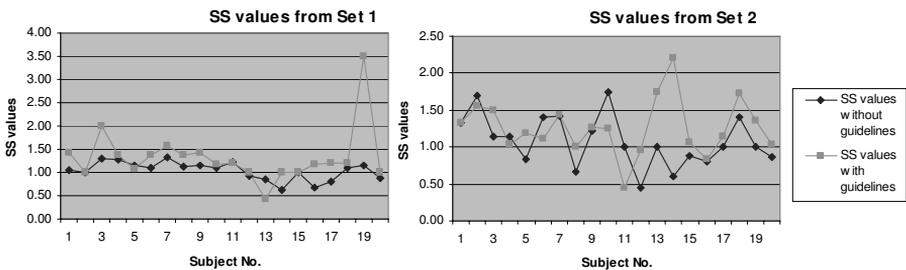
Figure 10.   SS values from experiments.
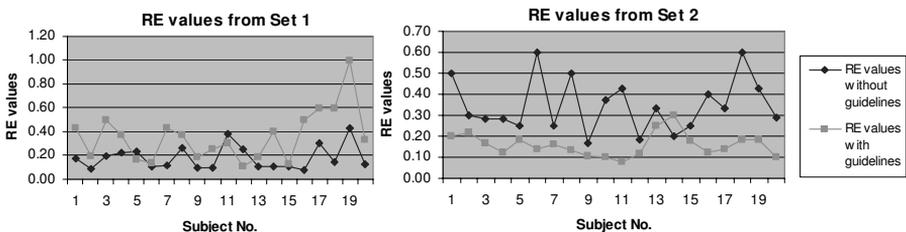
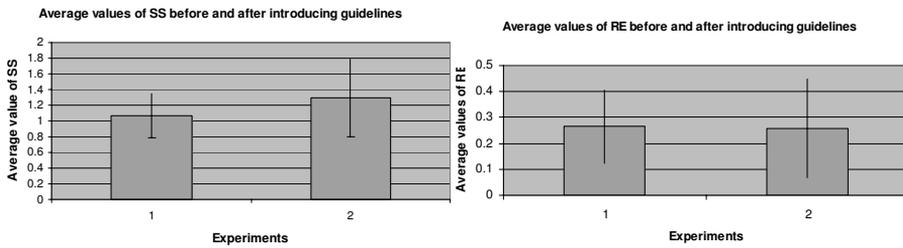**Figure 11.**   RE values from experiments.

Figure 12. Plot of average values of SS and RE of both Set 1 and Set 2.

6. CONCLUSIONS AND FUTURE WORK

Structure Sharing is observed in the field of logo designs, but currently there is no literature or explanations about this aspect in the design of logos. The translation of SS definitions in Engineering Design to Logo Design has been found effective, since the results of the experiments shows a substantial increase in the amount of sharing after the use of the guidelines. The results also show that the equation adopted for measuring SS is valid in logo designs by using a new set of definitions for the constructs of SS in logo designs. Functions and structures can be identified using an FM tree for logo designs.

Since the values of RE did not show any meaningful pattern after the experiments, further study is being done on defining what resources are with respect to logo designs and their use, with an objective to arrive at a new measure for RE and refined guidelines for this field. One reason for the reduced value for RE after introducing the guidelines in Set 2 experiments (see Figure 11), is observed to be because of the nature of the Problem # which has 9 lettered brand name (Rhythmica) compared to the 4 lettered brand name (Icon) of Problem $, which increased its no. of structures. The average value of the no. of structures for the Problem # was 23.78, where as for Problem $ it was 8.95. This has reduced the increase of RE in Set 2 after the introduction of guidelines. But the use of all the letters of 'Rhythmica' in the designs was not made compulsory for Problem # for both the sets.

Current studies on this work involve a survey on ranking the designs generated through these experiments. Aim of this work is to analyse whether the logos with the highest ranking match with the ones which have shown an increase in SS values after the introduction of guidelines. This study will show whether the structure-shared logos are perceived to be as more aesthetic designs by people.

Since some of the subjects were novices in logo design, in few cases the subjects attempted to structure-share all the structures, which resulted in more number of structures and hence complexity. More experiments are planned to be conducted among professional logo designers after a new measure for RE is developed.

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