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BRAND IDENTITY FOR PRODUCT DESIGN THROUGH COMPUTATIONAL DESIGN TECHNIQUES

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Abstract: *The purpose of this paper is to examine the relationship between the brand identity design principles and the physical shapes of products. Using a case study approach of the computational design point of view, a number of examples of branded shapes to support products for tourism industry were developed. Specifically, using the case study of Greek sculptures of Cycladic Early Bronze Age, authors explore how to develop product alternatives via computational design techniques. The main concept idea of the proposed paper is the exploration of product forms through the specific parameters of aesthetics, ergonomics, and functionality that they are related to brand identity design principles.*
Key words: *computational design, brand identity, self-design, Greek design, mass customization*

1. INTRODUCTION

The modern term of the 'product shape generation to support brand identity elements' is used to characterize a specific design methodology that uses the brand principles in computational design. Furthermore, nowadays product design industries and marketing firms aim at automated product design and manufacturing according to mass customization concept. The core idea of this unique design methodology is the end-user's contribution to the final branded product image.

The main pillars of the proposed research paper constitute a unique knowledge blend of miscellaneous scientific and commercial fields. Specifically, the 'product shape generation to support brand identity elements' methodology uses theories and techniques from the marketing area (branding and tourism principles), the computational design basis (advanced CAD tools) and finally, the customer's satisfaction research field.

1.1 Branding principles

Today's marketplace is very complex and noisy. Brands must be notably clear and strong about what they want end-users to remember about them. According to Efer (2017) the new role of the product branding is actually related to the value, service, function, and aesthetic design of the final product [1]. More specifically, Kumar et al. (2014) suggests the four fundamental principles of product branding [2].

These four specific terms are, the brand identity, meaning, response and finally, the brand relationship. Phillips et al. (2014) present the Visual Brand Identity (VBI) as the holistic visual style that identifies the brand according to two key theoretical concepts: familiarity and congruence [3]. Finally, Whan-Park et al. (2012) note that the brands with symbols as logos are more effective at providing self-identity than logos that consist purely of brand names (e.g., brand names using only typography) [4].

1.2 Computational design principles

Computational design is a digital tool of using textual or/and visual programming to produce and modify structures, forms, and geometries. Manavis et al. (2021) defined that computational design allow the creation of product forms based on parameters in relation to specific numerical values [5]. One of the most crucial advantages of generative or/and parametric design is the rapid automatic

generation of a great number of design alternatives with unique aesthetic, ergonomic and functional criteria. [6] Furthermore, it is important to be noted that computational design works using shape computational tools based on shape-grammar theory to support product forms and structures. [7] Already, Krause (2003) presented an application that it use computational design methods to generate objects from shape-grammar point of view. [8] Attending these references, the proposed scientific paper presents a novel methodology and application for product parameterization based on specific branding images. Finally, this approach explores similarities between branded products that they are created under the touristic souvenir concept.

1.3 Tourism industry through souvenirs

The tourism is a financial and cultural industry for each country, and it attempts to find many reasons with the intention of drawing in tourists. [9] Especially, tourists and tourism constitute a growing and dynamic business in design and manufacturing area in relation with the souvenir production. [10] Zinkhan (1992) suggest four characteristics describing the tourist destinations as products, symbols, organizations and as persons with their unique personalities. [11] The current case study of the proposed paper presents an approach that it is applied to Greek Early Cycladic marble figurines as formed branding images. Hadji (2015) & Manavis et al. (2020) report that Cycladic marble sculptures from Early Ages are simply flat pieces of stone, shaped to give an abstract feminine body outline at three parts (neck, shoulders, and waist). [12,13] The main scope of this case study is the production of novel and unique forms for Greek touristic souvenirs that they are reflect the modern Greek era.

1.4 Mass customization and end-user's contribution

In traditional product development designer adjust between constraints from engineering, manufacturing, and aesthetics point of view. Mugge et al. (2008) define that product personalization gives to the end-users all the advantages of co-creating the appearance and the functionality of the products [14]. Khalili-Araghia & Branko Kolarevic (2018) dealt with the development of an application by using computational design techniques in collaboration with a building information modelling (BIM) software [15]. This application provides the end-user with a simple and easy to use platform that can automate the design process of prefabricated housing in Canada under the same aesthetic characteristics.

Parallelly, Nordin et al. (2011) propose an alternative approach that allows for an improved integration of industrial design into the product development process. [16] Such an approach (a table generation system) allows for advanced mass customization by allowing end-users to use these digital tools. The proposed application offers significantly improved prospects for mass-customization. Finally, Kyratsis et al. (2019) presents an application for a bike's automate design. The bicycle is a product with many different aspects (i.e., parameters in relation with physical brand elements), e.g., size, frame style, color wheels, handlebar, saddle. [17]

1.5 Product shape generation to support brand identity elements

The current paper presents a novel methodology for innovative product generation, focusing on product's image (brand identity). The specific design method is known as "Product Shape Generation to Support Brand Identity Elements". In correlation with the proposed methodology, authors suggest the development of an application for the automatic design of Greek-themed souvenirs (Early Cycladic Figurines brand image). At the end, the application offers two different types of file exports: an STL model of the final product and a rendered image with the real-like texture of marble.

2. METHODOLOGY AND APPLICATION

"Product Shape Generation to Support Brand Identity Elements" is a design methodology for the automatic creation of objects based on specific morphological characteristics with

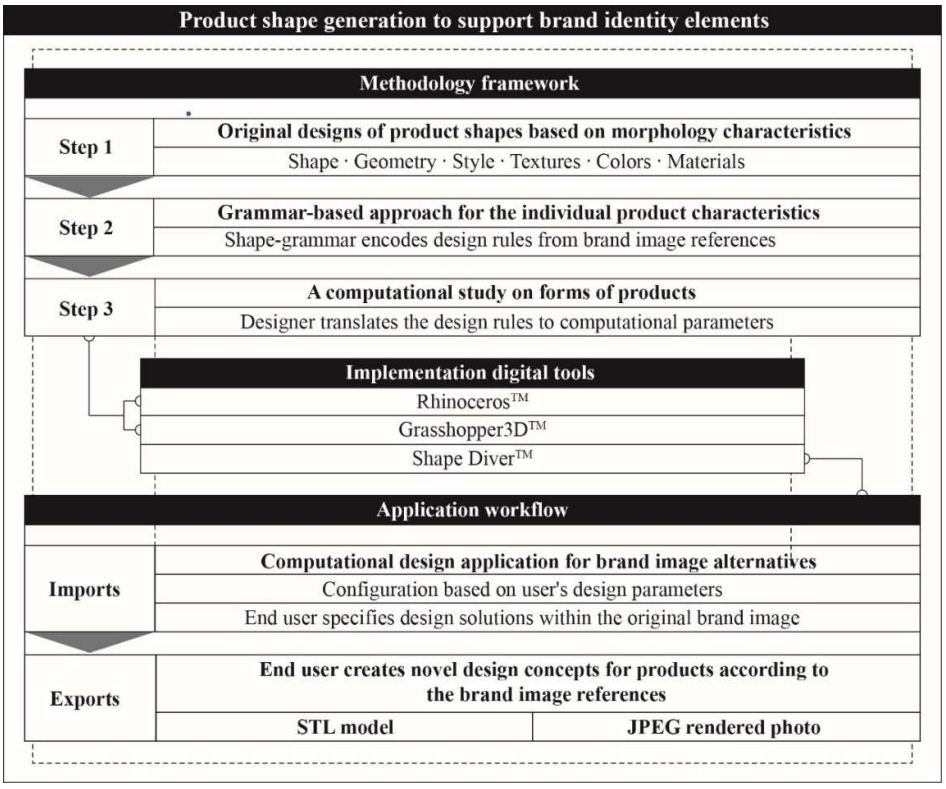

Fig. 1. 'Product shape generation to support brand identity' methodology and application.

brand value (e.g., shape, geometry, style, texture, colors, and material). Furthermore, it is suggested from the authors point a view an application under the core idea of the proposed methodology. The application was developed by using specific digital tools: Rhinoceros™ (a design software for visualization of CAD models), Grasshopper™ (a visual programming language for CAD models parameterization) and Shape Diver™ (an online platform that provides customized solutions from the end-user's point of view). Figure 1 illustrates the three different sections of the "Product Shape Generation to Support Brand Identity Elements" concept: a) the methodology framework, b) the implementation implementation tools and, c) the application workflow.

2.1 Methodology framework

The methodology framework is separated into three different steps. The first step includes all the specific procedures that it allows to the designer to deconstruct and reconstruct at the same time, the morphological characteristics of a specific brand. At the second step, the individual designer uses a shape-grammar methodology to transform the brand visual references into design rules. Finally, the third step includes the computational procedures for the design rules translation into parameters with specific numerical values.

2.2 Application development

The application was developed by using the online platform of Shape Diver™. The proposed app allows the end-users to create unique 3D CAD models under the original brand image. The basic parameters are based on design-rules from the previous stage. Specifically, end-users are ready to change the physical aspects of the produced models like the total size, or/and the specific design attributes.

3. RESULTS

3.1 The Early Cycladic Figurines as an original brand image

The proposed case study is a great example for designers to extend the role of visual branding beyond the original shapes and geometries of the

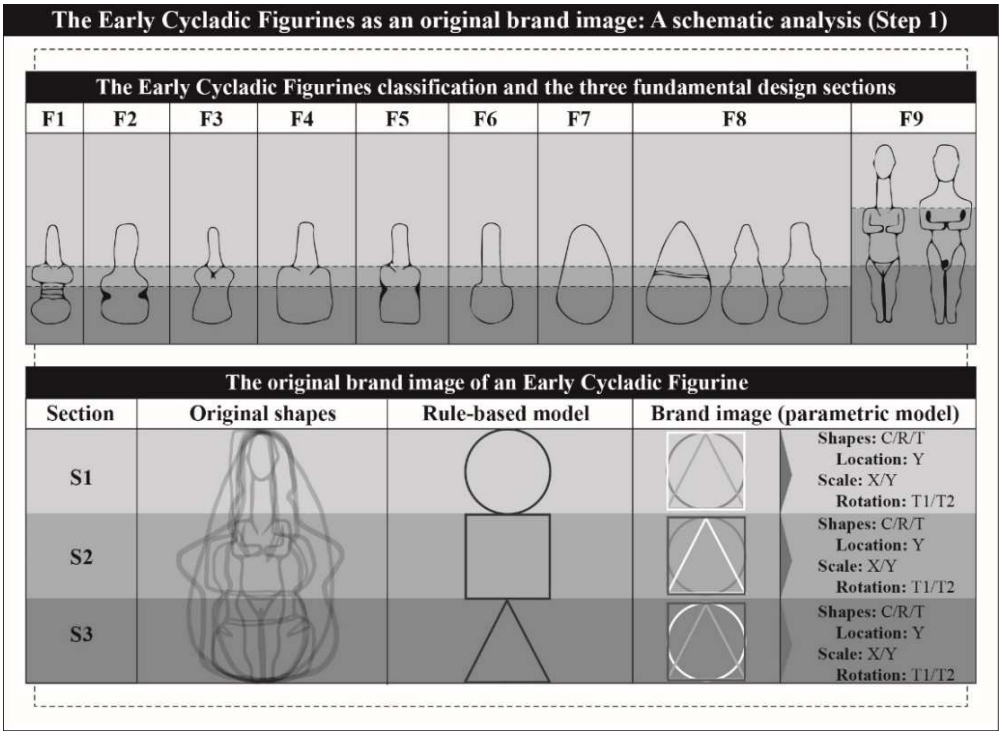

Fig. 2. 'The Early Cycladic Figurines as an original brand image: a schematic analysis.

core brand of the Early Greek Cycladic Figurines. The aim of the first step of the methodology framework is the study of the form of this particular branded product class in an ontological approach. Figure 2 illustrates the study of the form of Greek sculptures. The proposed study follows the formalism of computational ontologies. More specifically, the first section of the Figure 2 presents all types of the artifacts: Violin form (F1), Notch wasted form (F2), Shouldered form (F3), Notch wasted form - variation n.1 (F4), Notch wasted formvariation n.2, (F5), Apeiranthos style (F6), Pebble form (F7), Tripartite form (F8) and finally, Plastiras Type (F9). Following this, the schematic analysis of the figures is divided into three specific sections, one for each main characteristic of these anthropomorphic souvenirs. The first section (S1) includes the form of the neck, the second (S2) represents the shape of shoulders and the third is the waist section (S3). The rule-based model is an abstract version of the original shape of the core brand identity. The building elements of this rule-based model is the three primitive shapes of the circle, triangle and square. The final stage of the first step is the parameterization of the ruled-based model. Using computational design techniques with the help digital tools of Rhinoceros^{TM} and Grasshopper3D^{TM}, the abstract model is transformed into a parametric model. Each section of the whole models represents specific parameters of shape choices and transformation options.

Figure 3 illustrates the product shape generation concept to support the brand identity. More specifically, the shape options for each section are three (circle, triangle and square). Moreover, the transformation choices are a set of specific parameters that are represents the following options (for each section, again): Shape Rotation (Type 01 and Type 02), Scale X and Y, Location Y, Merge Operation, Shape Thickness and the Base Adding. Every parameter includes a specific range of numerical values close to the real specifications of the original models (e.g., total height, thickness, etc.). The aforementioned process was developed in the Grasshopper3D^{TM} visual programming language, and all the results were presented in the Rhinoceros^{TM} graphical environment.

Figure 3 illustrates the graphical environment for the automated creation of the novel Cycladic figurines

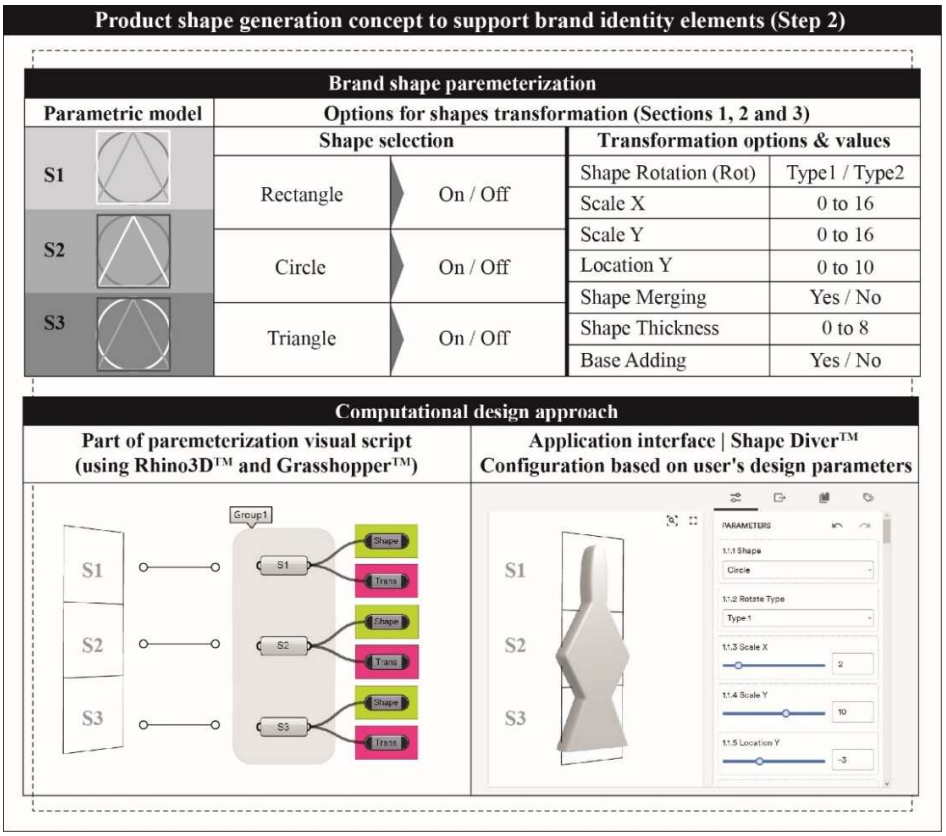

Fig. 3. Product shape generation concept to support brand identity elements.

(the section of the "application interface" in computation design approach table). The proposed application includes all the autonomous parameters with the specific numerical ranges. End-users are ready to interact with the whole design procedure in order to create their own souvenirs under the Cycladic brand. The application was developed via the web-based platform of Shape Diver™ (www.shapediver.com).

3.2 The Early Cycladic Figurines branding customization

The purpose of the proposed case study is the parameterization of all the types of Early Cycladic Figurines (F1 to F9) into specific parametric models in order to create a design database. This database is for the automated souvenir production under the theme of Greek Cycladic culture (brand identity).

Figure 4 illustrates the parametric models of all the figurine types. Moreover, it includes alternative models according to parameter configurations for each type.

All the novel models (NF1 to NF9) try to link to the originals according to the brand principles of Cycladic concept (i.e., Greek tourism identity, Greek culture meaning, Greek symbol response and finally, Greek relationship with global tourism industry).

Finally, authors note all the numerical values (data) of the parameters in order to help end-users to recreate the Cycladic prototypes or to redesign their own Cycladic concepts.

In addition, Figure 4 represents a correlation between the schematic analysis of the prototypes (prototype form, brand form), the original parametric models (F1-9) and finally, the new approaches of the souvenirs (NF1-9).

4. CONCLUSIONS

The application is proposed to non-designers, who are not familiar with the CAD tools. The end-user feels free to build his unique Greek souvenir according to Cycladic brand principles. Figure 5 illustrates an example from the

Cycladic Figurines database. Specifically, the 'notch wasted' figurine was chosen (F2) in order to present the application usage. The first section of the Figure 5 presents the end-user's transformations options according to application menu. The second part includes the exports files: a) a STL model for 3D printing usage and b) a rendered image of the final product. Similarly, the case of the new design of NF2 with the same imports and exports data is recorded.

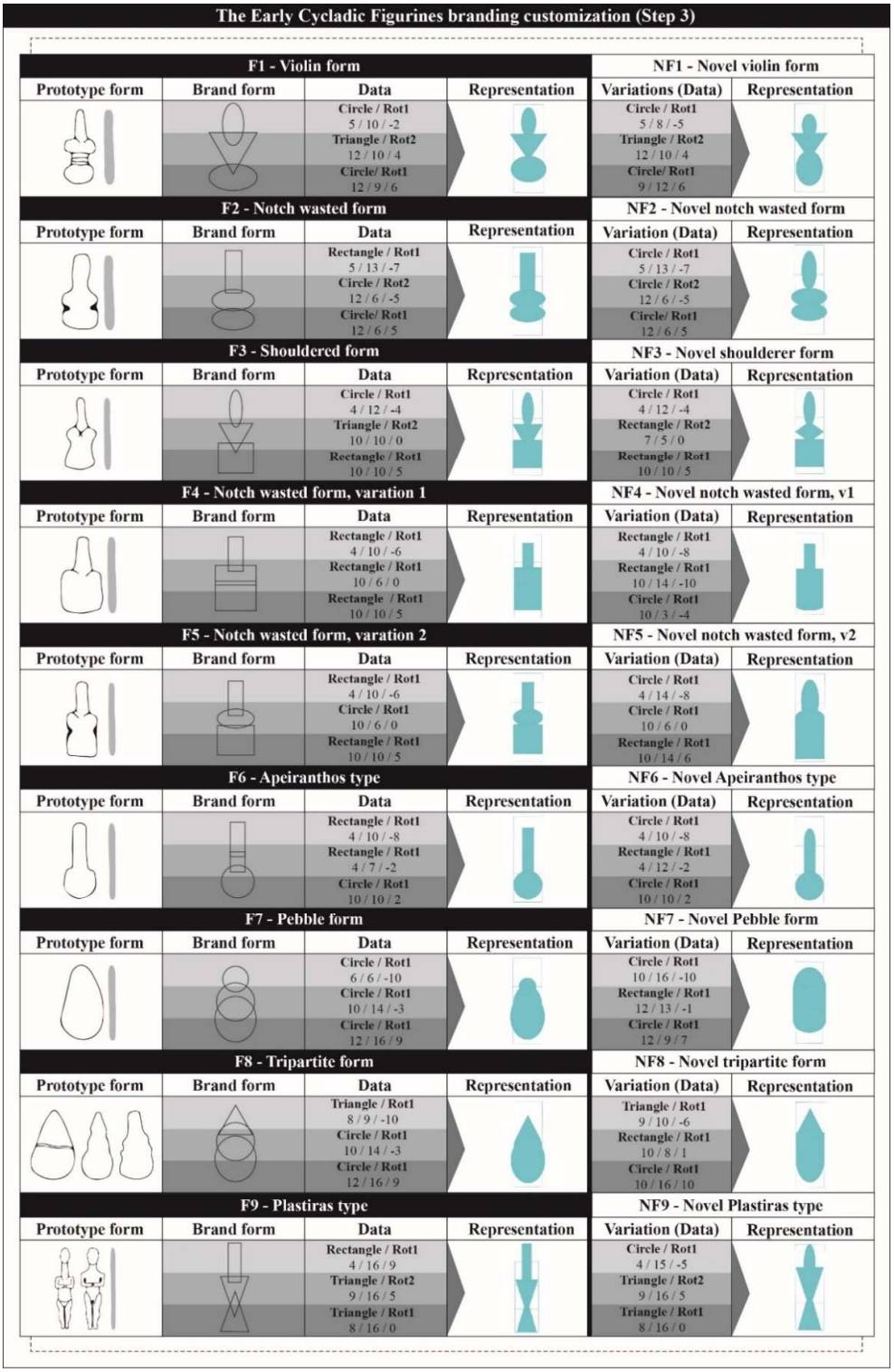

Fig. 4. The Early Cycladic Figurines branding customization.

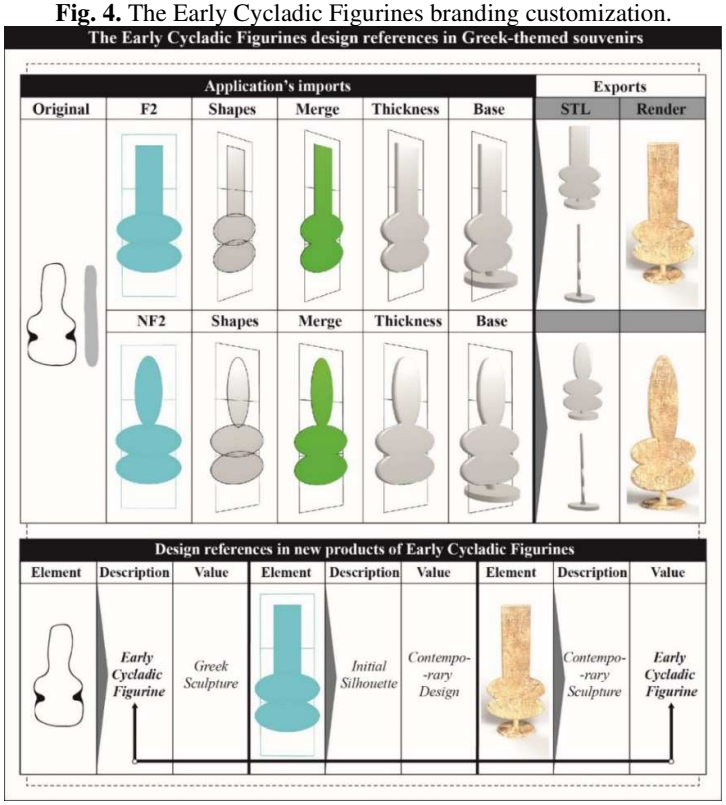

Fig. 5. Design references in Greek-themed souvenir.

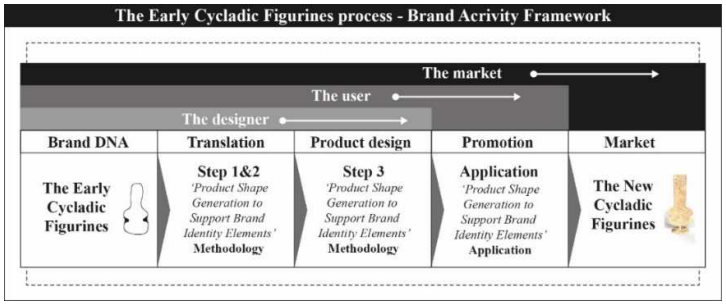

Fig 6. Brand activity framework.

The purpose of this application is to explore, how to develop a series of Greek souvenirs, under a holistic brand identity of Cycladic culture (Brand DNA), by using computational methodologies, techniques, and tools (i.e., design features translations and product design development). The aforementioned procedure is called "Product Shape Generation to Support Brand Identity Elements" and it links to the market directly through the application - Shape Diver^{TM} platform usage (Figure 6). This paper combines the use of the parametric design and the visual aspects of the brand DNA of Cycladic culture for developing innovative Greek souvenir concepts. Furthermore, the main contribution of the proposed research is the parameterization of all the types of Early Cycladic Figurines into specific parametric models in order to create a design database.

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IDENTITATEA DE MARCĂ ÎN PROIECTAREA PRODUSELOR PRIN TEHNICI DE PROIECTARE COMPUTAȚIONALĂ

Scopul acestei lucrări este de a examina relația dintre principiile proiectării identității de marcă și formele fizice ale produselor. Folosind o abordare a unui studiu de caz din punctul de vedere al proiectării computaționale, au fost dezvoltate o serie de exemple de forme de mărci destinate promovării produselor specifice industriei turismului. Mai exact, folosind studiul de caz al sculpturilor grecești din epoca bronzului, din perioada timpurie a Cicladelor, autorii explorează modul în care se pot dezvolta produse alternative prin tehnici de proiectare computațională. Ideea principală de concepere a lucrării propuse este explorarea formelor produselor prin luarea în considerare a parametrilor specifici de estetică, ergonomie și funcționalitate, parametri care sunt legați de principiile de proiectare a identității de marcă.

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