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ScienceDirect

Procedia Engineering 132 (2015) 1089 – 1095

Procedia Engineering

www.elsevier.com/locate/procedia

The Manufacturing Engineering Society International Conference, MESIC 2015

Interdisciplinary relationship between Designer and Craftsman based on Integrated Craft Manufacturing Systems

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Abstract

This paper aims to explore mechanisms that allow the establishment of a sustainable basis between designers and craftsmen in the context of their joint collaboration, to enable the revitalization and upgrading of the craft manufacturing processes through technological resources and concepts implemented in the industry focused on CAX (Computer Aided Technologies).The objective is to contribute to the project development and to its previous analysis before starting the production. In this regard, pilot projects have been developed between designers of the Design course of the University of Madeira and students of the Craft course in wicker, specialized in furniture, promoted and taught by IVBAM (Wine Embroidery and Crafts Institute, Madeira). This project attempts to address new development strategies through the application of design methodologies and the use of CAD (Computer Aided Design) technology in the craft manufacturing process, aiming at optimising processes and at providing craftsman with resources that allow them to upgrade and improve their production systems.

Peer-review under responsibility of the Scientific Committee of MESIC 2015

Keywords: CAX, Rapid Prototyping, craftsman-designer, sustainability

1. Introduction

During the last three decades, we have observed the increasing decline of craft due to the current market demands. The concept of need is changing. Currently, our society lives in a permanent dependency of objects that solve our problems. For every obstacle that we face, there are several types of proposals able to work out the

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Peer-review under responsibility of the Scientific Committee of MESIC 2015
doi:10.1016/j.proeng.2015.12.600

situation. This has made societies more dependent and consumers, men no longer feel the need to create and develop their own solutions, but consume objects in an uncontrolled manner, which are massively produced by the industry at low cost. This issue led artisans to loose competitiveness against the markets. In this sense, and from the socio-economic point of view, this is a clash of values: the cultural value of the handcraft knowledge and the responsiveness of technological and industrial progress to the increasing demands of the consumer society.

In this research project, we aimed at exploring methodological development parameters that value the importance of the interdisciplinary relationship between designers and craftsmen, in order to articulate and enhance the development of knowledge. In the context of sustainability, our objective was to recover and strengthen artisan knowledge and processes through the application of new design and production methods focused on digital tools CAD technologies and rapid prototyping.

In order to contribute to the development of craft activities, its restoration and maintenance, we aim to establish a sustainable basis for collaboration between designers and craftsmen in the development of craft products carrying identity and local uniqueness. The developed research was based on a case study methodology, understood as a holistic and constructivist knowledge dynamic. After a review of the theoretical foundations and main concepts related to crafts and design, particularly regarding the wicker crafts, the case study method was applied, taking into account the local context in multiple dimensions, in an interdisciplinary perspective. We have observed a given reality, using an interpretive approach of the main problems and possibilities of the case study (Denzin & Lincoln, 2000).

According to some dictionaries, craft is defined as an activity that develops objects or products resulting from the work of an artisan through a craft conception method. This was, for a long time, the only way of producing objects. However, António Houaiss classifies craft as "the art and technique of non-industrialized manual work, done by craftsman, escaping serial production; it has a utilitarian and artistic purpose"(Concise Oxford, 2007). According to Houaiss, we can see the importance given to manual labor, highlighting the wealth of craft with regard to their purposes. The object is produced individually depending on the capabilities and sensitivity of the craftsman, contrasting to the production of standardized series of objects, characteristic of industrial processes.

In general, several authors share this idea of craftsmanship, valuing the craftsman work and what is most characteristic of it. At the official level, we also find laws that meet this definition. According to the Portuguese law "Craft activity should be characterized by the compliance to traditional processes, in which the personal intervention is a predominant factor and the final product is of unique and genuine manufacture, notwithstanding its receptiveness to innovation "(...) (art.5Q of Decree-Law), and the "predominance of personal intervention is evaluated regarding the phases of the production process in which he quality and nature of the final product or service is influenced or determined" (Decree-Law No. 41 / 2001). These definitions and visions reflect the isolation status in which the craft was left, due to its inability to keep up with the constant demanding changes of society, neglecting the progress associated with industry.

Currently, some scientific studies are being undertaken to explore possible areas of action regarding craft. Specifically in the wicker crafts, we find some cooperation between technological research centers and institutions linked to craft, with the highest incidence in South America, where efforts have been made to stimulate small local economies.

When approaching the craft or professional craft activity, there is a direct association with the transformation domain and with the creation of solutions through sustainable materials which are made available by nature. In design, there is also an increasing concern with ecological sustainability, disturbed by strategies and policies adopted by the industrial production. The current designer is more aware of these issues and seeks to develop its activity following guidelines that aim at reducing the impact on the environment. In this context, it was given greater attention to projective methods used by both activities, as well as to the mechanisms and processes that approach both professionals and enhance their relationship.

This research project aims at implementing cooperation bases between designer and craftsman through the development of a joint project with guidance regarding the application of the DFMA (Design For Manufacturing and Assembly) array of concepts as a possible basis for the integrated development of craft products, and the use of SIM (Manufacturing Integrated System) model applied to craft production. With the exploration and the potential increase of the use of these concepts in the craft activity, it is expected that these positively contribute to its modernization and revitalization.

2. Presentation

As previously mentioned, the aim of this study is based on a partnership, in pilot phase, between the Department of Deseño in Enxeñeria the University of Vigo, the Design course of the University of Madeira and the IVBAM (Wine, Embroidery and Crafts Institute of Madeira). This partnership's objective is to explore strategies to improve local crafts, by creating dynamics with designers and by adapting new digital and manufacturing technologies, commonly used in industrial production, which can somehow positively contribute to the recovery and upgrading of the craft production system. The project was held in partnership with a training course in wicker craft, which was taking place under the coordination of IVBAM. This course was meant for unemployed people registered in the local employment center. It was found that most trainees belonged to the age group between 20 and 30 years. However, the course was not limited to this age group, this course also included people under 50 years old.

The developed project assumed an important role in the sense that all elements involved in the project were in the process of professional or academic training. For the purpose of the project two work teams, composed of designers and craftsmen, were organized.

Taking into consideration the specificity of the training course that was being held, the background training of the students, as well as the courses the project was associated with, it was determined that the project's theme should focus on handmade three-dimensional products supported by methods applied in product design concepts and development used in industrial manufacturing. In this sense, in order to standardize and allow a more concrete and precise analysis, the development of wicker furniture, was defined as the area of action.

This research sought to study project-development alternatives using design validated methods, analyze the potential of the use of CAD technology, rapid prototyping and its relevance in the recovery of lost or unregistered information. In the literature review carried out about craftsmen and artisans as professionals, it was possible to recognize personal details that turn them closer to the designer, regarding their mode of action within their activity. It appears that both professionals seek to develop solutions that meet the continuous daily needs of man, but when they start their professional practice, their development methods deviate due to the different visions and different technical backgrounds.

On the other hand, it appears that the artisan unconsciously uses concepts applied to the industrial production universe, including the application of "concurrent engineering" in the development of its products. The whole process of creation, development, production, distribution, marketing and maintenance goes through the craftsman, it is his responsibility. We can therefore conclude that the whole life cycle of a handmade product falls under the jurisdiction of the artisan activity, he is the only one fully responsible for all the steps involved in developing the product.

3. Project description

After defining the framework and context of the business and its employees, four working teams were created in order to implement the case study. Each work team had four elements. After the formation of the teams and a short briefing of the project, two initial meetings were held in order to present the means and conditions of each working environment. These meetings were intended to define a framework and provide the elements of the teams with the necessary information for the conscious and credible development of the project, taking into account the specifications and limitations associated with each activity. Each team was responsible for the organization of the group's work and management plan always supervised by me as the case study coordinator. I was also responsible for supervising the structure, methodological plan and timeline of the project.

To allow the implementation, analysis and validity of the case study proposed in this paper, it was necessary to develop a specific model of the methodological plan (Figure 1) that gathered the unavoidable conditions for the development of craft and that considered other issues associated to digital technologies and advances in industrial technology that could enhance the craft production systems. In this sense, and considering the fundamental principles that characterize craft, the product design and the manufacturing processes, a methodological plan which had to be complied by the projects was developed.

After establishing the guidelines for the development of the projects, each team began its work by scheduling a first meeting to discuss ideas, identify local identities, analyze market needs and define areas of opportunity. This meeting also analyzed the current market situation linked to local crafts and problems resulting from their weak attractiveness, issues of uniqueness and load of ancestral knowledge that are transmitted in their products. These factors were important in order to foster a positive and horizontal communication. The issues were fully discussed without reflecting the superiority of a professional activity over the other. Therefore, the conceptual development and formal ideas were discussed taking into account the characteristic of plastic craft language, while following the methodological coordinates of the design project development. At this stage of the project, we tried to clarify the niche markets and areas of intervention. This type of product should have different characteristics, specifically related to the tourism sector where the market showed greater receptivity.

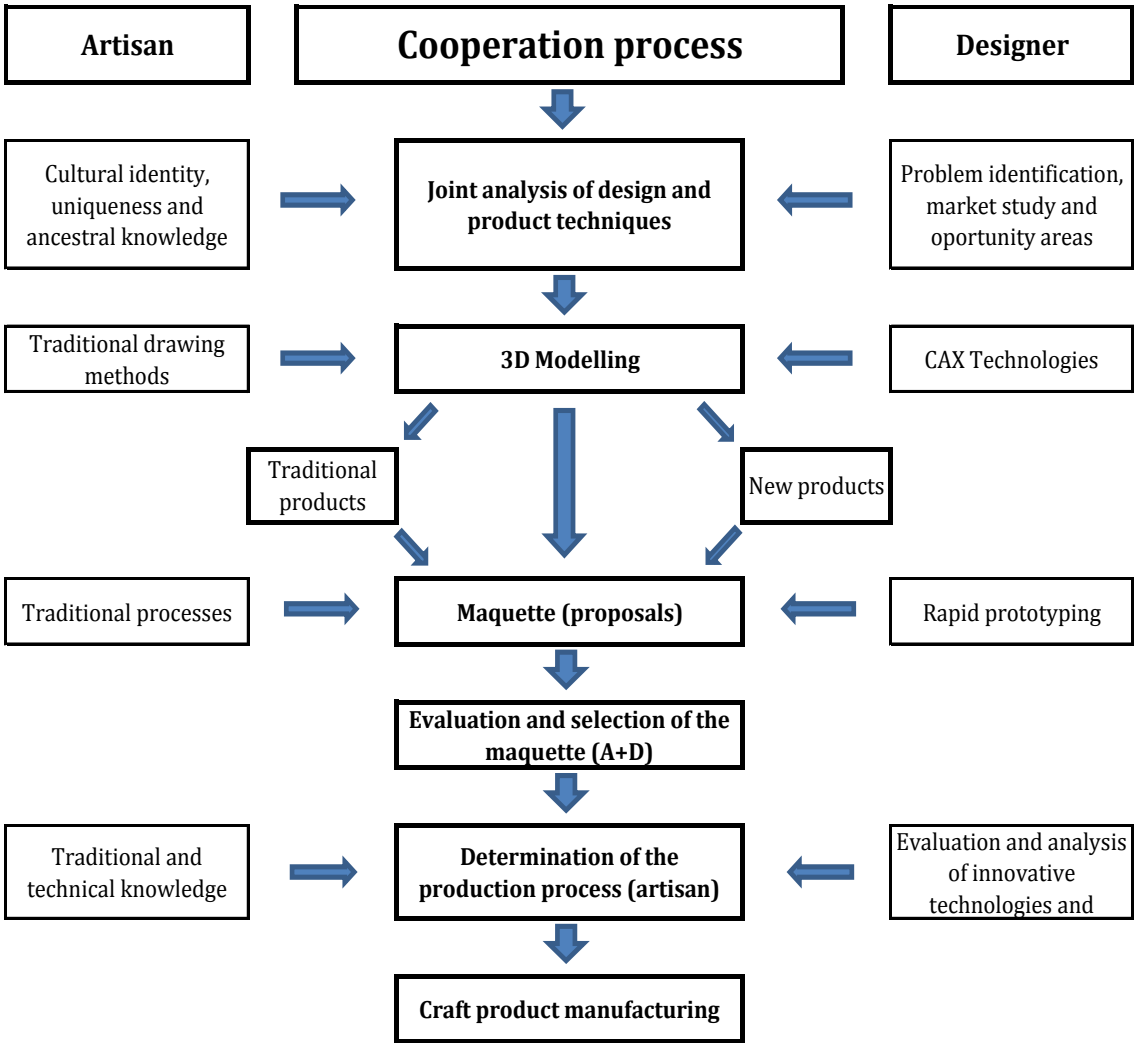

Fig. 1. Methodological plan to be applied in the development of craft products.

As observed in some projects, the concepts represent elements sought to identify the uniqueness of craft, (Figure 2). The concept was based on the fundamental tools of the activity of the wickerwork artisans, namely the wedge, an object that performs splitting the rattan stick into three parts.

Fig. 2."Cunha" handmade tool

Fig. 3."ManBio" 3D Model

Fig. 4. "Três" 3D Model

After exploring and development of formal concepts and ideas through traditional design methods with use of marker instruments, they were modelled using CAD technologies (Figures 3, 4), in particular through the Rhinoceros software. This work tool proved to be crucial for the formal, structural and functional analysis of the product, as well as for the clarification of details and production techniques to be used by craftsmen (Figure 5).

Fig. 5. This project that I developed is composed of a set of two rotary chairs serving different concepts which are joined by a top part providing solar protection.

At this stage of the projects, there was a strong discussion about the shapes and manufacturing techniques to be used and it was possible to notice a fluid communication between designers and artisans. The easy manipulation of the three-dimensional models facilitated the interpretation and analysis of the product. At this point, it was already discussed the difficulty about the production complexity. This finding was translated into a clear need to develop 3D models of study as an analysis element that can be touched and, at the artisan level, facilitate the correct reading in terms shape and dimension, given that these professionals have always based their analysis on tangible solutions.

Upon completion of this three-dimensional modelling step, the potential of CAX technologies was demonstrated. The artisans realised that they can develop new solutions through CAD technology and that is also possible to recover discontinued handmade models and for which there are no records of the production processes. In addition, CAX technologies can also be used in other situations where there are only two-dimensional records, in particular photos or rudimentary drawings. It is clear that the introduction of CAX technologies in craft can contribute positively to the recovery of lost information or information that was not recorded digitally, allowing craftsmen to have contact with new and innovative technologies for the industry while controlling the characteristic uniqueness of craft products and their production processes.

The 3D modelling phase of the product was performed by two separate methods to provide separate analyses. In this analysis process, it was intended to compare the different characteristics between traditional methods of 3D modelling (Figure 6) and the potential of rapid prototyping.

Fig. 6. Traditional maquette production methods.

In this sense, in the craft methods, we used materials like cardboard, polyurethane boards, plaster and timber. Taking into account the characteristics and intended purpose of the objects, in projects developed through rapid prototyping, it was decided to resort to the rapid prototyping system using LOM (Figure 7). Although it may be considered of low manufacturing cost, given its production process, this technological option requires a later stage of finishing work.

After obtaining a model, it was necessary to carry out the polishing of the object's surface, in order to coat it with a layer of material to turn its surface smoother. These two methods of obtaining three-dimensional models allow different levels of analysis. Through the rapid prototyping method there was a greater formal and dimensional accuracy, but this process also shows further advantages in terms of time allocated to that phase of the project. In addition, the details are more precise in comparison to traditional methods. After the three-dimensional implementation of the developed models, it was possible to make a detailed analysis of the solutions. These design concepts allowed the identification of gaps and the necessary changes to minimize their weaknesses. This phase also allowed the optimisation of the design in the course of further project development and allowed to more accurately and efficiently determine the traditional manufacturing techniques and processes (Figure 8) used in the production of the final solution (Figure 9).

Fig. 7. LOM Model

Fig. 8. Craft production method

Fig. 9 Final products

The pilot project developed required further and deeper research regarding the issues related to the process of small-scale manufacturing. In this primary stage of craft, it is clear that the production methods are still very rooted to ancestral processes, very dependent on the limited and exclusive knowledge of the artisan. Various operations related to the processing and manufacturing can be optimised based on concepts applied to industrial production, without missing the characteristic dynamics of small scale manufacturing. As previously mentioned, concepts such as Concurrent Engineering can perfectly apply to the professional craft activity. Making a more careful analysis of the professional activity performed by the craftsman, we find that the same applies to concurrent engineering in the exercise of its activity on the craftsman, all the responsibility throughout the product life cycle lies in him. In this sense, and checking that there are common points between these two manufacturing processes, you can explore "integrated systems of craft manufacturing" able to optimise and enhance productive resources, adapting the means of communication and management to current universal communication links.

Conclusions

This article aims to explore cooperative work bases between artisans and designers through the use of CAX tools, including CAD and rapid prototyping. Through the objectives set for the framework of the pilot project, artisans and designers have developed the project in perfect cooperation, constantly debating all issues and taking joint decisions. One of the main objectives of the implementation of the project was to provide a horizontal communication between the interveners. This situation was found throughout the project's development, where each participant presented his ideas, technical and scientific knowledge. The total availability and openness to dialogue was facilitated by the fact that the project was developed by young craftsmen and designers, devoid of vices and preconceived concepts usually resulting from a long career. Consequently, both professionals showed great interest in the knowledge of techniques used in the other's profession. This reciprocity was clear throughout the process, including the modelling phase, the layout and the final production phases. The use of digital tools in the development, definition and evaluation of the projects as well as the use of rapid prototyping for three-dimensional implementation of the models were the most valued operations by artisans. They find potential for these tools and technologies regarding information retrieval, formal optimisation and considerable time saving for the different stages. This methodology applied to the project, enabled a reduction of 10-15% in time and costs related to product development, including the project phase. However, although this reduction is confirmed, the main advantage is the possibility of using the CAD and Rapid Prototyping tools to obtain higher levels of optimisation and product quality. These two phases allow the elimination and correction of gaps and the definition and application of the most efficient production methods. The CAX tools and advanced prototyping technological policies also improve the perception and the quality of communication. It was observed, through 3D models and prototypes, an improvement in the efficiency and clarification of the communication. The designer drew from this experience greater awareness regarding the characteristics and limitations of craft production, therefore it is up to the designer to support and make the link between the identity of the craft and the application of the industrial technologies and production concepts. In this paper, it was also possible to conclude that there is a need to reflect, in the near future, about other methodologies applied in the industry that can contribute to the sustainable positioning of craft activities in the markets and its revitalization within the current society.

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