Design of new Fibre Based Packages Produced by Moulding Techniques

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Abstract: In order to launch new package formats the production of mock-ups is an essential part of the development process. In particular, in packages formed from fibre materials by moulding techniques, the production of tools such as the male and female moulds, is a time consuming and expensive sequence. The overall process from a new idea to a package involves several key parties. The artistic 3D form of the package as well as the graphic lay-out involves the work of designers. The development of material fit for the moulding purposes involves, besides material development, the knowledge of converting processes, such as cutting, creasing, and the production of cutting and creasing plates. Furthermore, knowledge of mechanical engineering and understanding of the mould presses is essential in the production of moulds. Typically this complex overall process generates delays in the production of mock-ups. However, there are possibilities in all process stages for improving performance, and fluid collaboration between different parties involved will contribute to a faster throughput in the development of new package formats. The focus of this paper is on the design of packages.

Keywords: mock-up, moulding, mould, 3D, CAD

1. Introduction

Plastic is considered to be a most versatile packaging material. However, if not biodegradable, the present sustainability demand is a burden for plastic packaging materials. Paper on the other hand is considered a sustainable packaging material but in certain cases it suffers from the rigid structure of the fibre network. This article describes the design process of a food package based on polymer coated paperboard. The properties of the material to be used, the contents to be packed and other limitations have been set by an industrial steering group1. As there are multiple parties involved in the package development process, a need for solution for speeding up work tasks in different stages of the process was recognized as well. This study focuses on the design phase of package development.

2. Materials and Methods

The product to be packed was defined as a soup. This product should possibly be heated in the package before consumption and consumption should be directly out of the package. Furthermore, the appearance of the package should be attractive both on the shelves and at consumption, either at home or on the go. The colors of the package should fit the product and offer an advantage for the product brand. The package should also be made to suit logistic demands both in production and transport, as well as in stores and at home. The package should at the end of its life be easily disposable and meet the set sustainability criteria as well as possible.

Two side PET coated Trayforma paperboard supplied by Stora Enso Oyj was considered to be the best match as a base material with regards to the criteria set for the task. As the product was soup the package had to be able to withstand both refrigerator and microwave oven conditions; this was addressed by the double sided PET coating. In addition, the package needed to be sealable with a suitable polymer lid. Furthermore, the printability was addressed by the selection of board as a base material. The formability of the package was addressed through the combination of a paperboard with improved formability features and polymer coating on both sides. Sustainability was taken into account in that the package in question was made disposable through the same collection system as liquid packaging cartons, meaning that the polymers and fibres could be separated with the fibres being used for making recycled boards and the polymers as an energy source in incineration.

The design task initially involved the definition of the design brief [1]. Among the aspects mentioned earlier the design team (LUAS) considered what the term on-the-go food means for a modern consumer. Additionally the designer needed to consider all the parts of the package, in this case the form and function of the bowl, the lid and the printing surface. The design team used mind map techniques and stories as a background for sketching the soup package [1]. The stories involved different types of real-life situations, in which the need of on-the-go food arises. Out of these situations a few of concrete usability
Aspects in consuming the soup came forth. These were; holding the soup bowl with one hand, holding and carrying the hot bowl, drinking from the bowl, pouring the content out of the bowl. Appearance-wise the paradox of soup being a traditional food and on-the-go being a modern lifestyle was considered. In addition, good shelf appearance and package size-suitability into the logistics chain was considered. The form, shape and size of the package was considered with the use of quick modeling clay mock-ups [1].

Figure 1. Sketches from the idea generation phase.

After idea generation and sketching phase the industrial steering group selected one of the sketches for further improvement. This sketched idea was properly dimensioned and modeled with three-dimensional (3-D) computer aided design (CAD) software. Later these 3D-models were used in creating mockups.

Figure 2. 3D-models constructed with CAD.

Figure 3. Color selection and comparison.

The graphical design task was based on the design guidelines from the industrial case company of the selected case products. The products were drinkable carrot-chili soup, smashed pumpkin soup and thai-chicken soup. In addition the steering group named healthiness and lightness as product attributes. The colors considered in the design task were selected based on the company guideline colors as well as colors that represented the products involved. Color variations were made with Adobe Photoshop and Illustrator software, where the basic forms of the package were colored using the previously decided colors. The design team considered the effect of the color combination in regards to the lightness of the product appearance and shelf appearance of the package.

Finally the design team used the rapid prototyping method with selective laser sintering (SLS) to build a 3-D printed model of the package as well as later on the 3-D printed collar parts which were used in the package mock-ups.

3. Package testing

Package and product testing is usually divided into early- and late-stage testing. Early-stage development studies are able to provide design guidance. Typically these tests are conducted in order to screen for the best product alternatives amongst a wide variety of possible future designs. Early-stage tests can identify the segments and the characteristics of a product that drive acceptance and brand learning on the basis of, for instance, sensory preference or interest. Often, in-house expert panels select products on the basis of their personal liking or preference. Design project creates prototypes, and out of these one or two potentially acceptable prototypes are chosen. Because of the fact that in-house expert panelists or members of the design project are somewhat biased also consumer research is needed. Besides, usually others using the results of product testing want to learn more about the product, for example what drives liking, are there segments in population that have different preferences, along what particular attributes is the product strong or weak and so on. Typically, these varying questions come from different parties that commission the research. In late-stage testing, most of the development work has been finished. Late-stage product testing is primarily used to verify the validity of earlier choices and to identify any remaining issues with the product design. It confirms that R&D has developed an appropriate product. Late stage product testing usually does not result in any drastic measures [2].

4. Results

In this design project testing was carried out in the middle of the design process and therefore the R&D process is open to moderate changes. The research was performed by sending out visual test materials and a questionnaire to an Internet panel consisting of 600 consumers in Finland. Test material was evaluated by 189 consumer panelists. The questionnaire was mainly structured as a forced choice form. Free comments concerning the test material were allowed in a separate section.
As previous research indicates the form and colors are among the most critical visual elements in a package design because they convey meanings, attract attention, differentiate products, and indicate the overall category and quality of the product. In this research the questions were focused on three package forms (square, round bowl, oval) and they were tested without graphics. Prototype layouts were designed and tested in two differing styles (ordinary convenience product design and symbolic life-style design). Accordingly, tested package colors referred either product (pumpkin soup) ingredients (yellow-orange-green and orange-light grey-light brown) or symbolic life-style related color combinations (black and steel grey, white and yellow).

Research results indicate that a round bowl was evaluated as the most interesting form (49%) and the results support the educated guesses of the designers’ group. There are also smaller segments in favor for square (31%) and oval (20%) package forms. Life-style designs were considered to be the most interesting by panellists (66%). The black-grey color combination was perceived to indicate most interesting product concept according to 54% of panellists, and the white-yellow version according to 12%. There was also a notable segment in favor of the ordinary yellow-orange-green colored version, as 22% perceived the design in question to indicate the most interesting product concepts for them. Consumers also link light colors to healthier product concepts. Grey as well as black colors were mentioned to be the most atypical and thus less preferred colors in this product context. However, in the context, a dark color may indicate sophistication, style and high quality according to panelists. The symbolic classification is very much in line with previous research results [3]. Consumer research also indicates that a light background color is sensitive to the quality of the design as texts in light colors do not contrast from light backgrounds, a cause of irritation amongst consumers.

5. Conclusions

When designing new packages for new products with mould technology, several processes occur simultaneously. One is the development of the product itself, the second is the development of the package form, the third is the graphic layout and the fourth is the development of the tools for making the package. If these processes are run in a sequential manner the whole process is likely to be too time consuming. If the processes can be run in parallel to each other, there is potential to speed up the overall process significantly. In the case presented the model likely to be used was chosen by the industrial steering group based on an educated guess. Simultaneously mock-up moulds were produced in order to verify whether there is a possibility to produce this package form by mould techniques. The graphical design started also simultaneously. The consumer survey was carried out later to verify the earlier choices.

The manner of parallel working used is much faster than working sequentially. However, in order to avoid disturbances in the process it is beneficial if the participants are in contact with the other parties involved regarding their specific work areas. A good steering of the project is essential for achieving a fluid project flow.

6. Acknowledgment

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References