THE CONTRIBUTION OF USER-CENTERED DESIGN TO CONSUMER PACKAGES

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ABSTRACT

THE CONTRIBUTION OF USER-CENTERED DESIGN TO CONSUMER PACKAGES

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End-users often complain about usability and safety problems in consumer packages. This study shows that these issues are an obstacle to the achievement of user satisfaction and to gain a competitive advantage in the market. To this end, a case study on food and beverage packages was done in order to identify and analyze these usability and safety problems based on the lifetime phases of packages in which end-users are involved.

The study revealed that safety, clarity, legibility, visibility, storability, openability, re-closability, usefulness, and pleasantness are key areas where problems are widespread and should be considered by package developers and designers. The study also indicated that the problems occurred during use result from insufficiencies in current package design processes. These insufficiencies occur basically in the specification of the context of package use, identification of usability requirements, and the active involvement of the actual users in the package design processes.

This study also highlights the need for a user-centered approach to package design in order to overcome the insufficiencies in current package design processes in a

structured way and thus to achieve usable and safe packages. In addition, based on the literature and case study findings, checklists for user-centered package design process activities and for the design and evaluation of the packages are included. Moreover, a set of methods to be used during user-centered package design process is recommended.

Keywords: Food and beverage packages, package design, user-centered design, package usability, package safety

ÖZ

KULLANICI ODAKLI TASARIM YAKLAŞIMININ TUKETİCİ AMBALAJLARINA KATKISI

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Yüksek Lisans, Endüstri Ürünleri Tasarımı Bölümü
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Kullanıcıların ambalajların kullanılabilirliği ve ambalaj kullanımında güvenlik ile ilgili sorunlardan kaynaklanan pek çok şikayeti var. Bu çalışmada, yaşanan bu sorunların kullanıcı memnuniyetine ve dolayısı ile rakip firmalara karşı avantaj sağlamaya engel oluşturduğu savunuldu. Bu doğrultuda, bahsedilen kullanılabilirlik ve güvenlik sorunlarının incelenmesi amacı ile yiyecek ve içecek ambalajlarının temel alındığı bir alan çalışması yapıldı. Çalışma, kullanıcıların ambalajlar ile etkileşim içinde olduğu, ambalajların yaşam evrelerini temel aldı.

Yapılan alan çalışması; kullanıcıların güvenlik, anlaşılırlık, okunaklılık, görünürlük, saklanabilirlik, açılabilirlik, tekrar kapatılabilirlik, faydalılık ve beğenilirlik unsurları ile ilgili çok fazla sorun yaşadığını gösterdi. Bu unsurların ambalaj geliştiricileri ve tasarımcıları tarafından dikkate alınması gerektiği sonucuna varıldı. Alan çalışması ayrıca, var olan bu sorunların tasarım sürecindeki bazı yetersizliklerden kaynaklandığına işaret etti. Bu yetersizlikler temel olarak ambalajların kullanım durumunun ve kullanılabilirlik gereksinimlerinin belirlenmemesi ve ambalajın asıl kullanıcılarının tasarım sürecine aktif olarak dahil edilmemesi ile ilgili idi.

Bu çalışmada, ambalaj tasarımı sürecinde yaşanan sorunların sistemli bir şekilde aşılabilmesi, kullanılabilik ve kullanımında güvenliğin sağlanabilmesi için kullanıcı odaklı ambalaj tasarımı sürecinin gerekli olduğu savunuldu. Ayrıca, yazın ve alan çalışmasından elde edilen bilgileri temel alarak kullanıcı odaklı ambalaj tasarımı süreci aktivitelerinin kontrolü ve tasarım değerlendirme çalışmalarına yardımcı olması amacı ile kontrol listeleri hazırlandı. Son olarak ise kullanıcı odaklı ambalaj tasarımı sürecinde kullanılmak üzere bir dizi metod tavsiye edildi.

Anahtar Kelimeler: Yiyecek ve içecek ambalajları, ambalaj tasarımı, kullanıcı odaklı tasarım, ambalajların kullanılabilirliği, ambalaj kullanımında güvenlik

To My Dear Parents

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CHAPTER 1

INTRODUCTION

1.1 Problem definition

In today's competitive market, well-designed packages with a positive brand image need to be offered to the ever more demanding consumer/user to be able to gain a sale advantage. In spite of this, as the literature survey has revealed, there are consumer/user complaints, dissatisfactions, and also safety problems related to consumer packages resulting from a lack of attention to consumer/user needs and to the usability of packages. This is mainly because most manufacturers and marketing experts believe that a well-designed package means a well-designed visual appearance. Therefore, most of the time usability concerns and consumer/user needs are neglected for the sake of aesthetic appeal. In addition, an extra effort to overcome usability problems is often considered unnecessary and expensive. However, package usability should be considered as a competitive factor as well as the visual appearance of a package.

In this context, some package types such as the packages of food & beverages, cosmetics, and cleaning products are particularly worth mentioning. Users generally interact with these packages more than any others in their daily lives. Most of the time, users interact with them until the contents are consumed since these packages are an inseparable part of the contents. For these reasons, the design of these packages is important in terms of usability.

To prevent consumer/user dissatisfactions and to ensure an improved everyday life, products that the users interact with must be easy to use, useful and safe. Attention should be paid to usability issues during the package design process as ignoring user needs and demands can be costly after the product is released to the market.

Changing the design of a package after it is already on the market requires new research, development, manufacturing, and also advertising costs.

Achieving package usability and providing consumer/user satisfaction requires a user-centered approach. User-centered design is a product development process whose goal is to ensure the quality of interaction between products and their users. Adopting user-centered package design, at first sight, seems to be an extra cost and extra time, but on the contrary, it reduces costs for the development of a new package; costs for the future redesigns, and package development time. In addition, achieving package-usability through user-centered design process is less time and cost consuming when compared to achieving usability in complex products, such as, software or audio/visual electronic products. This is possible because packages have fewer design variables and fewer tasks to support, and simple interfaces that the users interact with.

In addition, achieving usability in packages by means of user-centered design presents some significant potential benefits: enhanced ease of use; usefulness; reduced safety problems and thus consumer/user satisfaction and improved quality of life; and a better brand image. A usable and safe package may also increase end-users trust in a manufacturer because they are seen to notice and care about their customer needs and complaints. These benefits may enhance consumer loyalty and translate into consistent purchase of a single brand.

Although the problems and benefits are apparent, there are very few studies in literature on usability and safety problems regarding packages and ways of overcoming these problems.

1.2 Scope of the study

Based on the discussion above, the objectives of this thesis are to examine the usability and safety problems regarding consumer packages and to investigate ways of applying a user-centered approach to the package design process.

To achieve these aims, literature surveys on related contexts are utilized. Also, since there are few studies on this issue, a case study is included which investigates consumer/user complaints and usability problems.

1.3 Structure of the study

General structure of the study is based on four main questions. These are:

1. What is the importance of package design?
2. How do consumers/users interact with packages and what are the significant concerns related to this interaction?
3. What types of problems occur during consumer/user-package interaction and what are the effects of these problems?
4. What type of design process should be utilized to achieve usable packages?

The first question is addressed in the second chapter. In addition, this chapter includes a general description of packages and an explanation of their essential functions. A brief summary of the main considerations that affect the nature of package design are then identified. Lastly, available package design processes are presented to explain the current situation in this area.

The second question is addressed in the third chapter where user-package interaction is presented according to the literature on user-product interaction. This chapter includes definitions of package usability and safety in package use which can assist the identification and analysis of usability and safety problems.

The third question is addressed in the fourth chapter where the available literature on safety and usability problems and consumer/user complaints regarding packages are presented. Then, a case study, which focuses on the usability problems that may arise during package use, is presented. The case study focuses on food and beverage packages and problems resulting from poor package designs throughout the package lifetime. The lifetime phases cover the duration from the first package end-user interaction in the supermarkets to the disposal of the packages. The case study consists of two phases: a questionnaire survey followed by a usability test. The questionnaire survey presents the detected consumer/user dissatisfactions and complaints, and the usability test demonstrates consumer/user complaints during use of the packages to justify the problems.

The last question is addressed in the fifth chapter where a user-centered approach to package design is introduced and the key principles and activities of user-centered package design are presented. Thereafter, a set of checklists for the review of user-centered package design activities and another set of package design checklists for the design and evaluation of packages is presented. Lastly, a set of methods to be used for the user-centered package design process are discussed.

The conclusion provides a summary of the study and research findings. Furthermore, implications for further studies are explained.

CHAPTER 2

OVERVIEW TO PACKAGES

The purpose of this chapter is to provide a brief understanding of packages and package design. Accordingly, the term package is defined along with a brief history of packaging and its importance. Then, the main functions and environments of packages are explained, and the types of packages focused in the study are presented. Lastly, design variables in package design and information on the package design process are given.

2.1 Definition of package

From a general point of view, in a contemporary retail environment, a package is not just a container but a tool for delivering goods in a best condition for use. “If you go to a grocer and ask for a pound of flour, which he puts in a paper bag and hands you, that’s not really a package” states Hine (1995, p.17). It is also an interface between the product and consumer (Olsson and Györei, 2002). Thus, it communicates, informs, and interacts with consumers/users. From a marketing point of view, a package is an important tool that completes the advertising activities, attracts attention, communicates brand identity, and most importantly, sells goods in retail environments (Schwartz, 1971; Fitzgerald and Tsosie, 2004; Hine, 1995). From a designer’s point of view, a package is actually a product served to its users (Shell, 1996).

Apart from these definitions, the following explanations can further enhance understanding of packages. Keller (1993) defines packages as non-product-related but brand-related elements, which means they are external aspects of contents and symbolic elements. However, according to Richardson, Dick and Jain (1994),

packages are product-related but with extrinsic attributes. By extrinsic attribute they mean that the package is not part of the physical product itself, like brand name and price. Similar to the explanation by Richardson et al., Underwood (2003) defines packages as product-related attributes, but different from the previous two explanations, Underwood adds that packages can be defined as intrinsic or extrinsic attributes based on their features. They are intrinsic when they are physical part of the content (e.g. toothpaste tube), and they are extrinsic when the information on the package (e.g. logo, picture) is taken into account. Underwood (2003) also questions if classifying packages merely as symbolic elements is an accurate approach, especially for consumer non-durables, since they have experiential and functional benefits which are gained through lived experiences.

To summarize, a package can be defined as a designed-product served for use, which has to meet many requirements to satisfy the demands of the many stakeholders (e.g., manufacturer, distributor, retailer), and especially those of consumers/users.

2.2 A brief history of packages

This section explains the importance of consumer/user needs and their preferences throughout the history of packages. This section also provides a description of key developments in packaging area.

Berger (2002) points out the effect of consumer preferences as a core factor in his summary of packaging history:

> From containers provided by nature to the use of complex materials and processes, packaging has certainly changed. Various factors contributed to this growth: the needs and concerns of people, competition in the marketplace, unusual events (such as wars), shifting lifestyles, as well as discoveries and inventions. Just as no single cause influenced past development, a variety of forces will be required to create the packages of the future, but a very important factor will always be consumer choice (Berger, 2002, p. 5).

In early times, there was no need for packages to store or to transport goods to other places since humans consumed goods where they found or made them (Berger, 2002). Later, they needed to store their foods and they began to use various containers. Early containers were made of natural materials and they were chiefly utilitarian (Berger, 2002). From these early types of packages to the first modern package, they evolved as human needs changed so that by around the turn of the seventeenth century, a medicine package with a label and a distinctive form, "the first modern package", was made but it was still primitive (Hine, 1995, p. 46).

In the nineteenth century, modern packaging came into being through industrialization, which brought about new technologies, advanced production techniques, and rapid transportation (Hine, 1995). The developments in technology and production gave rise to a wide range of consumer goods, and new railroads made it possible to move them rapidly. Beside the movement of goods, industrialization caused the movement of populations and people began to work away from their villages in wage-earning jobs (Hine, 1995). All these factors decreased domestic production of goods and increased consumption. In this drastically changing environment, the need for packages increased in order to protect goods during transportation and storage until they reached consumers. Therefore, manufacturers began to deliver most of their products within packages.

In the second half of the twentieth century, the introduction of supermarkets increased the importance of package design and accelerated the growth of packaging (Hine, 1995). When the supermarkets became a part of everyday life, packages became an essential tool for marketing besides their already known protective and informative roles (Sonneveld, 2000; Olsson and Györei, 2002). As a result of the convergence between packages and marketing, the power of package design to sell products became apparent when packages began to appear alongside many competitive brands in self-service stores. In this competitive environment, manufacturers started to present their products in an attractive manner; they gave distinctive characteristics to their packages to differentiate their products (Hine, 1995). Moreover, package designs were also changed to accommodate the changing

life styles of consumers as the needs of smaller family units were altered, people had less time (Sonsino, 1990), and mobile lives became more common (Calver, 2004). Consumer preferences became a dominant factor in the decisions of manufacturers which in turn led to an increase in the use of more convenient and time saving packages in supermarkets.

Today, goods with packages and their alternatives are continuously increasing to accommodate modern lifestyles. The increase in packaged goods has been accompanied by increasing competition between producers of different brands. Parallel to increased competition, consumer/user demands and needs have been steadily increasing even though visually and functionally satisfactory packages are proliferating in the market (Doyle, 2004a; Louis, 1999; Olsson and Györei, 2002). Consumers are becoming "critical and not easy-to-please individuals" (Sonneveld, 2000, p. 30). They do not blame themselves anymore when they encounter problems during the use of packages, but they think that it is the manufacturers' failure and they demand improved packages (Doyle, 2004a).

As suggested by Kronowitz (1991) and Hine (1995), to satisfy consumer demands and to become a market leader, continuous improvement in the packaging sector is a 'must'.

2.3 Types of packages

In this section package types with which end-users interact is discussed in order to identify the package types mentioned in the study.

2.3.1 Classification of packages

According to Cravens and Woodruff (1986), consumer-products which are sold for personal consumption can be divided into two groups based on their durability:

consumer durables and consumer nondurables. Consumer durables are the products that are used for a relatively long time, such as furniture and cars. During their transportation and distribution to warehouses, stores or end-users, some of these products may need a package that usually does not come into contact with end-users. However, consumer non-durables are those products that are consumed immediately or after a number of uses and purchased again after consumption, such as food and beverages (Cravens and Woodruff, 1986). Most of these nondurables need a package that repeatedly comes into contact with end-users. Therefore, this study focuses on the packages of consumer non-durables.

The packages of consumer non-durables can be classified into three levels: primary packages, secondary packages, and tertiary packages (Robertson, 1993; Sauvage, 1996; and Hermansson, 1999). This distinction is important, because these packages are designed in different ways to fulfill different functions and needs.

Primary packages are also known as 'consumer packages'. They are "designed to come into direct contact with the product" (ISO DIS 21067, 2004). These packages are served as single units to the consumers and provide initial protection for the contained-product (Hermansson, 1999; Robertson, 1993). Examples of consumer packages include glass jars, plastic bottles, cans, and paper pouches. They are different from the other two package levels in that they directly interact with the consumers/users. As they interact with consumers/users, primary packages are especially of concern for marketing purposes (Bardi and Kelly, 1974).

Secondary packages are also known as 'retail packages'. They are "designed to contain one or more primary packages together with any protective materials where required" (ISO DIS 21067, 2004). Their main responsibility is to protect the products during distribution (Hermansson, 1999). These packages can also be used as a display for primary packages (Robertson, 1993). An example of retail packages includes corrugated boxes.

Tertiary packages are also known as 'transport packages'. They are "designed to contain one or more articles or packages or bulk material for the purposes of transport, handling and/or distribution" (ISO DIS 21067, 2004). These packages contain a number of retail packages. An example of transport packages includes stretch film around a pallet.

Based on the levels above, this study focuses on primary packages of consumer-nondurables since end-users more frequently interact with these packages when compared to the other package types.

2.3.2 Classifications of the primary packages of consumer nondurables

The primary packages of consumer nondurables can be classified into different groups based on their *flexibility, material, shape,* and *closures*.

Flexibility: Berger (2002) classifies the primary packages of the consumer-nondurables as *flexible, semi-flexible,* and *rigid*. A flexible package is the "package where the shape is likely to change after the contents are added or removed" (ISO DIS 21067, 2004). A rigid package is "where the shape remains essentially unchanged after the contents are added or removed" (ISO DIS 21067, 2004). A semi-flexible package is a type of package where the shape is likely to change relatively less than a flexible package after the contents are added or removed. Berger (2002) notes that as the flexibility of the primary package increases, the amount of material and thus the weight decreases. Examples of flexible packages include paper sacks, plastic bags, and plastic over-wraps; examples of semi-flexible packages include paperboard boxes; and examples of rigid packages include glass bottles and metal cans.

Material: Another classification is made by Sonsino (1990) who considered the main material used for packaging. Accordingly, the packages can be *paper, glass, metal,* or *plastic*. Paper packages include mainly sacks, bags, pouches, aseptic

carton boxes, ovenable trays, and cardboard folding boxes. Glass packages include jars and bottles. Metal packages include food and beverage cans, boxes, collapsible tubes, aerosols, and trays. Plastic packages include bottles, boxes, drums, pails, trays, tubes, sacks, bags, and pouches (Sonsino, 1990).

Shape: Package types based on their shape are mainly classified as *bags, bottles, jars, boxes, cans, drums, pails, the collapsible tubes,* and *trays* (ISO DIS 21067, 2004). According to the ISO DIS 21067 (2004) definitions, a bag is a flexible package of single or multiple layers enclosed on all sides; a bottle is a rigid package typically made of glass or plastic, with a narrow mouth and a closure; a jar is a rigid package typically made of glass and plastic with a wide mouth and a closure; a box is a package with rectangular or polygonal sides that surround the content; a can is a metal package usually shaped cylindrically; a drum is a cylindrical package with a removable or non-removable head; a pail is also a cylindrical package equipped with a lid and a handle; a collapsible tube is a flexible package having a nozzle and cap, serving as both container and dispenser; and a tray is a shallow box usually without a top.

Closures: Closures are also used for classifying packages, as they give distinctive characters to packages, assign filling processes and affect usage. This classification can be made according to the package caps or sealing types such as tamper-evident packages, heat-sealed foils, and screw top bottles (Sacharow, 1976).

2.4 Functions and environments of packages

Even though the sections above simply cover the functions of packages, it is necessary to discuss the functions and environments of them in a separate section to define them precisely.

Packages perform many different functions and may do so in different environments. According to Robertson (1993), there are four main functions that

packages should fulfil. These functions are containment, protection, convenience, and communication. These functions should serve in three main environments: physical, ambient, and human environments. Similar to Robertson's classification, Lockhart (1997) classifies functions as protection, utility, and communication; and the environments as physical, atmospheric, and human environment. However, as seen in Lockhart's (1997) classification, containment is not presented as a main function since it is the basic responsibility of a package. The 'convenience' function stated by Robertson and 'utility' function stated by Lockhart is very similar in the sense that their objectives are the satisfaction of consumer/user needs. Likewise, the 'ambient environment' and the 'atmospheric environment' have the same meaning. Based on Robertson's (1993) and Lockhart's (1997) classifications, it can be said that the main functions of packages are protection, communication, and convenience and the environments are physical, ambient, and human environments.

Physical environment is the environment within which the products are displayed, transported or used. Ambient environment is that which surrounds the package and human environment is that in which people interact with packages.

In relation to the three environments, the main functions of packages are explained as follows:

Protection is the primary function of packages. It can be explained in two aspects: protecting the package and its contents from environmental damages, and protecting the environments from the package and its contents (Lockhart, 1997). In the former, environmental damage can appear in all three environments. Damage to the package and its contents in the physical environment can result from falls, crushes, vibrations or shocks; in the ambient environment damage can result from humidity, cold, heat, odours, gases, vapours, light, and water effects (Robertson, 1993; Lockhart, 1997); and in the human environment damage can arise from theft, sabotage or vandalism. In the latter, protecting the physical and ambient environment from the package and its contents can be described as being environmentally friendly (e.g. protecting the physical environment by lessening

package related waste). Protecting the human environment can be explained as the protection of human beings from any dangerous contents of the packages (e.g. protecting the human environment by maintaining the freshness of the contents for specified time interval for food products), and from the accidents caused by packages.

Communication is the main concern of consumer marketing when it comes to packages; it helps attracting consumers, providing necessary information about the product and the brand, and most importantly, it helps to sell the goods in self-service stores. Additionally, it speeds up consumer's decision processes and thus lessens the time spent for shopping (Hine, 1995; Robertson, 1993; Rettie and Brewer, 2000).

Convenience is a relatively recently recognized function when compared to protection and communication functions. It can be explained as features which make a package useful or easier to use (Hine, 1995; Lockhart, 1997). These features play an important role in satisfying the demands and needs of consumers/users. In this regard, packages should be designed together with knowledge of user needs, demands, and legislative and regulatory requirements regarding safety (Robertson, 1993). Additionally, convenience of packages for the physical environment (e.g. suitability of the package shapes to the store shelves) and ambient environment (e.g. suitability of the packages to moisture or chilling) in which they take place should be taken into account.

It can be said that physical and atmospheric environments are mostly related to protection. On the contrary, human environment is related to all three main functions (protection, communication, and convenience) since packages are actually served to meet the requirements of the human environment. In spite of the differences, environments, functions, and their interactions should be considered as a whole. As Robertson (1993) emphasizes, "failure to consider all three environments during package development will result in poorly designed packages,

increased costs and consumer complaints, and even avoidance or rejection of the product by the customer" (p.6).

2.5 Package design

Package design can be defined as the arrangement of design variables in respect to the functions and requirements. The following sections will explain variables in package design and available package design processes in literature.

2.5.1 Variables in package design

Package design variables are mainly: colour, typography, pictures, shape, size, and material. Sonsino (1990) refers to all these elements except material, as graphical elements. However, just referring to shape and size as graphical elements leads to a two-dimensional (2D) design perspective. Perceiving packages as a 2D object or just as a concern of graphic design may result in visually satisfactory but functionally poor package designs. In addition to Sonsino (1990), some authors discuss the variables in package design in two headings: graphical and structural elements (Hine, 1995; Underwood, 2003; Calver, 2004). Accordingly, graphical elements are colour, typography, pictures; and structural elements are shape, size, and material. This grouping may not be satisfactory since the shape and size can be both a graphical and a structural element based on the areas of use and aim of design. For example, when the shape of the label on the package or the shape of the items shown on the label is the concern, shape can be classified as a graphical element, but when the shape of the package itself is taken into account, it can be classified as a structural element. Therefore, in the following sections, the design elements will be explained separately.

Colour is the most important tool for emotional expression of a package (Hine, 1995) as it reflects an image for the product (Sauvage, 1996). Underwood (2003,

p.65) notes that consumers give meaning to the package colours in three different ways: “the physiological, the cultural, and the associational”. The first one is universal and involuntary (e.g. the colour red speeding the pulse). The second one, cultural meaning for colours, has occurred over long periods of time in different societies (e.g. the colour black relates to elegance in Europe). The third one, associational meaning, is created through marketing efforts (e.g., the colour pink relates to the product with low calories). In addition, colour is a tool for brand identification and visual distinction (Underwood, 2003). It is also an important factor for legibility of the texts and comprehension of the images placed on the package.

Typography is the basic tool for communication; it serves necessary and important information about the contents, such as ingredients, production and expiry dates (Sonsino, 1990). On this account, carefully chosen typography is important for readability. It is also important that different styles of typography can change the perception of the package and the brand (e.g. solid strong typography usually represents reliability or durability).

Pictures and pictorials cover pictograms, symbols, and photographs on the packages. They provide information about, for example, instructions and safety warnings for consumers/users. They enhance incidental learning since they are more vivid stimuli than verbal explanations (Underwood, Klein and Burke, 2001).

Shape of a package is usually the first element that the consumer notices in stores (Sauvage, 1996). It is an important factor while creating an image about the product and the brand. For example, as Sonsino (1990) states, an old-fashioned shape of a package can suggest reliability and maturity to the consumer. In addition, the shape of a package affects the quality of experiential benefits, which means it affects how well the package is used (Underwood, 2003). Shape is also an important concern for the retailers since they prefer easy to stack shapes for especially fast-moving consumer goods (Sonsino, 1990).

Size is also an important element when considering the visibility of a package and the information it displays (Sonsino, 1990). It also affects the perception of the contents (Sonsino, 1990). For example, large-sized cereal packages are usually perceived as bountiful and small packages make cereals seem heavy or solid. In addition, when size is considered as a structural element, it determines the portions which a consumer/user would typically use and thus it becomes related to convenience function.

Material is one of the most important elements of package design. Package designers make use of a wide range of materials, including paper, cardboard, plastics, glass, wood, metals, and combinations of all (Fitzgerald and Tsosie, 2004). The type of contents, functional needs, and the product image are all considered while determining the right type of material (Sonsino, 1990; Sauvage, 1996). As the shape of a package creates an idea about the brand and the product, the selected material for a package also affects the consumer thoughts. For example, glass has a high-quality image on consumers' minds, whilst metal packages have an old-fashioned image, or plastics have a low-quality image for especially older consumers (Sauvage, 1996).

Graphical elements are mainly used to create the general appearance of a package. They are tools for attracting consumers; creating an aesthetic appeal, brand identity and an image. Besides**,** as graphical elements do, structural elements also reflect an identity for the product and the brand, differentiate the product, and attract attention in stores. However, as Hine (1995) points out, structural elements, different from the graphical elements, affect the concerns of the ease of use. They define how the package will be used, opened, and dispensed. Moreover, the use of structural elements during design process provides long-term advantages. For example, by using them, specific, innovative, and hard-to-copy designs can be achieved (Meyers and Lubliner 1998). However, as a disadvantage, modifications in structural elements may increase the cost and the time spent for producing them.

It is also worth mentioning that each of the design variables affects the decisions about other design variables (Hine, 1995). For instance, the shape of a package affects the design of the area used for the label, and the material of the label affects the print colours. Despite the differentiation of package design components, during the design process these elements should be carefully combined to constitute the overall design quality (Sonsino, 1990).

2.5.2 Package design process

To achieve a successful package, the package design process should be planned effectively. However, there is little information in the literature about how a package design process should be undertaken. Besides, most of the available information presents package development process for engineers and marketing experts. Moreover, the research techniques utilized during these processes are generally used for the generation of new package design ideas; for determination of their appropriateness for the market; and especially for their effectiveness on the shelves where the packages are sold.

DeMaria (2000) presents an entire package development process, which is principally for engineers and project managers (See Figure 2.1). Here the package design process begins with planning activities and continues with proving functionality of the package and then activities related to package launch. The following explanation is based on DeMaria's package development process.

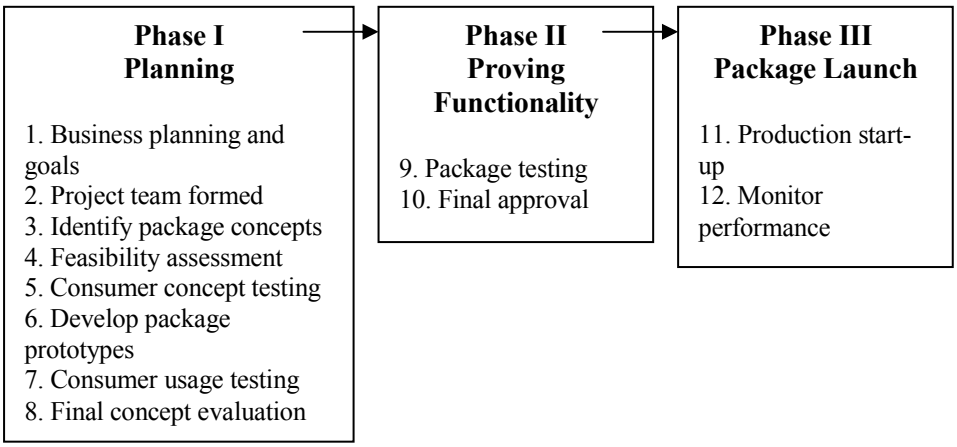

Figure 2. 1 Package development process flowcharts.
Source: DeMaria, 2000, p.x.

In the first phase, a business plan is formed and goals are identified. This plan and its goals provide a direction for the development process. The project team is then formed and a project charter and project timeline created. The charter is a framework for the project that includes the project goal, situation analysis, critical success factors, milestones, assumptions and risks, team members and roles, and the team rules. The project timeline, on the other hand, is a schedule for the events in the process.

After these activities, package concepts are identified and categorized based on the project-goal. Package concepts may come from different sources, including suppliers, consumer testing, brainstorm meetings, creative thinking activities, and field trips.

Thereafter feasibility assessment takes place. This includes determining whether the selected ideas meet the specified success criteria, determining the success probability, re-evaluating the ideas, determining whether extra ideas are needed or not, and determining the next steps to qualify selected ideas.

Once this has been achieved, consumer tests are conducted. For concept testing, which is applied when many ideas are needed, drawings or mock-ups are utilized. For usage testing, which is used to determine consumer opinions about the package and how well the package features function, prototypes are utilized.

The last step in the planning phase is final concept evaluation, whose decision drivers are technical feasibility, consumer preference, time requirement, and financial commitment.

In the proving functionality phase, every detail related to standards and functions of packages are considered. The package tests include material testing in which barrier, optical, and mechanical properties are tested; finished package testing in which tests are determined by the requirements of the product and the package-environment (e.g. shelf life test); distribution and storage testing; and package machinability testing. In addition to these tests, retail and consumer concerns are taken into account, preparation related to any crisis situation is made, and plant trials are carried out to gain package performance information. After all the evaluations and tests, a final decision on a package and its production is approved.

In the final phase, production starts. Once packages are served to consumers, performance is monitored by means of consumer response, sales volume, and test data and manufacturing records.

In addition to DeMaria's package development process, Meyers and Lubliner's (1998) package design process, which focuses on marketing requirements, is found by the author to be the most comprehensive package design process in literature. Its chief stages are presented in Figure 2.2. However, research techniques utilized during this design process mostly focus on the "shelf appeal" and brand perception. The following explanation will be based on Meyers and Lubliner's package design process.

Figure 2. 2 Package design process.
Source: Meyers and Lubliner, 1998, p.88.

In the first stage, brand identity and package design requirements, advertising and promotional plans, manufacturing place and machines, marketing and product category information, competitive products' packages and the firm's own product package are examined, and research on the consumer brand and category beliefs are carried out. Market research in this stage aims to gather the information about demographics and consumer purchase patterns.

In the second stage, research is undertaken on brand identity, graphical and structural design concepts. Design ideas are then selected for presentation to consumers. In this stage, many meetings between the marketing and the design team are held to evaluate and to select a design concept(s) to modify and improve.

In the consumer research stage, focus studies and one-to-one interviews are conducted, and the final design ideas are selected. They include mainly the questions of whether the design supports the brand identity, whether the package can easily be differentiated on the shelf, and whether the design reflects the marketing aims. These consumer researches are utilized to evaluate the strategic compatibility of the design, gather suggestions about design, confirm the design decisions, and identify the consumer complaints.

In the fourth stage, selected ideas are improved and modified, and models are prepared. These models are presented to the design consultant, marketing experts, technical personnel, and if possible to the package manufacturer in a meeting. For

the final decision, a consumer research is conducted. This stage usually lasts longer than the concept design stage, since the designers deal with the details of the concept design to improve it.

In the final stage, the selected design is adapted to the other sizes of the product and to the other package materials. Moreover, final models are prepared (if necessary). Furthermore, preparation meetings with the package manufacturer, typographer, and the colour experts are held. At last, the package design is finalized; and subsequently manufacturing and printing processes are carried out.

The frequently used package tests mentioned by Meyers and Lubliner (1998) are tachistoscope, eye tracking, focus group study, one-to-one interview, experimental retail environment test, and full-scale marketing test. Since there is no exact explanation for when and in which stage these tests are applicable, they were not integrated into the package design stages above. Thus, they are presented separately in the explanations below.

Tachistascope method, in which different packages are showed to subjects in a rapid way, aims to determine what the consumer sees first and measures the effectiveness in the recognition of the package (Sauvage, 1996). This method does not give wide information about package design, but it gives information about brand recognition (Meyers and Lubliner, 1998).

Eye tracking method, in which laser technology is used to track the eye movements of the subjects while looking at the shelves, aims to determine what holds attention on the shelves (Meyers and Lubliner, 1998).

Focus group study is a small group conversation, in which consumers and an experienced researcher take part and their conversation is video-recorded. This study aims to identify perspectives about the product category, market positioning, brand identity, and the package design (Meyers and Lubliner, 1998; Sauvage,

1996). In these studies package design elements, their comprehension and their appropriateness to consumer needs are discussed.

One-to-one interview, similar to the focus group study, aims to identify opinions about the product category and the package design. It can be held anywhere suitable for the interviewee's specifications (Meyers and Lubliner, 1998).

The experimental retail environment test aims to identify consumer preferences. An environment that is very similar to a part of a real retail environment is created with models of the package and while the subjects are shopping their attitudes are observed. Thereafter, they are asked about their preferences in one-to-one interviews (Meyers and Lubliner, 1998).

Full scale marketing test, in which real retail environments are used with real filled packages, aims to gather more detailed and realistic information. However, this test needs a well- prepared organization, lasts one month to one-year, and increases the cost (Meyers and Lubliner, 1998).

In addition to Meyers and Lubliner's explanations on package testing, Schwartz (1971) categorizes the package tests into three groups. These are visibility tests, image tests, and usage tests. The visibility tests are utilized to evaluate whether the package is visible and identifiable on the shelves. The image tests are utilized to evaluate consumer attitudes towards a package and product, their preferences, and the message communicated by the package design. The usage tests are utilized to measure the functionality of the package and reactions of the consumers toward the functions. They can be carried out in either subjects' houses or in field locations. In these tests, subjects are asked to handle, open, and use the package; and an interview is conducted with them while they perform these tasks.

CHAPTER 3

USER-PACKAGE INTERACTION

This chapter starts with a brief description of user-package interaction and then identifies the factors that affect it. Since the satisfaction from user-package interaction depends on package usability and safety in package use, this chapter also discusses these issues.

3.1 Description of user-package interaction

Ergonomics deals with humans and their interaction with products, environments and equipments as well as the activities performed during this interaction (Czaja, 1997). This interaction is generally defined as human-machine interaction or user-product interaction. McCormick and Sanders (1993) state that the concept 'machine' in this interaction constitutes any type of physical object required to achieve goals in performing activities. In this sense, since the package itself is also a physical object and is utilized by users to perform functions, the term 'machine' will be referred to as 'package' in the following parts.

While explaining user-package interaction, the term 'user' will be used instead of 'consumer' as the latter is a marketing term. The consumer may not be the end-user of a package and may not come into contact with it. For example, a consumer who is an adult may have purchased a packaged product, but the package may come into contact with a child and be used by him/her. Thus, the term 'user', which means "anyone who may come into contact with the product, either intentionally or unintentionally, and as a result of the primary or secondary interaction with the product" (Norris and Wilson, 1999, p. 76), will be used in the following parts.

Figure 3.1 simply describes a user-package interaction based on the Czaja's (1997) model of human-machine system. In this model, the user first becomes aware of the package and receives some information from it (e.g., perceiving the information on the package regarding how to open the closure), then processes what s/he perceives (e.g., getting the meaning of the information), and finally performs an action on the package to achieve his/her goal that is "an intended outcome" (ISO 20282 draft, 2003, definition 4.9) (e.g., opening the package according to the processed information to get into the contents). In this model, the process phases – perception, cognition and action – constitute the task that is defined as "the activities required to achieve a goal" (ISO 20282 draft, 2003, definition 4.15).

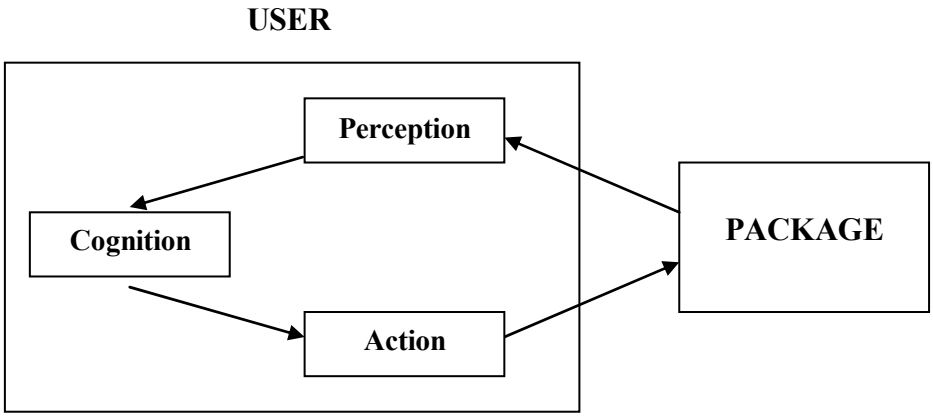

Figure 3. 1 A simple model of user-package interaction.

Very similar to this user-package interaction model, Torrens, Williams, and Huxley (2001) explain three physiological functions that are used for the openability of packages: visual, cognitive and manual. By means of visual function, one perceives a package, reads the related information, inspects and identifies the mode of opening; cognitive function relates to understanding the opening mechanism; and manual function relates to the force required to perform the action of opening the package.

Stanton (ed., 1998) on the other hand, presents a more detailed explanation of user-product interaction and describes the cycle of user activities. The user-package interaction based on this cycle is shown in Figure 3.2. This cycle begins with formulating user goals and continues with forming intentions and planning the sequence of actions. Then the user performs an action on the package and this action results in some changes in it. Afterwards, the user perceives these changes and interprets and evaluates them against the goal or formulates another goal. For example, one may want to drink some milk from a milk bottle. The intention may appear as opening the bottle and sequence of the action may be first holding the bottle with one hand and holding the cap with the other hand, then, turning the cap and lastly, removing the cap. Then, one executes these actions on milk bottle and removes the cap, and sees that the cap is removed but there is a foil seal on the bottle and interprets this information. Afterwards, one evaluates this situation and understands that the milk cannot be drunk without removing the foil seal and formulates another goal (most probably removing the foil seal) to drink the milk.

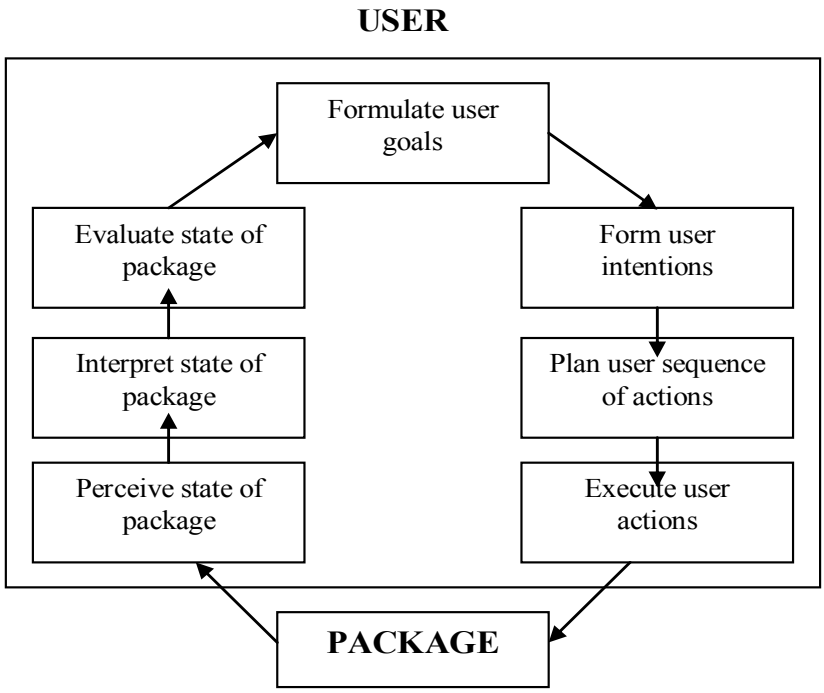

Figure 3. 2 Activities during user-package interaction.

In these two models, a direct action towards the package is described. This direct action leads to a change in the state of the package. However, it is worth mentioning that, for example, during purchase, while reading the information on a package, the user may not perform an action mentioned on the package and thus no change occurs. In this case, there is no physical interaction, but only a cognitive one between the user and the package.

3.2 Factors that affect the quality of user-package interaction

There are some factors that affect the quality of user-package interaction. These are environmental factors (e.g., light, temperature), task types (e.g., opening, closing, storing), user characteristics (e.g., age, gender, strength, and psychological characteristics), equipments used during the interaction (e.g., knife, can opener, fork, scissor, jar opener, and others with sharp edges or points), and the nature of

the content (e.g., liquids such as beverages or bleach, pastes such as tomato paste or toothpaste, granular products such as cereals or laundry detergents).

These factors form the context of package use. As can be seen in Figure 3.3, to be able to use the content, the user performs some tasks on the package by utilizing some equipment (if necessary) in a physical environment which is covered by an ambient environment. These factors will be further explained in Chapter V.

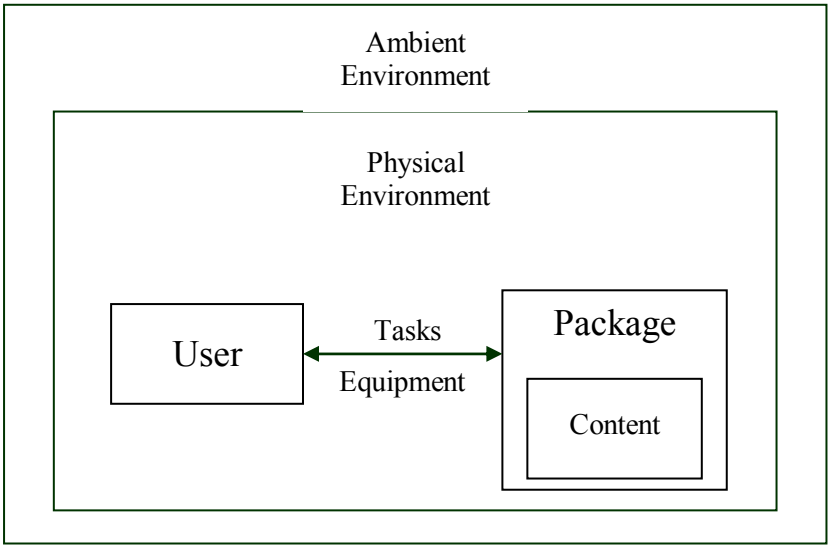

Figure 3. 3 Context of use of packages.

3.3 Package usability

Usability of a product, in general terms, is related to how effectively a person interacts with a product or how easy the product is to use. On the other hand, the International Standards Organization (ISO) defines usability of a product as:

> The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use (ISO 20282 draft, 2003, definition 3.16).

As Stanton (ed., 1998) states, this definition is mainly intended for software products but it can be applied to any kind of product. Thus, based on this definition, package usability can be described as the extent to which a package can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.

This definition relates to the quality of the user-package interaction. The fundamental attributes of this interaction are effectiveness, efficiency and satisfaction. They can be explained as follows:

Effectiveness is defined in ISO 20282 draft (2003) as "the accuracy and completeness with which users achieve specified goals" (definition 4.4). As can be seen, accuracy and completeness are important determinants of effectiveness in user-package interaction and they refer to how well the user achieves goals while using a package. As regards accuracy, it can be said that the effectiveness fails when, for example, a user opens a biscuit package by cutting it with a knife instead of utilizing the tear tab. On the other hand, when the concern is completeness, it can be said that, for example, four different outcomes from the task of opening may be obtained: the package is opened and the user reaches the content, it is partially opened and the user partially reaches the content, it is partially opened and the user does not reach the content, or it is not opened at all and the user does not reach the content.

Efficiency is defined in ISO 20282 draft (2003) as "the resources expended in relation to the accuracy and completeness with which users achieve" (definition 4.6). Efficiency of user-package interaction refers to the resources consumed in order to accomplish a goal while using a package. As Jordan (1998) underlines, the less effort required or the less resources are consumed, the higher the efficiency. In this sense, efficiency of a package can be determined by means of analyzing the time taken to achieve a task or error rates. For example, if a user tries several ways of opening and fails until s/he opens the package and spends 5 minutes instead of

opening it at the first attempt, it can be said that the package is unusable or inefficient based on the specified efficiency criteria.

Satisfaction, meanwhile, is defined in ISO 20282 (2003) as "freedom from discomfort and positive attitudes to the use of the product" (definition 4.13) and satisfaction from user-package interaction refers to the comfort or acceptability of package use while performing tasks. As Jordan (1998) emphasizes, satisfaction is the most important usability criteria since it is an effective determinant on the user's thought about overall usability of a product even though satisfaction is subjective and difficult to measure. For example, similar to Jordan's (1998) example in the explanation of satisfaction, the user tries to open two plastic bottles and s/he opens the first package more quickly than the second one, but s/he may find that the handling of the second one is more comfortable during the opening action than the first one, and then s/he may conclude that the second one is more satisfactory to use than the first one. In this case, satisfaction is a determinant factor. However, it cannot be said that effectiveness and efficiency is not related to satisfaction (Jordon, 1998). When the user is unable to open the second one even if the handling is comfortable, s/he will probably choose the first one as satisfactory to use.

While explaining package usability, it is worth noting that the term 'functionality' is generally used instead of 'usability' in the profession of packaging to imply how well it interacts with users and how well it meets user needs. However, usability differs from functionality. Functionality is related to how well a package works with its features and capabilities, but usability is related to how well functionality of a package is implemented in user environment. As mentioned by Wilson (2002) "usability is the degree to which potential utility becomes actual utility". A package with appropriate functionality should also present usability to satisfy its users and as Goodwin (1987) maintains that functionality becomes useless when a product is unusable. For example, a ring-pull on a can is a feature which serves for functionality, but may appear useless or unusable when it serves no ease to the user or creates difficulty in opening the can. In addition, as Jordan (2000) emphasizes "a product will be useless if it does not contain appropriate functionality" (p. 5). For

example, a traditional can without a ring-pull lacks functionality, and it appears meaningless to expect usability in opening from this package.

Dumas and Redish (1994) state "product usability is considered one of the most important factors for a product to be successful in the market" (as cited in Han and Kim, 2003, p. 189). Jordan (1998) explains why product usability is important by emphasizing four topics: annoyance, product sale, productivity, and safety. Annoyance is the feeling that we usually experience with difficult to use or useless everyday products (Jordan, 1998). Packages, as everyday products, usually cause annoyance or frustration when they present difficulties during use even though they have been intended for convenience, one of the main functions of packages. Product sale as the financial implication of usability, on the other hand, increases the importance of usability. As Jordan (1998) points out, "design issues – including usability – may be one of the few areas left where manufacturers can gain significant advantages over their competitors" (p.17). On the other hand, the usability of products used in work environments increases productivity (Jordon, 1998). For packaging, work environments can be anywhere the product is used, for example, kitchens or bathrooms. In these environments, usability can easily decrease the time consumed for the use of both the packages and contents, and thus accelerate the completion of the work. Safety, meanwhile, is the other important issue for consumer packages and it is discussed in detail in the following section.

3.4 Safety in package use

The general understanding of safety is the condition of being safe. However, in detail General Product Safety Regulations (GPSR) in UK defines the safe product as:

> Any product which under normal or reasonably foreseeable conditions of use, including duration, presents no risk or only the minimal risk compatible with the product's use (As cited in Benedyk and Minister, 1998, p.56).

Based on this definition, it can be said that packages should present no risk or only minimal risk to its users under normal or reasonably foreseeable conditions of use.

The key message contained in the GPSR's definition is emphasised by Hunter (1992) who said: "there is no such thing as an absolutely safe product" (p.1). It cannot be said that a product is free from all kinds of danger. Under certain conditions, a product may cause danger to its users or people other than its users. Thus, the responsibility of the designer is to identify the foreseeable conditions of use. For package designers, it may be easier to define foreseeable uses that may create a risk to the user since packages have simple interfaces.

On the other hand, reasonably foreseeable uses in the GPSR's definition cover normal and probable alternate uses. Hazards or any sort of threats to personal safety (Hunter, 1992), connected with those alternate uses which can be abuse or misuse whether intentional or not, must be taken into account in the design process (Benedyk and Minister, 1998). However, misuse and abuse of a product is more difficult to identify than the normal expected use of a product since they are "unpredictable behaviour of ordinary people" (Hunter, 1992, p.7). In this regard, product liability is an important concern when designing any consumer product (Woodson, Tillman and Tillman, 1992). Nevertheless, as Sonsino (1990) states "designers cannot afford to spend all their time worrying about product liability, but they must give enough care and attention or be found liable of criminal negligence" (p.156).

As stated before, there is no feasible way of eliminating all hazards, but the expected frequency or severity of foreseeable hazards can be reduced. This can be achieved by means of controlling strategies such as training for users of products, selection of users, supervision, back-upping warnings to users, including instructions and labels, modifying the design of product and design of environment, and maintenance as listed by Benedyk and Minister (1998). However, many of the strategies used to prevent accidents in industry cannot be applied to domestic products or otherwise portable consumer products (Benedyk and Minister, 1998).

Possible strategies to enhance safety in package use can be putting appropriate instructions and labels, and changing the design of packages. The latter is probably the most effective. As Van Weperen (1993) states, “all hazards should, in principle, be eliminated by design” (as cited in Benedyk and Minister, 1998, p.64). Hunter (1992) maintains that “designers should make hazard recognition and elimination a basic consideration in the early stages of product design” (p.8). Thus, hazards can be controlled before accidents happen. Woodson et al. (1992) present the typical risks that may arise during the design process if a proper and early safety analysis is nonexistent (See Table 3.1). In this table packaging related risks are identified. As can easily be identified from this list, risks related to packages seem relatively low when compared to other complex consumer products (e.g. electronic products). The statements of f and g are irrelevant to packages, but the remainder, in changing degree of importance, concern the safety of package use. Moreover, some risks are only relevant for specific package types such as the statement j.

Table 3. 1 Results of improper safety analysis and examples for packaging.

Results of improper safety analysis	Relevancy to packaging and examples
a. products in which toxic or flammable materials are used	e.g. material used for packaging can be toxic or instead the contents can be toxic such as aerosols
b. products which are made of breakable materials or which have sharp protrusions, corners, or edges	e.g. tins with sharp edges and breakable package materials such as glass
c. products in which exposed moving parts cause pinches, cuts, or amputations	e.g. moving caps of packages may cause pinches
d. products that can be used improperly to strike another person or to shatter glass	e.g. glass bottles can be used to strike another person
e. products that can be swallowed	e.g. separable part of packages such as caps or labels can be swallowed
f. products that can cause electric shock because of improper insulation or grounding	Irrelevant for packages
g. products that people can easily fall from	Irrelevant for packages
h. products that can produce injurious noise, extreme heat, or flying particles that could puncture a person's skin or eye	e.g. substance such as deodorants dispensed from a pressurized container
i. products that could cause rupture or strain when lifted or injury to a foot if dropped	e.g. 3lt or 5lt liquids packaged in PED bottles
j. products that can cause burns.	e.g. self-heated cans may cause burns

In addition, it is worth mentioning that the safety and the usability of a product are closely related issues. This relation appears in two ways. The first, as Kirk and Ridgeway (1970) state, is that "safety is an obvious criterion for a 'usable' product" (As cited in Norris and Wilson, 1999, p. 73). For packages, it is apparent that an unsafe package would not be accepted as usable. For example, when a traditional can causes injuries during opening or use of the package, it cannot be accepted as a usable package no matter how well it performs its other functions or how well it works in human environment. The second relation is that the usability of a product can affect safety in use (Jordon, 1998). For packages, lack of usability is an important factor in many accidents. If a package lacks usability, it may also cause

injuries during use. For example, since some tear-open milk cartons are hard to open, sharp tools (usually knives) are needed to open them and those tools used for opening are the main source of injuries.

In addition, as defended by Benedyk and Minister (1998), evaluating the safety of products is similar to ergonomic evaluation of product use. For example, assessing safety of a product includes evaluating the product's characteristics, its use, the effectiveness of instructions and labels, the type of user subject to danger, and demands and complaints of users. Consequently, as Benedyk and Minister (1998) state, ergonomic evaluation of a product is useful when evaluating the safety of products.

CHAPTER 4

PROBLEMS THAT OCCUR DURING USER-PACKAGE INTERACTION

This chapter presents usability and safety problems, and user complaints related to consumer packages. The objective is to prove the existence of various problems, and thus, to indicate the insufficiency of the current package design processes. This chapter comprises of two main sections: problems that are compiled from literature and a case study that identifies the problems during package lifetime phases and analyses the interaction between users and food and beverage packages.

4.1 Problems that are compiled from the literature

There are various demands from users regarding usability of packages. Doyle, (2004a) states that people are busier than ever and time-pressed users typically complain about performance and ease of use of packages. According to a research study carried out in the USA, users do not want to pay attention and spend extra time for package use, but they want portability, product protection (before and after opening), easy-opening, product visibility, value for money, legibility, easy-storage, and environmental-friendliness (Page, 2001).

At best, poor designs result in unusable packages, but at worst, they result in accidents. Unfortunately, there are many problems related to safety in package use. Thus the literature on package related problems focuses on safety issues rather than the wide variety of problems that occur during user-package interaction.

Based on DTI's (Department of Trade and Industry) research, which aims to identify the possible ways of reducing package related accidents in UK, it was

found that approximately 49.000 UK consumers each year need hospital treatment because of packages (Galley, 2004). Some of these are serious enough to require in-patient treatment. Moreover, as confirmed by the research, these reported accidents may represent only 35% of the total (DTI, 1997a), with the remaining 65% being treated at home.

In another DTI survey (1997b), approximately 2,000 people were interviewed and asked whether they or another member of their household had been injured in accident(s) connected with packages in the year before. 10% answered that they themselves had package related accident(s) and 8% answered that another person in their family had package related accident(s) (DTI, 1997b). All these findings show that safety problems related to packages are common and need to be seriously considered by manufacturers.

According to DTI (1997c), accidents occur during initial opening, re-opening/re-use, and after use. These are explained as follows:

Initial opening is the first time when the package or container is opened. Many of the accidents which occur during initial opening are due to inappropriate tool use (e.g. sharp knives, screwdriver).

Re-opening/re-use is the opening or use of the packages other than the first opening and first use to consume only a portion of the contents. The accidents which occur during re-opening or re-use are usually related to the misuse of a toxic product (e.g. drinking bleach).

After-use phase is related to accidents that occur after the package and the contents are consumed. Discarded packages are the main causes of such accidents.

The DTI research (1997a) in the UK concluded that there are eight main categories of non-medicine packages and three other key areas which contribute to accidents. The packages are food tins, glass bottles, plastic bottles, glass pots, jars, canisters, foil and films, plastic spray bottles, and aerosols. Three other key areas that are

related to accidents are knives, exploding bottles, and toxic substances (bleach, household cleaning agents, disinfectant, turpentine and perfume) (DTI, 1997a).

As can be understood from these findings, tins, glass and plastic packages are the main package groups that together account for 86% of all package related accidents (DTI, 1997a). As can be seen in Figure 4.1, tins are involved in 42%; plastic packages in 14%; and glass packages 30% of all accidents (DTI, 1997a).

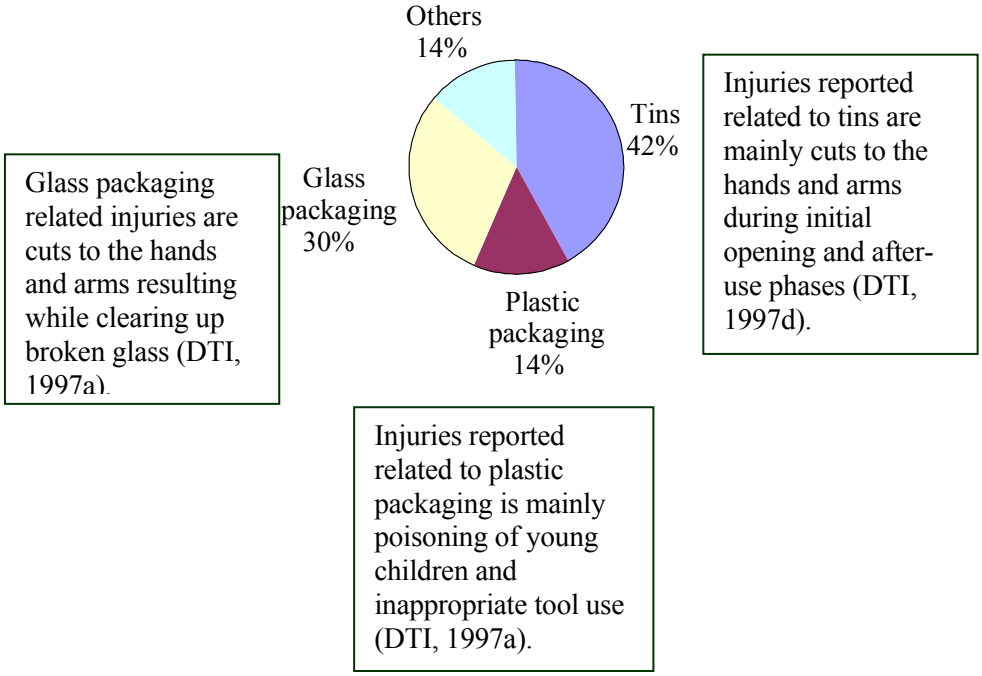

Figure 4. 1 Accidents based on package material.

4.1.1 Problems specific to openability

There is much interest in package-openability and more research has been undertaken on openability and the relation between openability and safety than other problems (Page, 2001; DTI, 1999a). Ease of opening was found to be the

most important characteristic of packages, based on a survey in the UK (Winder, 2003). This survey found that for 30.5% of subjects, openability is the most important characteristics of packages. The top eleven most important characteristics out of nineteen features based on this survey are presented in Table 4.1.

Table 4. 1 The most important packaging characteristics.
Source: Winder, 2003, p.5.

Characteristics of packaging	**Percentage of consumers choosing each feature as the most important**
Packaging that is easy to open	16.8
Packaging that keeps the product fresh	14.0
Packaging that makes it easy to use the product	13.2
Packaging is environmentally friendly	9.8
Packaging can be opened without the use of a tool	8.9
Excessive packaging is avoided	6.8
Packaging is sufficiently robust to house product	4.9
There are clear opening instructions on the package	4.8
Any reseal mechanism on the packaging is easy/effective to use	4.6
Packaging incorporates a tamper/child-proof device	4.4

The degree of openability of a package is also affected by some factors related to the package itself. These were first indicated by DTI (1999a) and mentioned by Torrens et al. (2001) and Winder et al. (2002) as the *shape, size, weight, surface finish, visuals,* and *opening devices* of packages. They all play a part in the openability of packages. In addition to these factors, *material* used for packages (e.g. a tear strip material that does not break) and *production techniques* (e.g. the application of glue to make a flap easy to tear open but strong enough to stand transport stresses) also have an effect on openability as pointed out by Hermansson

(1999). When one or more of these properties are not appropriately applied to packages, users experience difficulty in opening.

According to a study on food and beverage package openability problems, users reported that these packages were not strong enough to open; they could not see where or how to start opening it; they were worried about hurting temselves or about spilling or wasting the content; they always opened it wrongly so the product did not leave packaging properly; they were confused about the instructions; the tamper/child proof mechanisms made opening difficult, the packages were too fiddly to open, and it was not obvious how to open them (Winder et al., 2002). These problems frequently irritate users since "when consumers are opening packages they are generally doing so on autopilot, and while consumers are on auto-pilot they don't process negatives,…but when they are confronted with a pack they cannot open they are snapped out of auto-pilot in an annoying, frustrating way" (Winder cited in "The future…," 2002, p. 27).

Some types of closure used for packages are more likely to cause openability problems. These are specifically metal and plastic screw taps, Child Resistant Closures (CRCs), tamper evident features, and tear tabs.

Metal screw top closures on jars and other plastic or metal screw top closures on bottles and containers present difficulties while opening due to their inappropriate designs and/or due to their manufacturing and protective requirements. Some design related factors that are effective on problems are diameter, surface knurling and shape (DTI, 1999b). For example, opening eases as the surface roughness increases to an acceptable degree and square and angular shaped caps are more effective on openability than circular shapes (DTI, 1999b; Reuvers, 2004).

Another important closure type in relation to openability is CRCs that can be defined as "packaging designed and constructed to be difficult for young children, under the age of five, to open (or gain access to the contents) within a reasonable time, yet not difficult for adults to use properly" (DTI, 1999a, p.14). They are based

on “push down and unscrew”, “squeeze and turn”, and “line up arrows and push off” principles and they all include applying two dissimilar functions at the same time (Galley, 2003). Thus, they create openability problems for especially disabled and elderly since the ability of applying two different functions at the same time is usually difficult for them (DTI, 1997e).

The other problematic group is tamper evident features on various types of plastic and metal lids. They aim to ensure that the package is not opened by someone else. However, they are hard to remove and require a tool to open that is usually a knife, teeth or fingernails even though they are designed to fall away easily when the lid is twisted (DTI, 1997f). On the other hand, according to DTI report (1997e), even if users have problems regarding tamper evident features, they want them on food and drink packages due to their protective features. This indicates that instead of giving up using them on packages, their design should be improved to provide ease of use.

The other problematic seal group is tear tabs. This feature is generally used on traditional biscuit packages to provide ease of opening. They are popular with consumers (Kaleido, 2001) and they clearly reduce inappropriate tool use (DTI, 1999a). However, they usually appear useless since users do not perceive them and/or not understand where to open them (IGD, 1993). Moreover, their width creates problems for especially those who have mobility problems since they require great amount of pinch strength (DTI, 1999a).

It is also interesting to note that consumers agree that opening instructions are an essential feature of package openability, however many of them do not read these instructions before opening (Page, 2000). According to a study by the University of Sheffield, 60% of consumers never or only occasionally read instructions (Nelson et al., 2000). As stated previously, the elderly are the only group that usually read the instructions. On the other hand, as stated in DTI report (1999a) “the opening of any pack should be intuitive, rather than subject to a course of instructions, although there are obviously necessary exceptions to this” (p.6). This opinion is

especially true when the habits of consumers in relation to the reading of instructions are taken into account.

4.1.2 Problems specific to package groups

In the following explanations, the most problematic package types are presented followed by package related problems that can best be explained by classifying them according to their materials. These are tins, glass packages, plastic packages, and foils and films.

The following table presents the most problematic packages based on five different sources. Among these problematic packages, the most problematic package types appear to be tins and then jars.

Table 4. 2 The most problematic package types.

	The most problematic ones	Sources of the findings
Based on package types	bacon packs, fresh soup pots, ring pull tins, jam jars and sardine tins	Helen Hamlyn Research Institute (as cited in Galley, 2003)
	ring-pull cans, peel back lids, glass jars with screw lids and cans with keys	Copeland (2000) (as cited in Nelson et al. 2000).
	tinned goods with and without ring pulls, cans, flexible packaging, 'tray' goods, cartons/boxes, glass bottles/jars, and plastic bottles/jars	Kaleido (2001)
Based on contents	packages of sugar and flour, drugs in pill and tablet form, crackers and cookies, chips, canned soft drinks, cereal, milk, and two-litre soft drinks	"Consumers yearn" (2000)
	packages of corned beef, cheese, bacon, beetroot in vacuum packed plastic packaging, biscuits (standard packs), Heinz tomato ketchup, yoghurts, various jams and marmalades in jars, rice (in plastic bags), and vegetable oil, plastic cartons of milk and fruit juices, 2-litre plastic bottles and ring-pull cans of fizzy drinks, wine bottles, individual portions of milk & cream, various types of teabags, small bottled beers, small plastic cartons of squash drinks, and yazoo drinks (e.g. small chocolate milk drinks)	Winder (2003)

Tins: Tin-related problems usually occur during initial opening**.** These problems are mostly related to the physical property of tins. They have to be cut to open and thus they expose sharp edges (DTI, 1997d), which are a potential cause of injuries. There are two types of tins that usually create problems. These are ring pull tins and traditional tins without ring pull. Consumer attitudes towards the ease of opening of ring pull tins varied. Some consumers like ring pull tins since they are helpful, they do not need a tin opener, and they are less dangerous than other tins (DTI, 1997a; DTI, 1997d). Others dislike this package type. They stated that the rings are too

close to the surface of the lid. Thus, it is difficult to lift them and they need too much force to peel away (DTI, 1997a). In addition, they think that the lids do not come off easily or they rip off suddenly (Reuvers, 2004). For traditional tins, consumers emphasize that a good quality tin opener is necessary to open them (DTI, 1997d). This is because some can openers produce more sharp edges than others and they cause the lid to sink into the tin. When the lid sinks into the tin and when it is difficult to remove the lid, injury risk increases since the user utilizes inappropriate tools to remove it (DTI, 1997d).

Glass packages: Problems related to glass packages usually occur in vacuum-sealed jars. It is stated in DTI's report (1997a) that usually someone else's help is needed to open them or users utilize rubber gloves and some tools, or they stab the lid to loosen them. According to another study on jar openability, Voorbij and Steenbekkers (2002) states that available solutions to the problems are tool-based, such as clamps, vacuum releasing levers or antiskid pads. However, they defend that the opportunity for improvements in jar openability depends on analyzing the capabilities of users and developing jars which can be easily opened manually by the majority of the population. Moreover, they add that the applied torque to the lids during manufacturing process is often too large due to the concerns related to accidental or conscious opening of the package before it is purchased.

Plastic packages: The problems related to plastic packages usually occur in plastic bags, pouches and blister packages. McDaniel and Baker (1977) state that plastic bags of various chips and similar food products are too difficult to open and "tremendous force is required to tear open the package" (p.57). This is especially so if the application of initial force that breaks the seal is high (DTI, 2003). McDaniel and Baker (1977) also add that the force applied to the package usually destroys it and causes the contents spill, and makes re-closure impossible. The other problematic plastic package group is blister packs which comprise a combination of plastic and cardboard or foil (e.g. pack of toothbrushes). Many products are sold in them due to their good protective features especially minimizing theft and touch, and a display feature with transparent front side (Shell, 1996). However, they are

difficult to open and thus they encourage use of sharp tools and cause injuries (DTI, 1997a).

Peel type foils or films: Peel type features are used for many products such as foil seals on plastic milk bottles. They cause accidents due to use of a sharp knives during initial opening (DTI, 1997b; "Peel and tear," 2001). Especially, small and slippery grip areas and strongly sealed ones cause accidents (DTI, 2003).

4.1.3 Problems specific to tools

Some package types necessarily need opening tools since they cannot be opened just by hand, such as traditional tins, glass bottles with metal tap, and all other difficult to open packs. When appropriate tools are used to open a package such as a good can opener, jar opener, or bottle opener, risks to the user lessens, but when an inappropriate tool is used such as knife, screwdriver, or other sharp tools, probability of occurrence of injuries increases. On the other hand, knives are very popular tools for initial opening of packages since they are convenient and readily accessible (DTI, 1997e). In addition, most consumers use knives to open packages instead of scissors, even when they are recommended in the opening instructions (DTI, 1997e). The packages that are most commonly opened by a knife are biscuit packages, plastic vacuumed packs, cellophane and plastic over-warps (DTI, 1997a), blister packs, controlled atmosphere packs (DTI, 1997e), bottles with tamper evident features, frozen food and fresh food wrappings, cartons of grocery, sometimes cans (DTI, 1997b).

As Galley (2003) and Nelson et al. (2000) state inappropriate tool use is the result of mismatch between the design and the user. These mismatches can result from package design flaws or package-opener design flaws. The first one occurs when a package is difficult to open and the latter occurs as Nelson et al. (2000) state, when the tool used for opening is useless or difficult to use. They point out that the

companies should produce easy to use tools or packages that do not need tools to open them at all.

4.1.4 Problems specific to different user groups

This section summarizes usability and especially safety problems based on different user groups. These summaries will be based on an Internet report entitled "User capabilities & problems" (n.d.). The user groups determined in this report are babies and toddlers, children, teenagers, adult women, adult men, elderly, disabled, left-handed people, and social resistant people.

Children

Many accidents usually occur when children are playing. As stated in DTI report (1997e), "the child's inquisitiveness was a contributing factor to the accidents" (p.6). Woodson et al. (1992) give the typical misuse behaviours of children as follows:

> "Children are extremely curious. As a result, they investigate and examine or try to play with products or product elements which they should not touch…Small children investigate by touching things, putting their fingers or hands into openings, putting things into their mouths, or at least trying to put their tongues on things" (p. 133).

Where a package may contain toxic substances it is usual for the manufacturer to put warnings on it in an effort to draw the attention of the user to the risk of harm or injury. Users think "the warning must be instantly recognizable to children and deter them from opening pack" (DTI, 1997e, p.27). However, as most pre-school children cannot read or understand these labels and warnings on the packages, they appear to be useless for young children. On the other hand, even if young children do not understand warnings on the packages, they are, at least, useful for parents who are unaware of the danger of some household products to their children (Galley, 2003). Consequently, improvements in package designs such as utilizing

or improving CRCs (Child Resistant Closures) seem to be more beneficial than using warnings to deter young children from dangerous products. See Table 4.3 for package related risks to children.

Table 4. 3 Package related risks to children.

Risks to children
- Poisoning by means of swallowing the toxic substances such as bleach and medicines ("User capabilities", n.d.). - Poisoning by medicinal products especially the ones packed in blister packages ("User capabilities", n.d.; Kaleido, 2001). - Mistaking the packages that have attractive colours and labels on them (DTI, 1997a). - Cutting their bodies, especially their hands, from packages that have sharp edges ("User capabilities", n.d.). - Hurting themselves while trying to open packages ("User capabilities", n.d.).

Teenagers

Teenagers prefer to use specific products frequently and they can be injured from the packages of those products ("User capabilities", n.d.). These packages should be designed by taking the carelessness of the teenagers into account. See Table 4.4 for package related risks to teenagers.

Table 4. 4 Package related risks to teenagers.

Risks to teenagers
- Some hair sprays and deodorants causing injury due to the nozzle that does not work properly or carelessness of the teenager ("User capabilities", n.d.). - Spilling the hot content or using a knife to open the packages of ready meals for microwaves ("User capabilities", n.d.).

Adults

Women's grip and opening strengths are lower when compared to men's ("User capabilities", n.d.). Men can apply 30% more strength than women while opening packages (DTI, 1999b). Thus, they have less difficulty in opening packages that require more strength. For example, according to DTI (1997d), since the openability of tins is mostly related to strength, women especially have difficulty. See Table 4.5 for package related risks to adults.

Table 4. 5 Package related risks to adults.

Risks to adults
- Women utilizing inappropriate tools to open packages due to lack of sufficient strength ("User capabilities", n.d.). - Women experiencing more packaging related accidents than men because of their higher frequency of use of domestic packages than men ("User capabilities", n.d.; DTI, 1997d). - "Risk-taking behaviour" and "less knowledge of self-correcting strategies" of men making them more accident prone ("User capabilities", n.d.).

Elderly people

There is an increasing elderly population in developed or developing countries. The packaging related problems of these users are different than those of others. Along with age, their physiological state changes. This may include decline in the quality of visual, cognitive, and physical abilities (Gough, 2004). Changes in visual abilities are specifically "declines in static and dynamic visual acuity, near accommodation, contrast sensitivity, resistance to and recovery from glare, dark adaptation and colour discrimination"; while cognitive changes involve a decline in "perceiving, learning, remembering, thinking, reasoning and decision making"; and physical changes involve "gradual reduction in the power and speed of muscular

contraction, together with decreased capacity for sustained muscular effort" (DTI, 1999a, p.4).

Many packages in the market do not suit their abilities, and openability and legibility problems may even cause them not to buy specific packages. For example, as Doyle (2004b) states, some elderly users have stopped buying tins that they have difficulty in opening.

In addition, they feel manufacturers and designers do not take their visual and muscular problems into account (Doyle, 2004b). As stated in DTI report (1999a), "senior citizens feel they are badly treated" (p. 6). Their opinions are strengthened by a statement of IGD (1995) in which it is pointed out that the package-related difficulties of elderly people may be due to designers not taking into account their needs and concentrating on creating packages for the use of able-bodied people instead (as cited in Nelson et al., 2000). However, a package should be as easy for elderly users to use as the average user. Reuvers (2004) and Doyle (2004b) point out that manufacturers should rethink and improve the package designs based on elderly users needs. See Table 4.6 for package related usability problems and risks to elderly.

Table 4. 6 Package related risks to elderly.

Risks to elderly
- Having difficulty in reading opening instructions and expiry date on the package due to surface finishes and typography (Doyle, 2004b). - Hurting themselves due to being more likely to use inappropriate tools such as knives or screwdrivers since their physical handicaps make problems worse (DTI, 1999a).

Disabled people

Another user group that experiences difficulties with package openability is disabled people, whose problems are similar to those of elderly. They are more affected by poor package designs than the others (DTI, 2003).See Table 4.7 for package related risks to disabled people.

Table 4. 7 Package related risks to disabled people.

Risks to disabled people
- Being more likely to have accidents than others since they are forced to use products that do not fit their needs (Woodson et al., 1992). - Inefficiency in manipulation, gripping forces, lifting, transporting and using two hands in coordination at the same time increases injury risk ("User capabilities", n.d.)

Left-handed people

Left-handed users have more problems with packages than right-handed users while opening those (Winder et al., 2002). Moreover, they are more likely to experience package related accidents than right-handed users (Nelson et al., 2000). However, according to the results of a research study on food and beverage packages based on a questionnaire survey of shoppers at four supermarket stores in the UK, the accident types of left-handed and right-handed users are similar (Winder et al., 2002). They state that the main difference is in the number of package types that cause problems to left-handed users. This means that left-handed users have difficulties in many package types while right-handed users only have difficulty in specific package types since most packages are designed to be used by right-handed users. According to Winder et al. (2002), manufacturers should test their package and opening tools on left-handed users to prevent these problems and accidents. See Table 4.8 for package related risks to left-handed people.

Table 4. 8 Package related risks to left-handed people.

Risks to left-handed people
- Twisting their arms in an unnatural position or trying to open with the right hand since most of the packages are designed to open from the right ("User capabilities", n.d.). - Using a tool designed for right-handed users to open a package ("User capabilities", n.d.).

Social resistant people

An interesting group that is likely to experience difficulties with packages is social resistant users who resist asking for help when they have difficulty in using or opening packages (Winder et al., 2002). It is stated that they are more likely to have serious package related injuries ("User capabilities", n.d.). This results from the "decision-making style" of social resistance based on the research on food and beverage packages and analyses of the accidents (Winder et al., 2002, p.433). See Table 4.9 for package related risks to social resistant people.

Table 4. 9 Package related risks to social resistant people.

Risks to social resistant people
- Being more likely to injure themselves when they try to open difficult-to-open packages by themselves instead of asking for help ("User capabilities", n.d.).

4.2 A case study on food & beverage packages: Research into the problems resulting from poor package designs throughout the package lifetime

All the phases throughout the lifetime of a package in which users are involved must be examined. Analysing each phase will provide new insights into package related usability and safety problems. A research study of Winder (2003) in collaboration with Faraday Packaging Partnership shows that problems of various levels of importance occur during each phase of the package lifetime in which consumers are involved.

The case study was conducted in two parts: a questionnaire survey and usability testing. The questionnaire survey was carried out within the course of Models and Methods of Ergonomics (ID531) and the usability testing was carried out within the course of Application of Usability Testing and User-Centered Design (ID 705). The aim of the questionnaire survey was to establish consumer complaints related to food and beverage packages and the aim of the package usability testing was to observe the problems during use in laboratory environment.

4.2.1 Part 1 Questionnaire survey

The specific objectives of the questionnaire survey were:

- to identify the most significant phase(s) of a package lifetime in which problems exist,
- to identify the package types which present difficulty,
- to identify the effect of age and gender on package related problems and complaints.

4.2.1.1 Method of the study

4.2.1.1.1 Sampling

The questionnaire survey involved 18 males and 28 females, a total of 46 respondents. 38 of them had a university degree and 8 of them had a high school degree. Their ages ranged from 18 to 60 years. The sample was divided into three groups based on age and two groups based on gender to examine the differences in their problems (See Table 4.10). 31 of the 46 subjects were from Ankara and the rest from various other cities in Turkey.

Table 4. 10 The number of the respondents based on their characteristics.

		AGE		
		18-29	**30-49**	**50-60**
GENDER	**male**	9	5	4
	female	14	7	7

The study was based on "purposive sampling", in which the investigator uses his/her judgment and prior knowledge to choose people who would best serve the purpose of the study (Monette, Sullivan and Dejong, 1998). The purposive sampling method was chosen since it was observed in the pilot study that respondents with low educational background did not complete all the questions and they had to be omitted for the reliability of the results.

In the study, the subjects were mainly chosen from university graduates since they would give more detailed information and their response rate would be relatively higher than the others who had lower educational background. In addition, mostly

females were preferred in the study since they could give much more information on food and beverage packages than males. This was because they were more involved in buying and cooking activities than males. Moreover, the respondents who had children were included in the study since they were more concerned with problems relating to safety of packages. In addition, it was assumed that the findings would be enriched due to the respondents' different lifestyles and the way they choose to buy and use food and beverages.

4.2.1.1.2 Design of the questionnaire

The questionnaire was designed according to a matrix (See Appendix A for the questionnaire sample). This matrix was comprised of eight package lifetime phases in which users interact with packages and seven groups of food and one group of beverages (See Tables 4.11 and Table 4.12 for package lifetime phases and product categories). Lifetime phases were determined according to the main activities users undertake during the lifetime of packages. The product groups were determined by taking into account the divisions on the Internet shopping malls of Gima A.Ş. and Migros Türk T.A.Ş. These product groups covered a total of 46 food and beverages that are commonly consumed. The questionnaire included both open-ended and close-ended questions. The open-ended questions, which were the most important part of the questionnaire, were designed to receive the details of problems and complaints.

Table 4. 11 Lifetime phases of packages focused in the study.

Phases	Activities
Display and purchase	Recognizing, selecting, and purchasing a product and reading the information on a package
Carriage	Transporting the purchased product from supermarket to a place where it will be consumed
Storage	Storing the purchased product in a place until it is consumed
Initial opening	The first opening of a package to reach the contents
Usage	Getting out the contents to use
Re-storage	Storing the leftover part of the contents for the next uses
Re-use	Opening and using the product for the second and subsequent time to consume the leftover part
After-use	Recycling, reusing the package for another purpose, and just throwing it away.

Table 4. 12 Product categories focused in the study.

Product Categories	Products
Cereals, flour and flour-related foods	cereals, spaghetti, flour, bread, cracker
Breakfast foods	cheese, sheep cheese, olive, salami, sausage, 'sucuk', egg
Dairy foods	milk, yoghurt, ice cream, 'ayran', cream
Sauces and oils	margarine, butter, oil, ketchup, mayonnaise, vinegar
Preserved foods	tomato paste, garniture, fish, ready meal, corn
Sugar and sugar related foods	sugar, chocolate, biscuit, honey and jam, candy
Beverages	carbonated drinks, juice, tea & coffee, powdered drinks, water, soda
Miscellaneous foods	meat, fruit & vegetable, appetizer, spices, chips, and other

4.2.1.2 Findings of the questionnaire survey

Results of the questionnaire survey were classified according to product types, package types, lifetime phases of packages, and the effects of age and gender.

4.2.1.2.1 Product types

According to the answers of the respondents, problems with tomato paste, flour, yoghurt, and cheese packages were widespread when compared to the problems with other products. The most problematic products were presented in Table 4.13. The rates in the table imply the percentage of respondents who complained about a package out of all respondents. As can be seen in the table, many respondents complained about the packages of grained products i.e. flour, spaghetti, cereals, and crackers. They stated fewer problems about the packages of garniture, corn, cream, cake, and powder drinks since these products are not commonly consumed. On the other hand, many problems were stated with regard to the packages of commonly consumed products such as tomato paste and flour. Moreover, even though sugar, oil, margarine, and milk were not presented in the table due to their low percentages, it is worth mentioning that they had significant problems that were repeated in quite a few phases.

Table 4. 13 The most problematic product types.

Product Categories	Products
Cereals, flour and flour-related foods	flour 76%, spaghetti 65%, cereals 61%, cracker 63%
Breakfast foods	cheese 71%, 'sucuk' 65%, egg 65%
Dairy foods	yoghurt 78%
Sauces and oils	butter 61%
Preserved foods	tomato paste 87%
Sugar and sugar related foods	biscuit 61%
Beverages	carbonated drinks 63%

4.2.1.2.2 Package types

According to the answers to the open-ended questions, 19 package categories were determined. Package categories are presented in Appendix B. Some of these package types in this categorization are used for a lot of product types and some of them are used for only a few or just one product type because of their specific characteristics (e.g. vacuumed plastic covers are used for cheese, olive, salami, and sausage whereas plastic yogurt containers are typically only used for yogurt).

According to the findings based on package types, it was found that the users mostly have difficulties with tins, plastic snack overwraps, plastic film bags, and paper bags respectively. Problems related to tins were common during the opening phase, those related to plastic snack overwraps were common during the re-storage phase, and those related to plastic film bags were common during both the opening and re-storage phases, while those related to paper bags were common during the display and purchase phase. Frequency of complaints for each package type and their most problematic phases are given in Appendix B.

4.2.1.2.3 Lifetime phases of packages

According to the answers of the respondents, complaints and problems were conspicuous for the re-storage and initial opening phases. The other phases respectively were display and purchase, after-use, usage, carriage, storage, and re-use (See Table 4.14).

Table 4. 14 Percentages of the problems stated by the respondents based on the lifetime phases of packages.

Display & purchase	Carriage	Storage	Initial opening	Usage	Re-storag	Re-use	After-use
14.2	10.8	2.7	**23.9**	11	**24.1**	1.8	11.5

In the following paragraphs, an explanation of complaints and problems is presented based on each phase. The problems and complaints were classified under three headings: usability problems, safety problems, and marketing-related problems in the following tables. Even though the study aimed to present usability and safety related complaints, marketing related complaints were also presented since they were also important for the satisfaction of user needs.

Display and purchase phase

At the display and purchase phase, respondents mostly complained about paper bags, plastic film bags, and egg boxes. The problems arising during this phase were classified as in Table 4.15. The most common problems among them were ‘content related defects’ and ‘package related defects’. The former was mostly related to egg

boxes and plastic film bags, and the latter was related to paper bags and plastic film bags.

Table 4. 15 Complaints for the display & purchase phase.

Marketing problems	Usability problems
- Content related defects (e.g. smeared, oozed, poured out, broken, crushed contents) - Package related defects (e.g. crushed, torn, broken packages) - No distinguishable characteristic - Inconvenient portions - The contents of the package not visible - Insufficient information on the package (e.g. on production place, content)	- Invisible and/or illegible expiry date

Carriage

During the carriage phase, respondents mostly had complaints about plastic yoghurt containers, plastic snack overwraps, and egg boxes. The problems arising during the carriage phase were classified as in Table 4.16. The most common problems among them were 'content making dirty its surroundings' and 'content damages' that occur while carrying the product in plastic bags. The former was mostly related to plastic yoghurt containers and the latter was related to plastic snack overwraps and egg boxes.

Table 4. 16 Complaints for the carriage phase.

Usability problems	Safety problems
- Content making dirty its surroundings (e.g. oozing, smearing, pouring out) - Content damages (e.g. broken, crushed, melted products) - Package defects (e.g. crushed, torn, cracked, and broken packages) - Handle related problems (e.g. broken off, not ergonomic handles) - Package turning upside down in the bag - Packages clashing with each other - Weight problem	- Package piercing the bag

Storage

During the storage phase, respondents mostly complained about paper bags, paper overwraps, and big plastic bottles. The problems arising during the storage phase were classified as in Table 4.17. The most common problem among them was 'content making dirty its surroundings'. This problem was mostly related to paper bags and overwraps, but the most common problem related to plastic bottles was their placement in refrigerators.

Table 4. 17 Complaints for the storage phase.

Usability problems
- Content making dirty its surroundings (e.g. oozing, smearing, pouring out) - Need for an another container to store - Placement problems (e.g. not fitting to the refrigerator shelves) - Stability problem in the storage place

Opening

At the opening phase, respondents mostly complained about tins, plastic film bags, and plastic snack overwraps. The problems arising during the opening phase were classified as in Table 4.18. The most common problems in this phase were 'package being impractical to open' and 'content being damaged while opening'. The first one was mostly related to tins and the second one was mostly related to the plastic film bags and plastic snack overwraps.

Table 4. 18 Complaints for the opening phase.

Usability problems	Safety problems
- Package being impractical to open - Content being damaged while opening - Breaking, tearing of package while opening - Content making dirty its surroundings (e.g. oozing, smearing, pouring out) - Opening-ring related problems (e.g. broken off, bended, not ergonomic rings) - Difficulty in opening foil or plastic film seals - Package requiring force to be opened - Difficulty in finding where to open	- Need for a tool to be opened (especially sharp ones) - Risk of injury while opening due to sharp edges

Usage

In the usage phase, respondents mostly complained about tins, plastic or glass oil or vinegar bottles, and paper bags. The problems arising during the usage phase were classified as in Table 4.19. The most common problems in this phase were 'content making dirty its surroundings' and 'difficulty in taking out the content, pouring or

drinking'. The first one was mostly related to the oil and vinegar bottles and paper bags and the second one was mostly related to tins and paper bags.

Table 4. 19 Complaints for the usage phase.

Usability problems	Safety problems	Marketing problems
- Content making dirty its surroundings (e.g. oozing, smearing, pouring out) - Difficulty in taking out the content, pouring or drinking - Difficulty in measuring while taking out the content - Content wedging in the joints of package - Package being not ergonomic - Content sticking on the package	- Risk of injury during use - Hygiene problems - Package defects (e.g. cracked, broken, and sharp edges on package) - Change of taste of the contents	- Inconvenient portions - Usage of plastics for packages - Usage of metal for packages - Package not giving confidence - Insufficient information about usage

Re-storage

During the re-storage phase, respondents mostly complained about vacuumed plastic covers, plastic snack overwraps, and tins. The problems arising during the re-storage phase were classified as in Table 4.20. The most common problems in this phase were 'contents getting spoiled quickly after opening' and 'inability to re-store the leftovers with own packages'.

Table 4. 20 Complaints for the re-storage phase.

Usability problems	Safety problems	Marketing problems
- Inability to re-store the leftovers with own packages - Need for another container to re-store - Content making dirty its surroundings (e.g. oozing, smearing, pouring out) - Content smell spreading around - Difficulty in re-closing the lids - Package volume problems ("package after usage is still occupying same volume")	- Contents getting spoiled quickly after opening	- Insufficient information about re-storage on packages

Re-use

In the re-use phase, respondents mostly complained about plastic ketchup and mayonnaise containers, and paper bags. The problems arising during the re-use phase were classified as in Table 4.21. The most common problems in this phase were 'content making dirty its surroundings', 'inability to see the leftover contents', and 'inability to see the expiry date after the package is opened'. The first problem was mostly related to paper bags, the second problem was mostly related to ketchup and mayonnaise containers, and the third one was related to all package types whose parts with the expiry date are thrown away after opening.

Table 4. 21 Complaints for the re-use phase.

Usability problems	Safety problems
- Content making dirty its surroundings (e.g. oozing, smearing, pouring out) - Inability to see the leftover contents - Lid problems (e.g. breaking off, losing lids)	- Smell or taste changes - Inability to see the expiry date after the package is opened - Metal packages getting rusty

After-use

In the after-use phase, respondents mostly complained about plastic bottles, metal food containers, and plastic yoghurt containers. The problems arising during the after-use phase were classified as in Table 4.22. The most common problems in this phase were 'package occupying too much space in garbage bag' and 'insufficient or illegible information on recycling'.

Table 4. 22 Complaints for the after-use phase.

Usability problems	Safety problems	Marketing problems
- Package occupying too much space in garbage bag - Inability to reuse the package	- Package cutting the garbage bag	- Insufficient or illegible information on recycling - Package not environment-friendly

4.2.1.2.4 Age and gender

The effect of age:

The effect of age on package related dissatisfactions was allocated as in Table 4.23. As can be observed from the table, there was no significant difference among the percentages for the complaints of each age group on each package lifetime phase, except display and purchase, storage, and after-use phases. The rates for display and purchase phase related complaints were high with the second age group and those for after-use related complaints were high with the first age group and there was an increase in storage related problems with age.

In addition, there was a difference among the complaints based on package types. The first age group mostly complained about tins; the second age group complained about tins and plastic film bags; and the last age group complained about paper bags and plastic snack overwraps.

Table 4. 23 Allocation of the complaint-percentages based on age groups and lifetime phases of packages.

	Display and Purchase	Carriage	Storage	Opening	Usage	Re-storage	Re-use	After-use
18-29	14%	11%	1%	24%	10%	25%	1%	14%
29-49	19%	10%	3%	22%	13%	24%	2%	7%
50-60	12%	10%	6%	26%	11%	23%	2%	10%

The effect of gender:

The effect of gender on package related dissatisfactions was allocated as in Table 4.24. As can be observed from the table, there was no significant difference among the percentages for consumer complaints of each gender on each package lifetime phase, except usage, re-storage, and after-use phases. Females complained more than males about usage and after-use phases and males complained more than females about re-storage phase. However, both of the two groups mostly complained about the same package type, namely tins.

Table 4. 24 Allocation of the complaint-percentages based on gender and lifetime phases of packages.

	Display & Purchase	Carriage	Storage	Opening	Usage	Re-storage	Re-use	After-use
Male	14%	11%	3%	24%	9%	30%	1%	8%
Female	14%	11%	3%	23%	12%	22%	2%	13%

4.2.1.3 Analysis and conclusions

4.2.1.3.1 Significant problems specific to lifetime phases

Figure 4.2 presents the most remarkable usability and safety problems that were observed from among the respondents' complaints. Even though these problems are not valid for every package type, it may be useful to indicate possible consumer complaints related to a typical package.

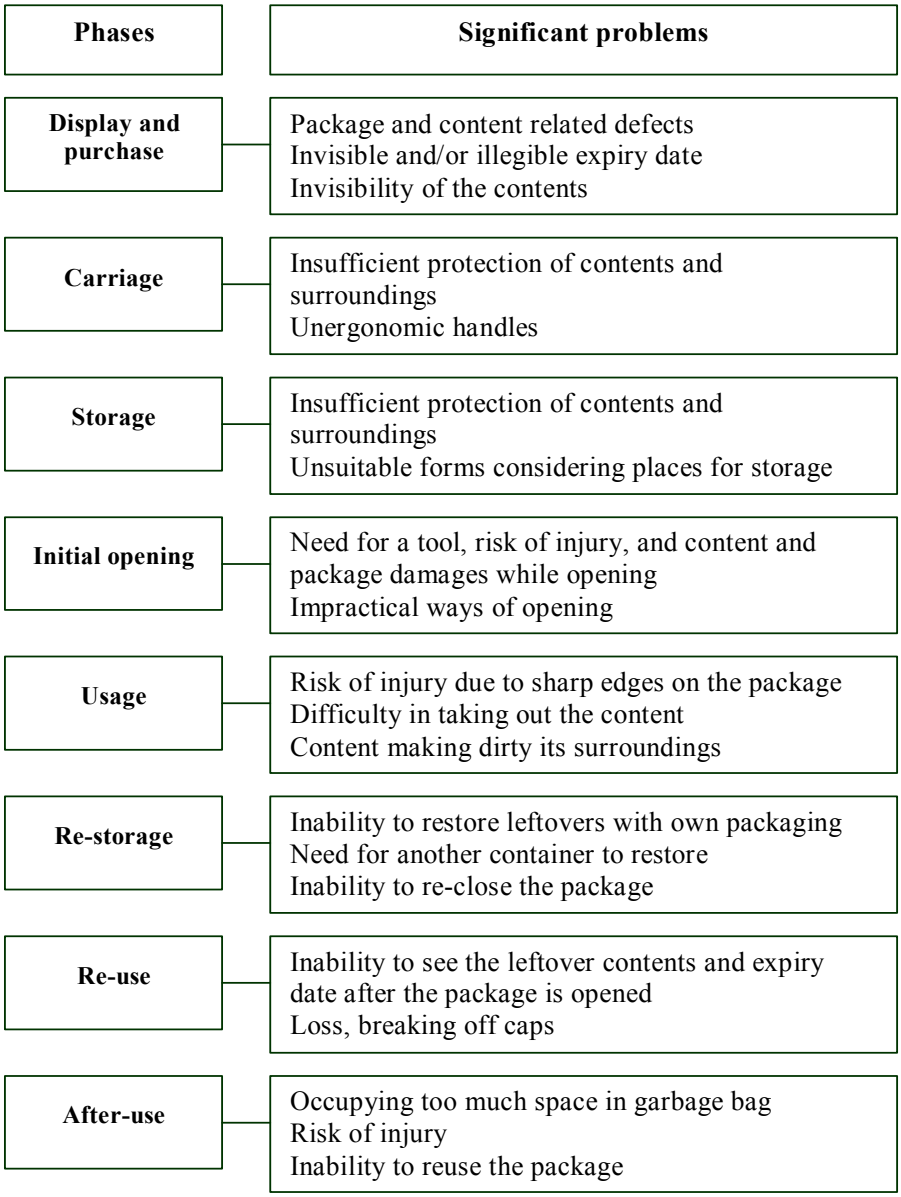

Figure 4. 2 Significant problems regarding each lifetime phase of packages.

Findings implied that complaints related to packages were not solely based on the initial opening phase as it appears in the literature, but also on the other phases which vary in importance. Among them, the re-storage phase was the most significant and it was as problematic as the initial opening phase. Furthermore, for the re-storage phase, the survey implied that respondents want all food and

beverage packages to be re-closable, especially those whose contents are consumed periodically over a longer duration.

4.2.1.3.2 Insufficiency in the analysis of context of use

Packages and their contents are not used by the same equipments and by the same users who have the same characteristics in the same environments, but they are used in different contexts. These different contexts should be analysed to be used as a base for the package design decisions and thus, to achieve package usability. However, complaints gathered from the survey indicated that analysis of the context of use of packages has usually been ignored or not undertaken.

4.2.1.3.3 Effect of package material on complaints

With regard to materials used for packages, the study indicated that usability related complaints are mostly about plastics and paper packages. On the other hand, fewer complaints were stated for metal packages and the least complaints were stated for glass packages. One of the reasons for this is the widespread use of plastics and paper and the limited use of glass and metal as a package material in the market. The other reason specific to glass packages seems to have resulted from positive attitudes towards glass packages since they are generally perceived to be of high quality.

4.2.1.3.4 Effect of age and gender

At the beginning of the study it was assumed that age and gender were effective factors on usability problems, but the results were similar for each age group and for each gender with a few exceptions. This might have resulted from the insufficient respondent number. In addition, at the beginning of the study it was

assumed that openability problems increased with age and females had more problems than males. However, for the initial opening phase, the results for age and gender were similar. These might have been due to the fact that the survey did not measure the severity of the problems, just their existence. On the other hand, this finding indicated that able-bodied and younger consumers also reported many problems with packages but the severity of these problems was less than that of elderly.

4.2.1.3.5 Reasons for continuity of sales

It was noticed that although consumers have problems with packages during use, most of them continue to purchase the same products. The main reason for this seems to be because consumers' economic conditions significantly affect their purchasing decisions. The other reasons are the unavailability of good quality package alternatives for the same product and favouring the taste of the content. For these reasons consumers usually have to account for trying to find their own solutions to package related problems. However, packages should not need adaptations created by users, but the package itself should serve both ease of use and usefulness.

4.2.2 Part 2 Usability testing

The specific objectives of the package usability testing were:

- to analyze usability problems related to packages throughout their lifetime phases
- to observe the effects of package usability on the perceived quality of the product, consumer satisfaction and preferences

4.2.2.1 Method of the study

4.2.2.1.1 Package selection

In the test, four tomato paste packages and four juice packages were tested (See Table 4.25 for the main differences between two product groups and key characteristics of each package). The reason for testing two different product groups was to compare the differences in problems for each lifetime phase. To represent the range of products for each group, 4 types of tomato paste and 4 types of juice packages were chosen. Photographs of the packages are presented in the Appendix C. All the tomato paste and juice packages contained a similar amount of product. The main differences among the tomato paste packages were in their materials and opening features. The first two tomato paste packages were glass jars; the other two were tins, one of which had a ring pull tin. The main differences among the juice packages were their forms and opening features. All the juice packages were made of glass, but one had a metal tap, one had a ring-pull, and the other two had screw tops.

Table 4. 25 Differences between the tomato paste and juice packages.

Product group	Main usage environment	Duration for the consumption of the content	Physical condition of the content	Code in the test	Product weight	Intended user group	Package features
Tomato paste	Kitchen	Long (average: 2-3 weeks)	Paste	A[1]	370 g	Middle and high economic status Mainly for women who cook	Wide, short, and smooth glass jar with a metal screw tap and a tamper evident band
				B[1]	350 g	Middle and high economic status Mainly for women who cook	Narrow, textured glass jar with metal screw tap and a tamper evident band with a sign for easy tear away
				C[1]	430 g	Low and middle economic status Mainly for women who cook	Ring-pull tin
				D[1]	425 g	Low and middle economic status Mainly for women who cook	Traditional tin
Juice	Outdoor	Short (average: 5-15 minutes)	Liquid	A[2]	250 ml	Middle and high economic status Mainly for children and young	Textured glass bottle with a metal screw tap
				B[2]	200 ml	Middle and high economic status Mainly for children and young	Smooth glass bottle with a metal tap
				C[2]	250 ml	Middle and high economic status Mainly for children and young	Textured glass bottle with a metal screw tap and a tamper evident band
				D[2]	200 ml	Middle and high economic status Mainly for children and young	Textured glass bottle with a metal ring-pull

4.2.2.1.2 Sampling

The sampling of the test consisted of 5 females and 3 males, a total of 8 participants (See Table 4.26 for the details of the participants). Their ages ranged from 25 to 45. The number of females was more than the number of males, since the females were generally more involved in buying and cooking activities and thus they could give more information than males. The sample included individuals both with and without children, since there were differences between these two groups in the way they choose, buy and use the products. Two of the males were single, since it was assumed that single males would be more interested in cooking and thus they could give more information on food and beverage packages than married male participants. In addition, since the selected products were mainly intended for consumers of middle-socio-economic status, the number of the participants who were from this group was higher.

Table 4. 26 The details of the participants.

	age	gender	marital status	child number	socio-economic status	experience with tomato paste packages	experience with juice packages	other
1	44	male	married	2	low	low	low	-
2	45	female	married	2	middle	high	low	sight problem
3	25	male	single	-	high	low	middle	-
4	26	male	single	-	middle	middle	high	left-handed
5	33	female	married	-	middle	middle	middle	-
6	37	female	married	1	middle	high	high	-
7	32	female	married	1	middle	high	high	sight problem
8	27	female	single	-	middle	low	middle	-

4.2.2.1.3 Design of the test

The test included two parts. In the first part, tomato paste packages and in the second part, juice packages were presented to the participants. The average time spent for each part was 25 minutes, a total of 50 minutes for each participant. Each of the two parts included three stages. These stages were titled: before package use, during package use, and after package use.

Stage I Before package use: The purpose of the first stage was to define consumer opinions and consumer awareness about usability and safety of packages before they began to use them. The packages were presented to the participants with all brand-related visuals hidden to prevent brand effect on the participants' perception of quality and purchase decisions. Before participants began to compare the packages according to their perceived quality and usability problems their usual purchase decisions and initial opinions were obtained. They were not guided with keywords during this stage. The average time spent for Stage I was 5 minutes. The questions asked of the participants are presented in Appendix D.

Stage II During package use: This stage aimed to make the participants experience the use of the presented packages. The packages were presented in their natural condition without hiding the brand-related visuals since it was not entirely possible to hide the brand-related visuals while the participants were performing certain tasks. In addition, this stage was based on the lifetime phases of packages which are presented in Table 3.4 with their meanings. In this stage, participants performed the tasks and compared the packages for display & purchase, initial opening, usage, re-storage, and re-use phases. For the storage, carriage, and after-use phases, they only stated their opinions and compared the packages. Participants were asked to find and read the expiry date and ingredients on the packages in the display & and purchase phase to establish the ease of finding and reading the written information on the packages. In the initial opening phase, participants opened the packages, in the usage phase they took out the contents, in the re-storage phase they closed the packages if possible, and in the re-use phase they perform the second opening and second use of the packages. Throughout the test, the

participants were asked to declare their problems. In addition, after each phase, their purchase decisions were obtained to establish if problems and ease of use of packages affected their preferences. The average time spent for Stage II was 16 minutes. The questions asked of the participants and the tasks for this stage are presented in Appendix D.

Stage III After package use: In this stage a questionnaire was given to participants to obtain the overall comparative opinions of them about the presented packages, and analyze the changes in their preferences after they experienced the use of the packages (See Appendix D for the sample satisfaction questionnaire). The questionnaire involved 12 statements and 2 questions. The first three statements were on efficiency, the second three were on clarity, the third three were on safety, the fourth three were on satisfaction, and the last two questions were on purchase decision and perceived quality. The questionnaires for each product group were given to the participants after they experienced the use of the packages. The average time spent for Stage III was 4 minutes.

4.2.2.1.4 Test environment

The evaluation was conducted in Middle East Technical University's UTEST Product Usability Testing Unit. Two video cameras were used for each participant. The left camera followed the participant's hand movements and products, and the other camera was set up directly in front of the participant and fixed to the participant's face and the products. The participants were informed about the video recording but they did not see the cameras, therefore encouraging natural behaviour.

The products were placed on a table and a code was given to each one (A, B, C, D). The necessary tools for opening and using the packages were placed on the table in the phases of initial opening, usage, and re-use. In the initial opening and re-use phases, for tomato paste packages, there were two can openers, one knife, one

scissor, and one jar opener; for juice packages, there were one bottle opener, one knife and one scissor available. In the usage phase, for tomato paste packages, there were one spoon, one plate; and for juice packages, there were one glass and one plate available (See Appendix D for the photographs of the equipments).

The video recordings for each participant were analyzed using freeze frame technique to observe how they had performed the tasks. In addition, the participants' opinions were analyzed from video recordings.

4.2.2.2 Findings of the usability testing

4.2.2.2.1 Findings for stage I

For tomato paste packages there were five and for juice packages there were three factors affecting the first purchase decisions of the participants without taking into account the content and the cost. For tomato paste packages, these factors were usability (6/8), visual appearance (4/8), hygiene (3/8), material (1/8), and safety (1/8); for juice packages, these were usability (4/8), visual appearance (3/8), and safety (1/8). Since the materials of the juice packages were the same, hygiene and material factors were not stated. See Appendix E for the participants' statements while making purchase decision.

When the participants were asked about their perception of the quality, participants stated four factors for tomato paste packages: visual appearance (6/8), material (5/8), usability (2/8), and hygiene (1/8); and they stated one factor for juice packages: visual appearance (7/8). Since the materials of the juice packages were the same, hygiene and material factors were not stated as for the previous question. In addition, one participant for tomato paste packages and three participants for juice packages stated that in order to decide on quality, it was necessary to see and taste the content. The stated opinions about the perception of quality are presented in the Appendix E.

In addition, six of the participants stated that they did not want to buy the products which had usability problems with their packages (The stated problems about the packages are presented in the Appendix E). Three of them stated that their confidence in the product would decrease if the package had usability problems. One of them stated that "if the product had had high quality, its package would have been easy to use".

4.2.2.2.2 Findings for stage II

This section presents the findings related to each package lifetime phase. The detailed data related to the problems and user behaviours observed during these phases, and the user comments for each package type are presented in Appendix F.

Display and purchase phase

It was observed that the way participants located the relevant printed-information was determined by their past experiences. They had a tendency to first look at the top of the tomato paste packages (7/8) to find the expiry date as it is usually printed there. When it was not on the top, participants experienced difficulty in finding it. Two of the participants could not find the expiry date on the package B1 since it had been printed on the side of the lid. In addition, participants experienced difficulty in reading the texts due to bad print quality; bad colour contrast between the texts and background; small typefaces; and narrow spaces between the letters, words, and text lines.

Carriage phase

Carriage phase was an insignificant phase for the presented types of small-portioned tomato paste and juice packages. The problems for this phase were mostly related to the characteristics of glass, especially related to its brittleness. In

addition, damages to the carry bag due to rough edges of package C1 and D1 were criticised by three participants.

Storage phase

Storage phase was also an insignificant phase, because the presented packages were completely protective; not needing much space to store; and they were small-portioned. No significant problem was stated for this phase.

Opening phase

Opening phase was among the most effective phases in preferences since the problems encountered during this phase were the most annoying ones. In addition, for the other phases, respondents mostly blamed themselves when they encountered a problem, but for the opening phase, they mostly blamed the manufacturer or simply the package itself (7/8).

The problems stated about jars mostly related to tamper evident bands on lids since they are difficult to tear away (See Figure 4.3). Two types of behaviour were detected while opening the safety bands on the jars. One was opening the jar while the safety band was on the lid (4/8) and opening the jar after tearing away the safety band (4/8). The test indicated that the first one was a much quicker way than the second one. In addition, complaints and problems related to the first method were relatively low compared to those of the second one since the safety band is torn away by itself while opening the lid.

Figure 4. 3 Difficulty in opening the tamper evident band

For tins, it was noticed that participants were unwilling to open them. This resulted from the problems and risk of injury that they had experienced before and those during the test. During the test, the risk of injury mainly resulted from the use of knife to raise the ring, to open, and to remove the lid (See Figure 4.4, 4.5, and 4.6). The risk of injury also resulted from the characteristics of the material (e.g. stiffness, having sharp edges) and the design of the ring (e.g. too narrow and stiff for the fingers).

Figure 4. 4 The use of knife to open the ring-pulls

Figure 4. 5 The use of knife to raise the ring

Figure 4. 6 The use of knife to remove the lid

For juice packages, participants preferred screw taps to the other two types of taps used in the test since screw taps were easier to open when compared to the other two types. The one with a metal tap was not preferred since it requires an opening tool. The other, which had a ring-pull tap, was not preferred since it is the most difficult one to open (See Figure 4.7). Four participants failed to open it (See Figure 4.8).

In addition, the necessity of an opening tool had a more negative effect on the preferences when compared to tomato paste packages since these juice packages are mainly for outdoor consumption.

Figure 4. 7 Difficulty in opening the ring pull taps

Figure 4. 8 Failure in the opening of ring pull taps

Usage phase

For tomato paste packages, it was noticed that having a narrow brim causes difficulty in taking out the content. Six participants stated that package B1's brim was too narrow for the spoons that are usually used in homes and thus it was difficult to take out the paste. However, for juice packages a narrow brim was more convenient to drink from and pour into a glass. Package A2 and C2' relatively wider brims cause the juice pour out through the edge of the bottles during pouring into a drinking glass (6/8).

Re-storage phase

Complaints related to re-storage phase for tomato paste packages were much more than for juice packages since the juice packages were for single-use, but tomato pastes were for several uses. However, it was noticed that even though the presented juice packages were for single-use, their re-closability was an advantage when comparing all four packages. All the participants stated that jars are good for preserving. Five of them complained that they would need another container to preserve the canned foods.

Re-use phase

There were a few problems and complaints in the re-use phase and they were mostly related to re-storage phase. For example, when the top of the traditional tin is not thrown away after opening and used to close the package, a risk of injury persists during re-use.

After-use phase

The comments for this phase were mainly related to the characteristics of the materials used for packages (e.g., brittleness, weight, etc.), re-usability of the packages, and space occupied in the garbage bag by the packages. During this

phase, the jars were preferred due to their re-closability and for being hygienic (8/8).

4.2.2.2.3 Findings for stage III

Analysis by hypothesis testing method

The data collected from the first 12 questions of the questionnaire survey were analyzed by hypothesis testing method to statistically determine whether the presented packages were sufficient enough to meet the four criteria which were efficiency, clarity, safety, and satisfaction and to compare the usability of the presented packages in terms of these criteria. Comparison of the packages based on the questionnaire survey results is also utilized to provide a confirmation of the results gained from the observations during the usability testing.

The results were analyzed to determine whether significant differences occur between the score means of the packages or not. T-Tests were used to compare the mean scores of each package based on each criterion and a significance level $p < 0.05$ was adopted. The hypothesis that the respondents had the mean quantitative score (μ) of 7.5 for each criterion was tested.

The mean values for tomato paste package' scores are listed in Table 4.27. It appears that mean scores for the efficiency of packages A1, B1, and C1 are much higher than those for package D1. Table 4.27 shows that package D1 is significantly insufficient in terms of efficiency. Only package A1 scores significantly well in terms of clarity when compared to other packages. For safety, the mean scores of package A1 and B1 are much greater than those of package C1 and D1. It was found that package D1 appears to be seriously unsatisfactory to use. On the other hand, scores for package A1, B1, and C1 are higher than the average and they appear to be satisfactory to use, with package A1 being the most satisfactory.

Table 4. 27 Tomato paste packages' mean scores (SD) comparison.

	A1	B1	C1	D1
efficiency	10,38 (1,923)	9,63 (2,387)	6,75 (1,909)	3,25 (0,463)
clarity	11,25 (1,165)	7,13 (1,642)	6,63 (1,996)	5,00 (1,773)
safety	10,00 (1,604)	10,38 (1,188)	5,88 (0,991)	3,75 (1,488)
satisfaction	10,50 (1,604)	9,75 (2,121)	6,63 (2,200)	3,13 (0,354)

The mean values for juice package' scores are listed in Table 4.28. The mean scores indicate that package A2 and C2 are much more efficient than package B2 and D2. Package A2 appears to be significantly better for clarity, but conversely package D2 appears to be seriously lacking in clarity. For safety, mean scores of package A2 and C2 are much greater than those of package B2 and D2. Table 4.28 indicates that package D2 appears to be unsatisfactory to use when compared to others. On the other hand, scores for package A2, B2, and C2 are higher than the average and they appear to be satisfactory to use with the fact that package A2 is the most satisfactory.

Table 4. 28 Juice packages' mean scores (SD) comparison.

	A2	B2	C2	D2
efficiency	11,13 (1,246)	5,75 (2,188)	9,38 (1,061)	3,75 (1,389)
clarity	10,88 (1,727)	8,50 (1,604)	7,38 (1,506)	3,25 (0,707)
safety	11,50 (0,926)	5,00 (1,069)	8,75 (1,488)	4,75 (1,035)
satisfaction	10,88 (2,232)	7,13 (1,553)	8,63 (1,923)	3,38 (1,061)

Analysis by correspondence analysis method

The data collected from the first 12 questions of the questionnaire survey were also analyzed by correspondence analysis method. Correspondence analysis is an interdependence technique which produces a graphical representation of

associations (Hair et al., 1998). This method was chosen since it is necessary to analyze the relations among the four criteria to explore whether a criterion affect one another.

For the purpose of exploring the associations, Table 4.27 and Table 4.28, which present the mean scores of each package against four criteria, were analyzed by correspondence analysis technique. Correspondence maps were then produced using SPSS (See Figure 4.9 and Figure 4.10). In these maps, the positions of criterions reflect associations. Points that are close indicate the criterions have a relation.

Figure 4.9 indicates that the efficiency criterion is closely associated with the satisfaction criterion for tomato paste packages. However, this relationship begins to break down for juice packages and the satisfaction criterion becomes close to clarity. Nevertheless, in Figure 4.10 efficiency criterion is the closest one to the satisfaction criterion when compared to others. The figures also show that there is not a close relation among safety, clarity, and efficiency when compared to the relation between satisfaction and efficiency.

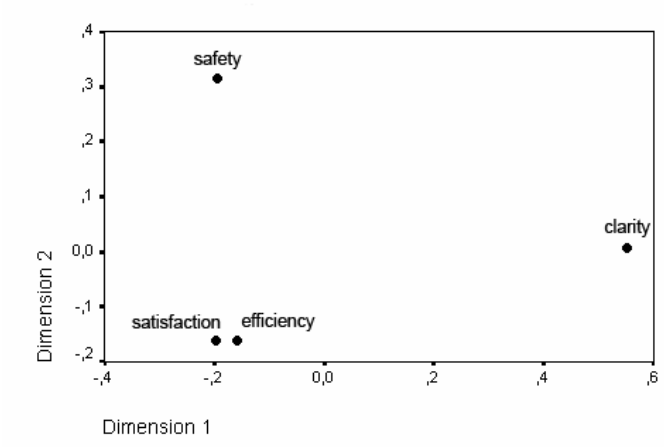

Figure 4. 9 A correspondence map for the criterions of tomato paste packages.

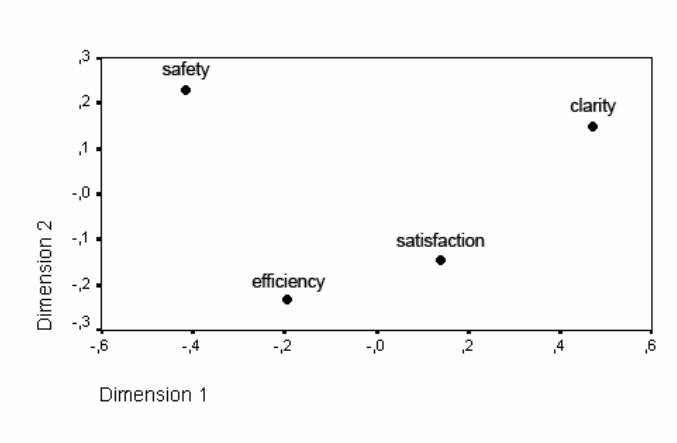

Figure 4. 10 A correspondence map for the criterions of juice packages.

Comparison of perceived quality and purchase decisions

Figure 4.11 and Figure 4.12 were produced to represent data collected from the last two questions relating to perceived quality and purchase decision. According to these figures, even though it was perceived by five participants that package B2 was better quality, two of them preferred to purchase package A1 and even though it was perceived by five participants that package C2 was better quality, four of them preferred to purchase package A2.

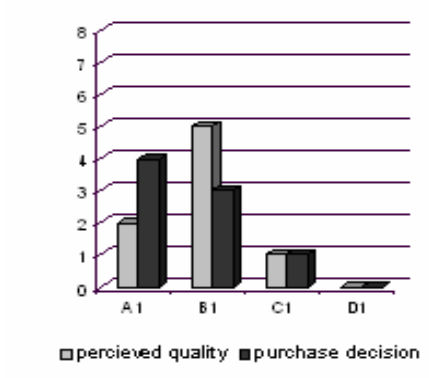

Figure 4. 11 Comparison of perceived quality and purchase decisions for the tomato paste packages.

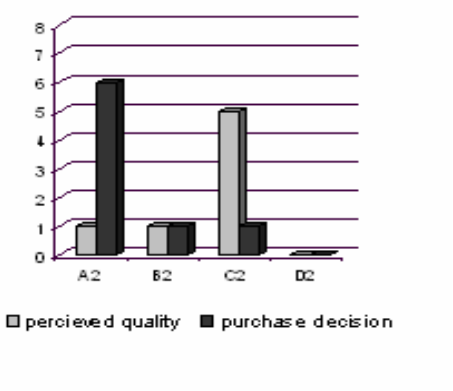

Figure 4. 12 Comparison of perceived quality and purchase decisions for the juice packages.

4.2.2.3 Analysis and conclusions

4.2.2.3.1 Stage I

When contents and costs were not taken into account, the preferences of the participants were mostly determined based on ease of use of the packages. The findings indicated that there is an awareness of usability of consumer packages and ease of use can be a competitive factor. However, the findings revealed that usability has a rather low effect on the perceived quality of the presented packages. The visual appearance of the packages, on the other hand, was the most important criteria for perception of quality.

4.2.2.3.2 Stage II

Based on the findings, a set of principles regarding package usability and satisfaction of user needs were identified. These are presented as follows:

1. *Safety:* A package should not cause accidents during use.
2. *Clarity:* How a package will be stored, opened, used, and closed should be apparent and easy to understand.

3. *Legibility:* Printed information on the package should be easy to read.
4. *Visibility:* Printed information, pictorials, and the features on the package should be readily visible.
5. *Openability:* "A package should be possible to open with few manipulations, in a short time and with limited force" (Hermansonn, 1999, p. 220).
6. *Re-closability:* A package should protect the content until it is consumed by means of re-closing the package (if necessary).
7. *Storability:* A package should be suitable to the place where it will be stored.
8. *Usefulness:* A package should serve useful features which helps users to achieve their goals
9. *Pleasantness:* A package should be pleasing to the senses.

4.2.2.3.3 Stage III

The results of the questionnaire indicated that package A1, B1, A2, and C2 were more satisfactory to use than the other packages used in the test in accordance with the observations during the test. However, even though the package C1 and B2 were over the average based on the analysis of the questionnaire results, it was observed during the test that there are many usability problems related to these packages.

The questionnaire survey also indicated that among the criteria employed, efficiency is the most effective one in package use satisfaction. This can be due to the fact that the most annoying problems during the test were related to efficiency.

In addition, questionnaire findings indicate that the initial preference of some participants had changed after experiencing usability problems during Stage II. For example, at Stage I, some participants found package D2 interesting because of its different opening feature. However, none of them preferred it due to the usability

problems experienced during Stage II. There was not a similar result for tomato paste packages, since most of the participants (7/8) had already known all of the presented tomato paste package types and they made their initial preferences according to their previous experiences. For this reason, their final preferences did not change as much for the juice packages. In addition, it was surprising that some participants (4/8) did not prefer the packages that they had perceived as good quality. These participants made their preferences not just according to the package's visual appearance and the quality of the content, but according to usefulness and ease of use of the packages.

4.2.3 Conclusion

The case study showed that if a usability test is conducted before packages come on to the market, usability and safety problems can be readily determined. In addition, the results of the study indicated that there is a need for a user-centered package design process to improve the quality of the package designs and to satisfy user needs.

CHAPTER 5

USER-CENTERED PACKAGE DESIGN AS A PROPOSED SOLUTION TO THE PROBLEMS

This chapter introduces a user-centered package design (UCPD) process based on the principles and activities of user-centered design (UCD). It is worth mentioning that user-centered approaches are mainly used in the area of user-computer interaction, but as Czaja (1997) states, principles and activities of UCD can be utilized in any area of user-product interaction.

This chapter also presents checklists for the use of package developers and designers. Lastly, this chapter provides a set of methods which can be utilized to achieve the goals of UCPD process.

In addition, it is worth mentioning that even if all the activities are carried out and all the principles are taken into account properly, technological factors such as manufacturing abilities and material related limitations may influence package usability.

5.1 Definition and key principles of user-centered package design

User-centered package design can be described as a process which aims to make packages usable for their actual users by preventing any problem occurring in user-package interaction before it happens and developing packages with the quality of user-package interaction in mind through implementing the following key principles:

- early adaptation of UCPD
- the active involvement of users
- iteration of design solutions

Early adaptation of user-centered approach to package development provides the greatest possible contribution for the manufacturer. It provides early detection of the usability and safety problems when the modifications are relatively cheaper when compared to the later stages of the design (Wiklund, 1994; INUSE 6.2, 1999). In addition, an evaluation after the design is concluded may not be sufficient enough to ensure package usability since the modifications to achieve package usability will be limited and costly.

The active involvement of users is one of the essential aspects of UCPD. By means of involving actual users in package the design process, their needs and demands can be identified and the package can be designed in light of their feedback. In this way the likelihood of acceptance of the final package is increased. As Kirvesoja (2001) points out it is almost impossible to foresee every way of use and usage environments. By involving actual users in design discussion and tests during package development, this problem is eliminated.

Iteration of design solutions is another important principle of UCPD. As stated in INCLUDE (2000), UCD is not a linear design process that begins from specifying the requirements to designing and than evaluating, but an iterative one in which the activities are repeated until a satisfactory design is achieved. By means of iterating the UCPD activities, the most satisfactory solution for a new package can be achieved. In addition, the iteration may also occur for the improvement of an existing package as the requirements of the users are changed over time.

5.2 User-centered design activities

ISO 13407 (1999) describes four essential UCD activities which should be undertaken. These are:

- Understanding and specifying the context of use
- Specifying the user and organizational requirements
- Producing design solutions
- Evaluating designs against requirements

In addition to the four essential activities, this process begins with planning. These activities provide a guide of what has to be done during the package development process. Therefore, the following explanations will be based on these activities and discuss how these activities can be applied to package design process.

Planning the user-centered package design process:

The UCD process should start with the production of a plan and build on that point. For an effective UCPD process, adequate attention should be paid to the planning process. During this phase, the overall goal for the package should be identified to define the boundaries of the UCPD project. This overall goal can then be decomposed into sub-goals (Mills, 2000). For example, the overall goal for a consumer package can be related to being useful, and easy and satisfactory to use; and the sub-goals can be related to legibility, visibility, ease of carriage and storage, openability, ease in the use of the contents, re-closability, and safe disposal.

Specifying context of use:

As pointed out by Bevan and Curson (1999), specifying context of use is a prerequisite to provide a basis for the UCD activities. Later in the process, the information related to the context can be used both for design decisions and

evaluation of the package. As stated in Chapter 3, contextual information relating to package use should focus mainly on the following aspects.

Users: Characteristics of the users of a package can be difficult to identify since packages are used by various users. For example, identifying the characteristics and needs of milk package users can be complex since the users could include children, adults, disabled, elderly, females, or/and males. Therefore, for this type of package it would be better to design for all these groups. In addition, while determining the user characteristics, a discrimination of actual users and sub-users should be made since the sub-users of a package might have totally different characteristics than actual users as explained in Chapter 3. For example, a package may be intended for the use of an adult but it could also be used by a child and thus, the characteristics of the children might also need to be defined.

Environments: Environment related aspects can sometimes also be difficult to identify. It is easy to identify when the users interact with packages just in their homes, but, it is hard to clearly identify the environment related aspects when the concern is, for example, portable products (e.g. cracker packages and single-served juice packages). For these types of products, the physical and ambient environments where the package may be used are harder to determine since they could be used anywhere that is considered suitable by the user.

Tasks: Characteristics of the tasks related to packages, on the other hand, are easier to identify when compared to other complex products since the tasks for package use are few and usually the same for all packages. In general, it can be said that the main tasks for package use are the activities that should be performed in each phase of a package lifetime as presented in the above case study.

Contents: Characteristics of contents should also be analyzed before designing packages. Thus, the exact package material and form, which is in harmony with the content, can be selected.

Equipments: Package use related equipments are mainly utilized while opening, such as a can opener or knife. Other equipments can also be utilized while using the packages, such as spoons. It is worth mentioning that appropriate opening tools should be recommended by the producers or, if possible, packages should be designed to avoid their use altogether.

Specifying user and organizational requirements:

After context of use information is gathered, user and organizational requirements can be specified. These requirements are the translation of user and organizational needs into criteria that the product must meet. It should be noted that, user requirements might contradict with organisational requirements. They might cause additional cost, production and filling difficulties, or storage problems. For example, increasing the surface area of a package for readability may increase the cost for the package and may cause storage problems, or putting a ring on a can will increase the cost and increase the production time. Therefore, there should be appropriate trade-offs between the user and organisational requirements. With this trade-offs a set of realistic and measurable usability objectives can be defined (INUSE 1.2, 1996). These usability objectives can be given in terms of effectiveness, efficiency and satisfaction or in terms of key principles that were determined in case study: safety, clarity, legibility, visibility, storability, openability, re-closability, usefulness, and pleasantness. For example, an openability objective for a jar can be given as it should be opened in a 10 seconds with a few manipulations.

Producing design solutions:

The next stage is to produce design solutions with reference to the identified context of use information, user and organizational requirements. In this stage, concept drawings, mock-ups, and prototypes are prepared to present them to representative users.

Evaluating designs against user requirements:

When a drawing, mock-up, or a prototype of the package is available, the design can be evaluated. As stated in ISO 13407 (1999) design evaluation can be used:

- to provide feedback from representative users to improve the design
- to assess whether the user and organizational requirements have been met

Feedback from users can be obtained in two ways: opinions about the design, and suggestions for further improvements (Wiklund, 1994). Providing feedback on problems is useful in early stages of the design. On the other hand, later in the design stages when a prototype is available whether objectives have been met or not can be assessed (INUSE 1.2, 1996).

5.3 Checklists for user-centred package design activities

The following checklists have been prepared to guide package developers and designers to review the UCPD process. These checklists are grouped under each UCPD activity.

Checklist for the planning phase[1]

- ✓ Does the plan define how UCPD activities will be integrated with other design activities?
- ✓ Does the plan identify the personnel involved in UCPD activities, their expertise, skills, and roles?
- ✓ Does the plan include appropriate milestones during the process to provide schedule-conformity and checkpoints for the goals of the project?
- ✓ Does the plan include appropriate arrangement of activities in timescale to allow feedback for modifications?

[1] based on INUSE 1.2 (1996)

- ✓ Does the plan identify the methods to be used during the process?

Checklist for specifying context of use phase

Checklist for the user characteristics[2]

- ✓ Are the personal characteristics of the users identified? (e.g. age, gender, literacy, education)
- ✓ Are the anthropometric characteristics of the users identified? (e.g. hand length and breadth, forefinger breadth, finger pinch, power grip)
- ✓ Is the strength of the users identified? (e.g. power grip strength, finger pulling strength)
- ✓ Is the experience of the users identified? (e.g. experience in use of opening tools, tasks)
- ✓ Are the personality related characteristics of the users identified? (e.g. motivation, risk taking, perseverance, inquisitiveness)
- ✓ Are the socio-economic backgrounds of the users identified? (e.g. housing, income)
- ✓ Are the cultural differences of the users identified especially for exported products? (e.g. physical, social, lingual)
- ✓ Are the disability related characteristics of the users identified? (e.g. old age, pregnancy, fatigue, blindness)

Checklist for the environment characteristics[3]

- ✓ Are the use spaces of the package identified? (e.g. kitchen, bathroom, outdoors, retails)
- ✓ Is the furniture in the use space identified? (e.g. tables, benches, bathtub, washbasin, refrigerator)

[2] based on Norris and Wilson (1999)

[3] based on Maguire and Bevan (2002)

- ✓ Are the ambient environment related characteristics identified? (e.g. temperature, humidity)
- ✓ Is special clothing identified? (e.g. glove)
- ✓ Are the visual environment related characteristics identified? (e.g. lighting)

Checklist for the task characteristics[4]

- ✓ Is the task list identified? (e.g. selection in the market, carriage, storing, opening, closing, re-opening, re-using, re-storing)
- ✓ Is the goal identified? (e.g. to be able to get out the content without experiencing safety and usability problem)
- ✓ Are the steps in the tasks identified? (e.g. handling, twisting the lid, tearing away the foil seal for opening)
- ✓ Is the frequency of the tasks identified? (e.g. frequency of use or opening)
- ✓ Is the duration of the tasks identified? (e.g. duration of carriage)
- ✓ Is the importance of the tasks identified? (e.g. carrying is an important task for those packages that have handles)
- ✓ Are safety critical tasks identified? (e.g. opening and after-use)

Checklist for the characteristicsof contents

- ✓ Are the content type and its characteristics identified? (e.g. liquids such as beverages and bleacher, solids such as soaps, pastes such as tomato paste and toothpaste, brittle products such as chips and crackers, granular products such as cereals and laundry detergents, liquid-solid combinations such as white cheeses and preserved vegetables).
- ✓ Are the safety critical content related characteristics identified? (e.g. toxic, flammable contents)

[4] based on Maguire and Bevan (2002)

Checklist for the equipment characteristics

- ✓ If it is necessary to utilize equipment during use of the packages, are the equipment types identified? (e.g. can opener, fork, scissor, jar opener)
- ✓ If it is necessary to utilize equipment during use of the packages, are their characteristics identified? (e.g. some can openers create sharp edges and let the lid sink into the can)
- ✓ Are the safety critical equipments utilized during use identified? (e.g. knife, screw driver)

Checklist for the specification of user and organizational requirements phase[5]

- ✓ Is the statement of design goal provided?
- ✓ Are the priorities for the different requirements determined?
- ✓ Is the appropriate trade-offs between different requirements determined?
- ✓ Are the usability criteria against which the design can be tested defined?
- ✓ Are the relevant safety and legislative requirements included?

Checklist for the producing design solutions phase

- ✓ Are drawings and/or mock-ups of the initial designs provided?
- ✓ As the design is improved; and the form, function, and features of the package are detailed, are the prototypes suitable for containing the exact content and weight provided?
- ✓ Is the context of use information and specified requirements taken into account while creating package design ideas?

[5] based on ISO 13407 (1999)

Checklist for the evaluating designs phase[6]

- ✓ Is an evaluation plan covering objectives of the evaluation, the roles of the personnel who will carry out the evaluation, the aspects of the product to be evaluated, the tasks to be assigned to users, methodology and the resources used for the evaluation provided?
- ✓ Are representative users identified and so appointed?
- ✓ Is the data collected and analysed by means of specified methods?
- ✓ Is a report covering the results, analysis, and recommendations for the improvement of the design provided?
- ✓ Is this report consistent with the evaluation plan set before? (e.g. If the evaluation aims to get feedback to design, the report should present appropriate information to support design decisions; if the evaluation aims to test the design against standards, it should present relevant standards and reasons for the use of them, evidence that a competent person conducted the assessment; and if the evaluation aims to test the usability performance, the report should present context of use, usability requirements, description of the product that was tested, methodology, detailed results of the test)
- ✓ Does the report indicate whether the package meets the objectives set before?

5.4 Checklists for the design and evaluation of packages

The following design checklists have been prepared utilizing the experience gained from the case study and its results. These checklists may be useful for design and evaluation activities since most consumer packages have common concerns regarding their design. However, using these checklists alone will not be sufficient to achieve usability and safety of the packages. In addition to these checklists, it is necessary to test the designs with actual users to identify the problems.

[6] based on INUSE 6.2 (1999)

Furthermore, in spite of the difficulty in achieving all or most of these, which "act as boundaries" (Underwood, Klein, and Burke, 2001, p. 421), as Calver (2004) states, the diversity of them may present an advantage for package designers since they work as a catalyst for new and creative design solutions.

These package design checklists are grouped under the nine key principles, which were defined in Chapter 4. Checklists are presented as follows:

1. Safety

- ✓ Are there any sharp and rough edges on the package before, during, and after use?
- ✓ Is the package slip-free while holding, opening, or closing? Does the package have a texture on it?
- ✓ Is the package safe for children? Is it child-proof for dangerous products?
- ✓ Does the package have visible and understandable warnings regarding inappropriate tool use?
- ✓ Are warnings regarding dangerous contents visible and understandable?

2. Clarity

- ✓ Is wording of instructions and other information easy to understand for specified user groups (especially for elderly and disabled)?
- ✓ Are pictures and symbols helpful?
- ✓ Is it obvious where and how to open, use, and close the package?
- ✓ Is information on recycling understandable?
- ✓ Are there headings within the information provided on the package that guide users to related topics?

3. Legibility

- ✓ Is the expiry date easy to read?

- ✓ Are the headings visually easy to identify?
- ✓ For the texts, are italics, simulated handwriting and ornate typefaces avoided?
- ✓ Do the texts have clear structure, sequences and patterns?
- ✓ Are texts on labels printed horizontally?
- ✓ Do the texts have strong and dark colours which contrast against the background colour?
- ✓ Are the type size and style appropriate?
- ✓ Are the text line, word, and letter spacing appropriate?

4. Visibility

- ✓ Is the expiry date visible until the contents are consumed?
- ✓ Can the information on recycling be easily found?
- ✓ Is the expiry date printed on the top of the package (if possible)?
- ✓ Are the contents visible (if possible)?
- ✓ Are the instructions close to the point of opening?

5. Openability

- ✓ Is the package easy to open (especially for elderly and disabled)?
- ✓ Is the force needed to be applied to the package to open it within the limits of the users' force?
- ✓ Is the package comfortable while opening?
- ✓ Is the package easy to open under any environmental condition such as cold, wet, or hot (especially for jars)?
- ✓ Is the package quick to open?
- ✓ Is the closure slip-free? Does it have a texture on it?
- ✓ Are tamper evident features of the package easy to grasp and break off/tear away?
- ✓ Are there instructions on openability?

- ✓ Can the package be opened without a tool (if possible)? Does it have tear-tabs, or a self opening mechanism such as ring-pulls?
- ✓ Does the package prevent contents spilling or scattering while opening?

6. Re-closability

- ✓ Is the package suitable for the re-storage of the content?
- ✓ Does the package protect the contents after initial opening?
- ✓ Does the package have a closure?

7. Storability

- ✓ Is the package easy to store and suitable to the places where it will be stored? (e.g. refrigerator, shelf)
- ✓ Does the package occupy the minimum possible space?
- ✓ Can the volume of the package be decreased as the contents consumed (if possible)?
- ✓ Is the package hygienic and dirt free when storing?

8. Usefulness

- ✓ Does the package prevent smearing of the content to environment?
- ✓ Is the package portable?
- ✓ Does the package provide ease of access to, and extraction of the content?
- ✓ Are the instructions relevant and useful?

9. Pleasantness

- ✓ Is the package interesting to use?
- ✓ Is the package interesting in its form and graphichs?
- ✓ Is the appearance of the package attractive?
- ✓ Is the package suitable to home decoration (if necessary)?

- ✓ Does the package have a pleasant texture on it?
- ✓ Does the package have a pleasant form?

5.5 Recommended methods for user-centred package design

This section briefly describes a set of methods which can be used in the UCPD process and selection of those methods.

Selection of appropriate methods was affected by the following factors:

- the stage in the design process,
- the information provided by a particular method,
- the form that the product takes (e.g. drawings, mock-ups, or prototypes),
- accessibility of representative users,
- constraints related to resources (e.g. time, cost, number and availability of users and analyst, skills and experience of the analyst) (INUSE 6.2, 1999).

By taking these factors into account, a set of methods appropriate to the evaluation of consumer packages and user activity were recommended by the author for the UCPD process. An analysis of the potential benefits and drawbacks of each method was also necessary so that the weakness of one method could be affectively countered by the application of another. The selected methods and their sequences are presented based on UCPD activities as in Figure 5.1.

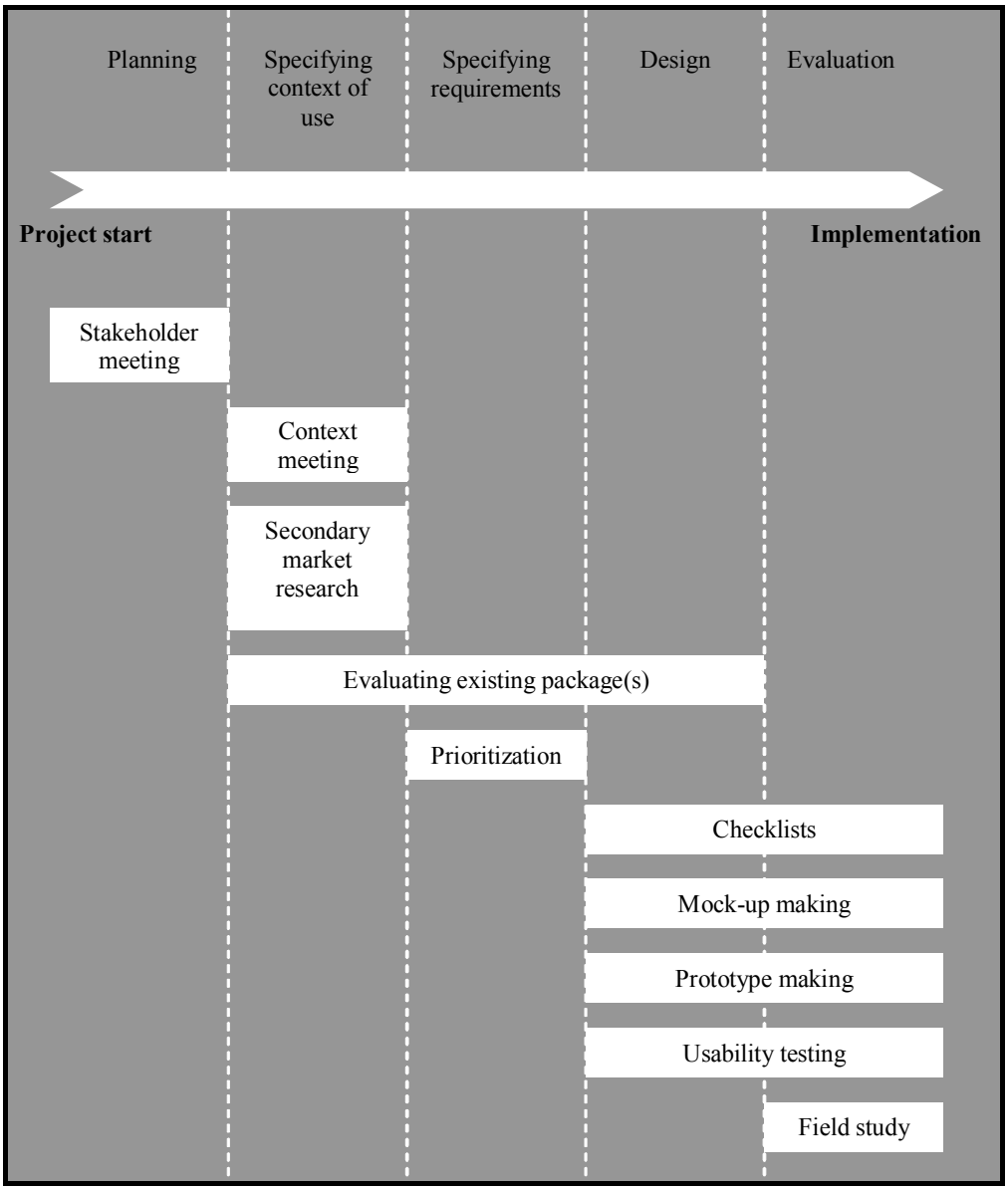

Figure 5. 1 Recommended methods for UCPD

In this figure, UCPD process starts with a stakeholder meeting in which all relevant stakeholders (project and product managers, user representatives, designers, manufacturers, etc.) are brought together to agree a common vision, and definition of the scope of UCPD process and activities. After the UCPD process is determined, in a context meeting, again the stakeholders define the characteristics of the package; who the package is for; which tasks will be carried out; and the anticipated circumstances of use are identified (Thomas and Bevan, 1996).

Secondary market research can then be carried out to specify characteristics of context of use factors. This method involves gathering information from published sources, such as research reports and demographic information reports (Maguire and Bevan, 2002). This method is cost-effective and provides a good overview of context of use, but the gathered information may be too general or out of date (Maguire and Bevan, 2002). To cope with the drawbacks of secondary market research, if available, firm's old packages or competitors' packages can be evaluated.

The existing package or competitor's packages can also be evaluated to identify existing problems to be avoided in a new package, users' demands, and new features by the involvement of representative users. This knowledge and the knowledge on context of use are used to specify usability and user requirements.

In addition, evaluation of existing packages method can be utilized during design activity when it is necessary to compare the existing packages and the new design. However, since the competitors' packages are evaluated, this method may cause a package similar to a competitors' (Maguire and Bevan, 2002).

After specifying requirements, the priority of each specified requirement in relation to the project goal should be determined by using the prioritisation method. This method provides appropriate direction of resources, but as a drawback poor prioritization may results in dissatisfied-users (Maguire and Bevan, 2002).

Design checklists can be used to make sure the full range of issues is considered based on the established knowledge set before (Stanton and Young, 1998). The design checklists presented in the previous section are useful during the early design stages and initial evaluation of the package designs. Checklists are quick, easy, and cost-effective to apply, but they do not deal with error prediction, nor do they provide rich data about user experience (Stanton and Young, 1998; Jordon, 1998), and they may also unnecessarily constrain the design.

To further evaluate the concept designs mock-ups are useful. They allow early detection of potential usability problems and errors; and provide rapid design iterations since they are easy and inexpensive to make. However, they do not support evaluation of the details of the usability problems. These mock-ups can be evaluated by the involvement of 3 to 5 represantative users and this activities can be iterated for several times to reach the best solution.

Thereafter, based on the feedback gained from the evaluation of the mock-ups, design can be modified and a prototype of it can be produced. Prototypes are a more detailed embodiment of the design. When a prototype is available usability testing can be carried out with at least 8 users (Bevan, 2003). This method is used to identify any remaining usability problems and evaluate whether objectives have been achieved (Bevan, 2003). During usability testing users are directly involved and use the package with its contents. This method provides rich data on the details of usability problems encountered during use of the package, but it is time consuming and need specialized equipment and expertise.

In addition to usability testing it might be necessary to make a field study to identify special problems in actual use environment with prototypes. In this method, an investigator observes users as they work and takes notes (Maguire and Bevan, 2002). The aim is to acquire information and understanding of how a package is used in its actual context. This method provides discovering unnoticed use processes and also the acceptability of the new package design (Maguire, 2001, p. 455). However it is time and money consuming.

CHAPTER 6

CONCLUSIONS

6.1 Review

It can be said that one of the most important challenges of package design is probably user needs satisfaction. For an organization to achieve a competitive advantage, to provide continuity of sales, to improve brand image, and to ensure long-term success, it is extremely important that user demands and complaints should be taken into account and good quality of interaction between users and packages should be achieved. The existing literature has revealed that usability problems which occur during this interaction may damage the relationship between the user and the brand due to a package presenting inconvenience and discomfort to the user. Poor packages also cause feelings of anger and frustration that may surpass any advantage that the contents may present. In the worst case, accidents which occur during this interaction may cause injuries or fatalities.

The literature implies that there are many usability and safety problems related to consumer packages, and that user complaints related to them are widespread. It was also noticed that these problems vary in relation to each phase in the lifetime of a package in which end-users are involved. In addition to these observations, this thesis focuses on a case study conducted to identify and further analyse problems which may arise during the lifetime phases of packages.

The literature mainly focuses on the most apparent problems related to safety, openability and legibility. However, the case study revealed that, in addition to these key problem areas, clarity, visibility, storability, reclosability, usefulness, and pleasantness are also key points where problems are widespread and should be considered by package developers and designers. It was observed that the re-

closability of packages is a particular area where improvements are necessary, especially for goods consumed after several uses such as food and beverages. The case study also indicated that user-package interaction is mainly affected by the context of use factors, which are characteristics of users, task types, equipments, environmental factors, and content.

Based on the literature survey and the case study, it was argued that most of the consumer packages on the market have not been designed considering the needs and demands of actual users. In addition, available package design processes seem to lack a structural approach regarding incorporation of users into the package design process. As the study indicated, usability and safety problems related to consumer packages can easily be identified and overcome using a structural approach: a user-centered approach to package design. To this end, as a contribution to the literature, user-centered design principles and activities have first been adapted to user-centered package design (UCPD) process. Second, to aid the review of each of the UCPD process activities, process checklists were prepared. Third, by utilizing the case study results, design checklists were also prepared for application within the design and evaluation of packages. Lastly, for use during the UCPD process, a set of relevant methods were identified and explained according to each UCPD activity.

6.2 Suggestions for future work

The study indicated that there is a need for further study on consumer awareness regarding package usability while making their preferences. This could reveal the potential competitive advantage of achieving usability for packages.

The sample size used for the case study was not large enough to make generalizations about the population. Therefore, further research using a large-scale randomized sample of end-users is required to confirm how users interact with packages and what their complaints and needs are in general practice. In addition,

since this research has specifically focused on food and beverage packages, further studies could be extended to other consumer product categories. Thus, additional insight into the generalization of the findings of this study could be gained.

Further studies could also be done for the improvement of the package design checklists. In addition, there should be a further study on the integration of user-centered package design process to package development process. The appropriateness of the recommended methods for UCPD process, how these methods can be applied, and their potential for success should also be further investigated.

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APPENDIX A

QUESTIONNAIRE FOR CASE STUDY PART I

YİYECEK VE İÇECEK AMBALAJLARI

Bu anket, Orta Doğu Teknik Üniversitesi Endüstri Ürünleri Tasarımı Bölümü araştırma görevlisi Burçin Kesercioğlu tarafından gerçekleştirilen bir araştırma kapsamında yapılmaktadır. Araştırmanın amacı, yiyecek ve içecek ürünlerinin ambalajlarında yaşanan sorunları saptamaktır. Bulgular, ambalaj tasarımlarının geliştirilmesine girdi sağlayacaktır.

Ankette verdiğiniz bilgiler, kimliğiniz açıklanmadan kullanılacaktır. Zaman ayırdığınız için teşekkür ederiz.

Kişisel Bilgiler

Ad:
Soyad:
Yaş:

Cinsiyet:
□ Erkek □ Kadın

Eğitim Düzeyi:
□ Lise □ Üniversite

Aşağıdaki bakliyat, un ve unlu mamüllerde hangi aşamalarda sorun yaşıyorsunuz, kutucukları işaretler misiniz?

Bakliyat, un ve unlu mamüller	bakliyat	makarna	un	ekmek	kraker	diğer	Ambalaj ile ilgili sorunu açıklar mısınız?
Markette ürünü seçme, raftan alma, kasaya ulaştırma ve satın alma sırasında							
Marketten çıktıktan sonra taşıma sırasında							
Ürünü kullanacağınız yere getirdiğinizde saklama sırasında							
Ambalajı açarken							
Ürünü kullanırken							
Ürünü kullandıktan sonra artanı saklama sırasında							
Ürünün kalanını tekrar kullanırken							
Ürün bittikten sonra ambalajın tekrar kullanımı, atılması, geri dönüşümü							

Aşağıdaki şarküteri ürünlerinde hangi aşamalarda sorun yaşıyorsunuz, kutucukları işaretler misiniz?

Şarküteri	peynir	kaşar	zeytin	salam	sosis	sucuk	yumurta	diğer	Ambalaj ile ilgili sorunu açıklar mısınız?
Markette ürünü seçme, raftan alma, kasaya ulaştırma ve satın alma sırasında									
Marketten çıktıktan sonra taşıma sırasında									
Ürünü kullanacağınız yere getirdiğinizde saklama sırasında									
Ambalajı açarken									
Ürünü kullanırken									
Ürünü kullandıktan sonra artanı saklama sırasında									
Ürünün kalanını tekrar kullanırken									
Ürün bittikten sonra ambalajın tekrar kullanımı, atılması, geri dönüşümü									

Aşağıdaki süt ve süt ürünlerinde hangi aşamalarda sorun yaşıyorsunuz, kutucukları işaretler misiniz?

Süt ve süt ürünleri	süt	yoğurt	dondurma	ayran	krema	diğer	Ambalaj ile ilgili sorunu açıklar mısınız?
Markette ürünü seçme, raftan alma, kasaya ulaştırma ve satın alma sırasında							
Marketten çıktıktan sonra taşıma sırasında							
Ürünü kullanacağınız yere getirdiğinizde saklama sırasında							
Ambalajı açarken							
Ürünü kullanırken							
Ürünü kullandıktan sonra artanı saklama sırasında							
Ürünün kalanını tekrar kullanırken							
Ürün bittikten sonra ambalajın tekrar kullanımı, atılması, geri dönüşümü							

Aşağıdaki yağlar ve soslarda hangi aşamalarda sorun yaşıyorsunuz, kutucukları işaretler misiniz?

Yağlar ve soslar	margarin	tereyağ	sıvı yağ	ketçap	mayonez	sirke	diğer	Ambalaj ile ilgili sorunu açıklar mısınız?
Markette ürünü seçme, raftan alma, kasaya ulaştırma ve satın alma sırasında								
Marketten çıktıktan sonra taşıma sırasında								
Ürünü kullanacağınız yere getirdiğinizde saklama sırasında								
Ambalajı açarken								
Ürünü kullanırken								
Ürünü kullandıktan sonra artanı saklama sırasında								
Ürünün kalanını tekrar kullanırken								
Ürün bittikten sonra ambalajın tekrar kullanımı, atılması, geri dönüşümü								

Aşağıdaki konservelerde hangi aşamalarda sorun yaşıyorsunuz, kutucukları işaretler misiniz?

Konserveler	salça	garnitür	balık	hazır yemek	mısır	diğer	Ambalaj ile ilgili sorunu açıklar mısınız?
Markette ürünü seçme, raftan alma, kasaya ulaştırma ve satın alma sırasında							
Marketten çıktıktan sonra taşıma sırasında							
Ürünü kullanacağınız yere getirdiğinizde saklama sırasında							
Ambalajı açarken							
Ürünü kullanırken							
Ürünü kullandıktan sonra artanı saklama sırasında							
Ürünün kalanını tekrar kullanırken							
Ürün bittikten sonra ambalajın tekrar kullanımı, atılması, geri dönüşümü							

Aşağıdaki şeker ve şekerli ürünlerde hangi aşamalarda sorun yaşıyorsunuz, kutucukları işaretler misiniz?

Şeker ve şekerli ürünler	şeker	çikolata	bisküvi	kek	bal, reçel	şekerleme	diğer	Ambalaj ile ilgili sorunu açıklar mısınız?
Markette ürünü seçme, raftan alma, kasaya ulaştırma ve satın alma sırasında								
Marketten çıktıktan sonra taşıma sırasında								
Ürünü kullanacağınız yere getirdiğinizde saklama sırasında								
Ambalajı açarken								
Ürünü kullanırken								
Ürünü kullandıktan sonra artanı saklama sırasında								
Ürünün kalanını tekrar kullanırken								
Ürün bittikten sonra ambalajın tekrar kullanımı, atılması, geri dönüşümü								

Aşağıdaki içeceklerde hangi aşamalarda sorun yaşıyorsunuz, kutucukları işaretler misiniz?

İçecekler	gazlı içecekler	meyva s suyu	çay, kahve	toz içecekler	su	soda	diğer	Ambalaj ile ilgili sorunu açıklar mısınız?
Markette ürünü seçme, raftan alma, kasaya ulaştırma ve satın alma sırasında								
Marketten çıktıktan sonra taşıma sırasında								
Ürünü kullanacağınız yere getirdiğinizde saklama sırasında								
Ambalajı açarken								
Ürünü kullanırken								
Ürünü kullandıktan sonra artanı saklama sırasında								
Ürünün kalanını tekrar kullanırken								
Ürün bittikten sonra ambalajın tekrar kullanımı, atılması, geri dönüşümü								

Aşağıdaki diğer ürünlerde hangi aşamalarda sorun yaşıyorsunuz, kutucukları işaretler misiniz?

Diğer	et ve et ürünleri	meyve sebze	hazır çorba	kuruyemiş	baharat	cips	diğer	Ambalaj ile ilgili sorunu açıklar mısınız?
Markette ürünü seçme, raftan alma, kasaya ulaştırma ve satın alma sırasında								
Marketten çıktıktan sonra taşıma sırasında								
Ürünü kullanacağınız yere getirdiğinizde saklama sırasında								
Ambalajı açarken								
Ürünü kullanırken								
Ürünü kullandıktan sonra artanı saklama sırasında								
Ürünün kalanını tekrar kullanırken								
Ürün bittikten sonra ambalajın tekrar kullanımı, atılması, geri dönüşümü								

Yiyecek ve içecek ambalajlarından değiştirilmesi veya geliştirilmesini gerekli gördüğünüz ambalaj var mı? Hangi ambalajlar?

Zaman ayırdığınız için teşekkür ederiz.

FOOD AND BEVERAGE PACKAGES

This questionnaire was designed for a study by Burçin Kesercioğlu who is a research assistant in Middle East Technical University. Aim of the study is to determine the usability problems regarding food and beverage packages. The finding will be used for the improvement of consumer packages.

Your answers will be used without declaring your identity. Thank you for your time and consideration.

Personal information

Name:
Surname:
Age:

Sex:
□ Male □ Female

Educational background:
□ High school □ University

Could you please fill in the blanks based on in which phase you encounter a problem?

Cereals, flour and flour-related foods	cereals	spaghetti	flour	bread	cracker	others	Could you please explain the problem?
Recognizing, selecting, and purchasing a product and reading the information on a package							
Transporting the purchased product from supermarket to a place where it will be consumed							
Storing the purchased product in a place until it is consumed							
The first opening of a package to reach the contents							
Getting out the contents to use							
Storing the leftover part of the contents for the next uses							
Opening and using the product for the second and subsequent time to consume the leftover part							
Recycling, reusing the package for another purpose, and just throwing it away.							

Could you please fill in the blanks based on in which phase you encounter a problem?

Breakfast foods	cheese	sheep cheese	olive	salami	sausage	'sucuk'	egg	others	Could you please explain the problem?
Recognizing, selecting, and purchasing a product and reading the information on a package									
Transporting the purchased product from supermarket to a place where it will be consumed									
Storing the purchased product in a place until it is consumed									
The first opening of a package to reach the contents									
Getting out the contents to use									
Storing the leftover part of the contents for the next uses									
Opening and using the product for the second and subsequent time to consume the leftover part									
Recycling, reusing the package for another purpose, and just throwing it away.									

Could you please fill in the blanks based on in which phase you encounter a problem?

Dairy foods	milk	yoghurt	ice cream	'ayran'	cream	others	Could you please explain the problem?
Recognizing, selecting, and purchasing a product and reading the information on a package							
Transporting the purchased product from supermarket to a place where it will be consumed							
Storing the purchased product in a place until it is consumed							
The first opening of a package to reach the contents							
Getting out the contents to use							
Storing the leftover part of the contents for the next uses							
Opening and using the product for the second and subsequent time to consume the leftover part							
Recycling, reusing the package for another purpose, and just throwing it away.							

Could you please fill in the blanks based on in which phase you encounter a problem?

Sauces and oils	margarine	butter	oil	ketchup	mayonnaise	vinegar	others	Could you please explain the problem?
Recognizing, selecting, and purchasing a product and reading the information on a package								
Transporting the purchased product from supermarket to a place where it will be consumed								
Storing the purchased product in a place until it is consumed								
The first opening of a package to reach the contents								
Getting out the contents to use								
Storing the leftover part of the contents for the next uses								
Opening and using the product for the second and subsequent time to consume the leftover part								
Recycling, reusing the package for another purpose, and just throwing it away.								

Could you please fill in the blanks based on in which phase you encounter a problem?

Preserved foods	tomato paste	garniture	fish	ready meal	corn	others	Could you please explain the problem?
Recognizing, selecting, and purchasing a product and reading the information on a package							
Transporting the purchased product from supermarket to a place where it will be consumed							
Storing the purchased product in a place until it is consumed							
The first opening of a package to reach the contents							
Getting out the contents to use							
Storing the leftover part of the contents for the next uses							
Opening and using the product for the second and subsequent time to consume the leftover part							
Recycling, reusing the package for another purpose, and just throwing it away.							

Could you please fill in the blanks based on in which phase you encounter a problem?

Sugar and sugar related foods	sugar	chocolate	biscuit	cake	honey and jam	candy	others	Could you please explain the problem?
Recognizing, selecting, and purchasing a product and reading the information on a package								
Transporting the purchased product from supermarket to a place where it will be consumed								
Storing the purchased product in a place until it is consumed								
The first opening of a package to reach the contents								
Getting out the contents to use								
Storing the leftover part of the contents for the next uses								
Opening and using the product for the second and subsequent time to consume the leftover part								
Recycling, reusing the package for another purpose, and just throwing it away.								

Could you please fill in the blanks based on in which phase you encounter a problem?

Beverages	arbonated drink	juice	tea & coffee	owdered drinks	water	soda	others	Could you please explain the problem?
Recognizing, selecting, and purchasing a product and reading the information on a package								
Transporting the purchased product from supermarket to a place where it will be consumed								
Storing the purchased product in a place until it is consumed								
The first opening of a package to reach the contents								
Getting out the contents to use								
Storing the leftover part of the contents for the next uses								
Opening and using the product for the second and subsequent time to consume the leftover part								
Recycling, reusing the package for another purpose, and just throwing it away.								

Could you please fill in the blanks based on in which phase you encounter a problem?

Miscellaneous foods	meat	fruit & vegetable	Ready soup	appetizer	spices	chips	others	Could you please explain the problem?
Recognizing, selecting, and purchasing a product and reading the information on a package								
Transporting the purchased product from supermarket to a place where it will be consumed								
Storing the purchased product in a place until it is consumed								
The first opening of a package to reach the contents								
Getting out the contents to use								
Storing the leftover part of the contents for the next uses								
Opening and using the product for the second and subsequent time to consume the leftover part								
Recycling, reusing the package for another purpose, and just throwing it away.								

Is there any package type which needs modifications or improvements? Which package types?

Thank you for your time and consideration.

APPENDIX B

PACKAGE TYPES AND THE MOST PROBLEMATIC PHASES

Package type	Used for	Number of the times problem stated	The most problematic phase
Tins	tomato paste, garniture, fish, cheese, olive, ready meal, and corn	133	Opening
Plastic snack overwraps	cracker, chocolate, cake, candy, biscuit, and chips	98	Re-storage
Plastic film bags	cereals, spaghetti, flour, bread, spices, and appetiser	95	Opening and re-storage
Paper bags	flour, sugar, powdered drinks, and tea	83	Display and purchase
Vacuumed plastic covers	cheese, 'kaşar', olive, salami, and sausage	67	Re-storage
Plastic yoghurt containers	yoghurt	61	Transportation
Plastic bottles	carbonated drinks, water PET bottles and milk, 'ayran'	58	Re-storage and disposal
Paper overwraps	ice cream, margarine, and butter	49	Transportation
Beverage carton boxes	juice, milk, and cream	46	Opening
Plastic or glass oil or vinegar bottles	oil and vinegar	44	Usage
Egg boxes	egg	36	Display and purchase and transportation
Metal oil containers	oil	28	Opening
Plastic 'ayran' containers	single-drink 'ayran'	23	Opening

Package type *continued*	Used for	Number of the times problem stated	The most problematic phase
Glass bottles	milk, carbonated drinks, juice, water, and soda	21	Re-storage
Plastic ketchup and mayonnaise containers	ketchup and mayonnaise	20	Usage
Food carton boxes	cheese, sugar, and flour	18	Opening
Plastic plates with plastic film covers	meat and meat products, and fruit and vegetable	17	Usage
Metal beverage containers	carbonated drink, and juice	16	Opening and using
Jars	ketchup, mayonnaise, tomato paste, garniture, corn, honey, and jam	12	Usage

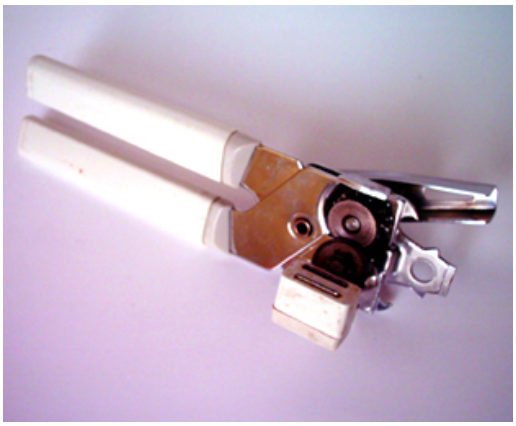
APPENDIX C

PHOTOGRAPHS OF THE PACKAGES AND THE EQUIPMENTS USED IN THE TEST

Tomato paste packages

Juice Packages

Can opener 1



Scissor

Can opener 2

Knife

Jar opener

Bottle opener

APPENDIX D

THE QUESTIONS ASKED TO THE PARTICIPANTS, THE TASKS TO BE DONE, AND THE QUESTIONNAIRE FOR CASE STUDY PART II

Salça ambalajları testi için deneğe sorulacak sorular ve gerçekleştirilmesi istenecek işler:

1. Aşama

Bu dört ambalajın hepsinin içinde salça var. Bu ambalajların içerisindeki ürünü, ürünün miktarını ve de fiyatını göz ardı ettiğinizde:

- Hangi ürünü satın alırdınız? Neden?
- Sizce hangi ürün daha kaliteli olabilir? Neden?
- Sizce hangi ambalaj sorun yaratabilir? Neden?
- Bu ambalajlardan birisinin kullanım ile ilgili sorunlar yarattığını varsayalım. Bu durumda o ambalajın içerdiği ürüne ve markaya karşı olan güveniniz değişir mi?

2. Aşama

Şimdi size bu ambalajların markaları ve grafik öğeleri açık olanlarını çıkaracağım ve bu ambalajlar hakkında size sorular soracağım. Bu ambalajların marka ve grafik öğelerini tamamen kapatabilmek mümkün olmadığından açık bırakıldı. Bu dört ambalajla ilgili bundan sonra soracağım sorulara fiyat ve markaya dair bilgilerinizi göz ardı ederek cevap vermenizi bekliyorum.

	Deneğe verilecek bilgiler	Deneğe sorulacak sorular ve gerçekleştirilmesi istenecek işler
markette ürünün satın alınması	Size markette ürünü seçerken ve satın alırken yaşadığınız problemlerle ilgili sorular soracağım ve bu ambalajları değerlendirmenizi isteyeceğim.	- Markette ürünü seçerken son kullanma tarihine ve içeriği ile ilgili bilgilere bakıyor musunuz? - Son kullanma tarihini bulup okur musunuz? - Hangi ambalajdakini en kolay ve hangi ambalajdakini en zor buldunuz? Sebebi ne olabilir? - Hangi ambalajdakini en kolay ve hangi ambalajdakini en zor okudunuz? Sebebi ne olabilir? - İçindekiler bilgisini bulup okuyabilir misiniz? - Hangi ambalajdakini en kolay ve hangi ambalajdakini en zor buldunuz? Sebebi ne olabilir? - Hangi ambalajdakini en kolay ve hangi ambalajdakini en zor okudunuz? Sebebi ne olabilir? - Markette iken ambalajla ilgili yaşadığınız başka sorunlar var mı? - Bilgilerin okunabilirliği satınalma kararınızı nasıl etkiler? Hangi ürünü alırdınız?
satış yerinden ürünün tüketileceği yere taşınması	Şimdi satış yerinden ürünün tüketileceği yere yani evinize taşınması sürecine dair size sorular sorarak düşüncelerinizi alacağım.	- Bu ambalajlar taşıma sırasında ne gibi sorunlar yaratabilir? - Fiyat ve markaya dair bilgilerinizi göz ardı ederek ürünün taşınması sırasındaki tecrübelerinizi düşündüğünüzde hangi ürünü satın alırdınız? Neden?
ürünün tüketilene kadar saklanması	Şimdi size ürünün tüketilmeye başlamadan önce buzdolabı veya diğer dolaplarda saklanması süreci ile ilgili sorular soracağım.	- Ürünü tüketmeye başlamadan önce saklarken bu ambalajlar ne gibi sorunlar yaratabilir? - Fiyat ve markaya dair bilgilerinizi göz ardı ederek ürünün saklanması sırasındaki tecrübelerinizi düşündüğünüzde hangi ürünü satın alırdınız? Neden?

	Deneğe verilecek bilgiler *devam*	Deneğe sorulacak sorular ve gerçekleştirilmesi istenecek işler *devam*
ambalajın ilk açılması	Şimdi size birkaç alet çıkaracağım ve bu ambalajları açmanızı isteyeceğim.	- 1. Ambalajı açar mısınız? - Açma yerini ve açma şeklini bulmakta zorlandınız mı? Neden? - Sizce açmak pratik miydi? Neden? - Ambalajı açarken ambalajı rahatlıkla tutabildiniz mi? Neden? - Ambalajı açarken fiziksel bir rahatsızlık duydunuz mu? 2 ve 3. Ambalajlar için de aynı işler ve sorular tekrar edecek - Sizce bu ambalajlarda yaralanma riski var mı? - Hangi ambalajın açma yerini şeklini bulmak kolay hangisinde zordu? - Hangi ambalajı açmak pratikti, hangisi pratik değildi? - Hangi ambalajı açarken daha çok güce ihtiyaç duydunuz, hangisinde en az güce ihtiyaç duydunuz? - Ambalajı açarken yardımcı bir alete ihtiyaç olmamasını ister miydiniz? - Ambalajı ilk açılışında yaşadığınız başka sorunlar var mı? - Fiyat ve markaya dair bilgilerinizi göz ardı ederek ambalajın açılması sırasındaki tecrübelerinizi düşündüğünüzde hangi ürünü satın alırdınız? Neden?
ürünün kullanılması	Şimdi size ambalajların içerisindeki ürünlerin kullanılması ile ilgili sorular soracağım.	- Ambalajların içerisinden sırayla birer kaşık salça alır mısınız? - Salçayı ambalajdan çıkarırken bir rahatsızlık duydunuz mu? Nasıl bir rahatsızlık? Sebebi ne olabilir? - Salçayı ambalajdan çıkarırken ne gibi sorunlar yaşadınız? - Ambalajın dibinde kalan salçayı çıkardığınızı düşünürseniz ne gibi sorunlar olabilir? - Salçayı ambalajdan çıkarırken hangi ambalajlar yaralanmalara sebep olabilir? Neden? - Hangi ambalajı kullanım sırasında temiz ve hijyenik buluyorsunuz? - Ürünün kullanılması sırasında bu ambalajlarla ilgili yaşadığınız başka sorunlar var mı? - Fiyat ve markaya dair bilgilerinizi göz ardı ederek ürünün kullanımı sırasındaki tecrübelerinizi düşündüğünüzde hangi ürünü satın alırdınız? Neden?

	Deneğe verilecek bilgiler *devam*	Deneğe sorulacak sorular ve gerçekleştirilmesi istenecek işler *devam*
artan kısmın saklanması	Ürünü bir miktar kullandıktan sonra ambalaj içerisinde geriye kalan kısmın saklanması sırasında yaşadıklarınız ile ilgili sorular soracağım.	- Ambalajları kapatabilir misiniz? - Hangi ambalajı kolaylıkla kapatabildiniz, hangisini kapatamadınız? Sebebi ne olabilir? - Ambalajı kapatırken hangi ambalajlar yaralanmalara sebep olabilir? Neden? - Ambalajı kapatırken yaşadığınız başka sorunlar var mı? - Kapağın olmaması sizce önemli bir sorun mu? - Ürünün artan kısmını saklarken hangi ambalaj yetersiz kalıyor? - Ürünün artan kısmını saklarken başka bir kaba ihtiyaç var mı? - Ürünün artan kısmını saklarken ambalajla ilgili yaşadığınız başka sorunlar var mı? - Fiyat ve markaya dair bilgilerinizi göz ardı ederek ürünün artan kısmının saklanması sırasındaki tecrübelerinizi düşündüğünüzde hangi ürünü satın alırdınız? Neden?
ambalajın tekrar kullanılması	Şimdi sizden ambalajları tekrar açmanızı isteyeceğim ve sorular soracağım.	- Ambalajları tekrar açar mısınız? - Hangi ambalajı tekrar açarken yardımcı alete ihtiyaç duydunuz? Neden? - Ambalajın tekrar kullanımı sırasında yaralanmalara sebep olabilir mi? - Ambalajı tekrar kullanımı sırasında yaşadığınız başka sorunlar var mı? - Fiyat ve markaya dair bilgilerinizi göz ardı ederek ambalajın tekrar açılması sırasındaki tecrübelerinizi düşündüğünüzde hangi ürünü satın alırdınız? Neden?
ambalajın elden çıkarılması	Şimdi size ambalajın elden çıkarılması yani içerisindeki ürün bittikten sonra ambalajın işi bittikten sonraki süreç ile ilgili sorular soracağım.	- Ambalajların içindeki ürünleri tükettikten sonra bu ambalajlar ile ilgili yaşadığınız sorunlar var mı? - Ambalajın elden çıkarılması sırasında yaşadığınız başka sorunlar var mı? - Fiyat ve markaya dair bilgilerinizi göz ardı ederek ambalajın elden çıkarılması sırasındaki tecrübelerinizi düşündüğünüzde hangi ürünü satın alırdınız? Neden?

3. Aşama

Kullanım Değerlendirme Anketi

Bu anket ambalajların kullanımı ile ilgili görüşlerinizi öğrenmek amacı ile hazırlanmıştır. Aşağıdaki soruları cevaplarken ambalajları uygunluk derecesine göre 1'den 4'e kadar sıralayınız.

	1	2	3	4	Hiçbiri
1. Bu ambalajı kullanırken güç sarf ettim.					
2. Bu ambalajı beklentilerime uygun bir hızda kullandım.					
3. Bu ambalajı çok uğraşmadan kullanabildim.					
4. Bu ambalajın üzerindeki bilgileri kolaylıkla bulabildim.					
5. Bu ambalajın üzerindeki bilgileri kolaylıkla okuyabildim.					
6. Bu ambalajın nasıl açılıp kapatılacağını kolaylıkla anlayabildim.					
7. Bu ambalaj yaralanma veya kazalara sebep olabilir.					
8. Bu ambalajı kullanmak güvenlidir.					
9. Bu ambalajı kullanırken yardımcı alete ihtiyaç duydum.					
10. Bu ambalajı kullanmaktan hoşlandım.					
11. Bu ambalajın kullanımını ilginç buldum.					
12. Bu ambalajı kullanırken rahatsızlık hissettim.					
13. Hangi ambalaja sahip ürünü satın almak istersiniz?					
14. Marka ve içerdiği ürünü göz ardı ederseniz sizce hangi ürün daha kaliteliymiş izlenimi veriyor?					

The questions asked to the participants and tasks to be done for tomato paste packages.

Part I

There are nearly same amount of tomato paste all in these packages. When you ignore the contents, its amount, and the cost of the product:

- Which product do you buy? Why?
- Which product is high quality? Why?
- Which package may cause problems? Why?
- When one of these packages causes problems, do your confidence in its brand changes?

Part II

Now I will present these packages in their natural condition without hiding the brand-related visuals since it is not entirely possible to hide the brand-related visuals while you are performing certain tasks. I expect you to answer the questions without taking into acount the cost and brand.

	Information for the participants	**The questions asked to the participants and tasks**
Display and purchase	I will ask some questions regarding choosing a product in a supermarket and purchasing it. Then, I will want to compare these four packages.	- Do you usually look at the expiry date and read the other information on the package? - Could you please find and read the expiry date? - For which package it was easy to find? Why? - For which package it was easy to read? Why? - Could you please find and read the ingredients? - For which package it was easy to find? Why? - For which package it was easy to read? Why? - Do you have any other problems that you encounter in the supermarkets regarding packages? - How the legibility of the information on the package effect your preferences? - Which product do you prefer? Why?

	Information for the participants *continued*	**The questions asked to the participants and tasks** *continued*
Carriage	I will ask some questions about transporting the purchased product from supermarket to a place where it will be consumed.	- What kind of problems do these packages cause while carrying them? - Without taking into account the cost and brand, when you think about your experiences during carriage which product do you prefer? Why?
Storage	I will ask some questions about storing the purchased product in a place until it is consumed.	- What kind of problems occur before you begin to consume the product while storing it? - Without taking into account the cost and brand, when you think about your experiences during storage which product do you prefer? Why?
Initial opening	I will present some equipment to you and I will want you to open these packages.	- Could you please open the first package? - Have you experience problem while trying to find out the way of opening? Why? - In your opinion, is this package practical to open? Why? - Do you easily and comfortably hold the package while opening? Why? - Do you feel any physical discomfort while opening? For the 2nd, 3rd, and 4th packages the same questions and tasks will be repeated. - Do you think any of these packages may cause injuries? - For which package it was easy to find out the way of opening and for which it was difficult? - Which package was practical to open and which was not? - Which package requires more force to open it and which requires less when compared to the other packages? - Do you want to be able to open a package without an opening tool? - Did you experience any other problems while opening these packages? - Without taking into account the cost and brand, when you think about your experiences during initial opening which product do you prefer? Why?

	Information for the participants *continued*	**The questions asked to the participants and tasks** *continued*
Usage	I will ask some questions about getting out the contents to use.	- Could you please get out a spoon of tomato paste from each package? - Have you experienced any difficulty or discomfort while getting out the tomato paste? What kind of discomfort did it? What can be the reason of that problem? - While getting out the content which was at the bottom, what kind of problems may occur? - Which package may cause injuries while getting out the content? Why? - Which package is clean and hygienic during use? - Do you have any other problems during use? - Without taking into account the cost and brand, when you think about your experiences during use which product do you prefer? Why?
Re-storage	I will ask some questions about re-storing the leftover part of the contents for the next uses.	- Could you please close the packages? - Which package is easy to close and which is not? Why? - Which packages may cause injury while closing? Why? - In your opinion, is it important for a package to have a closure? Why? - Which package is not satisfactory for re-storage? - For which package another container is necessary to re-store? - Do you have any other problems during re-storage? - Without taking into account the cost and brand, when you think about your experiences during re-storage which product do you prefer? Why?
Re-use	I will want you to re-open and re-use the packages.	- Could you please open the packages again? - For which package have you used an opening tool while re-opening? Why? - Which packages may cause injury while re-opening and re-using? Why? - Do you have any other problems during re-use? - Without taking into account the cost and brand, when you think about your experiences during re-use which product do you prefer? Why?

	Information for the participants *continued*	**The questions asked to the participants and tasks** *continued*
After-use	I will ask some questions about recycling, reusing the package for another purpose, and just throwing it away.	- After consuming the contents do these packages present any problems? - Without taking into account the cost and brand, when you think about your experiences during after-use which product do you prefer? Why?

Part III

Questionnaire for the evaluation of package use

This questionnaire was designed to learn your overall opinions about the presented packages. Could you please list the packages in order based on their appropriateness to the statements below?

	1	2	3	4	None
1. This package needed force during use.					
2. I used this package quickly as I expected.					
3. I used this package without much struggle.					
4. I was able to find the information on the package easily.					
5. I was able to read the information on the package easily.					
6. It was easy to understand how to open this package.					
7. This package may cause accidents and injuries.					
8. I felt, it was safe while using this package.					
9. I needed a tool while using this package.					
10. I pleased with the use of the package.					
11. This package was interesting to use.					
12. I felt discomfort during use of this package.					
13. Which product would you like to purchase?					
14. Without taking into account the cost and brand, which product seems higher quality when compared to others?					

APPENDIX E

OPINIONS OF THE PARTICIPANTS BEFORE THEY USED THE PACKAGES

The rates in the tables imply the number of participants who gave a comment out of all.

1. Statements while making purchase decisions

	Usability	Visual appearance	Hygiene	Material	Safety
tomato paste packages	- Ease of placing on refrigerator shelves (3/8) - Ease of opening (2/8) - Ease of gripping (2/8) - Ease of storage of leftover parts (1/8) - Usefulness (1/8)	- Package having nice appearance (2/8) - Ability to see the inside of the package (2/8) - Package being likeable and cute (1/8)	- Package being healthy (3/8)	-Package being made of glass (1/8)	-Package having safety band (1/8)
juice packages	- Ease of opening (3/8) - Package being usable with screwed-lid (1/8) - Ease of drinking due to having a narrow brim (1/8) - Ease of gripping (1/8) - Package being practical to use (1/8) - Package being suitable for outdoors (1/8)	- Package having nice appearance (2/8) - Package having different appearance (1/8) - Package being charming (2/8)	- Package having safety band (1/8)		

2. Statements about perception of quality

	Visual appearance	Material	Usability	Hygiene
tomato paste packages	- Transparency (2/8) - Pleasant appearance (2/8) - Nice colour (2/8) - Good design (2/8)	- Package being made of glass (5/8) - Package having thick glass (1/8)	- Ease of opening (1/8) - ease of usage (1/8)	- Package being healthy (1/8)
juice packages	- Pleasant appearance (2/8) - Charm (2/8) - Nice and different lid (1/8) - Good design (2/8) - Shiny material (2/8)			

3. Stated problems

	Usability	Safety	Material	Hygiene
tomato paste packages	- Difficulty in opening (7/8) - Difficulty in use (2/8) - Difficulty in storing the leftover content (1/8) - Need for an opening tool (1/8) - Content's suffering damage while opening (1/8)	- The risk of injury (2/8) - Need for a knife for opening (1/8)	- Package being made of tin (1/8)	- Package being unhealthy (1/8)
juice packages	- Difficulty in opening (4/8) - Need for an opening tool (4/8) - Slippery surface (1/8) - the ring breaking off (3/8) - Context's pouring out while drinking (1/8)			

APPENDIX F

OBSERVATIONS AND USER COMMENTS ON PRESENTED PACKAGES

The rates in the tables imply the number of participants who had a problem with presented packages and who gave a comment out of all.

Observations and user comments on tomato paste packages for display & purchase phase

	Observations	User comments
A1	▪ Difficulty in reading the expiry date (3/8). ▪ First place to look for the expiry date is the top of the lid (8/8).	▪ It is difficult to read the expiry date since the expiry date is printed on colorful brand-related visuals (2/8). ▪ The ease of reading the expiry date results from the quality of the print and its being placed on the top of the lid (6/8). ▪ When the information is printed on the right part of the label, it is easy to find (1/8).
B1	▪ Difficulty in finding the expiry date (8/8). ▪ Failures to find the expiry date since it is on an inconceivable place, on the side of the lid. (2/8). ▪ Misleading information on the place of expiry date (2/8). ▪ Difficulty in reading the expiry date since the print color is black on a dark blue surface (5/8). ▪ Failure to read the expiry date (1/8). ▪ Difficulty in finding the ingredient information since there is no sign for it (8/8). ▪ The first place to look for the expiry date is the top of the lid (7/8) and the label (1/8).	▪ Expiry date is on the worst place for finding it (4/8). ▪ The problem with finding and reading the expiry date results from wrong colour choices and print place (2/8). ▪ The information about the expiry date on the label is wrong (2/8).

C1	▪ Difficulty in finding the expiry date (2/8). ▪ Failure to find the expiry date (1/8). ▪ Misleading information on the place of expiry date (1/8). ▪ Difficulty in finding the information on ingredients since distinguishing the expiry date from the other information on the lid is difficult (3/8). ▪ The first place to look for the expiry date is the top of the lid (7/8).	▪ Cans' expiry date is usually printed on the bottom (2/8). ▪ Expiry date should be found immediately, otherwise it is a time consuming situation (1/8). ▪ The ease of reading the expiry date results from the quality of the print and the size of the typography (1/8).
D1	▪ Difficulty in reading the expiry date since it is indistinct (2/8). ▪ Difficulty in finding the information for ingredients (1/8). ▪ Difficulty in reading the information for ingredients (2/8). ▪ First place to look for the expiry date is the top of the lid (7/8).	▪ Top and bottom of the package seem to be the same since it has not got an opening ring that causes difficulty in finding the expiry date (1/8). ▪ The expiry date is indistinct (2/8). ▪ The information for the ingredients is not a conspicuous place (1/8). ▪ The information for the ingredients is difficult to read since it is printed on a wavy surface (1/8).

Observations and user comments on juice packages for display & purchase phase

	Observations	**User comments**
A2	▪ Difficulty in finding the expiry date since distinguishing the expiry date from the other information on the lid is difficult (4/8).	▪ There is no sign showing the expiry date (2/8). ▪ It is easy to find the expiry date since it is on the top (2/8). ▪ In general, the expiry date is printed below the production date, however, there is no production date and the expiry date is above all the other information (2/8). ▪ It is easy to read the expiry date since the size of the numbers are big (3/8), the print colour is dark and the print surface is bright (2/8). ▪ It is easy to find the ingredients because it is printed on the right part of the label (1/8) and it is separated from the other information (1/8). ▪ It is easy to read the ingredients since it is on a light and uniform colour (1/8).

B2	▪ Difficulty in reading the expiry date due to the size of the numbers and due to low contrast between the surface and print color (4/8).	▪ It is easy to find the expiry date since it is on the top (2/8). ▪ It is difficult to read the expiry date since its size is too small (2/8). ▪ It is easy to find the information on ingredients since it is printed on the right part of the label (1/8) and it is separate from the other information (1/8). ▪ It is easy to read the information since it has clear printing (2/8).
C2	▪ Failure to read the expiry date (2/8). ▪ Difficulty in finding and reading the ingredient information since it was vertically printed (8/8). ▪ Difficulty in finding and reading the ingredients since it is on a colorful surface (4/8).	▪ It is easy to find the expiry date since there is a sign for it (1/8). ▪ It is difficult to read the expiry date since it is on the brand-related visuals (1/8). ▪ It is easy to read the expiry date because it is on a large surface (2/8) and the numbers are big (2/8). ▪ Printing the information vertically is a bad idea; it should be parallel to the base (1/8). ▪ It is difficult to read the ingredients because it is printed among other information (1/8).
D2	▪ Failure to read the expiry date (4/8). The errors result from the size, the colorful print surface, and the absence of a sign for it. ▪ Some of the information is printed vertically and some is printed horizontally, thus it is necessary to lie the bottle on its side then raise it to find the ingredients (8/8).	▪ It is difficult to find and read the expiry date since it is too small (1/8), and it is mixed with other information on the lid (2/8) ▪ Printing the information vertically is a bad idea; it should be parallel to the base of the bottle (1/8). ▪ It is difficult to read the ingredients due to the bad quality of the print (2/8). ▪ It is difficult to read the ingredients because it is printed among other information (1/8).

User comments on tomato paste packages for carriage phase

	User comments
A1	▪ These glass packages can easily be broken (7/8). ▪ Glass packages are heavier than tins (2/8).
B1	▪ The sound of bumping into each other in the carry bag is annoying (1/8). ▪ These packages should be carried carefully (2/8).
C1	▪ The tins can damage the carry bag (3/8).
D1	▪ There is no problem with tins while carrying (5/8).

User comments on juice packages for carriage phase

	User comments	
A2		▪ There is no problem with these packages while carrying (3/8). ▪ It is an unimportant phase (1/8). ▪ Because they are all made of glass, they can easily be broken (4/8).
B2	▪ The lid can tear the carry bag (1/8).	
C2		
D2	▪ The ring might catch to other things in the bag (1/8). ▪ The ring can break apart in the bag (1/8). ▪ The lid can open by itself (1/8).	

User comments on tomato paste packages for storage phase

	User comments	
A1		▪ There is no problem with these packages while storing them (5/8).
B1	▪ It is easy to store on refrigerator shelves because of its thinness (3/8).	
C1		
D1		

User comments on juice packages for storage phase

	User comments	
A2		▪ There is no problem with these packages while storing them (4/8).
B2	▪ It needs less space to store because of its thinness (2/8).	
C2		
D2	▪ The ring might catch to other stuff in the refrigerator (2/8).	

Observations and user comments on tomato paste packages for opening phase

	Observations	User comments
A1	▪ Difficulty in gripping the safety band (4/8). ▪ Trying to tear away the safety band by using knife (1/8). ▪ Difficulty in removing the safety band after the lid was opened (4/8). ▪ Tearing away the safety band before opening the lid (4/8) (mean time: 14 secs). ▪ Opening the package while the safety band is on the lid (4/8) (mean time: 8 secs).	▪ It is not easy to tear away the safety band without long fingernails (1/8). ▪ It is easy and practical to open (6/8). ▪ The safety band makes opening difficult (2/8). ▪ The handling of this package is not comfortable because of its width (2/8). ▪ The handling of this package is comfortable because of its width (3/8). ▪ The surface of the jar is slippery because of its smoothness (1/8).
B1	▪ Difficulty in gripping the safety band (4/8). ▪ Difficulty in removing the safety band after the lid is opened (4/8). ▪ Difficulty in opening the lid (2/8). ▪ Tearing away the safety band before opening the lid (4/8) (mean time: 12 secs). ▪ Opening the package while the safety band is on the lid (4/8) (mean time: 6 secs)	▪ There are holes on the safety band for easy tear and a red sign showing its place, thus it is easy to find and tear (1/8). ▪ This lid needs more force to open when compared to the lid of A1 (1/8). ▪ It is easy to open the lid (6/8). ▪ It is easy to open because of the jar's thinness that causes comfortable grip (2/8).
C1	▪ Reluctance to open (2/8). ▪ Difficulty in pulling the ring (8/8). ▪ Difficulty in gripping the ring because of its closeness to the surface (8/8). ▪ Using knife to raise the ring to grip it (2/8). ▪ Sinking of the lid into the can after opening (3/8). ▪ Smearing of the content to hand when the lid sinks (3/8). ▪ Twisting of the lid while opening (2/8).	▪ The ring causes broken fingernails (1/8). ▪ This ring causes anxiety about hurting the finger (1/8). ▪ The ring causes pain on finger (1/8). ▪ The ring can be broken while opening (2/8). ▪ The sharp edges can cause injury (4/8). ▪ It is hard to open and it needs force to open (6/8). ▪ The lid might be dirty, thus it is annoying when the lid sinks into the tin (1/8). ▪ Opening this package is disgusting (2/8).

D1	▪ Reluctance to open (2/8). ▪ Trying to open the can by using knife and also using knife normally at home (1/8). ▪ Sinking of the lid into the can after opening (6/8). ▪ Using knife to take out the lid from the inside of the can (3/8).	▪ Opening this tin causes time-loss (2/8). ▪ Opening this tin is disgusting (2/8). ▪ Generally knife is used to open this type of tins (2/8). ▪ The sharp edges can cause injury (5/8). ▪ I had been injured before while opening this type of package (1/8). ▪ There is a need for someone else to open (2/8). ▪ The lid might be dirty, thus it is annoying when the lid sinks into the tin (1/8). ▪ Taking out the lid from the inside of the tin is time consuming (1/8). ▪ Taking out the lid from the inside of the tin may cause injury (2/8). ▪ While taking out the lid from the inside of the tin, the content smears to lid and hand (1/8).

Observations and user comments on juice packages for opening phase

	Observations	User comments
A2	▪ Pouring out of the content and smearing to hand while opening (1/8).	▪ It is very easy to open (8/8). ▪ It is practical to open (5/8). ▪ The sound emerging from the safety button while opening causes anxiety (1/8). ▪ Handling of the bottle is uncomfortable because of its width (1/8).
B2	▪ Trying to open the cap by hand (1/8). ▪ Need for an opening tool (8/8). ▪ Slippery bottle surface causes slippage while trying to open (2/8).	▪ It is not practical to open (5/8). ▪ It needs great force to open (8/8). ▪ An opening tool is a must to open (1/8). ▪ It is difficult to open (4/8). ▪ It is practical to open because of accustom to open (3/8). ▪ If it can be opened by turning the lid like beer bottles, it would be better (1/8). ▪ This type of bottle usually opened by hitting the lid to a strong thing (1/8). ▪ The content can be poured out while opening (5/8). ▪ There must be a texture on the bottle to prevent slippage (2/8).

C2	▪ Difficulty in gripping the safety band with fingernails (4/8). ▪ Trying to tear away the safety band by using knife (1/8). ▪ Getting angry while trying to tear away the safety band (1/8). ▪ Difficulty in removing the safety band after the lid is opened (4/8). ▪ Pouring out of the content while opening (1/8). ▪ Tearing away the safety band before opening the lid (5/8) (mean time: 18 secs) ▪ Opening the package while the safety band is on the lid (3/8) (mean time: 5 secs).	▪ Tearing away the safety band causes time-loss (1/8). ▪ There is no sign showing the tearing place on the safety band (2/8). ▪ The safety band gives the feeling of confidence about the product (1/8). ▪ The handling is comfortable (5/8). ▪ The texture on the bottle prevents slippage (2/8). ▪ It is not practical to open because of the safety band (3/8). ▪ It is not easy to tear away the safety band without fingernails (1/8). ▪ If the fingernails are not long enough a knife is necessary to tear the safety band (1/8).
D2	▪ Failure to open the lid (4/8). ▪ Failure to completely open the lid (4/8). ▪ Difficulty in understanding how to grip the ring (5/8). ▪ Narrowness of the ring causing finger pinch (8/8).	▪ It is necessary to apply force to open (8/8). ▪ Opening the package is difficult since one should do two types of actions (1/8). The first action is pulling the ring back to tear the top of the lid and the second action is pulling upwards to remove the lid from the bottle. ▪ The ring is not strong enough to pull it can break off (2/8). ▪ The ring causes pain on the finger (8/8). ▪ This package is not suitable for children because of the risk of injury (1/8). ▪ I hate opening this package (3/8). ▪ The content might pour out while opening (4/8).

Observations and user comments on tomato paste packages for usage phase

	Observations	User comments
A1		▪ It is easy to take out the content even if little is left at the bottom since the brim of the jar is wide (5/8). ▪ The brim of the jar is too narrow to remove the content when using a spoon (2/8). ▪ It feels hygienic during use since it is made of glass and can be cleaned up easily (3/8). ▪ It feels clean during use (2/8). ▪ While taking out, the content can smear to hand (1/8). ▪ It is easy to take out the content since the jar has no recess (1/8). ▪ It is good to see the inside of the package (1/8).
B1		▪ The brim of the jar is too narrow to take out the content (6/8). ▪ It is hygienic during use since it is made of glass and can be cleaned up easily (3/8). ▪ It feels clean during use (2/8). ▪ It is good to see the inside of the package (1/8).
C1		▪ It is easy to take out the content (3/8). ▪ It can cause injury while taking out the content (4/8). ▪ While taking out, the content and spoon can attach to the edges of the tin (2/8).
D1	▪ While taking out, smearing of the content to the hand (1/8).	▪ It is easy to take out the content (5/8). ▪ It is easy to take out the content since the edge is smooth (1/8). ▪ It can cause injury while taking out the content (5/8).

Observations and user comments on juice packages for usage phase

	Observations	User comments
A2	▪ Pouring out of the content through the edge of the bottle while transferring it to the glass (5/8).	▪ It pours out through the edges of the bottle while drinking and transferring it to a glass since its brim is wide (5/8). ▪ While drinking or pouring, one should be careful (2/8). ▪ Whether it is poured out or not is important (1/8). ▪ It is easy to pour the content because of its wide brim (1/8). ▪ The brim should be narrow for ease of drinking (1/8).

B2	▪ Dripping of the content while pouring to the glass (1/8).	▪ It is easy to drink and pour to a glass (4/8). ▪ The content is poured out suddenly because of the narrowness of the brim (1/8). ▪ To prevent slippage, there should be texture on the bottle (1/8). ▪ It is easy to handle because of its thinness (1/8).
C2	▪ Pouring out of the content the edge of the bottle while transferring it to the glass (6/8).	▪ It pours out through the edges of the bottle while drinking and transferring it to a glass since its brim is wide (4/8). ▪ While drinking or pouring, one should be careful (2/8). ▪ The brim should be narrow for ease of drinking (1/8). ▪ Whether it pours out or not is important (1/8). ▪ Bottle design causes the content pours out (1/8).
D2		▪ It is easy to drink from this bottle since its brim is narrow (1/8). ▪ It is not easy to handle due to the curves on the bottle (1/8).

Observations and user comments on tomato paste packages for re-storage phase

	Observations	**User comments**
A1	▪ Trying to close the lid without taking out the safety band (1/8).	▪ It is easy to close (4/8). ▪ It is difficult to close since the handling of the jar is difficult (1/8). ▪ The content can be preserved in jar after opening (8/8). ▪ Glass packaging preserves foods for a long time (1/8).
B1	▪ Trying to close the lid without taking out the safety band (1/8). ▪ Lid slippage while closing (1/8).	▪ It is easy to close (5/8). ▪ This lid is stronger than the lid of A1 (1/8). ▪ It is easy to close since the lid has wide threads (1/8). ▪ It is easy to grip while closing since the jar is thin (1/8). ▪ The lid does not fit well on the jar (1/8). ▪ The content can be preserved in jars after opening (8/8). ▪ Glass packaging preserves foods for a long time (1/8).

C1	▪ Falling of the lid into the tin (1/8). ▪ Smearing of the content to the hands (2/8). ▪ Discomfort because of the probability of smearing (8/8).	▪ There is a risk of injury while closing (5/8). ▪ The lid causes injury if it has sharp edges (2/8). ▪ While opening, the lid was deformed, so it is difficult to close it back (4/8). ▪ The lid is usually thrown away after opening (1/8). ▪ The content is always preserved in another container (5/8). ▪ For tins, after opening the content easily spoils, gets moldy, and dries (6/8). ▪ The package gets rusty after opening (1/8). ▪ A lid is necessary to preserve the content from air and microbes (4/8). ▪ One can not consume this type of product in a short time, so, it spoils in this type of package (1/8). ▪ An open tin in the refrigerator has an unpleasant visual appearance (1/8). ▪ An open tin causes a bad smell in the refrigerator (2/2). ▪ If it will be preserved in this type of package oil should be put on it (1/8).
D1	▪ Lid's falling into the can (2/8). ▪ Discomfort because of the probability of smearing (8/8). ▪ The content's smearing to hand (3/8).	▪ It is easy to close (1/8). ▪ There is a risk of injury (7/8). ▪ The lid causes injury if it had not been thrown away or it has sharp edges (2/8). ▪ The content is always preserved in another container (5/8). ▪ For tins, after opening the content easily spoils, gets moldy, and dries (6/8). ▪ The package gets rusty after opening (1/8). ▪ A lid is necessary to preserve the content from air and microbes (4/8). ▪ One can not consume this type of product in a short time, so, it spoils in this type of package (1/8). ▪ An open tin in the refrigerator has an unpleasant visual appearance (1/8). ▪ An open tin causes a bad smell in the refrigerator (2/2). ▪ If it will be preserved in this type of package oil should be put on it (1/8).

Observations and user comments on juice packages for re-storage phase

	Observations	User comments
A2		▪ It is easy to close (8/8). ▪ There is no problem with re-storage, because it has a re-closable lid (8/8).
B2		▪ It is necessary to apply force to close the lid (2/8). ▪ It can not be closed completely (4/8). ▪ If the lid was deformed while opening, it cannot be closed (1/8). ▪ These types of lids are usually thrown away after opening, thus it cannot be closed (1/8). ▪ Re-closing the package is important for juice packages (1/8). ▪ When it is opened, all the contents should be consumed because it cannot be re-closed (1/8). ▪ It should be re-closeable for outdoor use (2/8). ▪ The content might leak out, because it cannot be closed completely (1/8). ▪ The content spoils if it cannot be closed (2/8). ▪ If it is put in refrigerator, the smell of the content changes (1/8).
C2	▪ Trying to close while the safety band is on the lid (1/8).	▪ It is easy to close (7/8). ▪ There is no problem with re-storage, because it has a re-closable lid (8/8).
D2		▪ It can cause injury while trying to re-close (1/8). ▪ It cannot be closed (4/8). ▪ Closing the package is important for juice packages (1/8). ▪ When it is opened, all the contents should be consumed because it cannot be re-closed (1/8). ▪ It should be re-closeable for outdoor use (2/8). ▪ It can not be re-closed, so the content spoils (4/8). ▪ If it is put in refrigerator, the smell of the content changes (1/8).

Observations and user comments on tomato paste packages for re-use phase

	Observations	User comments
A1		▪ It is easy to re-open (1/8).
B1		▪ It is easier to re-open (2/8).
C1	▪ Breakage of the lid during the second opening (3/8).	▪ The lid shouldn't be broken (1/8). ▪ The lid is usually thrown away after opening since it is difficult to re-open (1/8). ▪ To take out the lid from the can a knife is necessary (2/8). ▪ There is a risk of injury while re-opening (1/8). ▪ The content might smear to hand during re-use (1/8).
D1	▪ Using knife to take out the lid from the can (7/8). ▪ Smearing of the content to the hand (3/8). ▪ Getting the lid caught in the tin while re-opening (1/8).	▪ The content can smear to hands during re-use (2/8). ▪ There is a risk of injury while re-opening (3/8). ▪ The lid shouldn't be broken (1/8). ▪ The lid is usually thrown away after opening since it is difficult to re-open (1/8).

Observations and user comments on juice packages for re-use phase

	Observations	User comments
A2		▪ It has no problem while re-opening (8/8). ▪ It is very easy to re-open (1/8).
B2	▪ Needing an opening tool to re-open (8/8).	▪ An opening tool is necessary again (5/8). ▪ The content can pour out while opening (1/8). ▪ It can cause injury while re-opening (1/8). ▪ The re-opening of this package is difficult (1/8).
C2	▪ Falling from hand of the lid while trying to re-open (2/8).	▪ It has no problem while re-opening (7/8). ▪ It is too easy to re-open (1/8). ▪ The lid's surface is sticky because juice was smeared on during initial opening (1/8).

D2		▪ It cannot be re-opened since there is no way to close it (3/8). ▪ The ring can break off (1/8).

User comments on tomato paste packages for after-use phase

	User comments
A1	▪ Glass packages may tear the garbage bag (1/8). ▪ Glass packages make weight in the garbage bag (1/8). ▪ Jars are not thrown away, they are usually reused (6/8).
B1	
C1	▪ Tins may tear the garbage bag (4/8). ▪ Tins occupy too much space in the garbage bag (3/8). ▪ Tins may cause injury while trying to compress the garbage bag (3/8).
D1	

User comments on juice packages for after-use phase

	User comments
A2	▪ There is no problem with these packages (7/8). ▪ Because they are glass they may be broken in the garbage bag (1/8). ▪ They may cause injury if they were broken (1/8). ▪ They can be used for another purposes since they are made of glass (2/8). ▪ Gathering the glass bottles to put in recycle-bin (1/8).
B2	
C2	
D2	