

DESIGN FOR EMOTIONAL DURABILITY: THE CASE OF HOUSEHOLD LIGHT DESIGN

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Abstract: Designers' hands-on experience in research through design process contributes them to produce and share knowledge from their own design practices. In this study, the primary purpose was exploring sustainable design concepts and developing solutions for improving the product lifespan of household light with research through design process. With a particular focus on "emotionally durable design", "product personalisation", and "localisation" were considered fruitful concepts. The do-it-yourself (DIY) approach, which means that users participate in production, and the halfway product rationale, which leaves space for users to complete the production, were the concepts used in personalisation. The outcome of the research through design process was a wall lamp manufactured with different scales of production, involving personalisation features facilitated by DIY and halfway product rationale. For "localisation", different scales of production opportunities were explored, and a design kit as a halfway product was considered as a sustainable design solution. DIY approach was benefited for producing complementary lace lampshade. In the design for sustainability framework, it is seen that experimenting and engaging with locally available materials and manufacturing capabilities in the research through design process nurtured developing sustainable design solutions.

Keywords: Research Through Design, Sustainability, Emotional Durability, Do-It-Yourself, Halfway Products.

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DUYGUSAL DEVAMLILIK İÇİN TASARIM: EV AYDINLATMASI TASARIMI ÖRNEĞİ

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Özet: Tasarımcıların, tasarım yoluyla araştırmadaki aktif katılımlı deneyimi, kendi tasarım uygulamalarından bilgi üretmesi ve bunu paylaşmasında etkilidir. Bu çalışmada birincil amaç, tasarım yoluyla araştırma süreciyle bir ev aydınlatmasının ürün ömrünü iyileştirmek için sürdürülebilir çözümler geliştirmektir. “Duygusal devamlılık için tasarım”a özel bir odaklanma ile “ürün kişiselleştirme” ve “yerelleştirme” etkili sürdürülebilir tasarım yaklaşımları olarak ele alınmıştır. Kullanıcıların üretime katılması anlamına gelen kendin-yap yaklaşımı ve kullanıcılara yapımı tamamlaması için alan bırakan yarı ürün mantığı, kişiselleştirme açısından yararlanılan kavramlar olmuştur. Tasarım yoluyla araştırma sürecinin çıktısı, farklı üretim ölçekleriyle üretilmiş, kendin-yap ve yarı tamamlanmış ürün mantığı ile kişiselleştirmeyi kolaylaştıran özellikleri içeren bir duvar lambasıdır. “Yerelleştirme” için farklı ölçeklerde üretim fırsatları araştırılmış ve yarı tamamlanmış ürün olarak bir tasarım kiti, sürdürülebilir bir tasarım çözümü olarak kabul edilmiştir. Tamamlayıcı dantel abajurun üretiminde kendin-yap yaklaşımından yararlanılmıştır. Sürdürülebilirlik için tasarım çerçevesinde, yerel olarak mevcut malzeme ve üretim yeteneklerinin tasarım yoluyla araştırma süreciyle denenmesi ve bunlarla etkileşime geçilmesinin sürdürülebilir tasarım çözümlerinin geliştirilmesini beslediği görülmektedir.

Anahtar Kelimeler: Tasarım Yoluyla Araştırma, Sürdürülebilirlik, Duygusal Devamlılık, Kendin-Yap, Yarı Tamamlanmış Ürünler.

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1. INTRODUCTION

Many sources typically describe the term sustainability as a capability of a system to endure and maintain itself. Sustainability is concerned with meeting our own needs without compromising the ability of future generations to meet their own needs (Brundtland Commission, 1987, p. 16). It has a multidisciplinary use and meaning, and various disciplines may apply this term differently.

Design for sustainability is concerned with the industry's environmental, social and economic issues by reconsidering contemporary production and consumption habits (Bhamra and Lofthouse, 2007, p. 28). The evolution of the response from the design discipline to sustainability issues marks the broad field of design for sustainability. These can occur in four different innovation levels: At the Product Innovation Level, design approaches focus on improving existing or developing completely new products. For the Product-Service System Innovation Level, the focus is on integrating products and services like business models. Spatio-Social Innovation Level addresses the context of human settlements and their communities from neighbourhoods to cities. The Socio-Technical System innovation level involves design approaches that promote radical changes on how societal needs, such as nutrition, transport and mobility are addressed (Ceschin and Gaziulusoy, 2016, p. 120).

Although designers can shape products and services that directly influence society and the environment (Papanek, 1971, p. 38), consumer behaviour during the use phase often determines the impacts (Bhamra et al., 2011, p. 441). It can be demanding to influence user behaviour when consumers are reluctant to adopt more sustainable habits (De Vries, 2006, p. 119). However, the designers are also crucial agents to influence user behaviour towards more sustainable practices (Bhamra et al., 2011, 428;

Lilley, 2009, p. 705). One of the most prominent design strategies to extend product lifespan by encouraging more sustainable behaviours is "emotional durability" or "emotionally durable design", which is concerned with the role of design in strengthening the user-product relationship to lengthen product lifetime.

2. RESEARCH THROUGH DESIGN APPROACH

"Research through design", which has also been termed practice-led research, has been used for over 20 years within the design community as a specific term to describe practice-based inquiry (Durrant et al., 2017, p. 3). In research through design approach, design practice is used to establish an evidence base for exploration. It includes a researcher carrying out a design project subordinate to the stated research goals and objectives. Therefore, the fundamental motivation of practice-led researchers is to produce and share new knowledge from their own design practices (Pedgley, 2007, p. 463).

Research through design frames making objects, interventions, processes to gain knowledge and involves the strategies of the practitioner, such as reflection in action, participant research and action research (Bang et al. 2012, p. 2). In certain situations, research through design approach may be the most convenient way to shed light on a proposal, a principle or material, a method or a function by constructing, implementing or testing it (Herriott, 2019, p. 4).

Research through design in a design project case study provides practical approaches to acquiring in-depth knowledge. It provides a catalyst for a holistic, craft-based approach in which form, construction and material are considered together by increasing the designer's awareness through the knowledge acquired (Pinski et al., 2017, p. 2).

3. EMOTIONAL DURABILITY AS A SUSTAINABLE DESIGN APPROACH

Design for sustainability requires reconsidering current production and consumption patterns at both societal and individual levels (Dogan, 2012, p. 321). According to Chapman (2009, p. 29), behavioural conditions that trigger and affect patterns of material consumption is an essential issue for product design for sustainability.

Therefore, the meaning and place of products in consumers' lives and their throwaway habits concern sustainable design. One of the designers' prominent roles is to raise awareness for product value, longevity, and meaning to encourage sustainable and responsible production and consumption habits (Dogan and Walker, 2008, p. 277; Dogan, 2012, p. 320).

Sustainable design approaches provide a range of strategies to prolong product lifespan. However, for certain types of products, the lifespan is not induced by technical problems. Instead, most discarded items still work properly (Van Nes and Cramer, 2005, p. 290). In some instances, this is due to psychological obsolescence, such as discarding products for changes in the perceived desires of consumers, a desire for social status emulation, or new trends in fashion and style (Cooper, 2005, p. 57).

The intangible and ethereal nature of the psychological functions of products makes it a challenging task for designers to achieve greater emotional longevity in products (Chapman, 2009, p. 32). Many of these non-utilitarian meanings are associated with connotations of ideas, memories, stories, and emotions. These connotations would accumulate additional meaning to the objects (Walker, 2010, p. 58).

While designing those meanings into an object exceeds the designer's commitment, the product's functionality, usefulness, and desirability need to sustain over time to empower such meanings to accumulate (Walker, 2010, p. 53).

Product attachment involves the presence of an emotional bond between the user and the product (Schifferstein and Zwartkruis-Pelgrim, 2008, p. 1). Popular labels used to describe this design approach are the "emotionally durable design (EDD)" or "design for product attachment" (Ceschin and Gaziulusoy, 2016, p. 123). EDD is a user-centred approach that explore the ways of thinking product longevity. It investigates and articulates the underlying emotional experiences between products and consumers to identify the complex emotional dynamics behind why we use, consume, and discard certain items more quickly than others (Haines-Gadd et al., 2018, p. 2). Product Attachment is defined as the "strength of the emotional bond a consumer experiences with a durable product" (Cooper, 2005, p. 62; Mugge, 2007, p. 12, Mugge et al., 2008, p. 426; Page, 2014, p. 266; Schifferstein and Zwartkruis-Pelgrim, 2008, p. 1). By fostering a robust emotional relationship or attachment between the user, this approach promotes slowing down product replacement. The conceptual framework of this approach is based on the theory that consumers are more willing to hold on to objects with which they have a profound psychological link, engage in more protective and preservation behaviours toward those objects, treat them with care, repair them when they break down and put off replacing them as late as possible. As a result, this psychological attachment to a product might lead to an improved product lifetime (Ko et al., 2011, p. 582). Therefore, product longevity must consider psychological lifetime of the product beside the physical, since long lasting products may serve little if it does not expose the experiences which evoke the desire to keep it (Chapman, 2005, p. 52).

Despite applying appropriate design strategies, designers may encounter some limitations. Firstly, the user may not attribute a particular meaning to the product. Secondly, these design

strategies may be irrelevant for utilitarian product categories. Thirdly, extending longevity beyond a certain point might negatively impact specific product categories that may require energy-efficiency improvements. Finally, manufacturers might refrain from implementing product attachment strategies to keep sales high (Mugge et al. 2005, p. 45-46; Cheschin and Gaziulusoy, 2016, p. 123).

Although designers have several limitations, the “emotionally durable design” paradigm has many implications to extend product attachment, thus lifespan. Product designers need to reconsider prolonging attachment duration and provide solutions for the product not being obsolete in a short time. It is known that despite still being perfectly usable, most products’ life in a vibrant sense may exhaust. The immaterial defect occurs between the subject and the object, caused by the incapacity of products in evolving to establish sustaining relationships between user and product (Chapman, 2009, p. 27).

An empirical study by Chapman questioning the meaning and places of objects in people’s lives and the contribution of material goods during the use phase uncovered that the following six experiential themes form the value of a product:

- *Narrative*, which is defined as sharing a common history with the product and memorial of the owning the object,
- *Detachment*, which means no emotional connection between the owner and the product or low-level dynamic demand or expectation,
- *Surface*, which denotes that the object is physically ageing well and developing a tangible character through time,
- *Fiction*, which can be regarded as a satisfying relationship with the product due to features still being explored and discovered,
- *Consciousness*, which implies that the product

is perceived as autonomous, and the interaction with it is an acquired skill that can only be learned through practice (Chapman, 2008, p. 16-17).

Considering Chapman’s framework, the reminders of the owned object (narrative), the emotional bond created by the meaning it serves (attachment), and evolving features of products creating a pleasing interaction (fiction) can be regarded as the empowering perceived qualities of a product for emotional durability. Empowering the users as active participants of production can change the behavioural nature of engagement with products. This participation can alter the wasteful and unsatisfactory character of material experience. One of the design strategies to enable the user as active participants of design, use and post-use phases can be “product personalisation” (Van Nes and Cramer, 2005, p. 296).

3.1. Product Personalisation

Product personalisation is defined as a process that defines or changes the aesthetic or functional qualities to increase its relevance to an individual (Blom, 2000, p. 313; Mugge et al., 2009, p. 468).

There are several reasons for users to personalise their products. First of all, personalising a product can increase the fit to individual functional and aesthetic preferences (Schreier, 2006, 319; Franke and Piller, 2003, p. 597), enhance its ease of use (Blom and Monk, 2003, p. 226), serve for reflecting personal or group identity, represent ownership of the product and communicate this ownership (Weightman and McDonagh, 2003, p. 39). The inherent pleasure makes the personalisation process an engaging activity (Mugge et al., 2009, p. 468).

Mugge et al. (2009, p. 472) showed that product personalisation could serve as a potential design strategy to stimulate emotional bonding with products. If personalisation takes a great deal of

effort and the individual is engaged in developing the product for a more extended time, the emotional connection with the outcome would increase. A personalised product may have a unique sense of self-expression to the user, which leads people to justify possession as special (Csikszentmihalyi and Rochberg-Halton 1981, p. 95). One of the design strategies to enable personalisation in products can be integrating the do-it-yourself (DIY) approach to the production or use phases.

3.2. Do-It-Yourself (DIY) Approach

“Do-it-yourself (DIY)” is the activity of doing or making something without professional training or assistance, or more broadly, can be described as an activity in which one does something oneself or on one’s own initiative¹. It can be defined as behaviours where “individuals engage raw and semi-raw materials and parts to produce, transform, or reconstruct material possessions, including those drawn from the natural environment”. DIY behaviour can be triggered by various motivations such as economic benefits, lack of product availability, lack of product quality, need for customisation, and identity enhancement like the fulfilment of craftsmanship, empowerment, community seeking, and need for uniqueness (Wolf and McQuitty, 2011, p. 155).

Creating one’s own product could also add value if it is viewed as a self-rewarding process. Intrinsically satisfying behaviours are usually correlated with characteristics such as satisfaction with interest, opportunities for experience and mastery of a specific subject, entertainment value and novelty (Kruglanski, 1975, p. 402). People seem to derive an intrinsic benefit from “doing it themselves”. A study on the traditional do-it-yourself (DIY) market revealed that most do-it-yourselfers engage in these activities in the first place because they perceive the “doing” itself as rewarding, enjoyable, and a fun experience (Schreier, 2006, p. 322).

The DIY approach has the potential to resolve aspects of sustainability, such as the efficient use of resources and materials, maintenance of goods, repair and update, personalisation of products (Dogan, 2018, p. 474). The product’s personalisation allows end-users to change, refresh and update the design solutions by contributing their effort (Mugge et al., 2009, p. 468). The DIY strategy strengthens the bond between the user and the product resulting in “emotional durability” that prolongs the “psychological lifespan” of the product (Verbeek and Kockelkoren, 1998, p. 29-30; Dogan, 2018, p. 472).

3.3. Halfway Products

Halfway products are manufactured to the extent of leaving a space for the user to complete the making. The user embeds their own creativity, stories and mistakes in the process of finishing the product, thereby linking a personal narrative, memory and associations that distinguish this product from other manufactured products. Halfway products differ from examples of “mass customisation” or “mass personalisation”, such as offering a range of colours or models or offering a standard model with variable components, such as external add-ons (Fuad-Luke, 2009, p. 98). Offering a “halfway” design rather than a completed product allows the end-user to voluntarily participate in the design process. It adapts the product according to their tastes and aesthetic concerns (Dogan, 2018, p. 473). Halfway products that enable active user participation and personalisation through the DIY approach can serve emotional durability and enduring and evolving products.

4. THE RESEARCH THROUGH DESIGN PROCESS: DESIGNING “EMOTIONALLY DURABLE” HOUSEHOLD LIGHT

Lights in the current mass production tradition are made of different materials with different

¹ <https://www.merriam-webster.com/dictionary/do-it-yourself>

materials with different manufacturing methods. However, the assessment data is not transparent in the production processes, which involve the raw material extraction, manufacturing, assembly, transportation and distribution to stores. On the contrary, mass-produced goods are stiff black boxes. These situations withhold and discourage people from comfortably repairing, updating or maintaining them. One available piece of information about this manufacturing process is that components of the product are mainly produced or assembled using sweatshop labour by firms in developing countries like the Far East that supply goods for large scale consumption in the west (Dogan, 2018, p. 473).

Contemporary aesthetic typologies of lights are based on visible and tactile traits of form and finish. Trends, fashion and consumerism for this kind of product are the leading cause of the temporariness of the objects. On the contrary, objects are often deeply symbolic and meaningful within traditional cultures, and for this reason, they have value over functional benefit (Walker, 2006, p. 50). Symbolic value, defined as the set of social and cultural meanings associated with a product, may enable consumers to use it to communicate about their identity and social and connection to a community (Ravasi and Rindova, 2004, p. 3). Personalisation is one way to enrich the aesthetic experience and take the product to a more meaningful state than functionalism.

In this research through design process, with a particular focus on “emotionally durable design”, “product personalisation” and “localisation”, the conceptual notions of the light design were identified. Based on these notions, a design kit involving the electrical components of light and the base for attaching the DIY lace lampshades was manufactured as a halfway product. The kit that re-contextualises user’s hand-made or inherited laces into lampshades through the DIY process was adopted as a design solution for

prolonging products’ lifespan.

The relationship between the user and the handicraft product is defined by cultures and traditions of societies that transform meaning into a form (Barthes, 1991, p. 117). For this, lacemaking and filigree handicrafts were considered sustainable design solutions during the research through design process.

Lace is a fine open fabric made of cotton or silk by looping, winding, or knitting thread in patterns and used primarily for garment trimming². Lacing has a long past in the native traditional culture. They are used for decorating furniture, bed covers, pillows, curtain edges, towel edges, etc. They require patience and passion, and enable people to exhibit their skills by employing handicrafts. As an artefact, lace connects past generations to the current and future by maintaining heritage roots and regenerating with each new commitment (Celikoglu, 2013, p. 39).

Filigree is an ornamental work of fine, typically gold or silver, wire formed into delicate tracery³. The work involves making patterns by bending silver wires and attaching these soft wire motifs or on a metallic ground by welding with silver or copper solder (Arseven, 1975 cited in Gündüz, 2019, p. 282). The most important centres of filigree in Turkey are Midyat district of Mardin and Beypazarı district of Ankara (Kuşoğlu, 1986 cited in Gündüz, 2019, p. 282).

For its cultural significance and meaning, lacing formed the background of the DIY part of the product. At the same time, filigree embroidery was considered a part of the halfway product as detachable rings to fasten the lace to a frame. In this way, traditional crafts production was integrated into the halfway design kit and the DIY part.

The DIY approach, adding value and rewarding through creation, coupled with a halfway design solution that facilitates user contribution

²<https://www.lexico.com/definition/lace>

³<https://www.lexico.com/en/definition/filigree>

to complete the product, was considered for personalisation. Traditional lacemaking skills were integrated into production and usage scenarios through a DIY approach. Users can make their lampshades from laces to display them in unconventional ways. During the research through design process, co-production with the artisans for the laceworks contributed to the design and production of DIY lace lampshade. Contacting local crafts and visiting their workshops facilitated exploring the opportunities for localisation in the output of the design kit

4.1. DIY Lace Light

The outcome of the research through design process was a wall lamp aimed at improving lifespan through personalisation, which was facilitated by DIY and halfway product rationale. Lace is re-contextualised as a lampshade through a design kit that involved components considered to be produced at different scales of production (Figure 1).

Halfway products enabling active user participation through the DIY approach facilitate personalisation, user comprehension and engagement in the production and use phases, give a sense of creative accomplishment and serve aesthetically pleasing qualities. Incorporating local materials, manufacturing capabilities and skills into the design for production, repair, upgrading and recovery at the local batch-production scale was also particularly significant for prolonging the product lifespan. Besides mass-produced electrical components, local crafts and batch production were considered for producing other parts. The halfway design kit consists of five main components:

- The base, where the electrical components (lamp, lamp-holder, electrical parts like switch, plug and cabling) and magnets (to carry the lampshade) are attached

- The circular frame, where the hemispherical shaped lace is fastened with detachable rings that are attached to the base through magnets
- The diffuser
- The metal sieve that the user can use for giving the hemispherical shape to the lace
- The instructions manual for producing the DIY lace lampshade.

The electrical components (LEDs, switch, plug and cabling) are produced at the mass production level; the base, the hemispherical sieve, the frame and the diffuser are manufactured at the batch production scale, and the detachable rings are made with craft production (Figure 2).



Figure 1. Lace Lamp, 2016.



Figure 2. The components of the lace lamp, 2016.

Base: The lamp's base is designed to be made of industrially planted tree stems cut into circular plates, which are available locally and ageing gracefully. Bases are designed to be manufactured at a wood workshop with a laser-cutting process (Figure 3). The magnets attached to the edge of the base's surface are strong enough to carry the lampshade lace and the attached frame.

Circular frame and the sieve: The metal frame and the hemispherical sieve are designed to be produced at a local metal workshop.

Diffuser: The diffuser (made of buckram, a stiff type of cloth) is designed to be produced by local tailors at the batch production scale.

Detachable rings: The detachable rings for fastening the lace are designed to be produced by using hand-skills of filigree artisans. Several artisans were making filigree as jewellery in the close neighbourhood. Thin silver wires turning into patterns could harmoniously serve with lace patterns. Besides, this design strategy would incorporate traditional filigree skills into the product. For the prototype, the detachable rings were made of the eye part of the hook and eye closure which is used for fastening garments together (Figure 4).

Lace lampshade as the DIY part: The sieve is a part of the design kit to serve users for obtaining the lampshade from the lace. To put the lace into a hemispherical shape and maintain it, the user can use PVA glue or produce the fixing mixture using natural ingredients. Deciding on the qualities of raw materials of the yarns for lacing and making natural adhesives such as homemade glue to raw materials of the yarns for lacing and making natural adhesives such as homemade glue to practically shape them into hemispherical shades required some trial-and-error to arrive at a practical solution. To make the lace tough enough to keep its shape after being treated with glue, testing with threads having different fibre compound percentiles and different measures



Figure 3. The manufacturing process of the wooden base, 2016.



Figure 4. The detachable rings that fasten the lace to the frame, 2016.



Figure 5. Left: The lace treated with PVA glue; Right: The sieve to lay the lace for drying to obtain hemispherical lampshade, 2016.

of compounds in homemade glue was a part of research through the design process. Yarns with high percentile cotton fibre were more convenient to turn laces into stiff lampshades. Corn starch was the main ingredient of homemade water-based glue. (Figure 5).

Instructions manual: The manual presented with the design kit involves a recipe for preparing the DIY lampshade. When the user wants to replace the lace lampshade with a new one, s/he can take out the old one, remove the water-based adhesive and return it to its former plain shape (Figure 6).

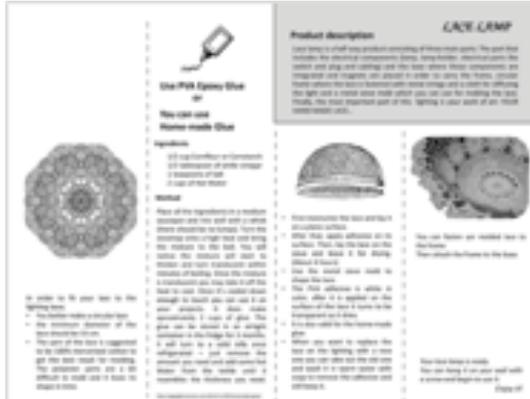


Figure 6. The design instructions manual, 2016.

When the hemispherical lace lampshade is fastened to the frame and assembled into the design kit, it is ready to be used. An appropriate place for the lace lamp is the wall, an attraction point of the house where photographs and paintings are exhibited. The user can hang it on the wall with a screw and begin to use it. When the user wants to replace the lace on the light with a new one, she can take out the used one and remove the adhesive and still keep it.

CONCLUSION

This paper presented research through design process of household light considering sustainable notions. Among these notions, enabling active user participation to prolong product lifespan was the main focus. Objects capable of unfolding narrative experiences depending upon the degree of care invested in them (Chapman, 2015, p. 112), sustaining attachments as they engage the senses, invade our lives, depend upon our care and attention to survive (p. 81), facilitating fictions that incorporate a measure of openness or space

within product semantics to enhance the degree of self that may be invested into the engagement between subject and object (p. 161), can be regarded as emotionally durable products. Personalisation was seen as a preferable option to achieve this purpose. DIY approach, which involves creating one's own product by adding value through self-rewarding, was chosen as a way to personalise objects. A halfway product is designed to be manufactured to an extent for leaving a space for the user to complete the making, which considers the end-user's role as an active production participant. Besides, it also regarded sustainability notions by embracing local crafts skills and production opportunities for halfway product components. The detachable rings, for instance, were designed to be manufactured by local crafts such as filigree. The iterative nature of the process provided by direct engagement with materials and the artisans revealed knowledge about material culture and values that informed the outcome. The material culture inherited in the community was experienced through close contact and co-production with the artisans. Research through design process helps the designer engage with sustainability concerns regarding product design with a hands-on approach and practice the theories through materiality. This experience enables a product designer to grasp essential sustainability issues and develop a critical mindset on current production and consumption habits and their practice's environmental, economic, and social impacts. The central concept grasped in this particular process was questioning product lifespan and the reasons for the throwaway habits of the society. Encouraging people to keep that specific product and endure the ownership requires the designers to develop design solutions to survive, evolve, or present the user with something new. Based on such issues, the outcome of this particular research through design process was a wall lamp, designed with

the DIY approach coupled with halfway product rationale.

This light concept re-contextualises lace and makes it available to exhibit the hand skills of the person who produces it practically with the help of light and shadows. The engaging and evolving design concept involves the user in the design process. The design concept enables personalisation and provides the user with an alternative way of exhibiting their handicraft. By this, it serves for connotations of meaningful experience. For example, hand-made laces, or lacemaking skills, inherited from one's elder of the family, is a precious and meaningful gift; exhibiting it with the help of light and shadows would be an engaging way for users to complete or upgrade their products. This light can evolve with the user as the user learns new models. S/he can replace the lace lampshade exhibited as she produces new models and upgrades the light, and increase the product's lifespan. For the user scenario of the product concept development, the local craftsmen were cooperated with, for lace and filigree production, while the user was expected to use their own hand-made or inherited lace. Although the parts such as eyes made by the local craftsmen are part of the design kit, it is also an option for the users to purchase these parts from local craftsmen, for example, filigree from Beypazarı, in a case it is worn off in time. The users alternatively can acquire their laces from local producers as well.

In the framework of design for sustainability, it is seen that experimenting and engaging with locally available materials and manufacturing capabilities, and traditional crafts in this research through design process nurtured developing sustainable design solutions.

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Images References

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