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INTEGRATING LIFE-CYCLE THINKING AND EMOTIONALLY DURABLE DESIGN FOR GARMENT LONGEVITY

Purpose. *To develop a coherent life-cycle-oriented design strategy for extending the actual use of everyday clothing by integrating emotionally durable design with technical durability, adaptability, maintenance and end-of-life considerations. The study treats emotional attachment not as a substitute for sustainable engineering, but as a complementary design mechanism intended to reduce premature replacement of garments that remain physically serviceable.*

Keywords: *emotionally durable design, garment longevity, life-cycle thinking, sustainable fashion, consumer attachment, modular design, slow consumption.*

Objectives. To define the research problem created by the gap between physical durability and perceived product relevance; to identify design mechanisms that strengthen long-term user–garment relationships; to analyse the motives reported by consumers for retaining clothing; to translate these findings into a design framework covering the principal stages of a garment life cycle; and to propose an illustrative use-intensity indicator that makes the role of actual wear duration explicit.

Methodology. The study combines conceptual analysis of emotionally durable and sustainable design [1–5], an exploratory consumer survey, and design-oriented synthesis. The survey involved 50 respondents (16 men and 34 women aged 20–48) and was used to identify motives associated with long-term garment retention. Because the research is on initial stage, source material does not document a probability-sampling procedure, the survey results are interpreted descriptively rather than as population-level estimates. The findings were then mapped onto five life-cycle stages: material selection, design and production, distribution and retail, use, and end-of-life. No full life-cycle assessment inventory was conducted; therefore, the proposed use-intensity indicator is treated as a conceptual analytical device rather than as an environmental label or substitute for a complete LCA.

Research results. The analysis shows that garment longevity should be approached as a multidimensional design problem. Physical durability is necessary

but insufficient: clothing can remain technically functional while being removed from use because it has lost emotional, symbolic or aesthetic relevance. Emotionally durable design addresses this form of premature obsolescence by considering whether a garment can remain meaningful, adaptable and sensorially satisfying throughout prolonged use [1, 3].

1. Research problem: physical durability versus perceived obsolescence

Conventional durability strategies primarily address measurable technical properties such as abrasion resistance, dimensional stability, seam strength and care performance. These characteristics determine whether a garment can continue to function. However, the decision to retain or discard clothing is not governed by physical condition alone. In fashion products, perceived obsolescence may occur before physical failure: a garment can still perform its function but cease to correspond to the wearer's identity, lifestyle or aesthetic expectations. This creates a methodological gap between designing a product that can last and designing a product that a person will actually continue to use.

The proposed approach therefore combines life-cycle thinking with emotionally durable design. Life-cycle thinking structures decisions across the sequence from material selection to end-of-life, whilst emotionally durable design addresses the quality of the user–product relationship during the use stage [1, 2, 5]. The integration of these perspectives changes the design question from 'How can the garment resist wear?' to 'How can the garment remain functional, relevant and meaningful for longer?'. This distinction is important because environmental benefits associated with longevity depend on realised use, not solely on the theoretical technical lifetime of the product.

2. Design mechanisms for emotionally durable clothing

Narrative value is created when a garment is capable of recording and communicating its history of use. Natural fading in denim, patination of leather, visible repairs or other controlled traces of ageing may be interpreted as elements of a personal biography rather than as defects. This principle follows the logic of emotionally durable design, in which the relationship between user and object develops through accumulated experience [1]. The designer can support this process by selecting materials that age acceptably and by avoiding finishes for which every trace of use is perceived as deterioration.

Customisation and co-creation strengthen ownership because the user participates in decisions about fit, trims, lining, colour combinations or other details. A garment adapted to an individual body or preference is more difficult to replace with a visually similar mass-market product. Modularity provides a related functional strategy: detachable sleeves, interchangeable hoods, removable linings

and adjustable construction elements allow a single garment to respond to changing seasons, body parameters and styling preferences. In this way, adaptability can postpone replacement when only one function or component has become unsuitable.

Material and sensory qualities form a third group of mechanisms. Texture, weight, thermal comfort and tactile response influence everyday experience and can contribute to attachment. Wool, linen, silk, corduroy and other materials with distinctive sensory qualities may develop recognisable signs of use without immediately losing aesthetic value. The design objective is therefore not simply maximum resistance, but a balance between technical performance, comfort and graceful ageing [2, 4]. User affordance complements this approach: adjustable fastenings, accessible seam allowances, detachable components, replaceable zips and deliberately visible repair zones can make future adaptation and maintenance understandable to the wearer.

3. Consumer motives for long-term garment retention

The exploratory survey provides empirical support for treating emotional and sensory factors as part of garment longevity. The strongest reported motive for retaining a garment was its biographical or memory-related value: 30% of respondents referred to clothing associated with a first salary, travel, a concert or another personally significant event. Tactile comfort was reported by 25% of respondents. Reliability and quality were also identified by 25%, whilst 20% emphasised uniqueness or identity expressed through unusual construction or distinctive details. These results indicate that long-term retention can emerge from several types of value simultaneously: functional, sensory, symbolic and personal.

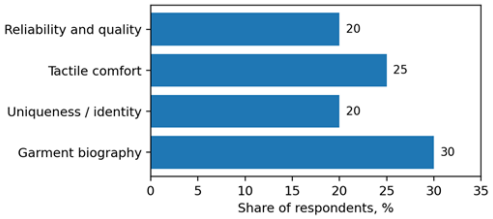


Fig. 1. **Factors associated with emotional attachment to clothing (survey, n = 50)**
Source: developed by author.

The results support a design approach in which the expected relationship between user and garment is considered during product development. A physically durable garment may still be discarded early if it is generic, difficult to adapt or emotionally neutral. Conversely, a garment with recognisable personal history,

comfortable material qualities and opportunities for adaptation can remain meaningful even after visible signs of use appear.

The findings also clarify the role of design. Emotional durability should not be interpreted as the deliberate addition of sentimental symbolism to every product. Rather, the product should provide conditions in which attachment can develop: recognisable identity, opportunities for adaptation, sensory comfort, materials that tolerate ageing, and sufficient construction quality to remain usable. The survey therefore supports a shift from designing only the physical object towards designing the conditions for a prolonged interaction between wearer and garment.

4. Integrated life-cycle design framework

The research findings were translated into a life-cycle-oriented framework in which technical and emotional strategies are coordinated rather than treated as separate sustainability measures. At each stage, engineering decisions establish the physical capacity for longevity, whilst emotionally durable design supports continued relevance and attachment.

Table 1 – **Integrated life-cycle design framework for garment longevity**

Life-cycle stage	Technical / circular strategy	EDD strategy
Materials	Durable/recyclable; care-compatible	Tactile quality; graceful ageing
Design & production	Low-waste; repair access; replaceable parts	Customisation; co-creation; modularity
Retail	Care and construction information	Product narrative; long-term value
Use	Maintenance; repair; adjustment	Comfort; styling variability; personal meaning
End-of-life	Disassembly; separation; resale/upcycling	Residual value; resource perception

The framework shows that the use stage is the critical point at which physical and emotional durability interact. A repairable garment may still be abandoned if it no longer feels relevant, whilst an emotionally valued garment may become unusable if its construction prevents repair. Longevity therefore depends on coordinated design decisions made before purchase but realised during use. This is consistent with circular-fashion approaches that treat adaptability, redesign and responsible resource use as design competences rather than solely as end-of-life interventions [4, 6–8].

5. Use intensity as an analytical link between design and environmental performance

To make the role of actual use explicit, the study proposes a simplified use-intensity indicator. For one defined environmental impact category, or for a consistently normalised aggregate score, the relationship can be expressed as

$$C_{use} = B_{life} / D_{use},$$

where B_{life} is the life-cycle burden assigned to the garment within the chosen assessment boundary and D_{use} is the number of days on which the garment is actually worn.

The indicator is deliberately simple: if the same life-cycle burden is distributed over a greater number of use-days, the burden attributed to each use-day decreases.

This formulation corrects an important limitation of treating longevity only as a material property. A technically durable product that is rarely worn may perform poorly from a use-intensity perspective, whereas a product that remains relevant and is repeatedly used distributes its initial production burden across a longer service period. At the same time, emotionally durable design does not automatically guarantee an environmental benefit. Higher-quality materials, modular systems or additional components may increase production impacts, and these trade-offs require case-by-case assessment. The proposed indicator therefore illustrates a relationship that should subsequently be tested within a defined life-cycle assessment rather than replacing such an assessment [2, 5].

6. Information continuity, maintenance and product longevity

Emotional attachment cannot compensate for missing technical information. A valued garment may still be discarded prematurely if care, alteration or repair is difficult. Long-term design should therefore preserve information about material composition, recommended maintenance, replaceable elements and possible interventions. Such information may be provided through durable labelling or digital product records. Its function is practical: to ensure that the design intention remains understandable to the owner, repair services and potential future users.

This leads to a three-dimensional interpretation of garment longevity. First, physical durability enables the product to remain functional. Secondly, emotional durability enables it to remain meaningful. Thirdly, informational durability enables it to remain maintainable and adaptable. Weakness in any one of these dimensions can shorten actual use. Their integration provides a more coherent strategy for slowing textile consumption than an approach focused exclusively on material strength.

Conclusion. The study demonstrates that the problem of premature garment replacement should be addressed through an integrated design strategy rather than through physical durability alone. The exploratory survey indicates that respondents retain clothing because of biographical value, tactile comfort, reliability and quality, and expressions of uniqueness or identity. These motives can be translated into concrete design mechanisms: narrative value, co-creation, modularity, sensory quality, user affordance and graceful ageing. Mapping these

mechanisms onto the garment life cycle shows that technical and emotional strategies are mutually dependent. Materials and construction must support repair, adaptation and extended use, while the product must remain aesthetically and personally relevant to the wearer. The proposed C_{use} indicator makes the relationship between actual wear duration and burden per use explicit, but it is an illustrative measure and does not replace a complete life-cycle assessment. The principal research outcome is therefore a life-cycle-oriented framework in which physical, emotional and informational durability are designed together. Further research should test the framework on specific garment prototypes and compare measured use behaviour and life-cycle impacts across alternative design solutions.

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