

Improving the sustainability and durability of performance swimwear through consumer knowledge and usage habits

Bridget Upton, Alana James

Department of Design, Arts and Creative Industries, Northumbria University, Newcastle upon Tyne, UK

Keywords: Performance Swimwear; Sustainability; Durability; Longevity; Aftercare.

Abstract: As with any sport, the desire to progress in swimming by any means is unending. There are constant advancements being made in the textile technology of performance fabrics, with most technologic developments being focused on synthetic fabrics. Synthetic fibres, such as polyester can take from 20 up to 200 years to degrade and can release a range of chemicals having a detrimental effect on the planet (Uren, 2024). This paper explores performance swimwear's environmental impact and proposes solutions for both industry and users. Key issues include the reliance on synthetic fibres, fabric deterioration, and insufficient consumer knowledge about reducing environmental impact and extending garment longevity.

The study begins with a comprehensive literature review, which dissects the issues at hand and begins to deliberate possible solutions. Gaps in knowledge were identified and addressed through a series of qualitative interviews to gain first-hand insight from consumers and users of performance swimwear. The findings suggest that consumer knowledge around aftercare is insufficient. There is a lack of communication from brands on this subject, as well as a reluctance from consumers to seek out this information. Thus, the common areas of wear and lack of knowledge on aftercare result in premature disposal of swimwear. The suggestion of designing for emotional durability presents a potential solution to increasing the longevity of swimwear. In addition to this, implementing upcycling schemes could reduce environmental impact and improvements in aftercare, such as improved communication and access to information is recommended.

Introduction

The fashion industry's environmental impact is increasingly of concern, with 92 million tonnes of waste and 79 trillion litres of water utilised annually (Niinimäki, 2020). Synthetic fibres are particularly problematic due to fossil fuel extraction and prolonged biodegradation rates. Swimwear is a product sector that relies predominately on the use of synthetic fibres, in addition to the use of harmful substances such as perfluorinated chemicals for water repelling (Cappelletti et. Al., 2023). There are few studies addressing the sustainability of swimwear and even fewer focusing on the performance swimwear sector. However as discussed by Pandey (2020) "there has been a tremendous change in the swimwear sector..., who are demanding performance enhanced fabrics which at the same time are sustainable as well'. When considering which fabric is best for a swimsuit, most articles would lead towards polyester or a blend of multiple synthetic fibres to improve functionality and fit (Peeke, 2018).

In addition to the environmental effects of fabrics used in swimwear, there are larger issues surrounding the longevity of swimwear currently. The high frequency use of swimsuits by athletes, as well as the exposure to chlorine results in a much shorter lifespan, leading to the premature disposal of swimwear and therefore more suits being sold.

The lack of knowledge about how to care for clothing post-purchase, is a topic gaining more popularity. Through interviews, this study will gather further insight into how much knowledge consumers have and how they implement such knowledge is to be explored. A better relationship between all stakeholders is needed to increase the understanding around aftercare which could result in longer lasting garments (Webb, 2020).

This paper aims to explore the sustainability, durability and relationship consumers have with performance swimwear. It sets out to find ways to reduce the environmental impact of performance swimwear production. The subject

will be split into two subthemes: durability and longevity, and after-care of garments, which will be referred to throughout the paper to address issues and present potential solutions. This research is necessary to lead advancements of performance swimwear in a sustainable and circular direction. It aims to inform the reader and build on information about sustainability and technological advances to create a more functional, longer lasting and ecological outcome.

Literature Review

Durability & Longevity

Durability in swimwear is widely studied, as shown by works like Afifi, Qurashi, & Gabr (2024) and Potočić Matković, Salopek Čubrić, & Krstović (2024). Competitive swimmer blogs, such as *Swim World Magazine* (2024), provide tips to improve suit longevity. Much of the literature around improving durability focuses on polyester, nylon and chemical coatings being the solution, lacking consideration of environmental impacts. A study was conducted testing degradation of swimwear which suggested that even synthetic fabrics do not have much resistance against sunlight, chlorine and sea water (Epps, 1987), leading research towards consideration of natural fibres for future innovation. More recently, studies by Islam, Mondal and Chandra Das (2021) and Pandey (2020) investigated ways that natural textiles could be treated to improve their functionality and therefore appropriateness for application. Both studies concluded that there is potential to design with natural fibres that are treated to improve functionality whilst reducing environmental impacts.

It is essential to consider a garment's overall impact through the whole product lifecycle, moving beyond source, to acknowledge the impacts of consumer use. Laitala, Klepp, & Henry (2018) evidenced that the production and use phase hold more of an impact than distribution and disposal. Critical considerations include the potential loss of microfibres, product lifespans, quality, and functionality (Laitala, Klepp, & Henry, 2018). Laitala and Boks (2012) emphasise the importance of the consumer use phase in achieving more sustainable products. When aiming to improve longevity they suggest, enhancing quality and designing for emotional connection to increase product satisfaction.

Emotional durability has been defined as an approach to increase longevity, with research aiming to understand the complex relationship between consumption and the meaning of products to consumers (Jensen, 2021). Studies based on emotional attachment explore how designers can implement this design approach in clothing to extend and prolong product use. Appalatch, are a company intending to utilise emotional attachment to improve the sustainability of their business (Spanne, 2015), as they discovered that fashion-conscious consumers were attracted to the emotional story of clothing. Their website encourages consumers to value the relationship with clothing and build connections with people based on this shared ideal (Ibid).

Niinimäki and Armstrong (2013) corroborate this explaining that 'garments could represent an accomplishment and include the effort invested'. This could be a predominant reason for a swimmer to emotionally attach to a product as they relate their swimwear to big accomplishments within their sport.

Aftercare of Garments

Misconceptions about clothing care are common, yet it contributes around 30% of a garment's carbon footprint (Webb, 2020), often being positioned as a primary reason for brands to focus on sustainability. Swimwear unlike most textile products, shouldn't ever be washed or dried in a machine (simpleswim, 2021). Many consumers are unaware that swimwear is cared for differently, resulting in fast deterioration of these garments. Information on aftercare is available on some brand websites; however, it is often hard to find, leaving consumers to actively seek out this information, often from different sources.

As sustainability becomes a core focus of business strategy, brands are beginning to take some responsibility for informing their consumers on aftercare (Brown, 2019). Currently, many brands use care labels as a form of protection, to reduce returns, rather than using it as an informative tool (Webb, 2020). This results in many clothing labels claiming 'dry clean only' or 'wash with similar colours' when that isn't necessary. Perez and Lonsdale (2018) established that most buyers lacked knowledge in clothing care and better labelling was needed. It is apparent that it is not

for lack of interest that people do not care for their clothes, but for lack of knowledge.

Brands like Patagonia and Finisterre lead the way in providing extensive care guides to help consumers reduce their environmental impact and extend garment longevity. The information available on their website details laundering, stain removal guides and fabric care, categorised by each individual fabric they sell (Patagonia, 2021).

A lot of information regarding how to care for swimwear is readily available through online blogs. Ness Swimwear (2019) provide detailed care instructions for competition swimwear. This, however, raises questions about who is responsible for providing information to swimmers and consumers alike. Blogs, whilst being accessible and informative, do not have access to specific information on technical fabrics, which is particularly important as brands continue to develop innovative fabric compositions which may have different care requirements. This is demonstrated by the Speedo LZR Racer, a page on the Speedo website explains, 'as highly technical garments, designed with a smart-fusion combination of fabrics... these garments require care when being handled' (Speedo, 2021a). Current industry strategies are lacking information on post purchase care. Although Speedo has some pages on how to take care of swimwear, they are located on their FAQ's or blog section of their website making it difficult to find (Speedo, 2021).

Methodology

To address the issues within durability and after-care of performance swimwear qualitative research was undertaken. An inductive approach was used to gather qualitative data through semi-structured interviews. Secondary research was carried out, in the form of a literature review, to find the gaps in knowledge within the chosen subject.

To frame the rationale of this research, it was necessary to evaluate the knowledge that exists within this field and where further research is needed. Semi-structured interviews provided authentic swimmer accounts, aiding final recommendations for the industry.

It is difficult for the researcher to experience the subject to a degree that gives them the knowledge and awareness to conduct research (Collins, 2010). The research is therefore improved, by talking to people that practice the

subject on a regular basis, e.g., frequent swimmers. Participants were chosen through existing personal networks within swimming organisations and selected through referral sampling, also known as snowball sampling (Evans and Rooney, 2018). Participants were selected based on their frequent use of performance swimwear throughout their life. The applicants had developed knowledge and opinions on this subject over a significant period. Using a sample group of swimmers at different levels enhanced the data collected, as opinions varied from the different experiences.

Data Analysis

To analyse the data the researcher focused on inductive approaches, with thematic analysis, allowing the researcher to cross-analyse interviews, pinpointing commonalities and differences (Harding, 2019).

To begin the analysis process all interviews were transcribed, through this process themes and similarities in the data began to emerge. Thematic analysis was used to divide the data into subsequent groupings and inductive coding was used to further analyse the data to pinpoint reoccurring opinions or statements. Cross-analysis was conducted comparing all participants data so that coding could be re-evaluated to group codes into relevant subsections.

Findings & Discussion

The thematic analysis of interview data resulted in five main thematic areas, which have been evaluated and explained. The findings have been ordered in a way to express the issues from the beginning of purchasing and manufacturing of swimwear, through to the disposal/relationship that results at the end of the products life.

Washing Habits

75% of participants explained their washing habits as rinsing their swimwear in the shower after swimming. These participants also expressed doubt, that this was the correct thing to do, participant 2 saying 'I just tend to like rinse them in cold water after training and then hang them all up. But now I'm like, oh, I should probably actually wash them'. When participant 4 was asked how often they washed their swimwear they replied 'probably never', however went on to explain they would rinse the suit out. This implying that the participant didn't class rinsing a costume, as washing it.

This links to the societal perception that nothing is clean unless it has undertaken a wash cycle in a machine. As stated in the literature review, swimwear shouldn't be washed in a machine (simpleswim, 2021). These results also justify that many consumers are unaware that swimwear is cared for and washed differently.

Care Labels

100% of participants revealed they had never looked at a care label. Most participants had an idea of what a care label looked like, but had never thought to look at one, expressing they didn't know what the symbols on care labels meant. Throughout the interview participant 2 looked at a care label on their swimwear and commented, 'there's four symbols on this label, but I honestly have no idea what they mean'. Participants had not sought care information and most stated that although they would find this useful, they would only do so for expensive garments. Participant 3 said 'I'm sure I looked at labels with my racing suits, because they were more money, so I probably gave them a bit more care'.

As detailed in the literature review, although some swimwear brands have information on aftercare online, it isn't easy to find. Aftercare information needs to be made easily accessible and digestible to consumers to be useful and successful in extending the life of garments. Participant 3 explained, 'I think the racing ones (costumes) usually come with like a leaflet or something a little bit more informative as well. But yeah, I can't say I've ever really looked at them'. This justifies brand's efforts to inform consumers but highlights the disconnect in communication of this information. Further research is needed to investigate ways in which this could be communicated for consumers to engage with it.

End of Life

Participants were asked what they did with swimwear when they considered it no longer usable. 75% of the participants confessed they threw swimwear in the bin with participant 2, expressing, 'they were so worn when I was done with them, they'd be useless to anyone else'. When asked if they had ever considered recycling or donating swimwear there was a mixed response. Some said they felt donating swimwear would be unhygienic. Participant 4 spoke about upcycling schemes they had heard of from friends 'you just post them off and then they can be remade into something', expressing a desire to try this to give swimsuits

another life. Undeniably there was a lack of knowledge from all participants around what to do with swimwear at the end of its life.

Highlighted in the literature review, the information around aftercare from brands is lacking, as is the responsibility they take to improving disposal of garments. Some brands already have systems in place for recycling of garments, such as the H&M scheme, they offer a £5 store voucher in return for bringing unwanted items to their in-store recycling bins (Gould, 2017). Similar schemes could be put in place for swimwear brands to encourage recycling or upcycling.

Durability

Participants were asked to list reasons for disposal and to highlight areas that show deterioration first. Participant 1 and 3 mentioned that their costumes often start to go see through. When asked what the main reason for disposal was, participant 3 said 'it'd just be once they started going see through'. This is shown in figure 1.



Figure 1. Worn fabric on the stomach which allows the lining to be visible. Interview Image (Participant 2).

Loss of elasticity was mentioned by 75% of the participants, participant 4 explained that lack of elasticity was apparent in poor quality swimwear, explaining, 'we had to wear the Adidas costumes, but they were really poor quality and were really baggy'. Shown in figure 2.



Figure 2. Loss of elasticity in straps. Interview image (Participant 2).

Fabric pilling was mentioned in relation to the bottom area of a swimsuit. All participants revealed that pilling was a reason for disposal. 50% of the participants established the relationship with both issues explaining that the fabric covering the bottom would become 'furry or bobbly', relating to pilling. Participant 3 expressed this as one of the main factors when choosing swimwear, explaining 'the first tick was, is it one of the chlorine resistant ones? Because they last longer, otherwise they're going to go furry after a few weeks'. Participant 2 also responded to this question 'on the bum and stuff, where it goes all white and bobbly, that's one of the reasons'. Pilling can be seen in figure 3.



Figure 3. Visible pilling of fabric. Interview Image (Participant 2).

Durability issues in swimwear can be related to fabric choices and garment design. Consumer's aftercare habits heavily affect the loss of elasticity. Misconceptions about clothing care are common, and the participants lack of knowledge about washing and usage habits could lead to premature loss of elasticity.

Emotional Attachment

Half of the participants interviewed stated that they had felt an emotional attachment to their swimwear. Participant 2 described that if she achieved a personal best wearing a costume, she would wear it for important races after that, as she felt the swimsuit had 'good luck'. Participant 4 reiterated this feeling, explaining 'even if its maybe not in as good condition anymore, sometimes it doesn't matter how good the quality is, it's about how it makes you feel mentally'. Referring to how, emotional and mental feeling is extremely important in sports. Participant 4 explained, 'I'm a bit of a hoarder. I have like a hundred costumes in my drawer upstairs and I just don't know what to do with them'. Expressing this resistance to dispose of swimwear but lacking the knowledge on options for end of life. They continued, 'my friend told me about something, where you can post off your costumes and I had thought about that. I kind of have that bit of attachment towards them'. Highlighting how emotional attachment can reduce the likelihood of premature disposal.

As previously established in the literature review section on designing for emotional attachment, garments often represent an accomplishment and effort invested (Niinimäki and Armstrong, 2013). This can then lead to consumers holding onto the item for an extended period, which was displayed in the findings.

Conclusions

The aim of this paper was to improve the sustainability and durability of performance swimwear through consumer knowledge of after-care. In addition to this it investigated the communication of this knowledge from brands and the level of interest from consumers. The following recommendations can be applied to brands, individual consumers and the industry with the aim of reducing environmental impact within this product sector.

As pointed out in the literature review section, durability is always a priority for swimwear brands. However, longevity must now be

brought to the forefront when creating swimwear for it to become more sustainable.

Regarding research on durability, methods of design have been investigated throughout this paper. Designing for emotional durability was investigated within the literature review and through primary research and it was proven implementation could be affective.

In relation to emotional durability, recycling and upcycling schemes were suggested within interviews. Implementation of these schemes would give consumers an incentive to recycle their costumes, as well as the option to give swimwear that consumers had emotional connection with, another life. Consumer interviews indicate confusion over swimwear disposal, and this would provide an ideal solution if paired with accessible information to various disposal options.

To improve sustainability in performance swimwear, aftercare must be a focus from both brands and consumers. The information provided by brands must be specific to each product and fabric they produce. This is especially important for 'tech' suits as they require more specific care, due to the complexity of the fabrics.

In addition to this, improved communication of this information to consumers is needed. Through interviews it was discovered that most consumers aren't willing to go out of their way to find this information, therefore brands need to encourage consumers by making the information as accessible as possible.

These recommendations are direct actions that could be taken to improve sustainability and durability within the performance swimwear industry.

1. Provide aftercare information that is specific to individual products and fabrics and is easily accessible to consumers.
2. Improve the communication of aftercare from brands to consumer, specifically provide links between the physical garment and the information online.
3. Implement upcycling and recycling schemes to reduce waste and increase awareness on how to dispose of swimwear in more sustainable ways.

4. Create a balance between designing for function, comfort and aesthetics. A bigger differentiation between the needs of a training costume and a racing costume could improve this.
5. Implement different design strategies such as designing for disassembly and designing for emotional durability.
6. Lead the way in change, take responsibility for action and devise strategies to encourage others to do the same.

Limitations and Future Work

This paper is limited to investigating the actions of individuals, with the consideration of social practice theory and the influence of this on participants behaviors was not considered. Articles have investigated the application of social practice theory to pro-environmental change and have found difficulties in attempts to change practices, over and above individuals' attitudes or values which instead often resume the organization of everyday life (Ward, 2011). As the research used a small number of participants it is difficult to categorise and generalize behaviours and expanding the study will be developed in future work.

References

- Affifi, S. R. I., Qurashi, W. A.-R., & Gabr, B. G. (2024). Swimwear longevity: A comprehensive analysis of factors affecting durability and replacement. *Clothing Cultures*, 9(1–2), p. 93–116. https://doi.org/10.1386/cc_00060_1
- Speedo. (2021). 4 easy ways to care for your swimming goggles. Speedo. Retrieved March 19, 2025, from <https://www.speedo.com/blog/swimwear/4-ways-to-care-for-your-swimming-goggles/>
- Brown, H. (2019). The afterlife: Why fashion aftercare is on the rise. *Drapers*. Retrieved October 28, 2021, from <https://www.drapersonline.com/insight/analysis/the-after-life-why-fashion-aftercare-is-on-the-rise#comments>
- Cappelletti, F., Menghi, R., Rossi, M., & Germani, M. (2023). Comparison between LCA results and consumers-perceived environmental sustainability of three swimming products. *International Journal on Interactive Design and Manufacturing (IJIDeM)*, 17, 1905–1932. <https://doi.org/10.1007/s12008-023-01284-x>
- Collins, H. (2010). *Creative research: The theory and practice of research for the creative industries*. AVA Publishing. Available from ProQuest Ebook Central. [19 August 2021].
- Epps, H. H. (1987). Degradation of swimwear fabrics: effects of light, sea water and chlorine. *Sage Journal*, 5(2), <https://doi.org/10.1177/0887302X8700500205>
- Evans, A. N., & Rooney, B. J. (2018). *Methods in psychological research* (4th ed.). SAGE Publishing.
- Goodwin, D. (2018, June 8). Swimsuit durability: How long do they last, how long could they? AquaMobile Swim School Blog. Retrieved October 25, 2021, from <https://aquamobileswim.com/blog/swimsuit-durability-long-lasting/>
- Gould, H. (2017, May 26). Zara and H&M back in-store recycling to tackle throwaway culture. *The Guardian*. Retrieved November 26, 2021, from <https://www.theguardian.com/sustainable-business/2017/may/26/zara-hm-step-up-instore-recycling-tackle-throwaway-culture>
- Harding, J. (2019). *Qualitative data analysis – from start to finish* (2nd ed.). London: Sage.
- Islam, J., Mondal, M., & Chandra Das, S. (2021). *Fundamentals of natural fibres and textiles*. Woodhead Publishing UK, 657–690.
- Jensen, M. B. (2021). Emotional durability: Strategies and future integration – A case study (Master's thesis, University of Borås, Faculty of Textiles, Engineering and Business). DiVA. <https://www.diva-portal.org/smash/get/diva2:1591142/FULLTEXT01.pdf>
- Laitala, K., Boks, C. (2012). Sustainable clothing design: use matters. *Journal of Design Research*, 10(1/2), #121-139#. DOI:10.1504/JDR.2012.046142
- Laitala, K., Klepp, I. G., & Henry, B. (2018). Does use matter? Comparison of environmental impacts of clothing based on fiber type. *Sustainability*, 10(7), 2524. <https://doi.org/10.3390/su10072524>
- Medelyan, A. (2021). Coding qualitative data: How to code qualitative research. *Insights*. Retrieved November 20, 2021, from <https://getthematic.com/insights/coding-qualitative-data/>
- Ness Swimwear. (2019, September 7). How to look after your swimming race suit. Ness Swimwear Blog. Retrieved October 26, 2021, from <https://www.nessswimwear.co.uk/blog/competition-swimwear-care-guide/>
- Niinimäki, K., & Armstrong, C. (2013). From pleasure in use to preservation of meaningful memories: A closer look at the sustainability

- of clothing via longevity and attachment. *International Journal of Fashion Design, Technology and Education*, 6(3), 190–199.
- Niinimäki, K., Peters, G., Dahlbo, H., Perry, P., Rissanen, T., & Gwilt, A. (2020). The environmental price of fast fashion. *Nature Reviews Earth & Environment*, 1, 189–200. <https://doi.org/10.1038/s41558-020-0698-0>
- Pandey, G. (2020). Sustainability matters: Design and development of multi-functional bamboo and modal fabrics for active swimwear. *Our Heritage*, 68(54), 17.
- Patagonia. (2021). Repairs. Patagonia. Retrieved December 7, 2024, from <https://www.patagonia.com/repairs/>
- Peeke, J. (2018, June 13). Why do you need chlorine-resistant swimwear? ProSwimwear Blog. Retrieved March 11, 2021, from <https://www.proswimwear.co.uk/blog/why-do-you-need-chlorine-resistant-swimwear/>
- Perez, A., & Lonsdale, M. (2018). Garment label design and companion information to communicate fashion sustainability issues to young consumers. *Visible Language*, 52(3), 114–139. Retrieved October 27, 2021, from https://www.researchgate.net/publication/330533771_Garment_label_design_and_companion_information_to_communicate_fashion_sustainability_issues_to_young_consumers/link/5c5145b4a6fdccd6b5d34455d/download
- Potočić Matković, V. M., Salopek Čubrić, I., & Krstović, K. (2024). The impact of chlorinated water and sun exposure on the durability and performance of swimwear materials. *Polymers*, 16(21), 3050. <https://doi.org/10.3390/polym16213050>
- Soke, A. (2021, August 10). 11 best sustainable swimwear brands. *Durability Matters*. Retrieved October 24, 2021, from <https://durabilitymatters.com/sustainable-swimwear-brands/>
- Spanne, A. (2015, January 17). Want people to buy a product that lasts? Sell them an emotional connection. *The Guardian*. Retrieved July 3, 2021, from <https://www.theguardian.com/vital-signs/2015/jan/17/the-struggle-to-sell-to-products-that-last>
- Swim Swam. (2021). Speedo's Fastskin 4.0: The future of fast. Retrieved October 22, 2021, from <https://swimswam.com/speedos-fastskin-4-0-the-future-of-fast/>
- Swimming World Magazine. (2024). 10 ways to increase the life of your racing suit. *Swimming World Magazine*. Retrieved December 7, 2024, from <https://www.swimmingworldmagazine.com/news/10-ways-to-increase-the-life-of-your-racing-suit/>
- Uren, A. (2024, March 18). How sustainable is polyester? Good On You. Retrieved December 7, 2024, from <https://goodonyou.eco/how-sustainable-is-polyester/>
- Vine, R. (2014, October 24). Why you should never, ever wash your jeans (unless you really, really have to). *The Guardian*. Retrieved December 7, 2021, from <https://www.theguardian.com/fashion/2014/oct/24/why-you-should-never-ever-wash-your-jeans-unless-you-really-really-have-to>
- Warde, A. (2011). Consumption and theories of practice. *Journal of Consumer Culture*, 11(3), 279–303. <https://doi.org/10.1177/1469540510390500>
- Webb, B. (2020). A new movement to reduce the hidden environmental cost of clothing care. *Vogue Business*. Retrieved March 11, 2021, from <https://www.voguebusiness.com/sustainability/a-new-movement-to-reduce-the-hidden-environmental-cost-of-clothing-care>