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Is Price an Indicator of Garment Durability and Longevity?

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Received: 25 September 2020; Accepted: 22 October 2020; Published: 27 October 2020

Abstract: Increasing focus on the sustainability of clothing has highlighted issues such as "fast fashion", impacts of laundering, durability, perceptions and expectations of wear and quality. The general consensus is that low-price garments (usually "fast fashion") are of low quality, low durability to laundering and are therefore more likely to be disposed of after minimal wears. The aim of this research is therefore to explore the relationship between price, perception of quality, frequency of laundering and durability to laundering of a common garment. Physical experiments on black T-shirts was undertaken to determine whether the price of a garment determines its quality in terms of durability to laundering; and a survey was conducted on perceptions of whether the quality of a garment is tied to its price. Price was found to not be a good indicator of physical performance, especially when it is lower. The two highest-priced T-shirts experienced the least change and this was attributed to better-quality fabric and construction. Participants expected more durability and higher quality as the price of the T-shirt increased and expectations were mostly pessimistic of garment performance to laundering compared to the actual performance compared against theoretically acceptable changes in garment dimension.

Keywords: fast fashion; durability to laundering; quality perceptions; dimensional change; care labels; longevity

1. Introduction

The term "fast fashion" usually refers to low-cost, low-quality, clothing collections that mimic luxury trends and traditionally have been perceived to embody unsustainability [1]. Reduced production time and costs in the fast fashion manufacturing process has involved the elimination or reduction of some stages in the production, such as product development and quality control [2]. This has lead in many cases to a decline in garment quality, shorter garment life span before disposal, and even more consumption. In addition, efficient manufacturing practices and increased volumes of consumption have helped to lower prices [3]. Modern-day fast fashion represents the advent of "disposable fashion", which drives the attention from product quality to affordability and produces garments that are not long lasting [4]. Younger fashion followers tend to consume fast fashion and do not expect to keep garments for a long time [5] and this is fuelled by the low price and quick turnover of current fashion trends. Aesthetics, tastes, styles, design and concepts of uniqueness and newness will also result in a garment being discarded whatever the price or condition [6]. Although these consumers have low expectations towards the length of time that they would keep a garment, and were satisfied with it at the time of purchase, they were not always satisfied with how the garment performed during use and the durability of the garment particularly to laundering [7]. When garments

are quick to shrink, fade or lose their shape, the bargain no longer seems worth it [8]. "Key threats to garment lifetimes are fabric failure, component failure, construction failure, accidental damage and colour change" [9].

The perception of a product's quality influences customer satisfaction. Perceived quality of a garment is a combination of extrinsic quality cues (e.g., brand, price, and advertising), intrinsic quality cues (e.g., fit, materials, and manufacturing), credence quality attributes (e.g., ethical production and low environmental impact), and experience quality attributes (e.g., low maintenance, durability, and life span) [3]. Although intrinsic quality attributes will influence the durability of garment, extrinsic attributes and experiences at purchase contribute more to purchase decisions [10], as does the context of use [11]. The experience quality attribute can result in customer dissatisfaction if the garment has unacceptable changes in dimensions, colour, and/or general appearance after laundering. Even if the garment is still wearable, it may be perceived as no longer fit for purpose. This can result in early disposal of the garment [3,12].

Consumers tend to use price as an indication of quality [13]. In an American survey, 58% of consumers believed that a higher-priced garment was of better quality than one at a lower price, and 78% (male, female, and ages 13–24 years and 35–70 years) believed that "you get what you pay for" when buying clothing. In addition, 59% of 13–24-year-old consumers were of the belief that higher-priced clothing lasted longer compared to 43% of 35–70-year-old consumers [14]. If consumers are unable to differentiate the quality of two similar garments, price would tend to be used as an indicator [8]. Quality and durability were perceived as being related by consumers and industry specialists [15]. Durability, "a measure of how long a product will continue functioning as intended and withstand 'wear and tear'... before it develops a defect.", is distinct from longevity (life span), "a somewhat different measure, being partly determined by factors other than attributes formed through design and manufacture" [16]. Despite increasing consumer interest in environmental matters, extending the longevity of a garment is not perceived to add value and therefore not given priority [17]. Additionally, a short life span may not be because of dissatisfaction with the garments durability but may result from a loss of the garment's symbolic value (e.g., no longer meets current fashion trends) [18].

Experience quality attributes are difficult to evaluate when purchasing a garment [19] and functional aspects such as durability and easy to care qualities are generally not considered by consumers at the point of purchase [19]. Although price may have an influence on perception of quality, it does not always reflect the experience of quality, i.e., durability to laundering. The belief that "you get what you pay for" has been proven incorrect by many studies both in the 1990s and more recent times [8,20,21]. Higher-priced jeans, [21], did not have the highest performance of durability or colour retention compared to medium- and lower-priced jeans, and only performed marginally better for fit, after one and five laundering cycles. Durability to laundering of 100% white and navy cotton T-shirts from three price point brands (US$4.88; US$17.99; US$49.50) showed variable results following 20 laundering cycles. Differences were observed between the white and navy T-shirts, and between the brands that challenged the idea that paying less for clothing means buying lower quality [8]. Quality issues related to laundering include shrinkage or garment growth in width or length, colour fading or becoming dingy [12], puckering of seams and hems, skewing of side seams, and surface fuzzing and pilling [8].

Expectation of quality for the price paid influences customer satisfaction. A lower-priced garment may not have the same level of quality as a higher-priced garment but if the experience of quality matches the customer expectation of quality for the price paid, the customer may be satisfied with the purchase decision [22]. Consumer expectation is that a lower-priced garment will not remain in satisfactory condition for as long as a higher-priced garment. If the experience of lower quality confirms the expectation of lower quality, consumer satisfaction is attained as the expectation has been met [7]. Value for money is often the highest-ranked reason given for purchasing a garment [23].

Consumers purchasing fast fashion have a higher frequency of turnover of clothing—both purchasing and disposal [7]. The in-use phase of the garment could be as little as one wear [4] and up to a target life span of 4.5 years [24]. Based on 2.1 wears a month [24] and washing every 2 wears [18,24,25], the expected life span of a T-shirt varies from as little as 2 weeks to 10 $\frac{1}{2}$ months (22 wears; 11 washes) [25], or 2 years (50 wears; 25 washes) [23] and up to 3.3 years (83 wears; 41 washes) with the target life span (4.5 years) [24] being equivalent to 113 wears (56 washes). This may reflect the differing levels of quality and attitudes regarding extending the life span of garments. A range between 1 and 22 wears may be more accurate for fast fashion T-shirts. However, sustainability campaigner, Livia Firth, and some bloggers have encouraged consumers to consider whether they can wear a garment for a minimum of 30 times (approximately 14 months of use) before deciding to dispose of it [26].

Increasing the life span of a garment by one-third will reduce the environmental footprint of clothing. However, lower-quality fabric and construction reduce the garment durability and therefore shorten the life span [17]. Although buying higher-quality, higher-priced products, which are perceived to be more durable, are touted as a sustainability strategy, this can only be successful if paired with changes in consumer consumption patterns and use behaviours [27]. Consumers are less likely to put designer, higher-priced garments into the rubbish compared to fast fashion garments when considering disposal options, indicating that price does influence disposal practices [28].

It is difficult to gauge from this research already undertaken whether judgements of the quality of a garment made on price are justified. Are "fast fashion" garments fulfilling poor expectations of durability over multiple washes? Are expectations of the quality of a garment tied into its price or does the price of a garment determine its quality in terms of durability to laundering? The aim of this research is therefore to explore the relationship between price, perception of quality, frequency of laundering and durability to laundering of a common garment.

2. Materials and Methods

A black cotton T-shirt was chosen as the common garment in both parts of this study. T-shirts are garments that are available at many different price points and are familiar garments to most people. Black was chosen as darker colours are more likely to experience colour change after repeated laundering [29] and black is a colour more consistently available across brands. This study was based in New Zealand and the T-shirts were selected from five brands readily available across the country.

Females tend to hold different perceptions to males and are likely to have different ways of thinking about and purchasing clothing [30] and hence it was decided to seek responses from only females in line with other similar studies [15,28]. The age range (18–25 years) was chosen as the participants will have grown up with fast fashion [9], tend to have a lower income, as many are tertiary students, and so perception and expectations would be more frugal in a retail environment [31].

2.1. Pre-Wash Assessment and Durability to Laundering

Women's black 100% cotton T-shirts were purchased online at five representative price points of: (a) under NZ$10 (type A = NZ$4, made in Bangladesh; and type B = NZ$9, made in India); (b) NZ$11–NZ$40 (type C = NZ$22, made in Bangladesh); (c) NZ$41–NZ$80 (type D = NZ$50, made in Bangladesh); and (d) NZ$80+ (type E = NZ$100, made in India, Fairtrade); and in the largest size available at the time. All were short sleeved, crew neck, single jersey T-shirts with a rib neckband and three of each T-shirt brand was purchased.

The T-shirts were conditioned at 20 °C and 65% relative humidity (ISO 139:2005) [32] pre- and post-laundering for at least 24 h before any measurements were taken in order to ensure consistency and reliability of results. All tests used non-destructive methods in the hope the T-shirts would still have usable 'life' after 30 washes. Hence, the initial mass and area of the T-shirts prior to laundering were calculated as the mass per area of the T-shirts. The area of the T-shirts was approximated using detailed measurements of the T-shirt dimensions. Other test methods used to assess the fabric and

T-shirt durability to laundering were: fabric thickness—following ISO 5084:1996 [33], using an Atlas digital thickness gauge, three measurements were taken on the back and on the front of each T-shirt; fabric count (wales and courses/cm)—ISO 7211–2:1994 [34]; fabric spirality—by sewing a thread into the T-shirt front that followed the warp and weft stitches, crossing to form an angle, from which the angle was measured; dimensional change—following ISO 3759:2011 [35], expressed as a percentage change from original, lengthwise = front neck to centre front hemline and width-wise = across front at junction of sleeve and side seams; seam twist—by holding the T-shirt at sleeve/side seam junction and then laying it flat. Twisting/distance of movement of the side seams from the garment edge was measured; colour change was assessed by determining L*a*b* measurements on two thicknesses of fabric using a HunterLab Mini Scan XE Plus; integrity of seams (including hems and neckline) was examined prior to laundering for initial sewing irregularities, and after laundering for changes due to laundering.

Washing was performed in an Electrolux Wascator using a non-phosphorus powder detergent, following instructions outlined in ISO 6330:2012(E) [36], on a gentle wash cycle at 20 °C. The T-shirts were washed in batches according to brand to avoid transfer of colour and any finishes. After washing, the T-shirts were tumble dried in a Fisher & Paykel domestic drier, set on low heat for 1 hr. Tumble dry was against the recommended care instructions for all but one T-shirt brand, but was used because it is a common method of drying clothing domestically [37,38].

The number of washes undertaken by some retailers was 5, but the number of washes conducted by researchers ranged from 20 to 50, because some changes are not observable after a small number of washes [39]. Hence, the T-shirts were dried and measured after 1, 6, 10, 20 and 30 washes, and measured following 24 h conditioning at 20 °C and 65% relative humidity. The analysis was carried out using R software [40] by fitting a repeated-measures mixed-effects model to the data. The model was fitted using the lme function from the nlme package [41].

2.2. Perception Experiment

A survey was conducted online using Qualtrics [42]. The dependent variable was consumer perception, the independent variable was the cost of a T-shirt at four different price points (<NZ$10, NZ$11–NZ$40, NZ$41–NZ$80, and NZ$80+) and the controlled variable was the make up of the T-shirt such as fibre type (100% black cotton), construction (single knit jersey), and garment type (T-shirt). Brands were excluded from the research to minimize the influence of brand labelling on perception.

An anonymous link was provided through the online platform, which consisted of 14 standard online questions and took approximately 3–5 min for users to complete. University ethical approval was obtained and participants were required to indicate their consent prior to completing the online survey. In addition, participants had to confirm that their age and gender fell within the selected sample (18–25-year-old female) in order to access the survey.

The validity of the results was dependent on the honesty of the New Zealand participants and the anonymous link did not allow for this study to confirm one-hundred percent validity of the sample. The participants were self-selected and recruited through social media and the survey was active for a two-week period. This study used [43] snowball sampling technique, which is a recruitment method that employs research into participants' social networks to access specific populations. One main limitation of this technique is that it is usually difficult to determine sampling error or make judgements about populations based on this sample. There was a total of 128 responses to the survey, with 109 completed and 19 incomplete responses (0.0022% of New Zealand population of 5 million). The 19 incomplete responses were excluded from this study and their responses were deleted online through Qualtrics. Data analysis was conducted through the online survey generator Qualtrics. The questions were concerned with participants purchasing, laundering and wear practices and available in Supplementary Materials.

3. Results

3.1. Pre-Purchase Indicators of Quality

Fabric thickness and mass per area are indicators of fabric quality and can be assessed by the consumer when handling a garment. T-shirt B had the lowest mass/area although a similar fabric thickness to T-shirts A and C (Table 1). T-shirt E had the greatest mass/area and T-shirt D the greatest fabric thickness (Table 1). With the exception of T-shirts A and B, mass/area increased with increase in price but not fabric thickness. The courses/cm (an indicator of needle size in knit fabric construction) was similar across all garments, whereas the number of wales per cm (an indicator of needle spacing) was lowest for T-shirts A and B (46/cm), and greatest for T-shirt E (54/cm). The straightness of the wales was viewed and compared pre-purchase, with the wales of T-shirt B being the least vertical (Table 1).

Table 1. Pre-purchase quality measures for the T-shirts.

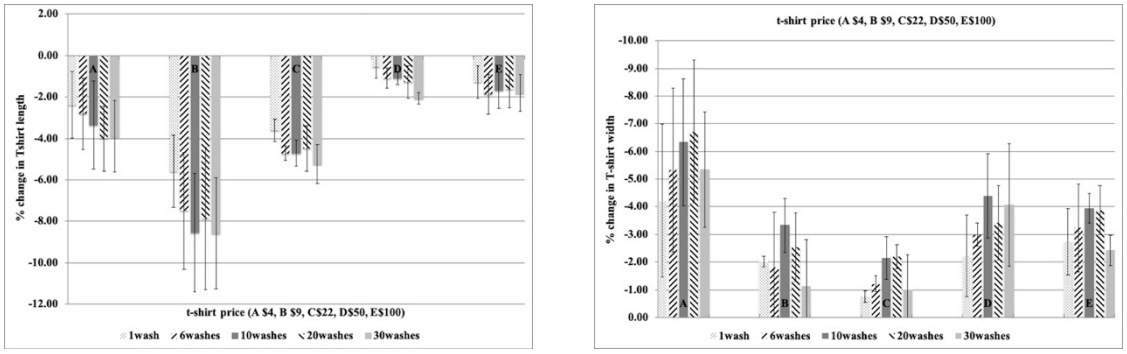
							Sett			
	Mass/Area (g/m^2)	**sd**	**Thickness (mm)**	**sd**	**Spirality (Angle in Degrees)**	**sd**	**Courses (/cm)**	**sd**	**Wales (/cm)**	**sd**
A ($4)	163.32	7.23	0.72	0.03	84	4	35	1.2	46	0.6
B ($9)	138.76	1.56	0.73	0.02	76	1	34	1	46	0.6
C ($22)	210.61	2.48	0.68	0.02	85	1	36	1	50	0.6
D ($50)	218.86	0.54	0.8	0.02	86	2	35	0.6	50	0.6
E ($100)	227.32	2.40	0.74	0.01	88	2	35	0.6	54	0.6

From these pre-purchase indicators of quality, T-shirt B would have been assessed as being of the lowest quality and T-shirt E as the highest quality of the five T-shirts. Poor fabric quality is one of the main contributors to the disposal of a garment because it results in unacceptable changes in the shape and fit of the garment [9].

3.2. Durability to Laundering

3.2.1. Dimensional Stability

The maximum acceptable decrease in length due to laundering, for weft knitted fabrics, is considered as 6% [29] (Figure 1a). T-shirt B ($9) had the greatest % change over 1–30 washes (−6 to −8%). All T-shirts, with the exception of type B ($9), had a mean decrease in length of less than 6%. However, allowing for standard deviation in measurements, T-shirt B was out of tolerance after 1 wash, T-shirt C after 6 washes and T-shirt A after 10 washes, as shown in Table 2. Dimensional stability is one of the areas of first failure for T-shirts and [39] found that their T-shirts were out of tolerance by the 5th wash.



(**a**) (**b**)

Figure 1. Percentage changes following laundering for T-shirt (**a**) length and (**b**) width.

Table 2. Durability to laundering data summary.

			Lengthwise % Change		Width-Wise % Change		Seam Twist (mm)		Spirality % Change		Colour Change ΔE		
			Less Than +2% or −6%		Less Than +2% or −6%				Less Than 3%		ΔE* Less Than 1		
			Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean		s.d.
A ($4)	number of laundry cycles	1	−2.38	1.61	−4.22	2.76	18	8	0.82	0.71	0.40	0.1	5
		6	−2.81	1.71	−5.32	2.96	19	14	0.00	0.00	0.60	0.0	7
		10	3.35	2.12	−6.33	2.29	21	12	0.76	1.79	0.45	0.0	5
		20	−4.00	1.57	−6.72	2.58	29	22	1.08	4.17	0.41	0.1	3
		30	−3.89	1.72	−5.34	2.09	14	2	1.16	1.14	1.08	0.0	9
B ($9)	number of laundry cycles	1	−5.59	1.74	−2.02	0.20	52	6	6.57	2.61	0.22	0.0	9
		6	−7.50	2.82	−1.80	1.99	64	13	6.56	3.93	0.43	0.1	3
		10	−8.53	2.85	−3.33	0.98	57	4	7.45	4.98	0.57	0.0	2
		20	−7.85	3.44	−2.54	1.24	77	6	5.70	4.23	0.62	0.0	7
		30	−8.59	2.69	−1.12	1.69	50	4	7.43	4.19	1.01	0.0	7
C ($22)	number of laundry cycles	1	−3.61	0.54	−0.75	0.20	12	2	1.16	1.16	0.40	0.0	6
		6	−4.72	0.34	−1.22	0.3	13	7	1.95	1.33	0.85	0.1	1
		10	−4.72	0.63	−2.15	0.77	12	6	1.95	1.33	0.70	0.2	4
		20	−4.48	1.10	−2.20	0.43	17	6	2.33	1.15	0.66	0.1	8
		30	−5.24	0.95	−0.98	1.28	11	10	2.33	1.15	0.95	0.1	2
D ($50)	number of laundry cycles	1	−0.55	0.55	−2.23	1.48	19	11	1.93	1.79	0.33	0.1	2
		6	−1.10	0.48	−2.99	0.42	15	8	2.32	0.04	0.58	0.0	7
		10	−1.09	0.31	−4.38	1.52	14	2	2.31	1.16	0.68	0.1	5
		20	−1.28	0.79	−3.42	1.34	18	7	1.16	1.18	0.40	0.0	6
		30	−2.07	0.29	−4.06	2.22	15	2	1.54	0.64	0.94	0.1	0
E ($100)	number of laundry cycles	1	−1.28	0.78	−2.73	1.21	5	5	0.00	0.00	0.40	0.1	6
		6	−1.86	0.95	−3.23	1.58	6	6	0.38	0.66	0.75	0.1	1
		10	−1.69	0.87	−3.94	0.53	4	4	0.38	0.66	0.98	0.0	3
		20	−1.63	0.89	−3.87	0.88	5	4	0.76	1.31	0.63	0.0	6
		30	−1.80	0.89	−2.41	0.55	5	1	0.38	0.66	1.25	0.2	7

T-shirt type had the greatest contribution to the percentage change in length ($F_{4,28} = 71.058$, $p \leq 0.001$) compared to wash number ($F_{4,28} = 10.034$, $p \leq 0.001$). A significant difference was observed between all T-shirt types, except T-shirts D ($50) and E ($100) which had the least % change in length (≤−2%) over 1–30 washes. This result is similar to the navy 100% cotton T-shirts examined by [8], where only the lower-priced T-shirt (US$4.88/NZ$ < 10) had a percentage decrease in length of greater than 5% after 20 wash cycles.

The pattern of width-wise percentage change across the different T-shirt types was similar for each wash number (Figure 1b) and fell within the acceptable range of +2% to −6% [29] throughout the 30 washes for T-shirts B, C and E. T-shirt A had the greatest width-wise change over all wash cycles and was out of tolerance after the first wash. Although each T-shirt type had a different percentage change in width with washing, there was no significant difference between the number of laundering cycles within each T-shirt type.

3.2.2. Spirality

Ideally, the wales of a knit fabric should be at 90° to the courses of the fabric [44]. A change from this with laundering could lead to distortion of the fabric and hence the shape and fit of the garment. A change greater than 3% would be considered unacceptable [24]. Only T-shirt type E started out with near to 90° between the wales and the courses (Figure 2a). All the other T-shirt types showed some spirality even before the first wash. Prior to washing, the comparison of the spirality measurements

for T-shirt type B was significantly different to T-shirt types A & C ($p \leq 0.01$); and to D & E ($p \leq 0.001$). However, shirt types A, C and D were not significantly different.

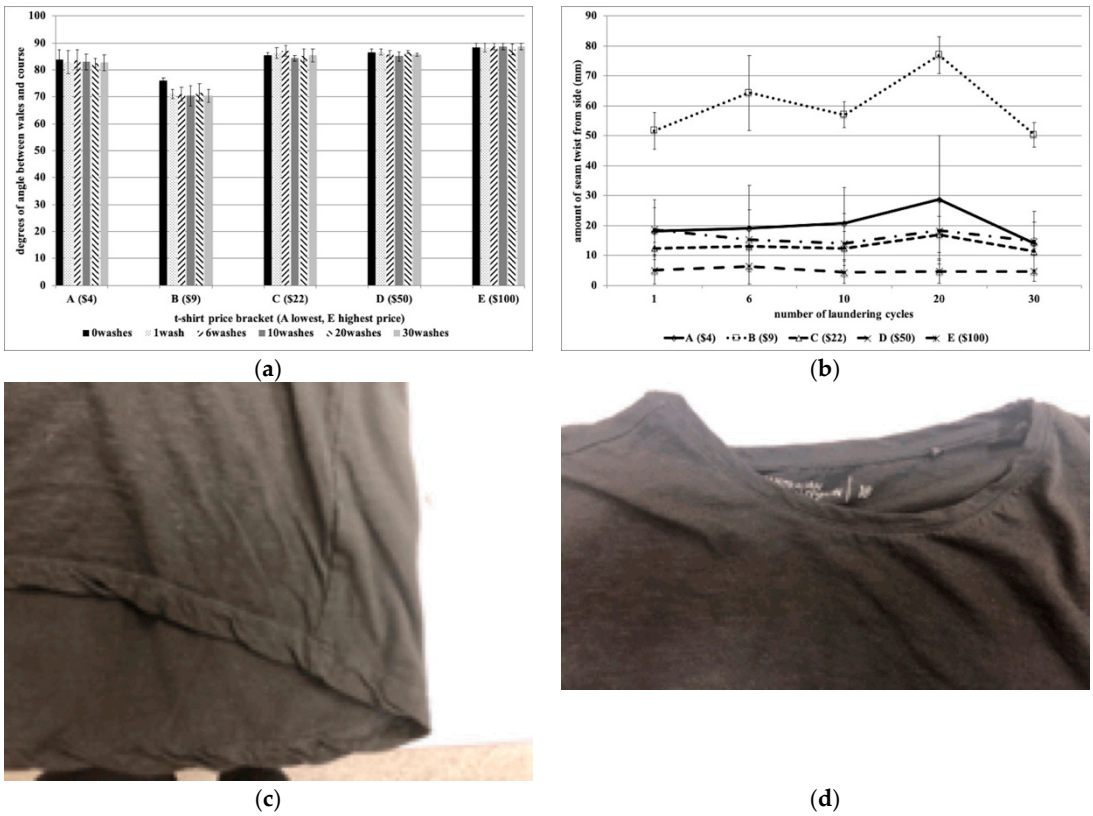


Figure 2. Post-laundering changes in T-shirts: (**a**) percentage change in angle between wales and courses; (**b**) amount of seam twist (mm); (**c**) detail of seam twist and hemline roping, T-shirt B; (**d**) detail of neckline twisting, T-shirt B.

Most notably, only T-shirt type B was significantly different to the other T-shirt types following 6, 10, 20 and 30 washes ($p \leq 0.001$). The contribution to variance of change for spirality was ($F_{4,58} = 233.4$, $p \leq 0.001$) for T-shirt type. T-shirt type B had the greatest spirality before washing (76°), which increased after the first wash at 71° (6.6% change), and at 70° (7.9% change) after 30 wash cycles. However, there was no significant difference in spirality between the number of laundering cycles within each of the T-shirt types. In general, the highest-priced T-shirt (type E) had the least amount of spirality both before laundering and after 30 wash cycles, as shown in Table 2. This was also observed for the highest-priced navy T-shirts after 20 washes were examined [8]. Spirality is usually the result of a poorly constructed fabric or a garment that has not been cut with the wales on the true grain; often a result of a lower-grade fabric, manufacturing process or quality control.

3.2.3. Seam Twist

The distance a seam twisted from the side into the front of the T-shirt was variable over the number of laundering cycles (Figure 2b). T-shirt type B had the greatest amount of twisting of the seams (50–77 mm) and had the largest visual change during laundering (Figure 2b). The amount of side seam twist for T-shirt type A (14–29 mm) was the next highest in amount of twisting as a result of laundering. T-shirt type D (14–19 mm) and C (11–17 mm) were similar in amount of twisting and variability with laundering. The most expensive T-shirt (type E) showed the least amount of seam twisting (4–6 mm), as shown in Table 2. The seams twisting to the front and back of a garment gives an unacceptable appearance and could be cause for early disposal.

3.2.4. Seam Appearance and Integrity

Seam integrity is the ability of the seams to withstand multiple laundering cycles without showing signs of damage such as puckering, hem roping, and unravelling of stitching, again possibly causing premature disposal. T-shirt type B showed some puckering at the seams and roping of the hemline after 1 wash. By 10 washes, the hemline roping was extensive and there was twisting of the neckline (Figure 2c,d). In addition, some unravelling of stitching was observed on the shoulder, armhole and neckline seams of T-shirt types A, B and C after six wash cycles. Only T-shirt types D and E did not display any issues with seam appearance or integrity. Changes in seam integrity can alter the acceptability of a garment and be the reason it is considered no longer suitable for use [29].

3.2.5. Colour Difference

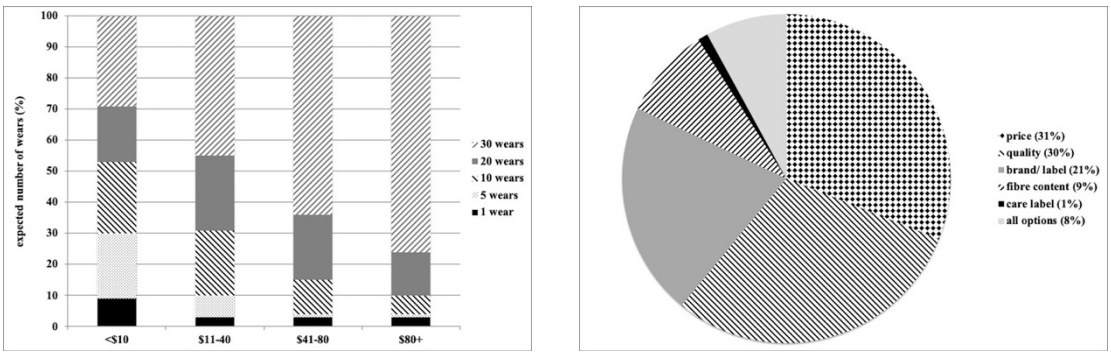
Colour difference varied with the number of laundering cycles for all T-shirts, and differed between T-shirt types. A colour difference (ΔE*) of less than 1 means that the difference is invisible to the human eye [45] and therefore can be considered to represent an indistinguishable change in colour. The ΔE* was near to or greater than 1 only after 30 washes, but was not significantly different between T-shirt types E (mean 1.25, s.d. 0.27), A (mean 1.08 s.d. 0.09), B (mean 1.01 s.d. 0.07), C (mean 0.95 s.d. 0.12), and D (mean 0.94, s.d. 0.10), as shown in Table 2. This is in contrast to the finding by [8], where a significant difference in colour change was observed between different brands after 20 washes. Loss of colour (fading) was one of the reasons a garment would be discarded [9].

3.3. Survey Findings

3.3.1. Purchase Price and Wear

The majority of survey respondents (85%) said that they would pay $40 or less for a black cotton T-shirt, the preferred purchase price being $11–$40 (74%). They also expected a $50 T-shirt to last longer than a $10 T-shirt (95%), and be of better quality (95%). Price is often used as an indication of quality, with consumers believing a higher-priced garment would be of better quality than a similar, lower-priced T-shirt [8,13,14].

When participants were asked how many times they expected to wear a T-shirt before deciding not to wear it any longer, a similar number expected to wear a $0–$10 T-shirt up 1 to 5 times (30%) as would wear it 30 times (29%) (Figure 3a). As the price of the T-shirt increased, the percentage of people who expected to wear the T-shirt 30 times increased: $11–$40 T-shirt (45%); $41–$80 T-shirt (64%); and $80 + T-shirt (76%). Interestingly, a small number of participants (3 people) anticipated only one wear from the higher-priced T-shirts (i.e., $11–$40, $41–$80 and $80+), compared to a T-shirt costing <$10 (10 people).



(**a**) (**b**)

Figure 3. (**a**) Expected number of wears of a T-shirt based on price; (**b**) consumer considerations when buying a T-shirt.

When purchasing a T-shirt, price (31%), quality (30%) and brand/label (21%) were the highest considered aspects (Figure 3b). Although only 1% of people said that they considered the care label when purchasing a T-shirt, when asked in relation to specific T-shirt price categories, a total of 10% said that they read the care label at point of sale. A study of 120 female and male participants (aged 18 and above) of mixed education and demographics in South Africa noted that 38% of respondents said that care label information had a modest influence on their purchasing decisions [46].

3.3.2. Wear and Laundering

Participants stated that they most commonly washed T-shirts after one wear (35%) or two wears (43%), compared to three wears (21%). Two and three wears was also most common for young consumers in Sweden (38.6% and 30.0%, respectively) [47], and two wears is often used when considering the use phase of T-shirts [25,45]. In this survey, only 1% of participants said that they would wear a T-shirt 4 or more times before washing compared to 15.7% of the young Swedish consumers [47]. Hence, most consumers of the medium- to higher-priced T-shirts, and 47% of the lowest-priced T-shirts, were inclined to wear a T-shirt 22–30 times based on the life span range, [25,26].

Although consumers understood the impact of 'care'/laundering on the garment life span, most consumers did not follow them after the first wash, if at all [48]. In the current survey, 47% of the participants said yes when asked whether they generally read the care labels of clothes. However, when whether if they would read care labels in relation to the four types of T-shirts, 59% of participants said that they did at either point of sale (10%) or before cleaning/after use (49%), although the number who did not read care labels at all decreased with increasing T-shirt price. In a South African study, 46% of participants said that they frequently or always read care label instructions [47]. Survey findings from Cotton Incorporated's Lifestyle Monitor [49] of the number of consumers who 'always' or 'usually' read care labels before laundering a garment have shown a decreasing trend (2003—77%; 2007—64%; 2009—57%), and noted that younger consumers (under 35 years) were less inclined to read care instructions.

It was also observed that the price of the T-shirt influenced the attitude to care labels: the lower the price paid, the less the care instructions would be followed. Care instructions were followed by more than 40% of participants before cleaning/after use for all but the lowest-priced T-shirts. Purchasers read the care labels of the highest-priced T-shirts at point of sale more than those who purchased lower-priced T-shirts.

4. Discussion

A study was undertaken to test physical aspects of garment durability to laundering as well as perceptions of quality and expectations of wear and laundering in relation to the price of a women's black cotton T-shirt. If the price is low, then it is expected by consumers that the T-shirt will change in colour and shape after laundering, with the majority expecting this to happen between 1 and 10 washes. The physical testing does indicate that price is the predominant factor when considering shape change, although this occurs after more washes than participants expected. Colour did not change a perceptible amount until 30 washes for all the T-shirts. Lower-priced T-shirts (A, B, and C), however, displayed other unacceptable changes after a low number of washes (1 to 6), such as seam puckering, roping of hems, unraveling of seam stitching, twisting of side seams and fabric spirality, which are all indicators of lower quality. Such changes were not observed, or only observed to a small extent, in the highest-priced T-shirts, even after 30 washes. These appearance changes could lead to early disposal of the T-shirt, even if it is still wearable, as it may be perceived by consumers as no longer being acceptable. The highest-priced T-shirt (E: $100) was made of the highest-quality fabric and after 30 machine washes had the least dimensional change, fabric spirality and twisting of seams. In addition, visual assessment of seam integrity was not compromised. However, like the other T-shirts, a colour change would be perceptible after 30 washes. The second-lowest-priced T-shirt (B; $9) was assessed to be made

from lower-quality fabric, and exhibited the highest spirality before laundering and after 30 washes, the highest amount of seam twisting, and its seam integrity was comprised after just one wash cycle.

Most participants expected a higher-priced T-shirt to be more durable, and their expectations were consistent with the test findings. They also expected to wear a higher-priced T-shirt more before discarding, but would still be more likely to buy a lower-priced garment. This could be a reflection of the demographic surveyed and their ability to afford an expensive garment. Participants were also much more likely to follow care instructions before laundering of higher-priced garments, therefore possibly increasing the wearable life of the T-shirt.

Based on the survey findings, more than 50% of consumers would discard a low-priced T-shirt (0–$10) after 10 washes. The performance of the two lowest-priced T-shirts that were tested (A: $4 and B: $9) highlight that price is not necessarily an indicator of performance as they responded very differently to laundering. The $9 T-shirt (B) changed the most when laundered. It was also the least well made, with noticeable spiraling, seam twist and poor seam integrity. In contrast, the cheapest T-shirt (A) was more durable with respect to all aspects of durability except width change, where there was no significant difference between T-shirt brands. Seam twist was the same after 30 washes as T-shirts C and D; change in length was less than T-shirt C over 30 washes, and spirality did not change over the 30 washes. Those who purchased the $9 T-shirt would have their low expectations of quality and performance met, but those purchasing the $4 T-shirt would have their expectations exceeded but may discard the garment anyway because the price drives this behaviour in the consumer. However, what is considered an acceptable change in shape by researchers (e.g., decrease in length below 6%) may still be a negative sign to participants that laundering has had an effect and is a signal to discard the garment. For example, T-shirt A ($4) had a mean pre-wash length of 61.6 cm and shrank 4% with laundering. This is equivalent to a decrease in length of 2.5 cm, which may be visible to the consumer and therefore render the garment unacceptable for purpose.

It is possible that Brand A may have higher manufacturing quality controls than Brand B accounting for the noticeable differences in quality between these lowest-priced brands. Brands of T-shirts were not named in the survey because knowing a brand could make a difference to purchasing decisions given that brand was the third largest aspect considered when purchasing a T-shirt, after price and quality. Given that quality is not always easy to assess, price would tend to be the indicator used [8] along with brand. T-shirt B had the lowest mass/unit area and sett, whereas T-shirt E had the highest mass/unit area and sett and therefore can be considered to be made of a fabric of comparatively higher quality to T-shirt B. This is then reflected in the greater durability to laundering. Therefore, it could be supposed that higher-quality resources were sourced for manufacturing T-shirts for Brand E than Brand B and that this is reflected in the retail price of the T-shirts. In addition, findings indicate that the construction of T-shirt E was of higher quality than for T-shirt B as indicated by the seam twisting and seam integrity results.

A lack of difference in the quality (after five laundering cycles of garments) of similar designer garments purchased at outlet stores (higher priced) and department stores (lower prices) was noted by [10]. They concluded that a lack of correlation between the durability of these garments to laundering and price was due to these items being made by the same manufacturer. The black T-shirts in the current study were produced in two different countries and an unknown number of manufacturers, were laundered 30 times, and were from 5 different price points. A difference in quality was observed (T-shirt E was more durable to laundering, and T-shirt B the least durable) and this difference did equate to price (T-shirt E $100; T-shirt B $9). Fast fashion garments are considered to be made of lower-cost/quality materials, compromising durability and encouraging early replacement [50]. However, lower price did not indicate low quality/durability in this study, as all the T-shirts, with the exception of B, had measures in acceptable ranges of performance after 5 washes, and in most measures after 30 washes.

From this research, there was some conflict between the judgement of the quality of a garment made on price compared with how a garment in that price range performed in physical durability

experiments. Garments that might be considered as "fast fashion" varied in their performance on durability over multiple washes. Price was found to not necessarily be a good indicator of physical performance when it is low. Higher-priced garments performed better as expected by consumers, with better-quality fabric used, better construction and greater durability to laundering. It is likely that the unexpected good performance of the lowest-priced T-shirt may be connected with the brand's quality control processes. Participants' expectations were on the whole pessimistic compared to actual performance, especially at the lower-priced points of garments. If consumers base disposal decisions on their expectations of quality and durability rather than actual garment performance, then garments could be discarded and become obsolete sooner than actual quality performance would dictate. This would have consequential impacts on the sustainability of that garment. An additional consideration is the need for increased labelling, certification and consumer education on obsolescence to assist in ascertaining whether a garment is likely to be durable, regardless of cost. This has the potential to then increase garment longevity with associated sustainability gains.

Supplementary Materials: The following are available online at http://www.mdpi.com/2071-1050/12/21/8906/s1, Table S1: Consumer survey questions.

Author Contributions: Conceptualization, S.W., and L.D.; methodology, L.D., D.P. and K.K.; formal analysis, S.W., L.D., T.J., D.P. and K.K.; writing—original draft preparation, S.W., L.D., D.P. and K.K.; writing—review and editing, S.W. and L.D.; supervision, S.W. and L.D. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

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