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Does Providing Information about the Environmental Benefits of Reusable Packaging Systems for Consumer Products Increase Consumers' Willingness to Use Them?

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Abstract: Systems for reusing packaging (e.g., refillable bottles for laundry detergent) have the potential to reduce plastic waste and lower the environmental impact of delivering products to consumers. However, despite the potential of reusable packaging, uptake of reuse systems is typically low and so the present research investigated whether informing consumers about these benefits increases their willingness to engage with reuse systems. A total of 969 participants were asked to imagine buying consumer products, such as laundry detergent in refillable bottles, and were then randomly allocated to either receive information on the potential environmental benefit of (i) their using the scheme, (ii) the scheme as a whole, or (iii) no information. The findings suggested that the information increased consumers' awareness of the environmental impact of reuse systems but did not increase their willingness to use such systems. This finding underscores the need for strategies that go beyond mere dissemination of information, to circumvent obstacles that prevent willing consumers from enacting desirable behaviours.

Keywords: plastic; packaging; reuse; refill; information; consumer willingness; consumer products; environmental information

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1. Introduction

Global plastic production has risen to 390 million metric tonnes annually [1], with a significant portion allocated to packaging and other products that are typically disposed of after use [2]. Packaging plays an essential role in protecting products and reducing food waste [3,4]. However, once this function has been fulfilled, most of this packaging rapidly becomes waste [5]. For example, in the UK alone, nearly 100 billion pieces of plastic packaging are discarded annually, with only 12% being recycled [6]. The remainder ends up in landfills or pollutes the environment, posing severe ecological and health risks. Approximately 50% of plastics are used for single-use items [7]. Governments are responding by banning single-use plastics and advocating for alternatives such as reusable packaging systems [8].

Reusable packaging refers to packaging that is designed to be used multiple times, thereby reducing waste, lowering demand for raw materials, and minimising environmental impacts, such as pollution and energy consumption [9–11]. Examples of reuse systems include returnable containers like glass milk bottles and beer kegs, reusable shopping bags, refill stations for products such as detergents and soaps, and reusable lunch containers and water bottles that replace single-use plastics. These systems can contribute to a more sustainable economy by reducing the environmental footprint of packaging [12]. However, to confer benefit, people need to be willing to buy products in reusable packaging, and that packaging must be used multiple times as intended [13].

Sadly, there are significant challenges engaging consumers with reuse systems, leading to relatively low rates of uptake and concerns that consumers may not reuse packaging and containers enough times to confer benefits over single-use alternatives. For example, the

University of Sheffield in the UK implemented a system that enabled customers to buy hot drinks and food from its catering outlets in reusable containers. However, two years after the scheme was implemented, less than 10% of sales were in reusable containers [14]. Trials are underway for refill systems for household products like laundry detergent (e.g., Lidl's partnership with Algramo [15]), but public data on uptake has yet to be released. One factor that might contribute to low uptake of reuse systems is a lack of awareness of the potential environmental benefits of reuse systems [16,17]. Although evidence suggests that most people are now aware of—and worried about—climate change [18], the environmental impact of choosing to purchase consumer products in reusable containers as opposed to single-use containers is not necessarily obvious. Indeed, sophisticated lifecycle analyses are needed to estimate the impact of different product delivery systems [19,20], meaning that the average consumer is likely unaware of how their choices influence energy, water, and CO_2 consumption. Indeed, a report by the Bring It Back Fund cautions against assuming that the public understands why reuse is preferable to recycling and suggests raising awareness of the environmental benefits of switching to reuse, making the environmental benefits tangible.

Digital technologies such as RFID (radio frequency identification), barcodes, magnetic cards, and smart cards, are being employed in reuse systems [21,22] These technologies facilitate enhanced tracking and management of products but may offer additional benefits. For instance, these systems could be used to provide users with real-time data on the environmental impact of their actions through an app. That is, when checking reusable containers in or out, digital reuse systems could enable users to receive information on the environmental benefits of their choices (e.g., purchasing products in reusable containers), such as reductions in carbon dioxide emissions, water, and energy savings relative to alternative choices (e.g., purchasing products in single-use containers). The present research investigates whether providing information motivates users to engage with reuse systems by clearly illustrating the direct benefits of their actions.

2. The Present Research

The present research hypothesises that providing information emphasising the environmental benefits of individual or collective reuse would have a positive effect on consumers' willingness to engage with reuse systems. We focused on a refill system for laundry detergent in a supermarket context, as similar schemes are being trialled (e.g., Lidl's partnership with Algramo [15], pilots conducted by Unilever [23]). We also decided to evaluate the effect of providing information on individual behaviour (e.g., an individual learns that they have reused 10 bottles, saving 3 kg of CO_2 compared to using 10 single-use bottles) as well as collective behaviour (i.e., the benefit of the system as a whole—e.g., an individual learning that the system has been used 2000 times, saving 6064 kg of CO_2).

The Theory of Planned Behaviour (TPB) [24] was used to identify pertinent beliefs that could (i) be affected by information concerning the environmental impact of reuse and (ii) predict willingness to engage with the system. Specifically, we assessed behavioural beliefs (e.g., attitudes towards reusable products, perceived effectiveness, anticipated emotions), normative beliefs (e.g., subjective norms), control beliefs (e.g., switching costs), and proximal determinants of action, such as willingness. Willingness was measured rather than intentions as specified by the TPB [24] because reuse systems are not yet mainstream, and so people are unlikely to intend to use something that they have not yet had the opportunity to use but may be willing to. The concept of willingness was developed within the Prototype Willingness Model (PWM; [25]), which expands the TPB (included in the PWM as a reasoned action pathway) to additionally specify a more reactive pathway, captured by willingness. We also measured participants willingness to make trade-offs in an effort to assess the depth of their commitment to sustainability (e.g., what might they be willing to forego in order to make more sustainable choices?). Finally, we measured participants awareness of the environmental impact of reuse systems to check that the information we provided had the desired effect. Figure 1 illustrates the variables that were

manipulated (i.e., information about the environmental impact of reuse) or measured (the other variables) and the hypothesised relations (shown by arrows between the variables).

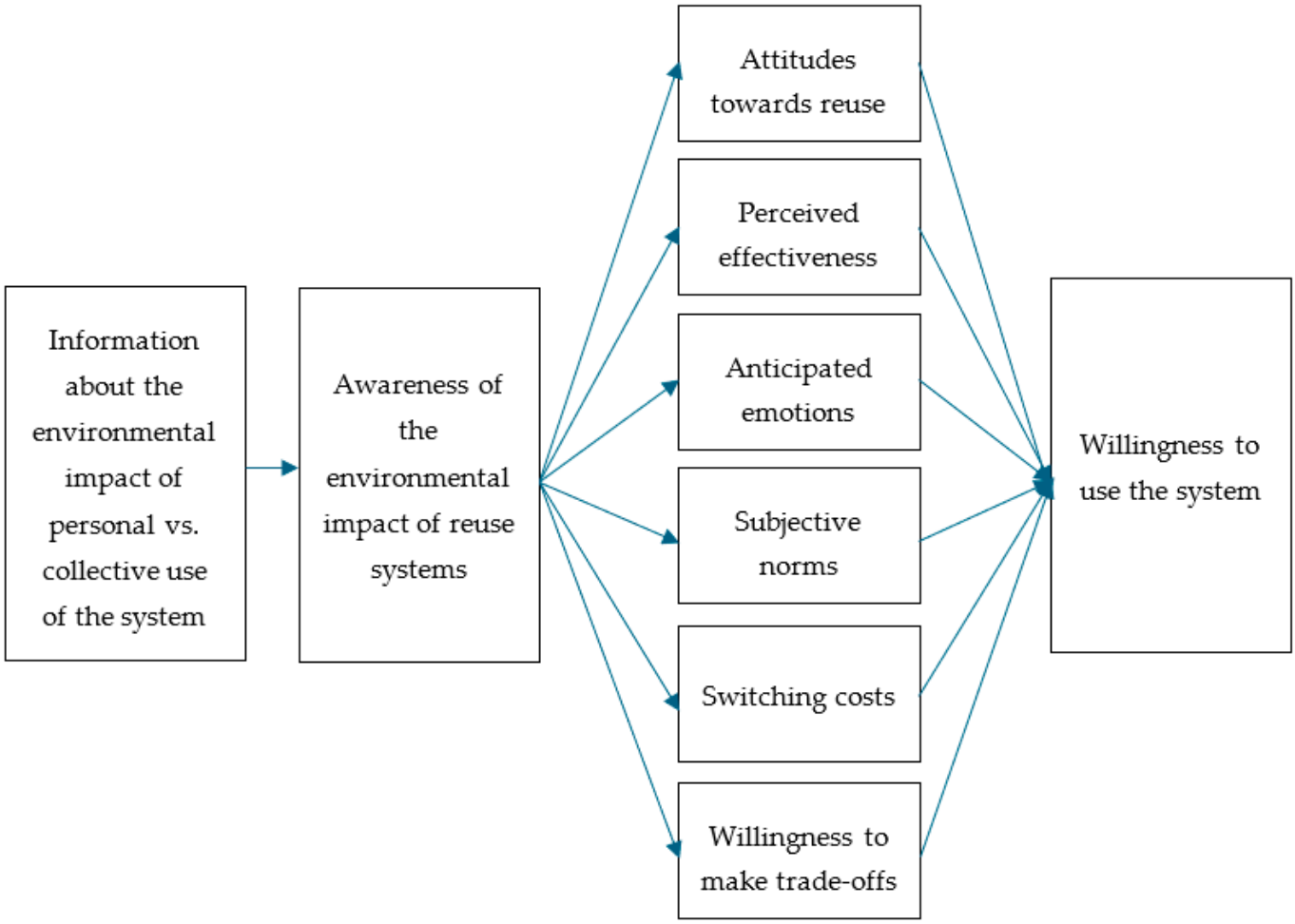


Figure 1. Illustration of how information about the environmental impact of reuse might influence willingness.

3. Methods

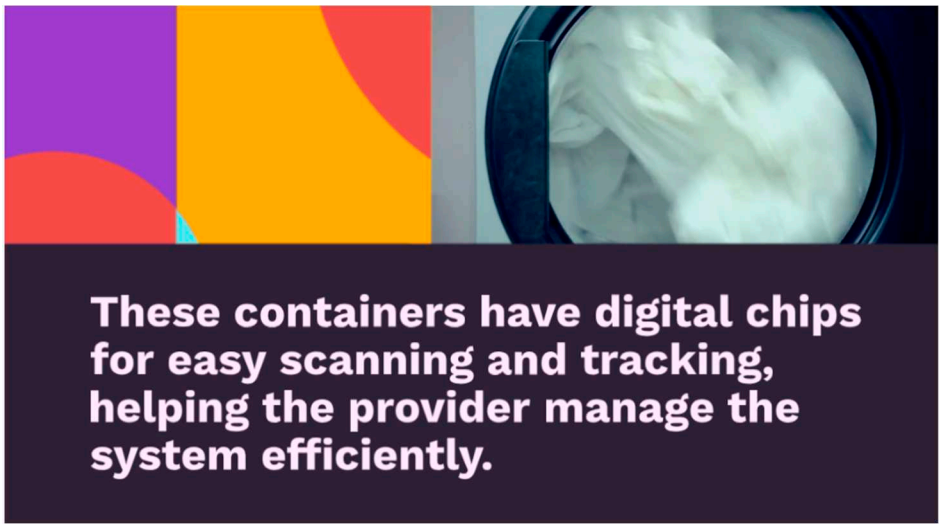
The study was pre-registered on the Open Science Framework (https://doi.org/10.17605/OSF.IO/APSH4).

3.1. Participants

G*Power [26] was used to estimate the required sample size. This analysis suggested that N = 969 participants would provide 80 power to detect a small (f^2 = 10) difference in willingness between participants who received information about the environmental benefits of (i) their or (ii) others use of the system and (iii) participants who did not receive information. The calculation was based on a fixed-effect, one-way, between-participants ANOVA, with alpha = 0.05. We predicted a small-sized effect of providing information based on previous research, which has typically found very small or no effects of environmental information on pro-environmental behaviour [27,28]. A nationally representative sample (UK) of 969 participants was recruited via Prolific (M age = 46.46, SD = 15.43, range = 18 to 83, 51.3% female). The study took less than 10 min to complete, and participants were remunerated £1.50 for their time.

3.2. Scenario

Participants completed an online survey hosted by Qualtrics (Qualtrics, Provo, UT, USA). After reading an information sheet and giving consent, they were presented with a scenario that asked them to imagine buying laundry detergent in a supermarket. They were told that some products, such as laundry detergent, are packaged in reusable plastic containers with digital chips that allow the containers to be scanned (e.g., at the point of purchase, cleaning facility, etc.), which helps the provider manage the system (e.g., know how many containers are waiting to be filled, are with customers). Participants were asked to imagine using this scheme, including that they would need to return the empty bottles to the collection point on their next shopping visit so that the bottles could be cleaned and refilled, ready to be used again. Alongside reading the scenario, participants also had the opportunity to watch a short video that illustrated how the digital reuse system would work (see Figure 2 for screenshots).



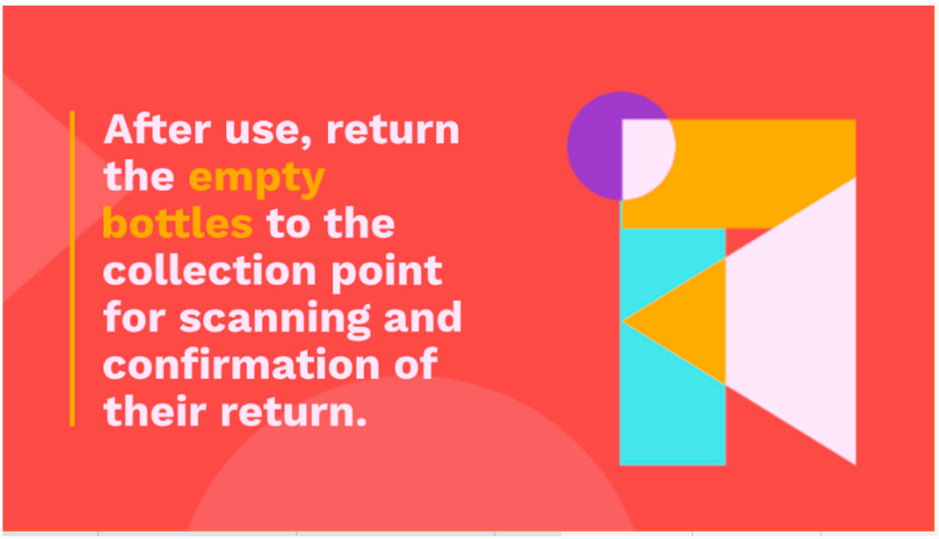


Figure 2. *Cont.*

Figure 2. Screenshots from the video illustrating buying laundry detergent in reusable bottles.

3.3. Manipulation of Information

Participants were then randomly assigned to one of three conditions in a between-subjects design: personal information, collective information, or no information. Participants in the information conditions were told that they could open an app at the refill point to see the number of times that they had used the system (personal information condition) or the system had been used (collective information condition) and the environmental impact of this use relative to purchasing the same amount of laundry detergent in single-use bottles. Figure 3 provides examples of the information that was provided to participants.

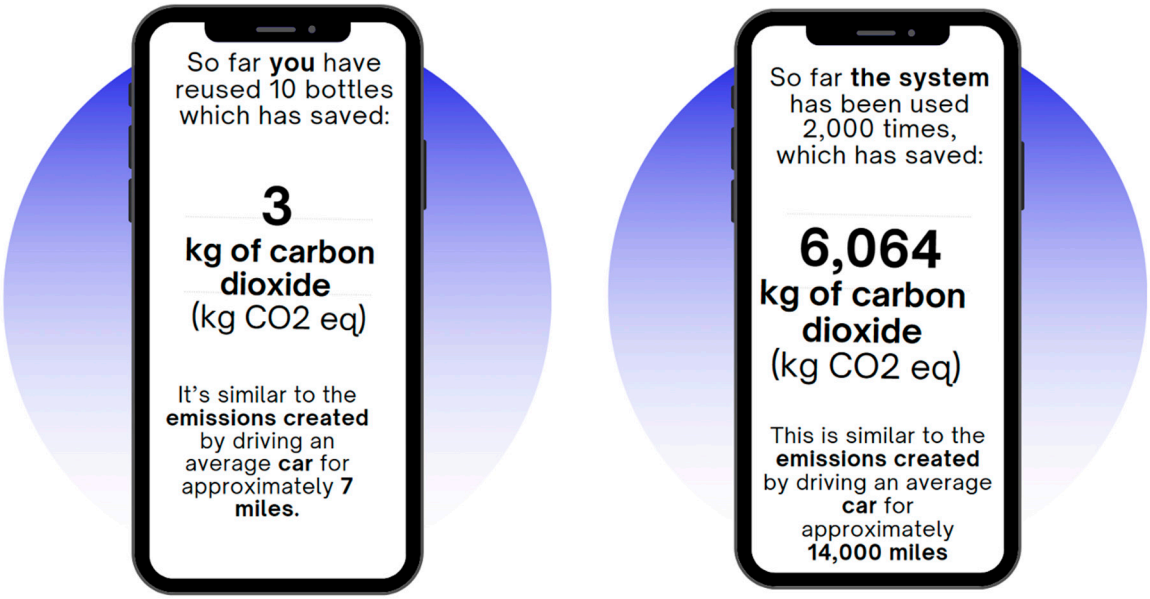


Figure 3. Screenshots showing examples of the information that participants received on the environmental impact of their behaviour (**left panel**) or the system as a whole (**right panel**).

Participants were presented with four metrics: (i) plastic consumption (i.e., number of bottles saved), (ii) energy saved (MJ), (iii) water consumption (m3), and (iv) carbon (kg CO_2 equivalent) to highlight the environmental impact. These values were estimated following lifecycle analysis conducted by the TRACE project team (https://gtr.ukri.org/projects?ref=10015760 (accessed on 1 July 2024)) and presented through a simulated app interface. The presentation was designed to mimic receiving real-time notifications on an app and

included information on equivalent actions (e.g., that 66 MJ of energy is similar to that used by a desktop computer over 8 days) to facilitate interpretation of the information.

3.4. Measures

After reading the scenario, participants completed measures to evaluate their beliefs about reuse. These measures were presented in a randomised order.

Attitudes towards buying laundry detergent in reusable bottles were measured using the stem "For me, buying laundry detergent in reusable bottles would be…", followed by seven 7-point semantic differential scales: (i) foolish-wise, (ii) bad-good, (iii) harmful-beneficial, (iv) unenjoyable-enjoyable, (v) unpleasant-pleasant, (vi) unfavourable-favourable, and (vii) negative or positive. These items were internally reliable (Cronbach's alpha = 92) and so were combined into a single index, with higher scores indicating a more positive attitude towards reusable products.

Perceived Consumer Effectiveness (PCE) reflects individuals' beliefs regarding their ability to influence environmental issues through their purchasing choices [29]. Participants were asked to indicate the extent to which they agreed with four statements on a 7-point scale ranging from 'strongly disagree' to 'strongly agree'. For example, "Buying laundry detergent in reusable bottles would help to reduce plastic pollution". These items were internally reliable (Cronbach's alpha = 83) and were combined to form an index reflecting participants beliefs about their ability to impact environmental issues through their purchasing decisions.

Subjective norms were measured by asking participants to indicate their level of agreement with three statements on a 7-point scale, ranging from 'strongly disagree' to 'strongly agree'. For example, "The people who are important to you approve of you buying laundry detergent in reusable bottles" These items demonstrated internal reliability (Cronbach's alpha = 85) and were combined to construct an index reflecting participants beliefs about what important others think they should do.

Anticipated emotions were assessed using items developed by Vu and Nielsen [30]. Participants were asked to indicate their agreement with four statements on a 7-point scale. For example, "I would feel good if I bought laundry detergent in a reusable bottle" and "I would regret it if I bought laundry detergent in a single-use bottle when a reusable alternative was available". The items demonstrated internal reliability (Cronbach's alpha = 87) and were combined to form an index reflecting the emotions that participants anticipated experiencing if they purchased detergent in reusable bottles.

Switching costs were assessed using items developed by Jones, Mothersbaugh, and Beatty [31], which gauge consumers' perceptions of the costs of switching from buying laundry detergent in single-use bottles to buying detergent in reusable bottles. Participants were asked to indicate their agreement with a series of statements on a 7-point scale. For example, "Switching to buying laundry detergents in reusable bottles would entail a significant investment of time and effort for me" and "Overall, transitioning to buying detergents in reusable bottles would be inconvenient". These items were internally reliable (Cronbach's alpha = 92) and were combined into a single index, where higher scores indicated a higher perceived cost of switching to reusable alternatives.

Participants' willingness to purchase laundry detergent in reusable bottles was evaluated by asking participants to rate their agreement with three statements on a 7-point scale: "I would be willing to buy laundry detergent in reusable bottles", "I will buy laundry detergent in reusable bottles", and "I am likely to buy laundry detergent in reusable bottles". The items exhibited internal reliability (Cronbach's alpha = 93) and were combined into a single index, with higher scores indicating a greater willingness to purchase laundry detergent in reusable bottles.

Willingness to make trade-offs was assessed using items adapted from Vu and Nielsen [30] to gauge the strength of consumers' dedication to purchasing laundry detergent in reusable bottles. Participants were asked to indicate their agreement with five statements on a 7-point scale. For example, "I would buy laundry detergent in reusable

bottles even if the quality is slightly lower than laundry detergent in single-use bottles" and "I would buy laundry detergent in reusable bottles even if the performance is slightly lower than conventional options". The items demonstrated internal reliability (Cronbach's alpha = 85) and were combined into a single index, where higher scores indicate a greater willingness to make trade-offs to purchase laundry detergent in reusable bottles.

Awareness of the environmental impact of reuse systems was assessed using measures adapted from Pinos, Hahladakis, and Chen [32]. Participants were asked to rate their agreement with four statements on a 7-point scale. For example, "I feel informed about the environmental impact of buying laundry detergent in reusable bottles" and "It's easy for me to observe and comprehend the environmental impact of buying laundry detergent in reusable bottles". These statements exhibited internal reliability (Cronbach's alpha = 89) and were combined into a single index, where higher scores indicate greater awareness of the environmental impact of reuse systems.

3.5. Approach to Analysis

To ascertain participants beliefs about reuse systems (e.g., attitudes, norms, willingness to use the system, and willingness to make trade-offs), we computed the means and standard deviations for each measure. To check that presenting information on the environmental impact of personal or collective action indeed increased participants awareness of the environmental impact of engaging with reuse systems as intended, we conducted a 3-between (condition: personal information, collective information, no information) ANOVA with awareness of the environmental impact of reuse systems as the dependent variable.

The main hypotheses and analyses designed to test them were pre-registered on the Open Science Framework (https://doi.org/10.17605/OSF.IO/APSH4). A univariate ANOVA was used to investigate whether providing information on the environmental impact of action influenced participants willingness to use the reuse system. Information regarding the environmental impact of buying laundry detergent in reusable bottles was the independent variable (i.e., information provided vs. not provided), and willingness to buy laundry detergent in reusable bottles was the dependent variable.

MANOVA was used to investigate the impact of information on other beliefs. The independent variable was information regarding the environmental impact of buying laundry detergent in reusable bottles (three levels: personal information, collective information, and no information). The dependent variables were participants' attitudes towards buying laundry detergent in reusable bottles, perceived consumer effectiveness, anticipated emotions, subjective norms, switching costs, and willingness to make trade-offs.

4. Results

4.1. Beliefs about Digital Reuse Systems

Table 1 presents descriptive statistics regarding various beliefs about digital reuse systems under different informational conditions. On average, attitudes towards reuse were quite positive (M = 6.53, SD = 1.34), participants were convinced that their behaviour could influence the environment (i.e., was effective, M = 5.81, SD = 0.99), and participants were willing to engage with the reuse system (M = 5.61, SD = 1.20). Participants believed that significant others would approve of their buying laundry detergent in reusable bottles (M = 5.50, SD = 1.05) and anticipated positive emotional outcomes from using these systems (M = 5.21, SD = 1.21). Participants evidenced some concerns about the challenges of switching from single use to reusable options (M = 3.31, SD = 1.47) but seemed moderately willing to make trade-offs necessary to adopt reusable alternatives (M = 4.95, SD = 1.13).

Table 1. Descriptive statistics for beliefs about reuse systems as a function of condition.

	Personal Information		Social Information		No Information	
	M	*SD*	*M*	*SD*	*M*	*SD*
Awareness of environmental impact	5.62	0.93	5.57	1.00	5.15	1.16
Attitudes towards reuse	6.57	1.34	6.52	1.34	6.48	1.35
Perceived effectiveness of reuse	5.86	0.98	5.83	0.94	5.74	1.04
Anticipated emotions	5.28	1.21	5.18	1.25	5.17	1.18
Subjective Norms	5.47	1.04	5.57	1.04	5.46	1.08
Switching costs	3.34	1.48	3.34	1.42	3.25	1.50
Willingness to use system	5.65	1.18	5.62	1.19	5.58	1.25
Willingness to make Trade-offs	5.01	1.12	4.96	1.16	4.87	1.12

4.2. Manipulation Check

To examine whether receiving information on the environmental impact of personal or collective action increased participants awareness of the environmental impact of engaging with reuse systems, a one-way ANOVA was conducted. The main effect of the condition was significant ($F(2, 969) = 20.01$, $p < 001$). Participants were more aware of the environmental impact of using reusable laundry detergent bottles when they received information regarding the environmental impact of their behaviour ($M = 5.62$, $SD = 0.93$) or the collective impact of others behaviour ($M = 5.57$, $SD = 1.00$) than when they received no information ($M = 5.15$, $SD = 1.16$).

4.3. Impact of Information on Willingness to Engage with the Digital Reuse Systems

A two-between (condition: information on personal or collective impact vs. no information) ANOVA with willingness as the dependent variable suggested no significant difference in willingness to engage with the reuse system as a function of receiving information on the environmental impact of reuse relative to single use ($F(2, 967) = 0.35$, $p = 554$, $eta^2 = 0.00$).

4.4. Impact of Information on Beliefs about Reuse Systems

To examine whether receiving information regarding the environmental impact of personal or collective action influenced beliefs about reuse systems and associated behaviours, a three-between (condition: personal information, collective information, and no information) MANOVA was conducted. The multivariate effect of condition was not significant ($F(14, 1920) = 1.06$, $p = 391$, $eta^2 = 0.01$), suggesting that the information did not influence participants beliefs.

5. Discussion

Reusing containers and packaging holds promise for reducing waste and mitigating the broader environmental impact of consumer goods like food and household products [11]. However, despite the availability of reuse systems, uptake has remained relatively low to date [33]. The present research investigated whether providing consumers with information about the environmental impact of their actions affects their willingness to engage with the reuse system and their beliefs about it. This hypothesis is intuitively appealing—reuse is a relatively new idea, particularly for some product categories (e.g., household products like laundry detergent), and the environmental benefits of such product delivery systems are not easily observable by those using the systems—indeed, estimating the environmental impact of systems requires sophisticated life cycle analysis [13,19,34]. This has led to calls for strategies to emphasise the environmental benefits of reuse [17]. Digital reuse systems that require people to use an app to check out or return containers offer the opportunity to present such information and increase users' awareness of the environmental impact of their actions, or the scheme as a whole.

In contrast to our hypotheses, however, the present research did not find evidence that providing information increased participants' willingness to engage with reuse systems. Furthermore, although providing information about the environmental impact of actions raised participants awareness of the environmental impact of the reuse system as intended, there was no indication that the information influenced consumers' (i) attitudes towards reuse, (ii) subjective norms with respect to purchasing laundry detergent in reusable bottles, (iii) perceived costs of switching from a single use to a reuse system, or (iv) anticipated emotions associated with such purchases. Taken together, the findings do not support the idea that providing information to consumers about the environmental benefits of reuse systems impacts their willingness to use the reuse system or alter their beliefs about it.

Our findings corroborate prior research that suggests information and education alone are rarely sufficient to influence behaviour. For example, Colombo et al. [35] point out that awareness and concern about climate change rarely translate into action, perhaps in part because approaches that seek to provide information and raise awareness fail to account for factors that could undermine the translation of pro-environmental intentions into action (e.g., relatively automatic, visceral reactions to reusing containers that may have been used previously [36]). Similarly, Mastria, Vezzil, and De Cesarei [37] found that information concerning the safety or justifying the increased cost of reusable packaging did not influence consumers' willingness to pay for reusable packaging. Finally, Pott et al. [38] did not find evidence that providing information about cleaning reduced people's concerns about contamination when reusing containers. Together with evidence across a series of studies, including the present research, that people are generally willing to engage with reuse systems (e.g., [28]), these insights suggest that enabling reuse at scale does not require changing minds but rather designing and providing systems that do not present barriers to willing consumers (e.g., add complexity relative to single use). In other words, we reach the same conclusion as a recent review by Albaraccin et al. [39], decision-makers and planners "...should focus on interventions that enable individuals to circumvent obstacles to enacting desirable behaviours rather than targeting salient but ineffective determinants of behaviour such as knowledge and beliefs" (see also [40]).

Limitations and Future Directions

The strengths of the present research include the experimental design that randomly allocated participants to conditions, thereby isolating the effect of information on participants' responses, and the recruitment of a sample that was broadly representative of the UK population. However, it is also worth bearing in mind two limitations. First, the research relied on hypothetical scenarios and assessed participants likely rather than actual responses. This decision was taken to maintain experimental control (i.e., it was relatively easy to directly manipulate what information participants received), but also because measuring actual responses to an opportunity to purchase consumer goods in reusable containers would have required partnering with a retailer and/or brand owner, which may have biassed both who took part (e.g., we would only have been able to recruit people who shopped at that store and/or bought that product) and participants responses, which may have been shaped by prior experience with the shop or brand. However, responses to hypothetical scenarios may not accurately reflect the complexities of real-life decisions about reusable packaging, including practical considerations like time pressure and more automatic influences on behaviour like habits and emotions. For example, research on the hot-cold empathy gap [41] suggests that people may underestimate the effect of emotions on their behaviour. Given that the present research did not find evidence that information about the environmental impact of reuse systems influences participants' responses, we do not believe that the use of hypothetical scenarios is a significant limitation. However, should future research using such scenarios identify potentially effective strategies for promoting reuse, it would be useful to also test them in a real-world context.

Second, the present research measured people's willingness to use the reuse system as opposed to actual purchasing decisions and also did not consider the other behaviours

inherent to a successful reuse system (e.g., returning the containers after use). Substantial evidence suggests that there is a gap between intentions and action [42]. Measuring willingness rather than intentions, helps as intentions may be undermined by the (current) scarcity of reuse systems (i.e., people are unlikely to intend to use something that they have not yet had the opportunity to do but may be willing to). Furthermore, research in other contexts has suggested that willingness is associated with actual behaviour (e.g., [43]). However, future studies should seek to identify ways to measure actual behaviour, ideally unobtrusively (e.g., via data on purchasing behaviour).

6. Conclusions

This study indicates that, although providing consumers with information about the environmental consequences of their choices increases awareness of the environmental impacts of action, it does not substantially change consumers' willingness to participate in reuse systems or modify their views about these systems. We therefore echo recent reviews that call for a shift away from informational approaches and towards interventions that focus on the barriers that motivated people encounter translating good intentions into action [39,40].

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Institutional Review Board Statement: The study was approved by the Research Ethics Committee at the University of Sheffield (Application #059030, approved 8 April 2024).

Informed Consent Statement: Informed consent was obtained from all participants involved in the study.

Data Availability Statement: The raw data supporting the conclusions of this article is available on the Open Science Framework (https://osf.io/4k5j9/files/osfstorage/668be927a5387a0709a3c702, accessed on 4 June 2024).

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

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