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ORIGINAL ARTICLE OPEN ACCESS

Assessing the Willingness to Pay for Different Types of Multi-Level Sustainability Labels in the Sports Apparel Industry

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ABSTRACT

Labels are effective tools for marketing environmentally and socially sustainable goods and can positively affect consumers' willingness to pay. But sustainability labeling is still rather uncommon in the sports sector and there is hardly any pertinent research. This is why this study analyses the impact of two different types of sustainability labels on the willingness to pay of German runners for sports apparel with the following research question: How do a percentage-based and a graphic label differ in their effect on consumers' willingness to pay for sustainable sports shirts? The data for this study were collected with two panel surveys that each include a choice-based conjoint analysis to assess the respondents' willingness to pay. In the first data collection, a percentage-based label is used to communicate environmental and social sustainability, and a graphic one in the second. The results show that the willingness to pay increases with higher levels of environmental and social sustainability in both samples. However, by communicating with graphic labels, lower levels of sustainability are already rewarded with a comparably high willingness to pay. For the percentage-based labels, the willingness to pay increases more gradually. These insights have many implications for academia, businesses, and political institutions.

1 | Introduction

Past research has shown that sustainability attributes are frequently valued by consumers (Osburg et al. 2016) and studies in various industries have highlighted a higher willingness to pay (WTP) for products and services with a higher environmental sustainability (ES) or social sustainability (SS) (Drozdhenko et al. 2011; Ellis et al. 2012; Nassivera et al. 2017; Könecke et al. 2021; Thormann and Wicker 2021). But even though research shows that sustainable goods need to be recognizable as such to generate these effects (Berger 2019; Majer et al. 2022), this is often difficult or virtually impossible for consumers (Boulding and Kirmani 1993; Rao et al. 1999; Johnston and Roheim 2006; Sigurdsson et al. 2022). One way

of communicating sustainability are labels that are placed on goods to assist consumers in their purchase decision (Majer et al. 2022; Naipak 2022). Osburg et al. (2020) showed that eco-labeling decreased information asymmetry and increased green consumption behavior. And even the United Nations endorse (environmental) labeling to encourage sustainable consumption and production (United Nations 1992).

Considering the above and studies that have shown a positive influence of SS and ES on WTP and/or purchase intention in sports contexts (Casadesus-Masanell et al. 2009; Könecke et al. 2021; Thormann and Wicker 2021; Spindler et al. 2023, 2025), the question arises which effect sustainability labels would have in the sports sector. This is particularly so because sports in

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general and particularly sports apparel as a part of the textile industry (Spindler et al. 2023) have a significantly negative impact on the environment and society through, for instance, the production of greenhouse gas emissions (Chard et al. 2012; Collins and Roberts 2018; Wicker 2018; Niinimäki et al. 2020), waste generation (Preuß 2015; Niinimäki et al. 2020; Neumann et al. 2021; Chand et al. 2023) or problematic working conditions (Goworek et al. 2012; Fulton and Lee 2013; Lundblad and Davies 2016; Mukendi et al. 2020).

Although there is literature on the effect of eco-labels in the apparel industry (Lin 2010; Ellis et al. 2012; Rothenberg and Matthews 2017), there is hardly any research on the relevance and possible effects of sustainability labeling in the sports sector.¹ Even though making sports products and services more sustainable has become a very important issue for consumers and providers alike (Hugaerts et al. 2021; Hugaerts, Scheerder, et al. 2023; Hugaerts, Schunk, and Könecke 2023; Hugaerts and Könecke 2025; Lintumäki et al. 2024), the only prior study that analyses a sustainability label in this regard is (Spindler et al. 2023, 2025), which has motivated the current study. Due to the potential that labeling could have in this context, further research on sustainability labeling in the sports sector is urgently needed. Such research can also be considered a contribution to the generally relevant question of how sustainability attributes should best be communicated to consumers (Janßen and Langen 2017; Osburg et al. 2017; Khan et al. 2024).

Therefore, this study analyzes the effects of different sustainability labels in the sports sector (for the first time also including a non-numeric, graphic label) on consumer preferences. This is done based on two panel surveys among adult German runners using two similar choice-based conjoint analyses (CBC). The surveys were performed in alignment with previous literature (e.g., Puentes and Trujillo 2025) that highlighted strategies to improve data quality when using online experiments for researching sustainable consumption behavior. Germany was chosen as the target market for this study because it is the largest economy in Europe (Eurostat 2025) and the third-largest in the world (IMF 2025), with a very considerable market for sports apparel that was worth around 5.34 billion EUR in 2023 (Federal Statistical Office of Germany 2025). Additionally, eco-labeling was introduced in Germany nearly 50 years ago and is the most commonly used tool for communicating sustainability in Germany today (European Commission 2009; Thøgersen et al. 2010). Runners were the target population because running is practised by people from all age groups, genders, and socioeconomic backgrounds (Schunk et al. 2016, 2017). Moreover, runners were found to have a high environmental awareness and high WTP for sustainability measures which makes them a relevant target group for sustainability-related sports research (Könecke et al. 2021; Triantafyllidis and Kaplanidou 2021).

The specific aim of this study is to examine the influence of the use of different types of labels communicating different levels of ES and SS (a percentage-based and a graphic one) on the WTP for sports apparel. The following question guides the research:

How do a percentage-based and a graphic label differ in their effect on consumers' WTP for sustainable sports shirts?

Since labeling of products has been a topic of research for decades, this paper is part of a broad research tradition (Majer et al. 2022). However, the intensity of the research differs profoundly between various research fields and industries. For the food industry, for instance, extensive literature on the labeling of food products in terms of environmental impact, social impact, or nutritional quality exists (Egnell et al. 2020; Lim et al. 2020; de Bauw et al. 2021; Sigurdsson et al. 2022). This study considerably draws from past research on nutritional labeling (Borin et al. 2011) and particularly regarding the so-called "Nutri-Score". This is a graphic label that indicates the nutritional information of a food product based on which the graphic labels used in this study have been developed.

2 | Literature Review and Theoretical Background

2.1 | Willingness to Pay for Sustainable (Sports) Apparel

Sustainable fashion consists of apparel which is either made from recycled material or organically grown natural fibers and/or needs less resources when worn or washed (e.g., cooler washing temperature, less ironing). Moreover, it could also be second-hand apparel or worn over a comparably long period of time (Kim and Damhorst 1998). Concerning the consumers' perception and acceptance of sustainable apparel, Bauer and Schunk et al. (2016) observed that ES is an important purchase criterion in the textile industry. Moreover, several studies have confirmed a higher WTP for sustainable apparel. Nimon and Beghin (1999), for instance, calculated a WTP of an additional 30% for apparel made from organic cotton in comparison to non-green alternatives. The same tendency can be seen in studies of Ellis et al. (2012), Hustvedt and Bernard (2010), and Rothenberg and Matthews (2017). SS also seems to be a purchase criterion for consumers as previous studies have shown that social responsibility is a relevant factor when buying apparel (Gupta and Hodges 2012) and that consumers are willing to pay higher prices for more socially sustainable clothing (Hustvedt and Bernard 2010; Hyllegard et al. 2014; Tully and Winer 2014).

Until now, only three studies have specifically looked at consumers' WTP and preference formation when buying more sustainable sports apparel. Firstly, a study by Casadesus-Masanell et al. (2009) used overall sales figures to calculate the WTP for organic cotton shirts of the brand Patagonia. The results showed an average additional WTP of 6.58 USD for these shirts compared to conventional cotton shirts. Secondly, Kim and Oh (2020) also observed that higher perceived sustainability levels increased the purchase intention of consumers when buying sports apparel. Lastly, a previously published detailed analysis of the first data collection included in the present publication showed an additional WTP of up to 31.50 EUR for 100% ES and 25.02 EUR for 100% SS when buying functional sports shirts (Spindler et al. 2023).

2.2 | Signaling Theory

Previous studies have found that consumers usually are unable to identify green or eco-friendly products (Osburg et al. 2020).

One of the reasons for this and the key problem in buying or selling such products is the lack of opportunities for consumers to inform themselves about a product's environmental characteristics. This information asymmetry between consumers and producers (Osburg et al. 2020; Sigurdsson et al. 2022) frequently even persists during and after consumption (Boulding and Kirmani 1993; Rao et al. 1999; Johnston and Roheim 2006; Sigurdsson et al. 2022).

Reducing such an information asymmetry is the key focus of signaling theory (Spence 1973; Rynes 1991; Connelly et al. 2011), which has been used in marketing research for decades already (Sigurdsson et al. 2022). The theory was first described by Spence (1973) who examined the labor market and found that more qualified applicants can distinguish themselves from less qualified ones by using their better education as a signal. Like in the current paper, marketing research mostly evaluates product signals (Rao et al. 1999).

Signaling theory includes four key elements: signaler, signal, receiver, and feedback. The signaler (e.g., product or company) has information about underlying qualities that are not apparent to the outsider (receiver). To balance these information asymmetries, a signal must be sent to the receiver. The receiver observes and interprets the signal. In marketing research, consumers are often the receivers (Rao et al. 1999; Connelly et al. 2011). Feedback is the reaction of the receiver to a perceived signal. In this study, consumers' observed additional WTP for more sustainable sports apparel is the feedback under scrutiny.

There are several key constructs regarding signaling theory that have been found relevant for determining the usefulness and effectiveness of signals. Firstly, signal cost is defined as "transaction costs associated with implementing a signal" (Connelly et al. 2011, 52). The main aspect here is that some signalers have advantages because they have lesser costs or can recuperate these faster. For example, if a company is already investing in sustainability, it will usually be cheaper for them to get to a sustainability certificate than a company that has not previously invested in this domain. If structured correctly, these costs reduce issues such as "false signaling" (Connelly et al. 2011, 45), which could be "green washing" in the context of this study. Secondly, signal clarity (also called observability) means the "extent to which outsiders are able to notice the signal" (Connelly et al. 2011, 52). Obviously, this has a profound effect on signal effectiveness. Cost and clarity are highlighted as the main "characteristics of efficacious signals" (Connelly et al. 2011, 52). Additionally, the construct "credibility" is highly relevant as it is a "combination of a signal's honesty and fit" (Connelly et al. 2011, 52).

2.3 | Labels

2.3.1 | Labels as Tools for Signaling Sustainability

In marketing, signaling can happen through brands or labels which act as "cues of the quality of unobservable product attributes" (Brach et al. 2018, 256; see also Montgomery and Wernerfelt 1992). These visual cues decrease the time consumers need to find the relevant information on the product (Egnell

et al. 2020). Moreover, these signals transform credence attributes into search attributes (Erdem and Swait 2004), which is why labels can also serve as signaling tools for sustainability (Sigurdsson et al. 2022).

Bjørner et al. (2004) and de Magistris et al. (2015) highlight that specifically environmental criteria can be signaled by using eco-labels on the products as a tool to inform consumers about a product's environmental compatibility in an aggregate way. The results of a study by Osburg et al. (2020) showed that eco-labeling decreased information asymmetry and increased green consumption behavior. This finding is supported by Fianu and Harrison-Arthur (1997) who proposed that labels support consumers in making "value judgments" (p. 97). Henninger (2015) also observed that eco-labels can enhance sustainable consumption and Pham et al. (2020) found an additional WTP of 37.7% for apparel with an eco-label in comparison to conventional products. Similarly, Majer et al. (2022) indicated a positive effect of visual sustainability labels in their review article with mainly food-related studies. Nevertheless, some studies point to unintended consequences of labeling as well (e.g., rebound effects or label dilution) (Horne 2009; Barkemeyer et al. 2023).

2.3.2 | Formats of Labels

Osburg et al. (2020) and Osburg et al. (2017) posit that different formats of labels may vary in their effect when trying to signal sustainability information. For this paper, it is of particular importance that summary labels, that is labels that summarize information without giving specific details, are often very accessible and can intuitively be understood (Julia et al. 2017; Egnell et al. 2019; Jürkenbeck 2023).

In this study, two distinct fictive five-level summary sustainability labels were used: a percentage-based and graphic one. Although the percentage-based label was presented as statements of how environmentally and socially sustainable a product was (in %), the graphic label was designed to resemble the Nutri-Score, which is probably the best-known graphic label in the German food market (German Federal Ministry of Food and Agriculture 2022) and likely beyond.

The Nutri-Score is a five-level, color-coded graphic label that informs about the nutritional information of a food product and can be used voluntarily (Federal Ministry of Food and Agriculture 2019). The label is displayed on the front of prepackaged and processed foods and was developed at Université 13 in Paris. It was first introduced in France in March 2017 (Julia et al. 2018; Federal Ministry of Food and Agriculture 2019). As can be seen in Figure 1, the Nutri-Score's levels are as follows: dark green (A), light green (B), yellow (C), orange (D), and red (E) (Egnell et al. 2020). The yellow category has the purpose of discouraging dichotomous thinking (Julia and Hercberg 2017), because research had found that consumers made little distinction between levels A and B on the one hand and D and E on the other (de Temmerman et al. 2021).

In this context, it is relevant to note that research on color psychology indicates a connection between color-coding and label salience (Egnell et al. 2020). According to Egnell et al. (2020),



FIGURE 1 | Different levels of the nutri-score (Santé publique France 2022).

Bargh (1992), and Schuldt (2013), colors are perceived as signals by consumers with green representing “go” and red “stop (and think)” (Koenigstorfer et al. 2014, 70). Marette (2022) also showed that a red category of a color-coded label has a higher impact on the purchase intention than yellow or green categories.

Previous research on graphic labels has found that the format positively impacts signal clarity, receiver interpretation, and, particularly, feedback. In research by Goiana-da-Silva et al. (2021), Hercberg et al. (2022), Julia et al. (2017), de Temmerman et al. (2021), and Ducrot et al. (2015) and consumer studies in France (Sarda et al. 2020), Spain (European Community of Consumer Cooperatives 2020), Belgium (Testachats 2020), and Germany (INFO GmbH Markt- und Meinungsforschung 2019), the graphic format of the Nutri-Score was superior compared to other nutrition labels regarding the perception as well as the ability of identification and speed of interpretation. A study by Jürkenbeck (2023) that was conducted in Germany indicated a higher WTP for higher levels of the Nutri-Score and the Eco-Score. The latter is based on the Nutri-Score and also uses color coding and the letters A to E but indicates ecological aspects. The Eco-Score is already commonly used on food products in France and has been tested regionally in Lidl grocery stores in Berlin (Germany) from 2021 to 2023 (Pistorius 2021; Lidl Dienstleistung GmbH and Co. KG 2024). But until today, the Eco-Score is still unknown to the majority of German consumers (Jürkenbeck 2023). In her study, Jürkenbeck (2023) used the two labels with food items (cereal and yogurt) as reference products. The results showed that consumers' preferences and WTP were influenced by the labeling, regardless of whether they knew the label (Nutri-Score) or not (Eco-Score). Therefore, the researcher concluded that (even unknown) colored graphic summary interpretive labels are “an effective tool in guiding food purchase decisions” (Jürkenbeck 2023, 6). The question of whether this observation was applicable to (sports) apparel as well was a key motivation for this paper.

3 | Methods

3.1 | Data Collection

When planning the data collections for this study, a number of steps summarized by Paul (2024) were taken to ensure a high data quality and appropriateness for publication in a leading journal in the field. Specifically, two data collections were conducted in collaboration with two panel providers between the 7th and 22nd of July 2021 (= Survey 1, see also Spindler et al. 2023) and between the 26th and 29th of June 2023 (= Survey 2). The questions from both surveys that were used for the analyses presented in this paper are included as a [Supporting Information](#). The inclusion criteria for both surveys were that the respondents needed to be over 18 years old, currently living in Germany,

active runners (run at least once per month), and have given their consent to participate in the study. Quotas were defined for gender, age, and regional distribution over the 16 German states to ensure a certain representativeness of the collected data for the German population, keeping in mind that based on past research, it could be expected that runners would differ from the average population to some extent. They should, for instance, have an above-average level of education and income (Könecke et al. 2021).

3.2 | Experimental Design

Generally, conjoint analyses are a multivariate and decompositional method for uncovering consumer preferences. The findings center around discovering product attributes that are preferred by consumers (Bajaj 1999; Gustafsson et al. 2007; Brand and Rausch 2021). For the analyses presented in this paper, data collected with two CBCs are analyzed. This type of conjoint analysis is considered the best option for multivariate discrete choice analysis (Brand and Rausch 2021) like the one conducted for this research. Within the CBC, the chosen reference product is split up into its characterizing attributes and variations of these attributes (Green and Rao 1971; Bajaj 1999; Gustafsson et al. 2007; Härdle and Simar 2015).

The CBCs were both designed using the software “Sawtooth Lighthouse Studio” (Version 9.13.1) and distributed using a link that led to a computer-assisted web interview (CAWI). Advantages of CAWIs are anonymity and accessibility as well as a high degree of accuracy even if sensitive information is gathered because the social desirability bias is minimized (Kreuter et al. 2008). Besides these advantages, another reason for choosing this method was that it made it possible to collect data in all 16 German states simultaneously.

As a reference product for the CBC, a functional sports T-shirt was chosen. This product is suitable for the CBC in the context of sports apparel since it is a rather common product which minimizes the effects of status motives (Yan et al. 2021). It is also available in many variations and is bought irrespective of gender and age (Bauer and Schunk 2016; Spindler et al. 2023), can be worn as an upper layer or under other pieces of clothing all year long (Schunk et al. 2017; Spindler et al. 2023).

After the attributes and levels were defined (Table 1), the experimental designs included in the surveys were automatically created by Sawtooth Lighthouse Studio (Sawtooth Software 2022c). As suggested by Sawtooth, the product concepts were created through the random task generation method “balanced overlap” to have good statistical properties regarding, for instance, level balance and independence of attributes (Orme 2024a). Therefore, they are not truly “random”.

TABLE 1 | Attributes and levels of the choice-based conjoint analysis (Survey 1 and Survey 2).

Attributes	Brand	Price (in EUR)	Environmental sustainability		Social sustainability	
			Survey 1: %-based	Survey 2: Graphic (GREEN-score)	Survey 1: %-based	Survey 2: Graphic (SOCIAL-score)
Levels	Adidas	9.95	0%		0%	
	Nike	14.95	25%		25%	
	Puma	19.95	50%		50%	
	Asics	24.95	75%		75%	
	Odlo	29.95	100%		100%	
	Reebok	34.95				
	Pro Touch	39.95				
	Runnerspoint	45.95				
		49.95				
		54.95				

For both data collections, 16 random choice sets were created that each consisted of three product options and a “none”-option (meaning respondents could choose not to buy any of the offered options). The shirts that could be chosen in the two CBCs differed in terms of brands, price, and level of ES and SS. The offered brands and price levels were the same in both CBCs, but they differed in how the levels of ES and SS were presented (Figure 2). In each of the surveys, the included choice sets were the same for all respondents.

The first data collection ranked ES and SS using a five-level percentage-based label (0%, 25%, 50%, 75%, 100%) (see also Spindler et al. 2023, 2025), whereas the second survey presented the sustainability attributes using graphic labels that have specifically been designed for this research on the basis of the Nutri-Score. As can be seen in Table 1, the graphic labels are called GREEN-Score (representing ES) and SOCIAL-Score (representing SS) and look very similar. Both have five levels as well as use a coding system that is based on letters and colors from A (green/best) to E (red/worst).

The attribute “price” ranged from 9.95 EUR to 54.95 EUR (Table 1) in both CBCs and was defined based on real market prices for functional sports shirts and a similar study by Schunk et al. (2017). To prevent an overestimation of the WTP (Sawtooth Software 2022c), no higher upper price boundary was used.

The attribute “brand” was included in the CBCs as well because brands play an essential role in product perception (Ha-Brookshire and Norum 2011; Wang et al. 2022). All chosen brands are

mentioned in Table 1 and the Supporting Information. When defining the levels, brands that particularly focus on sustainability (e.g., Patagonia or hessnatur in Germany) were excluded to avoid interaction effects with the sustainability attributes because, due to the focus of this paper, brands are not considered in the analyses.

German consumers are familiar with multi-level labels because, for instance, the label for energy efficiency in large electronic devices or the Nutri-Score are very common and well-known. However, no general multi-level labels neither exist in the textile industry nor for sustainability on the German market at this point in time. This is why the general suitability of the experimental design was tested in a pre-study using the percentage-based labels before the start of the first data collection. In this pre-study, 125 respondents from Germany filled in the survey. Overall, the experimental design proved to be suitable for further use, and the percentage-based sustainability labels turned out to be understandable for the respondents. Before starting the first data collection, some minor comments of the pre-study participants were used to improve the accessibility of the survey. Since the GREEN-Score and the SOCIAL-Score are very similar to the well-known Nutri-Score, no pre-study was conducted to test these labels before the second data collection.

3.3 | Conducted Analyses

In a first analytical step, the average utilities were estimated using the hierarchical Bayes estimation (HB) with the software “Sawtooth Lighthouse Studio” (Version 9.13.1). HB is strongly

Brand	Runners Point	Nike	Adidas
Price	49.95 €	34.95 €	44.95 €
Environmental Sustainability	This product is 50% environmentally sustainable.	This product is 25% environmentally sustainable.	This product is 100% environmentally sustainable.
Social Sustainability	This product is 25% socially sustainable.	This product is 100% socially sustainable.	This product is 75% socially sustainable.
	Select	Select	Select

I would not choose any of these options.			
Select			

Brand	Nike	Adidas	Asics
Price	49.95 €	24.95 €	19.95 €
GREEN-Score			
SOCIAL-Score			
	Select	Select	Select

I would not choose any of these options.			
Select			

GREEN-Score: indicates **environmental sustainability**.

SOCIAL-Score: indicates **social sustainability**.

FIGURE 2 | Translation of an exemplary choice sets of the choice-based conjoint analyses (translated from German by the authors).

recommended by Sawtooth as it has been “described favorably in many journal articles” (Orme 2024b, Introduction Section). The method can estimate individual average utilities on fewer choices than other methods by using population information, such as means or covariances (Sawtooth Software 2022c).

The calculated average utilities add up to zero for each attribute. This means that the average utilities for the different levels of each attribute can either be positive, negative, or zero. The average utilities of the levels display whether respondents prefer this option over the other options or not (Sawtooth Software 2022c). To check the feasibility of the results, the average utilities for the attribute price were plotted for data collection. The reasoning for this will be explained in the section where the results of this calculation are presented. Additionally, an aggregate logit analysis has been conducted to check for preference heterogeneity.

Next, the WTP for the different levels of SS and ES was calculated on the basis of the average utilities using the tool “Market

Simulator” of the above-mentioned software. The simulator converts average utilities into simulated market choices. As a simulation method “Share of Preference” is used because it should match real-life consumer behavior more closely than, for instance, first choice models (Orme 2024c). This method uses the logit equation for estimating shares and includes more information about the consumer’s preferences into the simulation. For the calculation, the price attribute was specified as “continuous” and “is price”. The results of the calculation show the additional amount of money a respondent is willing to pay to exchange the reference level with another level of the attribute. Therefore, the results are to be understood relative to this reference level. The software automatically defines the level that has the lowest average utility as the reference level (Sawtooth Software 2022c, 2022a, 2022b). This is done by exponentiating the average utilities for the attribute levels, normalizing them to sum to share of preferences summing to 100 for each attribute, and averaging those preference scores across respondents (Sawtooth Software 2022a). For sampling, the default setting was applied (no bootstrapping).

4 | Results

4.1 | Description of the Samples

After screening for speeders, straight liners, and excluding incomplete data, 1000 (Sample 1) and 1038 respondents (Sample 2) were considered for further analysis. As can be seen in Table 2, both data sets showed rather similar socio-demographic characteristics that were considered a good match for German runners in terms of gender (almost evenly split in both samples with 0.2% identifying themselves as “other” in Sample 2), age, and level of education.

Specifically, Sample 1 consists of 49.1% female and 50.9% male respondents (Table 2). The ages range between 18 and 69 years. Most respondents are between 18 and 29 years old (27.9%). Furthermore, most respondents have an academic degree (33.8%) or a high school diploma (22.8%). 41% of the “active runners” in the sample run multiple times per week, 44.5% at least once per week, and another 14.5% at least once per month. As

has been explained before, respondents with lower running frequency were excluded after answering the respective filter question. The net household income of the majority of respondents was between 3001 and 5000 EUR, followed by nearly equal counts for 2001–2500 EUR and 2501–3000 EUR.

Table 2 also shows that Sample 2 consists of 50.5% females, 49.3% males and 0.2% identifying otherwise (Table 4). The age range is between 18 and 87 years, whereas the largest age group was between 30 and 39 years of age (25.1%). Moreover, the majority of the respondents has a university degree (35.3%) or a high school diploma (23.7%). Most of the respondents runs multiple times per week (45.7%), 42.3% at least once per week, and 12% at least once per month. As can be seen in Table 2, almost one third of the respondents has a net household income between 3001 and 5000 EUR, followed by 2501–3000 EUR (13.7%), 2001–2501 EUR (11.0%) and 1501–2000 EUR (10.0%).

4.2 | Assessment of Preference Heterogeneity and Model Reliability

4.2.1 | Exploration of Heterogeneity

To test statistical uncertainty and preference heterogeneity, the average utilities of the attribute levels were estimated, including their standard deviation and the standard deviations of the aggregate logit analysis (Table 3).

As can be seen in Table 3, the standard deviations are large, which could be due to heterogeneity in consumers' preferences and large differences in opinions across consumers or as a result of poor experimental design. The latter was not validated by the logit analysis because the standard deviations of all attribute levels were below 0.05. This value indicates that the utilities were estimated with good precision (Orme 2025) and that the large standard deviations are, with high probability, a consequence of true heterogeneity in preferences.

4.2.2 | Feasibility Test

To evaluate the feasibility of the collected data and the conducted analyses, the average utilities of the attribute price were calculated. The results show a steadily falling price-utility graph for both samples (Figure 3). This outcome underscores the internal validity of the collected data because a steady, almost linear decline of the average utilities means that higher prices for an otherwise similar good decrease the good's utility for the consumer. This is logic due to budget constraints because paying more for a specific product means that a consumer has less money to buy other goods and services.

4.3 | Willingness to Pay Analysis

In general, an additional WTP for higher degrees of ES and SS is observable for both labels and both samples (Figure 4). This also means that 0% sustainability and level E, respectively, are always the reference levels in relation to which the additional WTPs are calculated for the other levels.

TABLE 2 | Descriptive statistics of the samples.

Variable	Sample 1 (N = 1000)		Sample 2 (N = 1038)	
	N	%	N	%
Gender				
Male	491	49.1	524	50.5
Female	509	50.9	512	49.3
Other	0	0	2	0.2
Age				
18–29	279	27.9	170	16.4
30–39	203	20.3	260	25.1
40–49	190	19	223	21.5
50–59	182	18.2	205	19.7
60 and above	146	14.6	180	17.3
Income				
No Income	20	2	8	0.8
< 500 EUR	26	2.6	10	1
501–1000 EUR	45	4.5	37	3.5
1001–1500 EUR	80	8	60	5.7
1501–2000 EUR	114	11.4	104	10
2001–2500 EUR	125	12.5	114	11
2501–3000 EUR	129	12.9	142	13.7
3001–5000 EUR	265	26.5	340	32.8
5001–6000 EUR	69	6.9	78	7.5
6001–7000 EUR	13	1.3	28	2.7
> 7000	41	4.1	58	5.6
N/A	73	7.3	59	5.7

TABLE 3 | Average utilities, standard deviation from HB estimation and aggregate logit.

		Sample 1			Sample 2		
		Average utilities	Standard deviation (HB estimation)	Standard deviation (aggregate logit)	Average utilities	Standard deviation (HB estimation)	Standard deviation (aggregate logit)
Brand	Adidas	26.49	38.09	0.03	18.50	29.82	0.03
	Nike	23.98	38.51	0.03	15.69	31.47	0.03
	Puma	9.42	24.13	0.03	6.86	22.21	0.03
	Asics	0.72	23.86	0.03	1.34	16.48	0.03
	Odlo	−22.68	34.05	0.03	−12.85	28.85	0.03
	Reebok	0.99	17.78	0.03	−1.59	14.40	0.03
	Pro Touch	−24.78	27.53	0.03	−16.78	27.92	0.03
	Runnerspoint	−14.12	25.81	0.03	−11.16	18.47	0.03
Price	9.95€	49.15	53.42	0.03	52.12	60.48	0.03
	14.95€	44.25	39.34	0.03	45.25	46.03	0.03
	19.95€	38.30	30.09	0.03	36.11	36.05	0.03
	24.95€	27.39	14.88	0.03	22.85	18.92	0.03
	29.95€	17.59	11.97	0.03	13.82	15.72	0.03
	34.95€	−4.64	13.87	0.03	−7.14	17.65	0.04
	39.95€	−14.08	18.29	0.04	−15.32	23.95	0.04
	44.95€	−41.13	27.98	0.04	−36.91	33.08	0.04
	49.95€	−45.59	36.06	0.04	−48.12	42.49	0.04
	54.95€	−71.25	47.71	0.04	−62.67	51.56	0.04
ES/GREEN-score	100% / A	39.36	29.55	0.02	39.79	31.07	0.02
	75% / B	26.16	18.57	0.02	36.07	26.75	0.02
	50% / C	7.51	11.61	0.02	4.34	12.49	0.02
	25% / D	−17.76	16.19	0.02	−25.71	22.61	0.02
	0% / E	−55.27	36.01	0.03	−54.49	38.24	0.03
SS/SOCIAL-score	100% / A	27.53	21.39	0.02	31.70	24.33	0.02
	75% / B	17.29	16.34	0.02	27.39	23.55	0.02
	50% / C	6.94	9.67	0.02	7.60	10.83	0.02
	25% / D	−9.54	15.48	0.02	−19.99	20.03	0.02
	0% / E	−42.21	30.79	0.03	−46.69	33.42	0.03

As can be seen in Figure 4 and Table 4, the results for the percentage-based labels show a steady increase of the WTP for ES and SS up to 31.50 EUR for 100% ES and 25.02 EUR for 100% SS. For ES, the smallest increase is the initial step to 25% with a WTP of 5.88 EUR followed by the largest increase of 12.41 EUR to a WTP of 18.29 EUR for 50%. The final steps to 75% (WTP of 25.21 EUR) and 100% (WTP of 32.92 EUR) show an additional WTP of 7.22 EUR and 5.99 EUR, respectively. For SS, the lowest increase in WTP is the final step to 100% (+3.99 EUR), while the other increases are 5.82 EUR for the step to 75% (WTP of 21.03

EUR), 7.37 EUR for 50% (WTP of 15.21 EUR), and 7.84 EUR for 25%.

For the graphic labels, the WTP for the highest levels of ES and SS (A/green) are 32.92 EUR for ES and 31.34 EUR for SS (Figure 4). But in contrast to the percentage-based labels, the WTPs show an increase of over 60% of the maximum WTP between levels E and D for both sustainability types (21.45 EUR for ES and 22.36 EUR for SS). As can be observed in Figure 4, the additional increases that follow for the steps to levels C and A for ES are much smaller

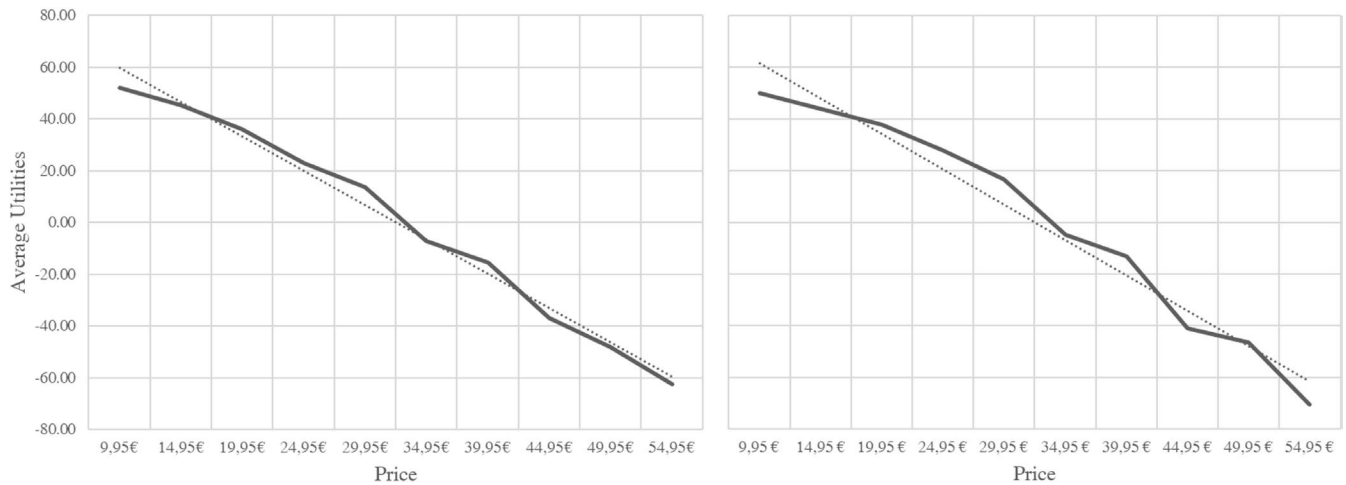


FIGURE 3 | Average utilities for the attribute “Price” (Sample 1 and Sample 2).

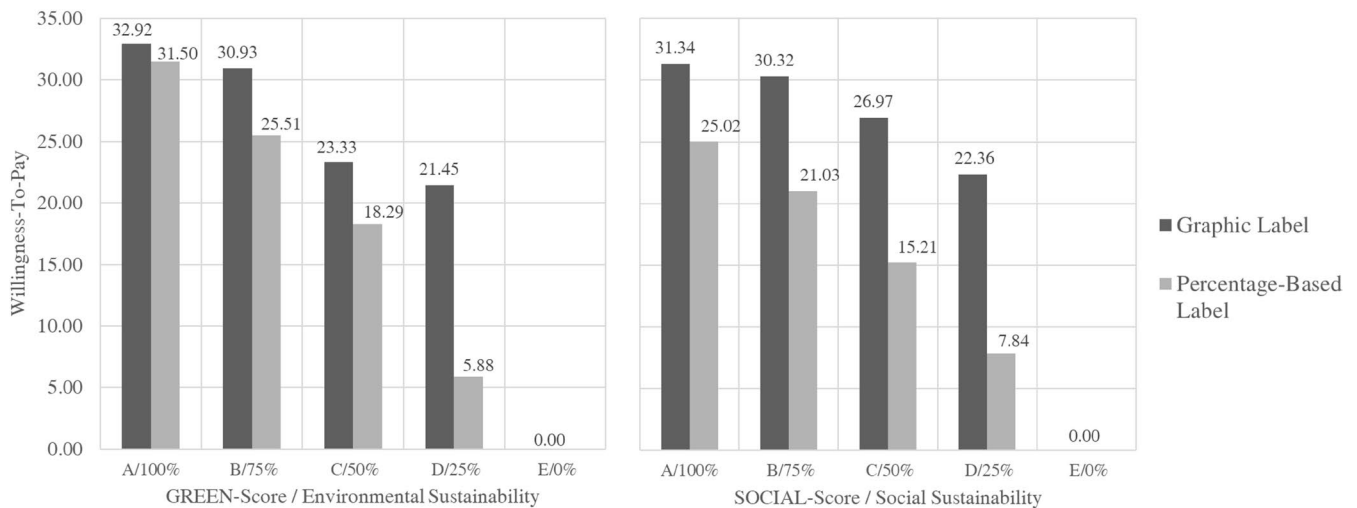


FIGURE 4 | Differences in willingness to pay between graphic and percentage-based labels.

TABLE 4 | Differences in willingness to Pay between graphic and percentage-based labels.

Variable	Environmental sustainability			Social sustainability		
	GREEN-Score	%-based	Difference in EUR	SOCIAL-score	%-based	Difference in EUR
D/25%	21.45	5.88	15.57	22.36	7.85	14.51
C/50%	23.33	18.29	5.04	26.97	15.21	11.76
B/75%	30.93	25.51	5.42	30.32	21.03	9.29
A/100%	32.92	31.50	1.42	31.34	25.02	6.32

and amount to 1.88 EUR for C (WTP of 23.33 EUR) and 1.99 EUR for A. The step from C to B is an exception with 7.60 (WTP of 30.93 EUR) because it is almost the same amount that can be observed for the increase from 50% to 75% ES for the percentage-based label. For SS, the additional WTPs are 4.61 EUR for the step to C (WTP of 26.97 EUR), 3.35 EUR for B (WTP of 30.32 EUR), and the smallest increase with 1.02 EUR for the final step to A (Figure 4).

Figure 4 and Table 4 also show that the WTP always is higher when the shirts have a graphic label and not the percentage-based label.

In Table 4, the specific differences for each level have been calculated. For ES the difference in WTP for the initial step to D/25% is particularly pronounced with 15.57 EUR. For the following two steps, it is considerably smaller with 5.04 EUR and 5.42 EUR, while there is hardly any difference between the WTPs for A and 100% with a difference of only 1.42 EUR. For SS the differences in the WTP between graphic and percentage-based labels steadily decrease. Initially, the difference amounts to 14.51 EUR for the first step to 25%/D to then decrease to 11.67 EUR, 9.29 EUR, and 6.32 EUR for the following steps up to 100%/A.

This study has shown that percentage-based and graphic labels seem to differ in their effect on consumers' WTP for sustainable sports fashion. As can be seen in Figure 4 and Table 4, the results for the percentage-based labels show a rather steady increase in the WTP for higher degrees of ES and SS, which amount to 31.50 EUR for 100% ES and 25.02 EUR for 100% SS. The results for the two graphic labels GREEN- and SOCIAL-Score, on the other hand, show a vast increase between the levels E and D for both sustainability types, which already amount to over 60% of the total WTP that was measured for the A-levels (32.92 EUR for the GREEN- and 31.34 EUR for the SOCIAL-Score). That the unknown graphic labels generally yielded a considerable WTP underscores the findings of Jürkenbeck (2023) who showed that—like the well-known Nutri-Score—the (rather) unknown Eco-Score also led to a higher WTP.

It is striking that most of the WTP already materializes for the initial increase from E to D for the graphic labels. When looking at Figure 4, it also becomes apparent that the final increase in sustainability from B to A is not very relevant in terms of an additional WTP for these labels. Past research supports that consumers see little difference between levels A and B (de Temmerman et al. 2021). The steep increase from E to D, however, opposes the findings of de Temmerman et al. (2021) who identified a missing distinction between D and E. Marette (2022), however, found red categories to have a higher impact on the purchase intention than the green category. This could be an explanation of why the coloring change from red to orange (E–D) seemingly had such a high impact.

Another explanation for the observed lower increases in WTP at high levels of sustainability could be that these levels seem implausible to the consumer, which is why lack of trust could be an issue. As Cho and Berry (2019) observe, the levels of the label must be in the “range of within-category expectations” (p. 75) to be credible, which might not be the case, since the textile industry is known to have a very negative environmental and social impact along the supply chain (Niinimäki et al. 2020; Neumann et al. 2021; Chand et al. 2023). In this context, a clearer, less interpretative contextualization of the product information (like percentage-based labels) could increase the signal credibility.

In practical terms, these insights mean that producers and vendors could already skim off most of the additional WTP for higher degrees of sustainability (over 60% for the initial step) with comparably limited efforts when using a graphic label. This is different for percentage-based labels, where less than one fourth (ES) and one third (SS) of the maximum additional WTP is realized with the initial increase to 25%. This shows that particularly graphic labels seem to have a high potential for green and/or social washing, since rather minor improvements—maybe even cosmetic ones—do already skim off a major part of consumers' WTP. This is particularly problematic because reaching higher degrees of sustainability should usually be much harder and more expensive than taking the first steps.

Politically these insights indicate that formal certification and/or labeling regulations or standardizations could be a good way to limit the potential abuse of different types of labels. This

implication is of particular relevance because past research has found a lack of effective governmental policies to be a barrier for sustainable development in the textile and apparel industry (Gardas et al. 2018). When establishing certification standards, what has been discussed thus far could be addressed by already foreseeing comparably high initial efforts for reaching lower levels of graphic labels. It could, for instance, be defined that reaching level D would require a sustainability percentage of 50% or more (how this were to be defined would have to be seen). But before very specific recommendations are implemented, it has to be considered that the impact of graphic labels depends on the specific scoring logic or formula and the competition in the market, which is highly controlled in this study. Future research should thus test different scoring formulas and real-life scenarios with real-life competition to further assess the impact of graphic labels.

Concerning the theoretical background that has been introduced in the beginning, the findings of this paper support the idea that percentage-based and graphic labels can both function as signals that impact WTP for sustainable products in a meaningful and profound way. Both marketing tools effectively signal the sustainable attributes of the product to the consumers by informing them about unobservable product attributes and, therefore, decrease the information asymmetry between the producer and consumer, which supports the findings of Bjørner et al. (2004) and de Magistris et al. (2015). Against the backdrop of signaling theory, the trend differences in percentage-based and graphic labels can be interpreted as follows. In this study, the focus was on the construct “feedback” by assessing the WTP of consumers for a simplified label format that should allow for an isolated evaluation of a graphic and a percentage-based presentation. Higher WTP represents the feedback that the signal was more effective. Therefore, the results suggest that for graphic labels the feedback from the receiver to the signaler was more favorable than for most levels of the percentage-based label, particularly when communicating lower sustainability level. However, for higher levels the feedback difference is much smaller, particularly for SS.

In future research, more proxies for receiver feedback (e.g., perceived credibility and trust) and potential distortions should be assessed. Since trust is known to mediate consumers' behavior regarding sustainability labels (Taufique et al. 2017), future research should explicitly examine label trust and credibility of (novel) sustainability labels in the sports industry. Besides the potential consumer distrust, label fatigue, and the proliferation of pseudo labels are key topics that could have an impact on the preference and WTP for sustainability labels. Moreover, the other constructs of signaling theory should be examined, particularly the cost, clarity, and credibility of the signal, as this could yield promising results with regards to sustainability labels. In addition, concepts such as numeracy, heuristic processing, and color psychology could be addressed more prominently in the future.

Regarding the methodology of this research and, particularly, the data collection, it has to be pointed out that recent studies on online experiments in the context of sustainable consumption behavior support the chosen approach (Puentes and Trujillo 2025). For example, using a panel provider who gives

the respondents a financial incentive should have reduced potential dropout rates. Moreover, the multi-faceted questionnaire with different scales and the conjoint experiment should have retained the respondents' attention, and the screening of data as well as the pre-test prior to the first study should have secured a high data quality.

Nevertheless, some limitations must be taken into consideration. For instance, the CBC works with hypothetical purchase situations and fictional products consisting of product bundles with only a few selected product attributes. Therefore, it could lead to a hypothetical bias (Miller et al. 2011). In real-life purchase situations, many more factors influence the purchase situations, which cannot be represented in this study. These other factors could, for instance, be the style of the shirt or perceived availability, which have been found to be reasons to not engage in sustainable purchase behavior (Diddi et al. 2019). Another characteristic of the CBC is the non-additivity of the WTP for the different levels of sustainability. Due to this, this study cannot give insights into the overall WTP for ES and SS or for specific sustainability initiatives.

Moreover, this study does not use specific sustainability measures as attributes in the CBC. A holistic measure of perceived sustainability was chosen that looks at ES and SS as general concepts not referring to, for instance, specific production processes, transportation, or material sources. This means that the implemented sustainability labels and their framing come with certain limitations. Firstly, the gradation of the attributes GREEN- and SOCIAL-Score should be discussed. Currently, a five-level sustainability label does not exist for apparel in Germany but the textile industry usually uses one-level labels, such as the OEKO-Tex Standard 100 (OEKO-TEX Service GmbH 2022). Nevertheless, German consumers are used to such segmentations in other industries and it is not expected that this should have constituted a problem. Furthermore, the combined presentation of the GREEN- and SOCIAL-Score could result in interaction effects that could reduce or increase the impact of the individual scores. But this dual-scoring has previously been tested by de Bauw et al. (2021) and Naipak (2022) regarding an additional eco-label in combination with the Nutri-Score in the food industry. These studies showed that the effects are the same if the labels are presented individually or together. However, this research was conducted in another industry and with different scores, which could also be relevant. Secondly, sticking to the comparison with the Nutri-Score, it has to be highlighted that in contrast to the Nutri-Score, the sustainability labels in this study lack standardized scoring algorithms. Since the respondents were not informed about which measures or sets of measures the different levels refer to. Therefore, due to the lack of clear benchmarks, the respondents' interpretation of the labels may have varied, and it is unclear for which specific measure(s) respondents are willing to pay (how much) more. Additionally, the sustainability labels in this study lack institutional credibility in contrast to, for example, the Nutri-Score because the respondents were not informed about the institution issuing the label. However, the survey was introduced to them within an academic setting by mentioning the universities of the researchers in the introductory text. This academic framing may have inadvertently increased the perceived credibility of the sustainability labels. Future research should address these limitations

and should, for instance, explore how consumers actually interpret certain labels and their credibility (among other aspects also contrasting perceived institutional guidance and the lack thereof).

Another limitation is the topic of sustainability which is prone to a social desirability bias (Alwitt and Pitts 1996; Vermeir and Verbeke 2006; Stöckigt et al. 2018). However, this bias should have been minimized by using an online CBC and simulating the WTP with an indirect experimental design. Additionally, the knowledge-action gap between environmental knowledge and the consumption patterns needs to be taken into consideration as it has already been found to be an issue regarding sustainable clothing (Diddi et al. 2019).

When looking at the scope of this research, one limitation is the geographical location: Germany. Eco-labels are fairly common in different industries on the German market and have an influence on the purchase decisions of German consumers (Thøgersen et al. 2010; Ecolabel Index 2024). Therefore, this research can be continued and enriched by performing similar studies in other countries and, in this way, offer cross-cultural insights (Paul 2024). Additionally, when talking about WTP analyses and comparisons with previous research in general, changing economic situations are an issue (e.g., inflation or overall economic situation). Regarding Samples 1 and 2 of this study, it needs to be taken into account that the first data collection took place during the COVID pandemic and the second afterwards (2 years later). This came with a change in the economic situation that needs to be considered when comparing the results. Talking about different data collection times, another noteworthy change between July 2021 and June 2023 is the European Commission's adoption of the "Proposal for a Directive on Green Claims" which was introduced in March 2023 (European Commission 2025). This directive focuses on companies and new requirements regarding their sustainability. As a consequence, consumers might have indicated a high(er) WTP for the GREEN- and the SOCIAL-Score because they expected the labels to align with the new regulations. Another limitation regarding the scope is the target group. Due to the fact that active German runners are included as respondents who are highly educated and have a high environmental awareness (Triantafyllidis and Kaplanidou 2021; Hugaerts and Könecke 2024), the generalizability of the findings to other market segments may be limited. But even in this population, heterogeneity tests have indicated strongly differing preferences among the participants. Accordingly, this heterogeneity should also be scrutinized further in following studies.

6 | Conclusion

Motivated by research conducted in other areas, this study compared the WTP of runners in Germany for different levels of ES and SS when buying a functional T-shirt. Information regarding ES and SS was conveyed by two different types of labels (a percentage-based and a graphic one) in two different CBCs with 1000 (Sample 1) and 1038 respondents (Sample 2). It turned out that higher degrees of sustainability always led to higher WTPs for both types of labels for ES and SS alike, which indicates that both label-types are effective signaling

tools that positively affect consumers' preferences. But while there was a steady increase in the WTP between 0% and 100% for the percentage-based labels, a vast increase between E and D was observable for the graphic labels that was then followed by much smaller increases in WTP for further improvements in the sustainability of the products. Therefore, percentage-based or somewhat similar labels seem to be more suited to generate revenue for producers while preventing extensive green and social washing or a very limited ambition in terms of improving sustainability.

In the future, it will be analyzed if a graphic label as presented in this study is appropriate for the textile industry or if the already common one-level labels are more credible and effective for sustainable consumption (at least for the time being). These considerations are particularly interesting as the German Ministry for Economic Cooperation and Development proposed the idea to introduce a multi-level label (ranging from A to G) in the textile industry that is based on the labeling system for energy efficiency in Germany (which is very similar to the Nutri-Score) (German Ministry for Economic Cooperation and Development 2024).

Author Contributions

All authors contributed to the study's conception and design. Material preparation, data collection, and analyses were done by Viktoria Spindler under the supervision of Thomas Könecke and Holger Schunk. The first draft of the manuscript was written by Viktoria Spindler under the supervision of Thomas Könecke and Holger Schunk, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Ethics Statement

All respondents who filled in the questionnaire for this study had previously given their consent for the use of their data. They were also informed that it was a data collection for a scientific study. All relevant procedures were respected and no data that could be used to identify individual respondents (name, IP address, postal address, date of birth, etc.) were recorded by the researchers.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Endnotes

¹ A Web of Science search on May 20, 2025, found less than 5 hits when using the terms "eco-labels" AND "sports apparel". None of them compared numeric with graphic labels.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Data S1:** [ijcs70191-sup-0001-supinfo.pdf](#).