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From Numbers to Choice: How Numerical Sustainability Claims Shape Visual Attention and Purchase Decisions in Fashion

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ABSTRACT

Sustainability information is difficult for consumers to evaluate because environmental performance represents a credence attribute. Although numerical sustainability claims have been shown to improve consumers' perceptions of sustainability communication, little is known about whether they influence product choice under realistic marketplace trade-offs or through which decision processes these effects emerge. Drawing on signaling theory, this research examines whether numerical sustainability claims function as stronger marketplace signals and investigates how visual attention is associated with their influence on consumer choice. Two complementary studies were conducted: a choice-based conjoint experiment ($N = 512$) examining product choice and willingness to pay, and an eye-tracking experiment ($N = 45$) investigating visual attention during product evaluation. Results indicate that numerical sustainability claims were associated with higher consumer preference and willingness to pay than equivalent non-numerical claims. Eye-tracking results showed that although numerical claims attracted greater visual attention, attention to the claims alone did not explain product choice. Instead, numerical claims were associated with broader visual attention during product evaluation. The findings suggest that numerical sustainability claims help translate sustainability communication into consumer choice under competitive marketplace settings.

1 | Introduction

Consumers increasingly consider sustainability when making purchase decisions (e.g., Hinsch et al. 2021; Park and Lin 2020), yet evaluating the environmental performance of products remains inherently difficult. Unlike observable product attributes such as price or design, sustainability is a credence attribute that consumers cannot verify before purchase (Kirmani and Rao 2000). Consequently, consumers must rely on marketplace information to infer a product's environmental performance (Kirmani and Rao 2000; Spence 1973). Understanding how sustainability information influences consumer decision-making, therefore, represents an important challenge for both marketing practice and consumer research.

One increasingly common way to communicate sustainability information is through numerical sustainability claims. Rather than relying on broad statements such as "environmentally friendly" or "sustainable," firms increasingly communicate quantified information, such as the number of recycled PET bottles incorporated into a product or the amount of carbon

emissions reduced during production. Previous research suggests that numerical sustainability claims function as stronger marketplace signals because they provide consumers with more verifiable information than vague messages, thereby increasing perceptions of transparency, objectivity, and credibility (Atkinson and Rosenthal 2014; Cho and Taylor 2020; Janssen et al. 2022; Khalil et al. 2021). However, this existing research has focused primarily on attitudinal outcomes, including credibility perceptions, brand evaluations, and purchase intentions, leaving two important questions unanswered.

First, it remains unclear whether numerical sustainability claims influence choice behavior in realistic marketplace simulations when consumers simultaneously evaluate competing marketplace attributes such as price, brand, and product design. Second, although signaling theory explains why quantified sustainability claims should function as stronger marketplace signals under conditions of information asymmetry (Kirmani and Rao 2000; Spence 1973), it provides limited insight into how these signals become incorporated into the value construction process underlying consumers' decisions. Addressing these questions is particularly important in the fashion industry, where growing concerns about greenwashing have increased consumer skepticism toward sustainability claims, making sustainability communication especially challenging (Cho and Taylor 2020; Neureiter et al. 2024; Schmuck et al. 2018).

To address these gaps, we draw on signaling theory and attention-based models of decision-making. We argue that numerical sustainability claims function as stronger marketplace signals because they provide more informative and verifiable evidence about otherwise unobservable sustainability attributes (Atkinson and Rosenthal 2014; Connelly et al. 2025). Building on research demonstrating that visual attention contributes to value construction in consumer choice (Krajbich and Rangel 2011; Martinovici et al. 2023; Smith and Krajbich 2018), we further propose that stronger sustainability signals are expected to receive greater visual attention, increasing the likelihood that sustainability information is incorporated into consumers' evaluations and subsequently contributes to product choice.

We test this framework using two complementary studies. Study 1 employs a Choice-Based Conjoint (CBC) experiment to examine whether numerical sustainability claims influence product choice and willingness to pay (WTP) while consumers simultaneously evaluate competing product attributes. Study 2 uses eye-tracking to investigate the attentional processes associated with these behavioral effects.

Overall, this research advances understanding of how stronger marketplace signals relate to consumer decision-making under conditions of information asymmetry. Specifically, it extends signaling theory by showing that numerical sustainability claims remain behaviorally influential when consumers evaluate competing marketplace attributes. It further provides process evidence suggesting that visual attention is one mechanism through which stronger marketplace signals may become incorporated into consumers' construction of value. Finally, it contributes to sustainability communication research by showing that stronger numerical sustainability claims are associated with higher WTP and greater choice likelihood under realistic marketplace trade-offs.

2 | Literature Review

2.1 | Numerical Sustainability Claims as Stronger Marketplace Signals

Signaling theory explains how consumers make decisions when important product attributes cannot be directly verified before purchase (Spence 1973). Sustainability represents a classic credence attribute because consumers are generally unable to independently assess a product's environmental performance at the point of purchase. Under such conditions of information asymmetry, consumers rely on observable marketplace signals that help them infer otherwise unobservable product characteristics (Kirmani and Rao 2000). However, marketplace signals vary in their effectiveness. Signals that provide more diagnostic information enable consumers to make more confident inferences about otherwise unobservable product attributes (Connelly et al. 2025; Kirmani and Rao 2000). Their importance is amplified in sustainable fashion, where consumers frequently encounter ambiguous or misleading environmental claims (Cho and Taylor 2020; Schmuck et al. 2018).

Numerical sustainability claims constitute one form of marketplace signal that may possess greater diagnostic value than other claims. Numerical precision represents a distinct form of message precision that enables consumers to evaluate claims with greater specificity than detailed qualitative descriptions alone (Xie and Kronrod 2012). However, the persuasive value of claim specificity depends not simply on providing additional information, but on presenting information that consumers perceive as useful for evaluating products (Janssen et al. 2022). In sustainability communication, quantified environmental information satisfies this condition by providing concrete evidence regarding environmental performance, making claims appear informative, transparent, and objective (Friske et al. 2023; Papadopoulou et al. 2025).

Existing empirical evidence supports the advantages of quantified sustainability communication. Numerical sustainability claims have been shown to generate more favorable responses toward brands and products (Atkinson and Rosenthal 2014; Ganz and Grimes 2018; Khalil et al. 2021). However, most prior research has focused on perceptions and attitudes, rather than on consumer choice. This distinction is theoretically important because marketplace decisions rarely depend on sustainability information alone. Instead, consumers simultaneously evaluate multiple competing product attributes, including price, brand, esthetics, and sustainability, when making purchase decisions (Guyader et al. 2017; Orquin et al. 2020). Consequently, evidence that numerical sustainability claims influence consumer choice and WTP would extend signaling theory by showing that stronger marketplace signals remain behaviorally influential under realistic competitive conditions rather than merely improving product evaluations.

Building on signaling theory, we propose that numerical sustainability claims should be associated with a greater likelihood of product selection and higher WTP than equivalent non-numerical claims.

Accordingly, we hypothesize:

H1. *Numerical sustainability claims in fashion communication increase (a) product choice likelihood and (b) WTP.*

2.2 | Visual Attention as the Mechanism of Value Construction

Although signaling theory explains why numerical sustainability claims may possess greater informational value (Connelly et al. 2025; Kirmani and Rao 2000), it provides limited insight into the psychological process through which this value is incorporated into consumer choice. This process depends on how consumers allocate attention while evaluating competing marketplace information (Guyader et al. 2017; Orquin et al. 2020). Eye-tracking provides a process-oriented method for capturing these attentional mechanisms during consumer decisions (Bigne et al. 2025; Casado-Aranda et al. 2023).

Consumers rarely evaluate sustainability information in isolation (Simonetti and Bigne 2025). In marketplace environments, sustainability cues compete simultaneously with other product attributes for consumers' limited attentional resources (Babakhani et al. 2020; Guyader et al. 2017; Orquin et al. 2020). Consequently, the influence of sustainability information depends not only on whether it is available but also on whether it receives sufficient visual attention to enter consumers' decision process (Pieters and Wedel 2004; Willemsen et al. 2011).

Recent decision-making research suggests that visual attention represents the mechanism through which marketplace information is incorporated into value construction (Martinovici et al. 2023; Simonetti and Bigne 2025). Importantly, visual attention is not conceptualized as equivalent to persuasion, preference, or choice. Rather, it represents the allocation of visual processing resources to decision-relevant information during product evaluation. Specifically, visual attention determines how evidence accumulates during decision-making, influencing the relative weight assigned to competing product attributes and ultimately shaping consumer preferences (Krajbich and Rangel 2011; Martinovici et al. 2023; Mormann and Russo 2021). Accordingly, attributes that receive greater visual attention exert a stronger influence on value construction and are more likely to affect final choices (Krefeld-Schwalb et al. 2025).

Consistent with this perspective, eye-tracking measures such as dwell time, fixation frequency, and revisit patterns systematically predict product choice beyond stated evaluation (Casado-Aranda et al. 2023). Specifically, dwell time reflects the amount of visual attention allocated to a product attribute, indicating the opportunity for information to be encoded and incorporated into evaluation (Pieters and Wedel 2004; Venkatraman et al. 2021). Fixation count captures repeated information sampling, increasing opportunities for that information to contribute to the ongoing evaluation process (Martinovici et al. 2023; Willemsen et al. 2011). Revisit count reflects consumers' tendency to return to previously inspected information during comparison, suggesting continued integration of that information into the evolving decision process (Krefeld-Schwalb et al. 2025; Martinovici et al. 2023). Collectively, these measures provide observable indicators of the extent to which sustainability information becomes integrated into consumers' value construction (Krajbich and Rangel 2011; Mormann and Russo 2021).

Importantly, visual attention is necessary, but not sufficient for consumer choice. Consumers may attend to numerical information simply because it is perceptually salient or cognitively demanding, without necessarily changing their preferences or choices (Babakhani et al. 2020; Takahashi et al. 2018). However, when numerical sustainability claims function as more diagnostic signals of environmental performance (Connelly et al. 2025), greater attention is more likely to reflect meaningful evaluation rather than processing effort alone (Krajbich and Rangel 2011; Martinovici et al. 2023). In turn, sustainability information should receive greater weight during value construction, increasing its influence on subsequent choice.

Accordingly, we propose:

H2. *Numerical sustainability claims elicit greater visual attention than equivalent non-numerical sustainability claims.*

H3. *Greater visual attention to numerical sustainability claims increases the likelihood of choosing sustainable products.*

2.3 | Environmental Awareness as a Boundary Condition

Although numerical sustainability claims may function as stronger marketplace signals by increasing the incorporation of sustainability information into consumers' value construction through visual attention, an important question is whether their effectiveness depends on consumers' pre-existing environmental awareness. Environmental awareness represents a theoretically relevant boundary condition because it is one of the most widely examined individual-difference variables in sustainability communication research and consistently predicts consumers' responses to environmental information (Hinsch et al. 2021; White et al. 2019).

Environmental awareness reflects the extent to which consumers consider environmental issues relevant to their daily decisions and purchasing behavior (Hinsch et al. 2021; Iovino et al. 2024). Consumers with higher environmental awareness generally report stronger preferences for sustainable products and place greater importance on sustainability information during product evaluation (Amatulli et al. 2019; Hinsch et al. 2021; Janssen et al. 2022). However, previous findings remain mixed. Although environmentally aware consumers consistently express stronger pro-environmental attitudes, these attitudes do not always translate into purchasing behavior when sustainability competes with other marketplace attributes, such as price or product design (Park and Lin 2020; White et al. 2019). Likewise, although environmentally aware consumers often allocate greater attention to sustainability information, it remains unclear whether stronger marketplace

signals alter this attentional process or simply reinforce existing preferences (Babakhani et al. 2020; Takahashi et al. 2018).

Signaling theory, however, suggests a complementary perspective. If numerical sustainability claims function as stronger marketplace signals by reducing information asymmetry, they should facilitate product evaluation by providing more diagnostic information about otherwise unobservable environmental attributes (Connelly et al. 2025; Kirmani and Rao 2000). Consequently, stronger marketplace signals may become less dependent on consumers' prior environmental awareness, benefiting both highly and less environmentally aware consumers. It therefore remains an open empirical question whether the greater motivation of environmentally aware consumers outweighs the uncertainty-reducing function of stronger marketplace signals.

These competing perspectives lead to the following hypotheses:

H4. *Environmental awareness positively moderates the relationship between numerical sustainability claims and sustainable product choice.*

H5. *Environmental awareness positively moderates the relationship between numerical sustainability claims and visual attention.*

Figure 1 summarizes the proposed conceptual framework. Study 1 examines the behavioral effects of numerical sustainability claims using a CBC experiment. Building on these findings, Study 2 employs eye-tracking to investigate the attentional processes underlying these behavioral effects during product evaluation.

The Ethics Committee of Universidade da Beira Interior granted ethical approval for this research. Written informed consent was obtained from all participants before data collection.

3 | Study 1: Choice-Based Conjoint Analysis

3.1 | Method

Study 1 employed a discrete CBC experiment implemented in Qualtrics to examine whether numerical sustainability claims influence consumer choice and WTP under realistic marketplace trade-offs. CBC is particularly appropriate for the present research because it estimates consumers' preferences from repeated product choices involving competing product attributes, closely approximating marketplace decisions while deriving WTP from observed rather than stated choices (Branca et al. 2023; Orme 2010).

3.1.1 | Claim Selection

An initial pool of 10 sustainability claims was compiled from existing fashion communications (see Appendices, Table A1). A pretest with 61 master's students evaluated each claim on perceived informativeness ("To what extent is this an informative advertisement message (i.e., provides fact-based, specific information)?") and believability ("How believable is this advertisement?"). Mean scores across both dimensions identified the three highest-rated claims ("37 recycled PET bottles," "41.62 kg of CO_2 compensation," and "100% biodegradable"), which were retained for the main experiment. These claims formed the basis for manipulating numerical versus equivalent non-numerical sustainability communication across both studies.

3.1.2 | Design

Participants completed eight CBC choice tasks, each consisting of two product profiles and a "none" option (Figure 2). The conjoint design reproduced realistic marketplace trade-offs in which sustainability information competes with price, brand, product design, and customization, rather than being evaluated in isolation. Five product attributes were included: product design, production claim, customization, brand, and price (Table 1). Consistent with conjoint design recommendations, no

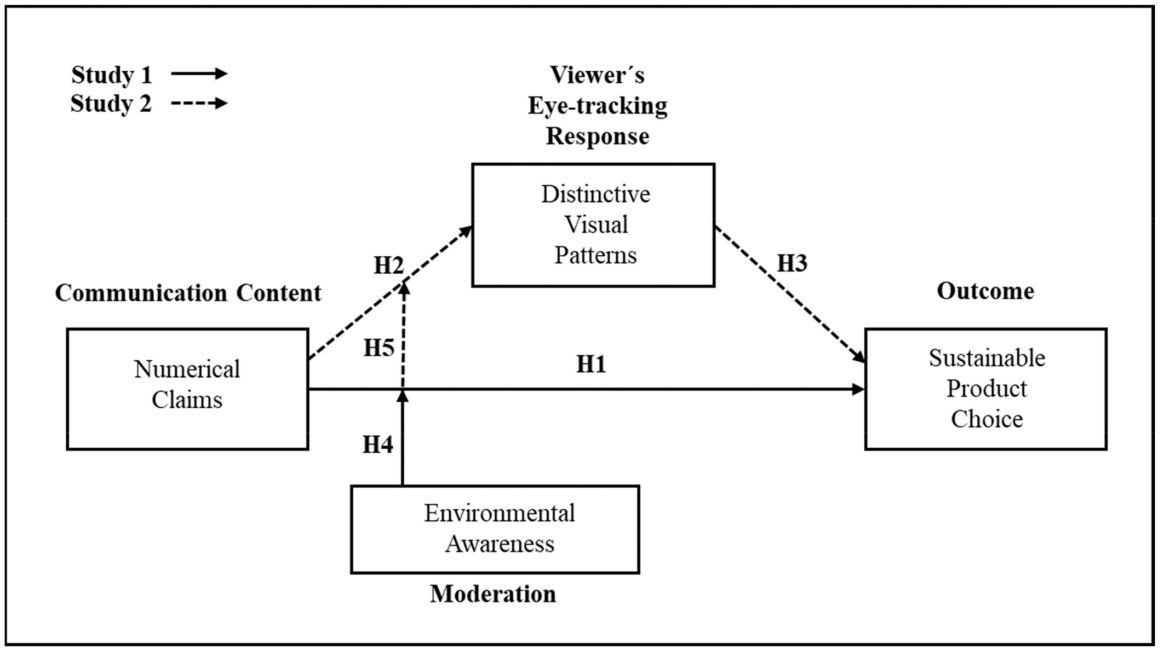


FIGURE 1 | Conceptual model and overview of hypotheses.

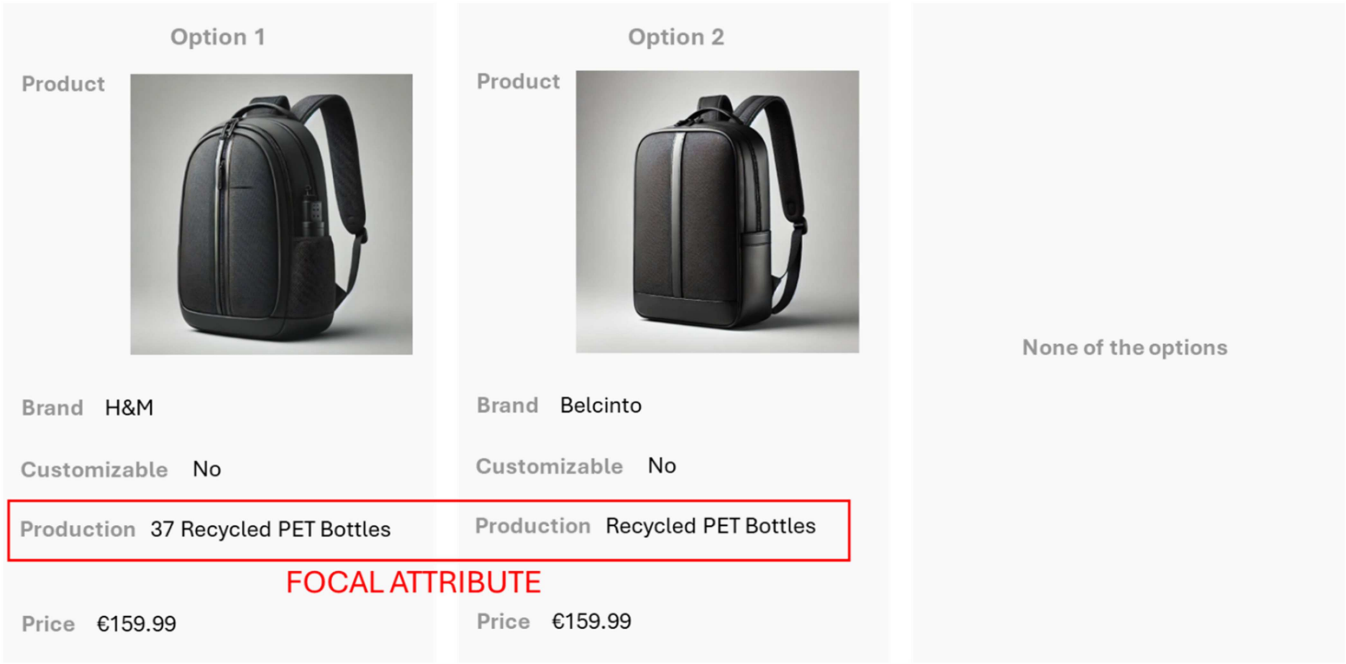


FIGURE 2 | CBC set example.

TABLE 1 | Conjoint attributes and levels in the choice tasks.

Attributes	Levels
Product	Product 1, Product 2, Product 3, Product 4, Product 5
Production[a]	"37 recycled PET bottles," "recycled PET bottles," "41.62 kg of CO_2 compensation," "CO_2 compensation," "sustainable," "no claim"
Customizable	yes, no
Brand	H&M, Patagonia, Belcinto
Price	€49.99, €99.99, €159.99

[a]Focal attribute code used to test claim effectiveness.

attribute contained more than five levels, ensuring reliable estimation of individual-level utilities (Jacobs and Hörisch 2022; Orme 2010). Attribute levels were selected to reflect realistic marketplace alternatives commonly encountered by consumers in the backpack category.

We labeled the claim attribute "production" to minimize participants' awareness of claim testing. This claim served as the focal attribute, varying across three conditions: numerical, non-numerical, and generic. "Product" corresponded to different backpack images, whereas "customizable" and "brand" acted as filler attributes to mask the study's focus and increase ecological validity. "Brand" varied across a fast-fashion retailer (H&M), an eco-leader (Patagonia), and an unfamiliar brand (Belcinto). "Price" represented low, mid, and premium market tiers.

Attribute order was randomized across participants to minimize order effects. Additionally, all attribute levels were orthogonally combined in the conjoint design. This approach allows part-worth utilities to be estimated independently, preventing confounding between attributes.

We used backpack images in the choice scenarios for assessing product design. The backpack category was selected because it is widely used across demographics, supports credible sustainability trade-offs (e.g., durability, materials, and price), and blends fashion and functional value. Potential visual confounds were minimized using AI-generated backpack images that differed subtly (see Appendices, Figure A1).

3.1.3 | *Sample*

A total of 555 participants were recruited via Prolific. After excluding 43 individuals who finished the experiment in under 4 min (below the respondents' average completion time), the final sample comprised 512 participants. This sample size was sufficient for hierarchical Bayes estimation (Orme 2010). The sample was diverse in terms of gender (47% female), age (58% under 35 years old), and education (60% holding a bachelor's degree or higher).

3.2 | Post-Conjoint Survey

After the CBC, participants completed a manipulation check by ranking the sustainability claims according to how informative they perceived them to be (1 = most informative; 5 = least informative). The results confirmed that the numerical PET and CO_2 claims were perceived as significantly more informative

than their equivalent non-numerical versions (all $ps < 0.01$). Participants then completed a survey measuring environmental awareness (Amatulli et al. 2019; $\alpha = 0.79$), skepticism toward sustainability advertising (Mohr et al. 1998; $\alpha = 0.72$), and social desirability bias (Reynolds, 1982; $\alpha = 0.70$), all on a 7-point Likert scale. Advertising skepticism and social desirability bias were included as robustness controls because both constructs have been shown to influence consumers' responses to sustainability communication (Cho and Taylor 2020; Jacobs and Hörisch 2022). Finally, demographic information was collected.

3.2.1 | *Analysis*

Choice data were modeled using hierarchical Bayes estimation in Sawtooth Lighthouse Studio (v. 9.16.12; 30,000 iterations), a standard method for deriving individual-level part-worth utilities that capture the marginal preference contribution of each attribute level to product choice (Orme 2010). Because attribute levels were orthogonally combined, part-worth utilities reflected the marginal contribution of each level to choice. To quantify these utilities in monetary terms, WTP estimates were calculated by dividing the utility difference between each attribute level and its baseline by the absolute value of the estimated price coefficient, following standard procedures in conjoint analysis (Jacobs and Hörisch 2022). Environmental awareness was evaluated as a moderator, using linear regression in R (v. 4.5.1). The utility difference between numerical and non-numerical claims was the dependent variable. Advertising skepticism and social desirability bias were included as covariates to account for potential response biases.

4 | Results

The CBC experiment generated 4096 hypothetical purchase choices from 512 participants. Hierarchical Bayes estimation produced individual-level part-worth utilities with strong model fit (average root likelihood = 0.737), exceeding the random benchmark (0.333) by more than twofold (Orme 2010). Relative attribute importance indicated that sustainability claims were a meaningful driver of consumer choice (18.19%), ranking third after price (43.37%) and product design (23.00%), and ahead of brand (9.73%) and customization (5.70%). Table 2 presents the estimated utilities and corresponding WTP for all attribute levels.

The numerical PET claim ("37 recycled PET bottles") produced substantially higher utility (31.31) and WTP (€38.56) than the corresponding non-numerical PET claim ("recycled PET

TABLE 2 | Hierarchical bayes utility modeling and WTP results in CBC analysis.

Attribute level	Average utility[a]	(SD)	Lower 95% CI	Upper 95% CI	Average WTP (€)[b]
Product					
Product 1	−15.93	(37.15)	−19.15	−12.71	0.00
Product 2	27.65	(50.63)	23.27	32.04	20.05
Product 3	−7.07	(65.59)	−12.75	−1.39	5.08
Product 4	8.03	(36.88)	4.84	11.23	12.84
Product 5	−12.69	(35.76)	−15.78	−9.59	1.22
Production (aka claim)					
"37 recycled PET bottles"	31.31	(22.96)	29.32	33.3	38.56
"Recycled PET bottles"	10.78	(23.32)	8.76	12.8	28.55
"41.62 kg of CO_2 compensation"	−6.8	(21.38)	−8.66	−4.95	19.07
"CO_2 compensation"	−7.48	(25.53)	−9.69	−5.27	17.22
"Sustainable"	15.62	(19.86)	13.9	17.34	29.63
"No claim"	−43.43	(22.6)	−45.38	−41.47	0.00
Customizable					
Yes	11.48	(12.54)	10.4	12.57	11.80
No	−11.48	(12.54)	−12.57	−10.4	0.00
Brand					
H&M	−16.52	(23.07)	−18.52	−14.53	−6.22
Patagonia	18.8	(24.17)	16.7	20.89	10.30
Belcinto	−2.27	(13.35)	−3.43	−1.12	0.00
Price					
€49.99	112.24	(58.6)	107.16	117.31	
€99.99	−19.72	(29.35)	−22.26	−17.17	
€159.99	−92.52	(48.15)	−96.69	−88.35	
"None" option	−84.47	(240.9)	−105.33	−63.6	

[a]Average utility across all respondents, scaled as zero-centered difference. Markov chain Monte Carlo algorithm with 30,000 total iterations.
[b]Average WTP across all respondents, calculated by dividing the utility difference between each level and its baseline by the absolute value of the average utility coefficient of price.

bottles"; utility = 10.78; WTP = €28.55), representing an additional €10.01 in estimated WTP. Relative to the no-claim condition, the numerical PET claim generated an estimated €38.56 WTP premium, equivalent to approximately 77% of the lowest backpack price (€49.99). Likewise, the numerical CO_2 claim generated slightly higher utility (− 6.80) and WTP (€19.07) than the equivalent non-numerical CO_2 claim (utility = −7.48; WTP = €17.22), representing a smaller €1.85 WTP difference. Together, these findings support H1a and H1b, indicating that numerical sustainability claims were associated with higher consumer preference and estimated WTP than equivalent non-numerical claims.

Beyond the hypothesized effects of numerical specificity, the utilities revealed differences in consumer responses across sustainability claims. Products without sustainability claims received the lowest utility (− 43.43), suggesting a preference for communicating sustainability rather than remaining silent. Moreover, the "sustainable" claim (utility = 15.62; WTP = €29.63) outperformed both CO_2-related claims, implying that consumers responded more positively to general sustainability wording than to carbon-compensation claims. On the other hand, both CO_2-compensation claims yielded negative utilities, indicating lower consumer appeal. Notably, adding numerical precision did not reverse this preference structure.

To test H4, we examined whether environmental awareness moderated the effect of numerical sustainability claims on product utility (Table 3). Numerical claims were associated with significantly higher utility ($\beta = 21.989$, $p < 0.001$), replicating the main effect observed in the conjoint analysis. However, neither environmental awareness ($\beta = -0.221$, $p = 0.841$) nor its interaction with numerical claims ($\beta = 1.761$, $p = 0.254$) was significant. Including advertising skepticism and social desirability bias as covariates did not alter these findings. Thus, H4 was not supported, suggesting that the positive association between numerical sustainability claims and product utility was consistent across consumers with different levels of environmental awareness.

5 | Study 2: Eye-Tracking Experiment

5.1 | Method

Study 2 was designed to test the proposed attentional mechanism linking stronger numerical sustainability signals to consumer choice. Using eye-tracking, we examined how visual attention contributes to the incorporation of sustainability information into consumers' value construction during product evaluation. Rather than re-estimating the behavioral effects established in Study 1, the objective was to explain how those effects arise during the decision process.

TABLE 3 | Moderation analysis of environmental awareness in product utility.

Variable	β	p-value
Numerical × EA	1.761	0.254
Numerical × EA + SDB + AS	1.761	0.253
Numerical	21.989	< 0.001
EA	−0.221	0.841
SDB	0.453	0.660
AS	0.369	0.607

Abbreviations: AS, advertising skepticism; EA, environmental awareness; SDB, social desirability bias.

5.1.1 | *Design*

A within-subjects choice task was implemented using a 3 × 3 design (claim type × sustainability theme; claim types: numerical, non-numerical, and no claim; sustainability themes: recycled PET, CO_2 compensation, and biodegradable), yielding nine backpack ads. The additional "100% biodegradable" versus "biodegradable" theme broadened the sustainability themes beyond PET and CO_2 claims. Ad images and price points were identical to those in Study 1 for consistency.

Unlike Study 1, which established the independent behavioral effect of numerical sustainability claims using an orthogonal conjoint design, Study 2 was designed to investigate the attentional processes that may underlie how numerical sustainability claims are incorporated into product evaluation. Process realism was prioritized by embedding sustainability claims with progressively higher price levels, reflecting the tendency for products with stronger sustainability positioning to command price premiums (McNeill and Moore 2015). This design enabled us to examine whether the behavioral advantages identified in Study 1 persisted under more naturalistic decision conditions, where sustainability information is evaluated alongside realistic price trade-offs (Branca et al. 2023; Orquin et al. 2020).

The eye-tracking experiment was conducted in a university laboratory [name omitted for blind review] with two blocks (see Figure 3). In Block 1, participants viewed three single products (stimuli) consecutively, followed by a multi-product (multi-stimuli) comparison, prompting participants to choose one or none (see Figure 4). The sequence was repeated three times for the numerical, non-numerical, and "no-claim" conditions. Block 2 included three extra multi-product stimuli, prompting participants to choose among the PET, CO_2, BIO, or "no-claim" conditions in their numerical, non-numerical, or "none" options. After the eye-tracking session, participants completed the same survey used in Study 1 to assess environmental awareness, skepticism toward sustainability ads, and social desirability, allowing for direct comparison and moderation analyses.

The colored areas represent the 15 areas of interest in the multi-product stimuli.

5.1.2 | *Sample*

Forty-five participants were recruited using non-probability convenience sampling. All had normal or corrected-to-normal vision. The sample was diverse regarding gender (44.4% female), age (44.4% under 35 years old), and education (75.6% holding a bachelor's degree or higher).

5.1.3 | *Analysis*

Participants completed six multi-product choice tasks, for which choice and connected eye movements were recorded.

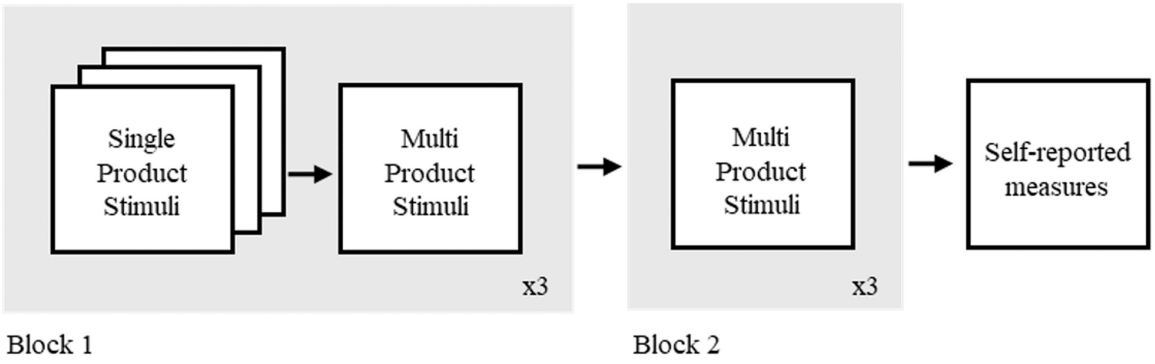
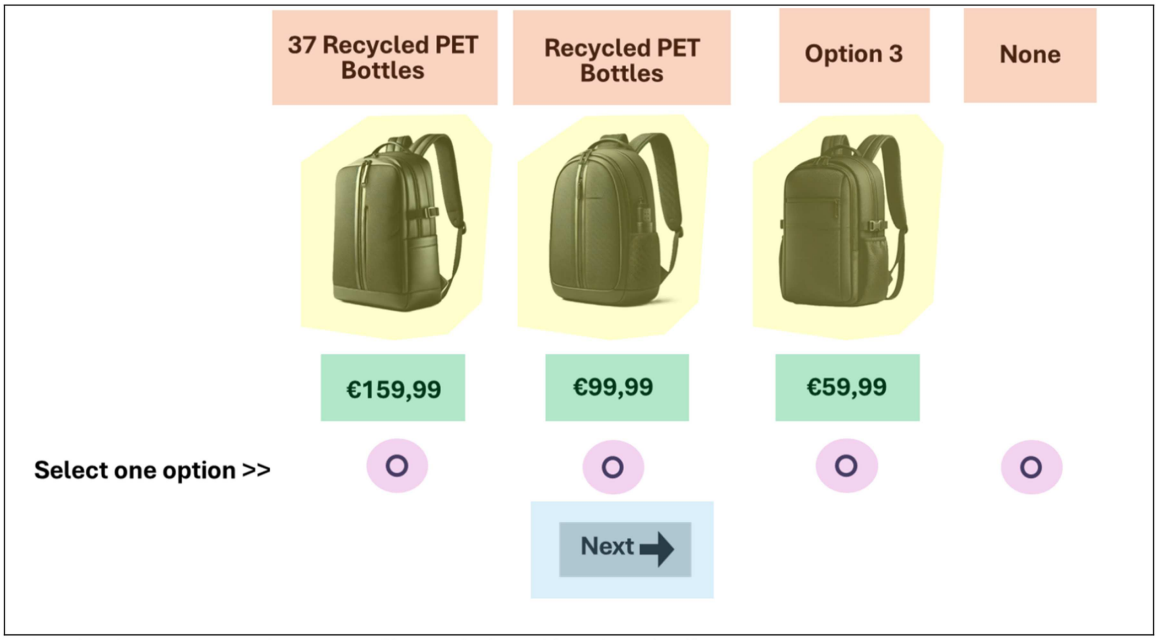


FIGURE 3 | Protocol for the eye-tracking experiment.



The colored areas represent the 15 areas of interest in the multi-product stimuli.

FIGURE 4 | Example of a multi-product choice stimulus.

This procedure resulted in 810 product-level observations (45 participants × 6 choice sets × 3 products per choice set), which were the focus of our analysis.

Eye movements were recorded using the Tobii X2-30 desktop eye tracker at 30 Hz. The multi-product stimuli included 15 areas of interest (AOIs) for the claim, the product image, price, and the choice and next buttons (Figure 4). We extracted three well-validated attention metrics for each AOI: dwell time (total seconds of gaze), fixation count (number of fixations), and revisit count (number of returns after leaving the AOI). These eye-tracking metrics provide established indicators of the extent to which product information receiving sustained visual processing is incorporated into value construction (Martinovici et al. 2023; Venkatraman et al. 2021).

Two mediation models were estimated using structural equation modeling (SEM) with the lavaan package in R (Rosseel 2012). This analysis follows a Type II approach in consumer neuroscience, where eye-tracking metrics serve as indirect measures of consumer preference (Bigne et al. 2025). Gaze metrics from the claim AOI were treated as first-stage mediators potentially directing attention toward the product, price, and choice-button AOIs. Product choice (selected = 1; otherwise = 0) served as the binary outcome. Model parameters were estimated using maximum-likelihood and bootstrapped standard errors (1000 draws), a robust approach for small-to-moderate eye-tracking samples and non-normal data (Preacher and Hayes 2008).

We estimated separate linear mixed-effects models for dwell time, fixation count, and revisit count using the lme4 package in R to test whether individual environmental awareness amplified the attentional pull of numerical claims (Bates et al. 2015). This method is well-suited to eye-tracking data (see Orquin et al. 2020) because it accommodates the hierarchically nested structure (multiple AOIs within stimuli within respondents) and yields unbiased standard errors with unbalanced observations (Baayen et al. 2008; Montoya 2019).

6 | Results

The eye-tracking experiment generated 810 product-level observations from 45 participants across six repeated choice tasks. This repeated-measures design provided a rich dataset for analyzing visual attention during product evaluation while accounting for the hierarchical structure of the observations in subsequent analyses (Hoogerbrugge et al. 2025).

Consistent with H2, numerical sustainability claims were associated with greater visual attention than equivalent non-numerical claims (Table 4). Claim AOIs associated with chosen products received longer dwell times (0.79 vs. 0.55 s, $p < 0.001$), more fixations (2.42 vs. 1.67, $p < 0.001$), and more revisits (0.92 vs. 0.55, $p < 0.001$). This effect was particularly pronounced for numerical claims. For example, numerical PET and CO_2 claims displayed on chosen products were associated with significantly longer dwell times (1.71 vs. 1.13 s, $p = 0.006$), more fixations (5.07 vs. 3.26, $p = 0.003$), and more revisits (1.79 vs. 1.08, $p = 0.016$) than when the products were not chosen. Although non-numerical claims also attracted greater attention when chosen, the magnitude of these effects was consistently smaller.

The effects extended beyond the sustainability claims. Products displaying numerical claims also generated greater visual attention to product images, prices, and choice buttons. For example, within the price AOI, numerical claims were associated with longer dwell times (0.75 vs. 0.31 s), more fixations (2.61 vs. 1.20), and more revisits (1.39 vs. 0.43) (all $p < 0.001$), suggesting that numerical sustainability claims were associated with broader visual attention during product evaluation rather than attention being confined to the claims themselves.

To examine whether visual attention helps explain the relationship between numerical sustainability claims and product choice, we estimated two SEMs (Table 5). The first model assessed whether attention directed exclusively to the claim AOI mediated the effect of numerical claims on product choice. Numerical claims were associated with significantly longer dwell time ($\beta = 0.209$, $p < 0.001$), fixation count ($\beta = 0.228$, $p < 0.001$), and revisit count ($\beta = 0.127$, $p = 0.003$) within the claim AOI. However, none of these attention measures significantly predicted product choice (all $p > 0.20$), resulting in non-significant indirect effects and limited explanatory power ($R^2 = 0.032$). Thus, increased attention to the sustainability claim alone was insufficient to explain the behavioral effects of numerical sustainability claims.

Because the descriptive analyses indicated that numerical claims were associated with attention beyond the claim itself (Table 4), we estimated a second SEM reflecting broader attentional patterns across the advertisement. Specifically, it examined whether attention directed to the claim subsequently influenced attention to the product, price, and choice AOIs, which in turn predicted product choice.

Consistent with the proposed process account, numerical claims were associated with significantly greater attention to the claim AOI (all a paths, $p < 0.01$), which was subsequently associated with greater attention to the product, price, and choice AOIs (all b paths, $p < 0.001$). Among the downstream

TABLE 4 | Average eye-tracking metrics by AOI type, claim, and choice.

AOI area/numerical condition	Dwell time (s)			Fixation count			Revisit count		
	Chosen	Not chosen	*p*-value	Chosen	Not chosen	*p*-value	Chosen	Not chosen	*p*-value
Claim type	0.79 (1.02)	0.55 (0.91)	< 0.001	2.42 (2.96)	1.67 (2.50)	< 0.001	0.92 (1.40)	0.55 (1.18)	< 0.001
Numerical	1.71 (1.36)	1.13 (1.37)	0.006	5.07 (3.99)	3.26 (3.62)	0.003	1.79 (1.96)	1.08 (1.71)	0.016
Non-numerical	1.07 (0.98)	0.66 (0.76)	0.002	2.96 (2.74)	1.89 (2.18)	0.004	1.22 (1.35)	0.70 (1.17)	0.006
Product	2.15 (1.70)	1.34 (1.36)	< 0.001	5.56 (4.40)	3.47 (3.44)	< 0.001	3.00 (2.61)	1.62 (1.95)	< 0.001
Numerical	2.44 (2.19)	1.28 (1.31)	< 0.001	6.41 (5.78)	3.42 (3.34)	< 0.001	3.52 (3.38)	1.66 (1.98)	< 0.001
Non-numerical	1.85 (1.59)	1.40 (1.48)	0.040	5.14 (4.19)	3.67 (3.75)	0.011	2.71 (2.36)	1.76 (2.13)	0.004
Price	0.63 (0.52)	0.27 (0.35)	< 0.001	2.33 (1.71)	1.07 (1.30)	< 0.001	1.21 (1.29)	0.41 (0.91)	< 0.001
Numerical	0.75 (0.55)	0.31 (0.32)	< 0.001	2.61 (1.61)	1.20 (1.19)	< 0.001	1.39 (1.33)	0.43 (0.82)	< 0.001
Non-numerical	0.60 (0.42)	0.27 (0.37)	< 0.001	2.55 (1.72)	1.05 (1.40)	< 0.001	1.25 (1.28)	0.44 (1.02)	< 0.001
Choice	0.39 (0.48)	0.03 (0.15)	< 0.001	1.00 (1.12)	0.10 (0.41)	< 0.001	0.27 (0.60)	0.02 (0.22)	< 0.001
Numerical	0.44 (0.53)	0.02 (0.11)	< 0.001	1.16 (1.40)	0.13 (0.45)	< 0.001	0.32 (0.64)	0.03 (0.24)	0.001
Non-numerical	0.42 (0.47)	0.03 (0.24)	< 0.001	1.12 (1.08)	0.09 (0.50)	< 0.001	0.28 (0.62)	0.03 (0.36)	0.002

Note: Numbers in parentheses represent standard deviations.

TABLE 5 | Model 2 – SEM results for the influence of numerical claims on attention and choice.

Path	Std. beta	*p*-value	Std. err
Direct: ClaimType → Claim AOI (a)			
ClaimType → Dwell_Claim (a1)	0.209	< 0.001	0.097
ClaimType → Fix_Claim (a2)	0.228	< 0.001	0.267
ClaimType → Revisit_Claim (a3)	0.127	0.003	0.134
Direct: Claim AOI → Product-Price-Choice AOIs (b)			
Dwell_Claim → Dwell_Product (b1)	0.264	< 0.001	0.074
Dwell_Claim → Dwell_Price (b2)	0.361	< 0.001	0.023
Dwell_Claim → Dwell_Choice (b3)	0.181	0.001	0.016
Fix_Claim → Fix_Product (b4)	0.365	< 0.001	0.078
Fix_Claim → Fix_Price (b5)	0.340	< 0.001	0.026
Fix_Claim → Fix_Choice (b6)	0.248	< 0.001	0.016
Revisit_Claim → Revisit_Product (b7)	0.513	< 0.001	0.095
Revisit_Claim → Revisit_Price (b8)	0.330	< 0.001	0.045
Revisit_Claim → Revisit_Choice (b9)	0.234	0.002	0.021
Direct: Product-Price-Choice AOIs → Chosen (c)			
Dwell_Product → Chosen (c1)	0.034	0.691	0.026
Dwell_Price → Chosen (c2)	0.135	0.148	0.109
Dwell_Choice → Chosen (c3)	0.237	0.001	0.108
Fix_Product → Chosen (c4)	0.071	0.553	0.014
Fix_Price → Chosen (c5)	0.167	0.132	0.035
Fix_Choice → Chosen (c6)	0.503	< 0.001	0.063
Revisit_Product → Chosen (c7)	0.019	0.849	0.020
Revisit_Price → Chosen (c8)	−0.149	0.091	0.039
Revisit_Choice → Chosen (c9)	−0.384	< 0.001	0.124
Direct: ClaimType → Chosen			
ClaimType → Chosen (d)	−0.053	0.069	0.028
Indirect			
Indirect via Dwell	0.021	0.025	0.009
Indirect via Fixation	0.047	0.010	0.018
Indirect via Revisit	−0.016	0.126	0.010
Total Indirect	0.052	< 0.001	0.011
Total Effect	−0.001	0.971	0.030

Note: Indirect via Dwell = a1 * (b1 * c1 + b2 * c2 + b3 * c3); Indirect via Fixation = a2 * (b4 * c4 + b5 * c5 + b6 * c6); Indirect via Revisit = a3 * (b7 * c7 + b8 * c8 + b9 * c9); Total Indirect = ind_dwell + ind_fix + ind_revisit; Total Effect = d + total_indirect.

attention measures, attention allocated to the choice AOI consistently predicted product choice across dwell time ($\beta = 0.237$, $p = 0.001$), fixation count ($\beta = 0.503$, $p < 0.001$), and revisit count ($\beta = -0.384$, $p < 0.001$), whereas attention directed to the product and price AOIs did not. Significant indirect effects through dwell time ($\beta = 0.021$, $p = 0.025$) and fixation count ($\beta = 0.047$, $p = 0.010$) supported the proposed mediation mechanism, whereas the direct effect of numerical claims on product choice was not significant. Overall, the model explained 56.4% of the variance in product choice.

Together, these findings suggest that numerical sustainability claims are not related to choice simply through attention to the claims themselves. Rather, they appear to be associated with broader patterns of visual attention that may contribute to consumers' value construction during product evaluation.

Attention to the price AOI did not significantly predict product choice across any attention metric (all $p > 0.05$), despite numerical claims being paired with premium price levels. This suggests that the observed attentional patterns cannot be explained solely by increased scrutiny of higher-priced products. Rather, numerical sustainability claims appear to be associated with broader evaluative engagement extending beyond price information alone.

These findings support H2 and H3 by showing that numerical sustainability claims are associated with greater attention to sustainability information and that this attentional advantage may contribute to consumers' value construction during product choice.

Finally, we tested H5 by examining whether environmental awareness moderated the effect of numerical sustainability

claims on visual attention. Environmental awareness was positively associated with overall fixation count ($\beta = 0.415$, $p = 0.021$) and revisit frequency ($\beta = 0.206$, $p = 0.038$), indicating greater visual engagement with sustainability information. However, environmental awareness did not moderate the effect of numerical claims on dwell time ($\beta = 0.055$, $p = 0.291$), fixation count ($\beta = 0.146$, $p = 0.292$), or revisit frequency ($\beta = 0.076$, $p = 0.314$). Thus, H5 was not supported, suggesting that the attentional advantage associated with numerical sustainability claims was consistent across consumers with different levels of environmental awareness.

7 | Discussion

7.1 | Interpretation of Findings

This research examined whether numerical sustainability claims function as stronger marketplace signals and how they influence consumer decision-making. Across two complementary studies, the findings indicate that numerical sustainability claims increase consumer preference and WTP by attracting greater visual attention that becomes incorporated into consumers' value construction.

Study 1 demonstrates that numerical sustainability claims outperform equivalent non-numerical claims under realistic marketplace trade-offs. Unlike previous research relying primarily on attitudes or purchase intentions (Ganz and Grimes 2018; Khalil et al. 2021; Papadopoulou et al. 2025), the conjoint design required consumers to choose among products while simultaneously evaluating price, product design, brand, customization, and sustainability information. Despite these competing attributes, numerical sustainability claims consistently generated higher consumer preference and WTP than equivalent non-numerical claims. Additionally, consumers responded less favorably to CO_2 compensation claims than to PET-related or general sustainability claims. Although explaining these differences was beyond the scope of this research, they suggest that sustainability concepts may differ in their persuasive effectiveness independently of numerical specificity.

Study 2 complements these behavioral findings by examining the attentional processes associated with the influence of numerical sustainability claims on consumer choice. Although numerical claims attracted greater visual attention than equivalent non-numerical claims, attention directed solely to the sustainability claim was insufficient to explain product choice. Instead, numerical claims were associated with broader patterns of visual attention, directing consumers' gaze toward other decision-relevant product attributes before choice was made. This pattern suggests that numerical sustainability claims do more than capture attention; they are associated with broader patterns of information processing that may increase the likelihood that sustainability information becomes incorporated into value construction (Martinovici et al. 2023; Smith and Krajbich 2018). Importantly, these effects emerged under more naturalistic decision conditions in which numerical claims were paired with premium prices. Yet attention directed to price did not predict product choice, suggesting that the observed attentional advantage is unlikely to be explained solely by greater scrutiny of higher-priced products.

Finally, contrary to our expectations, the behavioral and attentional advantages of numerical sustainability claims were not moderated by consumers' environmental awareness. Although environmentally aware consumers generally devoted greater visual attention to sustainability information, numerical claims were similarly effective across consumers with different levels of environmental awareness. Rather than suggesting that environmental awareness is unimportant, these findings indicate that communicating sustainability through numerical claims may reduce consumers' reliance on prior environmental motivation during product evaluation. In other words, numerical sustainability claims may facilitate the evaluation of sustainable products across consumers with varying levels of environmental awareness.

Taken together, the findings suggest that numerical sustainability claims may influence consumer decision-making not simply because they communicate sustainability, but because they communicate it in a way that receives greater cognitive processing and is more readily incorporated into consumers' evaluation of competing marketplace information.

7.2 | Theoretical Contributions

This research makes three main theoretical contributions to signaling theory, attention-based models of consumer decision-making, and sustainability communication research.

First, this research extends signaling theory by demonstrating that stronger marketplace signals remain behaviorally influential under realistic marketplace conditions. Signaling theory proposes that consumers rely on observable marketplace signals to infer otherwise unobservable product attributes (Kirmani and Rao 2000; Spence 1973), and that signals become more effective when they communicate information that is specific and difficult to falsify (Connelly et al. 2025; Friske et al. 2023). Previous sustainability research has therefore argued that numerical sustainability claims should function as stronger marketplace signals because they communicate environmental information more precisely and increase the perceived informativeness of sustainability communication (Atkinson and Rosenthal 2014; Janssen et al. 2022; Xie and Kronrod 2012). Our findings extend this argument by suggesting that stronger sustainability signals remain influential even when sustainability information competes directly with price, product design, brand, and customization during product choice. Thus, the contribution of stronger marketplace signals extends beyond improving consumers' evaluations of sustainability claims to increasing their influence on value-based marketplace decisions. Interestingly, the weaker performance of CO_2 compensation claims further suggests that the effectiveness of stronger marketplace signals depends not only on numerical specificity but also on the sustainability theme being communicated, highlighting an important direction for future theoretical development.

Second, this research advances understanding of the role of visual attention in sustainability decision-making by clarifying when attention becomes behaviorally influential. Attention-based models propose that visual attention contributes to value

construction by increasing the weight assigned to product attributes during evaluation (Krajbich and Rangel 2011; Martinovici et al. 2023; Mormann and Russo 2021). At the same time, previous research has shown that visually salient or cognitively demanding information may attract attention without necessarily influencing consumer choice (Babakhani et al. 2020; Takahashi et al. 2018). Our findings help reconcile these perspectives by suggesting that, in the context of sustainability communication, numerical claims function as stronger marketplace signals that increase the decision relevance of sustainability information during product evaluation rather than merely attracting attention. Importantly, this process remained evident even when numerical sustainability claims were presented alongside premium prices, while attention directed to price itself did not predict product choice. Together, these findings suggest that stronger marketplace signals may contribute to consumer choice not simply by increasing visual salience, but by facilitating the integration of sustainability information into consumers' broader evaluation of competing marketplace attributes.

Third, this research contributes to sustainability communication by questioning the assumption that effective sustainability communication primarily depends on consumers' pre-existing environmental motivation. Previous research consistently shows that environmentally aware consumers express stronger sustainability preferences and devote greater attention to environmental information (Amatulli et al. 2019; Hinsch et al. 2021; Janssen et al. 2022). At the same time, the literature recognizes that these attitudes often fail to translate into marketplace behavior when sustainability competes with other product attributes (Park and Lin 2020; White et al. 2019). Across both studies, environmental awareness did not moderate the behavioral or attentional advantages of numerical sustainability claims. Rather than suggesting that environmental awareness is unimportant, these findings indicate that improving the specificity of sustainability communication may reduce consumers' reliance on prior environmental motivation by making sustainability information easier to evaluate. This contributes to sustainability communication research by suggesting that stronger marketplace signals may facilitate the integration of sustainability information into consumer decision-making across consumers with different levels of environmental awareness.

7.3 | Managerial Implications

This research offers several practical implications for firms seeking to communicate sustainability more effectively. First, marketers should move beyond generic sustainability statements and communicate environmental performance through carefully selected numerical sustainability claims. Previous research has shown that quantified sustainability information enhances perceptions of credibility, transparency, and brand evaluations (Atkinson and Rosenthal 2014; Ganz and Grimes 2018; Janssen et al. 2022), while also helping reduce consumer skepticism associated with greenwashing (Neureiter et al. 2024). Our findings indicate that these benefits extend beyond perceptions to marketplace behavior: numerical sustainability claims attracted greater visual attention, encouraged more thorough product evaluation, increased product choice, and generated higher WTP. For example, communicating that a backpack was made from 37 recycled PET bottles increased average WTP by approximately €39 relative to products without sustainability claims, representing nearly 80% of the product's €49.99 entry price. Managers should therefore prioritize numerical sustainability claims to increase the perceived value of sustainability information and support sustainable product decisions.

Second, managers should carefully design numerical sustainability claims to maximize their relevance for consumers. Although numerical specificity consistently outperformed equivalent non-numerical claims, the effectiveness of quantified communication differed across sustainability themes, with PET-related claims outperforming CO_2 compensation claims. Because explaining these differences was beyond the scope of this research, managers should interpret this finding cautiously and recognize that not all sustainability themes may benefit equally from numerical communication.

Finally, numerical sustainability claims may help broaden the reach of sustainability communication. While prior research suggests that sustainability messages are often most persuasive among consumers with stronger pro-environmental orientations (Amatulli et al. 2019; Hinsch et al. 2021; White et al. 2019), our findings provide no evidence that the effectiveness of numerical sustainability claims differed across consumers with different levels of environmental awareness. This suggests that carefully designed numerical sustainability claims may resonate with a broader consumer audience, rather than primarily with highly environmentally engaged consumers.

8 | Conclusion, Limitations, and Future Research

This research provides evidence that numerical sustainability claims function as stronger marketplace signals and are associated with higher consumer preference and WTP for sustainable products. Across a CBC experiment and an eye-tracking study, the findings further suggest that these behavioral advantages may partly reflect the greater incorporation of sustainability information into consumers' value construction during product evaluation.

Collectively, these findings suggest that communicating sustainability through numerical evidence, rather than broad environmental rhetoric, may help firms communicate otherwise unobservable environmental attributes more effectively. As consumers face increasing amounts of sustainability information alongside growing concerns about greenwashing, improving how sustainability performance is communicated may be as important as improving sustainability performance itself.

Several limitations provide opportunities for future research. Although the conjoint experiment and eye-tracking study were designed to approximate realistic marketplace decisions, both studies were conducted in controlled experimental settings using backpack products. Moreover, although the eye-tracking sample size is consistent with current methodological recommendations for consumer eye-tracking research (Hoogerbrugge et al. 2025), the relatively modest number of participants warrants caution when interpreting the process-level findings. Future research should replicate these findings using larger and

more diverse samples across different product categories, retail environments, and real purchasing contexts.

An additional limitation concerns the design of the eye-tracking experiment. To approximate realistic marketplace trade-offs, numerical sustainability claims were paired with premium price levels rather than being orthogonally manipulated as in Study 1. Although this design allowed attentional processes to be examined under more naturalistic decision conditions, it limited the ability to isolate the independent contribution of numerical claims within the eye-tracking study alone. Future research could combine orthogonal experimental control with eye tracking to further disentangle the effects of sustainability claims and price on visual attention and product choice.

The present research also examined a limited set of sustainability themes and numerical formats. Although numerical specificity consistently outperformed equivalent non-numerical communication, consumers responded differently across sustainability themes, suggesting that the effectiveness of numerical sustainability claims depends on more than numerical specificity alone. Future research should disentangle the influence of numerical format (e.g., percentages *vs.* absolute values or smaller *vs.* larger numbers) from the sustainability theme itself (e.g., recycled materials, water savings, or carbon emissions) to identify additional boundary conditions governing the effectiveness of numerical sustainability communication.

Finally, although the present research identifies visual attention as one process associated with the influence of numerical sustainability claims on consumer choice, additional psychological processes may also contribute to these effects. Future research could examine how visual attention interacts with constructs such as perceived credibility, trust, comprehension, or cognitive effort to provide a more comprehensive understanding of how numerical sustainability claims influence consumer decision making.

As firms continue to invest in sustainability, designing relevant communications that help consumers recognize and incorporate environmental information into their decisions will become increasingly important for accelerating sustainable consumption.

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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.

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