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The impact of social vs environmental sustainability information disclosure on consumer choice of delivery time with varying sustainability concerns

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Abstract

Purpose – This paper investigates the impact of sustainability information disclosure on consumers' choice of order-to-delivery lead-time in relation to consumers' sustainability concern.
Design/methodology/approach – Based on two choice experiments with participants from the Netherlands (n = 348) and the United Kingdom (n = 1,387), the impact of sustainability information disclosure was examined in connection with consumers' concerns for environmental and social sustainability. Information on environmental impact (carbon emission) and social impact (warehouse workers and drivers' well-being) was considered and compared.
Findings – Disclosing sustainability impact information significantly increased consumers' preference and choice for longer delivery times, with equivalent effects for environmental and social impact information. Consumers' relevant (environmental or social) sustainability concern as personality traits enhanced effects on preferences, as did priming of environmental concern.
Research limitations/implications – Future research may consider differences between product categories or e-commerce companies' reputation in sustainability activities.
Practical implications – The findings provide opportunities for online retailers to influence consumer choice of delivery time, especially through disclosing environmental and/or social sustainability information.
Originality/value – This study fills a gap in the literature on sustainability information disclosure to actively steer consumer choice of delivery time, particularly regarding the effect of social sustainability impact information in comparison to its environmental counterpart.

Keywords Consumer behavior, Online retail, Last-mile logistics, Choice experiment, Delivery preference, Priming
Paper type Research paper

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Introduction

Last-mile delivery is one of the most important success factors in B2C e-commerce (Tokar *et al.*, 2020). Prior research consistently points to two dominant attributes in consumer choice of delivery service: delivery fee and delivery time (Gawor and Hoberg, 2019; Nguyen *et al.*, 2019). Generally, consumers are reluctant to pay a delivery fee and increasingly demand short delivery times (Tokar *et al.*, 2020). E-commerce retailers (e-retailers) have consequently adopted express delivery to boost consumer satisfaction and loyalty (Fisher *et al.*, 2019). Moreover, express delivery options have become more attractive to online consumers due to membership programs. For example, bol.com, a major e-retailer active in the Netherlands and Belgium, offers a membership program for €10 per year, which allows free same-day delivery (Bol.com, 2021).

This focus on speed comes at a prize. Muñoz-Villamizara *et al.* (2021) show in a case study that next-day delivery increases CO_2 emission up to 15% when compared with within-3-day delivery. Furthermore, express options such as same-day or next-day delivery hinder shipment consolidation and efficient route planning (Mangiaracina *et al.*, 2019; Jaller and Pahwa, 2020), increasing greenhouse gas emissions. Express options can also cause irregular or long work hours (e.g. late evening) and time-pressured schedules, which are directly relevant to increased fatigue, stress and, consequently increased accidents on roads and in warehouses (Chen *et al.*, 2021). Interestingly, social issues such as the well-being of warehouse workers and delivery drivers have often been overlooked in logistics and transportation research and practice (Davis-Sramek *et al.*, 2020). Currently, driver shortage in the logistics sector is a critical global problem (e.g. more than 400,000 truck driver positions remained unfilled in Europe by the end of 2021), and poor working conditions have been indicated as one of the major causes (IRU, 2022). We posit that these issues should not be neglected for online retailing. After all, delivery drivers are the only frontline employees who have physical face-to-face contact with consumers and are a scarce resource (Ji-Hyland and Allen, 2022).

Online consumers often have limited possibilities to influence the sustainability of last-mile delivery, mainly because they lack adequate information on sustainability impact (Sallnäs and Björklund, 2020). E-retailers have therefore been urged to educate and incentivize their consumers to opt for sustainable delivery options (Davis *et al.*, 2018) and to steer them away from choosing based on delivery speed. Yet, retailers often struggle with how to best share different types of sustainability information (IGD, 2022). Within the context of delivery lead-time, they could emphasize environmental gains from longer lead-times or social gains for delivery drivers and warehouse workers, but the value of providing environmental or social information to consumers is unclear. Moreover, it is unclear whether one type of sustainability information is more effective for all consumers than another type of sustainability information, or that there are individual differences. For instance, would consumers who are more concerned about the environment or about social sustainability respond differently?

In this paper, we investigate the possibility of influencing consumer choice of order-to-delivery lead-time by disclosing sustainability impact information associated with delivery options differing in order-to-delivery lead-time. Only few studies have explored this topic, most notably the studies of Agatz *et al.* (2021) and Ignat and Chankov (2020). Agatz *et al.* (2021) conduct choice experiments on the choice of delivery time slots across different days in e-grocery delivery. Time slots have different labels (a green label implying an environmentally friendly time slot vs no label) and prices. The authors find that green labels effectively steer shoppers toward the environmentally friendly time slots. Agatz *et al.* (2021) only consider environmental benefits and study the effect of greenness and length of delivery time slots (on different days) rather than the time lapse between a consumer placing an order and actual consumer delivery (i.e. the order-to-delivery lead-time). Ignat and Chankov (2020) include information on both environmental (i.e. CO_2 emission) and social

benefits (i.e. drivers' benefits). They find that consumer choice for delivery options, when provided with such sustainability information, is affected, but this study and other existing studies do not investigate how the effect of disclosing environmental sustainability information differs from disclosing social sustainability information. Our study aims to unravel the value of providing social sustainability information to make consumers change delivery lead-time options and to identify whether this has similar effects as providing environmental sustainability information. In doing so, this study separately examines the impact of last-mile delivery-related social sustainability information and environmental sustainability information. In addition, our study examines relevant differences between consumers related to sustainability concerns, both in terms of a personality trait and as a situationally activated concern. This provides insights into the effectiveness of providing sustainability information to different types of consumers and in different contexts.

To reach our objectives, we conduct two choice experiments. Experiment 1 examines the effectiveness of sustainability information disclosure on consumer choice of order-to-delivery lead-time in connection with consumers' sustainability concern as a personality trait. Experiment 2 reexamines the effectiveness of sustainability information disclosure in the context of priming this sustainability concern situationally. Overall, we find strong and equivalent effects of disclosing social and environmental sustainability information on consumer choice for sustainable delivery options.

Background and hypotheses

Information disclosure to promote sustainable consumption

The goal of sustainability information disclosure is to reduce information asymmetry between consumers and retailers (or producers) regarding sustainability attributes of a product or service (Delmas and Lessem, 2017). Information disclosure about the sustainability of delivery options implies that trade-offs between sustainability and delivery convenience become explicit for consumers. Especially if there are no additional delivery fees attached, consumers are likely to opt for faster delivery options (Nguyen *et al.*, 2019). Opting for slower delivery directly affects the consumer experience and may imply a personal sacrifice. Although consumers often choose for personal benefits above all, as evidenced by the high importance they place on low delivery fees (Nguyen *et al.*, 2019), the explicit disclosure of the sustainability vs delivery time trade-off may spur them to take sustainability into consideration and change their delivery choice. This is visible in the experiments conducted by Agatz *et al.* (2021), who found that disclosure of sustainability information leads to consumers choosing longer time slots. Their study does not specifically examine the effect of disclosing sustainability information on consumer choice for longer order-to-delivery lead-times; such longer lead-times may reduce pressure on operations and therefore increase opportunities to balance loads.

It is not obvious that consumers will take sustainability information into account when making delivery choices. In fact, Ignat and Chankov (2020) hypothesized, based on newspaper evidence, that customers do not care about carriers' driving conditions as long as delivery is cheap. In a similar vein, they built on existing work regarding consumer willingness to wait when presented with environmental sustainability information, and expected no effect there either. Results of their paper, however, point to a different conclusion. Both social and environmental information increased choice for more sustainable options, but the effects of these were not compared. Other studies have compared environmental and social sustainability information, outside of the context of last-mile delivery, and with conflicting results (Rondoni and Grasso, 2021; Shao and Ünal, 2019). These conflicting results may be due to differences in consumers' perceptions of how important social vs environmental information is in a specific context.

To understand whether environmental or social sustainability information is more impactful, we draw upon the concept of psychological distance (cf. construal level theory; Trope and Liberman, 2010). Objects and issues may be removed from the self in different ways, such as time, space and hypotheticality. Because consumers are in a concrete mindset when contemplating a product purchase for themselves in the here-and-now, they tend to respond more strongly to information and issues that have a low psychological distance than to information and issues that have a high psychological distance (Dhar and Kim, 2007). By their very nature, issues of environmental sustainability are psychologically relatively distant to people (Reczek *et al.*, 2018), as these issues concern the global environment and the future. Social sustainability issues may be more psychologically close to consumers in the current case, as consumers come into direct contact with delivery drivers, and this concerns local issues in the present. Based on this argumentation, we expect that social impact information has a stronger impact on relative preferences for a longer delivery time than environmental impact information. That is, we expect that consumers' degree of preference for an option with longer delivery time will increase in comparison to their preference for options with shorter delivery time. These relative preferences differ from actual behavior (i.e. choices) and do not necessarily translate into actions. That is, a slight shift in preference for one option may not affect choice at all if the preference for another option remains higher. Yet, when preferences between options become similar due to such a preference shift, consumers become indifferent between the options and may exhibit choice inconsistency over time (Alós-Ferrer and Garagnani, 2021). Furthermore, when a shift in relative preferences is large enough, it can lead to change in choice: consumers not only give the option with longer delivery time a relatively higher preference rating, but they will also choose this one over other options with shorter delivery time. This latter effect is what we expect to occur here, and we posit hypothesis 1 as follows:

H1. Consumers will (a) be more likely to choose and (b) give a higher relative preference rating to a delivery option with a longer delivery time when disclosing information on social sustainability impact associated with a longer delivery time compared to disclosing information on environmental sustainability impact associated with a longer delivery time.

Sustainability information disclosure and consumers' sustainability concern

Environmental sustainability concern is a concept that has been used to explain consumers' green consumption behavior (Liobikienė and Bernatonienė, 2017). Consumers with higher environmental concern are, for example, willing to pay more for carbon footprint labeled foods (Rondoni and Grasso, 2021), and highly eco-conscious consumers are more likely to choose green labeled delivery time slots compared to lowly eco-conscious consumers (Agatz *et al.*, 2021). Although environmental concerns have received much more research attention than social sustainability concerns (Rondoni and Grasso, 2021), both types of sustainability concerns are relevant for consumer choices.

Consumers with a high sustainability concern likely experience discomfort if they are confronted with a discrepancy between their preference for speedy delivery and the negative sustainability effects of this option. Consumers with a low sustainability concern will experience less discomfort. This type of psychological discomfort has been examined by cognitive dissonance theory. Cognitive dissonance theory argues that consumers have a strong tendency to minimize the occurrence of discomfort resulting from any inconsistency in their cognitions (e.g. environmental or social sustainability concerns) and behaviors (Harmon-Jones and Harmon-Jones, 2007). The theory posits that a discrepancy between cognitions leads to discomfort. The magnitude of this discomfort depends, among others, on the importance of cognitions (Harmon-Jones and Mills, 2019), in our case, on sustainability

concern. Consumers can alleviate this discomfort in various ways, for instance by changing, removing or adding cognitions or behavior.

Based on cognitive dissonance theory, we suggest that the disclosed sustainability information will have a stronger effect on consumers' decision-making when consumers have a high sustainability concern. The review by Rondoni and Grasso (2021) and the experiments of Agatz *et al.* (2021) confirm that this is the case for environmental sustainability information and environmental concern. To the best of our knowledge, the effect of disclosing social sustainability information and social concern on consumer choice for delivery options has so far not been investigated. We expect that a match between the type of information (i.e. environmental vs. social sustainability information) and the type of sustainability that consumers are concerned about (i.e. environmental vs. social sustainability concern) is essential for this effect to occur. Based on the above, we posit:

H2. The impact of environmental sustainability information disclosure on consumers' (a) choice of and (b) relative preference for delivery time is stronger when consumers have a higher trait environmental concern.

H3. The impact of social sustainability information disclosure on consumers' (a) choice of and (b) relative preference for delivery time is stronger when consumers have a higher trait social concern.

H2 aims to replicate and extend the findings of existing literature, most notably Agatz *et al.* (2021), who focused on delivery time slots. We aim to show that also for order-to-delivery lead-time, which consumers value greatly (Fisher *et al.*, 2019), information disclosure about environmental impact (H2) as well as social impact (H3) is effective. This also aims to extend the insights of Ignat and Chankov (2020) on the effect of disclosing social sustainability information on selecting a longer delivery lead-time, as they did not control for environmental or societal concern.

It is common to consider consumers' environmental and social sustainability concerns as personality traits, and assess chronic differences between consumers on these concerns (Hosta and Zabkar, 2021). Trait sustainability concerns are relatively stable individual tendencies. Additionally, consumers' sustainability concerns can be temporarily stimulated by the context that they encounter (Thøgersen and Alfinito, 2020). State sustainability concerns are temporarily induced by cues in the context, such as when consumers read about sustainability issues in newspaper or online. In this study, we examine sustainability concerns in both ways: chronic sustainability concerns as personality traits (Experiment 1) and situational sustainability concerns as states (Experiment 2). Hence, we also posit:

H4. The impact of environmental sustainability information disclosure on consumers' (a) choice of and (b) relative preference for delivery time is stronger when consumers have a higher situationally induced environmental concern.

H5. The impact of social sustainability information disclosure on consumers' (a) choice of and (b) relative preference for delivery time is stronger when consumers have a higher situationally induced social concern.

Methodology

As our research method, we opted for behavioral experiments as these are especially suited to test for the causality that we hypothesize. Recently, more researchers in the field of logistics and supply chain management have started to adopt behavioral experiments (Tokar *et al.*, 2020). In such experiments, researchers expose two or more equivalent participant groups to different treatments in a controlled setting, and then observe differences between the groups on the dependent variable(s) of interest (Lynn and Lynn, 2003). To measure the impact of sustainability

information disclosure (i.e. the manipulated factor), we conduct two between-subjects experiments. We opted for this design to diminish the possibility of demand effects, that is, participants attempting to provide answers that satisfy their perceptions of the experimenters' expectations (Charness *et al.*, 2012). As mentioned, Experiment 1 furthermore includes consumers' sustainability concerns as personality trait, and Experiment 2 as state variable.

Experiment 1 – Information disclosure and sustainability concern

Design and participants

Participants were randomly assigned to one of three conditions: Environmental Sustainability (ES) information vs Social Sustainability (SS) information vs control (no sustainability information provided). They were recruited using Prolific Academic service (https://www.prolific.co) and received USD 0.80 reward. To control for potential exogenous factors of different retail markets, we limited the participant pool to the Netherlands (NL) and to participants who had purchased a product online at least once. A total of 360 participants completed the experiment with a median response time of 4.5 min (response time includes the total time duration to complete all tasks and questions). Appendix 1 contains details on procedure and stimulus materials. Twelve participants (3.3%) were excluded from the sample because they failed the attention check (seven participants), responded extremely fast (less than 50% of the median response time; four participants) or provided the same answer to a series of unrelated questions (i.e. flat-lining; one participant) in combination with a short response time. The resulting sample consisted of 348 participants.

Table 1 shows the number of participants in each condition, their demographics and online shopping information. Most of the participants were under 40 years old, and a majority

	Count	%
Number of participants		
Control information condition	113	32.5
ES information condition	117	33.6
SS information condition	118	33.9
Gender		
Males	179	51.4
Females	165	47.4
Others	0	0.0
Answer declined	4	1.2
Age		
18–29	235	67.5
30–39	75	21.6
40–49	27	7.8
50–59	7	2.0
60 or over	3	0.9
Answer declined	1	0.2
Online shopping frequency		
More than once a day	0	0.0
Once a day	47	13.5
A few times a week	51	14.7
Once a week	154	44.3
A few times a month	61	17.5
Once a month	33	9.5
A few times a year	2	0.5

Source(s): Table by authors

Table 1. Experiment 1's sample description

shopped online once a week. Moreover, when asked to choose between one and three product categories they have purchased online the most, 57.5% of participants indicated fashion (i.e. clothes and footwear items), which is in line with the currently most purchased category by European online consumers (Eurostat, 2021).

Measures

Dependent variables. The two dependent variables in this study were choice (multi-categorical) and preference (rating scale from 1 (very unpreferable) to 7 (very preferable)). Besides the preferences for each of the options, that is, prefA, prefB and prefC, we were especially interested in the preference difference between option C and option B, that is, prefC-B. The difference (prefC-B) is an indicator to see how much more preferable option C becomes relative to option B as a result of information disclosure.

Environmental sustainability concern was measured with six items (Cronbach $\alpha = 0.91$) based on the scale developed by Haws *et al.* (2014). Participants were asked, "Please indicate to what extent you agree or disagree with the following statements": (1) "It is important to me that the products I use do not harm the environment"; (2) "I consider the potential environmental impact of my actions when making many of my decisions"; (3) "My purchase habits are affected by my concern for our environment"; (4) "I am concerned about wasting the resources of our planet"; (5) "I would describe myself as environmentally responsible"; and (6) "I am willing to be inconvenienced in order to take actions that are more environmentally friendly." These items were rated on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). The environmental sustainability concern (ES concern) score was the average of the six items.

Social sustainability concern was measured with five items (Cronbach $\alpha = 0.86$) based on the scale developed by Francis and Davis (2015). Participants were asked, "Please indicate how concerned you are about the following issues when purchasing a product": (1) "The use of child labor in producing the product"; (2) "Poor working conditions and wages of workers"; (3) "Whether purchasing the product supports local businesses"; (4) "Human rights in the country where the product was made"; and (5) "Whether the company producing the product is socially responsible." The items were rated on a 7-point scale ranging from 1 (not at all concerned) to 7 (extremely concerned) and averaged into an social sustainability concern (SS concern) score.

ES concern and SS concern are two distinct constructs (Catlin *et al.*, 2017). Because they both relate to sustainability, the two constructs were correlated ($r = 0.62$, $p < 0.001$), as expected. We assessed their discriminant validity by fitting two models – one-factor model and two-factor model – to the data (using "lavaan" package version 0.6–9 in *R*). The two-factor model clearly outperformed the one-factor model ($\Delta\chi^2(1) = 366.93$, $p < 0.001$), which indicates their discriminant validity as two distinct psychological constructs.

Analysis and results

H1 hypothesizes that (a) the choice of and (b) relative preference for the option with longer lead-time (option C) will be significantly higher for the condition with SS information than for ES information. In addition, in both these conditions, the preference for option C should be higher than in the control condition. Table 2 summarizes the results.

Delivery choice

In all conditions, very few participants chose option A. As expected, the choice for options A and B vs option C differed across conditions ($\chi^2(2) = 94.25$, $p < 0.001$). While 95.6% of the participants in the control condition selected options A or B, the numbers fell to 40.2% and 41.5% for ES and SS information conditions, respectively. Concerning option C, the choice increased from 4.4% (control condition) to 59.8% (ES information condition) and 58.5% (SS

	Control condition	ES information condition	SS information condition
Choice of option A	7	0	1
Choice of option B	101	47	48
Choice of option A&B	108	47	49
Choice of option C	5	70	69
Preference for option A: prefA	2.99[a]	2.26[b]	2.24[b]
Preference for option B: prefB	6.46[a]	5.70[b]	5.53[b]
Preference for option C: prefC	4.19[a]	5.52[b]	5.49[b]
Preference C-B: prefC-B	−2.27[a]	−0.18[b]	−0.03[b]

Note(s): Superscripts of the preference scores indicate results of Tukey's HSD post-hoc tests. The means with different superscripts (a vs b) differ significantly at $p < 0.001$
Source(s): Table by authors

Table 2. Delivery choices and preferences, Experiment 1

information condition). Comparing the ES information condition and the SS information condition showed no significant difference ($\chi^2(1) = 0.01, p = 0.94$). Thus, for lead-time choice, information disclosure about either ES or SS was helpful, and their impacts were not significantly different, which does not support H1a.

Delivery preference

As seen in Table 2, the means of prefA and prefB decreased when the ES or SS information was presented, whereas those of prefC and prefC-B increased. Four ANOVA tests on the means among the three treatment groups for prefA ($F(2, 345) = 8.50, p < 0.001$), prefB ($F(2, 345) = 18.22, p < 0.001$), prefC ($F(2, 345) = 28.24, p < 0.001$) and prefC-B ($F(2, 345) = 37.52, p < 0.001$) confirmed the significant increases of preference for the sustainable option (option C) and accordingly the significant decreases of preference for the less sustainable options (options A and B). Additionally, Tukey's HSD post-hoc tests' results (see Table 2) showed that the mean preferences were significantly different between the ES/SS information condition and control condition, and not significantly different between the ES and SS information condition. The impacts of ES information and SS information were thus not significantly different, and no support is found for hypothesis H1b.

The effects of environmental and social sustainability concerns

To study the moderating roles of ES and SS concerns on the impact of information disclosure (H2 and H3), we employed logit regression to model delivery choice for option C, linear regression to model delivery preference for option C (prefC) and the preference difference between options C and B (prefC-B). Table 3 describes the coding of independent variables.

Independent variables	Coding
ES_info and *SS_info*	Effect coding with control condition as the reference • Control condition: *ES_info* = −1 and *SS_info* = −1 • ES information condition: *ES_info* = 1 and *SS_info* = 0 • SS information condition: *ES_info* = 0 and *SS_info* = 1
ES_concern and *SS_concern*	*ES_concern* and *SS_concern* are the centered values (centered on the mean) of the ES concern and SS concern

Source(s): Table by authors

Table 3. Coding of independent variables of regression models in Experiment 1

We ran multicollinearity diagnostics and found – as expected – collinearity due to the interaction terms (using "mctest" package version 1.3.1 in *R*; Farrar $\chi^2 = 261.6$). Therefore, separate models were used to enter ES- and SS-related variables in the regression. Additional regression models with control variables, that is, age (7 categories) and gender (4 categories), showed that including them does not affect the findings on the effects of ES and SS concerns. Tables 4 and 5 thus present the models without these control variables.

The results of fitting the logit regressions are summarized in Table 4. The significant and similar main effects of ES and SS information and the significant main effects of ES concern and SS concern were confirmed. The interaction effects between the sustainability information disclosure and sustainability concern were found insignificant. This means we cannot accept H2a or H3a with regard to delivery choice: sustainability concerns do not moderate the impact of sustainability information disclosure on consumer choice of lead-time.

Table 5 summarizes the results of fitting linear regressions to model prefC and prefC-B. Consistent with the earlier results, significant and similar main effects of ES and SS

		Estimate	Std. error
ES concern model M1	*(Intercept)*	−0.82***	0.21
AIC: 311.09	*ES_info*	1.32***	0.24
	SS_info	0.90***	0.20
	ES_concern	1.11***	0.24
	ES_info × *ES_concern*	0.22	0.24
	SS_info × *ES_concern*	0.05	0.24
SS concern model M2	*(Intercept)*	−0.86***	0.21
AIC: 354.39	*ES_info*	1.26***	0.24
	SS_info	0.53***	0.19
	SS_concern	1.20***	0.24
	ES_info × *SS_concern*	−0.10	0.21
	SS_info × *SS_concern*	−0.08	0.21

Note(s): Significance codes: ***$p < 0.001$ **$p < 0.01$ * $p < 0.05$
Source(s): Table by authors

Table 4.
The result of fitting logit regressions to model delivery choice in Experiment 1

		prefC		prefC-B	
		Estimate	Std. error	Estimate	Std. error
ES concern models	*(Intercept)*	5.06***	0.08	−0.84***	0.11
	ES_info	0.47***	0.11	0.69***	0.15
	SS_info	0.39***	0.11	0.73***	0.15
	ES_concern	0.42***	0.07	0.68***	0.09
	ES_info × *ES_concern*	0.27**	0.09	0.36**	0.13
	SS_info × *ES_concern*	0.05	0.09	0.20	0.13
		model M3, $R^2 = 0.26$		model M4, $R^2 = 0.33$	
SS concern models	*(Intercept)*	5.06***	0.08	−0.84***	0.11
	ES_info	0.45***	0.11	0.64***	0.16
	SS_info	0.42***	0.11	0.79***	0.16
	SS_concern	0.27***	0.07	0.46***	0.09
	ES_info × *SS_concern*	0.06	0.10	0.09	0.14
	SS_info × *SS_concern*	0.14	0.09	0.26*	0.13
		model M5, $R^2 = 0.19$		model M6, $R^2 = 0.25$	

Note(s): Significance codes: ***$p < 0.001$ **$p < 0.01$ * $p < 0.05$
Source(s): Table by authors

Table 5.
The results of fitting linear regressions to model delivery preference in Experiment 1

information were found. Interestingly, whereas the interaction effects between information disclosure and sustainability concern were not significant in the choice models, they were found significant in the preference models for ES concern on prefC (model M3, *ES_info* × *ES_concern*, $t(342) = 2.93$, $p < 0.01$, $\eta_p^2 = 0.04$) and on prefC-B (model M4, *ES_info* × *ES_concern*, $t(342) = 2.82$, $p < 0.01$, $\eta_p^2 = 0.05$), and for SS concern on prefC-B (model M6, *SS_info* × *SS_concern*, $t(342) = 1.98$, $p < 0.05$, $\eta_p^2 = 0.01$). This means that the effect of ES (or SS) information disclosure is stronger for participants with higher ES (or SS) concern (except for the preference for option C, where the interaction between SS information and SS concern is not significant). Furthermore, as expected, there were no significant interaction effects between sustainability information and sustainability concern that do not match in terms of the dimension of sustainability, that is, *SS_info* × *ES_concern* and *ES_info* × *SS_concern*. These results imply that we can accept H2b and H3b with regard to delivery preference: a sustainability concern strengthens the impact of sustainability information disclosure on lead-time preference.

Discussion

The results have shown that disclosing information about environmental sustainability (ES) and social sustainability (SS) of delivery options impacts consumers' choice of lead-time: consumers are willing to wait longer for deliveries when ES or SS information is provided at the moment of delivery choice. Moreover, social sustainability information is as effective as its environmental counterpart, and thus social sustainability information should not be neglected when providing information on delivery options to consumers. We hypothesized (H1) that social sustainability would be more effective, given the direct contact between consumers and delivery service workers and the presumed lower perceived distance, yet found that both environmental and social sustainability information are effective to a similar extent. This suggests that consumers may perceive less distance to environmental issues than we originally anticipated, which could possibly be due to the public attention for climate change and greenhouse gas emissions. We will attempt to replicate these findings in our second experiment.

We furthermore find a significant effect of sustainability concern (as a personality trait) on consumer choice of lead-time. Model results allow us to only partially confirm the moderating role of sustainability concern on the effect of sustainability information disclosure: sustainability concern enhances the effect of information disclosure on delivery preferences, but not on choices. This could be because the rated preferences are capable of detecting more subtle changes than the absolute choice measures. Additionally, the results suggest that the disclosed sustainability information is more effective if it matches the individual traits on sustainability concern. This is in line with the hypotheses that we formed based on dissonance theory.

Experiment 2 – Information disclosure and priming sustainability concern

Experiment 1 assessed the impact of sustainability information disclosure in connection with consumers' sustainability concern as a generic personality trait. Yet, sustainability concern can also be activated situationally, for instance when consumers come across online news about sustainability. Therefore, Experiment 2 examines the impact of sustainability information in a context where consumers' sustainability concern is activated before making the choice of delivery time, that is, sustainability concern as a situational (state) variable. The literature indicates that priming sustainability concern will make consumers more aware of sustainability issues and make sustainability concern more salient in purchase decision-making (Lee *et al.*, 2020). According to this line of research, external cues can activate human

values, which, in turn, can increase consumer intentions to engage in pro-environmental behaviors such as the purchase of organic or sustainable products (Bullock *et al.*, 2017).

Consumers are unlikely to engage in sustainable behavior if they do not have knowledge of sustainability problems, potential actions and possible consequences (White *et al.*, 2019). In the case of last-mile delivery, sustainability knowledge is the ability to identify potential sustainability consequences of delivery options. We argue that because consumers generally have a lack of knowledge on this topic (Sallnäs and Björklund, 2020) and it is difficult for them to make the connection between different lead-times and sustainability consequences, priming sustainability concern by itself will not have a significant impact on consumer choice of delivery time.

Priming sustainability concern, however, should reinforce the positive impact of sustainability information disclosure. In other words, whereas Experiment 1 examined the interaction between (trait) sustainability concern and sustainability information disclosure, in Experiment 2 we test hypotheses H4 and H5 by examining the interaction effect between primed sustainability concern and sustainability information disclosure.

Methodology

Experiment 2 was designed similarly to Experiment 1, except that right before the choice part, sustainability concern was primed by presenting participants with sustainability material in the form of the headline for online news (without disclosing any information about the relative sustainability of different options). This form was selected because it is a common channel where consumers are exposed to sustainability information.

Three types of news headlines were created as stimulus materials for priming sustainability concern, as shown in Appendix 2: (1) control headline without a prime about sustainability (see Figure A4 in Appendix 2), (2) an environmental sustainability headline about the carbon footprint of deliveries of online shopping (ES prime, see Figure A5 in Appendix 2) and (3) a social sustainability headline about working conditions of delivery drivers (SS prime, see Figure A6 in Appendix 2). Our manipulation to activate general ES/SS concern is in line with manipulations used in prior research, for example, media communications that activate human values (Bullock *et al.*, 2017). Although the ES prime and SS prime activate sustainability issues, they do not provide information that connects this with delivery lead-times. In this way, we can prime participants' sustainability concern without influencing the effect of information disclosure in the choice task.

Additionally, we conducted a pre-test to check whether the topic of these news articles was clear. In total, 151 students were recruited, and they were randomly shown one of the three materials. They were asked two open-ended questions: "Wwhat do you think the main message of the news article is?" and "What are your immediate thoughts or feelings after reading the text?". We content-coded the answers to assess if they were related to sustainability (environmental or social or both) or not. The results in Table 6 confirm that the topics were clear to participants ($\chi^2(2) = 70.93$, $p < 0.001$). Considering the type of sustainability concern (the bottom three rows), the numbers clearly show that the ES prime correctly primes ES-related thoughts and feelings (χ^2-test for given probabilities, $\chi^2(2) = 65.64$, $p < 0.001$) and the SS prime correctly primes SS-thoughts and feelings ($\chi^2(2) = 74.0$, $p < 0.001$).

Experiment 2 thus had a 3 (information disclosure: control vs ES vs SS) × 3 (prime type: control vs ES vs SS) between-subject design. Participants were randomly assigned to one of the nine conditions. In this experiment, the United Kingdom (UK) online consumers were recruited using Prolific Academic service. This was to retest the impact of sustainability information disclosure in a different market (i.e. robustness). In total, 1,518 participants completed the experiment with a median response time of 4.8 min. A total of 131 participants

(8.7%) were excluded from the sample due to the following reasons: 17 failed the attention-check question; 13 had response times of less than 50% of the median; 101 provided the same answer a series of unrelated questions (i.e. flat-lining) in combination with a short response time. The resulting UK sample consisted of 1,387 participants.

Table 7 describes the demographics and online shopping information of the sample. Most of the participants were under 40 years old and a majority shopped online once or more a week. The most purchased product category by the UK sample was fashion (53.6%).

Analysis and results

Robustness of the information disclosure effect

Before examining the effects of priming sustainability concern, we first investigated only the three groups of no prime condition (n = 463, Table 7). For these groups, results should replicate the effects found in Experiment 1. Results were indeed similar to those in Experiment 1, with significant and equivalent impacts of ES and SS information disclosure. For this subset of the UK sample, sustainability information disclosure increased the choice of option C from 2.64% (control information condition) to 51.3% (ES information condition) and 50.0% (SS information condition). These numbers demonstrate the robustness of the effects of ES and SS information disclosure on consumer choice of delivery time.

Impact of priming sustainability concern

Table 8 describes the choices and preferences per condition. To examine the main effects of information disclosure and the prime, as well as the interaction effects between these, we employed the same regression analysis approach as in Experiment 1. Table 9 explains the coding of independent variables.

The model in Table 10 shows a significant effect of ES prime on the choice of option C ($p < 0.05$) and confirms the significant effects of the ES and SS information disclosure. The main effect of ES prime was relatively weak compared to the effects of ES or SS information disclosure. No significant effect was found for SS prime. Moreover, we observed no significant interaction effect between prime (activating sustainability concern) and information disclosure, thus providing no support for H4a and H5a.

The models in Table 11 show that both types of primes did not have any significant effect on prefC and prefC-B. Interestingly, there was a significant interaction term between *ES_info* and *ES_prime* ($p < 0.01$) on the preference for option C (model M8). This means that the effect of ES information disclosure was stronger for the treatment group for whom ES was primed (same dimension of sustainability), supporting H4b but not H5b.

	Control (no prime) condition	ES prime condition	SS prime condition
Number of participants	50	54	47
Related to sustainability	4	44	37
Not related to sustainability	46	10	10
Related to environmental sustainability	4	40	0
Related to social sustainability related	0	2	37
Related to both	0	2	0

Source(s): Table by authors

Table 6. Pre-test on the effectiveness of the priming materials

Table 7.
Experiment 2's sample description

	Control (no prime)			ES prime			SS prime			
	Control info	ES info	SS info	Control info	ES info	SS info	Control info	ES info	SS info	Total sample
Number of participants	151	152	160	154	153	152	153	161	151	1,387
Gender										
Males	37.1%	40.1%	33.8%	32.5%	37.9%	43.4%	33.3%	37.9%	35.8%	36.8%
Females	62.3%	59.2%	64.3%	66.3%	61.4%	55.9%	66.7%	62.1%	64.2%	62.5%
Others	0.6%	0.7%	0.6%	0.6%	0.7%	0.0%	0.0%	0.0%	0.0%	0.4%
Answer declined	0.0%	0.0%	1.3%	0.6%	0.0%	0.7%	0.0%	0.0%	0.0%	0.3%
Age										
Less than 18	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
18–29	33.7%	33.6%	31.3%	46.8%	35.9%	42.1%	36.6%	36.0%	43.0%	37.6%
30–39	32.5%	27.6%	28.8%	26.0%	31.4%	30.9%	31.4%	30.4%	18.5%	28.6%
40–49	14.6%	18.4%	17.5%	13.6%	14.4%	7.2%	16.3%	14.9%	17.2%	14.9%
50–59	14.6%	13.2%	13.7%	8.4%	11.1%	13.8%	10.5%	8.7%	11.9%	11.9%
60 or over	4.6%	6.6%	8.7%	5.2%	7.2%	5.3%	5.2%	10.0%	9.4%	6.9%
Answer declined	0.0%	0.6%	0.0%	0.0%	0.0%	0.7%	0.0%	0.0%	0.0%	0.1%
Online shopping frequency										
More than once a day	0.0%	0.0%	1.9%	0.6%	0.7%	2.6%	2.0%	0.0%	1.3%	1.0%
Once a day	2.0%	2.0%	0.6%	3.2%	0.7%	2.6%	1.3%	1.2%	2.0%	1.7%
A few times a week	27.8%	35.5%	25.6%	24.7%	34.0%	28.3%	29.4%	30.4%	28.5%	29.3%
Once a week	25.8%	17.1%	22.5%	22.7%	19.6%	23.0%	19.6%	19.3%	18.5%	20.9%
A few times a month	35.8%	31.6%	35.6%	36.4%	26.8%	31.6%	32.0%	32.9%	31.8%	32.8%
Once a month	6.0%	8.5%	9.4%	9.2%	9.7%	6.6%	9.8%	8.7%	8.6%	8.5%
A few times a year	2.6%	5.3%	4.4%	3.2%	8.5%	5.3%	5.9%	7.5%	9.3%	5.8%

Note(s): ES/SS: environmental/social sustainability; info: information condition
Source(s): Table by authors

		Control information condition	ES information condition	SS information condition
Number of participants	Control condition	151	152	160
	ES prime condition	154	153	152
	SS prime condition	153	161	151
Choice of options A and B	Control condition	147	74	80
	ES prime condition	142	58	62
	SS prime condition	142	70	64
Choice of option C	Control condition	4	78	80
	ES prime condition	12	95	90
	SS prime condition	11	91	87
Preference for option C: prefC	Control condition	4.96	5.75	5.83
	ES prime condition	4.70	5.99	5.65
	SS prime condition	5.05	5.75	5.71
Preference C-B: prefC-B	Control condition	−1.75	0.36	0.15
	ES prime condition	−1.95	0.56	0.25
	SS prime condition	−1.56	0.27	0.46

Source(s): Table by authors

Table 8. Delivery choices and preferences per condition in Experiment 2

Independent variables	Coding
ES_info and *SS_info*	Effect coding with control information condition as the reference • Control condition: *ES_info* = −1 and *SS_info* = −1 • ES information condition: *ES_info* = 1 and *SS_info* = 0 • SS information condition: *ES_info* = 0 and *SS_info* = 1
ES_prime and *SS_prime*	Effect coding with control (no prime) condition as the reference • Control condition: *ES_prime* = −1 and *SS_prime* = −1 • ES prime condition: *ES_prime* = 1 and *SS_prime* = 0 • SS prime condition: *ES_prime* = 0 and *SS_prime* = 1

Source(s): Table by authors

Table 9. Coding of independent variables of regression models in Experiment 2

		Estimate	Std. error
Model M7	*(Intercept)*	−0.79***	0.09
AIC: 1,485.6	*ES_info*	1.06***	0.10
	SS_info	1.02***	0.10
	ES_prime	0.26*	0.11
	SS_prime	0.13	0.11
	ES_info × *ES_prime*	−0.03	0.14
	ES_info × *SS_prime*	−0.14	0.14
	SS_info × *ES_prime*	−0.11	0.14
	SS_info × *SS_prime*	−0.05	0.14

Note(s): Significance codes: ***$p < 0.001$ **$p < 0.01$ * $p < 0.05$
Source(s): Table by authors

Table 10. The result of fitting logit regression to model delivery choice in Experiment 2

Discussion

The results suggest that the effect of priming sustainability concern on consumer choice of delivery time is limited and subject to the content of the priming. The effect of ES prime was significant, while SS prime was found ineffective. One possible reason is that environmental

Table 11.
The result of fitting linear regressions to model delivery preference in Experiment 2

	prefC		prefC-B	
	Estimate	Std. error	Estimate	Std. error
(Intercept)	5.49***	0.04	−0.36***	0.06
ES_info	0.34***	0.05	0.75***	0.08
SS_info	0.24***	0.05	0.65***	0.08
ES_prime	−0.04	0.05	−0.02	0.08
SS_prime	0.01	0.05	0.08	0.08
ES_info × *ES_prime*	0.20**	0.08	0.19	0.12
ES_info × *SS_prime*	−0.10	0.08	−0.21	0.12
SS_info × *ES_prime*	−0.04	0.08	−0.01	0.12
SS_info × *SS_prime*	−0.04	0.08	0.10	0.12
	model M8, $R^2 = 0.08$		model M9, $R^2 = 0.17$	

Note(s): Significance codes: ***$p < 0.001$ **$p < 0.01$ * $p < 0.05$
Source(s): Table by authors

sustainability has been more widely communicated by media and companies than social sustainability (Hosta and Zabkar, 2021). Moreover, it might not have been straightforward for the participants to make the connection from express vs non-express deliveries to sustainability consequences. This might be due to the lack of knowledge that consumers have concerning sustainability in last-mile logistics (Sallnäs and Björklund, 2020).

The results also indicate that the interaction effect between priming sustainability concern and sustainability information disclosure does exist but is weak and depends on the content of the priming. The interaction effect was found only for ES prime, but not for SS prime, in our experiment. This provides partial support for the hypotheses that we formed based on the expectation that information disclosure would lead to dissonance and hence affect choices when related sustainability concerns are relatively high.

In conclusion, our results suggest that priming sustainability concern cannot replace sustainability information disclosure. Even though sustainability concern is activated, consumers have difficulty making a sustainably sound decision, potentially due to a lack of sustainability knowledge. Moreover, priming sustainability concern can increase the impact of information disclosure, yet only to a limited extent on the preferences for delivery time but not the choices, which is in line with the results from Experiment 1.

Contributions, limitations, future research and conclusion

In the context of last-mile delivery service, this research addresses how to encourage consumers to select sustainable delivery options. Focusing on order-to-delivery lead-time (ranked second only after delivery fee), we investigate how sustainability information disclosure may stimulate consumers to wait longer for deliveries instead of selecting express options. This may help in reducing the environmental and social impact associated with last-mile logistics.

Contribution to the literature

We examined the effectiveness of sustainability information disclosure as an approach to steer online consumers toward non-express delivery options. This type of behavioral intervention has been studied in the sustainable consumption literature, yet has remained rather unexplored in the field of logistics management (Agatz *et al.*, 2021). The results of two choice experiments confirm the strong and robust impact of disclosing either environmental impact information (emission) and social impact information (warehouse workers and

drivers' well-being). Without the information, most of the participants (~90%) selected the next-day delivery option over the more sustainable option with longer delivery lead-time. With the disclosed sustainability information, more than 50% of the (now) well-informed participants choose the longer delivery time instead of next-day delivery.

In past research, the environmental sustainability dimension has received more attention than the social sustainability dimension (Davis-Sramek *et al.*, 2020). Little research has included or compared effects of environmental sustainability (ES) information with social sustainability (SS) information. Our study compared the impact of ES and SS information disclosure in the context of last-mile delivery service and finds that SS information is as effective as ES information. This suggests that the social sustainability dimension should be equally embraced (compared with its environmental counterpart) and further investigated in future studies.

We also find that consumers' environmental sustainability concern (ES) and social sustainability (SS) concern as personality traits have significant effects on preferences and choices for the sustainable delivery option. Moreover, we observe that trait sustainability concern can enhance the impact of the information disclosure on consumer preference (but not on choices). Our results show that disclosing a type of sustainability information has a higher impact when the sustainability dimension of that information is consistent with that of consumers' sustainability concern. This is in line with expectations derived from dissonance theory: primarily consumers for whom sustainability matters should experience dissonance due to the disclosed information, and would therefore adjust their preferences. This implies that information disclosure that is matched with the consumers' sustainability concern is more impactful. When it comes to the choice of delivery option, however, we do not find moderation effects of sustainability concern. This finding points to the complex nature of the relationship between attitude/intention with behavior that has been discussed in the ethical consumption literature (White *et al.*, 2019).

Given these findings, we further explored the potential of priming sustainability concern. We exposed participants to online news headlines about environmental or social sustainability issues concerning last-mile delivery. Regarding the main effect, priming of environmental sustainability concerns enhanced choices for the option with a longer lead-time. This implies that situationally induced environmental concerns can increase choices, regardless of information disclosure, which has policy implications as we will discuss later. Such a main effect is absent for primed social sustainability concerns. Possibly, consumers are not aware of the effects that the delivery options have on social sustainability, and therefore do not adjust their preferences and choices. Whereas a high trait social sustainability concern may be correlated with knowledge about the issue and its relation to consumer choices, such knowledge may be absent when social sustainability is induced situationally. This suggests that even when consumers' sustainability concern is activated, they still need sustainability impact information of the options to make a sustainable choice. Regarding the interaction effect, priming of environmental sustainability concerns boosted the impact of environmental information disclosure, however, only on consumer preferences but not choices. A similar interaction effect was not found for primed social sustainability concerns.

Managerial and policy implications

So far, sustainability activities of logistics service providers (LSPs) operating delivery networks have had a strong environmental focus (Abbasi and Nilsson, 2016), probably partly because the results are easier linked to economics, for example, through fuel savings (Davis-Sramek *et al.*, 2020). Our study finds that social impact information is as effective as environmental impact information with regard to influencing consumer choice of delivery

lead-time. Therefore, in their sustainability strategies, firms in the logistics sector should also focus on social sustainability performance dimensions (next to environmental) in response to growing concerns of customers and end-consumers (Thomas *et al.*, 2021), and this also holds for e-retailers. Investments in social sustainability performance has seen significant rewards in recruiting and retaining qualified workforce, which has been a struggle in logistics industry due to high rate of driver turnover. Our study suggests that such social-sustainability investments by logistics firms can also pay off when communicated to consumers, as consumers appear to appreciate and respond to such information. Particularly for a sector at times of considerable work pressure because of peak moments such as Black Friday or Christmas, but at the same time also a need to focus on safe driving behavior (see the study by Miller *et al.* (2017) for more background on motor carrier safety), targeted social-sustainability communication may help turn around working conditions through consumer pressure.

Our results imply that in order to push for sustainable delivery options, e-retailers should put efforts in informing consumers about the sustainability effects of delivery options and in particular of the sustainability effects of longer order-to-delivery times compared to shorter ones; delivery time length has a strong impact on emissions (Jaller and Pahwa, 2020). Consumers need to know which delivery option is more sustainable than others in order to make sustainable choices. Sharing sustainability information during online transactions (e.g. next to speed or order-to-delivery time information) turns out to be very effective in steering consumer behavior, and this responsibility lies in the hands of e-retailers, who control the checkout processes (Sallnäs and Björklund, 2020). This also provides opportunities to use segmentation of customers for logistics purposes (see Nguyen *et al.*, 2019) by targeting specific sustainability impact information to specific customer segments only. The size of effects may be dependent on product category, as consumers may choose differently dependent on urgency of need; this requires additional investigation. The technology is not the issue, judging by the patent Amazon filed ten years ago concerning a computer-implemented method that provides online consumers with environmental impact information to support them in making decision on shipping and packaging options (Amazon, 2009).

In addition to implications for e-tailers, our study also provides implications for policy makers. Experiment 2 has shown that situationally induced (i.e. primed) environmental sustainability concerns can impact consumer preferences and choices. This implies that bringing environmental issues in the public eye and raising awareness can impact consumer behavior. We do not find such effects for primed social sustainability concerns, and speculate that this lack of effects may be due to consumer not having enough understanding and knowledge to translate social sustainability concerns into their own preferences and choices between delivery lead-times. For policy makers, this would imply that awareness-raising campaigns about social sustainability may be insufficient to affect these consumer choices, and that enhancing consumer knowledge about the impact of their choices is needed as well.

Limitations and suggestions for future research

Our study has some limitations that can be extended by future research. The first limitation concerns the experimental setting. We selected fashion for the shopping situation. However, product categories have an influence on how consumers make trade-offs among time, money, convenience (Nguyen *et al.*, 2019) and potentially also for trade-offs with sustainability. Future studies can replicate our experiments using different product categories and include, for example, products that are linked to an urge for instant gratification, for which the effect of sustainability information disclosure may be less strong. Future studies can also adopt different sets of delivery options that fit the practices in the targeted markets. For example, the impact may be weaker when consumers need to choose between next-day and 1–5 days

instead of 1–3 days as in our experiments. Other delivery attributes such as home delivery vs pick-up point can also be integrated in the set of delivery options, as well as a variety of products with diverse characteristics. Furthermore, in our set of three delivery options, option C includes an uncertainty: a flexible delivery time (in 1–3 days) rather than a fixed delivery time. Although it was necessary to include the flexibility to make the option the most sustainable, it could raise a confounding effect between longer delivery time and uncertainty. Future research should design a choice scenario that disentangles this, preferably contrasting more choice options for delivery times (e.g. next day, 2-day, 3-day, 4-day deliveries) to investigate how much delay consumers would accept in relation to becoming more sustainable.

Second, the two types of information used in our experiments can be considered as qualitative information, which can be applied to a general context of last-mile delivery. Various types of quantitative information are also worth examining, such as amount of carbon emission or amount of resting time for drivers. Nevertheless, this quantitative information should be placed in a context that allows consumers to easily interpret the information, as suggested by Motoshita *et al.* (2015). They investigate the effect of disclosing CO_2 emission information on consumer choice of shopping method; the authors let participants compare the CO_2 emission saving of each shopping method with the CO_2 emission saving of well-known daily activities, for example, switching off lights when not in use. Future research could also examine the effect of different sources for this information. Information from retailers vs from media outlets may lead to different levels of trust and thereby elicit weaker or stronger responses. This may also include an estimation of actual emission reduction or improved driver safety.

Third, we did not consider consumer's skepticism toward sustainability initiatives in our experiment, which can influence the effectiveness of an intervention (Wang *et al.*, 2018). Consumers can possibly make a connection from longer delivery time to economic benefit for e-commerce companies, or consumers can be affected by retailers' good or bad reputation with regard to their sustainability activities.

Next, we used established scales to measure personality traits in our first experiment. These scales relate to general purchasing behaviors in relation to broad concerns. For instance, the scale on social concerns contains items related to both worker well-being and society. More focused scales, related to environmental and social impacts of logistics more directly, could produce stronger results.

Furthermore, a few factors could cause an overestimate of the impact of sustainability information disclosure in our study, such as demand effects or social desirability (Cho and Berry, 2019). Even though we have checked sample characteristics (e.g. online shopping frequency, purchased product categories), participants recruited via the Prolific Academic website in our study might not be representative of the general population as they have volunteered to be part of the panel. Future research could examine consumer responses to actual sustainability information disclosure in online shopping, using sales data.

Based on the assumption that social sustainability information would have lower perceived psychological distance than environmental sustainability information in the current context, we expected SS information to have more influence on preferences and choice than ES information. Although our results do not support this, future research can test the idea more thoroughly by measuring perceived psychological distance and testing effects across different decision contexts. Among others, this may include investigating the effect of perceived psychological distance to delivery drivers (sometimes drivers have been active in the same neighborhoods for long and have thus become familiar faces), and may be expanded to analyzing the effect of psychological distance to, for instance, in-store pickup of online orders (in-store pick up of online orders is known to positively affect sales and can be a sustainable option, cf. Bijmolt *et al.*, 2021). Future research could also examine whether

information provision which decreases the perceived psychological distance (e.g. by construing the issue as close in time or place) has a stronger effect than more abstract information. Additionally, different and stronger manipulations of situationally induced social sustainability concerns could be tested to see whether the expected interaction between these concerns and sustainability information (which we failed to find in our second experiment) could be detected.

Last, the literature expresses that sustainability information disclosure may not be enough to stimulate long-term (repeated) sustainable behaviors (White *et al.*, 2019). This also requires a better understanding of psychological reasons. We suggest to combine information disclosure with other tactics for long-term impact (including psychological). A potential way is, for example, green subscriptions: rather than setting express delivery as a default option, a green subscription can motivate consumers to commit to a combination of regular delivery time (as default) and a limited number of express deliveries per time period. After all, consumers may not need express delivery every time they shop online.

Conclusions

Our results show that e-retailers can effectively encourage consumers to choose longer delivery lead-times by sharing sustainability impact information associated with delivery options during checkouts. Both environmental and social sustainability information have similar effects. The combination of activating environmental sustainability concern together with disclosing environmental sustainability impact information seems promising as well. These interventions may have a considerable impact on society, as Muñoz-Villamizara *et al.* (2021) show that next-day delivery increases CO_2 emission up to 15% when compared with within-3-day delivery. Jaller and Pahwa (2020) argue that expedited delivery times are among the most important determinants in worsening emissions, leading to considerable increases in environmental and societal costs.

In such interventions, disclosing social impact information such as working conditions of warehouse workers and delivery drivers can be as effective as disclosing environmental impact information such as greenhouse gas emission. The effect of such sustainability information disclosure can be even stronger for consumers who have a positive attitude toward the same type of sustainability (environmental or social). Certainly, it is challenging for e-commerce companies to quantify such sustainability impact information, yet our research shows that qualitative information and infographics (as employed in our experiments) have a strong effect on consumer choice of delivery lead-time.

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Appendix 1
Procedure and stimulus materials in Experiment 1

Procedure

The experiment was administered using Qualtrics software and included two parts. The first part was a choice task using an online shopping situation in which participants chose one of three delivery options. Next, participants were asked to rate their preferences for each of the options. The second part consisted of questions to measure participants' concerns for environmental and social sustainability, and background questions about online shopping. At the end, participants were invited in an open-ended question to give their comments on the study.

Stimulus materials

The choice task is presented in the figures below (see Figures A1–A3). The accompanying text read: "Imagine that you are buying a pair of jeans and a pack of socks on a web-shop. It costs €59,98 in total and there are 3 possible options for home delivery as seen below. Which option would you choose?". We selected fashion products due to their popularity in online shopping (Eurostat, 2021). Moreover, we used the prices from major e-retailers in the Netherlands, and the total basket value was intentionally set to be above common thresholds for free next-day delivery in the Dutch market.

Lead-time was varied across the three options: same-day delivery (option A), next-day delivery (option B) and 1–3 days delivery (option C). These options were adopted from major websites in the Netherlands. The delivery time in option C ranges from 1 (as in option B) to 3 days. A fixed longer delivery time (e.g. 3 days) is not always more sustainable than a shorter delivery time (e.g. 1 day) because it depends on many factors such as the number of orders to be delivered each day in an area. Therefore, we include flexibility in option C, to make sure that it is the most sustainable option (Alm and Beullens, 2020). Furthermore, delivery was free for both options B and C. With this setting, we expected that a majority of participants would select option B when no further information was provided (control condition), since most people are expected to select delivery options based on delivery costs rather than order-to-delivery lead-time, even though there are small clusters of consumers that opt for short order-to-delivery lead-times (Nguyen *et al.*, 2019).

The manipulated factor in this experiment is the sustainability information provided to participants. ES or SS information groups correspondingly received ES (see Figure A2) or SS information (see Figure A3). The ES information concerned reducing vehicle' miles traveled and emissions, while the SS information concerned the well-being of warehouse workers and delivery drivers. With the ES and SS information, we expected that the choice for option C would increase as a result of consumers' trade-off between delivery time and sustainability.

https://www.awebshop.nl/order/basket.html

	Qty	Price
A pair of jeans	1	€49,99
A pack of 3 pairs of socks	1	€9,99
	Total	**€59,98**

Options for home delivery

	Option A	Option B	Option C
Delivery time	Order today, deliver today	Order today, deliver tomorrow (in 1 day)	Order today, deliver in 1 to 3 days
Delivery fee	€3,99	free	free
Delivery moment	19:00–22:00	08:30–21:30	08:30–21:30
	(the exact 3-hour time slot is informed on the day of delivery)		

Figure A1.
Control information condition

Source(s): Figure by authors

https://www.awebshop.nl/order/basket.html

	Qty	Price
A pair of jeans	1	€49,99
A pack of 3 pairs of socks	1	€9,99
	Total	**€59,98**

Options for home delivery

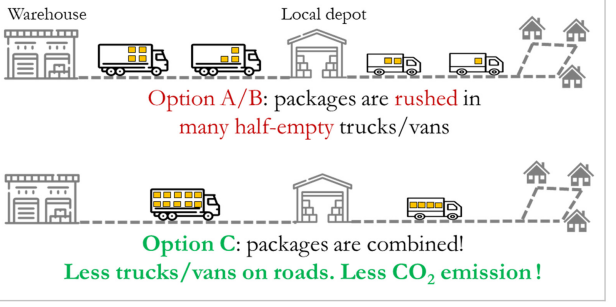
	Option A	Option B	Option C
Delivery time	Order today, deliver today	Order today, deliver tomorrow (in 1 day)	Order today, deliver in 1 to 3 days
Delivery fee	€3,99	free	free
Delivery moment	19:00–22:00	08:30–21:30	08:30–21:30
	(the exact 3-hour time slot is informed on the day of delivery)		
Sustainability information			

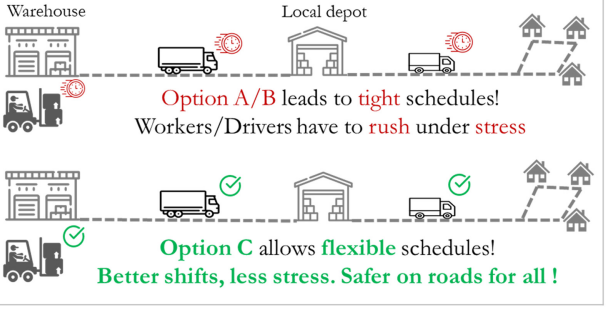
Figure A2.
Environmental sustainability information condition

Source(s): Figure by authors

https://www.awebshop.nl/order/basket.html

	Qty	Price
A pair of jeans	1	€49,99
A pack of 3 pairs of socks	1	€9,99
	Total	**€59,98**

Options for home delivery

	Option A	Option B	Option C
Delivery time	Order today, deliver today	Order today, deliver tomorrow (in 1 day)	Order today, deliver in 1 to 3 days
Delivery fee	€3,99	free	free
Delivery moment	19:00–22:00	08:30–21:30	08:30–21:30
	(the exact 3-hour time slot is informed on the day of delivery)		
Sustainability information			

Source(s): Figure by authors

Figure A3.
Social sustainability information condition

Appendix 2
Stimulus materials in Experiment 2

News.uk

News | Features | Blogs | Jobs | Housing | Best of the Web | Donate | Advertise

Home | Corona | Politics | **Business** | Society | Sport | Education | Health | International | Europe

Online shopping in the UK

Business

The UK is the world's third largest e-commerce market. On average, an adult in the UK spends around 14 minutes per day on online shopping sites.

"Clothes and footwear items are the most popular purchases made online", according to a recent study. Shopping online on smartphones increases ...

Read more >

Figure A4.
Control (no prime) condition

Note(s): "Read more" is included to mimic a news article. Participants could not click on this
Source(s): Figure by authors

News.uk

News | Features | Blogs | Jobs | Housing | Best of the Web | Donate | Advertise

Home | Corona | Politics | **Business** | Society | Sport | Education | Health | International | Europe

Carbon footprint of online shopping

Business

In the UK, an average of 9.6 million parcels are delivered per day as a result of online shopping. That's a lot of delivery vehicles on the road and many miles travelled every day.

"Most of the carbon footprint of online shopping comes from the transportation process", according to a recent study. The planning of the transportation is a complicated process ... Read more >

Note(s): "Read more" is included to mimic a news article. Participants could not click on this

Source(s): Figure by authors

Figure A5. Environmental sustainability prime condition

News.uk

News | Features | Blogs | Jobs | Housing | Best of the Web | Donate | Advertise

Home | Corona | Politics | **Business** | Society | Sport | Education | Health | International | Europe

Delivery drivers of online shopping

Business

On a typical day, a driver in the UK has 150-200 parcels to deliver. They earn a fixed rate per day, yet nearly every day there are problems that cause delays.

"Most delivery shifts are over 10 hours", according to a recent study. Things like tiredness and toilet breaks aren't always taken into account in route planning ...

Read more >

Figure A6.
Social sustainability prime condition

Note(s): "Read more" is included to mimic a news article. Participants could not click on this

Source(s): Figure by authors

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