



# A meaningful reminder on sustainability: When explicit and implicit packaging cues meet

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## ABSTRACT

Sustainable packaging innovations are becoming increasingly available in the marketplace. However, their communication to consumers remains a challenging task, as neither their distinctiveness nor their higher sustainability level is recognized. Contributing to research in environmental psychology, the current work conceptualized and tested the new concept of Meaningful Reminder as a strategy to communicate such distinctiveness and higher sustainability. To understand how a meaningful reminder can be created and used, this research investigated how eco explicit (logos, labels and statements) and implicit packaging design cues (auditory, tactile and visual elements) combine and interact and how such a combination can be used to the advantage of sustainability, to increase sustainability salience, perception and sustainable disposal behavior of the packaging and its content. Across three lab studies and different measures (lexical decision task, thought listing task, self-reported scales and observations of consumers' disposal behavior), we identify the conditions under which combining explicit and implicit cues can be counterproductive, not leading to any increase or even a decrease in sustainability salience and perception. However, under different conditions, we show how sustainability salience, perception of packaging sustainability and even consumer sustainable disposal behaviour can be positively affected.

## 1. Introduction

It is widely recognized that current patterns of mass production and consumption have not only contributed to welfare, but also created immense environmental problems, profoundly contributing to pollution, global warming and destruction of natural ecosystems (Krausmann et al., 2009; Oreskes, 2018). Packaging industry is one of the main actors, as almost all mass-produced goods have a packaging, which is functional for the transport, preservation and sales of such goods (Magnier & Schoormans, 2015; Meherishi et al., 2019; Steenis et al., 2017). Despite its essential roles in facilitating efficient logistics, preventing product losses and as a “silent salesman” (Rod, 1990), packaging is “moving waste”. Once it reaches the end user, it is a mere container that is thrown away. Only in Europe, more than 60 million tons of packaging waste are produced every year, negatively affecting the ecological footprint (Eurostat, 2018).

As a result, consumers, businesses, governments, science, and society at large are increasingly demanding actions to reduce the impact of packaging, both at the industrial level (reducing the environmental

impact of materials) and at consumer level (through a more sustainable disposal behavior) (Carrus et al., 2008; Esslinger, 2011; Grinstein & Nisan, 2009; Peattie & Peattie, 2009; Sonneveld et al., 2005). At the forefront of this effort, increasingly many industries are committed to eco-design, by for example developing and promoting new packaging alternatives with a lower environmental impact (Del Borghi et al., 2020; Guillard et al., 2018). Biobased, biodegradable, compostable, recycled materials or (packaging-related) technologies able to extend the shelf life of products and reduce their waste are rapidly becoming available in the marketplace (Boz et al., 2020; Guillard et al., 2018).

Despite the huge technological investments towards an enhanced sustainability, eco-packaging innovations are often not recognized by consumers in terms of 1) newness and distinctiveness and 2) improved sustainability (Magnier & Schoormans, 2015). Sustainability communication of these technologies thus remains a challenging task, limiting their market potential and, in turn, their real environmental efficiency, that ultimately lies in the hands of consumers (Magnier & Schoormans, 2017; Steenis et al., 2017).

The current research conceptualizes and tests the new concept of

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*meaningful reminder*, as a strategy to improve the sustainability communication of eco (packaging) innovations. We argue that to be properly recognized (in terms of distinctiveness and improved sustainability) eco-packaging innovations need to include an optimal combination of design elements that function as a *reminder*, disrupting from consumers' automated behavior as reflected in routines and habits, and reminding the distinctiveness and newness of the packaging and, additionally, as a *meaning provider*, re-storing the cognitive flow by conveying the intended meaning (sustainability). In order to investigate how such a meaningful reminder can be created, a deep understanding of how diverse packaging design elements combine and interact in affecting sustainable responses and their underlying psychological processes is essential, as increasingly advocated in the environmental psychological literature (Bamberg, 2003; Carrus et al., 2008; Costarelli & Colloca, 2004; Koenig-Lewis et al., 2014).

Prior research has largely explored how isolated packaging design elements affect consumers' responses (Ampuero & Vila, 2006; Creusen & Schoormans, 2005; Hultén, 2011; Pancer et al., 2017; Steenis et al., 2017, 2018), either through an informational or through an inferential belief formation route (Fishbein & Ajzen, 1977; Steenkamp, 1990). Explicit cues, in the form of statements, labels or claims, have long been studied in the packaging design literature for their explicit persuasive power (Bickart & Ruth, 2012; Grunert et al., 2014; Kronrod et al., 2012; Magnier & Schoormans, 2015; Rossi & Rivetti, 2020). These type of cues are purposively, deliberately and consciously used by consumers as diagnostic sources for inferring product and packaging benefits (e.g. sustainability) (Lähtenmäki et al., 2010; Roberto et al., 2012; van Ooijen et al., 2017).

In addition, research has focused on implicit cues, such as visual (e.g. colors, overall look), tactile or auditory packaging elements, and on how these influence consumers' reactions, by drawing attention (Garber Jr et al., 2008; Schoormans & Robben, 1997; Underwood, Klein, & Burke, 2001), affecting categorization, perceptions (Granato, Fischer, & van Trijp, 2021; Lindh et al., 2016; Raghuram & Greenleaf, 2006; Silayoi & Speece, 2004) or triggering specific emotions (Clark et al., 2021; Koenig-Lewis et al., 2014; Liao et al., 2015). Whereas explicit cues explicitly convey meanings to consumers predominantly through a deliberate, cognitive and informational belief formation route (Fishbein & Ajzen, 1977; Steenkamp, 1990), implicit cues connote a symbolic, abstract and implicit meaning through an associative inferential route (Lindh et al., 2016; Steenis et al., 2017; Underwood, 2003). Implicit cues are more likely than explicit cues to be processed automatically and unconsciously, serving as rather implicit tools for product-packaging communication (Becker et al., 2011; Dijksterhuis et al., 2005; Karjalainen, 2007; van Ooijen et al., 2017).

Implicit and explicit cues typically co-occur in a holistic packaging design to convey relevant and accurate meaning to consumers (van Ooijen et al., 2017) with the potential to function as a meaningful reminder. However, attention on the interaction effect between implicit and explicit cues is lacking (van Ooijen et al., 2017) and, up to our knowledge, no research has focused on how implicit and explicit cues combine and interact in affecting consumers' responses regarding sustainability.

Existing literature brings forward conflicting perspectives in this regard. On the one hand, combinations of cues have been advocated (Bocken et al., 2016), as they might enhance the persuasive effect of the packaging by increasing the amount of arguments and information (Eagly & Warren, 1976; Magnier & Schoormans, 2015; Petty & Cacioppo, 1984). Others, however, have argued that this effect is not so straightforward and may even backfire when the combination of eco design elements leads to a "green consumer confusion" or "green skepticism" (Irwin & Spira, 1997; Magnier & Schoormans, 2015; Mitchell et al., 2005; Vincent-Wayne & Vassiliou, 1999). Adding more cues is thus not necessarily better.

The present research has the interrelated aims of 1) providing more clarity on the controversial effect of the combination of eco implicit and

explicit packaging cues, and 2) exploring how such a combination can be used to promote sustainability, through what we coin as "a meaningful reminder". To do so, the following research questions are addressed: "How do eco implicit and explicit packaging design cues combine and interact in affecting sustainability salience, perception and sustainable disposal behavior?" and "How can this combination of implicit and explicit design cues be used to create a meaningful reminder, as a strategy to enhance sustainability communication?"

## 2. Theoretical background

### 2.1. Design elements as reminders for newness and distinctiveness

Packaging sustainability involves different configurations, relating to the input materials (biobased and recycled) and end-of-life stream (biodegradability or recycling), next to technological features that may extend the shelf life of products (Brujnes et al., 2020; Van den Oever et al., 2017). Various technologies are available, which often carry sensory features different from those of conventional plastics (Guillard et al., 2018; Sirviö et al., 2013; ten Klooster, 2008, pp. 475–480). For example, biomaterials, such as PLA (Polylactic Acid) present a distinct sound when handled (Diaz et al., 2016; Evans et al., 2020), recycled plastics (e.g. PET) present a non-uniform look<sup>1</sup> (Yam, 2010) and biodegradable and compostable materials have a different opacity or tactile properties, compared to conventional plastics (Guillard et al., 2018; Sirviö et al., 2013; ten Klooster, 2008, pp. 475–480).

In the communication to consumers, these distinctive sensory properties (e.g. different sound, touch feeling) can be either mitigated, through an imitation strategy, or highlighted, through a differentiation strategy (Magnier & Schoormans, 2015). In the imitation approach, companies aim to mimic the features of conventional packaging (e.g., the transparency of plastic) and "hide" those typical of eco-materials (e.g., the opacity level of a biodegradable packaging). An example of this imitation approach is the new Coca-Cola bottle, that although partly made of plant materials, (PlantBottle® technology), looks identical to the conventional version (Magnier & Schoormans, 2015). In the food and packaging industry the imitation strategy often prevails and is becoming a common practice (Guillard et al., 2018; Sirviö et al., 2013) for two main reasons: 1) due to the recent technological progresses that enable the production of sustainable packaging with a conventional look (e.g. transparent as plastic) (Magnier & Schoormans, 2015) and 2) due to the fear of a reduced consumer acceptance. Companies, for example, fear that consumers would not accept the opacity of a biodegradable packaging, distinct from the transparency of conventional plastic, associated with a fresh and trustworthy product (Billeter et al., 2012; Simmonds & Spence, 2017). While, on the one hand, this imitation practice prevents from potential negative associations of eco materials, on the other hand, it carries some disadvantages, as it risks to hide packaging cues that signal distinctiveness to consumers (Heidbreder et al., 2019; Magnier & Schoormans, 2015).

In the differentiation approach, instead, the distinctive sensory properties of eco materials are highlighted and exploited as differentiation tools (Azzi et al., 2012; Rettie & Brewer, 2000; Schoormans & Robben, 1997; Underwood, Klein, & Burke, 2001), as "reminders for newness and distinctiveness" (Lindh et al., 2016; Rundh, 2009, 2016). Research on new product development has highlighted the importance of detecting newness in a new product (Michaut, 2004; van Trijp & van Kleef, 2008), where change and surprise are two closely-related variables (Berlyne, 1960). A new and distinctive tactile element of a packaging, for example, might surprise consumers and make them realize that something in the packaging has changed (Chandon, 2013; Piqueras-Fiszman & Spence, 2011). A slightly atypical appearance can create a

<sup>1</sup> Described in the Wiley Encyclopedia of Packaging Technology as a look with a hint of grey, yellow or blue.

deviation from expectations, disrupt from consumers' automated behavior and catch consumers' attention (Magnier & Schoormans, 2015; Pancer et al., 2017; Schifferstein et al., 2013; Steenis et al., 2017). The interruption of this automatic flow reminds consumers about the distinctiveness of the new packaging (Lindh et al., 2016; Rundh, 2009, 2016) and provide the opportunity to create new associations (e.g., with sustainability) (Kurz et al., 2015; Verplanken & Wood, 2006; White et al., 2019).

## 2.2. Design elements as meaning providers for sustainability

Next to being "reminders", such distinctive sensory properties can be used as "meaning providers", aimed at making sustainability-related constructs more salient to consumers, activated in consumers' mind and accessible for the subsequent perception process (Fishbein & Ajzen, 1977; Higgins, 1996; Olson, 1978; Steenkamp, 1990).

Packaging design elements like visual, haptic, auditory packaging properties can be defined as implicit cues, as they implicitly convey sustainability (Peters, 2016) through an associative inferential belief formation route (Fishbein & Ajzen, 1977; Lindh et al., 2016; Steenis et al., 2017; Steenkamp, 1990). Through this inferential process, consumers draw inferences by filling in missing information. Research has largely studied implicit packaging design elements, such as green colors (Parguel et al., 2015), rough surfaces (Labbe et al., 2013), natural designs (Magnier & Schoormans, 2017), kraft paper materials (Lindh et al., 2016) as "meaning providers" for sustainability, as they can implicitly signal sustainability to consumers.

Which meaning consumers derive from packaging design depends on previously encountered associations and prior knowledge in consumers' memory (Olson, 1978; Steenkamp, 1990). Some cues, such as a green color or a natural graphic, hold well-embedded and learned associations with nature and environment (Pancer et al., 2017; Steenis et al., 2017), being inherently "meaningful" in signaling sustainability to consumers. On the contrary, other design cues, might be defined as "meaningless" in this regard: the noisy sound of PLA packaging, might not (yet) raise any association with the natural world, and might be unable to activate a sustainability related construct in consumers' mind (Evans et al., 2020; Guillard et al., 2018; Krishna et al., 2017; Littel & Orth, 2013). Like the noisy PLA, associations around other new materials deserve further investigation (Biermann & Rau, 2020). Meaningless cues, as the noisy sound of PLA, can be "loaded" with meaning by, for example, an ecological claim that explicitly communicates the sustainability of the PLA packaging (Magnier & Schoormans, 2015).

Whereas implicit cues gain impact predominantly through an associative inferential route, explicit cues convey associations, impressions and meanings to consumers predominantly through an informational belief formation route (Fishbein & Ajzen, 1977; Steenkamp, 1990). Informational and verbal statements about packaging (as packaging labels and claims) can be defined as explicit cues, as they explicitly communicate the packaging's environmental friendliness. Consumers use explicit cues to form evaluations (belief) about the sustainability of packaged products, through a more deliberate, cognitive and informational-making process (Holbrook & Moore, 1981; Veryzer & Hutchinson, 1998).

The functions of "reminders" and "meaning providers" of the implicit and explicit cues are not limited to the point of purchase, where they serve to draw attention and increase salience and perception of sustainability but extend beyond that. Despite the scarce attention to post-purchase and post-use behaviors (Bolderdijk et al., 2013; Klaiman et al., 2017; Steg et al., 2014), recent studies show that on-packaging explicit cues (e.g. logos and labels) (Borgman, 2018) or implicit design elements (e.g. environmentally friendly look) (Geiger, 2020) guide consumers towards more sustainable disposal behavior of packaging (Borgman, 2018; Geiger, 2020) and its content (Zeng et al., 2021).

## 2.3. The combination of design elements: a controversial effect

Implicit and explicit cues typically co-occur as meaningful parts of the design (van Ooijen et al., 2017) and might influence, in combination, consumer sustainable responses (Orth & Malkewitz, 2008). Although combining different sustainable design elements might be seen as a favorable option by companies (Bocken et al., 2016; Steenis et al., 2018), at a theoretical level, the effect of this combination is controversial. Traditional communication theories support the idea that increasing the amount of arguments in a message increases its persuasive effect, either by providing individuals with more information or simply by triggering the inference "the more the better" (Eagly & Warren, 1976; Maddux & Rogers, 1980; Petty & Cacioppo, 1984). Following this view, the combination of eco explicit and implicit cues would increase the persuasive impact of the sustainability related message. As a result, consumers would be expected to perceive the packaging as more sustainable (Magnier & Schoormans, 2015) and behave accordingly in its disposal.

However, the theory on the embedding effect suggests that items may be valued more highly when presented singularly than when they are combined (Cummings, 1986; Kahneman & Knetsch, 1992; Mitchell & Carson, 1989). Drawing from this perspective, we could assume that combining explicit and implicit cues would not create additional effects in increasing sustainable responses (Irwin & Spira, 1997). More extremely, the combination of explicit and implicit design cues might even backfire and have a counterproductive effect. Research on "green consumer confusion", "green skepticism" and "greenwashing" suggests that overloading consumers with eco-design elements could make them question the product's true sustainability (Aji & Sutikno, 2015; Magnier & Schoormans, 2015; Mitchell et al., 2005; Vincent-Wayne & Vassiliou, 1999). Thus, following this research line, we could expect that over-stating or exaggerating the sustainability message, through the combination of eco-explicit and implicit cues, might negatively affect the sustainability perception of the packaging.

To conclude, existing theoretical perspectives offer contradictory predictions, one supporting the view that more cues strengthen consumers' responses regarding sustainability: "*the combination of eco explicit and implicit design cues increases sustainability salience, perception and sustainable (disposal) behavior*" and another one in support to its opposite, that more cues actually harm (or do not lead to any increase in) consumer sustainable responses: "*the combination of eco explicit and implicit design cues decreases or leads to no increase in sustainability salience, perception and sustainable (disposal) behavior*".

The current research aims to shed light on this theoretical contradiction by identifying the conditions under which either of these perspectives is more dominant. We propose that the combination of implicit and explicit design elements improves sustainability communication if it functions as a meaningful reminder. First, packaging cues need to interrupt consumers' automated behavior to signal distinctiveness (reminder part) and then they need to re-store this automatic flow to convey the intended meaning, i.e. sustainability (meaning-provider part).

## 2.4. Studies overview

Three studies tested the concept of meaningful reminder and the effect of the combination of explicit and implicit design cues on a different range of sustainable responses, as sustainability salience, perception and disposal behavior. In study 1, we tested the general phenomenon, whether the combination of explicit and implicit design cues increases or decreases salience and perception of sustainability. After having provided evidence on this phenomenon through a Lexical Decision Task, a Thought Listing Task and a self-reported scale (study 1a), we replicated the findings with different stimuli (study 1b and study 1c). In study 2, we tested whether the general phenomenon depends on the implicit cues provided, and specifically, on whether these might function as "meaningful" or "meaningless" reminders by themselves. In



study 3, we tested whether the general phenomenon depends on the explicit cues provided and, specifically, on their ability to load a meaning to a (meaningless) implicit cue. In addition, study 3 tested whether the combination of implicit and explicit cues has an effect beyond salience and perception, on disposal behavior of the packaging and its content.

### 3. Study 1

Data for study 1 a, b and c were collected together with those of study 2. Participants received 10-euro compensation after completion of all parts of the studies.

#### 3.1. Methods study 1a

##### 3.1.1. Participants and design

Two hundred and twelve Dutch participants ( $M_{age} = 42.25$ ,  $SD = 13.69$ ; 55% females), recruited through a panel of a Dutch research center (CSO), participated in a two (implicit cue: absent/present) by two (explicit cue: absent/present) between-subjects design. To have sufficient power ( $\geq .80$ ) to detect a medium effect size ( $f = 0.25$ ) at  $\alpha = 0.05$ , a minimum sample size of 179 was calculated (G\*Power 3) (Faul et al., 2007). Some more participants were recruited to compensate for Covid19 related no-show.

##### 3.1.2. Stimuli

The stimulus material consisted of four different mock-ups of mono portion packaging for biscuits, one per experimental condition, created by graphic designers of the Dutch Research Institute of Sustainable Packaging (KIDV), within the European project MYPACK.<sup>2</sup> Each packaging consisted of a paper part containing two biscuits and of a plastic part. A fake brand “Granny” was created for this study and a label with the product information was printed on the back of the packaging to make the stimuli as realistic as possible (Table A.1, Appendix A).

The control condition (implicit and explicit cues absent) consisted of a transparent mono portion packaging, mimicking conventional plastic. The implicit cue was manipulated through a rough tactile property, typical of some eco-materials, while the explicit cue consisted of the official European logo of compostable and biodegradable packaging and explanation of this material<sup>3</sup> (Fig. 1; table A.1, Appendix A).

##### 3.1.3. Procedure and measures

After being welcomed in the experimental room, participants read the Covid19 guidelines for a safe experimental procedure, approved by an ethical committee, and signed an informed consent. They were then randomly assigned to one of the 4 conditions.

**3.1.3.1. Lexical decision task.** To measure whether implicit and explicit packaging cues enhance salience of sustainability, and specifically whether these cues spontaneously activate the sustainability related construct in consumers’ mind, participants first conducted a Lexical Decision Task (LDT). The lexical decision task represents an implicit method to measure the activation of knowledge that people may not be consciously aware of Fishbach and Dhar (2005); Förster et al. (2005); Schvaneveldt and Meyer (1973); Slabu and Guinote (2010); Wilcox et al. (2009). Based on the LTD assumption that reactions to words are

<sup>2</sup> MYPACK is a European consortium of food and packaging companies and research institutes with the aim to develop and commercialize sustainable food packaging innovations.

<sup>3</sup> The explanation of the biodegradable and compostable material was formulated in collaboration with MYPACK packaging experts and material engineers and stated: “This packaging is made from starch, a biodegradable material. In a compost plant it will turn into compost and organic matter” (translation from the original Dutch).

facilitated by accessibility, response time to sustainability words in the LDT indicated higher accessibility and salience of the sustainability related construct. As cover story for the LDT, respondents were informed that the task on the Dutch language would support their focus on the packaging evaluation afterwards.

After a LDT practice test of 10 trials repeated twice, participants were submitted to the priming phase, in which they were provided with the biscuit package of their condition and asked to experience and interact with it.<sup>4</sup> Then, the actual lexical decision task began. Participants were asked to indicate as quickly and accurately as possible whether a letter string appearing on a computer screen was an existing word, by pressing “yes” or “no” on the keyboard (Z for yes and M for no) (Holland et al., 2005). Across two cycles of 24 randomized trials, 12 non-words<sup>5</sup> and 12 real Dutch words (3 target and 9 control words) appeared at the center of the screen for 2 seconds, after a fixation dot. Dutch target words (sustainability related) comprised: *duurzaam* (sustainable), *natuur* (nature) and *milieu* (environment). Words and non-words were derived from the Dutch Lexicon project (Brybaert et al., 2016), had the same number of letters and syllables for target words, control words and non-words (Slabu & Guinote, 2010) and were pre-tested (table B.1, Appendix B).

**3.1.3.2. Thought listing task.** After the LDT, participants were asked to re-experience the biscuit packaging which was still in front of them and to report their thoughts and feelings while experiencing the packaging.<sup>6</sup> This Thought Listing Task (Edell & Keller, 1989; Shiv et al., 1997; Shiv & Fedorikhin, 1999) was used to identify the frequency of sustainability related thoughts and to supplement the LDT measure for salience of sustainability.

Sustainability perception was then measured on a single item seven-point scale ranging from 1 (very unsustainable) to 7 (very sustainable): “To what extent is this (biscuits) packaging sustainable to you?”. Respondents were thanked and introduced to study 1b.

##### 3.1.4. Analysis plan

An index of sustainability salience was computed from the lexical decision task data as the difference between the average response latency for control words and target words. The reaction time from trials where the stimulus was not correctly identified was excluded (Greenwald et al., 2003), as well as the data of the practice block. A higher score on the index indicates that sustainability is more salient (Förster et al., 2005). An ANOVA was conducted to test the effect of implicit and explicit cues on salience and perception of sustainability.

Sustainability salience from the thought listing task was analyzed using the number of sustainability-related thoughts and feelings. Text was coded by two coders not involved with the study setup using a predefined code book including the following codes: “sustainability” (e.g. natural, ecological, good for the environment etc.), “sustainability negative” (e.g. too much packaging, unsustainable etc.), “product quality”, “convenience”, “bad packaging quality”, “hedonic”, “hedonic negative”, “novelty”, “sensory properties” and “skepticism” (no trust/belief over the sustainability of the packaging; table B.2, in Appendix B provides further details). If respondents mentioned more than one thought/feeling related with the same code, this was counted one time only. Coding was checked by the first author and differences between

<sup>4</sup> “Please take in your hands the biscuits packaging you have on your desk. Interact with it as much as you can: look at it carefully, touch it, feel it, turn it around. Use all your senses to have a good impression of it. Think on the thoughts and feelings that go through your mind while experiencing this packaged product.” (translation from the original Dutch).

<sup>5</sup> Non-words are meaningless letter combinations that follow syntactic rules of existing words in having pronounceable syllables.

<sup>6</sup> “Which thoughts and feelings go through your mind while experiencing (looking at, touching, holding etc.) this packaged product? Please describe them here as complete and elaborate as possible” (translation from the original Dutch).



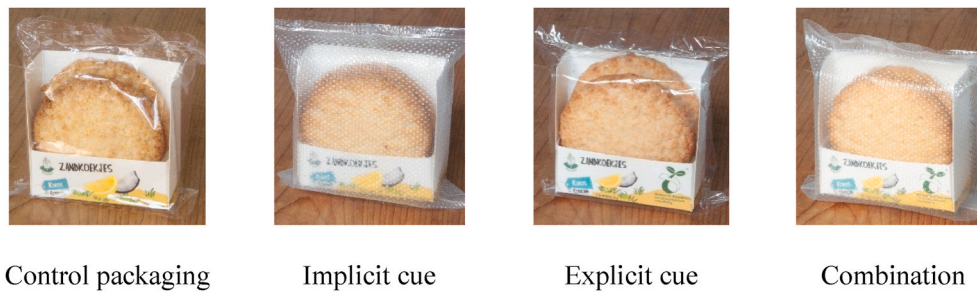


Fig. 1. Stimuli material for study 1a (front of the packaging).

coders were solved in mutual agreement. Frequencies of each code were calculated and analyzed through Crosstabs Chi-square test and z-test with Bonferroni-adjusted p-values to compare conditions.

### 3.2. Results study 1a

#### 3.2.1. Effect of explicit and implicit cues on salience of sustainability

**3.2.1.1. Results from the lexical decision task.** The lexical decision task showed no main effect of implicit cue ( $F(1, 208) = 0.04, p = .84$ ) nor of explicit cue ( $F(1, 208) = 0.37, p = .54$ ) but did suggest a marginally significant interaction between implicit and explicit cues ( $F(1, 208) = 3.44, p = .06$ , part.  $\eta^2 = 0.02$ ) on sustainability salience, to the extent that implicit and explicit cues work against each other. The sustainability related construct was less salient for the packaging with both implicit and explicit cues ( $M = 74.36$ ) as compared to those with only explicit ( $M = 94.21$ ) or implicit cues ( $M = 89.34$ ) (Table 1 and Fig. 2, panel a).

**3.2.1.2. Results from the thought listing task.** The results from the thought listing task showed that sustainability was more salient to consumers when the explicit cue was present than absent (Table 2). The combination of explicit and implicit cues led to no increase in sustainability salience when explicit cues were already present. Thus, comparable results were obtained measuring salience of sustainability through an implicit (LDT) and explicit self-reported method (thought listing task): the combination of explicit and implicit cues did not lead to any increase in sustainability salience (Fig. 2, panel b) and can even have a counterproductive effect (Fig. 2, panel a).

Table 1

Mean reaction time (RT) (SD) for target and control words and index of salience of sustainability across conditions (in milliseconds).

		Implicit cues absent	Implicit cues present
Explicit cue absent		n = 52	n = 53
	RT target words	689.69 (176.32)	723.60 (216.50)
	RT control words	754.25 (140.97)	812.95 (220.70)
	Index of salience of sustainability	64.57 (99.1) <sup>ab</sup>	89.34 (88.28) <sup>a</sup>
Explicit cue present		n = 50	n = 56
	RT target words	688.50 (138.79)	660.33 (128.41)
	RT control words	782.71 (110.68)	734.69 (111.49)
	Index of salience of sustainability	94.21 (96.17) <sup>a</sup>	74.36 (63.2) <sup>b</sup>

Values sharing the same superscript letter are not significantly different at the .05 level.

#### 3.2.2. Effect of explicit and implicit cues on sustainability perception of the packaging

An ANOVA showed a significant main effect of explicit cue ( $F(1, 208) = 66.45, p < .01$ , part.  $\eta^2 = 0.24$ ), no significant effect of implicit cue ( $F(1, 208) = 0.04, p = .85$ ) and a significant interaction effect ( $F(1, 208) = 3.84, p = .05$ , part.  $\eta^2 = 0.02$ ) on sustainability perception. Subsequent simple effects analysis showed that in the absence of implicit cues, consumers perceived the biscuits packaging as more sustainable when explicit cues were present ( $M = 5.80, SD = 1.22$ ) rather than absent ( $M = 3.75, SD = 1.44; F(1, 208) = 49.26, p < .01$ , part.  $\eta^2 = 0.12$ ). In the presence of implicit cues, consumers also perceived the biscuits packaging as more sustainable when explicit cues were present ( $M = 5.44, SD = 1.49$ ) rather than absent ( $M = 4.19, SD = 1.66; F(1, 208) = 19.92, p < .01$ , part.  $\eta^2 = 0.09$ ). The fact that consumers rated a packaging with both explicit and implicit cues as less sustainable ( $M = 5.44$ ) than a packaging with explicit cue only ( $M = 5.80$ ) suggests a rather weak efficacy of combining explicit and implicit cues (Fig. 2, panel c).

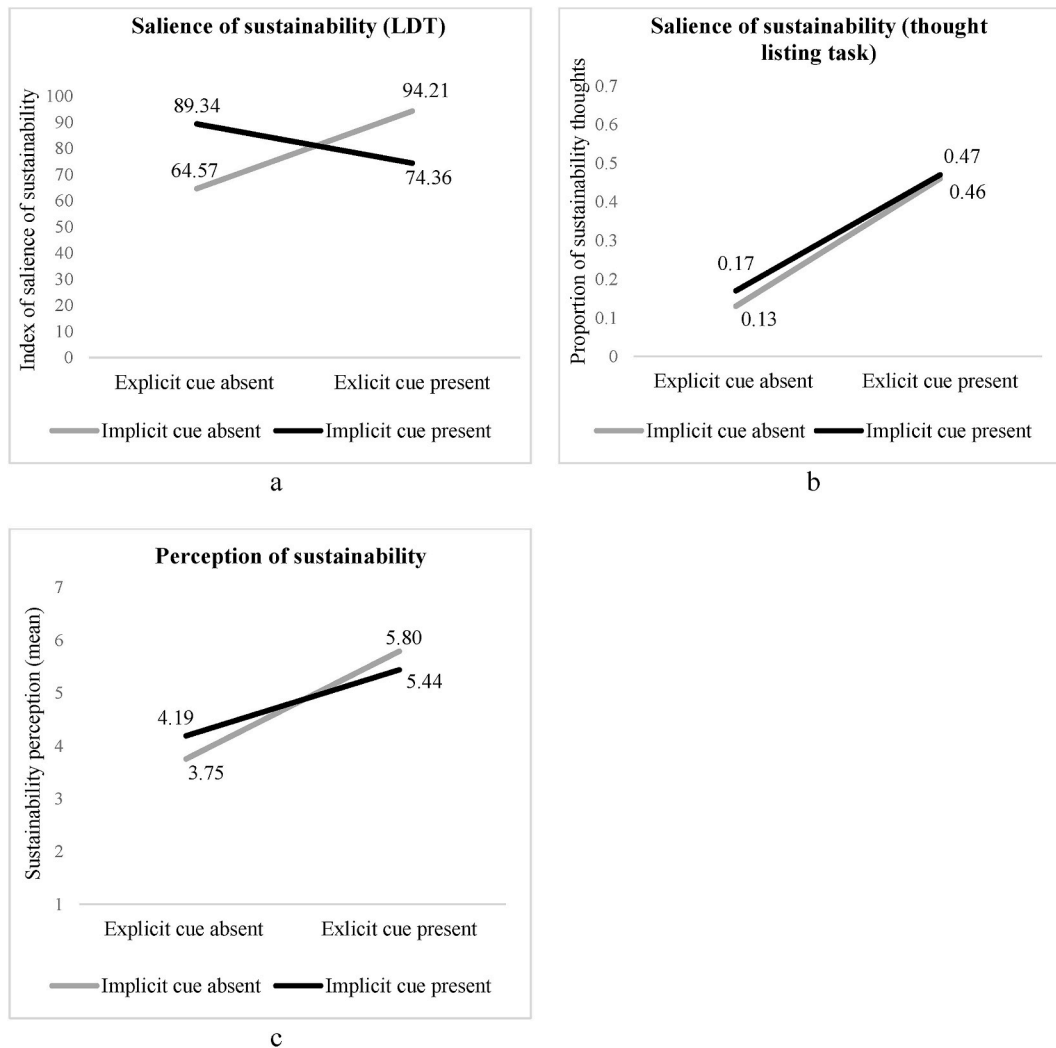
### 3.3. Studies 1b and 1c: replications

To test for robustness of the results, study 1a was partially replicated with different product-packaging combinations and implicit and explicit cues, chosen in agreement with the MYPACK consortium. In study 1b, consumers were shown a salad packaging (flexible bag) with a blow device technology which keeps the atmosphere inside the packaging constant and maintains the salad fresher for longer, reducing food waste. In study 1c, consumers were confronted with a rigid baby food jar made of recycled material. Study 1b and 1c had identical measures, design and procedure as study 1a, except for omitting the lexical decision task. Explicit cues consisted of the logo and explanation of the blow device (1b) and recycled material (1c).<sup>7</sup> Implicit cues were represented by a graphic for the blow device suggesting its function (a lady doing breathing exercises implying that the salad could “breathe better”) (1b) and by an heterogeneously colored, non-uniform look, typical of recycled plastics (1c) (pictures in tables A.2 and A.3, Appendix A).

#### 3.3.1. Results study 1b and 1c

**3.3.1.1. Salience of sustainability.** Results of study 1b and 1c showed a similar pattern to study 1a: sustainability was more salient when explicit cues were present rather than absent and the combination of implicit and explicit cues did not lead to any increase in sustainability salience (Table 3). Content analysis of the thoughts listed in study 1b gives also some insights on the “thoughts/feelings of skepticism” towards the overall packaged product. Relatively more consumers mentioned

<sup>7</sup> Explanation of the blow device: “This packaging includes a device that controls the atmosphere inside the packaging, thus it keeps the product breathing and extends its shelf life to reduce its potential food waste”. Explanation of the recycled material: “This packaging is made with recycled material. The material has been processed to be re-used for a new life in this packaging”. As in study 1a graphics and mockups were designed and developed within MYPACK.



**Fig. 2.** Sustainable responses to the biscuit packaging measured as: salience of sustainability through the lexical decision task (panel a), salience of sustainability through the thought listing task (panel b) and self-reported sustainability perception (panel c).

**Table 2**  
Frequency of the sustainability related thought (coded as “sustainability”) across conditions.

	Control (n = 53)	Implicit cue present (n = 53)	Explicit cue present (n = 48)	Combination (n = 57)	$\chi^2$ (df = 3); p value
Frequencies	7 <sup>a</sup>	9 <sup>a</sup>	22 <sup>b</sup>	27 <sup>b</sup>	24.87 p < .01
Proportion frequencies/total	.13	.17	.46	.47	

Columns sharing the same superscript letter are not significantly different at the .05 level (crosstabs with pairwise z-test Bonferroni corrected).

**Table 3**  
Frequency of the sustainability related thought (coded as “sustainability”) for study 1b and 1c.

		Control (n = 53)	Implicit cue (n = 53)	Explicit cue (n = 48)	Combination (n = 57)	$\chi^2$ (df = 3); p value
<b>Study 1b</b>	Sustainability	15 <sup>a</sup>	12 <sup>a</sup>	31 <sup>b</sup>	31 <sup>b</sup>	25.92, p < .01
<b>Study 1c</b>	Sustainability	6 <sup>a</sup>	8 <sup>a</sup>	28 <sup>b</sup>	38 <sup>b</sup>	55.46, p < .01

Columns sharing the same superscript letter are not significantly different at the .05 level (Crosstabs with pairwise z-test Bonferroni corrected).

thoughts related to skepticism towards the packaging when both implicit and explicit cues were present (n = 14), than in other conditions (control = 1, implicit = 8, explicit = 6;  $\chi^2 = 11.93$ ; p = .08).

**3.3.1.2. Perception of sustainability.** Results of the study 1b showed a significant main effect of explicit cues on sustainability perception of the packaging,  $F(1, 208) = 4.02$ ,  $p = .05$ , part.  $\eta^2 = 0.02$ , and a trend for the

interaction effect between implicit and explicit cues,  $F(1, 208) = 2.83$ ,  $p = .09$ , part.  $\eta^2 = 0.01$ . The main effect of implicit cues was not significant,  $F(1, 208) = 0.33$ ,  $p = .57$ .

The results of study 1c showed a significant main effect of explicit cues on sustainability perception,  $F(1, 208) = 43.314$ ,  $p < .01$ , part.  $\eta^2 = 0.17$ . Neither the main effect of implicit cues,  $F(1, 208) = 0.15$ ,  $p = .70$ , nor that of the interaction,  $F(1, 208) = 0.74$ ,  $p = .39$ , was significant.

This provides partial replication of study 1a, as 1) consumers perceived the packaging as more sustainable when explicit cues were present, 2) implicit cues did not have any effect and 3) the combination of explicit and implicit cues either did not add any effect (study 1c) or, as in study 1a, diminished it (study 1b) (Fig. 3, panel a and b).

### 3.4. Discussion study 1a, 1b and 1c

Study 1 showed consistent and robust effects across a diverse range of stimuli, in terms of packaging technologies for different implicit (rough tactile property, graphic for the blow device and non-uniform look) and explicit cues (logos and explanations of biodegradable and compostable materials, blow device technology and recycled materials) and different products (biscuits, salad, baby food). In addition, the main conclusions are demonstrated across different measures: 1) the lexical decision task that measures the activation of constructs that consumers might not be aware of, 2) the thought listing task that let consumers spontaneously report their thoughts and feelings while experiencing the packaging, and 3) a Likert scale for sustainability perception. Findings from all replications and measures showed that salience and perception of sustainability is significantly affected by explicit cues. The implicit cues that we have tested seem not to affect these responses. More importantly, looking at the interaction effect, results are in support of the “more is enough” and “more is less” assumption. Combining explicit and implicit cues does not increase sustainability salience and perception and may even backfire, arousing, in some cases, skepticism towards the packaging. This might be explained by the phenomenon defined as “green overload confusion” (Aji & Sutikno, 2015; Magnier & Schoormans, 2015; Mitchell et al., 2005; Vincent-Wayne & Vassiliou, 1999). Research on “green consumer confusion” and “green skepticism” suggests that over-emphasizing the sustainability message (e.g., in our case, through the combination of eco implicit and explicit cues) makes consumers question whether the product is actually sustainable or the opposite. The reasons why an overload of information generates confusion might be due to the strong associations between sustainability and simplicity (Oates et al., 2008). Sustainability constructs are indeed often associated with an idea of simplicity, with the reduction or avoidance of superfluous design elements (Granato et al., 2021). Thus, an overload of design elements might lead, through green confusion, to negative perceptions about the environmental features.

To further investigate the effect of combining explicit and implicit packaging cues on sustainable responses and specifically, whether this effect depends on the specific implicit and explicit cues provided, we conducted a study 2. While keeping explicit cues constant, study 2 extends study 1, by investigating how different implicit cues show different levels of meaningfulness. Therein, we assume that some implicit cues, for example a green color, may activate sustainability related thoughts independently from explicit cues, as they already hold a well embedded and learned association with nature and environment. While these cues (as the green color) may be inherently meaningful in signaling sustainability, others may not. Such “meaningless” cues might thus benefit more from adding explicit cues. In study 2, we test whether explicit cues represent more effective “meaning providers” if combined with meaningless rather than meaningful implicit cues.

## 4. Study 2

### 4.1. Methods

#### 4.1.1. Participants, design and stimuli

The same participants that participated in study 1 were randomly re-allocated to one of the two conditions of a two between (explicit cue: absent/present) by six within (implicit cue) subject design. The six levels of implicit cues were: (1) absent (control package), (2) sound, a *noisy loud sound*, typical of the biobased polylactic acid material (PLA), (3) opaque, a *cloudy, non-transparent look*, typical of biodegradable and

compostable plastics, (4) touch, a somewhat *sticky tactile property*, typical of water-soluble films and recycled plastic (PET), (5) look, a *recycled/kraft visual*, typical of recycled paper materials, (6) color, a *green color*. All the packaging's were identical to the control packaging except for the single implicit variation suggested by the name. We expected these variations to represent meaningful or meaningless reminders.

Explicit cues consisted of two different logos and explanations to avoid presenting respondents six packages with the same explicit cue (but different implicit cues). The logo and explanation of biodegradable and compostable material and the logo and explanation of recycled material were both used; counterbalanced across participants in the between group conditions (see table C.1, Appendix C for the stimuli).

#### 4.1.2. Procedure and measures

Respondents were informed that different European companies had developed new mono-portion packaging for on-the-go consumption of biscuits and that they wanted to know how consumers would evaluate them. Respondents were confronted with six biscuits packaging, one after each other. To be sure respondents experienced each of the six packages one by one, the packages were provided in a drawer cabinet presenting the opening sequences. Respondents were instructed to experience the packaging as much as possible and to reply to some questions measuring salience and perception of sustainability.<sup>8</sup> Respondents then completed a memory recall task to test whether they noticed the packaging manipulations (Barlow & Wogalter, 1993; Raghurir & Valenzuela, 2006; Shaw et al., 2000).<sup>9</sup> Results showed that the sensory aspects of the packaging (e.g. visual, tactile, auditory elements) were frequently mentioned by consumers (n = 161), therefore noticed, remembered and functioning as reminders for newness and distinctiveness.

## 4.2. Results

### 4.2.1. Effect on salience of sustainability: meaningless or meaningful cues

The results from the thought listing task showed that the different implicit cues did not make sustainability equally salient to consumers. In the condition without explicit cues (n = 107), the implicit cues of the noisy sound (n = 9) and the sticky touch (n = 6) did not significantly raise more sustainability related thoughts than the control condition (n = 8). Thus, these implicit cues can be defined as “meaningless” in signaling sustainability to consumers. More consumers mentioned sustainability related thoughts when they experienced the opaque packaging (n = 21), the packaging with a recycled/kraft look (n = 31) and the packaging with the green color (n = 35). These implicit cues can, thus, be considered as inherently “meaningful” in signaling sustainability.

When explicit cues were added to meaningless implicit cues, a higher proportional increment was observed on salience of sustainability (sound x2.67, touch x4.00), compared to when explicit cues were added to already meaningful cues (opaque x1.95, look x1.77). Combining explicit cues with the meaningful cue of green color even led to a decrease (of x0.66) in salience of sustainability (Table 4).

<sup>8</sup> Salience of sustainability was measured through the thought listing task as in study 1. To limit repetition, in this study, participants were asked to report thoughts and feelings using key words, rather than fully elaborating. “Write here your thoughts and feelings that go through your mind while experiencing this packaged product. You can use key words”. Perception of sustainability was measured identical to study 1.

<sup>9</sup> This was measured through the open question: “You have just evaluated 6 biscuits packaging one after the other. If you close your eyes, which element of the packaging you remember the most?”.



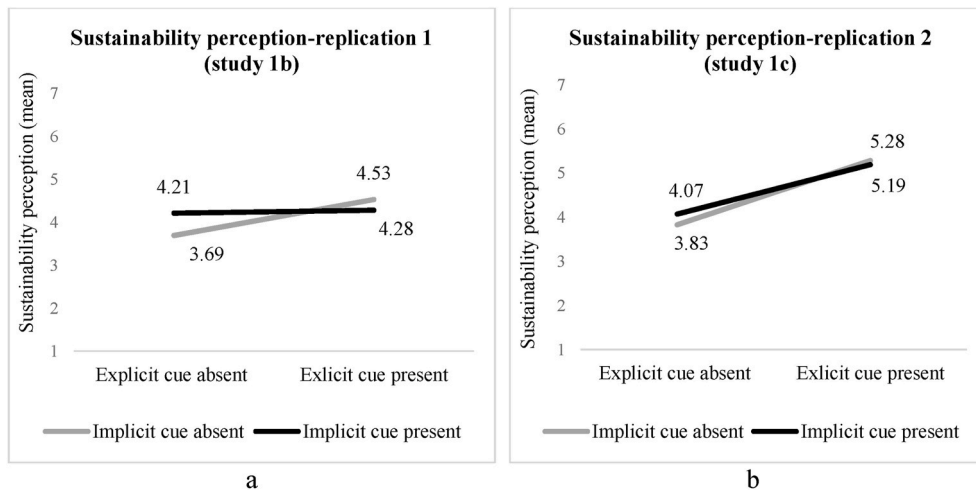


Fig. 3. Sustainability perception of salad packaging (panel a) and baby food packaging (panel b).

4.2.2. Combining explicit cues to meaningless/meaningful implicit cues: effect on sustainability perception

A mixed ANOVA with implicit cues as within subject variable and explicit cues as between subject variable was conducted, to test the effect of the combination of cues on sustainability perception. Results showed a main effect of implicit cues,  $F(5, 206) = 12.82, p < .01$ , part.  $\eta^2 = 0.06$ , a main effect of explicit cue,  $F(1, 208) = 67.3, p < .01$ , part.  $\eta^2 = 0.24$ , and an interaction effect between implicit and explicit cues,  $F(1, 206) = 8.85, p < .01$ , part.  $\eta^2 = 0.04$ , on sustainability perception. Results from the pairwise comparisons showed that meaningful implicit cues significantly increased sustainability perception of the packaging (opaque = 3.98, look = 3.89, green color = 4.42) compared to the control packaging (mean = 3.49; all  $p$  values < .05). Meaningless implicit cues (sound = 3.26, touch = 3.62), instead, did not significantly differ from the control condition (mean = 3.49; all  $p$  values > .05), aligning with the results on salience of sustainability (Table 4).

Results also showed that combining an explicit cue to a meaningless reminder (sound and touch) led to a higher increment on sustainability perception (sound = +1.37, touch = +1.26) compared to when the explicit cue was added to an already meaningful reminder (opaque = +1.05, green color = +0.53). The implicit cue of natural look, although a meaningful cue, still benefited from the addition of the explicit cue (+1.61) (Table 4, for visualization see figure C.1 Appendix C).

4.3. Discussion study 2

Study 2 demonstrated the different nature of implicit cues, as inherently meaningless or meaningful reminders for sustainability. Some implicit cues, as green color, recycled/craft look, and opaque material, carry inherent “meaningfulness” in relation to sustainability, while others, as sound and touch, lack such meaningfulness, despite being noticed by consumers and functioning as reminders for newness and distinctiveness. Adding an explicit cue, such as a label about the packaging biodegradability, to a meaningless reminder results in a relatively large increase in sustainability perception of the packaging, thus supporting the assumption of “more is more”. However, combining an explicit cue with an already meaningful reminder (e.g., opaque packaging) lead to a much smaller increment, or even to a decrease in sustainable responses (as for the green color combined to an explicit cue). This might still be explained by the phenomenon of the “green overload confusion” as in study 1a.

Building on study 1 that provides a first insight into the general phenomenon (more is more, or more is less?), study 2 investigated the nature of implicit cues, while keeping explicit cues constant. Study 3 further extends this by exploring the effect for different explicit cues, while keeping implicit cues constant. We assume that the effect of the combination of implicit and explicit cues depends on the ability of the

Table 4  
Effect of implicit and explicit cues on salience of sustainability (frequencies) and perception (mean, SD).

Measure	Explicit/implicit	Meaningless			Meaningful		
		Absent	Sound	Touch	Opacity	Look	Color
Salience of sustainability Frequencies	Absent (n = 107)	8	9	6	21	31	35
	Present (n = 105)	58	24	24	41	55	23
	Proportional increment	x7.25	x2.67	x4.00	x1.95	x1.77	x0.66
Sustainability perception M(SD)	Absent (n = 107)	3.49(1.55) <sup>a</sup>	3.26(1.49) <sup>a</sup>	3.62(1.63) <sup>a</sup>	3.98(1.60) <sup>c</sup>	3.89(1.53) <sup>b</sup>	4.42(1.74) <sup>d</sup>
	Present (n = 105)	5.41(1.45) <sup>c</sup>	4.63(1.57) <sup>a</sup>	4.88(1.52) <sup>ab</sup>	5.03(1.61) <sup>b</sup>	5.50(1.41) <sup>c</sup>	4.95(1.62) <sup>ab</sup>
	Absolute increment	+1.92	+1.37	+1.26	+1.05	+1.61	+0.53

Columns sharing the same superscript letter are not significantly different at the .05 level (Crosstabs with pairwise z-test Bonferroni corrected). Proportional increment represents of how many times the value increased from explicit cue absent to present. Absolute increment represents of how many points the value has increased in the 1–7 scale.

explicit cue to create an association between the (meaningless) implicit cue (e.g. the distinctive sound or tactile property of eco materials) and the improved sustainability of the packaging. If such association cannot be created, the explicit cue is unable to transfer a meaning to the implicit cue, which remains a meaningless reminder. Hence, for those implicit cues that do not hold any a priori association with sustainability, the ability of the explicit cues to transfer this missing link might be essential to create a meaningful reminder. We further extend studies 1 and 2, by replacing on-packaging logos and labels with information from external sources (a packaging expert) and by measuring sustainable disposal behavior.

## 5. Study 3

### 5.1. Materials and methods

#### 5.1.1. Participants and design

One hundred and seventy-one Dutch participants ( $M_{age} = 38.68$ ,  $SD = 15.09$ ; 63% female), recruited through a Dutch consumer panel, took part in a 20 min experiment for 7.50-euro compensation. After giving informed consent, participants were randomly allocated to one of the conditions of a three between (explicit information: none/non-associative/associative) by two within (implicit cue: meaningless/meaningful) subject design.

#### 5.1.2. Stimuli

Implicit cues were manipulated by four different biscuits packaging, that represented meaningless (sound or touch) and meaningful (opacity or kraft look) cues, based on study 2<sup>10</sup>. Packages were identical to those in study 2 and labelled with the participant number. Explicit information was manipulated by a video recording. In a professional video setting, an actor portrayed a packaging expert/material engineer, in a lab coat in his laboratory (Fig. D.2, Appendix D).

In the condition “no explicit information”, the packaging expert gave no information on the sustainability of the packaging (baseline video), stating (translated from the original Dutch): “Hello, my name is Michiel van der Kamp and I am a materials engineer. For many years, together with Wageningen University and the National Research Institute of packaging we have been researching new materials for food packaging. We have developed new packaging materials for example for biscuit products, such as these ones”.

In the “non-associative explicit information” condition, the packaging expert continued by explaining the sustainability of a packaging made of recycled material, including disposal instructions: “These packages are made of recycled material. A material can be recycled if we separate this packaging from the rest and dispose of it with plastic waste” “A recycled material is basically a material that has been processed to be reused and function as a new packaging”. In this condition, the information provided is defined as “non associative” as it explains the packaging technology (what recycled packaging means) without creating any association between the sensory properties of recycled materials (e.g., a distinctive look than conventional plastic) and their enhanced sustainability.

In the “associative explicit information” condition, instead, the packaging expert explains the packaging technology by providing a link, an association between the sustainability of the recycled packaging and its different sensory properties. Thus, the sustainability meaning is transferred and loaded to the implicit cues. After the disposal instructions, the video of this condition continued as: *A recycled material is basically a material that has been processed and therefore, can have different sensory features than conventional packaging, such as a different appearance, color, sound or tactile sensation*”.

<sup>10</sup> The green color was not used, as it is not an intrinsic property of sustainable packaging.

Manipulations were pre-tested.<sup>11</sup> In the main study, on a seven-point scale, respondents evaluated the information as understandable ( $M = 6.27$ ,  $SD = 1.12$ ) and realistic ( $M = 5.67$ ,  $SD = 1.24$ ). An attention check also confirmed that participants paid attention to the video and remembered specific elements of the experts’ speech.

#### 5.1.3. Procedure and measures

Participants took their places in a testing booth, with a computer, a pair of headphones, a doggy bag and a tray with two packages: one with a meaningless implicit cue (sound or touch) and another one with a meaningful implicit cue (opacity or look). Participants were first asked to briefly experience both packages and to watch a video with the explicit information of their condition. Then, they were instructed to re-experience the packages, this time more deeply and one by one, starting with package 1 (meaningless implicit cue) and to reply to some questions measuring sustainability perception and purchase intention for that packaging. Then, respondents experienced package 2 (meaningful implicit cue) and replied to the same questions. Sustainability perception was measured identical to study 1 and 2. Purchase intention was measured through: “To what extent would you buy this packaged product?”, on a seven point scale from 1 (very unlikely) to 7 (very likely) (Dodds et al., 1991).

A filler task was included to ensure that both packages were opened and emptied before measuring disposal behavior. Participants were asked to open the packages (starting from package 1), taste the biscuits, evaluate their taste and report their thoughts and feelings (thought listing task identical to study 1 and 2). This was repeated for packaging 2. Participants then completed a three item 7-point scale on environmental concern (1 = completely agree, 7 = completely disagree) (Cervellon, 2012)<sup>12</sup> and indicated whether they had left-over biscuits or if they had eaten them all.<sup>13</sup>

Finally, respondents were requested to empty their desk to follow Covid19 measures. They could use a doggy bag to take home left-over biscuits or throw them away on their way out. A doggy bag, labelled with the respondent’s code, was used to measure food waste behavior (de Visser-Amundson, 2020). Participants were asked to dispose the empty packaging in a bin station consisting of two sets of four bins (organic, paper, plastic and general), placed towards the exit (figure D.1, Appendix D). Participants were unaware that this formed part of the experiment.

#### 5.1.4. Analysis plan

Thoughts and feelings reported by respondents were analyzed as in study 1 and 2 (details in table D.1, Appendix D). Disposal behavior of the packaging was analyzed by examining the garbage. The code “sustainable behavior” was assigned if 1) participants had disposed of the paper inner part and plastic outside part of the packaging separately, and 2) respondents had sustainably disposed the recycled plastic packaging in the plastic bin (sorting and recycling) (Geiger, 2020). Otherwise, the code “unsustainable disposal behavior” was attributed. Data were analyzed with frequency analysis and binary logistic regressions to test effects of non-associative and associative information against the baseline “no explicit information”, controlled for environmental concern.

Sustainable behavior for biscuits was assessed using a doggy bag as

<sup>11</sup> The text of the speech of the packaging expert was checked with a small sample of consumers to verify whether 1) information on the sustainability of the packaging was provided 2) information created a link between the sensory properties and sustainability.

<sup>12</sup> To what extent do you agree with the following statements? Indicate per statement. 1) “I normally make a conscious effort to limit my use of products that are made of scarce resources”, 2) “I have switched products for ecological reasons”, 3) “When I have a choice between two equal products, I always purchase the one that is less harmful to other people and the environment.”

<sup>13</sup> Have you eaten all the biscuits? (yes/no).

**Table 5**

Frequencies of the thoughts related to the sustainability of the packaging (coded as “sustainability”), to the unsustainable aspects of the packaging (coded as “sustainability negative”) and feelings of skepticism (coded as “skepticism”).

	Explicit info/implicit cues	None (n = 57)	Non-associative (n = 57)	Associative (n = 57)	Total	$\chi^2$ (df), p value
Sustainability	Meaningful(N = 171)	12	20	13	45 <sup>a</sup>	Implicit $\chi^2(1) = 9.82, p < .01$
	Meaningless(N = 171)	6	7	9	22 <sup>b</sup>	
	Total	18 <sup>a</sup>	27 <sup>a</sup>	22 <sup>a</sup>		
Sustainability negative	Meaningful(N = 171)	7	4	3	14 <sup>a</sup>	Explicit $\chi^2(2) = 2.26, p = .32$ Implicit $\chi^2(1) = 4.08, p = .04$
	Meaningless(N = 171)	12	10	4	26 <sup>b</sup>	
	Total	19 <sup>a</sup>	14 <sup>a, b</sup>	7 <sup>b</sup>		
Skepticism	Meaningful(N = 171)	4	4	1	9 <sup>a</sup>	Explicit $\chi^2(2) = 6.17, p = .05$ Implicit $\chi^2(1) = 6.00, p = .01$
	Meaningless(N = 171)	10	8	4	22 <sup>b</sup>	
	Total	14 <sup>a</sup>	12 <sup>a</sup>	5 <sup>a</sup>		
						Explicit $\chi^2(2) = 4.75, p = .09$

Values sharing the same superscript letter across columns (explicit) or row (implicit) do not differ significantly at the .05 level (Crosstabs with pairwise z-test Bonferroni corrected).

proxy for avoiding waste (Stöckli et al., 2018). If respondents did not use the doggy bag, although they had some left-over biscuits, this was classified as “unsustainable behavior regarding the biscuits”. Otherwise, as sustainable behavior (no food waste).

## 5.2. Results

### 5.2.1. Salience of sustainability

Results from the thought listing task showed that more consumers mentioned sustainability related thoughts with the meaningful implicit cue (opacity or look;  $n = 45$ ), than with the meaningless implicit cue (sound or touch;  $n = 22$ ;  $\chi^2(1) = 9.82, p < .01$ ). This is in line with study 2, indicating that opacity and kraft look represent meaningful implicit cues. Similarly, consumers thought more about the unsustainable aspects of the packaging (e.g. “too much material”, “bad for the environment”) for meaningless implicit cues ( $n = 26$ ), than meaningful ( $n = 14$ ), ( $\chi^2(1) = 4.08, p = .04$ ; Table 5). These thoughts decreased when associative explicit information was provided ( $n = 7$ ), compared to when non-associative ( $n = 14$ ) or no information was provided ( $n = 19$ ),  $\chi^2(2) = 6.17, p = .05$ .

In addition, results from the content analysis showed that fewer consumers mentioned thoughts related to skepticism towards the packaging when associative explicit information was provided ( $n = 5$ ), compared to non-associative ( $n = 12$ ) or no information ( $n = 14$ ),  $\chi^2(2) = 4.75, p = .09$  (Table 5).

### 5.2.2. Effect on sustainability perception

A mixed ANOVA showed a significant main effect of implicit cues,  $F(1, 168) = 30.86, p < .01$ , part.  $\eta^2 = 0.16$  and explicit information,  $F(1, 168) = 3.60, p = .03$ , part.  $\eta^2 = 0.04$ , on sustainability perception. In line with study 2, participants perceived the packaging with meaningful implicit cues as more sustainable ( $M = 4.82, SD = 1.42$ ) than with meaningless implicit cues ( $M = 3.99, SD = 1.52$ ). The results also demonstrated that consumers perceived the packaging as more sustainable when associative explicit information was provided ( $M = 4.68, SD = 1.46$ ) rather than non-associative ( $M = 4.40, SD = 1.41$ ) or no information ( $M = 4.13, SD = 1.48$ ).

Although no significant interaction effect between the implicit cues and explicit information was found ( $F(1,168) = 1.08, p = .34$ ), a pairwise comparison analysis suggested that, in line with study 2, explicit information has more effect for meaningless rather than meaningful reminders. Moreover, associative explicit information significantly increased sustainability perception of the packaging with meaningless implicit cues ( $M = 4.33, SD = 1.56$ ), compared to when no explicit information was provided ( $M = 3.56, SD = 1.58; p = .01$ ). Associative explicit information did not increase the sustainability perception of the packaging with meaningful implicit cues (Fig. 4, panel a).

For purchase intention, a significant main effect of implicit cues was found,  $F(1,168) = 5.80, p = .02$ . No main effect of explicit information ( $F(1, 168) = 0.63, p = .53$ ) nor an interaction ( $F(1, 168) = 0.47, p = .63$ )

was observed. Pairwise comparisons showed a similar trend: when associative explicit information was provided, consumers were more willing to purchase the packaged product with meaningful ( $M = 4.82, SD = 1.28$ ) rather than meaningless cue ( $M = 4.33, SD = 1.64; F(1, 168) = 3.67, p = .06$ ).

### 5.2.3. Effect on disposal behavior

A logistic regression showed no significant effect of non-associative information on disposal behavior of the packaging with meaningless and meaningful cue but a significant effect of associative information. Environmental concern, as covariate, had a marginally significant effect on disposal behavior (Table 6). Consumers behaved significantly more sustainably in disposing the packages when associative information was provided rather than non-associative or none,  $\chi^2(2) = 10.93, p < .01$ , independently from the implicit cues (meaningless/meaningful),  $\chi^2(1) = 0.64, p = .42$  (Fig. 4, panel c). For the food waste behavior, no significant differences were observed across conditions,  $\chi^2(2) = 1.82, p = .40$ .

## 5.3. Discussion study 3

Study 3 showed that explicit information best serves meaningless reminders, reconfirming the results of study 2 and providing additional evidence on the function of explicit information as “meaning provider”. In addition, study 3 demonstrated that the effect of the combination depends on the ability of explicit information to load and transfer a meaning to the meaningless reminder. This effect manifests itself in both enhanced sustainability perception and actual sustainable behavior. Providing associative information is shown to reduce feelings of skepticism towards the packaging. Associative explicit information positively affected sustainable disposal behavior, although this does not rely on the implicit cue (meaningless/meaningful). This can be due to the fact that the within-subject manipulation was irrelevant to the discarding task, as consumers were instructed to simultaneously dispose of both packages (with the meaningless and meaningful cue) on their way out. The observed non-significant results for disposal behavior of biscuits might also suggest that the effect of sustainability packaging interventions does not carry over to other sustainable behaviors (as food waste prevention).

## 6. General discussion and implications

The current research conceptualized and tested the new concept of meaningful reminder as a strategy to improve sustainability communication. To understand how such meaningful reminder can be created and used, this study investigates how different packaging design elements combine and interact in affecting consumer sustainable responses. Such design elements are defined as either “explicit cues”, as on-packaging text or verbal explanation about the packaging technology or “implicit cues”, as colors, tactile properties, auditory elements,



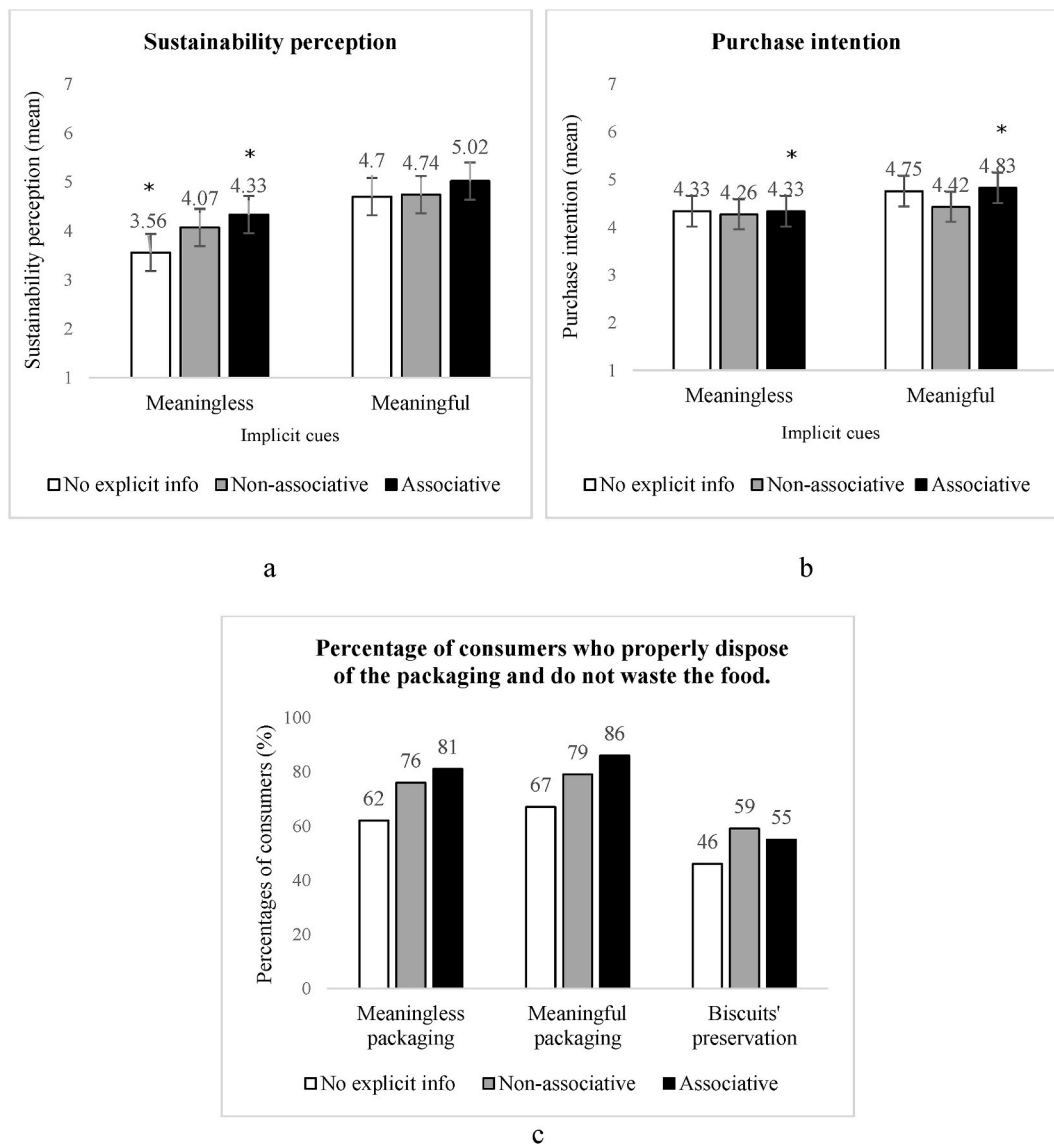


Fig. 4. Sustainability perception (panel a), purchase intention (panel b; columns with the asterisk show statistical significance between each other. Error bars indicate 95% confidence interval) and sustainable behavior regarding the packaging and its content (panel c).

Table 6

Effect of non-associative and associative explicit information on disposal behavior of the packaging compared to the “no explicit information” condition (baseline). Effect controlled for environmental concern.

Dependent variables	Meaningless implicit cue					Meaningful implicit cue				
	$\beta$	S.E.	Wald	df	p	$\beta$	S.E.	Wald	df	p
Non-associative	.65	.44	2.20	1	.14	.60	.44	1.90	1	.17
Associative	.98	.46	4.65	1	.03	1.13	.48	5.54	1	.02
Environmental concern	.26	.14	3.21	1	.07	.03	.15	3.96	1	.05
Constant	-.11	.65	.03	1	.09	-.03	.66	.003	1	.96

transparency/opacity level or graphic. Such a distinction between implicit and explicit cues is based on the process through which they convey meaning to consumers; the explicit cues through a deliberate, cognitive and informational belief formation route (Fishbein & Ajzen, 1977; Steenkamp, 1990) and the implicit cues through an associative inferential route (Lindh et al., 2016; Steenis et al., 2017; Underwood, 2003). Across three studies and two replications (for study 1), we showed how explicit and implicit packaging design cues can be used to the advantage of sustainability, increasing sustainability salience, perception and sustainable behaviour.

The effect of the combination varies depending on whether implicit cues are inherently meaningful or meaningless and whether explicit cues can load a meaning to the meaningless reminder, when this is missing. Our results show that combining explicit cues to an already meaningful implicit cue can be counterproductive, not leading to any (or substantial) increase or even a decrease in sustainability salience and perception. In other words, more cues lead to lower levels of sustainability (“more is less” or “more is enough”). This result supports prior research suggesting that the demand for external information decreases when information about a product is already present in consumers’ mind

(Schmidt & Spreng, 1996; Vos, 2017), as in the case of meaningful cues with a priori sustainability association. These findings are also in line with research on green confusion, green skepticism and green washing indicating that an overload of “green” information can lead consumers to question the real environmental efficiency and to perceive the product as less sustainable (Aji & Sutikno, 2015; Magnier & Schoormans, 2015; Mitchell et al., 2005; Vincent-Wayne & Vassilios, 1999).

Combining explicit cues to a meaningless implicit cue can increase sustainability salience, perception and even sustainable disposal behavior of the packaging. In other words, more cues contribute to sustainability. This depends on the ability of the explicit communication to create an association between the meaningless implicit cue (e.g., a different packaging sound) and the enhanced sustainability level. In this case, the combination of design elements creates a meaningful reminder: the explicit information provides a reason (sustainability) to believe and understand the distinctive sensory properties that, thus, become meaningful. Vos (2017) similarly suggested that the effectiveness of sustainability claims depends on the extent to which they explain (or make understandable) packaging sustainability. Claims without such explanation were considered less credible and required a higher level of trust from consumers (Vos, 2017). Similarly, we showed that combining non-associative explicit information makes consumers more skeptical and doubtful about the sustainability of the packaging, as they may interpret this combination as “too much to be true” or harmful for the actual sustainability.

### 6.1. Theoretical implications

Our findings contribute to research in environmental psychology, innovation and product design by addressing the controversial perspectives on the interaction between explicit and implicit communication and its effect on sustainability. To our knowledge, this is the first (publicly available) research to systematically study how explicit and implicit cues combine and interact in affecting a different range of sustainable responses, such as sustainability salience, perception and sustainable behaviour. We demonstrate the conditions under which such combination of cues can increase, leave unaffected or even decrease sustainability, adding clarity to a phenomenon with conflicting perspectives.

Contributing to the research in communication strategies and new product design, this paper conceptualizes and tests the new concept of meaningful reminder. Such a concept encompasses what an innovation should have to be recognized and understood as intended: a reminder and a meaning provider. Our findings show how such meaningful reminders can be created, as a one-step or two-steps process, depending on whether the “automatic flow of business as usual” is disrupted (through the reminder) and re-stored (by providing a meaning) through a meaningful reminder (one-step) or by combining a meaningless reminder with an explicit cue that transfers the intended meaning (two-steps).

The current work also adds to the understanding of the inferential and informational processes in packaging belief formation, relevant to sustainability communication within and beyond the packaging domain (Koenig-Lewis et al., 2014; Magnier & Schoormans, 2017; Steenis et al., 2017; Vos, 2017). Our focus on the interaction effect contributes to this literature that has mainly studied these processes separately, based on single implicit and explicit cues (Chan & Lau, 2004; Steenis et al., 2017; Van den Heuvel et al., 2007). While previous studies investigated how informational beliefs are formed through on-packaging cues, as logos and labels (Rettie & Brewer, 2000; Van Rompay & Veltkamp, 2014), our research shows similar effects with external information provided by an authoritative third-party, suggesting that explicit communication works regardless of the channel.

Last, our research provides contributions to environmental psychology and eco-design by exploring the linkage between packaging interventions and sustainable behavior. Prior studies have often

overlooked this phenomenon, predominantly focusing on pre-purchase stages (Lindh et al., 2016; Magnier & Schoormans, 2017; Steenis et al., 2018; Steg et al., 2013) and missing real life set-ups (Borgman, 2018). The current study demonstrates an effect on sustainable behavior, both in terms of disposal of the packaging and sorting.

### 6.2. Practical implications

Our findings might be of use for marketers, packaging designers and policy makers, involved in improving the communication of new sustainable technologies. Our results show to designers and marketers when and under which conditions explicit and implicit cues can improve, leave unaffected or decrease sustainable responses. Overall, this paper provides scientific based evidence in the field of packaging design, which is often driven by intuition (Spence & Gallace, 2011). We revealed that the intuitively plausible strategy of adding cues can actually be counterproductive. Designers and marketers might indeed opt to add explicit information on the packaging when implicit cues have no prior association with sustainability, avoiding the so-called “green overload confusion”.

As sustainability is becoming an increasingly important criterion in consumer decision making (Banerjee et al., 2003; Peattie & Peattie, 2009) and the technology is going hand in hand with this trend (Boz et al., 2020; Olsen et al., 2014), designers and marketers need new communication strategies to signal both newness and improved environmental efficiency. By testing a variety of different sensory properties, including auditory and tactile elements, our results provide suggestions to packaging designers beyond visual packaging elements (green color, natural look, images etc.) in the sustainability communication (Creusen & Schoormans, 2005; Magnier & Schoormans, 2015; Pancer et al., 2017; Steenis et al., 2017). Specifically, our results (study 2) showed that the distinctive sensory features of eco-materials can be used by companies as effective reminders for sustainability, rather than hidden in the overall design.

Moreover, rather than adopting generic claims which risk to be interpreted as forms of greenwashing, marketers should consider formulating specific and associative statements that link the distinctive properties of sustainable packaging with the higher sustainability and provide “a reason to believe” (e.g., “This is a new type of packaging, can you hear/feel its sustainability?”, “Can you hear the new sound of green/sustainability”).

By demonstrating that such associative statements, provided through an authoritative external source, can stimulate a more sustainable disposal behavior, this research provides implications relevant for policy makers or institutions committed to promoting recycling behavior. For example, municipalities could consider encouraging sustainable disposal behavior through advertisements in which governmental agencies or experts on the subject provide information on a new packaging technology, linking it to its distinctive sensory features.

### 6.3. Limitations and further research

The current research presents some limitations that should be acknowledged. First, this study does not take into account a supermarket context to simulate respondents’ real life cognitive load, which influences consumers’ responses to visual and verbal cues (Hoegg et al., 2010; Shiv & Fedorikhin, 1999). In all our studies, respondents were specifically instructed to interact with the packaging as much as possible and had time to cognitively elaborate on all the information provided. In the supermarket context of high cognitive load, low resources and motivation, it is likely that consumers would not process the explicit cues with the same level of attention and commitment as in our studies. Our study does, however, show promising effects that go beyond explicit cues alone and shifts attention to implicit cues that are less susceptible to low cognitive resources. Future research could test the influence of implicit and explicit cues in different conditions of cognitive load in

order to determine whether in situations of high cognitive load consumers' sustainable responses would be influenced to the same extent by implicit and explicit cues. Similarly, studying individual differences in cognitive abilities might help to understand the level of resources that different consumer groups allocate and need to process sustainability related messages. As the persuasive power of a message is not only influenced by individuals' cognitive abilities but also by their motivation, it could be interesting to study whether people with high (vs low) sustainability motivations are differently affected by the eco-implicit and explicit cues. Based on the Elaboration Likelihood model of persuasion (Petty & Cacioppo, 1986), we could indeed assume that individuals who care for sustainability are more likely to get persuaded by the quality of an argument, such as a strong explanation on the packaging's environmental efficiency. On the contrary, consumers with low sustainability motivations might be more likely to get affected by peripheral attributes, such as a green color, the number of arguments provided or the mere presence of an expert (Manca et al., 2020; O'Keefe & Jackson, 1995; Wagner & Petty, 2011).

This research's attempt to create an association between the meaningless implicit cues and the improved sustainability was limited to one confrontation. In reality, the learning process in which consumers create and grow these associations generally occurs over time and relies on repetitive encounters with products. While our findings show that explicit information can "load" sustainability associations to meaningless implicit cues, to confirm whether this happens in the long term, future research could include a longitudinal or time-extended study that investigates this effect across multiple encounters with the stimuli.

Similarly, while our studies suggest that explicit communication provided through on-packaging labels and external sources have similar effects, future work could explore this effect with different types of labels (private vs official) and/or third-party sources (more or less trustworthy and authoritative). This could indicate whether the effect of the explicit communication depends on perceived authority and trustworthiness.

## 7. Conclusion

Despite these limitations, the present research showed consistent and robust results on how packaging interventions can be used to improve sustainability communication. This is achieved through different 1) packaging technologies (biodegradable and compostable materials, recycled materials, blow device technology to extend food shelf life), 2) product categories (biscuits, baby food, fresh salad), 3) measures for consumer sustainable responses (lexical decision task, thought listing task, Linkert scales, observation of food waste and packaging disposal

## Appendix A. Stimuli for study 1

**Table A.1**

Pictures of the biscuits packaging for study 1a (front and back of the packaging, brand and logo).

Control packaging
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(continued on next page)

behaviour) and 4) specific manipulations for implicit cues (for study 1: rough tactile property, graphic for the blow device and non-uniform look, for study 2: sound, opacity level, sticky tactile property, graphic, color, for study 3: sound, opacity level, sticky tactile property, graphic) and explicit cues (for study 1: logo and explanation of biodegradability, blow device technology and recycled materials, for study 2: logo and explanation of biodegradability and recycled materials, for study 3: verbal information through a packaging expert about recycled materials). Overall, this research has identified an effective combination of design elements, coined as the Meaningful Reminder, as a promising step forward to increase sustainability salience, perception and consumer sustainable (disposal) behaviour.

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## Author statement

Giulia Granato: Conceptualization, Methodology, Software, Formal analysis, Investigation, Resources, Data curation, Writing-original draft, Writing-Review & editing, Visualization, Project administration.

Arnout Fischer: Conceptualization, Methodology, Writing-original draft, Writing-Review & editing, Supervision.

Hans van Trijp: Conceptualization, Methodology, Writing-original draft, Writing-Review & editing, Supervision, Funding acquisition.

## Declaration of competing interest

None.

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Table A.1 (continued)

Control packaging



Implicit cues



Explicit cues

(continued on next page)

Table A.1 (continued)

Control packaging



Combination



Logo of biodegradable and compostable packaging

(continued on next page)

**Table A.1** (continued)

Control packaging



The brand Granny



## The fake brand Granny

The brand logo shows a grandmother in a simple illustration, combined with the brand name.

A simple colour palette was used, with 3 colours that enhance sustainability and a somehow old-skool but modern look.

**Table A.2**  
Pictures of the salad packaging for study 1b.

Control packaging

(continued on next page)



Table A.2 (continued)

Control packaging



Implicit cues



Explicit cues

(continued on next page)

Table A.2 (continued)

Control packaging



Combination



Logo for the blow device

(continued on next page)

Table A.2 (continued)

Control packaging



Table A.3

Pictures of the baby food packaging for study 1c.

Control packaging



Implicit cues

(continued on next page)

Table A.3 (continued)

Control packaging



Explicit cues



Combination



Logo of recycled material

(continued on next page)



**Table A.3** (continued)

Control packaging



**Appendix B. Lexical decision task, study 1**

**Table B.1**  
list of words and non-words used in the lexical decision task

Target words	Letters	syllables	Control words	Non-words
Duurzaam	8	2	aandrang bakplaat feestdag	zweskind somspeen nijmpang dauwdoof
Natuur	6	2	razend dammen fanaat	begant Sorrig okfoor papper
Milieu	6	2	expres kelder oordop	autakt troven relmen zempen

**Table B.2**  
Details on the coding procedure for study 1a, b, c, study 2 and study 3.

Code	Meaning and examples of thoughts and feelings mentioned by respondents.
Sustainability	Anything related with sustainability of the packaging: natural, ecological, good for the environment, ecologically responsible, recycled.
Sustainability negative	When sustainability is mentioned in a negative way: environmentally unfriendly, too much packaging, unsustainable, bad for the environment.
Product quality	Anything related to the quality of the biscuit: fresh, healthy, crispy, tasty, texture, coconut, lemon, delicious.
Bad packaging quality	Anything related to the bad quality of the packaging: hard to open, annoying sound, vulnerable, cheap, too easy to open.
Convenience	Easy to open, good visibility, good quality of the packaging
Hedonic	Aesthetic of the packaging in positive terms: attractive, pleasant, nice, pretty
Hedonic negative	Aesthetic of the packaging in negative terms: unattractive, boring look, unpleasant
Sensory properties	Anything related to the sensory properties of the packaging (neutral judgement): soft, rigid material, hard plastic, sound, transparent, opaque, sticky.
Novelty	Different, new, curious, special, weird, different from plastic

(continued on next page)

**Table B.2** (continued)

Code	Meaning and examples of thoughts and feelings mentioned by respondents.
Skepticism	Not trusting/believing that the packaging is sustainable: scary, doubtful, skeptical, unclear, not sure, does not give me a reassuring feeling, I don't believe it is really sustainable, it raises many questions, I can hardly imagine this can be good for the environment.

**Appendix C. Stimuli study 2**

**Table C.1**

Pictures (and audios) of the biscuits packaging for study 2.

Implicit cue-absent (without and with explicit cue- biodegradable and compostable/recycled material)



Implicit cue-sound (alone and in combination with the explicit cue)



Video for audio: <https://youtu.be/D08WyJZbpW0>



Implicit cue-touch (alone and in combination with the explicit cue)

(continued on next page)

Table C.1 (continued)

Implicit cue-absent (without and with explicit cue- biodegradable and compostable/recycled material)



Video: <https://youtu.be/2ry3Hj4O2J4>



Implicit cue-opacity (alone and in combination with the explicit cue)



(continued on next page)

Table C.1 (continued)

Implicit cue-absent (without and with explicit cue- biodegradable and compostable/recycled material)



Implicit cue-natural look (alone and in combination with the explicit cue)



(continued on next page)



Table C.1 (continued)

Implicit cue-absent (without and with explicit cue- biodegradable and compostable/recycled material)



Implicit cue-green color (alone and in combination with the explicit cue)



(continued on next page)

Table C.1 (continued)

Implicit cue-absent (without and with explicit cue- biodegradable and compostable/recycled material)



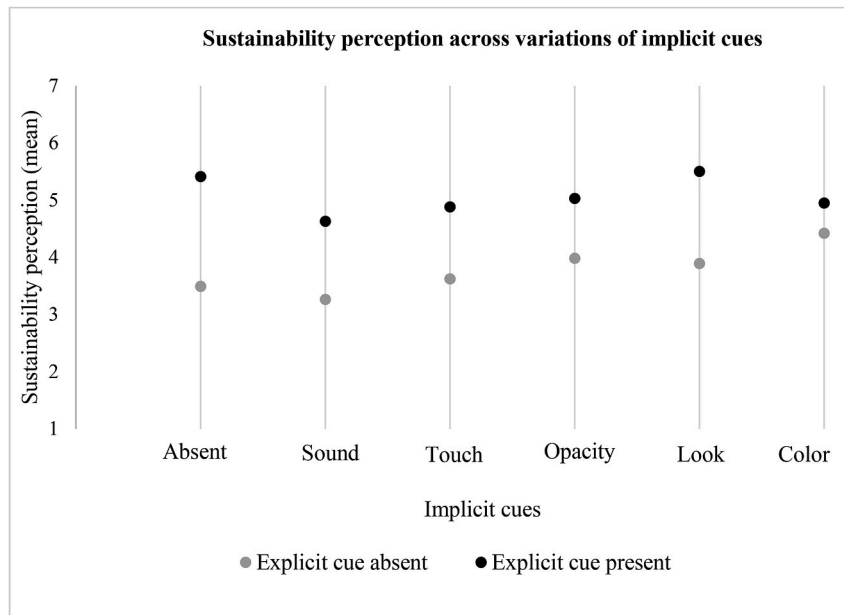


Fig. C.1. Sustainability perception across variations of implicit cues with and without explicit cues. The difference between the grey points and the black points on each vertical line indicates the increment in values from explicit cue absent to present.

**Appendix D. Study 3**

**Table D.1**

Extra results of the coding procedure

Frequencies of the code mentioned	Meaningless implicit cue (n = 57)	Meaningful implicit cue (n = 57)	Chi-square/p-value
Sustainability	22	45	9.82, p = .00
Sustainability negative	26	14	4.08, p = .04
Convenience	66	33	15.48, p = .00
Product quality	77	60	3.36, p = .07
Bad packaging quality	94	97	0.11, p = .74
Sensory properties	113	96	7.28, p = .06
Hedonic positive	61	56	0.36, p = .57
Hedonic negative	14	23	2.46, p = .12
Novelty	23	10	5.67, p = .02
Skepticism	22	9	6.00, p = .01

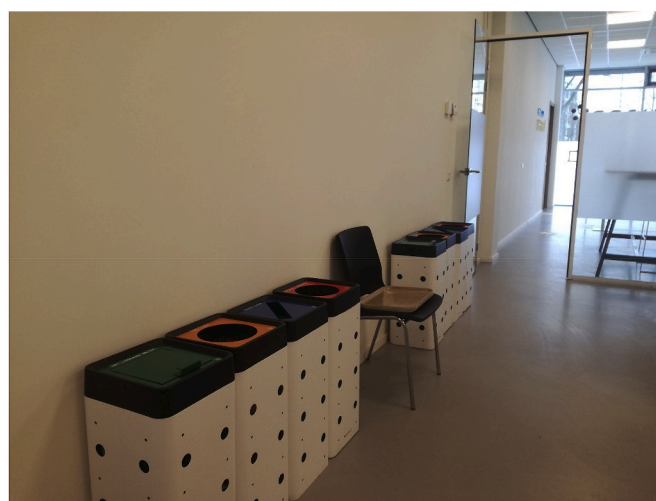


Fig. D.1. Picture of the bin station, study 3.



Fig. D.2. Fragment of the video material in study 3.

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