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Explicitly and Implicitly Measured Valence and Risk Attitudes Towards Plastic Packaging, Plastic Waste, and Microplastic in a German Sample

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Author Contributions

Claudia Menzel: Conceptualization, Methodology, Formal analysis, Writing - Original Draft, Writing - Review & Editing, Visualization, Supervision, Project administration. **Julia Brom:** Methodology, Software, Investigation, Writing - Review & Editing. **Lea Marie Heidbreder:** Conceptualization, Writing - Review & Editing, Supervision.

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Abstract

Within society, problem awareness related to plastic pollution is high. Nevertheless, plastic production and consumption is constantly increasing. Plastic consumption expresses two sides of a coin: consumers appreciate plastic packaging for its practicability and other benefits, likewise they also experience concern especially related to pollution with waste and microplastic. In the current work, we systematically investigated valence- (Study 1; sample size $[N] = 103$) and risk- (Study 2; $N = 105$) related attitudes towards plastic packaging, plastic waste, and microplastic. Therefore, we measured participants' attitudes implicitly and explicitly. By using single-category implicit association tests, we revealed that packaging and microplastic were automatically evaluated as 'bad' and neutral regarding risk, and waste as 'bad' and 'risky'. Explicit responses in both studies highlighted an overall negative evaluation of all plastic forms. Thereby, packaging was rated as less 'bad', 'unpleasant', 'unpractical', and 'risky' (in general and for the environment) than waste and microplastic. The latter was evaluated as much riskier for human health than packaging and waste. Environmental risk ratings were generally very high. In comparison to other materials (paper, glass, metal), plastic was generally rated as worse and riskier. We conclude that attitudes related to plastic mirror high problem awareness and, therefore, plastic-reduction interventions should support consumers in acting according to their attitudes rather than addressing only awareness and attitude change.

Keywords: plastic; packaging; waste; microplastic; environmental attitudes; risk perception; implicit association test

1 Introduction

Pollution is seen as one of nine planetary boundaries which exceedance will likely bring major adverse environmental changes that make humans' life on earth unsafe (Rockström et al., 2009; Steffen et al., 2015). Especially plastic pollution has drawn much attention throughout the last decades (e.g., Hartley et al., 2018; Heidbreder et al., 2019; Kramm & Völker, 2018). By now, plastic particles were found around the globe, including the deep sea, soil, and human body (e.g., Cunningham et al., 2020; Ragusa et al., 2021; Steinmetz et al., 2016).

Studies from various countries and contexts showed that problem awareness related to plastic and pollution therewith is high (Hartley et al., 2018; Heidbreder et al., 2019). Especially the negative impact of plastic pollution on the environment in general and wildlife in particular were highlighted by both lay people and researchers (Hartley et al., 2018; Li et al., 2016; Pearson et al., 2014). Concerns about adverse impacts on human health arose as well (Chang et al., 2020; Omari et al., 2018; Wright & Kelly, 2017). Despite this high problem awareness, plastic is still produced and used in high numbers (PlasticsEurope, 2019). This discrepancy between problem awareness and behaviour, which is often observed in environmental psychology (Kollmuss & Agyeman, 2002), makes it necessary to further understand related attitudes towards plastic packaging and waste to finally reduce the amount of plastic in the environment by effective interventions. Therefore, we here present research on attitudes towards plastic.

1.1 Literature Review

1.1.1 Factors Influencing the Perception of Plastic

Although media coverage related to plastic is very prominent from time to time (Males & Van Aelst, 2021), the social-scientific investigation of plastic-related behaviour started only recently, yet with a drastic rise (e.g., Heidbreder et al., 2019). Nevertheless, so far, such research is still limited and further studies are needed to effectively reduce plastic consumption and pollution (e.g., Heidbreder et al., 2019; Pahl et al., 2020). Previous social-scientific research mainly focused on either consumer preference regarding packaging characteristics, perceived environmental friendliness of packages, recycling behaviour, or plastic pollution (e.g., Hartley et al., 2018; Heidbreder et al., 2019; Varotto & Spagnoli, 2017).

Several studies showed that plastic-related problem awareness is high (as reviewed by Heidbreder et al., 2019). However, related knowledge seems limited (Afroz et al., 2017; Hammami et al., 2017; but see also Soares et al., 2021). Relatedly, some people fail to see the connection between plastic pollution and their own individual behaviour (Henderson & Green, 2020), although human behaviour is generally acknowledged to be a major contributor to pollution (Hartley et al., 2018).

Plastic is a highly preferred material by both consumers and producers (e.g., Aday & Yener, 2014; Draskovic, 2010; Venter et al., 2011). At the same time it is also perceived as environmentally unfriendly and therefore disadvantageous (e.g., Aday & Yener, 2014; Fernqvist et al., 2015; see also Heidbreder et al., 2019, for a review). In comparison to other materials, plastic is perceived as worse or relatively similar with regard to environmental friendliness (Lindh et al., 2016; Steenis et al., 2017; van Dam, 1996).

When considering the environmental friendliness of a packaging material, people seem to focus on post-consumption states (i.e., recyclability or degradability; Herbes et al., 2018). However, despite evaluating plastic as environmental problematic (Gelcich et al., 2014; Hartley

et al., 2018; Lotze et al., 2018), in everyday life consumers may not primarily think about risks or environmental problems related to plastic waste and/or microplastic when making a consumption decision. Rather, they are in the supermarket, focus on the desired brand and price range, and appreciate plastic's practicability, flexibility, light weight, transparency, and the possibility for re-opening a package (as reviewed by Heidbreder et al., 2019). Such positive evaluations of plastic packaging can be a barrier for plastic-reduced behaviour (Heidbreder et al., 2021).

Despite general preference, perceived risks related to plastic (pollution) are also important to be understood (e.g., Syberg et al., 2018). There is an increasing amount of studies suggesting health hazards caused by plastic particles (Chang et al., 2020; Wright & Kelly, 2017). However, especially the public debate seems biased as these risks might be perceived and communicated as higher than they actually are (Rist et al., 2018; Völker et al., 2020). At the same time, the occurrence, environmental impact, and abundance of microplastic may be also underestimated or seen as small (Anderson et al., 2016; Henderson & Green, 2020).

It is well-known that risk perception is biased (e.g., Rohrman & Renn, 2000). For perceived risks related plastic pollution, Syberg and colleagues (2018) summarized influencing factors, such as control, voluntariness, and knowledge, and thereby indicated some differences between visible plastic waste and microplastic. It is likely that these factors vary in influence and strength for different forms of plastic. For example, consumers (more or less) voluntarily decide for a plastic package, but involuntarily need to handle plastic waste and have no control over microplastic. Furthermore, the need for plastic packaging is much higher than for waste and microplastic. These two examples suggest lower perceived risk related to packaging compared to waste and microplastic.

1.1.2 Complex Relationship with Plastic

The research reviewed above indicated that humans may have a rather complex love-hate relationship with plastic (see also Zwicker et al., 2020). On the one hand, it is appreciated as a packaging material. On the other hand, it is disliked for its risk for the environment and human health. This observation of people perceiving plastic as both positive (e.g., convenient) *and* negative (e.g., environmentally problematic), reflects an ambivalence towards plastic as a material (for more information on ambivalence, see van Harreveld et al., 2009). With regard to plastic packaging, Hahn and colleagues (2021) recently showed that products wrapped in plastic evoked larger ambivalence than similar unpackaged products. Despite this ambivalence found for plastic as a packaging material, we assume that both the complex relationship with plastic in general as well as the discrepancy between problem awareness and plastic-related behaviour may also be due to the fact that respondents and/or researchers refer to different forms or states of plastic when making or requesting evaluations. For example, plastic packages were preferred, because they are perceived as convenient and product-protecting, while plastic waste and microplastic may evoke disfavour, because of their perceived risks for the environment and health. Therefore, we aimed at a systematic investigation of attitudes towards different forms of plastic, namely plastic packaging, plastic waste, and microplastic with regard to valence and risk. These plastic forms refer to significant steps in the life cycle of the material.

1.2 The Current Study

To our knowledge, the field lacks systematic investigations of attitudes towards different forms of plastic. To close this gap, we investigated attitudes towards plastic packaging, plastic waste, and microplastic, because these plastic forms represent the states which consumers are in contact with and which we assumed to be evaluated differently. Plastic packaging is the focused object when making a consumption decision, and therefore appreciating characteristics,

such as practicability, are likely salient. Plastic waste is visible after consumption both at home and in the environment and therefore pollution-related characteristics may be more salient. Although it is hard to detect with plain sight, humans are in contact with microplastic almost everywhere, from opening a product wrapped in plastic to marine pollution including seafood (Sharma & Chatterjee, 2017; Sobhani et al., 2020).

In addition to focussing on specific forms of plastic, an understanding of potential differences for deliberate and slow responses in comparison to fast and automatic evaluation is helpful to reveal potential sources for the discrepancy between problem awareness and behaviour. Thus, to comprehensively study attitudes towards the specified plastic forms, we used both explicit and implicit measurements, and thereby focused on two evaluation dimensions, namely valence and risk. Implicit measures were already used in an environmental context, for example to measure the risk perception towards nuclear power plants and mobile phone stations (Siegrist et al., 2006). An advantage of implicit measures is that no introspection on the evaluation is necessary as automatic responses were measured (De Houwer et al., 2009; Greenwald et al., 2002, 2009). Thus, responses are less prone to biases which is useful as social desirability may affect responses to environmental topics including plastic (Chirico et al., 2021; Vesely & Klöckner, 2020). Moreover, especially for attitudes and behaviours that diverge, different approaches to assess related attitudes are reasonable.

Our implicit measure of choice was a so-called single-category implicit association test (SC-IATs; Karpinski & Steinman, 2006), which is a specific form of an implicit association test (IAT). Many previous studies used an IAT, which contrasts two categories (e.g., nature vs. urban or black vs. white people; Greenwald et al., 2009; Sanchez et al., 2016). By using a SC-IAT, we were able to assess the evaluations for each plastic form independently without the need of a contrasting category. In such tests, evaluations are assessed indirectly, by measuring reaction times in a categorization task (see below for a detailed description).

In sum, our work aimed to fill the research gap of a systematic assessment of attitudes towards different plastic forms. Thereby, we intended to answer the following research question: How are three forms of plastic (packaging, waste, microplastic) evaluated explicitly and implicitly in relation to valence and risk? Our preregistered main hypothesis was that plastic packaging is explicitly and implicitly perceived as more positive (Study 1) and less risky (Study 2) compared to plastic waste and microplastic, and that microplastic is perceived as riskier than plastic waste (Study 2). Despite these general attitudes, we also assessed valence and risk evaluations of the three plastic forms in comparison to other materials, namely paper, glass, and metal (Study 1 and 2), and also to other risks, namely climate change, corona, and pesticides (Study 2). We assumed that plastic would be perceived as worse and riskier than paper and glass, but not metal (Peters-Teixeira & Badrie, 2005). Furthermore, we hypothesized that plastic is perceived as similarly risky as pesticides (Omari et al., 2018). For exploratory reasons we also asked to compare perceived risk with climate change and corona, as these are current threats.

To avoid repeated participation and to ensure similar sample characteristics in both studies, we collected data in parallel. Therefore, participants from a larger pool were randomly assigned to one of the studies (i.e., Study 1 with a focus on valence and Study 2 with a focus on risk). Both studies were conducted in accordance with the Declaration of Helsinki and approved by the local ethics committee of the University of Koblenz-Landau, Campus Landau, Germany (LEK-2020_263). Before data collection, we pre-registered the two studies together on AsPredicted.org (<https://aspredicted.org/nb7xy.pdf>).

2 Study 1: Valence

2.1 Methods

2.1.1 Participants and a-priori power analyses

Using G*Power (version 3.1.9.2; Faul et al., 2009), we calculated two a-priori power analyses to determine an appropriate sample size for detecting medium-to-small effects with a 1×3 repeated-measures ANOVA ($f = 0.15$; power = 0.8) to compare the three plastic forms, and with a one-sample t-test ($d = 0.3$; power = 0.8) to determine whether a given D-Score - the outcome variable of the SC-IAT that indicates the association strength (Greenwald et al., 2003; Karpinski & Steinman, 2006) - is different from zero. We chose medium-to-small effect sizes as a compromise between feasibility and the assumption of relatively high variance due to the online setup, while lacking comparable studies offering assumed effect sizes. Based on our two analyses, we intended a total sample size of at least 90 participants (and further 90 participants for Study 2).

Participants were recruited via university email lists, social media, and flyer at university facilities. In total, 212 participants, which were randomly assigned to either Study 1 or 2, finished the online survey. Of them, 105 were part of Study 1. Two participants were excluded because they indicated technical or other problems. Thus, the final sample consisted of 103 people (Table 1). Note that subsamples for the analyses of the SC-IATs were slightly smaller (i.e., 92, 92, and 94 for packaging, waste, and microplastic, respectively), because we applied exclusion criteria as Karpinski and Steinman (2006) for the calculation of D-Scores (see below for more details). All participants gave their informed consent before starting the experiment. For compensation, they had the chance to win one of ten 10€ vouchers in a lottery.

Table 1. Summary of demographics for samples in Study 1 and 2.

		Study 1:	Study 2:
		Valence	Risk
		(<i>N</i> = 103)	(<i>N</i> = 105)
gender	female	72	77
	male	31	28
	mean	30.94	31.29
	median	25	25
	range	18-66	19-77
age	no school degree	0	2
	high-school diploma (10 years)	3	4
	advanced technical certificate	3	4
	A-levels	46	47
	University degree	47	45
country	Other	4	3
	Germany	103	96
	Other	0	9

Note. *N* = sample size

2.1.2 Design and General Procedure

The study was conducted online using SoSci Survey (Leiner, 2021) between August 10th and September 30th, 2020. It was indicated during advertising and also checked when accessing the study link that the study cannot be completed from a smartphone or tablet. After giving their informed consent, participants were introduced to the SC-IAT task. For all participants the order of the three SC-IATs was identical: 1) plastic packaging, 2) plastic waste, and 3) microplastic (Figure 1). We decided for a fixed order to represent the life cycle of plastic and to ensure that participants recognize the microplastic stimuli as such. After completing the SC-IATs, we

asked the participants to explicitly state their attitudes towards plastic and other materials, namely paper, glass, and metal (see below for more details). We decided against instructing to ignore the other plastic forms when making ratings to avoid unintended thoughts about these other plastic forms (Wegner, 1994). At the end, we gave them the opportunity to watch a video and check on a petition related to plastic (see below). Finally, we collected demographical data of the participants.

Figure 1. General procedure (top row) for Study 1 and example trials for a plastic packaging SC-IAT (bottom row). Participants were asked to press the corresponding key (left: ‘E’, right: ‘I’) for the given stimulus (picture or word). Note that size of text and stimuli is not to scale. For further information, see main text. Example images were (from left to right) from colourbox.de, [RitaE on pixabay](http://RitaE.pixabay.com), and [washuugenius on creativecommons.org](http://washuugenius.creativecommons.org).

2.1.3 SC-IAT

2.1.3.1 *Stimuli*

Images were searched online based on the criteria of online use, appropriateness for the current work, and good recognizability of either plastic packaging, plastic waste, or microplastic, while avoiding the depiction of specific brands. Noteworthy, to ensure recognizability some microplastic images depict also plastic items larger than 5mm, and therefore they deviate from the most-often used threshold to define microplastic (e.g., Chang et al., 2020; Cunningham et al., 2020). All stimuli can be found in Supplement 1 (Tables S1-S3) in the Supplemental Material.

Word stimuli were selected to fit to the respective attribute and were based on previous research (Menzel & Reese, 2021; Sanchez et al., 2016). Words for the ‘good’ attribute were (for original German words, see Table S4 in Supplement 1): peace, joy, love, freedom, health, happiness, friend, fun, hope, tenderness. Words for the ‘bad’ attribute were: war, violence, abuse, spitefulness, despair, hopelessness, illness, poverty, hell, poison.

2.1.3.2 *Procedure of each SC-IAT*

Setup and procedure of a given SC-IAT were based on Karpinski and Steinman (2006) and realized in SoSci-Survey (Leiner, 2021). First, participants were introduced to the stimuli (words and images) and task, namely responding to words and images with the indicated keys (“E” and “I”) as “accurate and fast as possible”. Thereby we informed them about the correct assignments to the categories and keys in a given block: Participants were asked to respond to images always with the key for ‘plastic packaging’ (or ‘plastic waste’ / ‘microplastic’, depending on SC-IAT), to bad words (e.g., ‘poverty’) with the key for ‘bad’, and to good words (e.g., ‘peace’) with the key for ‘good’. Therefore, we provided feedback on accuracy (green ‘o’ for correct, red ‘x’ for incorrect, and [in German] ‘please respond faster’ when they responded

after 1500 ms after stimulus onset). Each stimulus was presented centrally (Figure 1) and disappeared as soon as a response was recorded. We asked participants to respond as fast and accurate as possible. The procedure of stimulus presentation was based on Karpinski and Steinman (2006). In a given block, a similar number of items from all active categories was shown. All stimuli were presented in random order within a given block, while subsequent repetition of a given stimulus was avoided.

For each of the three SC-IATs (one for each plastic form), participants completed two blocks with 96 trials each. Thereby, each block included 24 training trials which were excluded for the analyses. In one of the blocks, participants were asked to respond to a presented image with the same key as to positive words, and in the other with the same key as for negative words (Figure 1). The setting of the first block (whether ‘good’ or ‘bad’ was paired with ‘plastic packaging’) was randomized across participants. Based on the response times in the two blocks, we were able to assess association strengths between the images and the two attributes (e.g., ‘good’ and ‘bad’). For these assessments we used so-called D-Scores, which were automatically calculated within SoSci-Survey and were based on the procedure suggested by Karpinski and Steinman (2006). In brief, participants who had more than 20% erroneous trials were excluded (this explains the discrepancy between the subsamples for the SC-IATs and the total sample of $N = 103$). For the remaining participants, trials with response times shorter than 350 ms or longer than 1500 ms were excluded. Furthermore, response times of erroneous trials were substituted with the mean response time plus 400 ms of all valid trials within a given block. For these cleaned data, the difference of the mean response times for the two blocks were calculated and divided by the standard deviation of all valid response times. The resulting value is the D-Score. The sign of the D-Score was inverted for those participants who had the ‘plastic packaging’ key paired with the ‘bad’ key during the first block. Thus, in all cases a positive D-Score indicates an association of a given plastic form with ‘good’, while a negative D-Score indicates an association with ‘bad’. These D-Scores entered the statistical analyses.

2.1.4 Questionnaires and Further Materials

2.1.4.1 *Explicit Items on Valence*

To assess attitudes towards plastic, we asked participants the following questions:

- “How good or bad do you find the following forms of plastic?” on a 5-point scale from 1 = ‘bad’ to 5 = ‘good’
- “How pleasant or unpleasant do you find the following forms of plastic?” on a 5-point scale from 1 = ‘unpleasant’ to 5 = ‘pleasant’.
- “How practical do you find the following forms of plastic?” on a 5-point scale from 1 = ‘not practical’ to 5 = ‘practical’.

2.1.4.2 *Material Comparison*

For the comparison to other materials, we asked versions of the following question for each plastic form, comparison material, and evaluation dimension: „How [good, pleasant, practical] or [bad, unpleasant, unpractical] do you find the following forms of plastic in comparison to the material [paper, glass, metal]?” on a 5-point scale from 1 = ‘much worse’/‘much more unpleasant’/‘much more unpractical’ to 5 = ‘much better’/‘much more pleasant’/‘much more practical’. One specific item following a given version of this question was, for example, “In comparison to glass particles I find microplastic ...”). All questions and items can be found in Supplement 2.

2.1.4.3 *Further Measures*

As a measurement for further interest on the topic, we invited participants to watch a short (i.e., 2m 04s) video with the title “Wie kommt Plastik ins Meer?” [How does plastic get into the ocean?] by a German public TV station (Bayrischer Rundfunk), in which various sources and pathways of marine plastic waste (including microplastic) were described. We recorded whether a participant indicated interest in visiting the external site to watch this video.

As a measurement for related behaviour, we provided participants an invitation to visit a petition on change.org. This petition was on reducing marine plastic pollution by various policy measures related to (plastic) packaging- Our invitation included the title of the petition (“Unsere Ozeane sind keine Müllkippe! Endlich Schluss mit unnötigen Einwegverpackungen!” [Our oceans are no dumping ground! Finally end unnecessary disposable packages!]). We recorded whether a participant indicated interest in visiting the petition page. On average, participants took 16 min 36 sec ($SD = 3$ min 43 sec) to complete the entire study.

2.1.5 Data Analyses

For each dependent variable, we calculated 1×3 repeated measures ANOVAs to compare evaluations for the three plastic forms. Post-hoc tests were Bonferroni-corrected. Dependent variables were D-Scores, ratings on ‘good’, ‘pleasant’, and ‘practical’, and respective comparisons to other materials. To test whether a given D-Score is different from zero, we calculated one-sample t-tests against zero. Similarly, we also calculated one-sample t-tests against three (the midpoint of the scale, which stands for ‘equal’) to test whether plastic is perceived as worse or better than a given alternative material. Furthermore, we calculated Pearson correlations between D-Scores and explicit ‘good’-‘bad’-ratings and thereby applied Bonferroni-Holm corrections for p-values. To assess the predictive value of D-Scores and ‘good’-‘bad’-ratings for the interest in the video or petition, we calculated logistic regressions thereby also applied Bonferroni-Holm corrections for p-values. All statistical analyses were conducted in R (version 4.0.3) using the interface RStudio (version 1.4.1103). All tests were two-tailed with an alpha of 0.05.

2.2 Results

2.2.1 Implicitly Measured Attitudes

The randomization of key pairing (i.e., whether plastic image was paired with ‘good’ or ‘bad’ during the first block) did not affect D-Scores (see Table S6 in Supplement 3). Plastic packaging ($M = -0.303$, $SD = 0.404$, $t[91] = -7.18$, $p < 0.001$, $d = 0.75$), plastic waste ($M = -0.278$, $SD = 0.376$, $t[91] = -7.10$, $p < 0.001$, $d = 0.74$) and microplastic were associated with ‘bad’ ($M = -0.171$, $SD = 0.345$, $t[93] = -4.80$, $p < 0.001$, $d = 0.49$; Figure 2). Repeated measures ANOVA revealed a significant difference between D-Scores of the three plastic forms ($F[2,172] = 6.45$, $p = 0.003$, $\eta_p^2 = 0.07$). Post-hoc tests revealed that the D-Score for microplastic was higher (i.e. closer to zero) than for packaging ($p = 0.008$) and waste ($p = 0.014$; Figure 2), indicating that packaging and waste were associated more with ‘bad’ than microplastic.

Figure 2. Results of implicitly (A) and explicitly (B, C, D) measured attitudes towards all three plastic forms in Study 1. (A) represents boxplot with D-Scores (line represents median). A positive D-Score indicates an association with ‘good’, while a negative D-Score indicates an association with ‘bad’. High ratings represent ‘good’ (B), ‘pleasant’ (C), or ‘practical’ (D). Error bars in B, C and D represent standard error. *** $p \leq 0.001$, ** $p \leq 0.01$, * $p \leq 0.05$.

2.2.2 Explicitly Measured Attitudes

On the item ‘How good or bad do you find the following forms of plastic?’, plastic packaging was rated as more positive than plastic waste and microplastic ($F[2, 204] = 38.07, p < 0.001, \eta_p^2 = 0.27$; post-hoc $ps < 0.001$; Table 3, Figure 2). Similarly, on the item ‘How pleasant or unpleasant do you find the following forms of plastic?’, plastic packaging was rated as more positive than plastic waste and microplastic ($F[2, 204] = 43.51, p < 0.001, \eta_p^2 = 0.30$; post-hoc $ps < 0.001$; Table 3). Relatedly, on the item ‘How practical or unpractical do you find the following forms of plastic?’, plastic packaging was rated as more positive than plastic waste and microplastic ($F[2, 204] = 138.26, p < 0.001, \eta_p^2 = 0.58$; post-hoc $ps < 0.001$; Table 3).

In comparison with other materials, plastic packaging, waste and microplastic were generally perceived as worse, more unpleasant, and more unpractical than similar forms of paper, glass, or metal (please see Supplement 3 for more information).

D-Scores and explicit ratings on how good or bad a plastic form is perceived did not correlate (packaging: $r = -0.10$; waste: $r = 0.09$; microplastic: $r = 0.12$; all Bonferroni-Holm corrected $ps = 0.697$; exclusion of outliers did not change the pattern).

Table 3. Mean (M) and standard deviation (SD) for explicit ratings in Study 1. Repeated-measures ANOVA with respective post-hoc tests confirmed higher ratings for packaging on all three items (see main text).

	Packaging	Waste	Microplastic
bad - good	$M = 2.01, SD = 0.87$	$M = 1.37, SD = 0.66$	$M = 1.36, SD = 0.80$
unpleasant - pleasant	$M = 2.26, SD = 1.04$	$M = 1.43, SD = 0.69$	$M = 1.48, SD = 0.80$
unpractical - practical	$M = 3.32, SD = 1.06$	$M = 1.74, SD = 0.96$	$M = 1.54, SD = 0.94$

2.2.3 Further Measures

The majority of participants ($n = 64$) refused further information, while $n = 39$ selected at least one option (video and/or petition). Eleven indicated wanting to get information on both, twenty-two indicated to view the petition only, six indicated to watch the video only. There was no predictive value of D-Scores or explicit ratings on indicated interest (Supplement 3).

2.3 Discussion

Our assumption of more positive evaluations for plastic packaging compared to waste and microplastic was only true for the explicit but not the implicit measures: Explicitly measured, plastic packaging was rated as less negative (bad, unpleasant, and unpractical) than waste or microplastic. Implicitly measured, all three plastic forms were associated with ‘bad’, but this association was stronger for plastic packaging and waste compared to microplastic. The discrepancy between explicitly and implicitly measured attitudes was also reflected in non-significant correlations for the two kinds of measurements.

The implicitly measured evaluations of plastic packages cannot be biased by the assessment of the other plastic forms as the SC-IAT on plastic packaging was the first part in the current study. Therefore, the automatically assessed negative evaluation is assumed to be valid. However, the pattern of results when comparing all three plastic forms might be due to waste and microplastic being not as negatively assessed as assumed. Especially when the very low/negative explicit ratings were considered and descriptively compared to the D-Scores which are - despite being significantly below zero - relatively small considering the possible range of +2 to -2.

In comparison to other materials, plastic was generally perceived as worse, less pleasant, and less practical. This is true even for the comparison with metal, which was rated as worse than plastic in previous studies (Peters-Teixeira & Badrie, 2005). This discrepancy to previous

work might be due to increased problem awareness and media coverage related to plastic during the last years (Heidbreder et al., 2019; Kramm & Völker, 2018; Völker et al., 2020). Relatedly, this might also explain the finding that even for practicability, the ratings for plastic packaging were lower than for the other materials, although convenience and practicability were often-mentioned reasons for choosing plastic (e.g., Aday & Yener, 2014; Sun et al., 2017). The current results and their limitations as well as implications were further discussed in the general discussion.

3 Study 2: Risk

3.1 Methods

3.1.1 Participants and A-Priori Power Analyses

Sample size was determined as in Study 1. Participants were recruited in parallel to Study 1 and as described above. In total, 107 participants were part of this study, but two declined using their data for analyses after they received information about the aim of the study. Therefore, the final sample was 105 participants. Information about the final sample can be found in Table 1. Note that, as in Study 1, subsamples for the SC-IAT were lower due to further exclusion criteria for the respective analyses (i.e., 84, 88, and 84 for packaging, waste, and microplastic respectively).

3.1.2 Design and General Procedure

The general design and procedure was similar as in Study 1. Explicit rating terms were general risk, health risk, and environmental risk (see below for the exact items). In addition, participants were also asked to rate the risk of plastic packaging, plastic waste, and microplastic in comparison to other threats, namely climate change, pesticides, and corona.

3.1.3 SC-IAT

The SC-IATs were conducted and analysed as in Study 1. They only differed in the attribute dimensions ('risky' and 'safe') and word stimuli as follows. Words were selected based on previous research (Siegrist et al., 2006; Traczyk & Zaleskiewicz, 2016) and their fit into the respective categories. Words of the 'risky' attribute were (for the original German words, see Table S5 in Supplement 1): threat, concern, speculation, venture, unsafety, danger, doubt, error, suspicion, unpredictability. Words of the 'safe' attribute were: certainty, innocuousness, trust, reliability, protection, stability, harmlessness, guarantee, predictability, controllability.

3.1.4 Questionnaires and Further Materials

3.1.4.1 Explicit Items on Risk

Participants were asked the following question to rate different types of risk for each form of plastic: "How high or low do you rate the [general risk, health risk, environmental risk] of the following forms of plastic?" on a 5-point scale from 1 = 'very low' to 5 = 'very high'.

3.1.4.2 Material Comparison

For the comparison to other materials, we asked the following question for each form of plastic and comparison material: "How risky do you find the following forms of plastic compared to the material [paper, glass, metal]?" on a 5-point scale from 1 = 'much less risky' to 5 = 'much riskier'.

3.1.4.3 Threat Comparison

Similarly, for the comparison to other threats, participants were asked the following question for each form of plastic and comparison threat: "How risky do you find the following forms of plastic compared to [corona, climate change, pesticides]?" on a 5-point scale from 1

= ‘much less risky’ to 5 = ‘much riskier’. One specific item was, for example, “In comparison to pesticides I find microplastic ...”. All questions and items can be found in Supplement 4.

3.1.4.4 Further Measures

As in Study 1, the participants were invited to watch a video and/or visit a petition. On average, participants took 16 min 22 sec ($SD = 4$ min 27 sec) to complete the entire study.

3.1.5 Data Analyses

Data were analysed as in Study 1. Additionally, the comparisons of threats were analysed with one-sample t-tests against three (the midpoint of the scale, which stands for ‘equal’).

3.2 Results

3.2.1 Implicitly Measured Attitudes

The randomization of key pairing (i.e., whether plastic image was paired with ‘safe’ or ‘risky’ during the first block) did not affect D-Scores (see Table S8 in Supplement 5). While the D-scores for plastic packaging ($M = -0.026$, $SD = 0.414$, $t[83] = -0.58$, $p = 0.564$, $d = 0.06$) and microplastic ($M = -0.021$, $SD = 0.339$, $t[83] = -0.56$, $p = 0.574$, $d = 0.06$) were not different from zero, plastic waste was associated with ‘risky’ ($M = -0.124$, $SD = 0.339$, $t[87] = -3.42$, $p < 0.001$, $d = 0.36$; Figure 3). Repeated measures ANOVA revealed a significant difference between D-Scores of the three plastic forms ($F[2,152] = 3.60$, $p = 0.030$, $\eta_p^2 = 0.05$). Post-hoc tests revealed that the D-Score for waste was lower than for microplastic ($p = 0.033$; Figure 3).

Figure 3. Results of implicitly (A) and explicitly (B, C, D) measured attitudes towards all three plastic forms in Study 2. A represents boxplot with D-Scores (line represents median). (A) positive D-Score indicates an association with ‘safe’, while a negative D-Score indicates an association with ‘risky’. Ratings represent how risky in general (B), for health (C), or for the environment (D) a given plastic form is perceived; higher ratings indicate higher risk. Error bars in B, C, and D represent standard error. *** $p \leq 0.001$, ** $p \leq 0.01$, * $p \leq 0.05$.

3.2.2 Explicitly Measured Attitudes

The plastic forms were perceived differently with regard to general risk ($F[2, 208] = 26.46$, $p < 0.001$, $\eta_p^2 = 0.20$; Table 5, Figure 3). Post-hoc tests revealed that microplastic was perceived as riskier than plastic packaging ($p < 0.001$) and waste ($p = 0.006$), and that waste was perceived as riskier than packaging ($p < 0.001$). Regarding health, the plastic forms were perceived as differently risky ($F[2, 208] = 79.60$, $p < 0.001$, $\eta_p^2 = 0.43$). This effect was driven by microplastic, which was perceived as much riskier than plastic packaging ($p < 0.001$) and plastic waste ($p < 0.001$). With regard to environmental risk, the plastic forms were perceived differently ($F[2, 208] = 16.12$, $p < 0.001$, $\eta_p^2 = 0.13$). Post-hoc tests revealed that both plastic waste ($p < 0.001$) and microplastic ($p < 0.001$) were perceived as riskier than plastic packaging.

Table 5. Mean (M) and standard deviation (SD) of explicit ratings in Study 2.

	Packaging	Waste	Microplastic
general risk	$M = 4.06, SD = 0.90$	$M = 4.39, SD = 0.73$	$M = 4.62, SD = 0.79$
health risk	$M = 3.58, SD = 1.04$	$M = 3.75, SD = 0.94$	$M = 4.62, SD = 0.56$
environmental risk	$M = 4.44, SD = 0.77$	$M = 4.70, SD = 0.61$	$M = 4.79, SD = 0.49$

Detailed information on the results for the comparison of plastic with other materials and other threats can be found in Supplement 3. In brief, plastic packaging, waste, and microplastic were perceived as riskier than paper, glass, and metal. Plastic packaging was perceived as similarly risky as corona, less risky than climate change, and riskier than pesticides. Plastic waste was perceived as similarly risky as corona, climate change, and pesticides. Microplastic was perceived as riskier than corona and pesticides, but similarly risky as climate change.

Explicit ratings for general risk did not correlate with D-Scores (packaging: $r = 0.08, p = 0.969$; waste: $r = 0.14, p = 0.566$; microplastic: $r = 0.05, p = 0.969$). Similarly, explicit ratings for health risk did not correlate with D-Scores (packaging: $r = -0.07, p = 1$; waste: $r = 0.07, p = 1$; microplastic: $r = 0.04, p = 1$), neither did ratings for environmental risk (packaging: $r = -0.002, p = 1$; waste: $r = 0.06, p = 1$; microplastic: $r = 0.04, p = 1$). The same pattern was true when outliers were removed.

3.2.3 Further Measures

The majority of participants ($n = 65$) refused further information, while 40 selected at least one option (video and/or petition). Of them, 16 indicated wanting to get information on both, 18 indicated to view the petition only, six indicated to watch the video only. There was no predictive value of D-Scores or explicit ratings on indicated interest (Supplement 5).

3.3 Discussion

We expected higher risk ratings for plastic waste compared to plastic packaging. We confirmed this assumption for explicitly measured general and environmental risk. For implicitly measured risk, packaging and waste were evaluated similarly and only the D-Score for waste was significantly below zero, indicating an association with ‘risky’. Similarly, explicit ratings for health risks were similar for packaging and waste. In the explicit ratings, microplastic received the highest ratings, representing that it was perceived as riskier than the other plastic forms. In the SC-IAT, however, microplastic was perceived as *safer* than plastic waste. This contradiction may be rooted in one or several of the following issues. First, our SC-IAT or its stimuli may be limited. Second, our participants have not (yet) implemented microplastic-related risks into their automatic evaluation. Third the implicitly measured response pattern is less biased from public discussions than the explicitly one and reflects the de facto lower environmental threat of microplastic compared to plastic waste (Völker et al., 2020).

Noteworthy, all three D-Scores were relatively small and close to zero, indicating either low validity of the risk SC-IAT, ambivalent associations, or weak attitudes. In comparison to Study 1, SC-IATs on risk might have been slightly harder than those on valence, because words were longer ($M_{Study\ 1} = 7.7$, $M_{Study\ 2} = 10.7$, $t[38] = -2.70$, $p = 0.010$, $d = 0.85$; noteworthy, they were similarly frequent in the German language; Supplement 6). This is indicated by a slightly higher participant dropout due to high error numbers in Study 2 compared to Study 1 (e.g., for packaging: 20 % vs. 10.7 %). However, when comparing these dropout numbers to previous research (e.g., Karpinski & Steinman, 2006; dropout of 9 from 66 participants [i.e., 13.6 %] in their study 2), we can assume that our dropout was not extraordinarily high, indicating a general feasibility of the current SC-IAT. Noteworthy, however, in Study 2 the dropout led to a slightly smaller sample than was suggested in the a-priori power analysis to detect a small-to-medium effect.

In sum, risk was assessed differently for the three plastic forms. Based on the explicit ratings, we assume that microplastic was perceived as riskiest, followed by waste, and then packaging. However, the SC-IAT results were not in line with this pattern. This discrepancy between implicitly and explicitly measured evaluations was - as in Study 1 - represented by non-significant correlations between the measures. The lack of correlations left the question unanswered which risk (general, health, or environmental) participants referred to when they completed the SC-IAT. Overall, the results for the explicit ratings are more in line with our hypotheses and therefore seem more valid than the results of the SC-IATs.

In comparison to other materials, plastic was perceived as riskier than paper, glass, and metal. Thereby the ratings were similar for all states of the material, except for waste which was considered as riskier than particles when plastic was compared with glass. This indicates that glass particles were not seen as problematic as microplastic. Surprisingly, plastic was not perceived as safer than metal, although this was found previously (Peters-Teixeira & Badrie, 2005). Similarly, plastic packaging was perceived as riskier than pesticides, contrasting earlier research (Omari et al., 2018). As also discussed in Study 1, this might be due to increased media coverage during the last decade (e.g., Völker et al., 2020).

In comparison to other threats, the overall pattern indicated that microplastic was perceived as riskier than corona and pesticides, while packaging was perceived as less risky than the presented threats (except pesticides). Ratings for waste were generally in the middle and similar to the other threats. These findings were further integrated and discussed below.

4 General Discussion

This work's aim was to systematically examine valence- and risk-related evaluations of different plastic forms. The results showed that overall they were rated as relatively 'bad', 'unpleasant', and 'unpractical', as well as 'risky' for both the environment and human health.

Implicit tests partly confirmed this, although explicit and implicit responses did not correlate. As expected, explicit ratings indicated that plastic packaging was evaluated as less negative than the other plastic forms. This more positive evaluation for packaging was also mirrored in lower general and environmental risk ratings, albeit ratings were overall relatively high (i.e., ‘risky’). This pattern is in line with the known relationship between positive affect and lower risk (i.e., so-called ‘affect heuristic’, Finucane et al., 2000). All plastic forms, but especially microplastic, were explicitly rated as risky for both the environment and human health. In sum, the explicit responses generally support our hypotheses that packaging was perceived as more positive and less risky than the other plastic forms, and that microplastic was perceived as riskier than plastic waste. Unexpectedly, however, this pattern was not found with the implicit measure.

Surprisingly, implicit evaluations for microplastic were less negative than for plastic waste (Study 1 and 2) and plastic packaging (Study 1). As indicated above that may be caused by the stimuli or the characteristics and impact of microplastic. As we see no obvious reason for a limited validity of our microplastic stimuli compared to the images of the other categories, we assume the latter explanation as more likely. Maybe microplastic-associated risk is not (yet) automatically integrated as it can be seen as an relatively new and unknown risk (Kramm & Völker, 2018; Syberg et al., 2018).

With the use of another implicit measure (a so-called MouseTracker paradigm), ambivalence in an explicit decision between plastic-packaged or unpackaged food was measured previously: the former was rated as more negative and evoked a more ambivalent evaluation process compared to the latter (Hahn et al., 2021). Our study results from the SC-IATs - esp. in Study 2 - may indicate ambivalence or weak attitudes, as D-Scores were less distinct than the explicit ratings. When assuming social desirability at play, it is possible that the discrepancy between the rather ambivalent or weak attitude measured by the SC-IAT (esp. for packaging in Study 2) and the strong explicitly stated evaluation (partly) explains the

discrepancy between problem awareness and consumption behaviour in everyday life. A similar observation and assumption was made previously in a different context (Lautenbach & Antoniewicz, 2018). However, in contrast to their study, we found no significant correlations between explicit and implicit measures. Albeit surprising, it is not uncommon that these measures do not or only weakly correlate (as summarized by Hofmann et al., 2005). In our case, it might be caused by the fact that we used images for the implicit measure while focussing on words (i.e., plastic packaging, plastic waste, and microplastic) for the explicit measures. Therefore, the associations evoked by the attitude objects might be slightly different and more abstract for the explicit ratings, perhaps evoking more negative evaluations.

Together with previous findings (e.g., Hahn et al., 2021; Heidbreder et al., 2019; Zwicker et al., 2020), our results confirm humans' complex relationship with plastic. This complexity and ambivalence could be addressed by interventions that focus especially on the gap between the consumption of packages and pollution (e.g., Pahl et al., 2017) and/or guilt associated with it (Zwicker et al., 2020). The rather negative evaluation of all plastic forms, also in comparison to other materials (Study 1 and 2), indicates that people have not only high problem awareness regarding plastic pollution (Hartley et al., 2018), but dislike plastic packaging as well, despite neutral practicability ratings (Study 1). However, the high usage numbers indicate that - despite these negative evaluations and high problem awareness - consumers use plastic against their attitudes and lower preference compared to other materials (Study 1; Supplement 3). This likely leads to negative feelings evoked by this dissonance between attitudes and behaviour (Festinger, 1957; Zwicker et al., 2020). We assume that especially habits and low perceived behavioural control hinder plastic reduced behaviour, as was suggested previously (Heidbreder et al., 2021; Heidbreder et al., 2020). Relatedly, the majority of participants in both studies refused further information on plastic, indicating that improving plastic-related knowledge is not perceived necessary (at least when it means to invest some time). In comparison to the video, more participants indicated interest for the petition, suggesting that there is higher

willingness for supporting policy measures to reduce plastic packaging rather than receiving more information on the topic. Relatedly, Twitter data on a plastic reduction campaign (#plasticfreejuly) also points in the direction of solution-focussed rather than problem-focussed communication strategies (Heidbreder et al., 2021). Similarly, research in environmental psychology repeatedly showed that attitudes and problem awareness are only two out of many factors predicting pro-environmental behaviours (for a meta-analysis, see Klöckner, 2013). Social norms, breaking habits, and perceived behavioural control are important to close the gap between attitudes and behaviours (e.g., Heidbreder et al., 2021; Heidbreder et al., 2020; Klöckner, 2013). Therefore, interventions should not only focus on attitudes but rather on acting in line with them (e.g., by making pro-environmental social norms salient or helping to establish new habits).

The current study showed that our participants have no intense love-hate relationship with plastic - rather they significantly disliked all plastic forms to various degrees. Although plastic packaging was generally seen not as bad and risky compared to plastic waste and microplastic, its evaluations were negative too. Together with previous research, the current work emphasizes that attitudes related to plastic are negative (Study 1), problem awareness and risk perception are high (e.g., Hartley et al., 2018; Study 2), and many people already try or effectively reduce their plastic consumption (Barbir et al., 2021). Interventions should therefore help consumers to act according to their attitudes by, for example, communicating and providing appropriate alternatives and options for their disposal (e.g., bio-based and fully degradable materials; Haider et al., 2019) and/or banning or taxing certain products (e.g., Sharp et al., 2010; Thomas et al., 2019). Thereby researchers of related disciplines should work together to create effective measures, alternatives, and/or interventions (e.g., Haider et al., 2019; Heidbreder et al., 2019; Pahl et al., 2017). Research on plastic bag bans as well as the COVID-19 pandemic showed that under certain circumstances people can accept even drastic policy decisions (e.g., Dohle et

al., 2020; Sharp et al., 2010), which can be a motivator for further actions to tackle global crises (Reese et al., 2020).

4.1.1 Limitations

As stated earlier, we decided against instructing to ignore the other plastic forms when making explicit ratings. This prevented unintended thoughts about these other plastic forms (Wegner, 1994). However, it is still possible that ratings of a particular form of plastic was biased by associations with other plastic forms.

Our images used in the SC-IATs depict not only plastic items but also context information (e.g., food products, bins, environment). This information might have biased the response time in the SC-IATs. However, this context information reflects frequent occurrences of these plastic forms and ensured recognizability. Additionally, the plastic packaging images depict rather unnecessary packaging perhaps leading to more negative evaluations compared to other types of packages. Noteworthy, this kind of packaging is easiest to reduce for consumers and therefore especially interesting when studying individual behaviour.

One may argue that in our research risk may be equivalent to negative valence, while safety may relate to positive valence. However, the different patterns of results for both the implicit and explicit measures suggest that the valence and risk represent different constructs and evoke different responses.

The generalizability of our results is limited by our mainly German, rather young, and highly educated sample (Table 1). Noteworthy, preference and risk perception related to plastic can depend also on context, education, or cultural background (as reviewed by Heidbreder et al., 2019) which were not specifically considered here. For example, attitudes and behaviours to avoid plastic or littering are associated with higher education and/or income levels (Afroz et al., 2017; Madigele et al., 2017; Rayon-Viña et al., 2018). Moreover, younger people seem more aware of packaging characteristics (Draskovic et al., 2009; Elgaaïed-Gambier, 2016),

although the field lacks systematic studies regarding age effects. Furthermore, gender is also known to be related to environmental attitudes and behaviour (Gifford & Nilsson, 2014), and therefore the (environmental risk) perception of our female-biased sample might be slightly different than for the general public. In general, the sample characteristics indicate that our participants might have been more aware and more willing to reduce plastic than the general public. Nevertheless, as we focussed on the relative comparison of plastic types rather than absolute concern, these limitations have rather little impact on the general conclusions.

Obviously, our study is a snapshot of the current time, which is characterized by many crises. Despite plastic pollution and potential health effects of plastic products, humankind currently faces the climate crisis and the COVID-19 pandemic which both can trigger anxiety (Clayton & Karazsia, 2020; Petzold et al., 2020). In comparison to such crises, only microplastic was perceived as riskier than corona. Plastic waste and microplastic were evaluated as similarly risky as climate change, emphasizing the (perceived and actual) urgency to tackle the global plastic problem.

5 Conclusions

Our studies showed that the investigated plastic forms were evaluated differently both for valence and risk, but the responses mirrored relatively high concern - even for packaging. This was also highlighted by the comparisons to other materials and threats. Previous findings and the current data, therefore, suggest that informational campaigns on how bad or risky plastic is are likely not effective as attitudes towards plastic are already negative. Thus, our findings emphasize that consumers need help from producers and policy makers to act according to their attitudes.

6 References

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Supplemental Material to Menzel, Brom, Heidbreder (2021): Explicitly and Implicitly Measured Valence and Risk Attitudes Towards Plastic Packaging, Plastic Waste, and Microplastic in a German Sample (<https://doi.org/10.1016/j.spc.2021.08.016>)

Supplement 1: SC-IAT stimuli

Table S1. Image stimuli used in plastic packaging SC-IATs in Study 1 and Study 2. We square-cropped the original images.

Plastic packaging

Photo from colourbox.de
(#15599715)

Photo from colourbox.de
(#7395040)

Photo from nist6ss on
creativecommons.org (CC BY-SA
2.0 license)

Phot by Damien DUFOUR
Photographie on Unsplash

Photo from colourbox.de
(#18117184)

Photo from colourbox.de
(#6768557)

Photo from colourbox.de
(#13124702)

Table S2. Image stimuli used in plastic waste SC-IATs in Study 1 and Study 2. We square-cropped the original images.

Plastic waste

Photo by tanvi sharma on unsplash	Photo by Jasmin Sessler on unsplash	Photo by RitaE on pixabay

Photo by Hans on pixabay	Photo from colourbox.de (#41898337)	Photo by Public Domain Photos on creativecommons.org (CC BY 2.0 license)

Photo by Capri23auto on pixabay		

Table S3. Image stimuli used in microplastic SC-IATs in Study 1 and Study 2. We square-cropped the original images.

Microplastic

Photo by Chesapeake Bay Program on flickr (CC BY-NC 2.0 licence)	Photo by Wolfram Burner on flickr (CC BY-NC 2.0 licence)	Photo by MPCA Photos on flickr (CC BY-NC 2.0 licence)

Photo by Oregon State University on creativecommons.org (CC BY-SA 2.0 license)	Photo by washuugenius on creativecommons.org (CC BY-NC-SA 2.0 license)	Photo by Chesapeake Bay Program on flickr (CC BY-NC 2.0 licence)

Photo by NOAA Marine Debris Program on flickr (CC BY 2.0)		

Table S4. Words (in German) used as attribute stimuli in SC-IATs in Study 1.

good (gut)	bad (schlecht)
peace (Frieden)	war (Krieg)
joy (Freude)	violence (Gewalt)
love (Liebe)	abuse (Missbrauch)
freedom (Freiheit)	spitefulness (Gehässigkeit)
health (Gesundheit)	despair (Verzweiflung)
happiness (Glück)	hopelessness (Ausweglosigkeit)
friend (Freund)	illness (Krankheit)
fun (Spaß)	poverty (Armut)
hope (Hoffnung)	hell (Hölle)
tenderness (Zärtlichkeit)	poison (Gift)

Table S5. Words (in German) used as attribute stimuli in SC-IATs in Study 2.

safe (sicher)	risky (riskant)
certainty (Gewissheit)	threat (Gefährdung)
innocuousness (Unschädlichkeit)	concern (Bedenken)
trust (Vertrauen)	speculation (Spekulation)
reliability (Zuverlässigkeit)	venture (Wagnis)
protection (Schutz)	unsafety (Unsicherheit)
stability (Stabilität)	danger (Bedrohung)
harmlessness (Harmlosigkeit)	doubt (Zweifel)
guarantee (Garantie)	error (Irrtum)
predictability (Vorhersagbarkeit)	suspicion (Verdacht)
controllability (Kontrollierbarkeit)	unpredictability (Unberechenbarkeit)

Supplement 2: Questionnaire items in German (English) for Study 1

"Wie gut oder schlecht finden Sie folgende Plastikformen?" (How good or bad do you find the following forms of plastic?)

- Plastikverpackungen (plastic packaging)
- Plastikmüll (plastic waste)
- Mikroplastik (microplastic)

scale:

- 1 = schlecht (bad)
- 2 = eher schlecht (rather bad)
- 3 = teils teils (partly)
- 4 = eher gut (rather good)
- 5 = gut (good)

"Wie angenehm oder unangenehm finden Sie folgende Plastikformen?" (How pleasant or unpleasant do you find the following forms of plastic?)

- Plastikverpackungen (plastic packaging)
- Plastikmüll (plastic waste)
- Mikroplastik (microplastic)

scale:

- 1 = unangenehm (unpleasant)
- 2 = eher unangenehm (rather unpleasant)
- 3 = teils teils (partly)
- 4 = eher angenehm (rather pleasant)
- 5 = angenehm (pleasant)

"Wie praktikabel finden Sie folgende Plastikformen?" (How practical do you find the following forms of plastic?)

- Plastikverpackungen (plastic packaging)
- Plastikmüll (plastic waste)
- Mikroplastik (microplastic)

scale:

- 1 = nicht praktikabel (not practical)
- 2 = eher nicht praktikabel (rather not practical)
- 3 = teils teils (partly)
- 4 = eher praktikabel (rather practical)
- 5 = praktikabel (practical)

"Wie gut oder schlecht finden Sie die folgenden Plastikformen im Vergleich zum Material Papier?" (How good or bad do you find the following forms of plastic compared to the material paper?)

- Im Vergleich zu Papierverpackungen finde ich Plastikverpackungen... (In comparison to paper packaging I find plastic packaging ...)
- Im Vergleich zu Papiermüll finde ich Plastikmüll... (In comparison to paper waste I find plastic waste ...)
- Im Vergleich zu Papierteilchen finde ich Mikroplastik... (In comparison to paper particles I find microplastic ...)

scale:

- 1 = viel schlechter (much worse)
- 2 = eher schlechter (rather worse)
- 3 = gleich (equal)
- 4 = eher besser (rather better)
- 5 = viel besser (much better)

"Wie gut oder schlecht finden Sie die folgenden Plastikformen im Vergleich zum Material Glas?" (How good or bad do you find the following forms of plastic compared to the material glass?)

- Im Vergleich zu Glasverpackungen finde ich Plastikverpackungen... (In comparison to glass packaging I find plastic packaging ...)
- Im Vergleich zu Glasmüll finde ich Plastikmüll... (In comparison to glass waste I find plastic waste ...)

- Im Vergleich zu Glasteilchen finde ich Mikroplastik... (In comparison to glass particles I find microplastic ...)

scale:

- 1 = viel schlechter (much worse)
- 2 = eher schlechter (rather worse)
- 3 = gleich (equal)
- 4 = eher besser (rather better)
- 5 = viel besser (much better)

"Wie gut oder schlecht finden Sie die folgenden Plastikformen im Vergleich zum Material Metall?" (How good or bad do you find the following forms of plastic compared to the material metal?)

- Im Vergleich zu Metallverpackungen (z.B. Konserven) finde ich Plastikverpackungen... (In comparison to metal packaging (e.g., cans) I find plastic packaging ...)
- Im Vergleich zu Metallmüll finde ich Plastikmüll... (In comparison to metal waste I find plastic waste ...)
- Im Vergleich zu Metallteilchen finde ich Mikroplastik... (In comparison to metal particles I find microplastic ...)

scale:

- 1 = viel schlechter (much worse)
- 2 = eher schlechter (rather worse)
- 3 = gleich (equal)
- 4 = eher besser (rather better)
- 5 = viel besser (much better)

"Wie angenehm oder unangenehm finden Sie die folgenden Plastikformen im Vergleich zum Material Papier?" (How pleasant or unpleasant do you find the following forms of plastic in comparison to the material paper?)

- Im Vergleich zu Papierverpackungen finde ich Plastikverpackungen... (In comparison to paper packaging I find plastic packaging ...)
- Im Vergleich zu Papiermüll finde ich Plastikmüll... (In comparison to paper waste I find plastic waste ...)
- Im Vergleich zu Papierteilchen finde ich Mikroplastik... (In comparison to paper particles I find microplastic ...)

scale:

- 1 = viel unangenehmer (very unpleasant)
- 2 = eher unangenehmer (rather unpleasant)
- 3 = gleich (equal)
- 4 = eher angenehm (rather pleasant)
- 5 = viel angenehmer (very pleasant)

"Wie angenehm oder unangenehm finden Sie die folgenden Plastikformen im Vergleich zum Material Glas?" (How pleasant or unpleasant do you find the following forms of plastic in comparison to the material glass?)

- Im Vergleich zu Glasverpackungen finde ich Plastikverpackungen... (In comparison to glass packaging I find plastic packaging ...)
- Im Vergleich zu Glasmüll finde ich Plastikmüll... (In comparison to glass waste I find plastic waste ...)
- Im Vergleich zu Glasteilchen finde ich Mikroplastik... (In comparison to glass particles I find microplastic ...)

scale:

- 1 = viel unangenehmer (very unpleasant)
- 2 = eher unangenehmer (rather unpleasant)
- 3 = gleich (equal)
- 4 = eher angenehm (rather pleasant)
- 5 = viel angenehmer (very pleasant)

"Wie angenehm oder unangenehm finden Sie die folgenden Plastikformen im Vergleich zum Material Metall?" (How pleasant or unpleasant do you find the following forms of plastic in comparison to the material metal?)

- Im Vergleich zu Metallverpackungen (z.B. Konserven) finde ich Plastikverpackungen... (In comparison to metal packaging (e.g., cans) I find plastic packaging ...)

- Im Vergleich zu Metallmüll finde ich Plastikmüll... (In comparison to metal waste I find plastic waste ...)
- Im Vergleich zu Metallteilchen finde ich Mikroplastik... (In comparison to metal particles I find microplastic ...)

scale:

- 1 = viel unangenehmer (very unpleasant)
- 2 = eher unangenehmer (rather unpleasant)
- 3 = gleich (equal)
- 4 = eher angenehm (rather pleasant)
- 5 = viel angenehmer (very pleasant)

"Wie praktikabel finden Sie die folgenden Plastikformen im Vergleich zum Material Papier?" (How practical do you find the following forms of plastic in comparison to the material paper?)

- Im Vergleich zu Papierverpackungen finde ich Plastikverpackungen... (In comparison to paper packaging I find plastic packaging ...)
- Im Vergleich zu Papiermüll finde ich Plastikmüll... (In comparison to paper waste I find plastic waste ...)
- Im Vergleich zu Papierteilchen finde ich Mikroplastik... (In comparison to paper particles I find microplastic ...)

scale:

- 1 = viel weniger praktikabel (much less practical)
- 2 = eher weniger praktikabel (rather less practical)
- 3 = gleich (equal)
- 4 = eher praktikabler (rather practical)
- 5 = viel angenehmer (very pleasant)

"Wie praktikabel finden Sie die folgenden Plastikformen im Vergleich zum Material Glas?" (How practical do you find the following forms of plastic in comparison to the material glass?)

- Im Vergleich zu Glasverpackungen finde ich Plastikverpackungen... (In comparison to glass packaging I find plastic packaging ...)
- Im Vergleich zu Glasmüll finde ich Plastikmüll... (In comparison to glass waste I find plastic waste ...)
- Im Vergleich zu Glasteilchen finde ich Mikroplastik... (In comparison to glass particles I find microplastic ...)

scale:

- 1 = viel weniger praktikabel (much less practical)
- 2 = eher weniger praktikabel (rather less practical)
- 3 = gleich (equal)
- 4 = eher praktikabler (rather practical)
- 5 = viel angenehmer (very pleasant)

"Wie praktikabel finden Sie die folgenden Plastikformen im Vergleich zum Material Metall?" (How practical do you find the following forms of plastic in comparison to the material metal?)

- Im Vergleich zu Metallverpackungen (z.B. Konserven) finde ich Plastikverpackungen... (In comparison to metal packaging (e.g., cans) I find plastic packaging ...)
- Im Vergleich zu Metallmüll finde ich Plastikmüll... (In comparison to metal waste I find plastic waste ...)
- Im Vergleich zu Metallteilchen finde ich Mikroplastik... (In comparison to metal particles I find microplastic ...)

scale:

- 1 = viel weniger praktikabel (much less practical)
- 2 = eher weniger praktikabel (rather less practical)
- 3 = gleich (equal)
- 4 = eher praktikabler (rather practical)
- 5 = viel angenehmer (very pleasant)

Supplement 3: Further results for Study 1

Results of comparison between SC-Versions in Study 1

Table S6. Mean (*M*), standard deviation (*SD*), and comparison (independent t-test) of D-Scores for the two SC-IAT versions (response key for plastic image paired with good or bad during the first block).

plastic form	first paired with good	first paired with bad	<i>df</i>	<i>t</i>	<i>p</i>
plastic packaging	<i>M</i> = -0.36, <i>SD</i> = 0.45	<i>M</i> = -0.25, <i>SD</i> = 0.35	90	-1.27	.208
plastic waste	<i>M</i> = -0.32, <i>SD</i> = 0.40	<i>M</i> = -0.24, <i>SD</i> = 0.35	90	-0.95	.345
microplastic	<i>M</i> = -0.15, <i>SD</i> = 0.38	<i>M</i> = -0.19, <i>SD</i> = 0.31	92	0.45	.655

Results of comparison with other materials in Study 1

In comparison to paper, plastic packaging ($t[102] = -13.86, p < .001, d = 1.37$), plastic waste ($t[102] = -20.42, p < .001, d = 2.01$), and microplastic ($t[102] = -24.02, p < .001, d = 2.37$) were perceived as worse, and thereby the ratings were lowest for plastic waste and microplastic compared to plastic packaging ($F[2, 204] = 22.87, p < .001, \eta_p^2 = .18$; post-hoc p 's $< .001$; Table S4). Similarly, plastic packaging ($t[102] = -12.70, p < .001, d = 1.25$), plastic waste ($t[102] = -26.69, p < .001, d = 2.63$), and microplastic ($t[102] = -23.13, p < .001, d = 2.28$) were perceived as less pleasant than paper, and thereby the ratings were lowest for plastic waste and microplastic compared to plastic packaging ($F[2, 204] = 37.81, p < .001, \eta_p^2 = .27$; post-hoc p 's $< .001$; Table S4). Plastic packaging and paper packaging were perceived as similarly practical ($t[102] = -1.51, p = .135, d = 0.15$), while plastic waste ($t[102] = -17.84, p < .001, d = 1.76$) and microplastic ($t[102] = -18.97, p < .001, d = 1.87$) were perceived as less practical compared to paper (Table S4). In comparison to paper, plastic waste and microplastic were perceived as less practical compared to plastic packaging ($F[2, 204] = 95.77, p < .001, \eta_p^2 = .48$; post-hoc p 's $< .001$; Table S4).

In comparison to glass, plastic packaging ($t[102] = -13.50, p < .001, d = 1.33$), plastic waste ($t[102] = -10.81, p < .001, d = 1.06$), and microplastic ($t[102] = -9.92, p < .001, d = 0.98$) were perceived as worse, and thereby ratings were similar for all plastic forms ($F[2, 204] = 0.58, p = .548, \eta_p^2 = .01$; Table S4). Similarly, plastic packaging ($t[102] = -11.19, p < .001, d = 1.10$), plastic waste ($t[102] = -13.97, p < .001, d = 1.38$), and microplastic ($t[102] = -10.20, p < .001, d = 1.00$) were perceived as less pleasant than glass, and thereby ratings were similar for all plastic forms ($F[2, 204] = 1.94, p = .151, \eta_p^2 = .02$; Table S4). Relatedly, plastic packaging ($t[102] = -2.29, p = .024, d = 0.23$), plastic waste ($t[102] = -8.39, p < .001, d = 0.83$), and microplastic ($t[102] = -12.18, p < .001, d = 1.20$) were perceived as less practical than glass, and thereby the ratings for the plastic forms differed significantly ($F[2, 204] = 26.60, p < .001, \eta_p^2 = .21$; Table S4). Post-hoc tests revealed that, in comparison to glass, microplastic is seen as less practical than packaging ($p < .001$) and waste ($p = .019$), and plastic waste as less practical than plastic packaging ($p < .001$).

In comparison to metal, plastic packaging ($t[102] = -4.69, p < .001, d = 0.46$), plastic waste ($t[102] = -5.52, p < .001, d = 0.54$), and microplastic ($t[102] = -6.64, p < .001, d = 0.65$) were perceived as worse, and thereby ratings seem to be slightly different ($F[2, 204] = 3.44, p = .039, \eta_p^2 = .03$; post-hoc tests were non-significant, however; Table S4). Similarly, plastic packaging ($t[102] = -5.87, p < .001, d = 0.58$), plastic waste ($t[102] = -7.02, p < .001, d = 0.69$), and microplastic ($t[102] = -6.98, p < .001, d = 0.69$) were perceived as less pleasant than metal, and thereby ratings seem to be slightly different ($F[2, 204] = 3.70, p = .031, \eta_p^2 = .04$; post-hoc tests were non-significant, however; Table S4). Relatedly, plastic packaging ($t[102] = -2.13, p = .035, d = 0.21$), plastic waste ($t[102] = -6.49, p < .001, d = 0.64$), and microplastic ($t[102] = -10.20, p < .001, d = 1.00$) were perceived as less practical than metal, and thereby the ratings for the plastic forms differed significantly ($F[2, 204] = 32.58, p < .001, \eta_p^2 = .24$; Table S4). Post-hoc tests revealed that, in comparison to glass, microplastic is seen as less practical than packaging and waste, and plastic waste as less practical than plastic packaging (all post-hoc p 's $< .001$).

Table S7. Mean (*M*) and standard deviation (*SD*) for items comparing plastic packaging, plastic waste, and microplastic with respective forms of other materials in Study 1. Scale mean of 3 indicated that plastic was perceived as similar as the other material.

Comparison material	Dimension	Packaging	Waste	Microplastic
Paper	bad - good	<i>M</i> = 1.87, <i>SD</i> = 0.82	<i>M</i> = 1.40, <i>SD</i> = 0.80	<i>M</i> = 1.27, <i>SD</i> = 0.73
	unpleasant - pleasant	<i>M</i> = 1.86, <i>SD</i> = 0.91	<i>M</i> = 1.36, <i>SD</i> = 0.62	<i>M</i> = 1.33, <i>SD</i> = 0.73
	unpractical - practical	<i>M</i> = 2.83, <i>SD</i> = 1.11	<i>M</i> = 1.57, <i>SD</i> = 0.81	<i>M</i> = 1.46, <i>SD</i> = 0.83
Glass	bad - good	<i>M</i> = 1.83, <i>SD</i> = 0.88	<i>M</i> = 1.86, <i>SD</i> = 1.07	<i>M</i> = 1.94, <i>SD</i> = 1.08
	unpleasant - pleasant	<i>M</i> = 1.97, <i>SD</i> = 0.93	<i>M</i> = 1.79, <i>SD</i> = 0.88	<i>M</i> = 1.89, <i>SD</i> = 1.10
	unpractical - practical	<i>M</i> = 2.73, <i>SD</i> = 1.21	<i>M</i> = 2.12, <i>SD</i> = 1.07	<i>M</i> = 1.80, <i>SD</i> = 1.00
Metal	bad - good	<i>M</i> = 2.55, <i>SD</i> = 0.97	<i>M</i> = 2.50, <i>SD</i> = 0.93	<i>M</i> = 2.36, <i>SD</i> = 0.98
	unpleasant - pleasant	<i>M</i> = 2.50, <i>SD</i> = 0.87	<i>M</i> = 2.38, <i>SD</i> = 0.90	<i>M</i> = 2.27, <i>SD</i> = 1.06
	unpractical - practical	<i>M</i> = 2.79, <i>SD</i> = 1.02	<i>M</i> = 2.38, <i>SD</i> = 0.97	<i>M</i> = 2.06, <i>SD</i> = 0.94

Logistic regressions for interest in video and/or petition (Study 1)

We coded refusing any more information (video and petition) as 0 and indicating interest in at least one option as 1 and entered these values in individual logistic regressions. P-values are Bonferroni-Holm corrected.

D-Score plastic packaging: $\beta = -0.85, p = .468$

D-Score plastic waste: $\beta = -1.17, p = .298$

D-Score microplastic: $\beta = -1.32, p = .298$

bad-good rating plastic packaging: $\beta = 0.31, p = .546$

bad-good rating plastic waste: $\beta = -0.49, p = .546$

bad-good rating microplastic: $\beta = -0.29, p = .546$

Supplement 4: Questionnaire items in German (English) for Study 2

"Wie hoch oder niedrig schätzen Sie das Risiko der folgenden Plastikformen im Allgemeinen ein?" (How high or low do you rate the general risk of the following forms of plastic?)

- Plastikverpackungen (plastic packaging)
- Plastikmüll (plastic waste)
- Mikroplastik (microplastic)

scale:

- 1 = sehr niedrig (very low)
- 2 = eher niedrig (rather low)
- 3 = teils teils (partly)
- 4 = eher hoch (rather high)
- 5 = sehr hoch (very high)

"Wie hoch oder niedrig schätzen Sie für den Menschen das gesundheitliche Risiko der folgenden Plastikformen ein?" (How high or low do you rate the health risk of the following forms of plastic?)

- Plastikverpackungen (plastic packaging)
- Plastikmüll (plastic waste)
- Mikroplastik (microplastic)

scale:

- 1 = sehr niedrig (very low)
- 2 = eher niedrig (rather low)
- 3 = teils teils (partly)
- 4 = eher hoch (rather high)
- 5 = sehr hoch (very high)

"Wie hoch oder niedrig schätzen Sie das Umweltrisiko der folgenden Plastikformen ein?" (How high or low do you rate the environmental risk of the following forms of plastic?)

- Plastikverpackungen (plastic packaging)
- Plastikmüll (plastic waste)
- Mikroplastik (microplastic)

scale:

- 1 = sehr niedrig (very low)
- 2 = eher niedrig (rather low)
- 3 = teils teils (partly)
- 4 = eher hoch (rather high)
- 5 = sehr hoch (very high)

"Wie riskant finden Sie die folgenden Plastikformen im Vergleich zum Material Papier?" (How risky do you find the following forms of plastic compared to the material paper?)

- Im Vergleich zu Papierverpackungen, finde ich Plastikverpackungen... (In comparison to glass packaging I find plastic packaging...)
- Im Vergleich zu Papiermüll, finde ich Plastikmüll... (In comparison to paper waste I find plastic waste...)
- Im Vergleich zu Papierteilchen, finde ich Mikroplastik... (In comparison to paper particles I find microplastic...)

scale:

- 1 = viel weniger riskant (much less risky)
- 2 = etwas weniger riskant (somewhat less risky)
- 3 = gleich (equal)
- 4 = etwas riskanter (somewhat riskier)
- 5 = viel riskanter (much riskier)

"Wie riskant finden Sie die folgenden Plastikformen im Vergleich zum Material Glass?" (How risky do you find the following forms of plastic compared to the material glass?)

- Im Vergleich zu Glasverpackungen, finde ich Plastikverpackungen... (In comparison to glass packaging I find plastic packaging...)
- Im Vergleich zu Glasmüll, finde ich Plastikmüll... (In comparison to glass waste I find plastic waste...)
- Im Vergleich zu Glasteilchen, finde ich Mikroplastik... (In comparison to glass particles I find microplastic...)

scale:

- 1 = viel weniger riskant (much less risky)
- 2 = etwas weniger riskant (somewhat less risky)
- 3 = gleich (equal)
- 4 = etwas riskanter (somewhat riskier)
- 5 = viel riskanter (much riskier)

"Wie riskant finden Sie die folgenden Plastikformen im Vergleich zum Material Metall?" (How risky do you find the following forms of plastic compared to the material metal?)

- Im Vergleich zu Metallverpackungen (z.B. Konserven), finde ich Plastikverpackungen... (In comparison to metal packaging (e.g., cans) I find plastic packaging...)
- Im Vergleich zu Metallmüll, finde ich Plastikmüll... (In comparison to metal waste I find plastic waste...)

- Im Vergleich zu Metallteilchen, finde ich Mikroplastik... (In comparison to metal particles I find microplastic...)

scale:

- 1 = viel weniger riskant (much less risky)
- 2 = etwas weniger riskant (somewhat less risky)
- 3 = gleich (equal)
- 4 = etwas riskanter (somewhat riskier)
- 5 = viel riskanter (much riskier)

"Wie riskant finden Sie die folgenden Plastikformen im Vergleich zum Risiko durch Corona?" (How risky do you find the following forms of plastic compared to corona?)

- Im Vergleich zu Corona, finde ich Plastikverpackungen... (In comparison to corona I find plastic packaging...)
- Im Vergleich zu Corona, finde ich Plastikmüll... (In comparison to corona I find plastic waste...)
- Im Vergleich zu Corona, finde ich Mikroplastik... (In comparison to corona I find microplastic...)

scale:

- 1 = viel weniger riskant (much less risky)
- 2 = etwas weniger riskant (somewhat less risky)
- 3 = gleich (equal)
- 4 = etwas riskanter (somewhat riskier)
- 5 = viel riskanter (much riskier)

"Wie riskant finden Sie die folgenden Plastikformen im Vergleich zum Risiko durch den Klimawandel?" (How risky do you find the following forms of plastic compared to climate change?)

- Im Vergleich zum Klimawandel, finde ich Plastikverpackungen... (In comparison to climate change I find plastic packaging...)
- Im Vergleich zum Klimawandel, finde ich Plastikmüll... (In comparison to climate change I find plastic waste...)
- Im Vergleich zum Klimawandel, finde ich Mikroplastik... (In comparison to climate change I find microplastic...)

scale:

- 1 = viel weniger riskant (much less risky)
- 2 = etwas weniger riskant (somewhat less risky)
- 3 = gleich (equal)
- 4 = etwas riskanter (somewhat riskier)
- 5 = viel riskanter (much riskier)

"Wie riskant finden Sie die folgenden Plastikformen im Vergleich zum Risiko durch Pestizide?" (How risky do you find the following forms of plastic compared to pesticides?)

- Im Vergleich zu Pestiziden, finde ich Plastikverpackungen... (In comparison to pesticides I find plastic packaging...)
- Im Vergleich zu Pestiziden, finde ich Plastikmüll... (In comparison to pesticides I find plastic waste...)
- Im Vergleich zu Pestiziden, finde ich Mikroplastik... (In comparison to pesticides I find microplastic...)

scale:

- 1 = viel weniger riskant (much less risky)
- 2 = etwas weniger riskant (somewhat less risky)
- 3 = gleich (equal)
- 4 = etwas riskanter (somewhat riskier)
- 5 = viel riskanter (much riskier)

Supplement 5: Further results for Study 2

Results of comparison between SC-Versions in Study 2

Table S8. Mean (*M*), standard deviation (*SD*), and comparison (independent t-test) of D-Scores for the two SC-IAT versions (response key for plastic image paired with safe or risky during the first block).

plastic form	first paired with safe	first paired with risky	<i>df</i>	<i>t</i>	<i>p</i>
plastic packaging	<i>M</i> = -0.09, <i>SD</i> = 0.44	<i>M</i> = 0.04, <i>SD</i> = 0.38	82	-1.35	.181
plastic waste	<i>M</i> = -0.15, <i>SD</i> = 0.34	<i>M</i> = -0.10, <i>SD</i> = 0.34	88	-0.69	.489
microplastic	<i>M</i> = -0.06, <i>SD</i> = 0.27	<i>M</i> = -0.02, <i>SD</i> = 0.40	82	-1.09	.277

Results of comparison with other materials in Study 2.

Plastic was perceived as riskier than paper (packaging: $t[104] = 19.67, p < .001, d = 1.92$; waste: $t[104] = 19.28, p < .001, d = 1.88$; microplastic: $t[104] = 20.75, p < .001, d = 2.02$). Thereby the ratings were similar for the three forms ($F[2, 208] = 1.15, p = .317, \eta_p^2 = .01$; Table S5). Plastic was perceived as riskier than glass (packaging: $t[104] = 15.42, p < .001, d = 1.51$; waste: $t[104] = 17.07, p < .001, d = 1.67$; microplastic: $t[104] = 11.69, p < .001, d = 1.14$). Thereby, the plastic forms were rated rather similarly ($F[2, 208] = 3.76, p = .061, \eta_p^2 = .03$). Plastic was perceived as riskier than metal (packaging: $t[104] = 8.91, p < .001, d = 0.87$; waste: $t[104] = 9.69, p < .001, d = 0.95$; microplastic: $t[104] = 8.25, p < .001, d = 0.80$). Thereby the ratings were similar for the three forms ($F[2, 208] = 0.89, p = .403, \eta_p^2 = .01$).

Table S9. Mean (*M*) and standard deviation (*SD*) of ratings in comparison to other materials (Study 2).

	Packaging	Waste	Microplastic
paper	<i>M</i> = 4.57, <i>SD</i> = 0.82	<i>M</i> = 4.60, <i>SD</i> = 0.85	<i>M</i> = 4.66, <i>SD</i> = 0.82
glass	<i>M</i> = 4.35, <i>SD</i> = 0.90	<i>M</i> = 4.37, <i>SD</i> = 0.82	<i>M</i> = 4.18, <i>SD</i> = 1.04
metal	<i>M</i> = 3.69, <i>SD</i> = 0.79	<i>M</i> = 3.73, <i>SD</i> = 0.78	<i>M</i> = 3.78, <i>SD</i> = 0.97

Results of comparison with other risks in Study 2.

In comparison to corona, only microplastic is perceived as riskier ($t[104] = 2.45, p = .016, d = 0.24$), while the packaging ($t[104] = -0.68, p = .497, d = 0.07$) and waste ($t[104] = 1.10, p = .274, d = 0.11$) were perceived as risky as corona. Thereby, the ratings were different for the three plastic forms ($F[2, 208] = 19.57, p < .001, \eta_p^2 = .16$; Table S6). Post-hoc tests revealed that packages received lower ratings than waste ($p > .001$) and microplastic ($p < .001$), and waste lower ratings than microplastic ($p = .015$). In comparison to climate change, plastic packaging was perceived as less risky ($t[104] = -3.43, p < .001, d = 0.33$), while there was neither a difference for waste ($t[104] = -1.58, p = .116, d = 0.15$) or microplastic ($t[104] = 0, p = 1, d = 0$). Thereby, the ratings differed between the plastic forms ($F[2, 208] = 12.52, p < .001, \eta_p^2 = .11$; Table S6). Post-hoc tests revealed that ratings for packaging were lower than for waste ($p = .021$) and microplastic ($p < .001$), but rather similar for waste and microplastic ($p = .084$). In comparison to pesticides, packaging and microplastic were perceived as riskier (packaging: $t[104] = -2.02, p = .046, d = 0.20$; microplastic: $t[104] = 3.44, p < .001, d = 0.34$), while waste ($t[104] = 0.36, p = .720, d = 0.04$) was perceived as similarly risky. Thereby, the ratings were different for the three plastic forms ($F[2, 208] = 21.36, p < .001, \eta_p^2 = .17$; Table S6). Post-hoc tests revealed that packages received lower ratings than waste ($p = .006$) and microplastic ($p < .001$), and waste lower ratings than microplastic ($p < .001$).

Table S10. Mean (M) and standard deviation (SD) of ratings in comparison to other threats (Study 2).

	Packaging	Waste	Microplastic
corona	$M = 2.90, SD = 1.43$	$M = 3.15, SD = 1.42$	$M = 3.35, SD = 1.47$
climate change	$M = 2.67, SD = 1.00$	$M = 2.86, SD = 0.92$	$M = 3.00, SD = 0.95$
pesticides	$M = 2.82, SD = 0.92$	$M = 3.03, SD = 0.81$	$M = 3.29, SD = 0.85$

Logistic regressions for interest in video and/or petition (Study 2)

We coded refusing any more information (video and petition) as 0 and indicating interest in at least one option as 1 and entered these values in individual logistic regressions. P-values are Bonferroni-Holm corrected.

D-Score plastic packaging: $\beta = -0.74, p = .909$

D-Score plastic waste: $\beta = -0.48, p = .909$

D-Score microplastic: $\beta = -0.71, p = .909$

general risk rating plastic packaging: $\beta = 0.25, p = .909$

general risk rating plastic waste: $\beta = 0.45, p = .844$

general risk rating microplastic: $\beta = 0.39, p = .909$

Supplement 6: Calculation of word frequencies in the German language

We used a German website that searches German texts with 46,843,422 sentences from 2018 to determine the rank a given word reaches within the texts (i.e., larger rank numbers indicate lower frequency in the texts): Abteilung Automatische Sprachverarbeitung, Universität Leipzig. (2021). Leipzig Corpora Collection—Wortschatz German. https://corpora.uni-leipzig.de/de?corpusId=deu_newscrawl-public_2018#

Frequencies (i.e., ranks) were not different between Study 1 and Study 2 ($M_{Study 1} = 29845.40, M_{Study 2} = 58606.95, t[37] = -0.88, p = .384, d = 0.28$)