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Adding Breadth and Nuance to the Study of Recycling Perceptions: Development the Multidimensional Negative Perceptions of Recycling Scale

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Abstract

Perceptions remain central in many models and theories applied to understand recycling behaviors; however, researchers often assess specific perceptions in isolation or administer multiple measures of perceptions together without support for their simultaneous application, causing uncertainty regarding the true effects of relevant perceptions on recycling behaviors. A preferred approach would be to assess each distinct and relevant perception associated with recycling behaviors via a supported multidimensional measure, which could add appropriate breadth and nuance to relevant models and theories with assurances for the validity of findings. To resolve this tension, the current article reports the development of the Negative Perceptions of Recycling Scale (NPRS). Via a five-study process, we provide robust support that the NPRS produces appropriate psychometric and validity evidence. In our discussion, we reflect upon how its dimensions can advance relevant theory. The NPRS can provide a more accurate

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understanding of how unique perceptions can cause people to perform—or not to perform—recycling behaviors.

Keywords
psychology, attitudes, perception, pro-environmental behavior, recycling, quantitative research, survey research, structural equation modeling, environmental psychology

The average person in the United States generates about five pounds of household trash (i.e., municipal solid waste) per day, resulting in the generation of almost 300 million tons of trash per year in the United States alone (EPA, 2023). Most of this trash is sent to landfills, which poses well-known environmental and public health concerns (Siddiqua et al., 2022; Vasarhelyi, 2021). Even more concerning, much of this trash never makes it to a landfill, and it instead produces devastating impacts by polluting natural resources (Horton, 2022; MacLeod et al., 2021). A primary solution to these concerns is household recycling, which is the process of collecting, preparing, and sending waste materials from home to be reprocessed into new products. Household recycling is an environmentally friendly approach to prevent trash from appearing in landfills or becoming pollution (Awaja & Pavel, 2005; Reck & Graedel, 2012; Shen & Worrell, 2024). Unfortunately, only about one-third of all trash is recycled (EPA, 2023). Many people do not recycle, and those that do often fail to recycle most household trash (World Economic Forum, 2021). Due to these concerns, researchers have continuously sought effective interventions to promote recycling behaviors, stemming from primary research on the predictors of household recycling (Cheung et al., 2018; Gainforth et al., 2016; Largo-Wight et al., 2013).

Researchers have applied increasingly nuanced models developed from theories of behavioral decision-making to understand recycling behaviors (Oliver et al., 2021; Phulwani et al., 2020; Tchetchik et al., 2021). Across these models and theories, perceptions remain a central element,[1] which is also the focus of the present article. For example, the theory of planned behavior proposes that perceptions about the behavior (i.e., cognitive component of attitudes), others (i.e., subjective norms), and context (i.e., perceived behavioral control) each relate to behavioral intentions and ultimately behaviors (Ajzen, 1991, 2020). Further iterations of the theory have been developed that include "background factors" (Ajzen, 2020, p. 318) as predictors of these perceptions or moderators that influence the relations of

these perceptions (Montano & Kasprzyk, 2015; Yadav & Pathak, 2017; Yuriev et al., 2020); however, across modern developments and revisions, perceptions remain a central focus and primary predictors of intent and behaviors. The widespread integration of perceptions in models of decision-making and recycling behaviors is, in part, due to their sizable predictive ability. Perceptions have been repeatedly shown to predict behaviors beyond other relevant constructs (Ajzen, 2020; Ajzen et al., 2018; Glasman & Albarracín, 2006; Kim & Hunter, 1993; Sheeran et al., 2016), showing the clear importance of perceptions in understanding behaviors generally and recycling specifically.

Despite the known importance of perceptions in understanding recycling behaviors, several tensions are evident in the current literature. Authors have increasingly recognized that perceptions are more nuanced than often treated in research (Ajzen et al., 2018; Howard, 2022; Wuttke et al., 2020; Zhang & Laroche, 2020). Relevant models and theories often include a relatively small number of perceptions, sometimes including only one or two perceptual constructs. People can have several different—and even conflicting—perceptions about the same behavior (Sidique et al., 2010; Tonglet et al., 2004; Wan et al., 2012, 2017), suggesting that only including one or two perceptions in relevant models or theories overlooks their dynamic nature and complete predictive abilities. Further, other concerns arise in studies that assess multiple perceptions together. While authors may administer measures that have been supported individually, it cannot be guaranteed that they function adequately when administered together. Unexpected cross-loadings and even factor structures may arise, as it is possible that perceptions believed to be different do not demonstrate sufficient discriminant validity.

We argue that contemporary approaches produce an incomplete and potentially unstable depiction of the role of perception in the recycling decision-making process. When studied in isolation, researchers cannot identify which perceptions produce stronger effects, preventing the development of theory by drawing relative comparisons across the studied perceptions (Gardner, 1996; Reid, 2006). Studying multiple perceptions with measures that have not been supported together may also produce obfuscated observations, as substantial psychometric and validity evidence (as seen in scale development efforts) is infrequently obtained for these measures when applied together (Gardner, 1996; Hendrick et al., 2013; Reid, 2006). Even when psychometric and validity evidence is provided, it is typically identified with unrecommended approaches (e.g., underpowered analyses) (Goretzko et al., 2024; Howard et al., 2025), as this evidence is often a secondary objective to the primary goal of model testing in these studies. Due to

these limitations, prior studies may have regularly produced attenuated or even inaccurate effects, resulting in misinterpretations regarding the relation of perceptions with relevant behaviors—including recycling. This has caused recent authors to call for novel approaches to the study of perceptions (Howard, 2022; Z. Wang et al., 2021; Wuttke et al., 2020; Zhang & Laroche, 2020). Ajzen et al. (2018) specifically recommends developing multidimensional conceptualizations by focusing on outcomes of importance and identifying the primary perceptual determinants, and Puzzo and Prati (2024) make a similar call explicitly for the study of recycling behaviors.

In the current article, we resolve this tension by identifying a multidimensional conceptualization of recycling perceptions, for which we provide an operationalization that produces appropriate psychometric and validity evidence. In doing so, we specifically investigate negative perceptions of recycling.[2] Prior research has supported that negative perceptions are particularly effective at understanding why people do not perform certain behaviors, as negative perceptions more closely relate to the perceived barriers associated with that behavior (Bal et al., 2011; Crosby et al., 2013; Howard, 2022; Robertson & Kenny, 2016). By focusing on negative perceptions, we develop a well-defined and comprehensive conceptualization that can inform modern research on the recycling decision-making process.

In developing this conceptualization, we do not propose an a priori framework or set of dimensions. Extant research has not produced a comprehensive perspective regarding the negative perceptions of recycling, and a systematic effort has not been made to comprehensively identify the prominent negative perceptions of recycling. For this reason, any framework or dimensions developed from extant research alone would have a significant potential of being incomplete, resulting in substantial concerns about construct deficiency. Nevertheless, we do highlight certain perceptions that we expect to emerge in our Theorical Background.

Our first study is a qualitative investigation (Study 1). We ask participants to provide reasons as to why both they and people in general do not recycle, and we thematically code responses to identify emergent dimensions. In doing so, we identify the primary negative perceptions of recycling, resulting in an inductively generated framework. By using this approach, we better ensure that our framework is comprehensive, as we obtain a sizable number of participant responses; but we also ensure that our dimensions reflect the most predominantly expressed perceptions, as we develop our framework from participants themselves rather than prior research or extant theory (Bradley et al., 2007; Douglas, 2003).

Following Study 1, we create an operationalization for our inductively generated framework to develop an over-representative item list. In Study 2,

we reduce this item list via exploratory factor analysis (EFA), providing support for the measure's psychometric properties. In Study 3, we confirm the psychometric properties of the reduced item list via confirmatory factor analysis (CFA), which we henceforth label the Negative Perceptions of Recycling Scale (NPRS). In Studies 4 and 5, we assess the measures' convergent, concurrent, and discriminant validity by testing the relations of the NPRS with other relevant constructs. Study 4 assesses the relations of the NPRS dimensions with the constructs in the theory of planned behavior (Ajzen, 1991, 2020) and certain additions when applied to study recycling (Terry et al., 1999; Tonglet et al., 2004) due to the clear relevance of the theory to perceptions. Study 5 tests the broader nomological net of the NPRS, placing a particular focus on multiple conceptualizations of recycling attitudes due to their close relation to perceptions. Via this process, we provide robust evidence for the psychometric properties and validity of the NPRS, encouraging its application.

From these efforts, the article provides several contributions to research and practice. First, we provide clarity to the study of recycling perceptions, which is among the stronger predictors of recycling behaviors. While prior research may have provided uncertain estimates for the relations of recycling perceptions and behaviors, our investigation enables future researchers to investigate these effects with greater methodological soundness. Second, prior research may have overlooked important dimensions that are associated with theories yet to be applied to study recycling behaviors. By identifying novel dimensions of recycling perceptions, we can provide justifications for future researchers to apply these theories to study recycling behaviors, providing the opportunity to significantly advance theory. Third, by adhering to calls of prior authors (Ajzen et al., 2018), we provide a model for future authors to likewise develop multidimensional conceptualizations of perceptions associated with behaviors of importance. Fourth, as perceptions strongly relate to behaviors, researchers can target our identified perceptions with interventions to increase recycling behaviors. Developing a multidimensional conceptualization of recycling perceptions particularly lends itself to the creation of adaptive interventions, wherein participants can receive intervention components specifically catered to them—increasing intervention efficacy while minimizing resource use.

Theoretical Background

We apply a qualitative methodology to inductively generate dimensions for our measure of negative perceptions about recycling. We do not propose an a priori framework or set of intended dimensions to prevent the creation of an

incomplete measure, but we do discuss perceptions that are pervasive in the current literature. It is reasonable to expect any created measure to include these dimensions, and prior research on these specific perceptions can enable our developed measure to speak towards the extant literature. We specifically discuss perceptions associated with four dominant theoretical perspectives in the study of recycling behaviors: self-efficacy theories, expectancy theory, habit theories, and the theory of planned behavior.

Many authors have supported that the awareness of a behavior is a primary determinant of its performance, and recycling is no different (Babaei et al., 2015; Holt et al., 2023; Puzzo & Prati, 2024). Indeed, people must be aware of how to perform the behavior and/or avenues to ease the performance of a behavior to engage in it. A person will not recycle if they are unaware of any opportunities, and a person may be unlikely to recycle if they believe that bringing waste to a facility is the only opportunity in a location that has curbside pickup unbeknownst to them. Knowledge of recycling behaviors (or lack thereof) has associations with theories of self-efficacy (Bandura, 1982; Lippke, 2020). Low self-efficacy can manifest as feelings of being too unknowledgeable to perform behaviors, resulting in a lack of initiation or persistence. In extant investigations, perceptions of being unknowledgeable of recycling is a common and potent predictor of recycling behaviors (Babaei et al., 2015; Holt et al., 2023; Puzzo & Prati, 2024). Perceptions of being too unknowledgeable about recycling is expected to emerge in our studies.

Expectancy theory has also been applied to understand perceptions of recycling behaviors (Kiatkawsin & Han, 2017; Ramus & Killmer, 2007; Tang et al., 2023). This theory proposes that peoples' perceptions regarding their expectancy (effort leads to performance), instrumentality (performance leads to reward), and valence (value of reward) determine their behavior (Vroom, 2005). Each of these three elements is associated with the perceived necessary effort and the perceived expected reward of performing a behavior, which is also conceptualized as whether the inputs are worth the outputs when judging whether to perform a behavior. In the context of recycling, the necessary effort or inputs are often conceptualized as the perceived inconvenience of performing the behavior, and people are widely known to not recycle if they perceive the behavior as inconvenient (Kiatkawsin & Han, 2017; Ramus & Killmer, 2007; Tang et al., 2023). The expected reward or outputs are often conceptualized as the perceived benefits of performing the behavior, and people are likewise widely known to not recycle if they perceive the benefits as modest (Kiatkawsin & Han, 2017; Ramus & Killmer, 2007; Tang et al., 2023). Therefore, perceptions about the burden of effort (i.e., perceived inconvenience) and the rewards (i.e., perceived benefits) are believed to be common and powerful influences on recycling behaviors.

Additionally, habit theories suggest that people develop automatic cognitive processes to perform certain behaviors, which cause the performance of those behaviors to be less cognitively taxing (and potentially the regulation of those behaviors to be taxing) (Verplanken & Aarts, 1999; Wood & Rünger, 2016). When a habit is developed to recycle, for example, a person is more likely to recycle because they do not perceive it as a difficult behavior to perform—and sometimes they do not cognitively perceive performing the behavior at all (Verplanken & Aarts, 1999; Wood & Rünger, 2016). While habits are behavioral routines and therefore not perceptions, people develop perceptions regarding whether they have developed habits for certain behavioral routines, which is separate from the habit itself. Indeed, people may be less likely to perform a behavior if they perceive that it is not a habit, as they may instead believe that the behavior would be cognitively taxing to perform and/or difficult to maintain. For this reason, perceptions of habit formation may be likely to emerge in our studies, as perceptions about the development of a habit to recycle may be a strong predictor of recycling behaviors.

Lastly, several specific negative perceptions may emerge that are associated with the theory of planned behavior (Ajzen, 1991, 2020), particularly those involving perceived behavioral control. People may perceive a number of external barriers that prevent them from performing recycling behaviors, thereby limiting their control over this behavior. Among the most common and potent may be associated with the waste itself, namely its inability to be recycled (Catlin et al., 2021; Liu et al., 2021). Some household waste must be recycled at specialized facilities. For instance, batteries and motor oil most often must be delivered to specialized facilities to be recycled. Due to these difficulties, some companies have created drop-off locations for customers to deliver this difficult-to-recycle waste, such that it can be transported to the appropriate facilities; however, these locations may not be available to everyone, and bringing waste to these locations incurs a barrier even to those with transportation. Likewise, some waste cannot be recycled altogether. People who particularly rely on these products may be largely unable to recycle their waste. In some cases, the inability to recycle these products may cause people to overestimate the number of products that cannot be recycled, causing the mere perception—even in the absence of actual barriers—to prevent recycling behaviors (Catlin et al., 2021; Liu et al., 2021). Therefore, the perceived inability or inconvenience to recycle certain waste may cause people to refrain from recycling altogether.

It is also likely that people develop negative perceptions about recycling based on their location, which represent another set of perceptions associated with perceived behavioral control (Ajzen, 1991, 2020). Indeed, access to recycling is not universal. Many people do not have the ability to recycle

their household waste (Catlin et al., 2021; Liu et al., 2021), as a recycling facility must be accessible to receive and process the waste. Without access to facilities, people do not have access to recycling. In turn, these people may perceive recycling as impossible due to a lack of access. Even when recycling is available, the associated costs can be prohibitive. Not all recycling facilities are not for profit entities, and they may charge a fee for customers to recycle their waste (Hong & Adams, 1999; Nixon & Saphores, 2007). In these cases, people may perceive recycling as particularly difficult due to associated costs. Lastly, people must have space to store their household waste to recycle. In high-density areas, living arrangements may not provide sufficient space to recycle, thereby serving as another perceptual barrier to recycling. Perceptions of having no access to recycling may emerge as an influential dimension.

In all, these theoretical perspectives suggest a number of dimensions that may emerge for a measure of recycling behaviors, including dimensions associated with self-efficacy theories (unknowledgeable), expectancy theory (inconvenience and few benefits), habit theories (lack of habit), and the theory of planned behavior (inaccessibility, cost, lack of space, and unable to be recycled). In developing our measure, we reference these extant theoretical perspectives to assess whether known perceptions emerge in the generation of our items and dimensions, and we also link our results to these perspectives to directly speak to the extant literature. By doing so, we provide inferences regarding the validity of our emergent items and dimensions, and we more directly specify the impact that our work makes on the present literature. Namely, although these perceptions have been studied in a relatively independent manner, our measure may be necessary to accurately and reliably study these perceptions together.

Empirical Studies

The Institutional Review Board of the primary authors' institution approved all procedures for each study. Each study utilized the online survey methodology. No written informed consent was obtained. Participants' signatures would have been the only identifying information, and not obtaining these signatures maximized the confidentiality and anonymity of the study. Instead, participants were shown an information sheet with the study information, including risks and benefits, and they were asked to click a button to proceed and indicate their willingness to participate. We conducted a priori power analyses based on the anticipated analysis with the greatest sample size demands, and we obtained sample sizes for each study to ensure at least a 0.80 level of statistical power. For some analyses, such as EFA and CFA, we

referenced prior guides and power tables to determine the appropriate sample sizes.

Study 1

The goal of Study 1 is to inductively identify potential dimensions of negative perceptions about recycling. We perform a qualitative investigation, wherein we code participant responses to identify themes that may represent emergent dimensions. Subsequently, we use these responses to create items and quantitively test their dimensionality in Studies 2 and 3.

Study 1 Participants and Procedure

Participants ($Age_{\bar{x}} = 35.82$, $Age_{SD} = 13.66$, 63% female, 100% located in United States) enrolled via Prolific, and they immediately completed the online survey in return for monetary compensation. Prolific is an online platform that connects researchers with participants (and other services), and it is regularly used in survey studies (Eyal et al., 2021; Peer et al., 2022). This platform ensures authentic responses by regularly assessing participant identity, such as requiring identification to be periodically provided while completing studies. Prolific has been supported to provide high-quality responses when applying safeguards of data quality (e.g., attention checks), which were used in our studies (Armstrong et al., 2021; Eyal et al., 2021; Peer et al., 2022). Participation was restricted to those fluent in English. We removed two participants who provided nonsensical responses, resulting in a final sample of 154 participants.

Study 1 Measures

Qualitative Items. We used two items to identify negative perceptions about recycling, similar to prior scale development articles (e.g., Howard, 2022). These questions read:

> Recycling provides significant benefits for the environment, but many people do not recycle their household trash that can be recycled (e.g., cans, plastic, paper, etc.). In the space below, please list as many reasons as possible that [you / people in general] do not recycle household trash that can be recycled. Please write at least three reasons.

We asked participants to respond regarding themselves because they would be most capable at identifying their personal feelings about recycling;

however, we also asked participants to respond regarding people in general to avoid potential issues with social desirability biases (Krumpal, 2013). This approach can also address biases arising from the fundamental attribution error, wherein participants are more likely to attribute external sources for their negative behaviors and internal sources for the negative behaviors of others (J. Harvey et al., 1981). By asking about both self- and other-reported justifications, we can ensure that we obtain a more accurate and wider range of responses. Lastly, while we asked participants to provide three reasons for each question, many provided more than three reasons, resulting in an even larger amount of qualitative data than originally anticipated.

Study 1 Results

We used an inductive thematic categorization approach to analyze our qualitative responses, adhering to the recommendations and guidelines of prior authors (DeVellis & Thorpe, 2021; Hinkin, 1995, 1998; Howard, 2019). For each item, we coded individual responses into emergent categories in a stepwise process without any predefined expectation for the nature of these categories. That is, we created the category that was believed to represent the most uncategorized responses, and then we coded one-at-a-time whether each response belonged to that category. We continued this process until the uncategorized responses (i.e., "other" category) represented 10% or less of the total responses for the item, as this was considered the cutoff for a category to represent a meaningful number of responses (Hinkin, 1995, 1998).

Further, we followed the recommendations of prior authors to determine the labels and definitions of emergent categories (DeVellis & Thorpe, 2021; Hinkin, 1995, 1998; Howard, 2019). Once all statements were coded into categories, each category was reviewed for its inductively generated predominant theme. This theme was then described in as few words as possible, one or two in most cases, and these became the category labels. We then reviewed the extant literature for definitions of any labels that represented constructs studied in the recycling literature. We compared the obtained definitions to the content of these categories, which were then applied for any definitions that matched the category content. For other categories, such as those not studied in the prior literature, new definitions were developed, relying on the subject matter expertise of the authors. The category labels and definitions were lastly shared with other subject matter experts, who approved of their relevance and readability.

Table 1 provides the results of our inductive categorization process. Eight categories met the cutoff for the self-referenced responses, whereas six met the cutoff for the other-referenced responses. These eight dimensions were:

Table 1. Emergent Dimensions from Qualitative Analysis of Study 1.

Dimension	Definition begins with "Perception that. . ."	Frequency of self (%)	Frequency of others (%)
Inconvenience	Recycling takes too much time and effort.	54	52
Inaccessibility	Recycling locations are not close and recycling pickup is not available.	41	39
Unknowledgeable	They do not know enough about recycling to do it.	26	37
Lazy	They do not want to put in the effort to recycle.	25	35
Few benefits	Recycling provides few benefits for the environment.	24	58
Lack of space	They do not have enough physical space to recycle.	18	14
Unable	Many items cannot be recycled due to their material composition.	15	9
No habit	It is just automatic for them to throw away their trash instead of recycle.	15	7
Worse problems	Recycling pales in comparison to worse things that are happening.	5	1
Compensation	They do enough other behaviors to make up for not recycling.	5	2
Cost	Recycling is too expensive relative to how much they make.	4	5
Dirty	Recycling is too messy for them to regularly do it.	3	1
Other	Other responses that could not be categorized into the categories above.	8	10

Note. Frequency of self indicates the number of participants that mentioned the dimension as a reason that they do not recycle. Frequency of other indicate the number of participants that mentioned the dimension as a reason that they believe others in general do not recycle.

Inconvenience, Inaccessibility, Unknowledgeable, Lazy, Few Benefits, Lack of Space, Unable, and No Habit. Definitions for these dimensions are provided in Table 1. As all following categories fell well short of the cutoff, we solely considered these eight categories as potential dimensions of our developed measure.

Study 1 Discussion

Study 1 identified eight potential dimensions for our negative perceptions of recycling measure, which we use as our framework in developing items for our scale. These dimensions are: Inconvenience, Inaccessibility, Unknowledgeable, Lazy, Few Benefits, Lack of Space, Unable, and No Habit. It should be recognized that these perceptions aligned with extant theories. The two most referenced perceptions, Inconvenience and Inaccessibility, are both associated with perceived behavioral control in the theory of planned behavior, and two other of the eight perceptions, Lack of Space and Unable, likewise correspond to perceived behavioral control (Ajzen, 1991, 2020). The third most referenced perception, Unknowledgeable, may reflect low efficacy beliefs (Bandura, 1982; Lippke, 2020); the frequently mentioned perception of Few Benefits corresponds to expectancy theory (Kiatkawsin & Han, 2017; Ramus & Killmer, 2007; Tang et al., 2023); and the commonly referenced perception of No Habit relates to habit theories (Verplanken & Aarts, 1999; Wood & Rünger, 2016). This finding indicates that the theory of planned behavior, specifically perceived behavioral control, may be particularly informative in understanding recycling perceptions, but the other referenced theories should also be recognized to obtain a complete understanding of recycling perceptions. Equally important, these findings support the validity of our approach. Because our inductive qualitative approach identified several perceptions that have been recognized to be important in extant research, our results suggest that our approach was indeed able to identify the most potent perceptions for recycling.

Additionally, one common perception did not directly relate to any of the discussed theories, which was the perception of Lazy. Many participants responded that they do not recycle simply because they did not have the motivation to dedicate sufficient effort. This unanticipated perception reflects a benefit of our work, as it demonstrates that our qualitative process was able to discover perceptions not readily identified by theory. Likewise, some perceptions were too infrequently mentioned to be included, but they corresponded to the discussed theoretical perspectives, such as Cost. Again, this reflects a benefit of our work, as it shows that our qualitative process was able to distinguish between less and more promising perceptions than would have otherwise been recognized by theory alone. Therefore, we proceed to

developing our items based on the eight perceptions identified in our qualitative process.

Item Development. Guides on the development of measures almost universally recommend creating an over-representative item list, such that more items are created than needed in the final measure (DeVellis & Thorpe, 2021; Hinkin, 1995, 1998; Rossiter, 2002). This process helps ensure the content validity of the final measure, as the full domain of a construct can be better assessed. Likewise, because the over-representative item list is reduced in a multi-study process, concerns about construct contamination are minimized due to thorough scale testing.

We intended our final measure to include four items per dimension. We chose this number because dimensions with fewer than four items are more likely to produce estimation errors in psychometric assessments (e.g., CFA) (H. Marsh et al., 1998), among other concerns (e.g., measurement bias) (R. Harvey et al., 1985; Robinson, 2018). Likewise, we felt that each dimension was well-defined and could be adequately measured by four items. Including more items would only increase scale redundancy, ultimately reducing data quality when applying the measure. For these reasons, we initially created six to eight items per dimension with the expectation that each would be reduced to four items through our scale development process.

We created these items from the qualitative responses of Study 1. For example, the qualitative response of, "Sometimes I am unsure whether certain plastics are recyclable," was used to create the item, "I am not sure about what things can be recycled." By doing so, we could better ensure that our items reflected actual perceptions that people may have about recycling. Further, we utilized two primary approaches to identify focal qualitative responses. First, we identified which qualitative responses were most common in each dimension, and we assessed which common qualitative responses could be represented by the same item. For instance, the responses, "I don't know what can be recycled" and "Sometimes I am unsure whether certain plastics are recyclable" could both be represented by the item, "I am not sure about what things can be recycled." Via this process, we carefully ensured that the most common responses were represented. Second, we identified uncommon responses representing perceptions that are widespread and/or potent influences on recycling behaviors. These items were based on the subject matter expertise of the authors. We did not observe many responses that matched this criterion, but we did utilize some to develop novel items. Lastly, subject matter experts reviewed the items for relevance and readability. Together, this process was believed to result in the most common and/or proximal perceptions to recycling behaviors.

Study 2

The primary goals of Study 2 are to reduce the over-representative item list into a concise scale and to provide initial evidence for the psychometric properties and validity of this measure.

Study 2 Participants and Procedures

Participants ($Age_{\bar{x}} = 43.04$, $Age_{SD} = 14.25$, 62% female, 100% located in United States) enrolled via Prolific, and they immediately completed the online survey in return for monetary compensation. Participation was restricted to those fluent in English and did not participate in Study 1. We removed those who failed more than one of four attention checks (e.g., "Please mark agree to show that you are paying attention."), resulting in the removal of three participants. The final sample size was exactly 400.

Study 2 Measures

Recycling Perceptions. We administered the over-representative item list created from the Study 1 qualitative results which included 53 items and 8 intended dimensions.

Recycling Behaviors. We asked participants to indicate the percentage of their trash that they recycle on a sliding scale from 0% to 100%.

Study 2 Results

To conduct our EFA, we used a principal axis factoring method with oblimin rotation. To determine the number of factors to retain, we used parallel analysis and visual scree plot analysis (Goretzko et al., 2021; Howard, 2016, 2023; Ledesma et al., 2021). Lim and Jahng (2019) supported that researchers can interpret one more or one less factor than a parallel analysis suggests based other supporting information, such as theoretical rationale or other retention approaches (e.g., scree plot), which we considered when interpreting our factor structures.

Bartlett's test was statistically significant ($\chi^2[1,378] = 22{,}990$, $p < .01$), and the KMO test value was 0.96. Both findings support that our data is suitable for EFA (Howard, 2016, 2023). Our initial parallel analysis and visual scree plot analysis suggested that seven factors should be retained. For this reason, we began with a seven-dimension solution and removed

items based on Howard's (2016) 0.40–0.30–0.20 criteria, which recommends that items should load above 0.40, cross-load no more than 0.30, and have a difference of at least 0.20 between primary and secondary loadings. When applying these standards, an eighth dimension emerged after items with cross-loadings were removed, and most dimensions included more than four items with strong primary loadings and minimal cross-loadings. For this reason, we removed the items with the lowest factor loadings until only four items remained for each dimension. This process resulted in a 32-item scale with eight dimensions, and each anticipated dimension emerged in this final factor structure. Table 2 provides the final factor loadings and extracted eigenvalues.

Table 3 includes the correlations of Study 2. Table 4 includes the regression results of each dimension predicting recycling behaviors for each study. Each dimension produced significant intercorrelations in the expected direction, supporting their construct validity. The dimensions produced significant and negative correlations with recycling behaviors, supporting their concurrent validity.

Study 2 Discussion

Study 2 reduced our item list into a scale of 32 items and 8 dimensions, each reflecting the intended dimensions identified in Study 1. It also produced initial psychometric and validity evidence, providing significant support for the continued investigation of our measure.

Study 3

The primary goal of Study 3 is to confirm our reduced item list by providing further evidence for the psychometric properties and validity of our developed measure.

Study 3 Participants and Procedure

Participants ($Age_{\bar{x}}$ = 31.57, Age_{SD} = 9.38; 59% female; located in 33% South Africa, 13% Portugal, 8% Poland, 6% United Kingdom, 5% Italy, 35% other) enrolled via Prolific, and they immediately completed the online survey for monetary compensation. Participation was restricted to those fluent in English and did not participate in Studies 1 or 2. We removed those who failed more than one of three attention checks, resulting in the removal of two participants. The final sample size was 412.

Table 2. Exploratory Factor Analysis Results of Study 2.

Items	1	2	3	4	5	6	7	8
Inconvenience 1	0.84							
Inconvenience 2	0.93							
Inconvenience 3	0.83							
Inconvenience 4	0.79							
Inaccessibility 1		0.92						
Inaccessibility 2		0.94						
Inaccessibility 3		0.99						
Inaccessibility 4		0.91						
Unknowledgeable 1			0.87					
Unknowledgeable 2			0.95					
Unknowledgeable 3			0.82					
Unknowledgeable 4			0.80					
Lazy 1				0.59				
Lazy 2				0.83				
Lazy 3				0.54				
Lazy 4				0.82				
Few benefits 1					0.87			
Few benefits 2					0.87			
Few benefits 3					0.81			
Few benefits 4					0.83			
Lack of space 1						0.84		
Lack of space 2						0.53		
Lack of space 3						0.80		
Lack of space 4						0.86		
Unable 1							0.51	
Unable 2							0.84	
Unable 3							0.84	
Unable 4							0.85	
No habit 1								0.87
No habit 2								0.96
No habit 3								0.64
No habit 4								0.93
Extracted eigenvalues	14.28	2.58	1.78	1.44	1.01	0.67	0.55	0.34

Note. Reported figures represent factor loadings. Factor loadings below 0.30 not shown. Extracted eigenvalues relate to common variance, and our factor extraction methods supported the retention of eight factors in the final solution.

Table 3. Correlations and Cronbach's Alphas of Study 2.

Variables	1	2	3	4	5	6	7	8	9
(1) Inconvenience	.95								
(2) Inaccessibility	.54**	.98							
(3) Unknowledgeable	.49**	.42**	.94						
(4) Lazy	.55**	.18**	.47**	.87					
(5) Few benefits	.55**	.24**	.40**	.37**	.92				
(6) Lack of space	.71**	.55**	.55**	.51**	.51**	.93			
(7) Unable	.39**	.20**	.37**	.28**	.46**	.45**	.89		
(8) No habit	.68**	.57**	.55**	.57**	.39**	.68**	.37**	.96	
(9) Recycling behaviors	−.52**	−.58**	−.38**	−.33**	−.23**	−.53**	−.36**	−.69**	—

Note. Cronbach's alpha listed on diagonal.
*$p < .05$. **$p < .01$.

Table 4. Regression Analyses of NPR Scale Dimensions Predicting Recycling Behaviors.

Predictors	Study 2: Time 1	Study 3: Time 1	Study 4: Time 1	Study 4: Time 2	Study 5: Time 1	Study 5: Time 2
(1) Inconvenience	−.07	−.12**	.02	−.14	−.18	.00
(2) Inaccessibility	−.26**	−.20**	−.29**	−.02	−.10	−.22*
(3) Unknowledgeable	.05	−.02	.09	−.01	.13	.07
(4) Lazy	.03	−.02	−.08	−.06	.23**	.09
(5) Few benefits	.12**	−.02	−.09	.09	.05	.04
(6) Lack of space	−.04	−.03	−.01	.09	−.00	−.01
(7) Unable	−.16**	−.06	−.09	−.02	−.14	−.08
(8) No habit	−.50**	−.51**	−.47**	−.29**	−.65**	−.58**
Adj. R^2	.54**	.59**	.45**	.15**	.46**	.38**

Note. Reported figures represent standardized beta coefficients.
*$p < .05$. **$p < .01$.

Study 3 Measures

Recycling Perceptions. We administered the reduced item list created from Study 2, which included 32 items and 8 intended dimensions.

Recycling Behaviors. We administered the same recycling behaviors item as Study 2.

Study 3 Results

Following modern recommendations (Brown, 2015; Harrington, 2009; Jackson et al., 2009), we performed a CFA on our reduced item list. We modeled each set of four items to load onto its own latent factor. Because we did not have a theoretical rationale for a second-order latent factor, we tested two models. The first covaried the first-order latent factors, whereas the second loaded each first-order latent factor onto a second-order latent factor. We applied typical cutoffs for model fit (SRMR = 0.08, RMSEA = 0.06, CFI = 0.95, IFI = 0.95, and $\chi^2/df \leq 3$), but we also adhered to widespread recommendations in considering fit indices closely approaching these values to be appropriate (Hu & Bentler, 1999). We also expected each item to load 0.32 or stronger on its intended latent factor, as recommended by prior authors (Hinkin, 1995, 1998).

The model with covaried first-order latent factors produced superior model fit (SRMR = 0.07, RMSEA = 0.07, CFI = 0.92, IFI = 0.92, $\chi^2/df = 3.00$)

to the model with a second-order latent factor (SRMR = 0.09, RMSEA = 0.07, CFI = 0.90, IFI = 0.91, $\chi^2/df = 3.26$), and we chose to further interpret the model with covaried first-order latent factors. This model produced strong factor loadings (≥.39), but some fit indices did not exceed our cutoffs. To analyze localized strain, we inspected our modification indices. Two pairs of error terms had large modification indices, each associated with pairs of items loading onto the same latent factor. When inspecting these items, each pair had similar wording, likely producing their additional shared variance. Authors have recommended that covariances can be added error terms when items load onto the same factor and their additional shared variance can be explained (Brown, 2015; Harrington, 2009). For this reason, we covaried these two pairs of error terms. The resultant fit indices exceeded or closely approached our cutoffs (SRMR = 0.07, RMSEA = 0.06, CFI = 0.94, IFI = 0.94, $\chi^2/df = 2.62$), and our factor loadings met expectations (≥.32). Table 5 provides our final loadings.

It should be highlighted that two items produced weaker factor loadings in Study 3 compared to Study 2, both loading onto the Few Benefits dimension. These two items had similar wordings, and they were, "Recycling provides few benefits for the environment" and "There are few benefits from recycling." While these two items still produced factor loadings to suggest that they are representative of the Few Benefits dimension, people from various cultures may perceive the meaning of these items differently than those in the United States given the sampling differences between Studies 2 and 3. To probe this possibility, we performed an assessment of measurement invariance by combining the datasets of Studies 2 and 3 (Meredith, 1993; Van De Schoot et al., 2015). The test of configural (CFI = 0.95, RMSEA = 0.06) weak (CFI = 0.95, RMSEA = 0.06) and strong (CFI = 0.94, RMSEA = 0.07) invariance each produced acceptable fit indices, but the chi-square difference test between the configural and weak ($\chi^2[24] = 57.28$, $p < .01$) and between the weak and strong ($\chi^2[24] = 196.50$, $p < .01$) tests of invariance were statistically significant. These results suggest that the reduced item list can assess perceptions of recycling across cultures, but additional considerations are required when making cross-cultural comparison when using the measure (Meredith, 1993; Van De Schoot et al., 2015).

Table 6 includes the correlations of Study 3. The dimensions produced significant and positive intercorrelations, supporting their construct validity. The dimensions produced significant and negative correlations with recycling behaviors, supporting their concurrent validity. Thus, these correlations were the expected magnitude and in the expected direction, providing support for the construct and concurrent validity of our developed measure.

Table 5. Confirmatory Factor Analysis Results of Study 3.

Items	1	2	3	4	5	6	7	8
Inconvenience 1	0.80							
Inconvenience 2	0.90							
Inconvenience 3	0.89							
Inconvenience 4	0.85							
Inaccessibility 1		0.97						
Inaccessibility 2		0.85						
Inaccessibility 3		0.96						
Inaccessibility 4		0.90						
Unknowledgeable 1			0.89					
Unknowledgeable 2			0.91					
Unknowledgeable 3			0.92					
Unknowledgeable 4			0.95					
Lazy 1				0.93				
Lazy 2				0.63				
Lazy 3				0.84				
Lazy 4				0.74				
Few Benefits 1					0.33			
Few Benefits 2					0.77			
Few Benefits 3					0.85			
Few Benefits 4					0.39			
Lack of Space 1						0.89		
Lack of Space 2						0.72		
Lack of Space 3						0.92		
Lack of Space 4						0.68		
Unable 1							0.70	
Unable 2							0.86	
Unable 3							0.80	
Unable 4							0.85	
No Habit 1								0.95
No Habit 2								0.96
No Habit 3								0.83
No Habit 4								0.92

Note. Reported figures represent standardized factor loadings.

Study 3 Discussion

The results of Study 3 supported the psychometric properties of the reduced item list. It produced appropriate model fit statistics that met the guidelines of Hu and Bentler (1999), and it produced factor loadings that met expectations

Table 6. Correlations and Cronbach's Alphas of Study 3.

Variables	1	2	3	4	5	6	7	8	9
(1) Inconvenience	.92								
(2) Inaccessibility	.42**	.94							
(3) Unknowledgeable	.34**	.22**	.92						
(4) Lazy	.51**	.23**	.30**	.88					
(5) Few benefits	.42**	.25**	.22**	.32**	.71				
(6) Lack of space	.56**	.41**	.34**	.53**	.36**	.88			
(7) Unable	.37**	.15**	.39**	.31**	.32**	.32**	.88		
(8) No habit	.56**	.52**	.28**	.63**	.35**	.55**	.16**	.96	
(9) Recycling behaviors	−.55**	−.54**	−.29**	−.50**	−.34**	−.50**	−.25**	−.73**	—

Note. Cronbach's alpha listed on diagonal.
*$p < .05$. ** $p < .01$.

of Hinkin (1995, 1998). The scale also produced appropriate validity evidence. It produced intercorrelations of the expected magnitude and direction, supporting its construct validity; and it produced correlations with recycling behaviors of the expected magnitude and direction, supporting its concurrent validity. Henceforth, we label our reduced item list, the Negative Perceptions of Recycling Scale (NPRS) (Appendix A).

Study 4

The first goal of Study 4 is to assess the concurrent and discriminant validity of the NPRS, wherein we show that the scale significantly correlates with relevant constructs but not to an extent to suggest that they are repetitive. The antecedent constructs in the theory of planned behavior (i.e., attitudes, perceived behavioral control, and subjective norms) are each associated with perceptions (Ajzen, 2020; Tonglet et al., 2004). Due to the importance of this theory for understanding recycling behaviors and relevance to the NPRS, we assess whether the dimensions significantly relate to the theory's antecedent constructs. We expect that Inconvenience, Inaccessibility, Lack of Space, and Unable each significantly and strongly relate to perceived behavioral control, as each are associated with being unable to recycle. We also expect the other four dimensions of Unknowledgeable, Lazy, Few Benefits, and No Habit to significantly relate to the theory of planned behavior antecedents, with a particular expectation that they relate to attitudes because it reflects a general positive or negative evaluation of recycling. In testing these relations, we provide notable support for the construct validity of our measure.

The second goal of Study 4 is to assess whether the NPRS dimensions explain significant variance in recycling intentions and behaviors beyond the theory of planned behavior antecedents and additions to the theory when studying recycling behaviors. Recycling self-identity (Terry et al., 1999), perceived consequences, and moral norms (Wan et al., 2017) each have been supposed to explain variance in recycling intentions and behaviors beyond the theory of planned behavior antecedents. Therefore, we assess whether the NPRS dimensions explain variance in recycling intentions and behaviors when also including these additional antecedents as predictors. By doing so, we can provide significant support for the utility of our measure.

Study 4 Participants and Procedure

Participants ($Age_{\bar{x}}$ = 40.57, Age_{SD} = 14.81, 58% female, 100% located in United States) were recruited from Prolific for monetary compensation. Participation was restricted to those fluent in English and did not participate

in Studies 1, 2, or 3. We removed those who failed more than one of six attention checks, excluding three participants already reflected in the sample sizes reported below. Participants enrolled via Prolific, and they immediately completed an online survey that contained all measures. Fifteen days later, they were provided with a second survey that included the measures of behavioral intention and recycling behaviors. Of the 149 that completed the first survey, 107 completed the second survey.

Study 4 Measures

Recycling Perceptions. We administered the NPRS finalized in Study 3. The Cronbach's alpha of each dimension was .85 or above.

Theory of Planned Behavior Constructs. We measured attitudes (6 items), subjective norms (6 items), perceived behavioral control (7 items), and intentions (3 items) with the measures of Wan et al. (2017), which were adopted from Tonglet et al. (2004), Sidique et al. (2010), and Wan et al. (2012). Example items are: "Recycling is good" (attitudes), "Most people who are important to me think I should recycle" (subjective norm), "I have plenty of opportunities to recycle" (perceived behavioral control), and "I intend to recycle my recyclables in the next four weeks" (intentions). The Cronbach's alpha of each measure was .80 or above.

Additional Constructs. We measured awareness of consequences (6 items) and moral norms (5 items) with the scales of Wan et al. (2017), adopted from Tonglet et al. (2004), Sidique et al. (2010), and Wan et al. (2012). We measured recycling self-identity (3 items) with the scale of Terry et al. (1999), but we removed an item because it produced small relations with the other items and notably worsened the Cronbach's alpha of the scale. Example items are, "Recycling reduced pollution" (awareness of consequences), "I feel I should not waste anything if it could be used again" (moral norms), and "To engage in household recycling is an important part of who I am" (recycling self-identity). The Cronbach's alpha of each scale was .80 or above.

Recycling Behaviors. We used the same recycling behaviors item as Studies 2 and 3

Study 4 Results

Table 7 includes the correlations of Study 4. Inconvenience ($r = -.57$, $p < .01$, 95% CI [−0.67, −0.46]), Inaccessibility ($r = -.64$, $p < .01$, 95% CI [−0.72,

Table 7. Correlations and Cronbach's Alphas of Study 4.

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
(1) Inconvenience	.94																	
(2) Inaccessibility	.46**	.98																
(3) Unknowledgeable	.50**	.39**	.96															
(4) Lazy	.43**	−.01	.39**	.85														
(5) Few benefits	.38**	.02	.29**	.36**	.91													
(6) Lack of space	.65**	.47**	.46**	.35**	.32**	.94												
(7) Unable	.48**	.34**	.34**	.21*	.36**	.48**	.86											
(8) No habit	.55**	.41**	.49**	.45**	.26**	.45**	.34**	.96										
(9) Attitude	−.34**	−.02	−.20*	−.32**	−.55**	−.26**	−.14	−.13	.86									
(10) Subjective norms	−.33**	−.27**	−.17*	−.24**	−.18*	−.22**	−.12	−.34**	.40**	.80								
(11) Behavioral control	−.57**	−.64**	−.53**	−.25**	−.16*	−.61**	−.33**	−.55**	.29**	.40**	.91							
(12) Consequences	−.26**	−.02	−.19*	−.21*	−.59**	−.23**	−.28*	−.05	.70**	.37**	.26**	.89						
(13) Moral norms	−.50**	−.30**	−.24**	−.27**	−.35**	−.36**	−.13	−.50**	.56**	.53**	.50**	.46**	.87					
(14) Recycling identity	−.41**	−.28**	−.24**	−.19*	−.31**	−.37**	−.27**	−.54**	.39**	.58**	.54**	.35**	.65**	.80				
(15) Recycling intentions T1	−.51**	−.55**	−.29**	−.27**	−.17*	−.45**	−.19*	−.68**	.27**	.54**	.69**	.16*	.62**	.63**	.88			
(16) Recycling behaviors T1	−.45**	−.48**	−.34**	−.29**	−.24**	−.40**	−.36**	−.63**	.13	.35**	.60**	.14	.47**	.52**	.68**	−		
(17) Recycling intentions T2	−.52**	−.28**	−.29**	−.46**	−.25*	−.45**	−.19	−.69**	.25*	.41**	.57**	.10	.54**	.79**	.59**	.68**	.87	
(18) Recycling behaviors T2	−.27**	−.18	−.22*	−.23*	−.04	−.16	−.12	−.36**	.05	.16	.16	−.06	.16	.23*	.22*	.18	.32**	—

Note. Cronbach's alpha listed on diagonal.
*$p < .05$. **$p < .01$.

−0.53]), Unknowledgeable ($r = -.53$, $p < .01$, 95% CI [−0.63, −0.40]), Lack of Space ($r = -.61$, $p < .01$, 95% CI [−0.70, −0.49]), and Unable ($r = -.33$, $p < .01$, 95% CI [−0.46, −0.18]) related most strongly to perceived behavioral control, and Few Benefits most strongly related to attitudes ($r = -.55$, $p < .01$, 95% CI [−0.65, −0.43]). Lazy significantly related to all three theory of planned behavior antecedents (all $p < .01$; all 95% CI exclude 0), whereas No Habit significantly related to subjective norms and behavioral control (both $p < .01$; both 95% CI exclude 0). These findings provide significant support for the concurrent validity of the NPRS.

To test the discriminant validity of our dimensions, we calculated HTMT ratios, which is among the most supported approaches to testing the discriminant validity (Henseler et al., 2015). The discriminant validity of a construct is supported if its confidence interval excludes 1.00. No two constructs produced a confidence interval that included 1.00, and the closest pairs of constructs were those of prior additions to the theory of planned behavior, such as recycling self-identity and moral norms. Thus, the discriminant validity of the NPRS was supported.

Table 8 includes our regression results with recycling intent and behaviors as outcomes. We tested whether the NPRS related to recycling intent and behaviors beyond the theory of planned behavior antecedents and selected additions. Our results supported that the NPRS dimensions explained an additional 8% of variance in recycling intent ($\Delta R^2 = .08$, $p < .01$) and an additional 11% of variance in recycling behavior ($\Delta R^2 = .11$, $p < .01$). As both results were statistically significant, Study 4 supported the utility of the NPRS.

Study 4 Discussion

The goal of Study 4 was to test the concurrent validity, discriminant validity, and utility of the NPRS. Our results supported that the NPRS dimensions relate to the theory of planned behavior constructs as anticipated. These dimensions were not so strongly related to suggest that they are repetitive, as the HTMT ratio confidence intervals for each pairing of constructs excluded 1.00—providing strong support for the discriminant validity of the tested measures. These findings supported the concurrent and discriminant validity of the NPRS. Likewise, the NPRS dimensions explained significant variance in recycling intent and behaviors beyond the theory of planned behavior antecedents and selected additions to this theory. This finding supported the utility of the NPRS. Together, Study 4 suggests that the NPRS is a suitable measure of recycling perceptions, encouraging its future application.

Table 8. Regression Analysis of Study 4.

Predictors	Recycling intent: Time 1			Recycling behavior: Time 1			Recycling intent: Time 2			Recycling behavior: Time 2		
(1) Attitude	−.03	−.03	−.03	−.10	−.21*	−.19*	−.01	.01	−.14	−.05	.08	.11
(2) Subjective norms	.32**	.20**	.15*	.17*	.03	.02	.18	.04	.02	.12	.09	.09
(3) Behavioral control	.57**	.43**	.32**	.56**	.42**	.32**	.48**	.31**	.32**	.12	.01	−.20
(4) Consequences		−.20**	−.08		−.02	−.05		−.24*	−.19		−.27	−.16
(5) Moral norms		−.29**	.12		.23*	.17		.24*	.13		.06	−.07
(6) Recycling identity		.18*	.13		.21*	.11		.32*	.21		.20	.12
(7) Inconvenience			−.03			.09			−.11			−.18
(8) Inaccessibility			−.18**			−.15			.07			−.06
(9) Unknowledgeable			.18**			.10			.19*			−.05
(10) Lazy			−.02			−.12			−.19*			−.05
(11) Few benefits			−.03			−.15			−.19*			.08
(12) Lack of space			−.00			.08			−.03			.05
(13) Unable			.11			−.14			.07			−.02
(14) No habit			−.34**			−.26**			−.27*			−.25
ΔR^2	.56**	.09**	.08**	.37**	.07**	.11**	.35**	.15**	.14**	.04	.05	.09

Note. Reported figures represent standardized beta coefficients.
*$p < .05$. ** $p < .01$.

Study 5

In our final study, we explore the broader nomological net of the NPRS, while further supporting the measure's concurrent validity, discriminant validity, and utility. We investigate related constructs such as recycling affect (Smith et al., 1994) and personal norms (Vining & Ebreo, 1992), but we place a particular focus on attitudes. Authors have developed a multitude of attitudinal measures to represent different feelings and cognitions about recycling (Smith et al., 1994; Voss et al., 2003). Many of these directly reflect perceptions (Best & Mayerl, 2013), making it more so important to demonstrate that the NPRS is distinct from these prior constructs while explaining greater variance in outcomes, namely recycling behaviors. Likewise, because a goal of the scale development effort was to both explore the nomological network of our measure and assess whether it predicts outcomes beyond other relevant predictors, we chose to study attitudes because they are closely related to perceptions, known to relate to recycling behaviors, and widely studied in the current recycling literature. For these reasons, we investigate the relation of the NPRS with the following attitudes about recycling: general attitudes, utilitarian attitudes, hedonistic attitudes, specific affective attitudes, general affective attitudes, specific cognitive attitudes, general cognitive attitudes, and attitude importance.

Study 5 Participants and Procedure

Participants ($Age_{\bar{x}}$ = 40.13, Age_{SD} = 15.24, 67% female, 100% located in United States) were recruited from Prolific for monetary compensation. Participation was restricted to those fluent in English and did not participate in Studies 1, 2, 3, or 4. We removed three participants who failed more than one of five attention checks, which is already reflected in the sample sizes reported below. Participants enrolled via Prolific, and they immediately completed an online survey that contained all measures. Fifteen days later, they were provided with a second survey that included the measures of behavioral intention and recycling behaviors. Of the 149 that completed the first survey, 107 completed the second survey.

Study 5 Measures

Recycling Perceptions. We administered the NPRS finalized in Study 3. The Cronbach's alpha of each dimension was .85 or above.

Recycling Attitudes. We measured general attitude (4 items, $\alpha = .91$) and attitude importance (2 items, $\alpha = .89$) with the scales of Smith et al. (1994). The former asks participants to indicate how they feel about recycling between two labels (e.g., Bad and Good), whereas an example item for the latter is, "Recycling is an extremely important issue." We measured utilitarian (5 items, $\alpha = .94$) and hedonic (5 items, $\alpha = .93$) attitudes with the measures of Voss et al. (2003). These two measures also ask participants to extent that they feel about recycling between two labels. Example labels for utilitarian attitudes are Effective and Ineffective, and example labels for hedonic attitudes are Dull and Exciting. The final attitudes were measured with the scales of Best and Mayerl (2013). Example items are: "I fear that we are going to drown in all the waste we produce" (specific affective attitude, 2 items, $\alpha = .67$), "If we continue to behave the way we used to do, we will soon experience a major ecological catastrophe" (general affective attitude, 3 items, $\alpha = .80$), "I would be willing to separate more kinds of recyclables in the future" (specific cognitive attitude, 3 items, $\alpha = .65$), and "Environmental measures should be enforced even if there is a loss of jobs" (general cognitive attitude, 6 items, $\alpha = .81$). We used the original versions of these scales apart from specific cognitive attitude, as the four-item measure produced a poor Cronbach's alpha that was improved with removing an item.

Additional Constructs. We measured recycling personal norms with the five-item scale of Vining and Ebreo (1992) ($\alpha = .84$). An example item is, "I would recycle household materials whether or not I received payment." We measured recycling affect with the scale of Smith et al. (1994) ($\alpha = .92$). An example item is, "When I recycle, I feel good."

Recycling Intentions. We measured recycling intentions with the same three-item measure as Study 4. The Cronbach's alpha of the scale was .90.

Recycling Behaviors. We used the same recycling behaviors item as Studies 2, 3, and 4.

Study 5 Results

Table 9 includes the correlations, and Table 10 includes the regression results of Study 5. Of the eight NPRS dimensions, four significantly related to all eight attitude constructs, one related to seven, three related to five. As each dimension of the NPRS related to most attitude constructs, these results support the concurrent validity of the NPRS. Further, our HTMT ratios again found that no two constructs produced a confidence interval that included

Table 9. Correlations and Cronbach's Alphas of Study 5.

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
(1) Inconvenience	.96																				
(2) Inaccessibility	.53**	.97																			
(3) Unknowledgeable	.42**	.35**	.95																		
(4) Lazy	.58**	.17*	.40**	.85																	
(5) Few benefits	.50**	.32**	.34**	.39**	.93																
(6) Lack of space	.73**	.55**	.42**	.52**	.50**	.91															
(7) Unable	.40**	.24**	.41**	.27**	.37**	.45**	.90														
(8) No habit	.60**	.50**	.52**	.59**	.52**	.61**	.35**	.95													
(9) General attitude	−.33**	−.35**	−.21**	−.20*	−.60**	−.29**	−.11	−.47**	.91												
(10) Utilitarian attitude	−.36**	−.26**	−.25**	−.20*	−.68**	−.31**	−.24**	−.45**	.84**	.94											
(11) Hedonistic attitude	−.34**	−.12	−.19*	−.22**	−.32**	−.26**	−.30**	−.30**	.48**	.56**	.93										
(12) Specific affective att.	−.24**	−.06	−.18*	−.10	−.23**	−.13	−.06	−.23**	.33**	.27**	.37**	.67									
(13) General affective att.	−.23**	−.24**	−.18*	−.10	−.22**	−.28**	−.11	−.33**	.45**	.34**	.34**	.64**	.80								
(14) Specific cognitive att.	−.36**	−.12	−.27**	−.32**	−.37**	−.27**	−.21*	−.33**	.34**	.42**	.39**	.45**	.39**	.65							
(15) General cognitive att.	−.34**	−.25**	−.18**	−.15	−.37**	−.34**	−.14	−.43**	.43**	.37**	.26**	.56**	.74**	.34**	.81						
(16) Attitude importance	−.46**	−.40**	−.31**	−.32**	−.68**	−.41**	−.21*	−.62**	.76**	.74**	.45**	.52**	.52**	.51**	.53**	.89					
(17) Personal norms	−.53**	−.46**	−.28**	−.37**	−.64**	−.53**	−.21*	−.67**	.69**	.64**	.40**	.46**	.45**	.43**	.48**	.82**	.84				
(18) Affect	−.42**	−.33**	−.15	−.25**	−.60**	−.40**	−.20*	−.57**	.68**	.63**	.44**	.44**	.47**	.43**	.47**	.79**	.78**	.92			
(19) Recycling behaviors T1	−.47**	−.46**	−.27**	−.24**	−.33**	−.45**	−.33**	−.63**	.40**	.37**	.42**	.24**	.21**	.19*	.29**	.54**	.60**	.43**	—		
(20) Recycling intentions T2	−.47**	−.57**	−.20*	−.31**	−.43**	−.46**	−.18	−.67**	.47**	.45**	.26**	.14	.22*	.19	.30**	.61**	.71**	.52**	.62**	.90	
(21) Recycling behaviors T2	−.36**	−.46**	−.25*	−.21*	−.34**	−.39**	−.26**	−.61**	.37**	.38**	.34**	.11	.14	.05	.20*	.49**	.53**	.35**	.75**	.72**	—

Note. Cronbach's alpha listed on diagonal. Att. = attitude.
*$p < .05$. **$p < .01$.

Table 10. Regression Analysis of Study 5.

Predictors	Recycling behavior: Time 1		Recycling intent: Time 2		Recycling behavior: Time 2	
(1) General attitude	−.04	.04	.04	−.04	−.03	−.03
(2) Utilitarian attitude	−.29*	−.20	−.15	.03	−.13	−.06
(3) Hedonistic attitude	.38*	.30**	.06	.06	.25*	.21
(4) Specific affective att.	−.15	.00	−.23*	−.11	−.18	−.07
(5) General affective att.	−.15	−.21*	.05	.03	.03	.01
(6) Specific cognitive att.	−.13	−.09	−.03	−.07	−.20*	−.23*
(7) General cognitive att.	.13	.03	−.14	−.14	−.11	−.10
(8) Attitude importance	.46**	.40**	.40*	.22	.55**	.31
(9) Personal norms	.57**	.37**	.68**	.49**	.48**	.24
(10) Affect	−.22	−.27**	−.10	−.10	−.25	−.24
(11) Inconvenience		−.09		−.12		−.00
(12) Inaccessibility		−.07		−.28**		−.18
(13) Unknowledgeable		.10		.12		.05
(14) Lazy		.24**		−.05		.09
(15) Few benefits		.22*		.05		.08
(16) Lack of space		−.05		.06		.01
(17) Unable		−.15*		.08		−.08
(18) No habit		−.49**		−.24*		−.50**
ΔR^2	.49**	.15**	.47**	.10**	.42**	.13**

Note. Reported figures represent standardized beta coefficients.
*$p < .05$. **$p < .01$.

1.00. This finding supports the discriminant validity of the NPRS. Finally, we tested whether the NPRS dimensions relate to recycling behaviors beyond the other administered measures. The VIF of two predictors, attitude importance and personal norms, either exceeded or closely approached 5.0. Our inferences are consistent regardless of whether these measures are included, and we therefore report the results while including these measures. The NPRS dimensions explained an additional 15% of variance in recycling behaviors ($\Delta R^2 = .15$, $p < .01$), providing significant support for the utility of the NPRS beyond relevant prior measures.

Study 5 Discussion

Our results support that the NPRS dimensions relate to prior measures of attitudes, but not to an extent to suggest that they are repetitive. These findings supported the concurrent and discriminant validity of the NPRS. The NPRS dimensions also explained significant variance in recycling behaviors beyond the relevant prior measures, supporting the utility of the NPRS. Study 5 together suggests that the NPRS is a suitable measure of recycling perceptions.

It should be highlighted that some of the prior measures produced VIF closely approaching or larger than 5.0. This result suggests that the prior measures produce significant multicollinearity when studied together, drawing into question their uniqueness and utility when studied together. A benefit of the NPRS is that it does not demonstrate this concern of prior measures, enabling greater methodological soundness for future research on predictors of recycling behaviors. Now, researchers can study multiple perceptions together with greater assurances that these measures function adequately when studied alongside each other.

General Discussion

The primary goal of the current article was to develop a multidimensional measure of recycling perceptions that reflects the many different—possibly even conflicting—perceptions that people may hold about household recycling. To begin, we reviewed theories that specify important perceptions for understanding recycling behaviors, which provided expectations as to which dimensions may emerge in our studies. These theoretical perspectives suggested the emergence of dimensions associated with self-efficacy theories (unknowledgeable), expectancy theory (inconvenience and few benefits), habit theories (lack of habit), and the theory of planned behavior (inaccessibility, cost, lack of space, and unable to be recycled). We expected these

dimensions to emerge in our scale, but a benefit of our investigation was also the explicit testing as to whether these dimensions (and any others) would be observed. It was possible that extant theory overestimates the importance of certain perceptions, such that widely discussed perceptions should not emerge; whereas was is also possible that extant theory has overlooked the importance of other perceptions, such that largely undiscussed perceptions should emerge.

We then began our empirical process by performing a qualitative investigation in Study 1 to identify the primary perceptions that people hold and believe others to hold about recycling. This study identified eight potential dimensions. Most of these dimensions reflected perceptions identified by the theories listed above, but certain dimensions were novel. At the same time, some perceptions referenced by prior theory were mentioned infrequently by participants, indicating that not all perceptions referenced in extant theory are widespread. Therefore, our qualitative study was effective in identifying potentially important dimensions, and participants' qualitative responses were utilized to generate an initial over-representative item list.

We proceeded with our scale development effort following modern recommendations (Brown, 2015; DeVellis & Thorpe, 2021; Harrington, 2009; Hinkin, 1995, 1998; Howard, 2019; Jackson et al., 2009). Study 2 reduced the over-representative item list into a more concise measure, and it initially supported the psychometric properties of this measure via EFA. Study 3 confirmed the psychometric properties of the measure via CFA, which we then labeled the NPRS. Study 4 supported the concurrent validity, discriminant validity, and utility of the NPRS by assessing its relations with constructs associated with the theory of planned behavior. We found that the NPRS dimensions relate to these constructs as expected, and these dimensions also explained significant variance in recycling behaviors beyond these constructs. Study 5 also supported the concurrent validity, discriminant validity, and utility of the NPRS by assessing its relations with various conceptualizations of attitudes and selected other constructs. We again found that the NPRS dimensions relate to these constructs as expected, and these dimensions also explained significant variance in recycling behaviors beyond these constructs.

These studies cumulatively support that the NPRS is an appropriate measure to assess the primary negative perceptions people may have about recycling, which are: Inconvenience, Inaccessibility, Unknowledgeable, Lazy, Few Benefits, Lack of Space, Unable, and No Habit. These studies also support that the NPRS explains greater variance in recycling behaviors than broad collections of well-studied predictors, and these results together suggest that the NPRS may be an important tool in understanding why people

may or may not engage in recycling behaviors. They also indicate that the NPRS can provide unique theoretical insights. We discuss these associated implications and potential directions for future research directions below.

Implications and Future Research Directions

Advancing Theory of Recycling Perceptions. In modern research, the relations of recycling perceptions are obfuscated by the study of specific perceptions in isolation and the study of multiple specific perceptions without robust support for being applied together. These concerns prevent researchers from obtaining accurate and appropriately nuanced insights into recycling conceptions, and they pose the threat of skewing observed relations (Howard, 2022; Wuttke et al., 2020; Zhang & Laroche, 2020). By providing a supported multidimensional measure of recycling perceptions via a multiple-study process, we enable researchers to avoid these concerns in future research, as they can soundly assess the differing relations of specific dimensions representing recycling perceptions.

Furthermore, the current article identified the primary perceptions of recycling, but it also produced initial evidence for which perception most strongly relates to recycling behaviors. When tested together, the dimensions of Inaccessibility and No Habit were the most common significant predictors of recycling behaviors. Inconvenience, Lazy, Few Benefits, and Unable intermittently produced significant relations, whereas Unknowledgeable and Lack of Space did not produce any significant relations with recycling behaviors. This result suggests that the perceptions of not having a location (i.e., Inaccessibility) or routine (i.e., No Habit) for recycling are the largest perceptual relations of recycling behaviors, and future research should focus on theory associated with these two dimensions. As discussed further below, self-determination theory and habit theories may be particularly fruitful for future research. On the other hand, it may be less important to investigate the role of Unknowledgeable and Lack of Space, as people seem to persist with their recycling behaviors despite holding these two perceptions.

By demonstrating that our dimensions more strongly relate to recycling intentions and behaviors than representative constructs of the theory of planned behavior and certain additions (Ajzen, 1991, 2020; Terry et al., 1999; Tonglet et al., 2004), the current article supports that the NPRS dimensions may either be more proximal to recycling behaviors or a more comprehensive representation of important predictors to recycling behaviors, especially considering that the perceptions are representative of multiple theorical perspectives. Similarly, the same can be said by showing that our dimensions more strongly relate to recycling behaviors than a multitude of attitudinal and

closely related constructs (Best & Mayerl, 2013; Smith et al., 1994; Voss et al., 2003). Future researchers should shift their empirical focus and theoretical perspective to examine the perceptions represented by the NPRS. Namely, these dimensions were identified in an inductive manner, but a rationale may be developed as to why these dimensions and not others arose. A second- or third-order factor structure may be identified, for instance, that may differentiate broader constructs that define the emergence of these dimensions (Jackson et al., 1999; Li et al., 2017). For instance, perceptions that correspond to common theoretical perspectives may load together, which would then ultimately load onto a general higher-order factor. Likewise, these dimensions may serve as proximal mechanisms, and they may be key portions of pathways that can be elucidated now that these dimensions have been identified (Jagers et al., 2021). Thus, theorizing on recycling behaviors may benefit from a perception-focused perspective.

In performing these investigations, it is pertinent to draw from recent work on general perceptions. Ajzen et al. (2018) recommended identifying predominant perceptions by working backwards, which was the approach taken in the current article. That is, we identified a behavior of interest, and we identified the most relevant perceptions to that behavior. The current article now serves as a guide to satisfy the calls of Ajzen et al. (2018) and other authors, such that analogous approaches can be taken for similar behaviors (e.g., preventive behaviors) (Howard, 2022; Zhao & Knobel, 2021); however, the current article also serves as an application to test the broader theorizing of Ajzen et al. (2018) and other authors. Namely, Ajzen et al. (2018) made their call after observing that many relevant operationalizations do not produce strong relations with their outcomes of interest, producing a disconnect between theory and observation. The authors suggested that once this tension was resolved, further theoretical proposals could be more adequately tested. For instance, researchers could now investigate the association of our identified perceptions with behavioral, normative, and control beliefs, which could in turn further clarify the constructs' associations with attitudes, subjective norms, and perceived behavioral control. Researchers could also assess which grouping of constructs (i.e., the former or latter) may be more informed by the study of perceptions. By providing support for our general approach, future authors can perform similar investigations to further resolve these tensions.

It should also be highlighted that the NPRS dimensions did not produce multicollinearity issues in any of our studies. The variance explained by each of the dimensions was sufficiently unique, and the eight dimensions can be reliably studied together without producing statistical concerns. This finding should be contrasted with the alternative constructs administered in Study 5,

each of which have been considered important predictors of recycling behaviors in prior research. These alternative constructs produced multicollinearity issues, suggesting that they cannot be reliably studied together due to statistical issues. Perhaps more importantly, these findings indicate that the NPRS represents a sounder conceptualization than studying these multiple alternative constructs together. That is, while authors have considered these alternative constructs to be sufficiently distinct, they are instead too strongly related to reliability study together. Although these alternative constructs have differing labels, they produce very similar effects (i.e., jangle fallacy) (H. Marsh et al., 2019; Ponnock et al., 2020). On the other hand, we supported that the NPRS are sufficiently distinct. By providing this evidence, we suggest that the NPRS is a more appropriate theoretical perspective to apply, and we suggest that research on predictors of recycling behaviors should be shifted to studying our identified dimensions.

Theory of Planned Behavior and Recycling. While our results enable future researchers to re-envision their theorizing on recycling behaviors, they also provide insights into the theory of planned behavior. We identified the dominant perceptions of recycling when creating our measure, and we associated our identified perceptions with general perceptions of the behavior (e.g., attitudes), others (e.g., subjective norms), and context (e.g., perceived behavioral control). Our results showed that many dimensions most strongly related to perceived behavioral control, followed by attitudes. None most strongly related to subjective norms. These findings provide two implications.

Prior research may have focused too little on perceptions of the context (e.g., perceived behavioral control) to understand recycling behaviors. In prior research, authors have studied broad operationalizations of contextual barriers, such as assessing global perceptions of barriers or perceived behavioral control (Gardner, 1996; Hendrick et al., 2013; Reid, 2006). Our results support, however, that more specific perceptions about the context may produce unique relations with recycling behaviors, and one perception may produce a strong relation while the other produces almost no relation. This finding indicates that future researchers should reinvestigate prior findings on contextual influences. Researchers have supported that these perceptions about the context are pivotal mediators and moderators (Best & Mayerl, 2013; Smith et al., 1994; Terry et al., 1999; Tonglet et al., 2004); however, it is likely that only certain perceptions mediate or moderate these relations, and the significant mediators or moderators may differ for each antecedent effect. By reconducting these studies with our multidimensional perspective, future authors can add appropriate nuance to relevant theoretical

perspectives, better understanding exactly why and how certain antecedent effects may or may not influence recycling behaviors.

Researchers may have also limited their models by devoting equal attention to perceptions about the behavior (e.g., attitudes), perceptions about others (e.g., subjective norm), and perceptions about the context (e.g., perceived behavioral control). By diving focus across these domains, these researchers may not be devoting enough attention to the most meaningful predictors. In future studies, it may be appropriate to place a larger focus on perceptions about the context, as these perceptions produced the strongest relations with recycling behaviors. Alternatively, it may also be appropriate to place less focus on perceptions about others. By doing so, a more focused field of research on recycling behaviors may emerge, as the current article narrows future possibilities in addition to identifying further directions for future research.

Further, the theory of planned behavior includes beliefs (Ajzen, 1991, 2020), which should be contrasted with perceptions due to their similarities. Both are conceptualized as multidimensional constructs, and both relate to behavioral outcomes (Montano & Kasprzyk, 2015; Yadav & Pathak, 2017; Yuriev et al., 2020). Beliefs are more deep-seeded individual differences formed through repeated exposure, whereas perceptions are more readily influenced—sometimes through a single exposure (Pickens, 2005). While both are important, it may be effective to focus on perceptions in understanding recycling behaviors, as these may be more susceptible to change. Also, future research should investigate the role of both beliefs and perceptions in tandem, as the similarities between the two may enable research on perceptions to inform the theory of planned behavior. For instance, authors have argued and supported that beliefs can be altered by changing perceptions (Carlton et al., 2016; K. L. Marsh & Wallace, 2005), indicating that perceptions are a predictor of beliefs in addition to the other elements of the theory of planned behavior. This link enables the study of perceptions and beliefs in relevant models, frameworks, and theories, which may lead to models of behavioral change via the deeper integration of perceptions into the theory.

Additional Theoretical Perspectives. Our results draw insights into additional theoretical perspectives. Habit theories suggest that people develop automatic cognitive processes to perform certain behaviors, which cause the performance of those behaviors to be less cognitively taxing (Verplanken & Aarts, 1999; Wood & Rünger, 2016). These theories tend to solely focus on the development of habits, and they rarely consider perceptions about the formation of habits. Our results found that people's perception of whether they have developed a habit for recycling is among the most consistent

predictors of recycling behaviors. This finding suggests that people may be motivated towards recycling behaviors if they believe a habit has been developed, perhaps because they view these behaviors are more of less cognitively taxing to perform. Based on this finding, the study of perceptions should be integrated into habit theories to obtain a complete understanding of the recycling decision making process, and perhaps even more broadly, perceptions may inform how habits form, how they motivate behavior, and how they sustain behavior.

Expectancy theory has been extensively supported to explain behaviors (Kiatkawsin & Han, 2017; Ramus & Killmer, 2007; Tang et al., 2023), and the current article provided further support that it may be important in understanding recycling perceptions and behaviors. The perception of Inconvenience relates to whether the efforts to recycle are burdensome, and the perception of Few Benefits relates to whether recycling provides modest rewards. In the context of expectancy theory, these two perceptions relate to whether the inputs (Inconvenience) are worth the outputs (Few Benefits) when recycling. Our results showed that these two perceptions produced intermittent relations with recycling behaviors. Expectancy theory could be applied to inform research on perceptions, but additional perceptions should also be investigated in studies on expectancy theory. Because these two relevant perceptions only produced intermittent relations when studied alongside other predictors, our results suggest that their effects may be exaggerated in prior studies that investigated them in isolation, and future research could obtain more accurate insights by replicating their effects when applying the NPRS.

The perception of Unknowledgeable produced among the weakest relations of the studied perceptions. This perception may be a manifestation of low self-efficacy (Bandura, 1982; Lippke, 2020), and its weak relations may suggest that this theoretical perspective may be less relevant to understanding recycling behaviors. Thus, future researchers should explore the other avenues for research before turning to self-efficacy theories when applying the NPRS.

Lastly, the contribution of the NPRS beyond prior measures of recycling perceptions should be emphasized. Prior recycling perception measures are either broad and assess perceptions based on valence alone (e.g., positive or negative) or narrow and assess a specific recycling perception (e.g., expectancy beliefs) (Kiatkawsin & Han, 2017; Ramus & Killmer, 2007; Tang et al., 2023). Both of these approaches fail to capture the true nuance of perceptions, as they are unable to identify how different perceptions about recycling may either conflict or work together in predicting behaviors. Even when authors apply multiple narrow measures together, they run the risk of unidentified

psychometric and validity issues producing skewed results, as authors rarely test these attributes when applying measures together for the first time. On the other hand, our measure assesses multiple distinct perceptions; it can capture this nuance in perceptions; and we provided robust support for its psychometric and validity evidence. Therefore, our work is a significant step forward in research and practice, and it enables future research to accurately assess undiscovered relations in the study of recycling perceptions.

Intervention Development. Our identified perceptions can inform the development of interventions. Researchers can develop interventions that specifically target the perceptions that we identified as most relevant to recycling behaviors, but it would perhaps be more effective to use the NPRS to create adaptive interventions. Adaptive interventions provide components to participants based on their standing of key variables, often resulting in more effective interventions at reduced costs (Collins et al., 2004; L. Wang & Miller, 2020). The NPRS could be used to first identify participants' perceptions, and then individualized intervention components could be presented to each participant based on their relative standing for each dimension. For instance, only participants that score highly on Few Benefits would be provided information about the positive impacts of recycling on the environment. By doing so, each participant can be more focused on the intervention component that may be most relevant to them, ultimately producing more effective behavioral changes.

Limitations and Future Research Directions

The current article relied on the self-report methodology. We chose this approach due to our interest in the study of recycling perceptions, and the self-report methodology is the predominant approach to assess recycling perceptions (Sidique et al., 2010; Tonglet et al., 2004; Wan et al., 2017). Future researchers should replicate our results with alternative measurement approaches and methodological designs. Perhaps most notably, we utilized a self-report measure of recycling behaviors, but more sophisticated, robust, and innovative approaches have been created to obtain more objective indicators of this outcome. For instance, authors have obtained observations of recycling bins and behavioral tracking measures to assess recycling behaviors. (Werner & Makela, 1998). Future researchers should apply these methodologies to further support that the NPRS relates to these behavioral indicators beyond prior measures.

Also, we utilized a qualitative approach to generate initial items and dimensional labels, which has been supported in many studies (DeVellis &

Thorpe, 2021; Hinkin, 1995, 1998; Howard, 2019, 2022). We also asked two separate questions to alleviate concerns with the fundamental attribution error (J. Harvey et al., 1981). It should be recognized, however, that this approach assumes that participants can cognitively identify their negative perceptions towards household recycling. It is well-known that several subconscious factors influence the decision to recycle (Carrus et al., 2008). While many of these factors are not perceptions (e.g., emotions), some may be less-noticeable perceptions that failed to be recognized. Our approach was also applied in a post hoc manner, such that participants were asked about perceptions associated with prior recycling behaviors. Post hoc approaches could be influenced by rationalization and other subconscious cognitive processes (Knoll et al., 2020). For this reason, future researchers should consider replicating our qualitative results with more implicit tests and/or querying participants at specific times of (in)action to identify all possible perceptions. We expect our results to replicate, as our results were able to explain a large amount of variance in recycling behaviors; however, this assessment could provide strong support for the validity of our findings.

The current article applied time-separated research designs to partially address common method biases (Podsakoff et al., 2024), but we did not apply designs that can provide robust insights into causal effects. As the study of perceptions is often focused on mediating effects, we urge researchers to apply designs that can provide these robust tests of causality, such as panel designs (Göritz, 2007). Likewise, we did not assess the test-retest reliability of our measure. While perceptions are known to change, they also demonstrate moderate temporal stability, and an accurate measure of perceptions should show some extent of test-retest reliability. Future researchers could contribute to supporting our measure by assessing its test-retest reliability.

Researchers should also explore the NPRS across contexts. While the measure produces adequate psychometric and validity evidence across the varying populations studied in the current article, future researchers should assess which dimensions may be particularly important in broader contexts. In doing so, researchers can obtain a better understanding of the recycling decision making process for all people. Similarly, the current article did not assess the cross-cultural validity of the developed measure, which is an ideal direction for future research. It is likely that perceptions of recycling differ across cultures, and it is even possible that the structure of recycling perceptions differs across cultures. While we expect our results to largely replicate across cultures, it is possible that a different number of dimensions emerge when our measure is studied in a specific cultural context.

Therefore, future researchers should continue to assess the psychometric properties of NPRS, especially when it is administered in novel cultural contexts.

Finally, a common idiom is the scale development process is never complete. Future researchers should continuously reassess the psychometric properties and validity of the NPRS across different populations and with different constructs. While the current article studied constructs associated with the theory of planned behaviors and attitudes due to their relevance to perceptions, future researchers should explore the broader nomological net of the NPRS. We particularly recommend assessing contextual predictors, such as location (e.g., rural vs. urban), as the NPRS dimensions produced many strong relations with perceived behavioral control.

Conclusion

The current article developed a multidimensional measure of recycling perceptions, the NPRS, via a five-study scale development process. We demonstrated that the measure produces appropriate psychometric and validity evidence, and we also supported that it explains more variance in recycling intentions and behaviors than many other popular constructs in the study of recycling. Via these efforts, we support that the NPRS may be particularly informative for understanding the recycling decision making process, opening several avenues for future research and the development of potentially more effective interventions.

Appendix A

Negative Perceptions of Recycling Scale

Below is a list of statements about recycling trash in your daily life. Please indicate the extent that you disagree to agree with these statements below about recycling.

(1) Strongly disagree
(2) Disagree
(3) Slightly disagree
(4) Neither disagree or agree
(5) Slightly agree
(6) Agree
(7) Strongly agree

Inconvenient

(1) Recycling is too inconvenient.
(2) Recycling takes too much time.
(3) Recycling is too much effort.
(4) Recycling is a hassle.

No Access

(1) There is no recycling service for my area.
(2) I do not have the community resources to recycle.
(3) There is no recycling near me.
(4) I would have to travel too far to recycle.

Unknowledgeable

(1) I do not know what can be recycled.
(2) I am not sure what things can be recycled.
(3) I am not educated enough about recycling.
(4) I am generally unsure what should be recycled or thrown away in the trash.

Lazy

(1) I am simply too lazy to recycle.
(2) When I choose not to recycle, it is because I am lazy.
(3) I am not disciplined enough to recycle.
(4) I sometimes feel too lazy to recycle.

Few Benefits

(1) Recycling provides few benefits for the environment.
(2) Recycling does not help much in the grand scheme of things.
(3) It does not matter if I recycle.
(4) There are few benefits from recycling.

Space

(1) I do not have physical space to recycle.
(2) Recycling bins take up too much space.

(3) I do not have the storage space to recycle.
(4) I do not like having to store things for recycling.

Unable to Be Recycled

(1) I use a lot of things that are unable to be recycled.
(2) A lot of things cannot be recycled.
(3) Many items are not collected by recycling.
(4) Many things have parts that cannot be recycled.

Habit

(1) It is automatic for me to just throw things in the trash.
(2) It is a habit for me to throw things away in the trash.
(3) I do not have the routine to recycle.
(4) It is second nature for me to throw things in the trash.

Note. When administering the Negative Perceptions of Recycling Scale, do not include dimensional labels.

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Ethical Approval

All research procedures were approved by the IRB of the primary author's institution.

Informed Consent

Informed consent was not obtained. All procedures were conducted over the internet, and obtaining informed consent would be the only identifying information that would link participants to the study. To ensure maximum confidentiality and anonymity, it was decided to not obtain participants' informed consent.

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Notes

1. We refer to perceptions as the lasting interpretation of a stimuli, which is developed via the stages of stimulation, registration, organization, and interpretation (see Pickens, 2005). While conceptualizations of perceptions may pose slight differences, this definition speaks to the core of most conceptualizations.
2. In addition to negative perceptions being strong predictors of behaviors, negative perceptions are often stronger predictors of behaviors than positive perceptions, and theories have been crafted to explain this phenomenon. For instance, the conservation of resources theory (Halbesleben et al., 2014) argues that resource loss is a stronger motivator than resource gain, explaining why negative perceptions (often associated with resource loss) are stronger predictors than positive perceptions (often associated with resource gain). Further, we expected a sizable number of dimensions to be identified for negative perceptions alone, and it was undesirable to develop a scale that would burden participants and produce poor quality responses from including too many indicators. Therefore, we focus on negative perceptions alone.

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