When doing more requires knowing more : explaining the intention to seek procedural information about recycling

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When doing more requires knowing more:

Explaining the intention to seek procedural information about recycling

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Abstract

This study examines the relationship between the intention to recycle more and the intention to seek procedural information, in this case, information about how to recycle. In contrast to prior research that used information seeking as a predictor of behavior change, this study considers behavioral intention as a predictor of intention to seek information.

Regression analysis of survey data from Singapore residents confirms that prediction, explaining 27% of the variance in intention to seek procedural information. Moderation analysis suggests the effect of intention to recycle more is stronger among individuals with low recycling self-efficacy. An alternative analysis suggests the greater the intention to recycle more, the stronger effect of perceived information insufficiency on the intention to seek information. We discuss these effects in relation to the instrumental utility of information and information avoidance. This research contributes to a growing literature describing the importance of procedural information to support recycling behavior.

Keywords: recycling intention, theory of planned behavior, procedural information, information seeking, self-efficacy

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Introduction

It is not surprising people with convenient access to recycling bins are more likely to recycle (Martin, Williams, and Clark 2006). Infrastructure is important for recycling to occur, but it does not guarantee people will recycle. Individual-level factors are also important (Thomas and Sharp 2013). For example, lack of information and knowledge are barriers to household recycling (Prestin and Pearce 2010, Nixon and Saphores 2009, Nyamwange 1996). Addressing informational barriers can complement infrastructure to promote recycling behavior (Ham 1984). But why would people pay attention to or seek information about recycling?

There are at least two perspectives explaining why people seek information about environmental behaviors. One perspective draws attention to value-related beliefs. People often seek information to validate their existing attitudes and behaviors and seeking information can reinforce beliefs about the personal and social value of an environmental behavior (Trumbo and O'Keefe 2005, 2001). Another perspective focuses on the utility of information, where individuals seek information to help them deal with prospective challenges (Griffin et al. 2004). From that view, information can help individuals process the issue at hand and formulate an appropriate behavioral response (Kowatsch and Maass 2010, Workman 2014, Pelletier and Sharp 2008).

Whereas the former perspective draws attention to information about *why* to recycle, the latter emphasizes information about *how* to recycle. This study is interested in that latter perspective because information about how to recycle, which we label *procedural information*, facilitates the correct use of recycling infrastructure. This kind of information can reduce doubts pertaining to the behavioral process, which should be especially useful to

individuals who wish to increase their level of recycling. In addition, obtaining information about how to perform a behavior can increase perceived self-efficacy (Moore, Chang, and Smith 2006) and perceived behavioral control (Rosenthal 2018). Even when individuals lack knowledge about how to recycle, some may still wish to recycle because they have a positive attitude toward it or feel compelled by a perceived social norm. Hence, we ask the research question, do individuals who feel they lack procedural knowledge about recycling seek out information about how to recycle because they wish to recycle more? We also question whether intention to seek procedural information increases when perceived ability to recycle (i.e., recycling self-efficacy) is low. We propose the answer to both questions is yes. Such an outcome would support the information-as-utility perspective, highlighting the importance of clear, actionable information about the recycling process.

The current study draws on the planned risk information seeking model (PRISM; Kahlor 2010)—a derivative of the theory of planned behavior (Ajzen 1985) and the risk information seeking and processing model (Griffin, Dunwoody, and Neuwirth 1999)—which we explore in the following literature review. First, we review the concepts of perceived knowledge and information seeking, arguing that people are motivated to seek information when they feel their knowledge is lacking. Next, we review relevant literature about behavioral intention and self-efficacy. Central to our thesis, we argue self-efficacy is related to having knowledge about how to perform a behavior. Finally, we synthesize these two conceptual areas, arguing that recycling self-efficacy is related to perceived procedural knowledge sufficiency, which creates a link between intention to recycle more and intention to seek procedural information. Specifically, people actively seek out information about how to recycle when they wish to increase their level of recycling, and this is especially so when they feel their self-efficacy to recycle is low.

Procedural Information and Information Seeking

Pelletier and Sharp (2008) argued that procedural information supports behavior because it increases behavioral autonomy. This is because procedural information conveys information about how to perform a behavior. It is typically instructive and action-oriented, allowing individuals to understand how to act upon their behavioral intentions. A logical extension of that characterization is that individuals who have behavioral intention will have a need for procedural information to help ensure they can successfully perform the behavior. Despite the logic of that argument, scholars have yet to examine behavioral intention as a predictor of procedural information seeking. The PRISM (Kahlor 2010; see Figure 1) gives a comprehensive explanation of information seeking in the context of environmental and health risks, offering a good starting point to consider how behavioral intention may motivate intention to seek information.

[Insert Figure 1 about here.]

The PRISM extended the risk information seeking and processing model (Griffin, Dunwoody, and Neuwirth 1999, Kahlor 2007). The central idea of the risk information seeking and processing model is people put more effort into seeking out and processing information when they have information insufficiency, or feel their current knowledge about an issue is lacking (see also Chaiken 1980). Researchers often operationalize perceived information insufficiency as the difference between how much people think they need to know about an issue (i.e., their *information sufficiency threshold*) and how much they think they already know about it (i.e., their *perceived current knowledge*). Griffin et al. (1999) used perceived information insufficiency to explain individuals' motivations to seek and process risk-related information. They identified two additional key concepts affecting perceived

information insufficiency. The first is affective response to a perceived risk, which corresponds with feelings of concern and worry. The second concept is seeking-related subjective norm, which reflects the belief that important others would approve of information seeking or that others engage in it. Presumably, such beliefs would affect the perceived value of information, thus increasing the amount of knowledge individuals think is necessary for them to pass confident judgment about a risk-related issue. The PRISM further extended that prior model by directly integrating concepts from the theory of planned behavior (Ajzen 1991, 1985), including seeking-related subjective norm, attitude toward seeking, and perceived seeking control, as predictors of both information insufficiency and intention to seek information. Several studies have validated the PRISM in the contexts of cancer (Hovick, Kahlor, and Liang 2014), fossil fuel extraction (Eastin et al. 2015), and even the 2016 U.S. Presidential election (Kahlor, Yang, and Liang 2018).

As with the risk information seeking and processing model, the central argument of the PRISM is people seek information when they feel their current level of knowledge is insufficient for dealing with a prospective issue. This implies information has subjective utility and seeking information can help individuals feel confident in how they deal with issues. This idea is generally consistent with Atkin (1973), who proposed that people seek information because it has instrumental utility, fulfilling their different aims and objectives. The concept of instrumental utility concerns the practical use of information to guide attitudes or to direct behaviors (Atkin 1973), which relates to the present study.

In the context of recycling, procedural knowledge may include what items can be recycled, how to prepare items for recycling, and where to recycle. These kinds of information have utility to individuals who wish to have a better understanding of how to recycle. Motivation to seek these kinds of information may arise when, for example, individuals have perceived procedural information insufficiency (Kahlor 2010, Hovick,

Kahlor, and Liang 2014, Griffin et al. 2008, Eastin et al. 2015). But what is the source of this perceived insufficiency? Extending the PRISM, we suggest intention to perform more of a behavior also affects perceived information insufficiency, particularly for behaviors involving procedural steps. Assuming individuals are aware of the procedural aspect of such behaviors, then the intention to perform more of those behaviors ought to elevate the sufficiency threshold for procedural information. That is, if performing a behavior requires knowing how to do it, performing more of a behavior may require even more knowledge. This will result in greater information insufficiency and enhance the subjective utility of procedural information. This is most likely the case for individuals who plan to start a new behavior. It is uncertain whether this would also occur for individuals who intend to perform an existing behavior more frequently. For those latter individuals, learning how they can perform the behavior more effectively (e.g., by learning how to reduce contamination of recyclables) could help them increase the behavior, even if they already have a general understanding of how to do it.

Hypothesis 1. The greater the intention to recycle more, the greater the (a) perceived procedural information insufficiency and (b) intention to seek procedural information about recycling.

Hypothesis 2. The relationship between intention to recycle more and intention to seek procedural information about recycling is mediated by perceived procedural information insufficiency.

In contrast to hypotheses 1a and 2, it may also be intention to recycle more moderates the effect of procedural information insufficiency on intention to seek procedural information. This is because individuals will react to their perceived information insufficiency (by seeking information) especially when that information has utility to them.

In the context of recycling, procedural information has utility because it helps individuals recycle. Thus, we propose an alternative hypothesis.

Hypothesis 3. The greater the intention to recycle more, the more positive the relationship between perceived procedural information insufficiency and intention to seek procedural information about recycling.

Behavioral Intention and Self-Efficacy

Our first three predictions concern the intention to recycle *more*, which we conceptualize as an intention to change, a special kind of behavioral intention. Behavioral intention reflects a desire to perform a behavior in the future. It arises from behavioral motivation and suggests individuals' willingness to perform a behavior (Ajzen 1991). Given motivation and ability to perform a behavior, intention is a good predictor of actual behavior (Armitage and Conner 2001). Additional evidence suggests behavioral intention is strongly related to past behavior (Conner and Armitage 1998); however, some individuals who have not previously engaged in a behavior may nonetheless intend to perform it in the future. For those individuals, intention suggests a desire to change. This intention to change may also apply to individuals who currently perform a behavior, but not to the extent or in the way they prefer.

Intention to change has appeared in some prior research. Pai and Edington (2008) conceptualized it as arising from motivational factors and measured it in the context of health risk appraisal by asking, "In the next six months, are you planning to make any changes to keep yourself healthy or improve your health?" Essentially, their operationalization measured future expectations of behavioral change. Mir, Behrang, Isaai, and Nejat (2016) measured intention to change to eco-friendlier modes of transportation as the difference of "greenness" between the current mode of transportation and the desired future mode of transportation.

The current study focuses on the intention to recycle more, which reflects motivation and ability to increase the amount of waste individuals recycle. For current purposes, a broad definition suffices. It encompasses both individuals who do not currently recycle but would like to start recycling and individuals who currently recycle and would like to recycle more. Also, it does not specify whether “more” refers to the volume of recycling or the percentage of waste recycled. An increase in either metric would indicate more recycling.

We highlight this concept because the motivations to increase a behavior may be distinct from motivations to maintain an existing behavior. Individuals whose intention is to maintain an existing behavior should have little need for information about how to perform the behavior, as they are simply repeating past behavior that over time becomes automatic (Anderson 1982, 1987). On the other hand, when individuals wish to increase a behavior like recycling, their intended behavioral change requires more systematic effort. That additional effort may benefit from seeking information about how to recycle more effectively. This in turn has relevance to acquiring skills and developing a sense of self-efficacy.

According to Wood and Bandura (1989), self-efficacy reflects “beliefs in one’s capabilities to mobilize the motivation, cognitive resources, and courses of action needed to meet given situational demands” (p. 408). In the context of recycling, self-efficacy reflects how capable individuals feel to recycle, and may refer to such factors as ability to sort recyclable materials (Tabernero and Hernandez 2011, Lindsay and Strathman 1997) and generally understanding the procedural steps of how to recycle (White, MacDonnell, and Dahl 2011). Thus, it follows that recycling self-efficacy should be related to knowledge of the procedural steps of recycling, which individuals can gain by seeking procedural information about how to recycle (Moores, Chang, and Smith 2006). Research has shown the effect of persuasive and educational information on behavior is partly due to its ability to increase self-efficacy in the contexts of environmental behaviors (Witzling, Shaw, and Amato 2015),

computer use (Gravill, Compeau, and Marcolin 2002), and fraud avoidance (Arachchilage and Love 2014). These arguments suggest individuals have needs for procedural information to feel more capable of performing the intended behavior. Consequently, individuals should especially desire procedural information when they wish to perform more of a behavior but feel they lack capability to do so.

Hypothesis 4. The lower individuals' recycling self-efficacy, the stronger the relationship between their intention to recycle more and intention to seek procedural information about recycling.

Alternatively, self-efficacy may mediate the effect of perceived procedural information insufficiency on intention to seek procedural information. Individuals may have low recycling self-efficacy because they feel they have too little information about how to recycle. Therefore, they will be motivated to seek procedural information insofar as it improves their self-efficacy.

Hypothesis 5. The relationship between perceived procedural information insufficiency and intention to seek procedural information is mediated by recycling self-efficacy.

In summary of our hypotheses, we have expanded the PRISM, arguing that people are motivated to seek information when they wish to perform more of a behavior. This effect occurs through mediated and moderated pathways, which Figure 2 shows in two alternative models. Before we test those models, we describe the context of our study.

[Insert Figure 2 about here.]

Study Context

This study takes place in Singapore, which is a low-lying tropical city-state. Singapore's small land area of roughly 720 square kilometers (Data.gov.sg 2018) means there is limited space for landfills to dispose of municipal solid waste. Of the waste generated in 2018, 60% was recycled, but most of the recycling is being done in the commercial and industrial sectors (NEA 2019). Most of the unrecycled waste is incinerated, with the ash sent to an offshore landfill located on an island. At the current rate of waste disposal, the landfill will reach capacity around 2035 (Patra, Whaung, and Kwan 2017).

In 2001, Singapore's National Environment Agency launched the National Recycling Programme to improve the domestic recycling rate in Singapore. The program achieved widespread availability of single-stream recycling bins at residential properties and dedicated single-stream recycling chutes in newer high-rise buildings. Despite convenient recycling facilities, the domestic recycling rate is around 20% and more than one-third of recyclables have food waste or other contaminants that impede successful recycling (Boh 2016). The contamination issue is related to inadequate rinsing by household members, contamination spreading in the recycling bins to uncontaminated items, and strict standards the public waste collectors follow when sorting recyclables at their material recovery facilities (R. Cheah, personal communication). In sum, people residing in Singapore are not recycling frequently, and many people who are recycling are doing so wrongly.

In the context of Singapore, there are two key information strategies for improving the effective recycling rate. First, general information campaigns about how to recycle correctly could encourage individuals to start recycling or, among those who already recycle, to do so more consistently. Second, information campaigns focusing on the issue of contamination could reduce the number of recyclable items that start in recycling bins but end up in

incinerators. Such campaigns would be helpful to individuals who currently recycle but lack consistency or have unknowingly been recycling contaminated items.

Method

Sample

Participants ($N = 1,468$) were part of a Singapore-based online research panel. Participant ages ranged from 18 years to 65 years ($M = 35.42$, $SD = 11.81$) and comprised similar numbers of both sexes (52% female, 48% male). Participants had a median educational attainment of a diploma, which is the equivalent of an associate degree in the United States. These demographics appear in the statistical analysis as control variables.

Dependent Variable: Intention to Seek Procedural Information

Participants responded to three items (see Table 1) ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), which had good reliability. The items referred to seeking information “during the next two weeks” because our study is interested in how intention to seek information in the near term is related to intentions to perform subsequent behaviors. Although the kinds of information these measures concern are not all-encompassing of the recycling procedure, they nonetheless measure important aspects of it. Knowing more about what can be recycled, where to recycle, and how to properly sort recyclables can help people who wish to start recycling, as well as people who wish to recycle more consistently or avoid contamination.

[Insert Table 1 about here]

Independent Variables

Perceived procedural information insufficiency. This construct reflects perceived information insufficiency about aspects of the recycling procedure. Participants indicated

their perceived current knowledge and information sufficiency threshold on a scale of 0 (*knowing nothing*) to 100 (*knowing everything*). Separate items asked about current knowledge (“how much do you currently know about...”) and information sufficiency threshold (“in order to recycle confidently, how much should someone know about...”) for “the kinds of waste that can be recycled” and “the locations of recycling bins” (see Table 2). We based this measurement on prior research (e.g., Kahlor et al. 2006, Griffin et al. 2008, Ho et al. 2014).

Consistent with recommendations of Rosenthal (2013), we analyzed the residual variance of information sufficiency threshold after removing the effect of perceived current knowledge. This is superior to computing raw difference scores (Cohen et al. 2003) and reduces problems of biased estimates when there is multicollinearity in linear regression (Rosenthal 2013). This procedure involves two steps: (1) regress information sufficiency threshold (y) on perceived current knowledge (x) and note the unstandardized regression coefficient, B ; then (2) compute the residual variance as $y - x*B$. We applied this procedure to the two items about the kinds of waste that can be recycled and separately to the two items about the locations of recycling bins. This resulted in two residual scores (see Table 2), which we averaged to create a composite measure ($M = 52.21$, $SD = 18.72$, Spearman-Brown coefficient = .75). The higher the score, the greater the information insufficiency.

[Insert Table 2 about here.]

Intention to recycle more. Participants responded to four items (see Table 1) ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), which had acceptable reliability. The items referred to recycling “during the next month” following Ajzen’s (2006) recommendations for measuring behavioral intention.

Recycling self-efficacy. Participants responded to three items (see Table 1) ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), which had acceptable reliability.

Control Variables

PRISM control variables. In addition to controlling for demographic variables, we controlled for predictors of intention to seek information according to the PRISM (Kahlor 2010), which we measured using Likert items ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Table 1 contains the item wording. The measures of attitude toward seeking and perceived seeking control used single-item measures. We used a single-item proxy for seeking-related subjective norm. That item measured a descriptive norm of being knowledgeable about recycling. We measured affective response to perceived risk as the level of agreement with two statements, which had acceptable reliability. These variables form a baseline model of intention to seek information, drawing on one of the most current frameworks for explaining information seeking in the context of environmental issues and environmental behaviors. By including these variables, we are better able to determine if the hypothesized predictors have unique explanatory power.

Past recycling behavior. We included past recycling behavior in the PRISM extension as an additional control variable (see Table 1). This was a self-reported measure asking, “During the previous month, approximately how many percent of your waste did you recycle?” (Note, “how many percent” is common English phrasing in Singapore.) Respondents indicated their response by dragging a slider from 0% to 100% in five-point increments. The logic behind including this measure is individuals who say they have recycled in the past may already feel they understand how to recycle and have lower perceived information insufficiency, but also express greater intention to seek recycling-related information to reinforce existing beliefs. By controlling for those relationships, we can better predict perceived information insufficiency and information seeking intention.

Results

First, we conducted descriptive analysis of past recycling behavior. Despite it being a self-report, this analysis is useful for roughly classifying respondents by how much they already recycled. Few respondents (3%) reported they did not recycle any of their waste in the previous month. About one-fifth of respondents (22%) reported recycling between 5% and 15% of their waste. Nearly half of respondents (46%) reported recycling between 20% and 50% of their waste. One-fourth (25%) reported recycling between 55% and 80% of their waste. Finally, few respondents (4%) reported recycling 85% or more of their waste. The median reported recycling rate was 35%.

We tested hypotheses using multiple regression analysis in SPSS version 25 and report the standardized estimates and *p*-values in-text. In support of H1a, information insufficiency was positively related, albeit weakly, to intention to recycle more ($\beta = .06$, $p = .048$) after controlling for age ($\beta = -.02$, $p = .549$), gender ($\beta = .10$, $p < .001$), education ($\beta = .01$, $p = .789$), attitude toward seeking ($\beta = .08$, $p = .011$), information seeking subjective norm ($\beta = -.08$, $p = .004$), perceived seeking control ($\beta = -.04$, $p = .130$), affective response ($\beta = .07$, $p = .016$), and past recycling behavior ($\beta = -.05$, $p = .101$). In support of H1b, intention to seek procedural information was positively related to intention to recycle more ($\beta = .24$, $p < .001$) after controlling for demographics, the baseline PRISM, and past recycling behavior (see Table 3, Model 3). The greater the intention to recycle more, the greater the intention to seek procedural information about recycling. This model explained 27% of the variance in intention to seek procedural information.

[Insert Table 3 about here.]

The test of H2 used mediation analysis, which requires the mediator be associated with both the predictor and outcome variables (Judd and Kenny 1981). As our regression analysis showed, perceived information insufficiency was unrelated to intention to seek procedural information ($\beta = .02, p = .399$; see Table 3, Model 3). Therefore, the data fail to support the proposed mediation.

The tests of H3 and H4 included interaction terms to predict intention to seek procedural information (see Table 3, Models 4a and 4b), which we computed using mean-centered values of the interacting variables. In support of H3, there was a positive interaction of perceived information insufficiency and intention to recycle more ($\beta = .07, p = .002$). Although this effect was weak, it suggests the higher the intention to recycle more, the more positive the relationship between perceived information insufficiency and intention to seek procedural information (Figure 3). In support of H4, there was a negative interaction of intention to recycle more and recycling self-efficacy ($\beta = -.05, p = .042$). Although the effect was weak, it suggests the lower the perceived recycling self-efficacy, the stronger the relationship between intention to seek procedural information and intention to recycle more (Figure 4). We used the Akaike information criterion (AIC) and the Bayesian information criteria (BIC) to compare the relative fit of the two models. With both information criteria, a lower value indicates better fit (Fabozzi et al. 2014). Both information criteria were lower for the model containing H3 (AIC = -1555.33; BIC = -1486.53) than for the model containing H4 (AIC = -1549.77; BIC = -1480.97). This means the model containing H3 is superior to the model containing H4, which is not surprising given the former had a slightly higher R^2 value.

[Insert Figures 3 and 4 about here.]

The test of H5 used mediation analysis, which requires, in addition to the previous requirements noted, the predictor to be associated with the outcome (Judd and Kenny 1981). Because perceived information insufficiency was unrelated to intention to seek procedural information, the data fail to support the proposed mediation.

Discussion

When people learn how to perform a behavior, they are generally better able to perform it as a result. This is a straightforward assertion. When people see the utility of procedural information for performing certain behaviors, they may actively seek it out to support their behavioral intentions, especially when they wish to perform more of a behavior. We examined this process in the context of recycling, as it is a behavior requiring the successful execution of multiple sequential steps. We argued individuals who intend to recycle more will be motivated to seek procedural recycling information, or information about how to recycle. We were also interested in how perceived procedural information insufficiency and recycling self-efficacy affect the intention-seeking relationship. Analysis of cross-sectional survey data supported most of our predictions and extended the literature on why people seek information that has instrumental utility.

Our hypotheses were interested in the linkages among the intention to recycle more, recycling self-efficacy, information insufficiency, and intention to seek information. These predictions built on the framework of the PRISM (Kahlor 2010). It is worth pointing out the PRISM accounted for most of the variance in intention to seek procedural information, which provides another validation of that model. Notably, intention to seek procedural information was positively related to attitude toward seeking, seeking-related subjective norm, and negative affective response to perceived risk, and unrelated to perceived seeking control. Those findings are consistent with prior work showing perceived seeking control is a weak predictor of intention to seek information (Kahlor 2010, Eastin et al. 2015). This is interesting

because it suggests perceived seeking control may not always be needed to predict intention to seek information. It may be enough to use the theory of reasoned action (Fishbein and Ajzen 1975), which as a predecessor of the theory of planned behavior did not include perceived behavioral control. However, such speculation is beside the point of the current work.

In extending the PRISM, we found the intention to recycle more was positively related to perceived information insufficiency (H1a) and intention to seek information (H1b). To the extent information seeking can help individuals engage in a desired course of action, they will have a positive view of information seeking, and will form intentions to seek information when they feel their knowledge is lacking. When individuals wish to engage in more of a behavior, they may identify a need for additional procedural information and have the intention to seek it. The utility of procedural information, then, is it can help individuals change their behaviors, an argument Rosenthal (2018) also developed. However, the motivation to seek procedural information may depend on individuals being aware of that utility. Such understanding may reflect a kind of procedural metacognition (Roebbers and Feurer 2016), which would define for the individual recycler why procedural information is helpful in facilitating their behavior. It is unclear if such metacognition would moderate the relationship between the intention to recycle more and the intention to seek procedural recycling information. Future research could examine if individuals need to be cognizant of the utility of procedural information for their behavioral intentions to motivate procedural information seeking. Related to that point, future research might clearly delineate between different ways individuals may do “more” of a behavior. We suspect procedural information has the most utility for individuals who plan to start a new behavior, as opposed to those who intend to perform an existing behavior more frequently.

Our next hypothesis (H2) stated perceived information insufficiency mediates the linkage between intention to recycle more and intention to seek procedural recycling information. Analyses failed to support our prediction as, contrary to some prior work (Hovick, Kahlor, and Liang 2014, Eastin et al. 2015), we found information insufficiency did not significantly predict intention to seek information. We failed to support our final hypothesis (H5) for the same reason. We think the null finding is because there was not a large difference between perceived current knowledge and the information sufficiency threshold. Despite most participants reporting some degree of information insufficiency, it may not have been large enough to motivate information seeking. It would be informative research to identify an *information insufficiency threshold* at which perceived information insufficiency drives intention to seek information.

Related to that explanation, it is possible that participants believed people in general need a high amount of procedural information, and despite their own current knowledge being lower than the sufficiency threshold, it was enough for them. We suspect this was the case because the question about sufficiency threshold asked “how much should someone know” about what and where to recycle. What a person thinks they should know and what they think “someone” should know may be different things. Given this operationalization, having knowledge below the sufficiency threshold may matter only to individuals who have a specific need for procedural information, such as those who intend to recycle more. Our test of H3 offers some support to this explanation because it showed the relationship between perceived procedural information insufficiency and intention to seek procedural information was more positive among individuals with a stronger intention to recycle more. This finding is consistent with long-standing characterizations of the instrumental utility of information (Atkin 1973).

We also found support for the predicted interaction of self-efficacy and the intention to recycle more (H4). The relationship between recycling intention and intention to seek information was consistently positive, but stronger when self-efficacy was lower. This finding suggests individuals who wish to recycle more are motivated to seek procedural information, especially when they feel their ability is lacking. This is an everyday phenomenon that may occur when, for example, individuals use instruction manuals to assemble furniture for the first time. In many instances when individuals seek information that helps them perform a new behavior, they are using procedural information to bolster their self-efficacy. When individuals seek this kind of information strategically, it is likely because they recognize the link between information acquisition and self-efficacy. This idea is consistent with prior research showing exposure to information and self-efficacy are related (Trumbo and O'Keefe 2001, Huang 2016).

Limitations and Conclusion

This study's primary limitation is that the sampling frame comprised opt-in members of an online research panel. The fact that all the panel members are Internet users means they are not representative of the general population with respect to information access. This issue is partially mitigated by the fact that most residents of Singapore have broadband Internet access at home (Infocomm Development Authority of Singapore 2015). There were a few measurement-related limitations. First, all measures were self-reported and might not be valid indications of the thought processes that led individuals to seek procedural recycling information. Second, this study did not examine how seeking procedural information affects actual recycling behavior, a limitation related to self-reported measures and the study's cross-sectional design. Third, our measure of recycling intention did not clarify how individuals recycle more. To individuals who seldom recycle, "recycling more" could mean increasing the frequency of recycling. To individuals who always recycle, that phrase could mean taking

more time to remove contamination. Increasing the amount of recycling is not necessarily the same thing as doing a better job of recycling the same items. The different ways people go about recycling implicate different uses of procedural information. Fourth, our measurement of self-efficacy was limited. Like our measure of intention to recycle more, it failed to isolate specific ways individuals may recycle more. Further, it concerned ability to engage in recycling, not to ability increase it. As we argued in the literature review, the motivations for increasing a behavior may often be different from the motivations to simply maintain it. These points of misalignment may help explain the weak effect of self-efficacy on intention to recycle more. Finally, whereas we measured intention to seek procedural information during “the next two weeks,” we measured intention to recycle more during “the next month.” If people seek information in anticipation of behavior change, then it is reasonable to measure information as temporally antecedent to behavior change. However, given the current cross-sectional design, we cannot assume such a causal ordering.

In conclusion, this study suggests individuals are motivated to seek procedural recycling information when they wish to increase their level of recycling. This contributes to research about the instrumental utility of information by showing information seeking is related to behavioral goals. Further, the effect of intention to recycle more on intention to seek procedural information was stronger when individuals had low recycling self-efficacy. This moderation effect suggests individuals are most motivated to seek information when they have an intention to recycle more but feel their ability to recycle is low. These findings clarify how procedural information may complement recycling infrastructure to help individuals reach their recycling goals.

In the grander scheme of things, we believe the findings of this study are not exclusive to the recycling context. Any behavior involving several steps for successful enactment might benefit from individuals having greater procedural knowledge. Especially in

more complex behaviors where individuals may have lower self-efficacy to successfully enact the behavior, the role of procedural information in empowering individuals to act on their intentions becomes even more evident.

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Figure 1. The planned risk information seeking model, simplified

Figure 2. Alternative models of intention to seek procedural information. PRISM control variables include attitude toward seeking, seeking-related subjective norm, perceived seeking control, and affective response to perceived risk. The plus and minus signs indicate the directions of the predicted relationships.

Figure 3. Interaction of intention to recycle more and perceived procedural information insufficiency to predict intention to seek information

Figure 4. Interaction of perceived recycling self-efficacy and intention to recycle more to predict intention to seek information

Table 1

Descriptive statistics for measurement items and composite indexes

<i>Construct</i>	Mean	Std. Deviation	Skewness	Kurtosis
Item wording				
<i>Intention to Seek Procedural Information (Cronbach's $\alpha = .87$)</i>	3.68	0.69	-0.56	1.03
During the next two weeks, I will learn more about what kinds of waste can be recycled.	3.71	0.74	-0.57	0.87
During the next two weeks, I will learn more about the locations of recycling bins.	3.63	0.80	-0.47	0.49
During the next two weeks, I will learn more about how to properly sort recyclables.	3.71	0.78	-0.55	0.64
<i>Intention to Recycle More (Cronbach's $\alpha = .72$)</i>	3.85	0.53	-0.25	1.19
During the next month I will do more to recycle.	3.92	0.65	-0.52	1.35
During the next month I plan to increase the amount of waste I recycle.	3.61	0.81	-0.63	0.80
I would like to recycle more than I currently do.	4.06	0.63	-0.46	1.04
I don't feel the need to recycle more (reverse-coded).	3.83	0.78	-0.56	0.27
<i>Recycling Self-Efficacy (Cronbach's $\alpha = .77$)</i>	3.17	0.81	-0.05	-0.046
It is easy for me to recycle if I want to.	3.42	0.94	-0.47	-0.41
I feel that recycling is difficult (reverse-coded).	3.14	1.01	-0.08	-0.84
I find that I am often unable to recycle (reverse-coded).	2.94	0.97	0.13	-0.82
<i>Attitude Toward Seeking</i>				
It is a good idea to learn about recycling.	4.17	0.56	-0.14	0.65
<i>Seeking-Related Subjective Norm</i>				
The people whose opinions I value have good knowledge about recycling.	3.23	0.78	0.02	-0.06
<i>Perceived Seeking Control</i>				
If I wanted to, I could easily seek information about recycling.	3.82	0.76	-0.69	0.73
<i>Affective Response to Perceived Risk (Spearman-Brown coefficient = .74)</i>	3.93	0.73	-0.72	0.92
I am concerned there isn't enough recycling in Singapore.	3.91	0.85	-0.89	1.17
I worry that Singaporeans aren't doing enough to recycle.	3.96	0.79	-0.78	0.96
<i>Past Recycling Behavior</i>				
During the previous month, approximately how many percent of your waste did you recycle?	38.76	25.15	0.31	-0.97

Table 2

Descriptive statistics for sufficiency threshold, current knowledge, and perceived procedural information insufficiency

Construct		Std.		
Item wording	Mean	Deviation	Skewness	Kurtosis
<i>Perceived Current Procedural Knowledge about</i>				
What kinds of waste can be recycled?	64.96	20.47	-0.53	0.75
The locations of recycling bins?	57.78	26.84	-0.36	-0.73
<i>Procedural Knowledge Sufficiency Threshold about</i>				
What kinds of waste can be recycled?	74.45	20.63	-0.74	0.24
The locations of recycling bins?	75.12	24.60	-1.04	0.40
<i>Perceived Procedural Information Insufficiency about</i>				
What kinds of waste can be recycled?	48.70	18.97	-0.18	0.00
The locations of recycling bins?	55.73	22.89	-0.43	0.64

Note. Two items measuring current procedural knowledge had the stem, “How much do you currently know about....” Two items measuring procedural knowledge sufficiency threshold had the stem, “In order to recycle confidently, how much should someone know about....” Perceived procedural information insufficiency is the residual variance of the sufficiency threshold after controlling for perceived current knowledge.

Table 3

Prediction of intention to seek procedural information

Predictor	<i>B</i>	<i>SE</i>	95% <i>CI</i>		β	<i>p</i>
			Lower	Upper		
<i>Intercept</i>		0.20	1.85	2.65	.00	<.001
<i>Model 1: Demographics</i>						
Age	0.00	0.00	0.00	0.01	.05	.053
Sex	0.06	0.03	0.00	0.12	.04	.056
Education	-0.05	0.01	-0.07	-0.03	-.10	<.001
$\Delta R^2 = .02$						
<i>Model 2: PRISM baseline</i>						
Attitude toward seeking	0.23	0.03	0.16	0.29	.18	<.001
Seeking-related subjective norm	0.14	0.02	0.10	0.18	.16	<.001
Perceived seeking control	-0.04	0.02	-0.09	0.00	-.05	.056
Negative affect	0.05	0.02	0.01	0.10	.06	.024
Information insufficiency	0.00	0.00	0.00	0.00	.02	.399
$\Delta R^2 = .20$						
<i>Model 3: Model extension</i>						
Past recycling behavior	0.00	0.00	0.00	0.01	.14	<.001
Intention to recycle more	0.31	0.04	0.24	0.38	.24	<.001
Recycling self-efficacy	-0.02	0.02	-0.06	0.03	-.02	.511
$\Delta R^2 = .06$						
Alternative moderation models						
<i>Model 4a</i>						
Information insufficiency $\times$ intention to recycle more	0.00	0.00	0.00	0.01	.07	.002
$\Delta R^2 = .005$						
<i>Model 4b</i>						
Intention to recycle more $\times$ recycling self-efficacy	-0.07	0.03	-0.13	0.00	-.05	.042
$\Delta R^2 = .002$						

Note. Estimates reflect the final model, which includes all blocks of predictor variables. *B* is the unstandardized regression slope and β is the standardized regression slope. The change in explained variance associated with each block of predictor variables (ΔR^2) is significant, where $p < .001$. PRISM = Planned risk information seeking model. “Negative affect” refers to negative affective response to perceived risk. “Information insufficiency” refers to perceived procedural information insufficiency.