Understanding Recycling While Tailgating: Applying an Information-Motives-Behavior Skills Approach

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Abstract

At large sporting events, venues often include multiple ways stadium spectators can recycle. However, outside the stadium, tailgaters often make up a large percentage of the event's attendees and yet may have unaccounted barriers to recycling. This paper uses both observational and survey data to examine the recycling behavior of tailgaters at an American Division I University's football events. Surveys revealed high reported intent to recycle, but observed behaviors revealed lower rates of recycling (48.7 %). Many of the tailgaters observed (40.7 %) used their own waste disposal bags, which was associated with decreased use of the venue's recycling infrastructure. Large groups not only used more of the venue's infrastructure, but were also more likely to use the venue's bags over bags they brought from home. Greater knowledge about the venue's infrastructure, higher motivation to recycle, and higher behavioral capacity to recycle were associated with increased reported recycling behavior. Certain groups, like alumni, those who tailgate frequently, and tailgaters who recycle at home reported the highest levels of predictors of recycling. Implications for future interventions and facility managers are discussed.

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W. Leal Filho and M. Zint (eds.), *The Contribution of Social Sciences to Sustainable Development at Universities*, World Sustainability Series,
DOI 10.1007/978-3-319-26866-8_18

Keywords
Interdisciplinary research · Behavior change · Large venue · Recycling · University setting

1 Introduction

Academic institutions are increasingly recognizing the potential detrimental impacts they pose to the natural environment. In attempt to mitigate some of these consequences, various universities have enacted measures to promote the sustainability of their institutions by enhancing energy efficiency, reducing petroleum-based transportation, and limiting the production of waste (The Association for the Advancement of Sustainability in Higher Education 2013). For example, The Pennsylvania State University (PSU) adopted the goal to make PSU a zero-waste institution.

While efforts have proven successful in integrating sustainable practices into some aspects of the university's operations (e.g., housing, food services), concern has been raised over the ability to achieve zero-waste at sporting events. Moreover, waste managers have expressed concerns over the effectiveness of enacted measures at football games. This concern is particularly relevant for the 200,000 or more tailgaters at each game, who camp and socialize at each event just outside the stadium, sometimes for days before the game starts. These and other sporting events pose a significant barrier not just to Penn State and its goal of zero-waste but to other campuses and their overall ability to be a sustainable, and environmentally conscious institutions.

In order to increase tailgater engagement in recycling, it is necessary to examine current recycling levels, and identify constraints to recycling specific of football tailgaters (McKenzie-Mohr 2000; McKenzie-Mohr et al. 1995). Thus, the primary purpose of this paper is to utilize a social psychological approach to better understand tailgater recycling engagement on campus. Doing so will provide Penn State with information needed to work toward becoming a zero-waste institution. Further, it will help other institutions overcome similar sustainability challenges associated with large sporting events.. To do this, we examined the applicability of Psychology's information-motives-behavior skills (IMB) model of behavior change to recycling at tailgates by utilizing a Sociological multi-method quantitative approach. The IMB model offers a unique, but powerful frame to study recycling behavior at large events. A frame that is particularly suited to study large events that are made up of smaller groups, such as tailgates.

2 Identifying the Scale of the Problem

Boasting the second largest football stadium in the United States (Beaver Stadium), State College, Pennsylvania receives a large influx of people to attend football games and participate in tailgating. PSU football games and associated activities (tailgating) bring over 200,000 individuals to the 110 acres surrounding the football field (PSU Sustainability Institute 2013), effectively tripling the size of the town on game days. This temporary increase in population creates positive benefits, such as increased sales at local businesses. However, if poorly managed, there is potential for such activities to create negative environmental impacts.

The environmental impacts of sporting events have only begun to receive academic attention in a growing body of scientific literature. Most cite increased traffic resulting in excess carbon output and greater waste production from increased consumption (Collins et al. 2009; Lenskyj 1998). At PSU football games, it is estimated that those who attend the game and tailgating events produce anywhere from 50 to 150 tons of waste each game (A. Matyasovsky 2013, personal communication, 20 September; PSU Sustainability Institute 2013), of which only 20–35 % is recycled (A. Matyasovsky 2013, personal communication, 20 September). This increase in waste production has significant impacts on the environment, including increased resources related to waste removal, processing, and disposal. Without addressing the amount of waste produced at football events, PSU cannot meet its goal of becoming a zero-waste institution.

3 The IMB Model

Recycling behavior has drawn a wide range of attention from several academic disciplines since the 1970s (Hornik et al. 1995). Early studies predominantly focused on external incentives towards recycling, such as monetary rewards (Vining and Ebreo 1990). Subsequent research explored internal motivators, such as psychological facilitators in determining actual recycling behavior (Hornik et al. 1995).

To date, most studies on recycling behavior have focused on household or curbside recycling. Importantly, the determinants of recycling behavior in the public sphere have been found to be different from those in other environments (e.g. household recycling; Andersson et al. 2005). For example, studies conducted in the workplace demonstrated that the physical layout of workplace infrastructure (Marans and Lee 1993), workplace group norms (Tudor et al. 2007), and organizational support (Paillé and Borial 2013) had impacts on employees' recycling behavior.

Given their public nature and the fact that tailgating often happens in social groups, recycling behavior at sporting events is likely more similar to workplace behavior than private behavior. Very few studies to date have examined recycling behavior specifically at sporting events. In a qualitative study, McCullough and

Cunningham (2011) found that while participants had positive attitudes towards recycling, lack of recycling opportunities, misinformation about recycling programs, and lack of accessibility to recycling facilities made it difficult to recycle. They also found that in addition to family and friends, the athletic department of the university had strong influence on recycling intention.

Effective interventions are theory-based and informed by evidence gathered from the specific population (McKenzie-Mohr 2000). We selected the IMB model for our study because of its ability to identify possible avenues for intervention of behavior change (Darnton 2008), and its congruity with previous findings' emphasis on motivation, information, and behavioral barriers (Horhota et al. 2014; McCullough and Cunningham 2011; Mosher and Desrochers 2014; Mulder et al. 2015). The IMB model has commonly been used in preventative health behaviors, though it has also found traction in studies examining other types of behavior (Misovich et al. 2003; Osborn and Egede 2010). The IMB framework suggests information, motivation, and behavioral skills are fundamental determinants of changing behavior patterns (Fisher et al. 1994).

IMB posits that behavior is determined by three elements: *information* that is directly relevant to how to conduct the behavior, *motivation* to engage that behavior, and *behavioral skills* (objective/subjective ability) for performing that behavior. The theoretical mechanism is that information and motivation have direct effects on the behavioral skills "necessary for initiating and maintaining patterns" (Fisher et al. 1996, p. 115) of behavior. Information and motivation may have direct influence on behavior when there is no need for too complicated or novel behavior skills, such as recycling.

Seacat and Northrup (2010) were one of the first to utilize the IMB framework to predict pro-environmental behaviors, employing the model in a study of community-based curbside recycling behavior. Their findings suggest that while the IMB model significantly predicted curbside recycling behaviors in two communities, the relationships between these variables differed between them. Furthermore, they suggest that while the IMB model is useful in predicting recycling behaviors, relationships between information, motives, and behavioral skills are often site and context specific (Seacat and Northrup 2010).

While research efforts aimed to increase recycling at PSU football games have been on-going (EPA 2009), no one has examined the recycling engagement of tailgaters, the largest waste contributing group at football events (A. Matyasovsky 2015, personal communication, 3 March). To be effective, researchers and practitioners interested in designing interventions to increase recycling at tailgates must first identify potential barriers to that engagement (McKenzie-Mohr 2000; McKenzie-Mohr et al. 1995). Knowing the extent to which tailgaters' knowledge, motivation, and behavioral capacity to recycle influences their recycling behavior would be informative for future attempts to increase recycling. In the context of a sporting event, increasing information or ease of environmental engagement may be relatively easy and cost-effective ways to encourage behavior change.

4 The Present Research

The purpose of this study was to (1) examine the extent to which tailgaters are using the venue's recycling infrastructure; (2) determine who is most likely to recycle; and (3) identify possible avenues for future intervention. To do this, we collected both observational and survey data over the course of three football games. Based on the IMB model, it was hypothesized that people who (a) possess greater knowledge of how to recycle at the tailgating site; (b) are more motivated to recycle; and (c) report greater behavioral capacity to recycle at the venue, would report higher intent to recycle at the event.

5 Description of the Venue Infrastructure

The recycling program in Beaver Stadium began in 1996 with placement of recycling bins inside the stadium and throughout adjacent tailgating lots (EPA 2009). Approximately 15 student volunteers distributed roughly 2000 blue recycling bags to tailgaters. The waste disposal bags are colored to reflect the university colors: blue for recycling, white for waste. Recycling and trash bags were also available via bag dispensers attached to dumpsters and on 30 A-frame dispensers in the tailgating areas. Tailgaters also had the option to place their recyclables in the 290 blue recycling bins.

6 Procedure

Data were collected during three of the seven home games of the 2013 PSU football season in State College, PA. Individuals participating in tailgating activities were approached by a pair of researchers, explained the purpose of the study, and invited to take part in the survey. Nine independent observers worked in pairs. While survey respondents completed the questionnaire, both researchers collected observational measures.

Eleven lots were selected of the 35 tailgating lots around the stadium. Lots were chosen to provide a representative sample of potentially different group types: standard car lots, student lots, family lots (alcohol prohibited), recreational vehicle lots, and premium reserved automobile lots. Approximately 10 % of each tailgate lot was observed and surveyed. Tailgates were selected by picking every fifteenth car with the presence of at least one tailgater. In the absence of an observable tailgate at the fifteenth car, the tailgate immediately to the right of that vehicle was selected.

7 Participants

A total of 2741 tailgaters were observed. Most were men, between the ages of 31-55 and were wearing PSU apparel with no additional décor (see Table 1). The modal group size was 4 people. For the survey, 428 tailgates were approached, with 415 having at least one individual willing to participate in the survey. This resulted in a 97 % response rate. All data were collected prior to the start of each game to increase access to visible tailgaters. Only one individual per tailgate completed the survey and was selected based on their proximity to (the immediate right of) the first person that provided eye contact with the researchers. Survey respondent demographics generally reflected the group demographics (Table 1). Most

Table 1 Demographics of groups and individual survey respondents

Observations (group level)			
	Mean	SD	Mode
Group size	6.6	4.18	4
Estimated mean age	N	Percent	
18–30	142	34.2	
31–55	172	41.4	
55+	100	24.4	
Décor present	Amount	N	Percent
	No Décor	35	8.43
Home team	Apparel only	207	49.9
Home team	Apparel + Décor	159	38.3
Visiting team	Apparel only	0	0
Visiting team	Apparel + Décor	14	3.4
Avg. no. each gender	Mean	SD	
Men	3.91	2.61	
Women	2.7	2.46	
Survey respondents (individual level)			
Estimated age	N	Percent	
18–30	225	54.3	
31–55	156	37.6	
55+	34	8.1	
Gender			
Men	224	54	
Women	190	46	
PSU alumni	203	49	
PSU non-alumni	212	51	
	Mean	SD	
Tailgating frequency	2.66	1.42	
Recycle at home	4.51	0.87	

respondents were men, between the ages of 18–30, identified as PSU alumni, and reported to tailgate at every game.

8 Observational Measures

8.1 Waste Disposal Behavior

Researchers observed a number of tailgate group qualities, summarized here with their inter-rater reliability statistics. As respondents completed surveys, the research pairs counted the number of visible used (r = 0.81, $p < 0.001$) and unused (r = 0.59, $p < 0.001$) venue-provided waste bags, used (r = 0.89, $p < 0.001$) and unused (r = 0.62, $p < 0.001$) venue recycling bags, and used r = 0.80, $p < 0.001$) and unused (r = 0.70, $p < 0.001$) waste bags brought from home. Inter-rater reliability was satisfactory for all measures observed. In addition to being highly correlated, raters also showed high agreement on their observations with the largest inter-observer mean difference at 0.03.

8.2 Estimated Group Demographics

Researchers estimated overall group composition, the number of males and females in the group (coded 0 = male, 1 = female; $r_{men} = 0.94$, $p < 0.001$; $r_{women} = 0.94$, $p < 0.001$), modal estimated age (coded 0 = less than 18, 1 = 18–30 years old, 2 = 31–55, 3 = 56+; r = 0.81, $p < 0.001$), the amount of apparel/décor for either the home or opposing team (coded as 0 = nothing visible, 1 = apparel only, 2 = a mix of apparel and décor, 3 = a large amount of both apparel and décor; r = 0.65, $p < 0.001$). Due to survey length restrictions, researchers also estimated the gender (Kappa = 0.943, $p < 0.001$) and approximate age of the survey respondent (r= 0.85, $p < 0.001$). Again, inter-observer reliabilities were satisfactory for all measures. For the demographic observations all mean differences were 0.07 or less.

9 Survey Measures

To measure the self-reported amount of information, motivation, and behavior skills individual tailgaters had about recycling at the venue, respondents answered five questions on a 5-point Likert scale (1= “strongly disagree” to 5 = “strongly agree”) (see Table 2). Respondents then reported their intent to recycle that day with a single item “I am planning to recycle at today’s tailgate” with a 5-point Likert scale response (1 = “strongly disagree”, 5 = “strongly agree”). Respondents were asked whether they were PSU alumni (“yes” or “no”), whether they recycle at home (1 = “strongly disagree”, 5 = “strongly agree”), and how frequently they tailgate at the

Table 2 Survey measures

Skill	Items[a]
Information (α = 0.76)	I know the difference between a blue waste bag and a white/clear waste bag at Penn State tailgating
	I know which materials are recyclable
	I know where to leave my trash when I'm done tailgating a Penn State
	I know where to leave my recycling when I'm done tailgating at Penn State
	I know how to ensure that my recycling is collected by Penn State employees
Motivation[b] (α = 0.49)	Recycling at Penn State tailgates is important to me
	I'm concerned about what happens to my trash after I leave Penn State tailgates
	Recycling at Penn State tailgates is not a high priority during my time here
Behavior (α = 0.68)	Recycling at Penn State tailgates is inconvenient (reverse coded)
	Recycling at Penn State tailgates takes too much time (reverse coded)
	Recycling at Penn State tailgates is confusing (reverse coded)

[a]Measured on a 5-point Likert scale: 1= "strongly disagree" to 5 = "strongly agree"
[b]The motivation items showed low reliability (α = 0.49) and could not be improved with the removal of any items. Therefore, the single item most closely related to the motivation construct was selected to represent motivation in subsequent analyses: *Recycling at Penn State tailgates is important to me*

venue (1 = Less than once per year, 2 = Once per year, 3 = 2–3 times per year, 4 = 4–6 times per year, 5 = every game).

10 Analytical Strategy

In addition to statistical significance, all analyses were interpreted with an emphasis on practical significance. To help avoid the interpretation of correlations with inflated power caused by the large sample size, an absolute value Pearson product-moment coefficient of 0.3 was used as the cut-off for practical significance, though all correlation coefficients are reported (see Tables 3 and 4). As an indicator of strength of the linear relationship between two variables, a coefficient of 0.3 or higher indicated a relationship that was at least moderately strong (Cohen 1988).

Additionally, reviewing the means for the unused bags reveals possible floor effects, meaning the means for observed unused bags were so low that they are unlikely to produce meaningful effects (all Ms < 0.14). This may reflect a limitation of the observational measures: people may have kept their unused bags in their cars/RVs (hidden from observers' view), or had yet to obtain bags.

Table 3 Correlations of bag-use variables

	Mean	St. dev.	Bag-use variables				
			No. used PSU trash bags	No. used personal bags	No. unused PSU rec. bags	No. unused PSU trash bags	No. Unused Personal Bags
No. used PSU rec. Bags	0.52	0.60	0.62**	−0.22**	0.15**	0.13*	−0.03
No. Used PSU Trash Bags	0.50	0.61		−0.34**	0.18**	0.16**	−0.04
No. Used Personal Bags	0.42	0.63			−0.13**	−0.07	−0.02
No. Unused PSU Rec. Bags	0.11	0.35				0.48**	−0.02
No. Unused PSU Trash Bags	0.07	0.29					−0.02
No. Unused Personal Bags	0.06	0.78					

**$p < 0.001$

Table 4 Correlations of bag-use variables and group demographics

	Mean	St. dev.	Demographic variables					
			PSU gear	Opponent gear	No. women	No. men	Est. modal group age	Group size
No. used PSU rec. bags	0.52	0.60	0.33***	−0.07	0.19**	0.26***	−0.04	0.28***
No. used PSU trash bags	0.50	0.61	0.32***	−0.09	0.16**	0.22***	−0.04	0.23**
No. used personal bags	0.42	0.63	−0.02	0.05	0.14**	0.06	−0.02	0.11*
No. unused PSU rec. bags	0.11	0.35	0.04	−0.02	0.04	0.03	0.01	0.04
No. unused PSU trash bags	0.07	0.29	0.09	0.03	0.06	0.13**	−0.05	0.12*
No. unused personal bags	0.06	0.78	−0.01	−0.01	−0.05	−0.06	0.04	−0.07

*$p < 0.05$ **$p < 0.01$ ***$p < 0.001$

11 Behavioral Observations

11.1 How Much Are Tailgaters Using the Venue's Infrastructure?

Of 415 observed tailgating sites, 202 (48.7 %) were using the provided recycling bags (with and without other trash bags), which lessens the venue's environmental impact. 32 (7.7 %) were using only the venue's provided trash bags, which increases the venue's environmental impact. 99 sites (23.9 %) were using only personal trash bags. Their contribution to the venue's impact is unclear. It is possible that some of these tailgaters may have collected their recycling and taken it home with them to recycle there. However, those that left their bags at the tailgating grounds likely contributed to the venue's impact, because the grounds crew treat all personal waste bags as trash (A. Matyasovsky 2015, personal communication, 3 March). 69 (19.9 %) of tailgaters had no visible trash bags on site, and their contribution to the venue's environmental impact is unknown.

Based on possible associations revealed during correlation analyses (see Table 3), independent samples t-tests were conducted to examine the relation between bringing one's own trash bags and using the venue's infrastructure. Not

Table 5 Means and regression coefficients for information, motivation, and behavior skills, controlling for frequency of tailgating and home recycling behavior on reported recycling behavior at the tailgate

Variable	Means (SD)	Unstandardized beta	S.E.	Standardized beta	*t*	*p-value*
Intercept		−0.06	0.28		−0.21	0.84
Tailgating frequency	2.66 (1.42)	−0.03	0.03	−0.05	−1.24	0.22
Home recycling behavior	4.51 (0.87)	0.20	0.04	0.20	4.82	<0.001
Information	4.07 (0.78)	0.21	0.05	0.19	4.07	<0.001
Behavior skills	4.25 (0.78)	0.30	0.05	0.26	5.89	<0.001
Motivation	3.93 (0.77)	0.35	0.05	0.30	6.77	<0.001

$R^2 = 0.64$, R^2-adj = 0.41

surprisingly, groups who used personal trash bags were significantly less likely to use the venue's recycle bags, $t(413) = 4.45$, $p < 0.001$, and trash bags, $t(411.83) = 8.38$, $p < 0.001$ (see Table 5 for means). This suggests people who brought their personal bags from home may increase the environmental impact of the venue because it significantly decreases the likelihood they will use the venue's recycling bags.

11.2 Who Is Using the Venue's Infrastructure?

To investigate who was most likely to use the venue's infrastructure, we examined correlations between demographics (PSU gear, opponent gear, estimated age, and group size) and bag use. PSU gear was positively associated with more used venue recycle bags and more used venue trash bags, but not with used personal bags, (see Table 4).

Group size showed a significant, but weak trend of association with the number of used venue recycle bags, the number of used venue trash bags, and the number of used personal trash bags (Table 4). Because group size can be correlated with the amount of waste produced, the low correlation coefficients may reflect a limitation of the observational measures, like low trash bag visibility on each tailgating site.

To further explore possible relations between PSU gear, group size, and bag use, we divided group size into small (1–4 tailgaters), medium (5–7), and large (8+) groups, each category representing approximately one-third of the sample. A 3(-group size: small, medium, large) X 2(PSU gear: apparel only, more than apparel) X 3(bag type: venue recycling, venue trash, personal) mixed-model ANOVA revealed a significant main effect of bag type, $F(2720) = 11.56$, $p < 0.001$. There

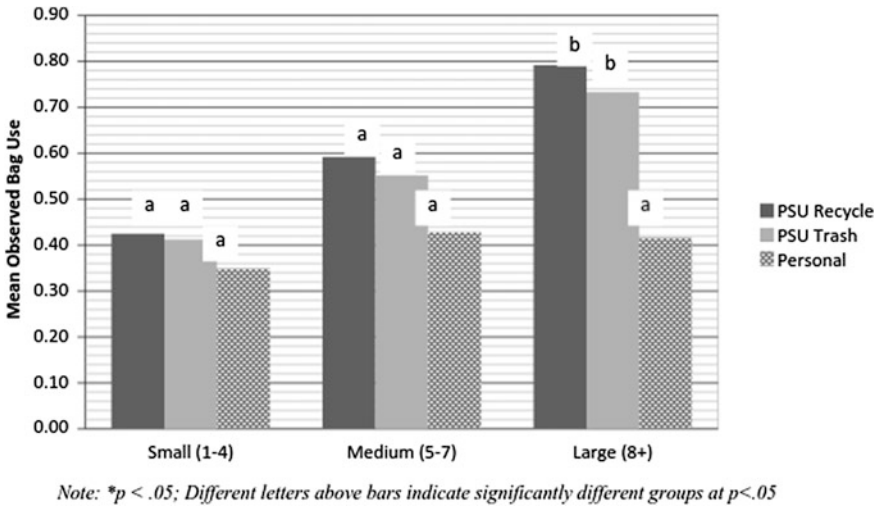

Fig. 1 Group size and bag type on bag use

were fewer personal bags observed than PSU recycling or trash bags. There was also a significant main effect of PSU gear, $F(1360) = 23.16$, $p < 0.001$. Sites with more PSU gear were observed using more bags.

Importantly, a marginally significant interaction between group size and bag type was also found, $F(4720) = 2.15$, $p < 0.07$ (see Fig. 1). Simple effects tests revealed that in addition to using more PSU bags than any other group, large groups were the only groups that were more likely to use more of the PSU infrastructure than their own personal bags.

12 Reported Recycling Behavior

12.1 Predictors of Recycling

Individual-level self-reported recycling behavior was weakly correlated with observed number of used venue recycle bags ($r = 0.263$, $p < 0.001$). Overall, respondents reported a high degree of knowledge, motivation, and behavioral skills about recycling at PSU tailgates (see Table 5). Additionally, the majority of respondents reported they were planning to recycle at that day's tailgate (90.6 %).

As predicted by the IMB model, regression analyses revealed knowledge about recycling at PSU tailgates, motivation to recycle at PSU tailgates, and behavioral skills for recycling at PSU tailgates were all significant predictors of reported recycling behavior at the tailgate (Table 5). Regression analyses also revealed the extent to which the respondent recycled at home as being a significant predictor of reported recycling behavior. Information, motives, and behavioral skills remained

significant predictors of reported recycling behavior when controlling for tailgating frequency and home recycling behavior.

Also included in the regression model was the respondent's reported frequency of tailgating and observer-estimated age of the respondent, neither of which were significant predictors of reported recycling behavior. Respondent gender and whether the respondent was an alumnus of PSU were also analyzed for predicting tailgating recycling behavior. A 2 (respondent gender: male, female) X 2 (PSU alumnus: yes, no) Analysis of Variance revealed that respondent gender and alumni status were not significant predictors of reported recycling at tailgates, all $Fs < 1.00$, all $ps > 0.30$.

12.2 Who Is Most Likely to Recycle While Tailgating?

Because the IMB model was supported in our tailgating sample, we then examined who among tailgaters was most likely to be high in information, motivation, and behavior skills. Independent-samples t-tests revealed that compared to non-alumni, PSU alumni reported higher information, $t(387.11) = 4.78$, $p < 0.001$, and behavior skills, $t(400) = 2.65$, $p < 0.01$, but not motivation ($t < 2.00$, $p > 0.20$).

Regression analyses revealed a similar pattern for frequent tailgaters (see Table 6). The more frequently respondents tailgated, the higher their venue-specific recycling information and behavioral skills were. No significant relations were found for frequency of tailgating and motivation. Importantly, home recycling behavior positively predicted all three constructs (Table 6).

Table 6 Regression coefficients for information, motivation, and behavior skills, tailgating frequency and home recycling behavior

Outcome	Predictor	Unstandardized b	Std. Error	Standardized b	*t*	*p-value*
Information	Tg freq.	0.194	0.025	0.351	7.64	<0.001
	Home beh.	0.166	0.041	0.184	4.011	<0.001
Motivation	Tg freq.	−0.009	0.026	−0.017	−0.366	0.72
	Home beh.	0.271	0.042	0.308	6.472	<0.001
Beh. Skills	Tg freq.	0.133	0.026	0.25	5.198	<0.001
	Home beh.	0.105	0.042	0.121	2.512	0.012

Note *Information* $R^2 = 0.16$, R^2-adj = 0.15; *Motivation* $R^2 = 0.10$, R^2-adj = 0.09; *Behavior Skills* $R^2 = 0.08$, R^2-adj = 0.07

13 Discussion and Conclusions

As expected, the IMB model was supported for predicting reported recycling behavior while tailgating. Tailgaters who were higher in venue-specific information, motivation, and behavioral skills were more likely to recycle than tailgaters who were low in these constructs. PSU alumni and people who tailgated frequently reported higher information and behavioral skills related to recycling while tailgating, but not necessarily motivation to recycle. Whether or not tailgaters recycled at home was a strong predictor of information and behavioral skills, as well as motivation.

Just over 40 % of observed sites were using trash bags from home. Perhaps not surprisingly, bringing one's own trash bags was associated with lower usage of venue provided recycling infrastructure. It is unknown what the contribution of these tailgaters were to the venue's environmental impact, because it is possible they sorted their recycling and then took the recycling home with them to ensure its proper disposal. However, they may have left their bags at the venue.

Interestingly, our observational results also suggest that large groups not only use more of the venue's recycling infrastructure than small and medium groups, but they are also the only demographic that is more likely to use the venue's infrastructure than their own personal waste bags. There was a difference between large groups and the others in the number of venue recycling and trash bags used, but not in the number of personal bags used. One possible explanation for this pattern is that large groups are bringing just as many trash bags from home as smaller groups are, but may run out and start using the venue's recycling and trash bags.

13.1 Practical Implications

The confirmation of the IMB model in predicting tailgater recycling behavior suggests that campaigns to increase recycling information and motivation should be audience-specific. More effective campaigns may aim to increase information and behavioral skills among non-alumni and people who do not tailgate frequently, since they were found to have lower levels of information and behavioral skills related to recycling than alumni and people who do tailgate frequently. Additionally, as a significant predictor of all three psychological constructs, home recycling behavior may be a key to future interventions. 91.3 % of respondents reported that they recycle at home. Campaigns that relate tailgating recycling behavior to home recycling behavior may be particularly effective in increasing recycling behavior among tailgaters.

Regarding the frequent use of personal waste bags we observed, these results also suggest that tailgaters who brought their own trash bags may be particularly unlikely to recycle because when they are organizing their trip, they are not planning to use the venue's provided infrastructure. Planning for a behavior has been shown to be a powerful predictor of behavioral engagement (for an extended discussion see Bandura 2001). They are instead planning to use their own trash

bags, which reduces the ability to have their recycling collected by grounds crew. Taken with the IMB model findings, these results suggest a particularly effective intervention may be to increase tailgaters' information about recycling at the venue prior to them entering the stadium grounds.

Future interventions may also want to specifically target large groups, since they are the biggest users of the venue's infrastructure. It may be beneficial to examine different ways of organizing the tailgating lots, such as grouping large parties together in several lots and concentrating more recycling facilities there. This type of intervention would help ensure that the infrastructure is readily available for those who are most reliant on it.

13.2 Limitations

This study had several limitations. First, observed recycling behavior was limited by visibility. Researchers could only observe waste disposal behavior that occurred publically. This limitation may have been particularly applicable for tailgaters who stored used and unused waste bags in their vehicles. Another major limitation of the research was that there was no way to verify if tailgaters were using the recycling infrastructure properly. We could only observe whether or not the provided recycling bags were being used. Future studies should examine to what extent recyclable materials were being sorted and disposed of properly in the venue's provided infrastructure.

Additionally, during data collection there were dramatic weather changes ranging from sunny to cold, intermittent snow. Finally and importantly, the survey instrument was not validated on the sample before data collection. In particular, motivation proved particularly hard to measure for people who were already quite energetic and motivated to do all they could to support the home team.

13.3 Moving Forward and Broader Implications

This research provided theoretical support for applying the IMB model to recycling at tailgating events, as well as shedding light on sociodemographic predictors of recycling engagement at tailgating events. In particular, our data suggested tailgaters possessed general knowledge about how to recycle at the venue, the behavioral capacity to recycle, and were motivated to do so. However, our observational results suggest that less than half of tailgaters may be recycling. A particularly effective intervention may be to increase tailgater information about the recycling infrastructure prior to their visit, when they are planning their trip and that recycling while tailgating should be related to home recycling behavior.

These findings have important theoretical and practical implications beyond PSU's campus. Theoretically, future investigations could explore the relation between pro-environmental behaviors and different spaces, like home and sporting event recycling. Future research could also compare recycling at sporting events to

other large-scale events, like outdoor concerts or ceremonies and identify additional barriers to pro-environmental engagement.

Practically, if PSU is able to reach its zero-waste goal, it would mean thousands of tons of trash would be diverted from landfills every year. Additionally, managers and stakeholders at PSU are already discussing possible ways of helping other large universities set and achieve similar sustainability-oriented goals (A. Matyasovsky 2015, personal communication, 3 March). These efforts of understanding and improving recycling compliance could be easily adapted to and replicated at other universities that host very large sporting events or other events that require large numbers of visitors to plan and pack for an extended stay at the campus.

Acknowledgments The authors would like to acknowledge Albert Luloff and William Elmendorf for their advising on this study and the writing of this manuscript. The authors would also like to thank Emily Osborn, Seth Tanner, and Lan Xue for their contributions during the design and implementation of this study, as well as Maryam Shahri and Tomasz Zawadzki for their assistance during the implementation of the study.

References

Andersson L, Shivarajan S, Blau G (2005) Enacting ecological sustainability in the MNC: a test of an adapted value-belief-norm framework. J Bus Ethics 58(3):295–305

Association for the Advancement of Sustainability in Higher Education (2013) Available from: http://www.aashe.org/. Accessed 8 Dec 8 2013

Bandura A (2001) Social cognitive theory: an agentic perspective. Annu Rev Psychol 52:1–26

Cohen J (1988) Statistical power analysis for the behavioral sciences, 2nd edn. Erlbaum, Hillsdale, N.J

Collins A, Jones C, Munday M (2009) Assessing the environmental of Mega sporting events: two options? Tour Manag 30:828–837

Darnton A (2008) Reference report: an overview of behaviour change models and their uses. GSR Behav Change Knowl Rev 1–81

Environmental Protection Agency (EPA) (2009) Recycle on the go success story: recycling at Penn State's beaver stadium. Available from: http://www.epa.gov/epawaste/conserve/tools/rogo/documents/beaver.pdf. Accessed 8 Dec 2013

Fisher JD, Fisher WA, Misovich SJ, Kimble DL, Malloy TE (1996) Changing AIDS risk behavior: effects of an intervention emphasizing AIDS risk reduction information, motivation, and behavioral skills in a college student population. Health Psychol 15(2):114–123

Fisher JD, Fisher WA, Williams SS, Malloy TE (1994) Empirical tests of an information-motivation-behavioral skills model of AIDS-preventive behavior with gay men and heterosexual university students. Health Psychol 13(3):238–250

Horhota M, Asman J, Stratton JP, Halfacre AC (2014) Identifying behavioral barriers to campus sustainability: a multi-method approach. Int J Sustain High Educ 15(3):343–358

Hornik J, Cherian J, Madansky M, Narayana C (1995) Determinants of recycling behavior: a synthesis of research results. J Socio Econ 24(1):105–127

Lenskyj HJ (1998) Sport and corporate environmentalism. Int Rev Sociol Sport 33(4):341–354

Marans RW, Lee YJ (1993) Linking recycling behavior to waste management planning: a case study of office workers in Taiwan. Landscape Urban Plann 26(1):203–214

McCullough BP, Cunningham GB (2011) Recycling intentions among youth baseball Spectators. Int J Sport Manage Mark 10(1):104–120

McKenzie-Mohr D (2000) Promoting sustainable behavior: an introduction to community-based social marketing. J Soc Issues 56(3):543–554

McKenzie-Mohr D, Nemiroff LS, Beers L, Desmarais S (1995) Determinants of responsible environmental behavior. J Soc Issues 51(4):139–156
Misovich SJ, Martinez T, Fisher JD, Bryan A, Catapano N (2003) Predicting breast self-examination: a test of the information-motivation-behavioral skills model 1. J Appl Soc Psychol 33(4):775–790
Mosher HR, Desrochers M (2014) The effects of information regarding sustainability issues and behavioral self-management instruction on college students' energy conservation. Int J Sustain High Educ 15(3):359–370
Mulder KF, Ferrer D, Segalas Coral J, Kordas O, Nikiforovich E, Pereverza K (2015) Motivating students and lecturers for education in sustainable development. Int J Sustain High Educ 16 (3):385–401
Osborn CY, Egede LE (2010) Validation of an information–motivation–behavioral skills model of diabetes self-care (IMB-DSC). Patient Educ Couns 79(1):49–54
Paillé P, Boiral O (2013) Pro-environmental behavior at work: construct validity and determinants. J Environ Psychol 36:118–128
PSU Sustainability Institute (2013) Available from: http://sustainability.psu.edu/sustainability-institute. Accessed 8 Dec 2013
Seacat JD, Northrup D (2010) An information–motivation–behavioral skills assessment of curbside recycling behavior. J Environ Psychol 30(4):393–401
Tudor TL, Barr SW, Gilig AW (2007) Strategies for improving recycling behaviour within the Cornwall national health service (NHS) in the UK. Waste Manage Res 25(6):510–516
Vining J, Ebreo A (1990) What makes a recycler? A comparison of recyclers and Nonrecyclers. Environ Behav 22(1):55–73

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