THE RELATIVE EFFICIENCY OF WASTE DIVERSION STRATEGIES IN MEMORIAL STADIUM AT THE UNIVERSITY OF MISSOURI

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And hereby certify that in their opinion it is worthy of acceptance.

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"*It's not what the world holds for you, it's what you bring to it.*" -L.M. Montgomery

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ABSTRACT

Recycling and composting are strategies to save landfill space, generate additional revenue, and use fewer natural resources, resulting in an important paradigm shift for waste – from burden to resource. If the University of Missouri (MU) athletics wants to incorporate “zero waste” (a goal to recover 100% of the waste stream) into their waste management goals, then source separation is crucial for success. However, this standard may be problematic for fans who attend sporting events since their behavior is unpredictable. This study measured the influence of three waste disposal conditions at six Mizzou home football games in fall, 2015: bins only, bins with messaging, and bins with messaging and volunteers. Relative effectiveness was determined by analyzing the contents of recycling, compost, and trash bins located at the north end zone of Memorial Stadium. A total of 108 observations were made. The study produced mixed findings, depending on the condition. Results indicated that messaging was effective for compost and landfill, but not for recycling. Volunteers had no significant influence. Many extraneous factors should be considered before implementing waste separation strategies in natural settings, such as a football stadium.

INTRODUCTION

According to the United States Environmental Protection Agency (EPA), over 250 million tons of waste were generated in the U.S. during 2013, of which approximately 34% was recycled or composted (EPA, 2014b). The remainder, around 165 million tons, was sent to landfills. Although necessary, landfills are a primary source of environmental contamination (EPA, 2015b). Liquids produced from contaminants (e.g. cleaners, paints, batteries), can leach through the soil and pollute groundwater supplies commonly used for irrigation and drinking. These contaminants can affect human and environmental health if not addressed properly. For example, children exposed to lead contaminated water can experience developmental issues, and pregnant women may have higher chances of miscarriages (EPA, 2015b; Watt et al., 2000). The EPA requires new landfills to have clay or synthetic liners to protect the soil and water from contamination, but they are prone to leaking, while older landfills have no form of protection (EPA, 2015b). For these reasons, landfill retention should be improved, but also the amount of recyclables and compost should be reduced from entering the system. One way to accomplish this goal is through public education and outreach efforts.

Despite the large amount of garbage that reaches landfills each year, the percentage of diverted waste (i.e. used in a manner that prevents its addition to landfills; mainly recyclables) has increased significantly in the U.S. since 1980 (EPA, 2014b, 2015a). This diversion can be attributed to a societal paradigm shift regarding the value of waste. Traditionally, industries and communities considered waste as a burden, thus a symbol of inefficiency. Today, waste is also seen as a valuable resource (Lehmann, 2010; Zaman & Lehmann, 2013). This dual view of waste, burdensome yet usable, creates an important opportunity. Waste is not wanted, but at least there is a purpose for much of it.

Uses of waste include reusing, recycling, composting, and incineration, but this study will focus on recycling and composting. Recycling can be defined as “collecting and processing materials that would otherwise be thrown away as trash and turning them into new products” (EPA, 2014c). Recycling decreases the amount of raw materials and carbon emissions, which also can result in significant cost savings (EPA, 2014b). Composting also diverts materials away from landfills, but it is limited to organic matter only (EPA, 2014a). Compost can provide additional nutrients for soil which reduces or eliminates the need for chemical fertilizers, also yielding economic benefits (EPA, 2014a). Recycling and composting can reduce the amount of waste sent to landfills by simply diverting these materials prior to arrival. Approximately 75% of waste in the United States is recyclable or compostable, but the current diversion rate is about 34% (EPA, 2014b).

One holistic approach to sustainable waste management is called “zero waste.” According to the Zero Waste International Alliance (ZWIA), “zero waste” can be defined as a process that develops strategies and products that reduce the amount and toxicity of initial waste, and recovers all materials from the end waste stream to use as resources (ZWIA, 2009). A waste stream is the flow of a certain type of material from generation to end of life (like recycling), regardless of contamination. Businesses and institutions can qualify for zero waste recognition from ZWIA when they reach a 90% diversion rate, with the understanding that 100% recovery is the ultimate goal. Zero waste strategies have been adopted by cities such as Seattle, Washington (Fry, 2013), and Adelaide, Australia (Zaman, 2014), although the goal has not yet been attained. This idea is attracting much interest from businesses, universities, and, most relevant to this study, athletic facilities.

While zero waste is ideal, the goal may be unrealistic in the short-term, thus making it necessary to focus on one aspect at a time. A sub-step might include waste stream separation, namely compost, recycling, and trash. In order to create a desirable end product, recycling and compost streams must be as clean as possible. When the waste stream is contaminated, like heavy metals in compost or food scraps in recycling, the end product will be less valuable and sometimes unusable (Paradelo, Moldes, & Barral, 2009). One solution is separation, either before or after waste is thrown away. If separation occurs, then the recycling and composting processes will operate more efficiently, resulting in less waste in landfills and a positive economic impact.

Currently, the state of Missouri has eighteen open landfills. Nearly 8 million tons of materials were diverted in 2013, resulting in a 57% diversion rate (Missouri Recycling Association, 2015). The landfill in Boone County, Missouri receives an average of 460 tons of trash per day, resulting in 167,171 tons of waste in fiscal year 2015 (N. Paul, personal communication, October 20, 2016). Most of the waste is from Columbia, Missouri (population 115,000). A landfill consists of multiple cells (a cell varies in size, but is typically between 60 to 80 feet deep), and an “open cell” is where all waste is dumped until it is filled. The landfill in Boone County is currently filling its fifth out of six cells. Columbia’s material recovery facility (MRF) diverts waste from the landfill. In January 2015, the facility started accepting #1-7 plastics (previously it was only #1-2). In addition, the MRF accepts paper, cardboard, metal (aluminum, steel, tin) food/drink containers, and glass containers. Other items, like tires, electronic waste, and household hazardous waste, can be recycled at other locations in the city. Despite persistent efforts to encourage recycling, Columbia's recycling rate is a mere 17% (City of Columbia, 2016), pale in comparison to the state's 57%. The city also has a composting facility that collects organics from commercial organizations (i.e., not residential areas), but the amount composted is negligible to the amount being landfilled. The Boone County landfill, materials recovery facility, and compost facility collects waste from the University of Missouri (MU). On average, campus generates 16 tons of waste per day, with a total of 6,354 tons in fiscal year 2016. The campus recycling rate is 21%, and composting only comprises 3% of the diversion (MU Recycling Report, 2016).

Although recycling and composting should be integrated into waste management processes throughout university operations, few college football stadiums have implemented such strategies. Sporting events create unique and interesting settings for waste diversion scenarios due to the nature of athletic facilities. For example, most football stadiums have ticket requirements and restrictive policies regarding items that can be brought in and/or sold on the premises. Such policies may reduce the amount and variety of items thrown away on game days, perhaps lessening fan confusion in the process. Environmentally friendly publicity is another positive outcome of waste diversion strategies since collegiate athletics is one of the most visible aspects of campus life.

Football fans play a key role in waste management, not only because of the large amount of trash generated, but also their behavior, which may be unpredictable. Some fans dispose of trash properly; however, others do not, as evidenced by the mounds of trash left in and outside the stadium on game days. Although recycling and trash receptacles are available, it does not mean that fans use them properly (i.e., mixed contents often appear in the bins, regardless of labeling). This situation offers much potential and a great challenge for waste management at college football stadiums across the U.S. Although source separation can aid in waste diversion from landfills, fans must make "environmentally-responsible choices" for it to be effective, namely disposing of their waste into the proper bins.

A few examples of effective waste separation programs exist across the United States. The Ohio State University (OSU) operates a highly efficient and successful waste management system. In 2011, OSU started a zero waste program with a goal of diverting 90% of game-day waste from the landfill (Wright, 2011). As mentioned earlier, achieving a 90% diversion rate (or higher) is sufficient for receiving special recognition from The Zero Waste International Alliance (ZWIA, 2013). On November 3, 2012, OSU diverted 98% of game-day waste during a football game against the University of Illinois (Wright, 2012).

To meet this waste reduction goal, OSU implemented many structural changes to game day operations and management. To ensure fan compliance, OSU removed all trash cans, restricting fan choice to recycling and composting bins (OSU, 2012). The receptacles were color-coded (grey for compost and scarlet for recycling) and monitored by an employee at each station, instructing fans where to toss their trash (OSU, 2012). Employees sorted trash for the fans when necessary, and were instructed to correct improper disposal by moving the waste into the appropriate receptacle, if possible. Trash cans were removed because, although there were items present that were not recyclable or compostable, there was enough post-sorting labor to create a clean stream. Source separation by fans was helpful, but not entirely necessary. Specifically, OSU focused on increasing the waste stream efficiency by manual labor (i.e., waste station monitors and post-sorters) and to a lesser extent, by fan behavior. Although some studies can inform efforts in stadiums (see literature review), there are no studies that have evaluated voluntary waste separation behavior of fans attending football games.

The average amount of waste generated from game day operations during the 2015 home football season at Memorial Stadium (University of Missouri's football stadium) was 14 tons, resulting in a season total of approximately 84 tons (N. Paul, personal communication, October 20, 2016). Memorial Stadium offers some waste diversion strategies, but the highest diversion rate during the 2014 season was about 40%, decreasing to 30% with an average of 24.6% in 2015 (GameDay Challenge, 2015), leaving much room for improvement. The first game day recycling effort began in 2005 when Sustain Mizzou, a student organization, started a project called Tiger Tailgate Recycling. Volunteers distributed blue recycling bags to tailgaters. A few years later, recycling bins were installed in the stadium proper. These efforts continue each year, although the amount of waste diverted has remained relatively stagnant, averaging 20 tons each season (see Figure 1). A waste separation study will inform waste diversion practices of game day operations at Memorial Stadium.

Figure 1.

Total recycling tonnage from Mizzou home games (2005-2015)

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Tons	12.1	19.1	24.0	19.2	15.1	18.6	14.8	21.1	11.9	46.0	24.6

Memorial Stadium is increasing its sustainability efforts to boost visibility, attract new fans, decrease spending, and lessen its impact on the environment. The easiest goal of sustainability is waste diversion. Yet, waste stream contamination by fans (i.e., placing items into incorrect bins), either on purpose or inadvertently, is the primary obstacle for reaching a "zero waste" goal. If the composting or recycling streams contain significant amounts of foreign matter, then any waste diversion system, no matter how elaborate or expensive, would not be worth the effort. The most effective ways to implement waste management practices need to be determined, while balancing resource constraints. This study examined ways to influence environmental decision-making behavior of football fans in Memorial Stadium, a crucial aspect of waste management.

Purpose

The purpose of this study was to evaluate the relative efficiency of two waste diversion strategies with football fans in Memorial Stadium at the University of Missouri: 1) bins with messaging, and 2) bins with messaging and volunteers, in relation to a control group (bins only).

Objectives

1. To compare the overall waste stream efficiencies over the three factors.
2. To compare the waste stream efficiencies over the three factors for recycling
3. To compare the waste stream efficiencies over the three factors for compost.

4. To compare the waste stream efficiencies over the three factors for landfill.

Hypotheses

This study tested the following hypotheses:

H1: Overall waste separation efficiencies will show a significant difference over the three conditions.

H2: There will be a significant difference of waste separation efficiencies between the three conditions for recycling.

H3: There will be a significant difference of waste separation efficiencies between the three conditions for compost.

H4: There will be a significant difference of waste separation efficiencies between the three conditions for landfill.

Definitions

Waste stream: This term describes the total flow of waste from one or more locations from generation to end-of-life that is handled through a specific and separate process. For example, all items collected in the recycling bins on Mizzou's campus and brought to the materials recovery facility are in the same waste stream. The parameters of the waste stream must be defined.

Waste stream efficiency: This describes the percentage of correctly deposited items in a certain waste stream; it could also be described as the opposite of a contamination rate. For example, if 25% of a recycling bin is foreign matter (e.g., trash), the efficiency would be 75%. The contamination rate would be 25%.

Zero Waste: "Zero waste means designing and managing products and processes to systematically avoid and eliminate the volume and toxicity of waste materials, conserve and recover all resources, and not burn or bury them." (ZWIA, 2009)

Identity salience: Explores the importance of a given identity of a person, relative to other identities. Salient identities are those that are an important part of one's life and those that are displayed frequently (Laverie & Arnett, 2000).

Diverted waste: The amount of waste that is used in a manner that prevents its addition to landfills

Diversion rate: The percentage of diverted waste from landfills, or a specific landfill(s)

Source separation: The separation of waste into desired categories (e.g. recycling, compost, landfill) by those that generate the waste (e.g. consumers)

LITERATURE REVIEW

The majority of published studies on waste separation and diversion practices are conducted in households (e.g. Bernstad, 2014; Martin, Williams, & Clark, 2006; Vicente & Reis, 2008), schools (e.g. Camp, 2010; O'Connor et al., 2010; Závodská, 2008), cafeterias (e.g. Craig & Leland, 1983; Sussman et al., 2013), and communities (e.g. Aremu & Sule, 2012; Hopper & Nielsen, 1991; Zhang et al., 2012), not at athletic venues. Although athletics has many policies and programs for waste diversion, most receive notoriety through newsletters and trade publications, not in the peer-reviewed literature. Some exceptions include reviews about sustainability initiatives at the 2010 World Cup (Death, 2011) and strategies to reduce litter in a football stadium (Baltes & Hayward, 1976). Each athletic facility is unique, which makes it difficult to generalize the findings to other facilities, due to the complexity of human behavior. One meta-analysis found that consumer knowledge and social influence commonly influenced recycling behavior, yet are contingent upon many other factors (Hornik & Cherian, 1995). However, much has changed since 1995 when this study was published.

Internal Factors Influencing Waste Separation Behavior

Some studies have highlighted internal factors that influence waste separation behavior such as demographics (Abbott, Nandeibam, & O'Shea, 2013; Martin et al., 2006; Wright, 2013), economic issues (Blaine et al., 2005; Lake, Bateman, & Parfitt, 1996; Martin et al., 2006), level of environmental awareness/concern (Abbott et al., 2013; Fujii, 2006; Miranda & Blanco, 2010; Vicente & Reis, 2008), attitudes and intentions (Derksen & Gartrell, 1993; Karim Ghani et al., 2013; Ölander & Thøgersen, 2006; Vicente & Reis, 2008). Some of these factors are shaped by external influences, until they become personal influences. The degree of influence from these factors is dependent on the situation and environment. For example, a large community may have a different level of environmental awareness than a university, requiring separate program strategies to be effective.

Generally speaking, demographics are considered a weak predictor of waste separation behavior, yet they show statistical significance at times. Households with older people tend to participate more in recycling, but if children are present, the rate tends to decrease (Martin et al., 2006; Wright, 2013). Income could be a positive (Martin et al., 2006) or insignificant factor (Wright, 2013), depending on the population. Sometimes, demographics affect recycling behavior as rates have a tendency to increase when communities are thought to be similar (Abbott et al., 2013). Each study, however, acknowledges that there are compounding reasons for this behavior, and demographics may only offer a partial explanation. For example, recycling is less common in younger, less affluent households, but if the infrastructure and convenience were equivalent with the older, more affluent households, these rates may be similar (Martin et al., 2006).

Economic variables affect waste separation behavior considerably. As stated previously, affluence may determine the frequency and consistency of recycling behavior (Martin et al., 2006). However, willingness to pay for supporting waste separation programs can also shed light on how successful a program will be. For example, if the program has been implemented, the majority of participants would rather pay something than lose it, but the amount they are willing to pay may not be enough to cover operating costs (Blaine et al., 2005). Socio-economic factors can influence a person's willingness to pay for a program or activity, especially if it is new (Lake et al., 1996).

The level of environmental awareness and concern is an underlying theme in many waste separation articles, and it is often linked with other factors such as attitudes and behavioral intentions. For example, individuals who were more aware of the environment and environmental issues were more likely to recycle paper in Europe (Miranda & Blanco, 2010). However, it has also been argued that concern for the environment plays only a slight role in waste separation behavior because other internal forces, like altruism and social norms, seem to have a much larger effect (Abbott et al., 2013). Environmental awareness and concern should be combined with other motives, like positive attitudes/intentions and information provided, to influence pro-environment behavior (Fujii, 2006; Vicente & Reis, 2008).

Attitudes and behavioral intentions are some of the most studied factors that influence waste separation. For example, Karim Ghani et al. (2013) have shown that positive attitudes and intentions are antecedents for a successful waste separation program. Indeed, many studies that explore influences on waste separation behavior ultimately find that attitudes and intentions are important factors (Derksen & Gartrell, 1993; Ölander & Thøgersen, 2006; Vicente & Reis, 2008). Positive attitudes are significant in waste separation behavior when there is accessible and convenient infrastructure; without these factors, attitudes have a weaker effect (Derksen & Gartrell, 1993; Ölander & Thøgersen, 2006).

Although studies have shown that the internal factors discussed above influence waste separation behavior, they are not measured in this study. The football stadium environment is not conducive for measuring these factors. Typically, these influences are assessed through surveys, which would be difficult to implement on game days. External factors, discussed next, are more applicable to this study because of the natural setting.

External Factors Influencing Waste Separation Behavior

Waste diversion studies have also considered external factors such as available information (Bernstad, 2014; Karim Ghani et al., 2013; Vicente & Reis, 2008), incentives (Vicente & Reis, 2008; Viscusi, Huber, & Bell, 2011), accessibility and convenience (Aremu & Sule, 2012; Derksen & Gartrell, 1993; O'Connor et al., 2010; Ölander & Thøgersen, 2006), infrastructure (Aremu & Sule, 2012; Bernstad, 2014; O'Connor et al., 2010; Ölander & Thøgersen, 2006), personal and social norms (Abbott et al., 2013; Hopper & Nielsen, 1991; Karim Ghani et al., 2013; Viscusi et al., 2011), messaging (Craig & Leland, 1983; Geller, 1989; Geller, Witmer, & Orebaugh, 1976; Sussman & Gifford, 2012; Sussman et al., 2013), and models (Hopper & Nielsen, 1991; Lin et al., 2016; Sussman et al., 2013). Typically, participants in the waste separation programs have little control over these factors. Similar to internal factors, external influences can affect behavior differently in various situations and environments, such as households compared to schools. A combination of factors / strategies has been suggested to attain optimal waste separation behavior.

Information about waste separation may seem effective, but published literature shows a pattern of mixed results. Some studies show strong correlations between the amount/quality of information distributed and the propensity to comply with recycling (Vicente & Reis, 2008). However, it has also been found that distributing isolated recycling information may have little to no effect on the tendency to pre-sort waste, due in part to the other barriers faced when implementing recycling programs. For example, an information campaign in households on kitchen waste separation went unnoticed, but when infrastructure to sort the waste was provided, large increases were seen (Bernstad, 2014). Also, if the information is not targeting a specific audience and addressing the attitudes and intentions of that population, the campaign goals may be misaligned (Karim Ghani et al., 2013).

As with many other factors influencing waste separation behavior, incentives for participation produce different levels of effectiveness. Depending on the situation, they may be one of the main factors of participation, as is the case in regions with individual can/bottle deposit laws (Viscusi et al., 2011). Conversely, incentives may have very little importance to participants, in which case other influences should be considered (Vicente & Reis, 2008).

Accessibility and convenience of waste separation programs and infrastructure is one of the most important and basic factors that influence behavior. Multiple studies, one resulting in the A-B-C Theory (Ölander & Thøgersen, 2006), address the relationship between attitudes / intentions toward positive waste separation behavior and convenience / accessibility of programs and infrastructure. Attitudes are not a significant behavioral influence unless convenient and accessible programs are available (Derksen & Gartrell, 1993; Ölander & Thøgersen, 2006). In general, individuals with access to convenient programs and/or infrastructure for recycling and composting are much more likely to participate than those without (Aremu & Sule, 2012; O'Connor et al., 2010). When receptacles are located closest to the point of consumption (e.g., in a classroom), participation increases (O'Connor et al., 2010). There must be a balance, however, between the level of accessibility and convenience, and the economic, environmental, and social impacts of the program. For example, when public satisfaction nears 100%, efforts must be evaluated so resources are not used just to provide a seemingly more convenient program (e.g. providing more bins, because common sense would suggest this increases participation, when there are plenty of bins present already) (Aremu & Sule, 2012).

Infrastructure is intimately tied with accessibility and convenience (e.g., it can qualify as the convenient feature of a program). If the waste diversion program is convenient because of the environment (e.g., installing organic waste receptacles in household kitchens), then the presence of the infrastructure is crucial (Bernstad, 2014). However, solely providing infrastructure will not increase waste separation behavior. If separation bins are present, but inconvenient, then waste separation will occur at a much lower rate than if they were located in a convenient location (Aremu & Sule, 2012; O'Connor et al., 2010).

Personal norms are standards that individuals create regarding why one should or should not perform a specific behavior, most times internalized from social norms (Bertoldo & Castro, 2016; Cialdini, Kallgren, & Reno, 1991). A social norm is an informal understanding about others that is considered normal (Cialdini, Reno, & Kallgren, 1990). It has been found that personal norms have a large positive impact on waste separation behavior (Hopper & Nielsen, 1991; Viscusi et al., 2011). One study has shown that social norms have a larger influence than warm-glow, i.e., joy from an activity without considering the outcome (Abbott et al., 2013). Ultimately, social and personal norms are intimately related, so they should both be considered when implementing waste separation strategies (Bertoldo & Castro, 2016).

Messaging can complement structures and programs to increase pro-environmental behavior, including waste separation. Messaging and signage provide practical and influential information, as well as behavioral cues (Geller, 1989). Multiple studies have shown that signage, compared to just infrastructure, increases correct waste separation behavior (Craig & Leland, 1983; Sussman et al., 2013) and other pro-environmental behaviors (Sussman & Gifford, 2012). Different and combined messages have produced mixed results. Baltes and Hayward (1976) found that the type of message (either a positive or a negative prompt) was insignificant when attempting to influence littering behavior in a football stadium, but both types were more effective than no messaging at all. Yet, effectiveness is dependent on the type of message (Morgan & Chompreeda, 2014; Terrier & Marfaing, 2015), reviewed later in this section.

Lastly, modeling has received some attention as a method for behavior change. Models display ideal behavior in plain view of others with the idea that people will follow their example. Depending on the situation, they may also assist people in making desired choices through information and vocal interaction. Multiple studies suggest that models combined with messaging are the most effective influences on pro-environmental behavior, such as conserving water in a shower facility and composting in a cafeteria (Aronson & O'Leary, 1982; Sussman et al., 2013). Sometimes peer modeling is effective in increasing waste separation behavior and changing attitudes (Hopper & Nielsen, 1991). However, Lin et al. (2016) warns that models may not be effective, such as in apartment complexes where they are present for a short time, but residents have 24-hour access to waste receptacles. One must also be conscious of the additional costs/efforts needed to incorporate models into a program (Lin et al., 2016).

Although there are many external factors that influence waste separation behavior, only a few will be measured in this study social norms, messaging, and models (i.e., volunteers). Other factors, such as information, infrastructure, and accessibility and convenience are considered in the study, but influences from these factors are not measured directly.

Additional Factors Influencing Waste Separation

Many factors influence waste separation behavior, and each environment offers a unique situation. The following section describes some factors that might influence fans at football stadiums.

Alcohol consumption by fans is a common activity before, during, and/or after football games. One study examined fan support of alcohol-related restrictions on college football game days (Glassman et al., 2007) and found that non-drinkers were the most supportive of alcohol interventions and regulations, while the heaviest drinkers were the least supportive. A similar study found that sports fans were more likely to binge drink at games (Nelson & Wechsler, 2003). Subsequently, the decision making skills of fans may become impaired after consuming too much alcohol (Brevers et al., 2014), a consideration that may limit the success of any intervention strategy at the football stadium.

Many people identify with athletics, and sport teams in particular. Sometimes they will display behavior that expresses their feeling of association with the team, overshadowing their own identity in the process. This phenomenon is called identity salience; it describes one’s identity that is more important and frequently expressed compared to other, less important identities (Laverie & Arnett, 2000). In all likelihood, identity salience will influence attendance at sporting events and also behavior at them, depending on team performance (Laverie & Arnett, 2000). Fans attend football games for various reasons, such as enjoying it as a pastime and wanting to spend time with friends and family (Parry, Jones, & Wann, 2014; Ward, 2009). These game day motivations are not consistent with appeals to dispose of waste properly, thus yielding additional challenges. Some venues are implementing pro-environmental initiatives (e.g. low-flush toilets, LED lighting, etc.), but without a marketing strategy to convey these features to fans, few results will be produced (Kellison & Yu Kyoum, 2014). When provided structure and prompts to engage in pro-environmental behavior (like anti-littering), fans are more likely to participate, even with other social influences present (Baltes & Hayward, 1976).

Social Science Theory Applied to Waste Diversion Studies

Researchers have used a variety of theories to describe waste separation behavior, but explanations are difficult due to the number and relative contributions of factors. Some include the theory of reasoned action, theory of planned behavior, norm activation model, A-B-C model, and social norm theory.

The theory of planned behavior is frequently used to examine waste separation behavior, more so than the theory of reasoned action. Both look at attitudes toward and subjective norms about a particular behavior, but the theory of planned behavior also incorporates perceived behavioral control (Ajzen, 1991). These factors determine behavioral intentions, which are presumably linked to actual behavior. Karim Ghani et al. (2013) used this theory to predict participation in food waste separation in households. Results showed that residents had positive attitudes and intentions for participation, provided that information and facilities were available to complete the task (Karim Ghani et al., 2013). Park and Ha (2014) also used the theory of planned behavior, combined with the norm activation model, to examine the drivers that underlie behavior intentions for recycling. However, the theory of planned behavior has limitations; it leaves no room to test for other influences like structure, accessibility, messaging effects, etc., which can be influential, depending on the setting. Analyzing intentions also requires evaluation prior to the behavior, making it virtually impossible to study at a football stadium. Football fans would not likely respond well to a survey that is marginally relevant to their primary activity or motivation.

The norm activation model posits that altruism and moral beliefs influence personal norms, which determine behavior (Schwartz, 1977). Studies by Park and Ha (2014) and Onwezen, Antonides, and Bartels (2013) argue that the determinants of pro-social and pro-environmental behavior are not only intentions, but also personal norms that have been influenced by emotions. This model and the theory of planned behavior explain such phenomena. Altruistic and moral beliefs are just as difficult to measure as intentions in naturalistic settings, such as football stadiums.

The A-B-C model was formed to incorporate influences other than mere intentions to perform a behavior. Ölander and Thøgersen (2006) describe the A-B-C model as follows: "The model suggests that (relevant) attitudes (A) and behavior (B) are most strongly correlated when behavioral facilitation by the structural conditions (C) is on an intermediate level, that is when the structural conditions make the behavior possible, but do not further it to such an extent that even those with the least favorable attitudes would perform it" (Ölander & Thøgersen, 2006). Even in cases of high willingness and environmental awareness, recycling participation will be low without the structure and accessibility of waste diversion systems and programs (Bernstad, 2014; Derksen & Gartrell, 1993). Although this study does not measure participant attitudes, the A-B-C model has some implications for game day recycling. The setting is not controlled by the individual, but instead managed by MU athletics, an external factor. Yet, the structure must be present for recycling behavior to occur.

Attitudes, values, and intentions are nearly impossible to measure at football stadiums, as compared with other locations. Instead, this study measured external factors, focusing on social norms. Cialdini et al. (1990) postulate that social norms can influence human behavior without determining attitudes or intentions, although they represent the possibility of feelings and/or actions. There are three types of social norms (Cialdini et al., 1990): 1) descriptive norms represent what is commonly done or being done, implying the behavior is sensible if others are engaging in it (Cialdini, 1988); 2) injunctive norms are framed as moral appeals (what "ought" to be done), which influences behavior through perceived social pressure (Cialdini et al., 1990); and 3) personal norms describe how one perceives they would approve or disapprove of one's own conduct (Cialdini et al., 1991). The social norm theory is ideally-suited for this study because norms are thought to be present, can be activated without interfering with the game day experience, and can be easily measured.

Signs and messages can depict two types of social norms, either injunctive or descriptive. Studies suggest that injunctive norms are powerful influences, such as the decreased likeliness that people will litter where anti-littering social cues are present (e.g. messaging about recycling on handbills) (Cialdini et al., 1990). In another case, injunctive messages which encouraged visitors to hang towels for reuse in a tourist resort had a positive effect on behavior (Morgan & Chompreeda, 2014).

Although Cialdini et al. (1991) suggest that both norms are effective when attempting to influence behavior, descriptive norms are especially useful when most individuals are actually *performing* the behavior. For example, people are more likely to litter in a setting that contains trash than a clean setting because they are influenced by what most people have done in that environment (Cialdini et al., 1990). Other pro-environmental behaviors can be influenced by descriptive norms, especially when using behavioral prompts, like messaging found in hotel rooms for water conservation purposes (Morgan & Chompreeda, 2014; Terrier & Marfaing, 2015) and messaging on waste bins to reduce littering (de Kort, McCalley, & Midden, 2008). In fact, some research suggests that descriptive norms are more powerful than injunctive norms. Injunctive messages provide opportunities for psychological reactance, such as telling someone what they *should* be eating (Stok et al., 2014).

The combination of descriptive and injunctive norms may be effective, but the presence of one type of norm is shown to be equally effective in certain situations (de Kort et al., 2008; Morgan & Chompreeda, 2014; Schultz et al., 2007; Thøgersen, 1994, 2008). The descriptive norm is most useful for this study (i.e. within a football stadium environment) because it can be framed as a short message that does not shame the fans into the behavior, as an injuctive message might do.

Social norms can change human behavior, but the literature suggests they must be activated for influence to occur (Cialdini et al., 1991). In other words, the norm must be brought into focus, or made salient by, some factor that stimulates norm-consistent behavior. If incompatible or competing norms are present, only one is activated, thereby producing an associated response or behavior (Cialdini et al., 1991). For example, Hopper and Nielsen (1991) showed that the perceived social norm for recycling (represented through a personal norm) was present in their community, but was activated only after awareness of consequences was high.

People, as models, volunteers, or authority figures, can activate social norms. Multiple studies have shown that people who model the desired behavior have a significant effect on influencing others' behavior (Aronson & O'Leary, 1982; Sussman et al., 2013). The presence of volunteers to assist in the waste sorting process increased the diversion of food waste in one study (Lin et al., 2016). Hopper and Nielsen (1991) found that peer leaders, or block leaders, were the most influential on recycling rates in a community. Authority figures, such as park rangers, can also influence pro-environmental and anti-depreciative behavior (Manning, 2003; Marion & Reid, 2007). The social norm theory represented through messaging and volunteers is suitable for this study due to the focus on actual behavior, as measured by waste separation.

The literature review addresses internal and external factors for participation in waste separation systems and programs; factors to be considered in athletic facilities; and social science theory. However, this study will only measure some external factors (i.e., social norms, messaging, and volunteers), and will test the social norm theory, specifically using descriptive norms and norm activation. Several studies have been conducted in cities, businesses, and institutions that measure efficiency and program participation rates, but there is a paucity of research in athletics, specifically at football stadiums. These studies do not address common factors that are encountered in football stadiums, such as weather, time of game, type of game (conference vs. non-conference), and others. Waste diversion in athletics is an emerging concept, and some colleges and universities are developing policies to address this important issue. However, research is needed to understand the nature of fan behavior, in light of site-specific requirements. This study will begin to fill the gap between theory and practice of waste diversion programs, through an analysis of football fans at the University of Missouri.

METHODS

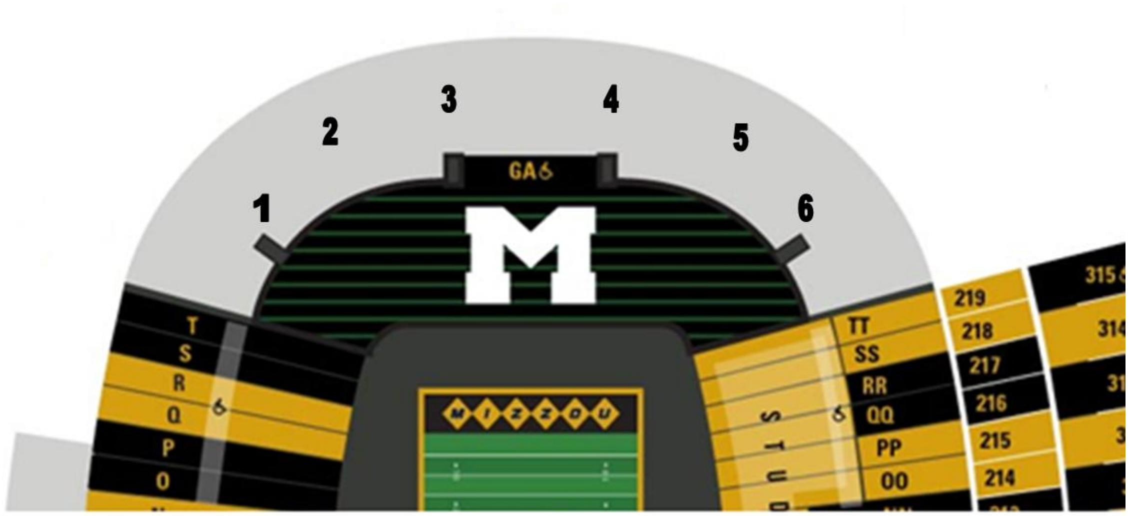
Study Site

This project measured waste disposal behavior of football fans at the University of Missouri-Columbia. Only one section of Memorial Stadium (the north end zone) was used for testing purposes, instead of conducting a facility-wide study (see Figure 2). The stadium, at large, is an immense structure that seats over 71,000 fans. There are hundreds of trash and recycling receptacles placed throughout the facility at various locations, making a stadium-wide study virtually impossible. A wide concrete walkway above the north end zone (i.e. the north concourse without bleachers) was selected as the study site, which provided a good mix of fans throughout the game (between student and general seating). Fans are drawn to the area because of concessions, souvenirs, restrooms, and the need to socialize. Some waste resulted from spontaneous purchase behavior, and bins were provided for that purpose. However, fans could dispose of their waste products anywhere in the stadium, including, but not limited to this particular zone. The research team, not MU Athletics custodial staff, monitored this area to ensure maximum control and consistency over waste collection procedures. Waste bins not associated with this study were removed from the testing site.

Figure 2.

Study site: north end zone

The grey area represents the north concourse at Memorial Stadium. The black numbers within this zone represent the six, three-bin arrangement locations.



Participants

Participants in this study were football fans at Memorial Stadium during the 2015 season. Average home game attendance was over 65,000 fans, of which, any could have been a test subject. However, fans in suite seating were unlikely participants because they had separate food and drink options, including their own waste disposal system. Since the design featured free-choice behavior, random selection or assignment of individuals to either treatment or control conditions did not apply. Both people and trash were present for the duration of each game. Fans disposed of their trash somewhere, either inside or outside the stadium.

Research Design

Eighteen bins were placed in the study section (six units with three bins each: recycling, compost and landfill). Rectangular in shape, the bins were fastened together, each measuring 20" L x 15" W x 30" H. Compost, recycling and landfill bins were color-coded: green, blue and black, respectively. Each had a label on the front in white lettering, corresponding to the bin type. The bins were equipped with removable sign flaps; these were absent during the control, but present when signage was being tested. See Figure 3 for an example of a three-bin unit. Color coordinated bags were placed in each of the bins – clear for compost, blue for recycling, and black for landfill. The area was monitored continuously from the opening to the closing of the gates (about an hour and a half before game time and around 30 minutes after game completion). Bins and bags were also numbered individually to identify their exact location (see Figure 2). The research team replaced bags when they were about two-thirds full.

Figure 3.

Example of a three-bin arrangement

Because there were three conditions to be tested and six home football games during the season, each condition received two exposures (see Figure 4). With the introduction of the three-bin units, fans experienced something different than in previous years. Moreover, a slight exposure effect on returning fans in 2015 could not be avoided, but to gain baseline data before messaging and volunteers were introduced, the first two games were designated as controls. The third and fifth games tested treatment one, and the fourth and sixth games tested treatment two. See Figure 5 for a flowchart of the conditions, followed by a detailed list.

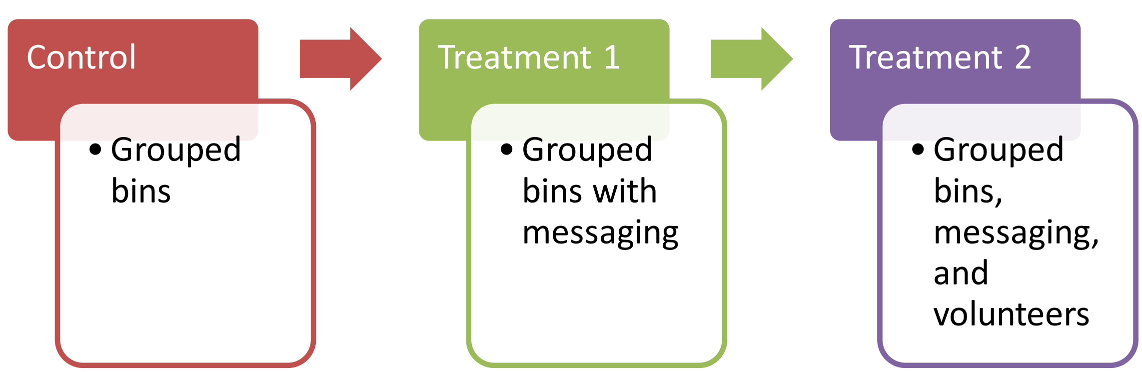
Figure 4

MU 2015 home football game schedule and associated condition tested

Date	Opponent	Condition
9/5/2015	**Southeast Missouri**	**Control (Bins)**
9/19/2015	**Connecticut**	**Control (Bins)**
10/3/2015	**South Carolina**	**Treatment One (Messaging)**
10/10/2015	**Florida**	**Treatment Two (Volunteers)**
11/5/2015	**Mississippi State**	**Treatment One (Messaging)**
11/21/2015	**Tennessee**	**Treatment Two (Volunteers)**

Figure 5.

Flowchart explaining the three tested conditions



Control: Six grouped units of compost, recycling and landfill bins were evenly distributed throughout the study area. Units were connected, making them less vulnerable to movement, either purposeful or accidental. Without signage above the bins, it was hypothesized that visitors would be less inclined to separate their waste, resulting in the highest level of inefficiency. Data collected from this setup provided baseline information for this study and a reference point to measure treatment effectiveness.

Treatment One: Messaging was added to the sign flaps that connected to the previous bin arrangement, which showed the proper placement for each waste item using a combination of pictures and words. The pictures matched common waste items sold in the stadium to minimize confusion (see Figure 6). The message placed above the bins read "Paws Before You Toss!" and "*Most Tigers Sort Their Waste*" (see Figure 7). These phrases created a play on words with Mizzou's mascot, the tiger. This message consisted of a descriptive social norm, telling fans what most tigers do. An increase in waste stream efficiency compared to the control was predicted because of this intervention strategy.

Figure 6.

Informational signs above bins

Figure 7.

Descriptive norm messaging above bins

Treatment Two: Volunteers stood next to the bin arrangement, helping fans make correct choices about waste disposal if they were asked to do so (see Figure 8). The message was identical with treatment one. Volunteers acted as a type of social influence and were placed at these locations to activate the descriptive norm in the message. They answered questions and encouraged people to discard their waste properly, but did not intervene if the waste was placed in the wrong bin. An increase in waste stream efficiency compared to the control and treatment one was expected during this treatment.

Figure 8.

Volunteer standing next to bins

Measures/Instruments

Efficiency is defined as the percentage of “correct” material respective to each bin type. This is an empirical reflection of how well visitors sorted their waste; higher efficiencies mean better pre-sorting. Efficiencies were measured at each of the football games, by bag type. All bags within the study site were collected and weighed, but only the first full bag of waste from each bin was selected for analysis. At some games, only one bag of waste per bin was generated. One bag was analyzed at a time to avoid cross-contamination and careful measures were taken to identify the bin location of each bag. During the waste audit, researchers separated the contents of each bag into three categories: recycling, compost, and trash. Liquids were left in their respective containers to represent how most waste management systems operate. Any liquid that was left at the bottom of the bag was counted as compost since it qualified as organic matter. Once separated, the bag contents were weighed and recorded. Each empty bin was weighed prior to the audit for calibration purposes (only net weight was recorded).

Data Analysis

Multiple weights were recorded for each bag that was selected for analysis: one for each of the three waste streams (compost, recycling, and landfill), and the weight of all contents (see Appendix A for an example data recording sheet). To determine the efficiency of a selected bag, a percentage was generated by dividing the weight of correct waste stream contents by the total weight of that bag. For example, if a recycling bag contained 3kg recyclables and 1kg of foreign matter (either trash or compost), the efficiency for that bag would be 75% (3/(3+1) = .75). Microsoft Excel was used to generate graphs, employing this formula to calculate averages of percentages for overall and specific bin type efficiencies:

$$\frac{(p_1 * t_1) + (p_2 * t_2) + (p_n * t_n)}{(t_1 + t_2 + t_n)} = p_a$$

where p=percentage, t=total weight, p_a=average percentage, and subscripts 1, 2, and n represent the observation number. Data was then entered into Statistical Package for the Social Sciences (SPSS). The independent variable was one of the three conditions (bins only, bins with messaging, and bins with messaging and volunteers) measured using nominal data. The dependent variable was calculated as efficiencies, measured by ratio data.

To test the statistical relationships and significance between these two variables, one-way analysis of variance (ANOVA) tests were used. Because of the uneven distribution of data from the recycling bin type, it was transformed with [asin(sqrt(variable)]; other bin type data were evenly distributed so transformation was not necessary. The Tukey-Kramer procedure was used as a post hoc test to determine the relative differences between each of the conditions in relation to overall efficiencies and those of specific waste streams. All tests were evaluated at a significance level of 0.05, a common practice of social scientists that assumes moderate risk in detecting Type I and Type II errors.

Limitations

The study site covered a small portion of the entire stadium. While waste receptacles were present in this area, fans had many opportunities to discard their trash at other locations. The east and west concourses join the main bleacher entry points, and were the most convenient locations to dispose of waste for fans sitting in those sections. The north-end zone was chosen because of the potential mix of fans from the east and west concourses. Fans from the opposing team varied in number and behavior, adding another layer of complexity to the study.

Each game presented a different setting. All games were on Saturday, except for one on Thursday night. Game times, temperature and precipitation varied throughout the season. Some games were exciting and fans stayed until the end, resulting in a mass exit after the fourth quarter. However, fans at other games left early, depending upon the outcome – winning handily or losing badly. It is unreasonable to expect fans to act to the same way in light and dark, dry and wet, hot and cold and different team performances.

Because of the limited study space, it was not feasible to test all conditions during a single game due to the strong possibility of control vs. treatment contamination.

RESULTS

This study measured the relative effect of waste separation strategies on fan behavior. A significant difference between the three conditions for each bin type and the average of all bins was expected.

Season Overview

The 2015 Mizzou home football season displayed a variety of extraneous variables. Attendance at the first four games was near stadium capacity (71,000), but there was a noticeable drop-off in the last two (about 59,000 fans per game), perhaps due to cooler and wetter weather. See Table 1.

Table 1

Extraneous variables per game

Date	Attendance[1]	Time	Opponent	Win/Loss[1]	Temperature (°F)[2]	Precipitation[2]
9/5/2015	64,670	3:00 pm	Southeast Missouri	W (34-3)	91° (H), 70° (L)	None
9/19/2015	70,079	11:00 am	Connecticut	W (9-6)	74° (H), 55° (L)	None
10/3/2015	66,751	11:00 am	South Carolina	W (24-10)	68° (H), 42° (L)	None
10/10/2015	70,767	6:30 pm	Florida	L (21-3)	70° (H), 40° (L)	None
11/5/2015	58,878	8:00 pm	Mississippi State	L (31-13)	67° (H), 56° (L)	Rain (.45 in)
11/21/2015	59,575	6:15 pm	Tennessee	L (19-8)	43° (H), 24° (L)	Sleet/snow (.31 in)

A total of 177 bags (recycling, compost and trash) were collected throughout the duration of the study; the contents of 108 bags were analyzed (18 per game). Less waste

[1] Retrieved from: http://www.mutigers.com/cumestats.aspx?path=football&year=2015

[2] Retrieved from: https://www.wunderground.com/history/

was generated during the last two games of the season, perhaps due to lower attendance due to lower temperatures and higher precipitation. See Table 2.

Table 2.

Total number of bags and weight collected in the parameters of the study

Date	Condition	n (bags)	Total Weight (kgs)
9/5/2015	Control (just bins)	37	118.45
9/19/2015	Control (just bins)	40	134.45
10/3/2015	Messaging	29	115.80
10/10/2015	Messaging + volunteers	35	124.05
11/5/2015	Messaging	18	64.55
11/21/2015	Messaging + volunteers	18	33.50
Totals		177	625.10

Overall Efficiencies

Hypothesis 1: Overall waste separation efficiencies will be significant over the three conditions.

Hypothesis 1: Reject

Table 3 and Figure 9 show the overall efficiencies; all bin types, all games. These efficiencies slightly increased over the treatments, starting with the control (54.5%); messaging (61.3%); and the use of messaging + volunteers (64.2%). This increase was not significant, with a *P* value of .174 (see Table 4), clearly showing that one treatment was no more effective than the others were.

Table 3

Average overall efficiencies for each condition

Condition	N	*M*	SD
Control	36	.545	.278
Message	36	.613	.172
Message + Volunteer	36	.642	.210

Figure 9.

Average efficiencies for all bin types over all conditions

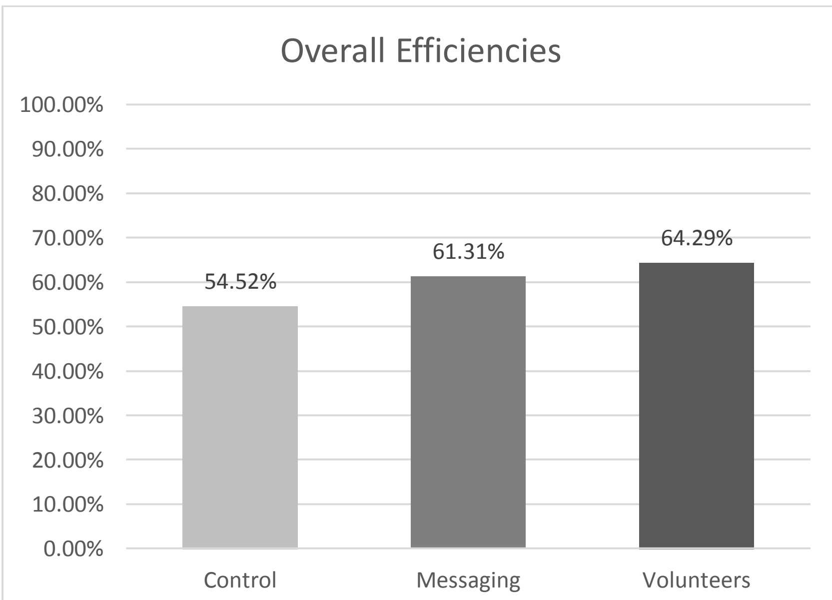


Table 4.

One-way ANOVA for all bin types over all conditions

Trial	*SS*	*df*	*MS*	*F*	*P*
Between Groups	.179	2	.089	1.776	.174
Within Groups	5.291	105	.050		
Total	5.470	107			

Separate Bin Types

This study also measured the effectiveness of waste separation influences on each bin type: recycling, compost, and landfill. Following the premise of the overall efficiencies, each bin's individual efficiencies were hypothesized to have a significant difference over the three conditions. Figures 10-12 show the overall efficiencies for recycling, compost, and landfill, per bin type. As the figures indicate, a pattern of mixed results was seen for each bin type, except for compost, which was linear and positive.

Bin Type: Recycling

Hypothesis 2: There will be a significant difference of waste separation efficiencies over the three conditions for recycling.

Hypothesis 2: Accept

Table 5 shows the transformed data for recycling efficiencies used in the analysis. Figure 10 shows original efficiencies. The efficiency for recycling was highest during the control condition (88.97%). When messaging was added, the efficiency decreased to 68.49%, but increased again when the volunteer accompanied the message (78.84%). The main effect was significant (P=.001) (see Table 6). Post-hoc comparisons revealed significant differences between the control and treatment one, and the control and treatment two ($P < 0.05$) (see Table 7)

Table 5.

Average efficiencies for asin(sqrt(Recycling) over the three conditions

Condition	N	*M*	SD
Control	12	1.123	.170
Message	12	.787	.276
Message + Volunteer	12	.916	.120

Figure 10.

Average efficiencies for recycling over all conditions (prior to data transformation).

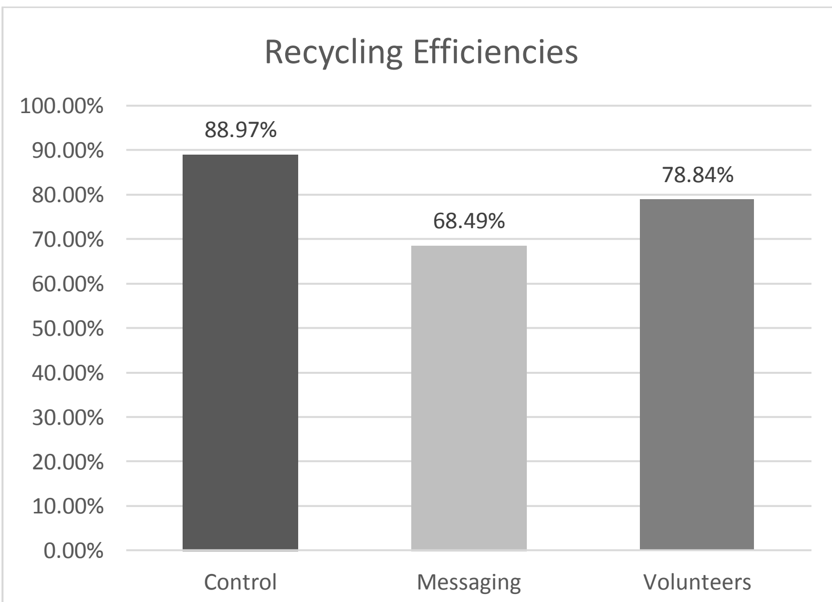


Table 6.

One-way ANOVA of control, messaging and volunteer efficiencies for recycling

Trial	*SS*	*df*	*MS*	*F*	*P*
Between Groups	.687	2	.343	8.559	.001
Within Groups	1.324	33	.040		
Total	2.010	35			

Table 7.

Tukey-Kramer post-hoc comparisons of condition efficiencies for recycling

	N	Control	Messaging	Messaging + Volunteer
Control	12	1.0	.335*	.206*
Messaging	12		1.0	.129
Messaging + Volunteer	12			1.0
P		.269	1.00	

Mean differences shown
** indicates a significant mean difference at the 0.05 level*

Bin Type: Compost

Hypothesis 3: There will be a significant difference of waste separation efficiencies over the three conditions for compost.

Hypothesis Three: Accept

Compost showed a positive trend, increasing from the control (38.9%) to messaging (63.7%) to messaging + volunteers (71.92%). See Table 8 and Figure 11. ANOVA results showed a significant difference ($P < .05$) (see Table 9), so the Tukey-Kramer post-hoc test was employed. The differences between the control and treatment one ($P = .002$) and between the control and treatment two ($P=.000$) were significant. However, between the two latter conditions, messaging and messaging + volunteers, the difference was insignificant ($P=.432$) (see Table 10) despite a nearly 10% increase in efficiency. Although treatment two (messaging + volunteers) was more effective than treatment one (message alone), there was no significant difference between them.

Table 8.

Average efficiencies for compost over the three conditions

Condition	N	*M*	SD
Control	12	.389	.172
Message	12	.637	.159
Message + Volunteer	12	.719	.149

Figure 11.

Average efficiencies for compost over all conditions.

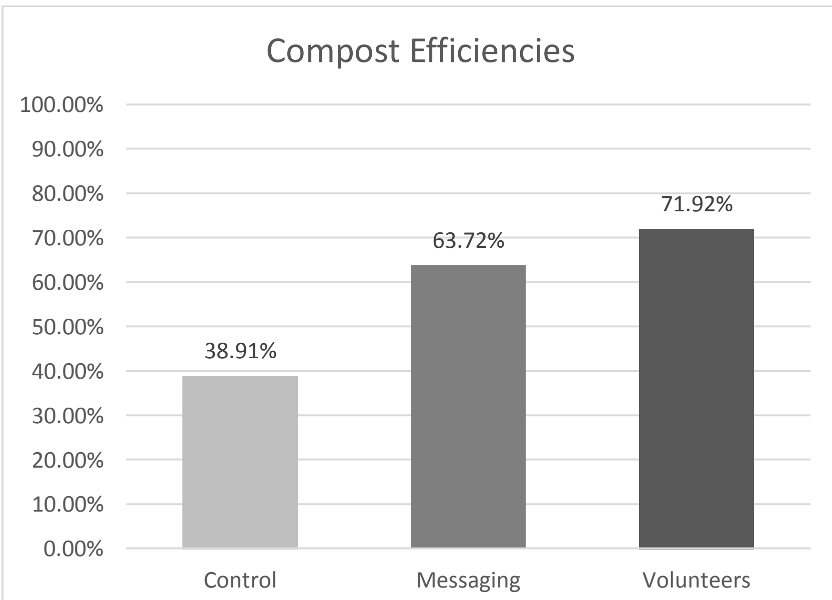


Table 9.

One-way ANOVA of control, messaging and volunteer efficiencies for compost

Trial	*SS*	*df*	*MS*	*F*	*P*
Between Groups	.709	2	.354	13.756	.000
Within Groups	.850	33	.026		
Total	1.559	35			

Table 10.

Tukey-Kramer post-hoc comparisons of condition efficiencies for compost

	N	Control	Messaging	Messaging + Volunteer
Control	12	1.0	.248*	.330*
Messaging	12		1.0	.082
Messaging + Volunteer	12			1.0

Mean differences shown
** indicates a significant mean difference at the 0.05 level*

Bin Type: Landfill

Hypothesis 4: There will be a significant difference of waste separation efficiencies over the three conditions for landfill.

Hypothesis Four: Accept

Landfill bins produced consistently lower efficiency rates and a different pattern of results as compared to recycling and compost. The control yielded a 35.6% efficiency that increased to 51.7% when messaging was implemented. However, treatment two (messaging + volunteers) resulted in a decrease to 42.0% (see Table 11 and Figure 12). The overall effect was significant ($P < 0.05$) (see Table 12). Upon further analysis, the control group was significantly different from treatment one ($P = .021$) (see Table 13), thus establishing that messaging was most effective for landfill purposes.

Table 11.

Average efficiencies for landfill over the three conditions

Condition	N	*M*	SD
Control	12	.356	.120
Message	12	.517	.114
Message + Volunteer	12	.420	.174

Figure 12.

Average efficiencies for landfill over all conditions.

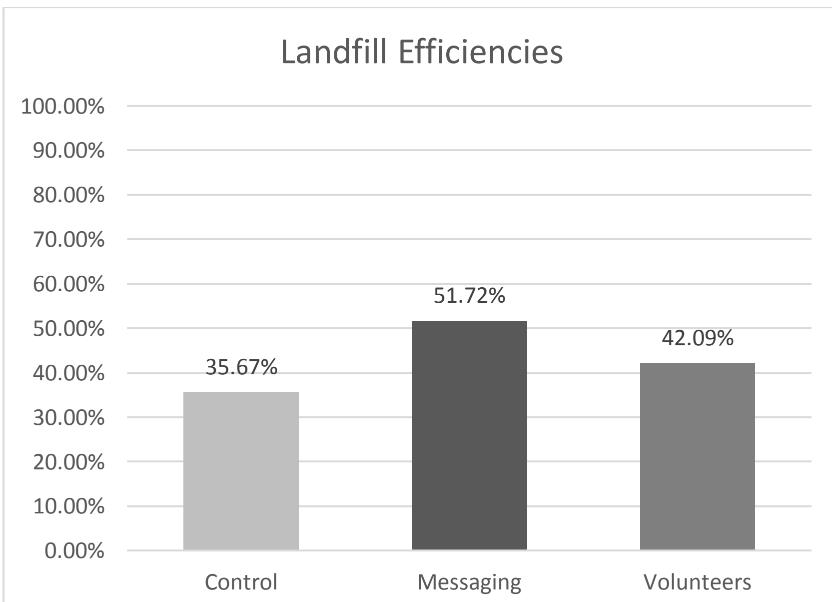


Table 12.

One-way ANOVA of control, messaging and volunteer efficiencies for landfill

Trial	*SS*	*df*	*MS*	*F*	*P*
Between Groups	.157	2	.078	4.051	.027
Within Groups	.638	33	.019		
Total	.794	35			

Table 13.

Tukey-Kramer post-hoc comparisons of condition efficiencies for landfill

	N	Control	Messaging	Messaging + Volunteer
Control	12	1.0	.160*	.064
Messaging	12		1.0	.096
Messaging + Volunteer	12			1.0

Mean differences shown
** indicates a significant mean difference at the 0.05 level*

DISCUSSION

The study showed mixed patterns of results, and although some were statistically significant, most were inconsistent with predictions. Multiple tests detected significant differences between the three conditions, although all three bin types showed mixed trends. Significant differences were detected between the control and treatment one (recycling, compost, and landfill) and the control and treatment two (recycling and compost). Overall efficiencies produced no significant results, despite showing a positive and linear trend. Each bin type will be discussed separately due to the mixed trends and inconsistencies with overall efficiencies.

Recycling Efficiencies

Recycling efforts showed unexpected results, largely due to a significant decrease from the control condition (bins alone) to treatment one (bins + messaging). At first glance, these results may seem illogical; however, there are several possible explanations. First, social norms for recycling have existed for years, indicated by studies as early as the 1990s in the U.S. (Derksen & Gartrell, 1993; Hopper & Nielsen, 1991; Hornik & Cherian, 1995). Recycling was introduced to Memorial Stadium and its respective tailgate areas in 2005; awareness of recyclable material continues to increase on campus. Cialdini et al. (1991) indicate that social norms must be made salient in order for the norm to be activated. The blue bins labeled “Recycling” are easily recognizable, and as long as they are conveniently placed, may have activated the social norm to recycle (O'Connor et al., 2010). The familiarity of this social norm may contribute to the higher efficiencies in general for recycling over the other two bin types.

In this study, however, extraneous factors should be examined carefully due to the dissimilarities of many football games. When the control was measured during the first two games, the ambient temperature was high (75-95°F), resulting in the sale of many disposable plastic water bottles. Perhaps visitors had a higher inclination for recycling because a) they may have received an incentive to recycle plastic bottles in the past (Viscusi et al., 2011), b) they have encountered this social norm elsewhere (O'Connor et al., 2010), and c) they may have been influenced by the presence of many water bottles already in the bins (Cialdini et al., 1990). Subsequent home games varied between cool and cold, night and day, and wet and dry, which resulted in a greater variety of items that were sold and discarded (e.g. Styrofoam cups, food items and associated containers). Compared to previous games, less disposable water bottles were sold. Despite the attempts to influence fan behavior with visual prompts and models, the recycling efficiencies decreased during the games, relative to the control condition. Perhaps these results are due to the inconsistent nature of products being sold, thus creating some possible confusion at the point of disposal despite the presence of a recycling social norm.

Compost Efficiencies

Compost efficiencies showed a positive increase from the control to treatment two, yet the results were not mutually exclusive. Significant increases were detected from the control to treatment one, and the control to treatment two. Yet, the two treatments were not significantly different from each other. Composting is a new concept at Memorial Stadium, and this is one possible explanation for such a low efficiency, especially during the control condition. Several studies on composting are conducted in households (Bernstad, 2014; Karim Ghani et al., 2013; Kliopova & Stanevičiūtė, 2013), but few are done in "uncontrolled" settings, such as a football stadium. Only pre-consumer food waste (e.g. potato skins, lettuce cuttings, etc.) had been collected previously at Memorial Stadium; this study introduced the first collection of compostables for football fans. During this study, food waste was accepted in the compost bins, but so were unfamiliar items, such as paper boats, napkins, and paper drink trays. These items are not typically composted at home because they require specific conditions to break down. Perhaps this created confusion and uncertainty for visitors, another explanation for the low efficiency during the control.

The introduction of descriptive norms and instructions in treatment one (messaging condition) led to an increase in compost efficiency. Because the idea of composting in a public venue was unfamiliar, messaging informed the fans of proper disposal procedures via pro-environmental social norms. Composting is rarely done at the University of Missouri, except for some behind-the-scenes activity at cafeterias. In contrast, composting is a behavior that individuals might practice at their households or perhaps at some businesses. Attitudes toward composting are considered to be positive (Karim Ghani et al., 2013), even though it may not be a common practice. This finding implies that pro-composting behavior can occur in some situations. The messaging focused on pro-environmental behavior, thereby informing fans about an unfamiliar process.

After volunteers were introduced in treatment two, composting efficiency increased again. Volunteers were expected to have the largest influence on fan behavior, presumably due to norm activation. Other studies indicate that social pressure from a perceived authority figure results in greater compliance (Cialdini & Goldstein, 2004; Marion & Reid, 2007). Despite the strong influence on fan behavior from volunteers, their effect on compost separation behavior was no different from messaging alone.

Perhaps fans wanted to perform the correct behavior, but were frustrated with the complexity and length of time it took to sort their waste, according to some of the volunteers through personal communication. For example, a basket of fries could contain recyclable items (i.e. plastic cup that was used for ketchup), compostable items (i.e. uneaten fries and paper boat), and landfill items (i.e. waxy paper to prevent oil saturation). Simplifying the items sold in the stadium would make it easier for fans, thus allowing research to focus on social norms and other behavioral influences. This would especially apply to compostables because of the unfamiliarity with the concept in the stadium. The simplest solution is to have the compost bins accept food items only.

Landfill Efficiencies

Although the efficiencies for landfill bins were consistently lower than recycling and composting, they produced some interesting results. The increase from the control to treatment one was significant, but the efficiency declined in treatment two. One possible explanation for the consistently low efficiencies pertains to the history of trash collection and separation. Since the 1970s, researchers have studied antecedents and influences for littering behavior (Baltes & Hayward, 1976; Cialdini et al., 1990; Reiter & Samuel, 1980). Mostly, the littering problem in the United States has been quelled, resulting in much of the collected waste going in one type of bin: trash. For decades, this has been the norm, with recycling and composting slowly entering the waste management scene.

For this reason, trash receptacles still serve as a “catch-all”, as seen by the low efficiency rates in this study.

Efficiencies of trash receptacles need to be examined separately from recycling and composting because the end product for recycling and composting must be uncontaminated for processing, unlike trash. In other words, trash cannot be contaminated like recycling and compost; it can only contain items that could have been used for different purposes. As a result, few studies have focused on the “contamination” rate of trash, instead focusing on anti-littering behavior (Baltes & Hayward, 1976; Cialdini et al., 1990; Reiter & Samuel, 1980) and/or general waste separation strategies to increase the recovery of materials. There is scant evidence about the presence of a social norm to “decontaminate” trash, providing yet another reason for low efficiency rates in this study.

The significant difference between the control group and treatment one showed that messaging increased compliance by eliminating the number of recyclable and compostable items in the trash stream. Although a social norm to “decontaminate” the trash was not present, pro-environmental norms are obvious as shown by the higher efficiencies in recycling and composting. Messaging was able to activate pro-environmental norms, at least to some degree.

When volunteers were introduced, efficiency ratings declined for the landfill bins. This result was surprising, considering that volunteers at the other bins yielded positive results. In theory, volunteers that stood next to the bins represented a form of authority, and generally speaking, people defer to authority (Cialdini & Goldstein, 2004).

However, success is dependent upon the behavior in question and the salience of authority. At the football stadium, littering is a common behavior and the volunteers might be perceived as weak agents of norm activation. In sum, it cannot be concluded that volunteers had a positive effect on landfill separation behavior.

Social Norm Salience

Descriptive norms are most effective when people actually engage in the behavior and when the norm is present at the time of behavior (Cialdini et al., 1991). Results from this study suggest that the descriptive norm from messaging was more salient for compost and trash, and less for recycling. Volunteers who stood by the bins were actors to increase norm salience, and although increases were seen in recycling and compost, no empirical evidence was found to support this hypothesis. One explanation for this observation is the variability of interactions with fans. Some volunteers were more proactive and engaging than others, despite given the same instructions: answer questions, provide assistance when asked, and not to move items from one bin to another if they happened to be misplaced. Personalities of the volunteers were an extraneous variable that was difficult to control, as some were bold while others were shy.

Some people are fearful of authority (Sennett, 1993) and will go to great lengths to avoid correction or shame due to social embarrassment. Although norm activation can occur in this manner, it seemed unlikely for this particular study. Many fans were not fearful of the volunteers because they lacked enforcement capability, including the symbolism that often accompanies those in power, such as vests, badges, hats, etc. In fact, some fans were emboldened while approaching the containers, taking no time to read the instructions or be influenced by the presence of volunteers. Perhaps fear was insufficient as a motivator. For many fans, trash at the stadium is insignificant. However, if fans were discarding contraband items (e.g. disposable alcohol bottles brought from outside the stadium), interaction with a volunteer might prove to be embarrassing. These fans paid no attention to the messages or volunteers, but were merely trying to avoid an uncomfortable situation.

All three bin types in each condition were contaminated, regardless of efforts to minimize it. If social norms were the only factors influencing pro-environmental behavior at the football stadium, then greater efficiencies would be likely. On game days, however, other factors, such as more salient norms, were possible. There are many reasons for attending sporting events, such as team identity, socializing with family and friends, and enjoyment (Laverie & Arnett, 2000; Parry et al., 2014). Perhaps other norms, consistent with common fan behavior at the stadium were more prominent than pro-environmental norms. Anecdotal evidence would suggest that few fans are concerned with waste disposal at the stadium because somebody else is responsible for cleanup. Athletics should not rely exclusively on pro-environmental norms at the stadium if zero waste is the overarching goal.

Managerial Implications

Results of this study have some important managerial implications. Historically, Memorial Stadium has had trash and recycling bins scattered throughout the concourses, with inconsistent designs and minimal messaging. This may be sufficient to achieve a moderate level of success, but this is only a small step in reaching a zero waste goal. The low efficiency rates in compost and landfill suggest that having bins with no messaging or volunteers will not significantly increase waste diversion. However, introducing new, color-coded units, even without messaging or volunteers, may increase diversion. Infrastructure, such as the bins used in this study, has been shown to be more convenient for waste separation than scattered bins, in turn increasing participation.

Increases were seen in compost and landfill efficiencies when messaging was introduced, but not for recycling. However, these results do not suggest abandoning messaging entirely. This is especially pertinent if the goal is to qualify for zero waste certification where the diversion rate must be at least 90%. In this study, all bin types with messaging were below 70%, but it could be improved with more control of extraneous variables.

However, volunteers may not be the best management decision either, as hypothesized. Slight increases in efficiencies were seen in recycling and compost with volunteers compared to messaging, although no increases were statistically significant. This should be positive for game-day operational staff because volunteers are resource intensive; sometimes it requires hiring additional staff (e.g. Ohio State), or time spent recruiting volunteers, both of which come at a significant cost. However, if the stadium is attempting to increase their diversion rate in small increments, volunteers may be helpful, as shown from the non-significant increases in recycling and compost efficiencies. While a diversion increase cannot be guaranteed, different measures could be taken to improve the effectiveness of volunteers, such as increased incentives, longer orientation, and recruitment specifically from groups that are invested in pro-environmental ideas. It should be noted that the volunteers in this study were not correcting behavior (i.e. taking items out of incorrect bins and placing them into the correct bin). Although this is a potential option for reaching zero waste, it is increasing the burden for staff, not the fans. This may be an unsustainable practice as fans become accustomed to their waste being sorted for them.

The fact that mixed results were seen implies the presence and strength of other influences than those tested in this study. It cannot be assumed that approaches that work well in other environments will have carry-over value in a football stadium. Rather, extraneous factors should be studied within the stadium to determine the best waste management approach, and the results may not be generalizable from one stadium to another. For example, if the most observed incorrect behavior is Styrofoam in the recycling, a ban of Styrofoam could be considered. Restrictive lids may be an option for behavioral control. Pro-environmental educational campaigns may need to incorporate other motivators for attending games (social, team identity, pastime, etc.) to be successful. Messages could be displayed on the jumbo-tron. In summary, a series of small-scale studies might be more useful to tease out the various effects of treatments rather than implementing a larger study to address more issues.

Limitations

The 2015 Mizzou football schedule consisted of six home games, five on Saturdays and one on Thursday evening (a nationally televised) game. Data was collected at each home game, although they differed considerably (weekend vs. weekday; day vs. night; non-conference vs. conference; and weather). Fans differed at least to some degree between games. Some were season ticket holders and present at each home game. Those from the opposing team were likely first-timers. Some fans were rowdy and intoxicated, but others were not. Should fans be expected to behave similarly? Precipitation occurred during the last two games, ranging from rain to an ice/snow mixture. Is it reasonable to expect that fans should act the same way, wet or dry? Considerably fewer fans attended these last two games, resulting in a reduced total weight amount. There was a large rush of fans exiting the stadium when the game was over. During the exit, some fans were throwing away trash, but others were not. Should fans be expected to read the messages and/or comply with norm-activation agents such as volunteers at this time? These variables could not be controlled and resulted in a large variance of fan behavior.

Only one section of the stadium was included in the study, the north end zone. Fans had many options to dispose of their waste in other locations at the stadium, and did so, especially when volunteers were stationed by the bins. For example, many fans would purchase concession stand items at this site, yet had unlimited opportunities to dispose of their trash at their seating location. Conversely, fans could bring items from other parts of the stadium and deposit them in the study area. The north end zone is a common meeting location for fans. As a result, it is relatively easy to cover the entire distance in a short period of time. This arrangement made it impossible to test all three conditions at each game due to the likelihood that fans would be exposed to different treatments in a small amount of space.

Future Research

Study limitations actually open up many opportunities for research in the future. A stadium-wide study would be ideal to capture waste from all fans, given enough resources. It may be possible to test multiple conditions during the same game with control of the whole stadium, thus controlling extraneous variables such as weather, time of day, outcome, etc. In the same way, if the study was situated in the tailgating lots, all conditions could be tested during each game. However, additional factors should be considered because of the uncontrolled nature of the environment (i.e. fans can bring disposable items of their choice). Conducting a similar study in other sporting venues, especially indoors, would explore the variation of waste separation behavior between multiple sports.

A study to test the effects of different signage (e.g. descriptive vs. injunctive) may assist managers who decide messaging is best for their facility. Experimenting with different pictures of items, including 3-D displays, may also be worth studying. In addition, research evaluating the effectiveness of restrictive lids, such as a round hole for recycling, may help determine if they would be useful in the stadium. The effects of other initiatives could be studies as well, such as announcements over the loud speakers, or an incentive program to dispose of waste properly. The possibility of future studies are vast, and should not be limited to those listed here. Each venue should be observed for potential improvements, and possible studies may stem from there.

REFERENCES

Abbott, A., Nandeibam, S., & O'Shea, L. (2013). Recycling: Social norms and warm-glow revisited. *Ecological Economics, 90*, 10-18.

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-211.

Aremu, A. S., & Sule, B. F. (2012). A case study evaluation of the impacts of optimised waste bin locations in a developing city. *Civil Engineering & Environmental Systems, 29*(2), 137-146.

Aronson, E., & O'Leary, M. (1982). The relative effectiveness of models and prompts on energy conservation: A field experiment in a shower room. *Journal of Environmental Systems, 12*(3), 219-224.

Baltes, M. M., & Hayward, S. C. (1976). Application and evaluation of strategies to reduce pollution: Behavioral control of littering in a football stadium. *Journal of Applied Psychology, 61*(4), 501-506.

Bernstad, A. (2014). Household food waste separation behavior and the importance of convenience. *Waste Management, 34*(7), 1317-1323.

Bertoldo, R., & Castro, P. (2016). The outer influence inside us: Exploring the relation between social and personal norms. *Resources, Conservation and Recycling, 112*, 45-53.

Blaine, T. W., Lichtkoppler, F. R., Jones, K. R., & Zondag, R. H. (2005). An assessment of household willingness to pay for curbside recycling: A comparison of payment card and referendum approaches. *Journal of Environmental Management, 76*(1), 15-22.

Brevers, D., Bechara, A., Cleeremans, A., Kornreich, C., Verbanck, P., & Noël, X. (2014). Impaired Decision-Making Under Risk in Individuals with Alcohol Dependence. *Alcoholism: Clinical and Experimental Research, 38*(7), 1924-1931.

Camp, S. L. (2010). Teaching with trash: archaeological insights on university waste management. *World Archaeology, 42*(3), 430-442.

Cialdini, R. B. (1988). *Influence: Science and practice* (2 ed.). Glenview, IL: Scott, Foresman.

Cialdini, R. B., & Goldstein, N. J. (2004). Social Influence: Compliance and Conformity. *Annual Review of Psychology, 55*(1), 591-621.

Cialdini, R. B., Kallgren, C. A., & Reno, R. R. (1991). *A Focus Theory of Normative Conduct: A Theoretical Refinement and Reevaluation of the Role of Norms in Human Behavior* (Vol. 24): Academic Press, Inc.

Cialdini, R. B., Reno, R. R., & Kallgren, C. A. (1990). A focus theory of normative conduct: Recycling the concept of norms to reduce littering in public places. *Journal of Personality and Social Psychology, 58*(6), 1015-1026.

City of Columbia. (2016). Recycling Opportunities. Retrieved from https://www.como.gov/PublicWorks/Solidwaste/recycling.php

Craig, H. B., & Leland, L. S. (1983). Improving Cafeteria Patrons' Waste Disposal. *Journal of Organizational Behavior Management, 5*(2), 79-88.

de Kort, Y. A. W., McCalley, L. T., & Midden, C. J. H. (2008). Persuasive Trash Cans: Activation of Littering Norms by Design. *Environment & Behavior, 40*(6), 870-891.

Death, C. (2011). 'Greening' the 2010 FIFA World Cup: Environmental Sustainability and the Mega-Event in South Africa. *Journal of Environmental Policy & Planning, 13*(2), 99-117.

Derksen, L., & Gartrell, J. (1993). The Social Context of Recycling. *American Sociological Review, 58*(3), 434-442.

EPA, U. S. (2014a). Composting for Facilities Basics.

EPA, U. S. (2014b). *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2012*. Retrieved from http://www.epa.gov/epawaste/nonhaz/municipal/pubs/2012_msw_fs.pdf

EPA, U. S. (2014c). Recycling Basics.

EPA, U. S. (2015a). *Generation, Materials Recovery, Composting, Combustion, and Discards of Municipal Solid Waste, 1960 to 2013*. Retrieved from: https://www.epa.gov/smm/studies-summary-tables-and-data-related-advancing-sustainable-materials-management-report

EPA, U. S. (2015b). *Getting Up to Speed; Groundwater Contamination*. Retrieved from https://www.epa.gov/sites/production/files/2015-08/documents/mgwc-gwc1.pdf.

Fry, E. (2013). Seattle Shoots for Zero Waste. *Fortune*, *168*(8), 26.

Fujii, S. (2006). Environmental concern, attitude toward frugality, and ease of behavior as determinants of pro-environmental behavior intentions. *Journal of Environmental Psychology, 26*(4), 262-268.

GameDay Challenge. (2015). GameDay Challenge - National Diversion (Competition Results) Retrieved from http://gamedaychallenge.org/participating-schools/2015-results/. http://gamedaychallenge.org/participating-schools/2015-results/

Geller, E. S. (1989). Applied Behavior Analysis and Social Marketing: An Integration for Environmental Preservation. *Journal of Social Issues, 45*(1), 17-36.

Geller, E. S., Witmer, J. F., & Orebaugh, A. L. (1976). Instructions as a determinant of paper-disposal behaviors. *Environment and Behavior, 8*(3), 417.

Glassman, T., Werch, C. E., Jobli, E., & Bian, H. (2007). Alcohol-Related Fan Behavior on College Football Game Day. *Journal of American College Health, 56*(3), 255-260.

Hopper, J. R., & Nielsen, J. M. (1991). Recycling as Altruistic Behavior: Normative and Behavioral Strategies to Expand Participation in a Community Recycling Program. *Environment and Behavior, 23*(2), 195-220.

Hornik, J., & Cherian, J. (1995). Determinants of recycling behavior: A synthesis of research results. *Journal of Socio-Economics, 24*(1), 105.

Karim Ghani, W. A. W. A., Rusli, I. F., Biak, D. R. A., & Idris, A. (2013). An application of the theory of planned behaviour to study the influencing factors of participation in source separation of food waste. *Waste Management, 33*(5), 1276-1281.

Kellison, T. B., & Yu Kyoum, K. (2014). Marketing Pro-Environmental Venues in Professional Sport: Planting Seeds of Change Among Existing and Prospective Consumers. *Journal of Sport Management, 28*(1), 34-48.

Kliopova, I., & Stanevičiūtė, K. (2013). Evaluation of green waste composting possibilities. *Å1/2aliÅ³jÅ³ atliekÅ³ kompostavimo galimybiÅ³ Ävertinimas., 65*(3), 6-19.

Lake, I. R., Bateman, I. J., & Parfitt, J. P. (1996). Assessing a Kerbside Recycling Scheme: A Quantitative and Willingness to Pay Case Study. *Journal of Environmental Management, 46*(3), 239-254.

Laverie, D. A., & Arnett, D. B. (2000). Factors affecting fan attendance: The influence of identity salience and satisfaction. *Journal of Leisure Research, 32*(2), 225-246.

Lehmann, S. (2010). Resource Recovery and Materials Flow in the City: Zero Waste and Sustainable Consumption as Paradigms in Urban Development. *Sustainable Development Law & Policy, 11*(1), 28-68.

Lin, Z. Y., Wang, X., Li, C. J., Gordon, M. P. R., & Harder, M. K. (2016). Visual prompts or volunteer models: An experiment in recycling. *Sustainability (Switzerland), 8*(5).

Manning, R. (2003). Emerging principles for using information/education in wilderness management. *International Journal of Wilderness, 9*(1), 20-27.

Marion, J. L., & Reid, S. E. (2007). Minimising visitor impacts to protected areas: The efficacy of low impact education programmes. *Journal of sustainable tourism, 15*(1), 5-27.

Martin, M., Williams, I. D., & Clark, M. (2006). Social, cultural and structural influences on household waste recycling: A case study. *Resources, Conservation and Recycling, 48*(4), 357-395.

Miranda, R., & Blanco, A. (2010). Environmental awareness and paper recycling. *Cellulose Chemistry and Technology, 44*(10), 431-449.

Missouri Recycling Association. (2015). *Missouri Recycling Guide 2015*. Retrieved from http://www.mora.org/uploads/1/4/0/6/14061154/2015_mora_final_guide_2015_5_26.pdf

Morgan, M., & Chompreeda, K. (2014). The Relative Effect of Message-Based Appeals to Promote Water Conservation at a Tourist Resort in the Gulf of Thailand. *Environmental Communication, 9*(1), 20-36.

Nelson, T. F., & Wechsler, H. (2003). School spirits:: Alcohol and collegiate sports fans. *Addictive Behaviors, 28*(1), 1-11.

O'Connor, R. T., Lerman, D. C., Fritz, J. N., & Hodde, H. B. (2010). Effects of Number and Location of Bins on Plastic Recycling at a University. *Journal of Applied Behavior Analysis, 43*(4), 711-715.

Ölander, F., & Thøgersen, J. (2006). The ABC of recycling. *European Advances in Consumer Research, 7*, 297-302.

Onwezen, M. C., Antonides, G., & Bartels, J. (2013). The Norm Activation Model: An exploration of the functions of anticipated pride and guilt in pro-environmental behaviour. *Journal of Economic Psychology, 39*, 141-153.

OSU, O. S. U. (2012). Zero Waste at Ohio Stadium: Achieving Zero Waste in 2012.

Paradelo, R., Moldes, A. B., & Barral, M. T. (2009). Magnetic susceptibility as an indicator of heavy metal contamination in compost. *Waste Management & Research: The Journal of the International Solid Wastes & Public Cleansing Association, ISWA, 27*(1), 46-51.

Park, J., & Ha, S. (2014). Understanding Consumer Recycling Behavior: Combining the Theory of Planned Behavior and the Norm Activation Model. *Family and Consumer Sciences Research Journal, 42*(3), 278-291.

Parry, K. D., Jones, I., & Wann, D. U. (2014). An Examination of Sport Fandom in the United Kingdom: A Comparative Analysis of Fan Behaviors, Socialization Processes, and Team Identification. *Journal of Sport Behavior, 37*(3), 251-267.

Reiter, S. M., & Samuel, W. (1980). Littering as a Function of Prior Litter and The Presence or Absence of Prohibitive Signs1. *Journal of Applied Social Psychology, 10*(1), 45-55.

Schultz, P. W., Nolan, J. M., Cialdini, R. B., Goldstein, N. J., & Griskevicius, V. (2007). The Constructive, Destructive, and Reconstructive Power of Social Norms. *Psychological Science, 18*(5), 429-434.

Schwartz, S. H. (1977) Normative Influences on Altruism. *Vol. 10. Advances in experimental social psychology* (pp. 221-279).

Sennett, R. (1993). *Authority*: WW Norton & Company.

Stok, F. M., de Ridder, D. T. D., de Vet, E., & de Wit, J. B. F. (2014). Don't tell me what I should do, but what others do: The influence of descriptive and injunctive peer norms on fruit consumption in adolescents. *British Journal of Health Psychology, 19*(1), 52-64.

Sussman, R., & Gifford, R. (2012). Please turn off the lights: The effectiveness of visual prompts. *Applied Ergonomics, 43,* 596-603.

Sussman, R., Greeno, M., Gifford, R., & Scannell, L. (2013). The Effectiveness of Models and Prompts on Waste Diversion: A Field Experiment on Composting by Cafeteria Patrons. *Journal of Applied Social Psychology, 43*(1), 24-34.

Terrier, L., & Marfaing, B. (2015). Using social norms and commitment to promote pro-environmental behavior among hotel guests. *Journal of Environmental Psychology, 44*, 10-15.

Thøgersen, J. (1994). A model of recycling beaviour, with evidence from Danish source separation programmes. *International Journal of Research in Marketing, 11*, 145-163.

Thøgersen, J. (2008). Social norms and cooperation in real-life social dilemmas. *Journal of Economic Psychology, 29*(4), 458-472.

Vicente, P., & Reis, E. (2008). Factors influencing households' participation in recycling. *Waste Management & Research, 26*(2), 140-146.

Viscusi, W. K., Huber, J., & Bell, J. (2011). Promoting Recycling: Private Values, Social Norms, and Economic Incentives. *American Economic Review, 101*(3), 65-70.

Ward, T. (2009). The roar of the crowd. *Soccer & Society, 10*(5), 544-557.

Watt, G. C. M., Britton, A., Gilmour, H. G., Moore, M. R., Murray, G. D., & Robertson, S. J. (2000). Public health implications of new guidelines for lead in drinking water: a case study in an area with historically high water lead levels. *Food and Chemical Toxicology, 38, Supplement 1*, S73-S79.

Wright, R. E. (2013). Demographics and Recycling: Effects of Types of Materials. *The Journal of Applied Business and Economics, 14*(5), 11-18.

Wright, S. (2011). Ohio State scores with zero waste. *Waste & Recycling News, 17*(12), 0001-0001.

Wright, S. (2012). Ohio State's diversion efforts reach 98%. *Waste & Recycling News, 18*(17), 0004-0004.

Zaman, A. U. (2014). Measuring waste management performance using the 'Zero Waste Index': the case of Adelaide, Australia. *Journal of Cleaner Production, 66*, 407-419.

Zaman, A. U., & Lehmann, S. (2013). The zero waste index: a performance measurement tool for waste management systems in a 'zero waste city'. *Journal of Cleaner Production, 50,* 123-132.

Závodská, A. (2008). Is Recycling Garbage?--The Report of a Pilot Study at Barry University, Miami, Florida. *Journal of Solid Waste Technology & Management, 34*(3), 136-139.

Zhang, W., Che, Y., Yang, K., Ren, X., & Tai, J. (2012). Public opinion about the source separation of municipal solid waste in Shanghai, China. *Waste Management & Research: The Journal of the International Solid Wastes & Public Cleansing Association, ISWA, 30*(12), 1261-1271.

ZWIA. (2009, 2009). Zero Waste Definition Adopted by Zero Waste Planning Group. Retrieved from http://zwia.org/standards/zw-definition/

ZWIA. (2013). ZWIA Zero Waste Business Recognition Program.

APPENDIX A

Waste Audit Data Recording Sheet

Date:
Opponent:
Game Time:

Waste Audit Data Collection

Mizzou Football Tailgating/Game Time

		Total Weights (kgs)		
		Recycling	Compost	Trash
Unit #	Type	Initial Tub Wt.	Initial Tub Wt.	Initial Tub Wt.
1	Recycle			
	Compost			
	Landfill			
2	Recycle			
	Compost			
	Landfill			
3	Recycle			
	Compost			
	Landfill			
4	Recycle			
	Compost			
	Landfill			
5	Recycle			
	Compost			
	Landfill			
6	Recycle			
	Compost			
	Landfill			