ANALYZING ON-SCREEN SUSTAINABLE BEHAVIOR AND MESSAGE PLACEMENTS

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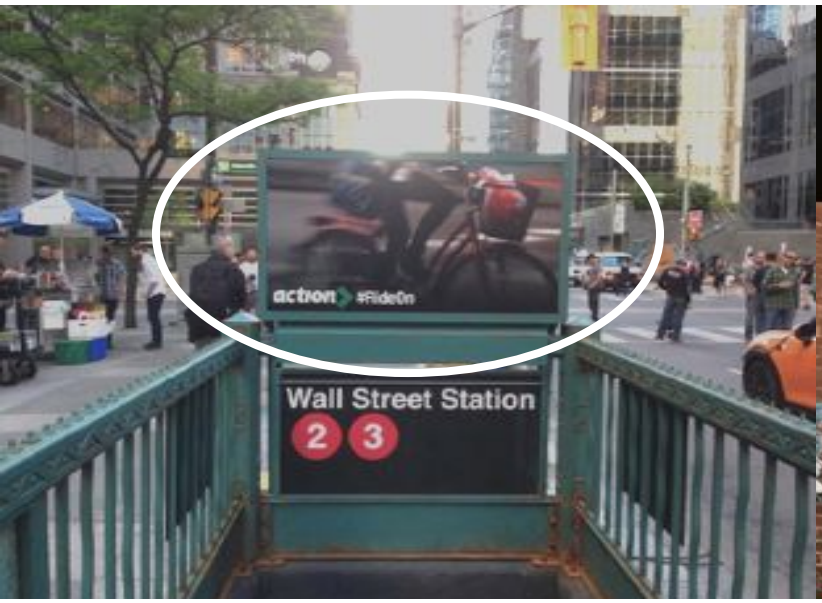
TABLE OF CONTENTS

ABSTRACT

Our study addresses the following research questions: 1) What sustainable and unsustainable behaviors occur most frequently in past and present TV shows? And 2) are the behaviors present on television the most relevant to the environmental problems we face in our society today? We reviewed 50 of the most popular drama and comedy television series and analyzed the demographics of characters who engaged in both sustainable and unsustainable behaviors, the context of those behaviors, and how the frequency of such behaviors changed over time. We developed a coding instrument to help us understand the behaviors or placements that were most frequently depicted. We watched 5 episodes for each of the 50 shows, and two coders reviewed each episode to increase reliability of the data. In total, we watched 425 hours of television. We found minimal sustainable behaviors and placements in television: the overwhelming majority of sustainable behaviors were typical for their setting— for example, characters using reusable dining ware at home; There was also no increase in sustainable behaviors or placements in recent shows compared to older shows. Further, many of the sustainable behaviors/placements that were evident were not high impact environmental behaviors such as eating a meatless meal. Future studies may build upon our research to examine the efficacy of sustainability placements and further refine the list of recommended best practices to display on-screen.



INTRODUCTION

Television and streaming services are more readily accessible to the general public than ever before. Media is a source of learning and those who consume high amounts of media, particularly television, are more informed on political and social issues (Emmers-Sommer and Allen, 1999). Knowledge on environmental issues is a significant predictor for individual choices to engage in more environmentally conscious behavior (Connell and Kozar 2014). Individuals who are exposed to media coverage of global warming show a positive direct increase in accommodating, promotional and proactive pro-environmental behavior (Huang 2016).

However, little to no research exists on the frequency or relevancy of message placements with the goal of promoting sustainable behavior, or on the potential it may have to influence the decisions media consumers make on a daily basis. Our study seeks to fill this gap in knowledge regarding on-screen environmental messaging placements.

The majority of Americans believe that climate change is being caused by human activities and that carbon dioxide should be regulated as a pollutant (Howe et al., 2015). However, major behavioral shifts from the public and policymakers will be necessary if the United States is to curb its emissions in the near future. Behaviors and message placements in the context of this study are considered more sustainable if they actively reduce emissions, conserve water, or reduce energy usage.

Utilizing media as an educational platform for sustainability may be a key instrument in encouraging sustainability as a cultural norm. We turned to previous research on how television has been able to influence shifts in attitude and behavior in regards to everyday issues ranging from practicing safe sex to changing diets in order to avoid chronic diseases like diabetes. The background research we undertook prior to the start of our project helped us discover how television has been used as a catalyst for attitude and behavior changes through the implementation of a concept known as “entertainment education” (EE) (Shin et al., 2017). Entertainment education has been successful in improving knowledge in a variety of areas and has the potential to encourage healthy behaviors (Shin et al., 2017). The few EE interventions relevant to environmental science have taken place in Asia, Europe, and several countries of the Caribbean. These programs have been effective due to their emotionally engaging narratives, which are able to raise awareness, shift attitudes, and spark public conversations (Reinermann et al., 2014).

We wanted to apply scientific methods to the topic of environmental messaging in order to evaluate its current state in American television shows and areas for improvement and potential application in the future. We built on the work done by the Producers Guild of America Green (PGA Green) and their Green Production Guide. PGA Green focused on the production side of television; their representatives typically discuss best practices on set involving construction, props, and set decoration. Their recommendations are incorporated on a voluntary basis. These recommendations generally focus on set dressing and background props such as billboards, posters, and swapping to sustainable products such as reusable water bottles. There has been little dialogue with writers about show content and incorporating environmental messaging into the storyline. PGA Green has a list of recommended behaviors for producers to include on-screen. Our team hopes our research findings will be used to refine and empirically support the recommendations provided in the PGA Green Unified Best Practices.

METHODS

Phase 1: Frequency-Representations of Sustainable Behaviors

The goal of Phase 1 was to obtain categorical data on the frequency of sustainable and unsustainable behaviors that appeared on television over the past decade. We aimed to examine aspects of these behaviors such as character demographics, sustainability category, and the context in which the behavior or message was performed.

Development of Coding Instrument

PGA Green provided us with a list of their "Top Twenty-Five On-Screen Behaviors" that suggests realistic on-screen sustainable actions to producers. We combined this list of behaviors with other behaviors we discussed in-person with our clients. The additional behaviors included reusable ware, green cleaners, Energy Star appliances, and turning off water during household activities. We also included a category for environmental messaging in the form of spoken lines, clothing slogans, or art (see Appendix 1 for the complete list of behaviors). Through our review of the literature, we recognized that our list does not include most of the behaviors recognized as most impactful, such as having one fewer child and voting for environmental causes (Wynes & Nicholas, 2017). We chose behaviors that we expected to be more frequent in a household setting or on an individual level, since they were the most likely to appear on television. We limited our scope by focusing on attitude and behavior shifts at the individual level, and how sustainability concerns can be normalized through media.

Using data from Nielsen Holdings as our primary source for show ratings, we selected television programs from the top rated list of shows from broadcast television networks (Table 1). To compare sustainable and unsustainable behaviors across years, we compared showed from 2003-2011, 2012-2015, and 2016-2017. We had 11 shows from 2003-2011, 19 from 2012-2015, and 20 from 2016-2017. We found the top 5 comedy series and top 5 drama series for each year, and specified our scope to productions set in the modern day. We only obtained data from this time period because modern era shows are the most relevant to the existence of the concept of "sustainability." These shows also were considered popular when audiences began to fully utilize streaming services such as Netflix, Amazon, and Hulu. Limited data exists on ratings for streaming websites due to a lack of disclosure from these platforms, so we drew information from websites that ranked Netflix shows based on award recognition, social media analytics, and number of reviews. We selected 50 shows in total—30 from TV networks and 20 from Netflix—and analyzed the frequency of sustainable and unsustainable behaviors by watching five episodes per program (Table 1).

Table 1. List of Shows, Season, and Year

Show	Season	Year
Roseanne	10	2017
This is Us	2	2017
One Day at a Time	1	2017
Mom	5	2017
13 Reasons Why	1	2017
The Good Doctor	1	2017
911	1	2017
Bull	2	2017
Instinct	1	2017
Iron Fist	1	2017
Chicago Med	3	2017
SEAL Team	1	2017
Hawaii Five-0	8	2017
Easy	1	2016
The Ranch	1	2016
Luke Cage	1	2016
Gilmore Girls: A Year in the Life	1	2016
Haters Back Off	1	2016
The OA	1	2016
Fuller House	1	2016
Daredevil	1	2015
Master of None	1	2015
Jessica Jones	1	2015
Unbreakable Kimmy Schmidt	1	2015
Sense8	1	2015

Show	Season	Year
Lovesick	1	2014
House of Cards	1	2013
Orange is the New Black	1	2013
Longmire	1	2012
NCIS	10	2012
Person of Interest	2	2012
Body of Proof	3	2012
The Mentalist	5	2012
Two and a Half Men	10	2012
Elementary	1	2012
Modern Family	4	2012
Castle	5	2012
Big Bang Theory	6	2012
Blue Bloods	3	2012
House	4	2007
Law & Order: Special Victims Unit	9	2007
Samantha Who?	1	2007
Without a Trace	6	2007
CSI: Crime Scene Investigation	8	2007
Heroes	2	2007
Lost	4	2007
Brothers & Sisters	2	2007
Grey's Anatomy	4	2007
Criminal Minds	3	2007
Arrested Development	1	2003

We collected data by creating a coding instrument that includes the following coding variables: show information (season and episode, time of appearance); behavior or message type (i.e., water, waste, energy, message, product); behavior context (setting, level of inclusion, connotation of the behavior); as well as character demographics (character role, role size, age, gender, race, and social class) (see Appendix 2 for complete coding instrument). We also coded for whether behaviors were "typical" for the setting in which they appeared, such as the use of reusable ware at home. This information aimed to answer the following research questions:

Primary Research Questions

1. What sustainable and unsustainable behaviors occur most frequently in past and present TV shows?
2. Are the behaviors present on television the most relevant to the environmental problems we face in our society today?

Sub-research Questions

1. Are women or men more often shown engaging in sustainable behaviors?
2. How does representation of environmental behaviors vary by race?
3. How does representation of environmental behaviors vary by social class?
4. How does representation of environmental behaviors vary by age?
5. How does representation of environmental behaviors vary by size of a character's role?
6. What are the demographics of sustainable behaviors that are portrayed negatively?
7. Are protagonists or antagonists more likely to be shown performing sustainable or unsustainable behaviors?

Hypotheses on Research Questions

Primary Research Questions: Our team expected to observe more typical behaviors while coding rather than intentionally placed sustainable/unsustainable behaviors— mainly, using reusable products at dine-in restaurants or single-use products at take-out restaurants. We expected that the categories of "reusable ware" and "single-use products" would be the most observed behavior because characters often use these products throughout a show. Additionally, these categories are broad compared to some of the other categories we coded for such as turning off lights when leaving a room. We also hypothesized that over the time period in which a show was released, there would be an increase in the frequency of sustainable behaviors compared to unsustainable behaviors due to social and environmental progression.

Sub-research Questions: We hypothesized that Caucasian characters, middle-class characters, adult aged characters, and protagonists would engage in more sustainable behaviors because these demographics were expected to have the most screen time. We expected women characters to engage in more sustainable behaviors because many of the behaviors we looked for took place in the home, and women are more often depicted as homemakers and caretakers in television compared to men. We also hypothesized that the role size of the characters would not be significant in determining whether they perform sustainable or unsustainable behaviors; characters with smaller roles would most likely adhere to what is typical based on the setting, or mirror the behaviors of the main characters.

Data collection/Coding procedure

The coding procedure was designed over several trials in which our team assessed the usability of the system for recording sustainable behaviors on-screen. We used Google Forms for our coding instrument due to its efficiency in collecting data as well as its user friendliness. Each time an individual identified either a sustainable or unsustainable behavior while watching an episode, the show was paused to record information about the behavior through the coding instrument. For our data collection, two coders individually watched each show to account for behaviors one coder might have missed and to compare the differences in coding consistency. Shows were coded once by one of our team members and a second time by a student volunteer. Volunteers were recruited through pitching to environmental science courses and clubs as well as the UCLA Bruin Film Society. Research volunteers attended a 1 hour training session to standardize our coding method in which we went over the form in detail. Volunteers were partnered with a member of our team and went through a trial of one episode before beginning their coding. Collectively, our team and volunteers watched 212.5 hours of television shows, amounting to 425 hours total as every show was reviewed and coded by two individuals.

Phase 2: Relevancy-Impact Assessment

We defined sustainable behaviors as those which lower greenhouse gas emissions, conserve water, and/or reduce energy usage in comparison to conventional practices. Our relevancy analysis looks at the overall sustainability potential of these behaviors if they were adopted by all individuals, meaning behaviors which have the largest impact are the most relevant to climate change mitigation. In order to categorize the behaviors we recorded, used Project Drawdown's ranked list of climate change solutions to determine which actions are largely agreed to be "high" impact and feasible in our current day (Drawdown Solutions). Project Drawdown has collected data from many sources including researchers, scientists, and policy makers to provide the 100 climate solutions which would have the greatest environmental, social, and financial benefit if implemented within the next 30 years. The final behaviors that were determined to be high-impact are eating meatless meals, installing household solar panels, composting, recycling, and taking forms of transportation other than gasoline passenger vehicles, which included electric vehicles.

We defined medium impact behaviors as those which have a measurable impact on energy use, water consumption, or greenhouse gas emissions at the household level, but were not included on Drawdown's list of top 100 impactful actions. Our "medium-impact" behaviors are garage sales/donations, reusable bags, reusable ware and water bottles, more efficient electronics and unplugging/turning off electronics, conserving water, backyard gardening and the action of line-drying clothes instead of machine drying. The primary group of behaviors which we classified as low impact were those which either do not directly lower greenhouse gas emissions, conserve water, or reduce waste, or have a marginal or difficult to quantify impact. The "low-impact" behaviors include environmental art, clothing with green slogans, eco-messaging on advertisements or posters, lines related to sustainability or environmentalism, use of green cleaners, and placement of living plants indoors. Appendix 1 provides further information on how we categorized the impacts of sustainable actions.

Our review of the literature revealed some important conclusions pertaining to the sustainability of human behaviors. First, use alone of a certain product might not be the most important factor when considering environmental impact—end of life and disposal choices look to be essential to understanding the sustainability of products (Woods and Bakshi, 2014, Muthu et al., 2011, and Norum, 2015). Another crucial factor is the efficiency of the machinery and infrastructure used for production (Papong et al., 2014, Young 2008, and Woods and Bakshi 2014). Monitors are important if people are to know the energy usage of specific appliances in the home (Drawdown Solutions). We also recognize that many of our recommendations only apply to those in industrialized societies, but this is an important demographic to target as wealthy nations have the greatest climate change effect (Sims et al., 2014).

As there is no one source which ranks every human action by sustainability impacts, we had to use some discretion in assigning our categories to high, medium, or low rankings. We increased the reliability of our impact categories by sending our list to five environmental science experts for them to rank the behaviors and see where consensus exists. We compared the experts' opinions based on the most common rankings for each category and compared this with our own impact rankings. Thirty-three percent of the responses from experts did not match our rankings; for example, we ranked "gasoline cars" as high impact when most experts listed the behavior as medium impact. However, many of the unmatched rankings had varying responses from each expert and, therefore, a lack of consensus. We conclude that the impact levels of many sustainability categories can be variable depending on where the behavior takes place or what type of messaging occurs. Appendix 3 details the findings of our literature review which we used to justify our rankings.

Phase 3: Data Cleaning and Analysis

Data Cleaning and Final Data Analysis

We cleaned the data by determining which behaviors to include or exclude in our analysis. We chose to exclude behaviors which were not coded consistently between different coders or those which could not be definitively categorized as either sustainable or unsustainable. We assume these actions are not relevant to the overall analysis of trends. If a behavior was observed by both coders, we included only the primary coder's demographic information for the data analysis since the primary coder did background research on the character roles and demographics. We also included all valid behaviors that were observed by only one of the coders, even if the other coder did not observe it. We then labeled "unavoidable single-use" behaviors such as wearing disposable gloves in a hospital or crime scene setting. These behaviors were included in frequency analyses and when ranking the impact of different actions. We relabeled many of the settings coded by coders in the "other" category. For example, there were entries for "prison hall," "prison cell," and "jail cell" which were re-coded to belong in the broader setting category of "prison." Relabeling was also done for sustainable and unsustainable behaviors that coders listed in the "other" category when they observed a behavior that did not fit the given category list. After cleaning the data set, we created frequency tables and graphs to address our primary research questions and sub-research questions.

Inter-rater Reliability (IRR) Analysis

Before analyzing the data, we performed an inter-rater reliability (IRR) analysis. The IRR statistics answer the question of whether coders recorded the same behaviors within a specific television show when they each coded a behavior at the same time. We used the package irr on R (Gamer et al., 2012 and R Core Team, 2017). As most shows had two coders, we mainly calculated the Cohen's Kappa statistic. For the few shows which had 3 coders, we calculated Fleiss' Kappa statistic. These range between 0 and 1.

IRR Results and Discussion

The value of Kappa for sustainable behaviors and products for the 50 shows included in the study ranged from 0.2 to 1, however, 96% of the shows had values of Kappa that were above 0.61, meaning there was good agreement between coders (Table 2). Only one show, Chicago Med, had poor strength of agreement between coders for sustainable behaviors. The value of Kappa for unsustainable behaviors and products ranged from 0.4 to 1, and 83% of the shows had values of Kappa over 0.61. Jessica Jones had the lowest strength of agreement between coders for unsustainable behaviors.

Table 2. Inter-rater reliability results

Value of Kappa	Strength of agreement	Fraction of 50 shows for Sustainable Behaviors/Products in each category	Fraction of 50 shows for Unsustainable Behaviors/Products in each category
< 0.20A	Poor	2%	0%
0.21 - 0.A40	Fair	0%	2%
0.41 - 0.60	Moderate	2%	15%
0.61 - 0.80	Good	6%	13%
0.81 - 1.00	Very good	90%	70%

While the strength of agreement between coders was typically high, variability in our IRR statistics may have been a result of a flawed coding training strategy for volunteers. We could have improved data collection by creating an extensive list of every possible behavior, defining everything that could be in category for unsustainable and sustainable and providing examples of behaviors found in shows. This would have ensured that coders knew what to look for and, thus, we would have likely achieve more consistent results. However, it would have been considerably more taxing on the volunteers who agreed to watch and code the television shows.

Although the IRR statistics for a few shows indicated low strength of agreement between coders, it does not necessarily mean that the data itself is flawed. Low similarity results only indicate how many of the same behaviors were coded for at a specific time. However, sometimes one coder noted different behaviors that the other did not. One of the main purposes of having two individuals code each show was to ensure behaviors were not missed. If behaviors missed by one coder was picked up by the second coded, the data itself would be reliable, however the IRR statistic might still be low.

RESULTS

Sustainable behaviors accounted for 47% of total behaviors while unsustainable behaviors accounted for 53%. Shows with the highest proportion of unsustainable behaviors were often the medical dramas, which featured many unavoidable single-use items such as medical gloves, gauze, or syringes, and crime dramas, which featured a higher proportion of car scenes (Figure 1).

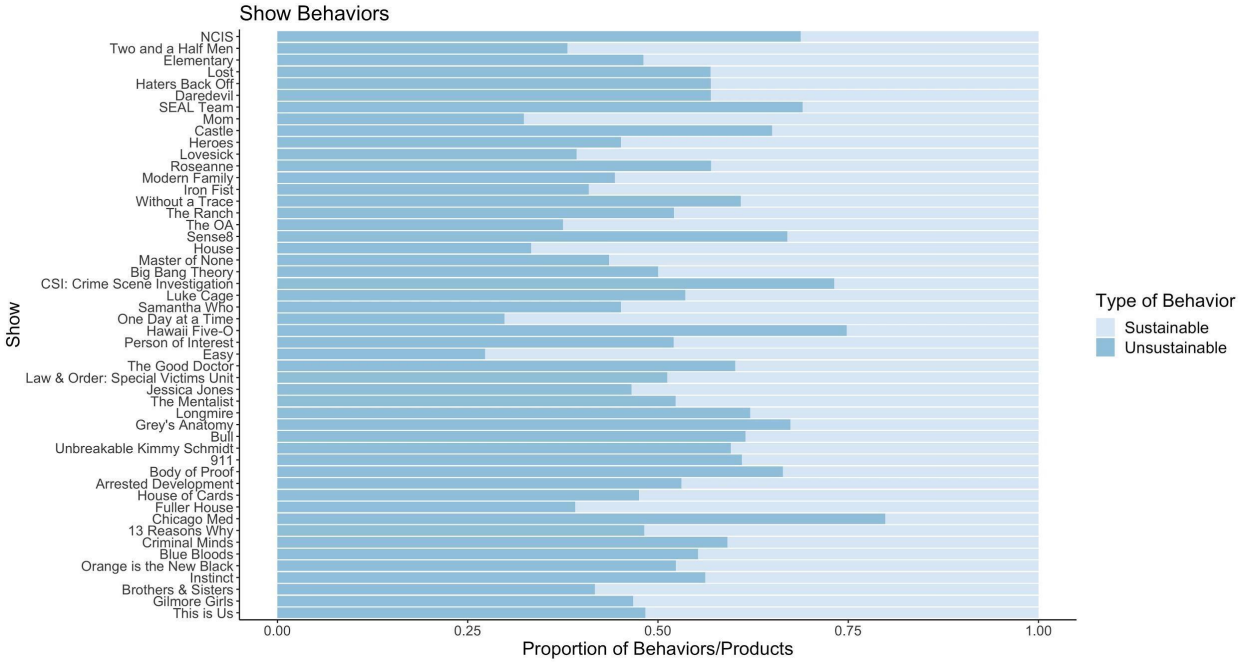


Figure 1. Proportion of behaviors in each show that were sustainable versus unsustainable non-typical behaviors

Shows with the highest frequency of sustainable behaviors were generally half-hour comedies, or included plotlines that involved sustainability. Reusable ware was the most frequently observed behavior (Figure 2). Additional top placements/behaviors were indoor plants, green transportation, and meatless meals. Reusable ware and indoor plants are medium and low impact, respectively, while green transportation and meatless meals are both high impact. Some of the behaviors provided by PGA's list of recommendations were very rarely or never observed, including Energy Star appliances and rooftop solar panels which were never seen, eco-pet food which appeared once, and volunteering and composting which both appeared twice. The most frequent unsustainable behaviors are gasoline cars, single-use ware, single-use unsustainable products, and meals with meat, all of which have a high or medium impact (Figure 3).

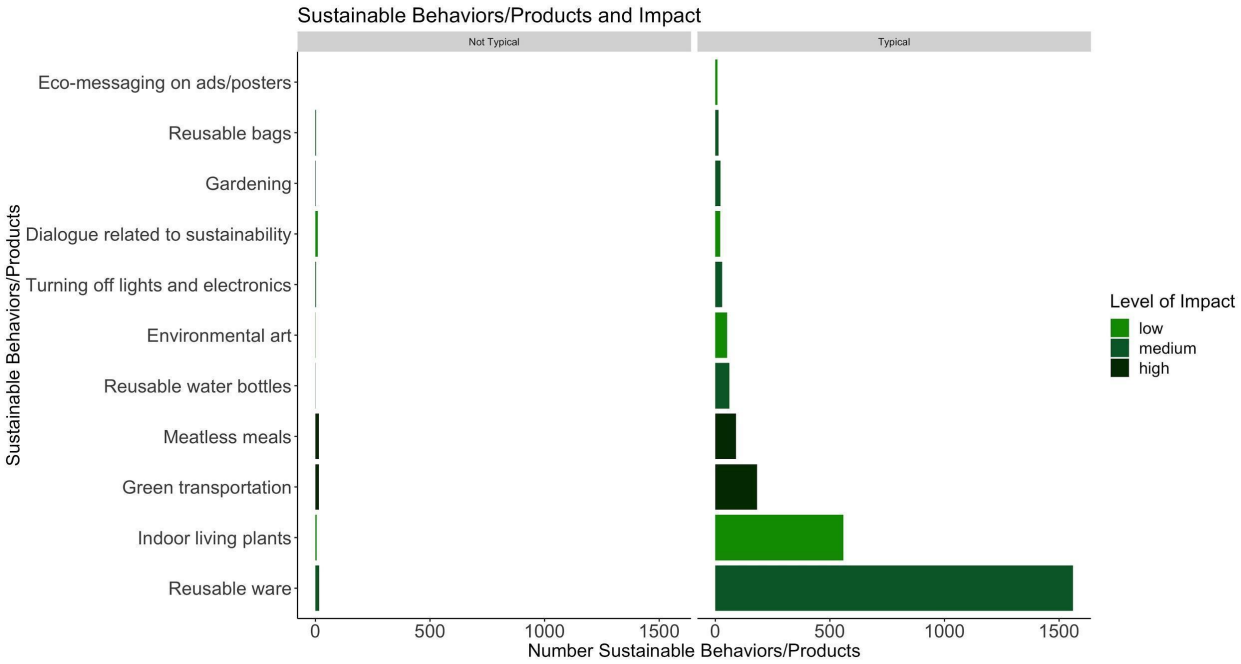


Figure 2. Number of the most frequent sustainable behaviors and their impact, comparing typical and non-typical behaviors

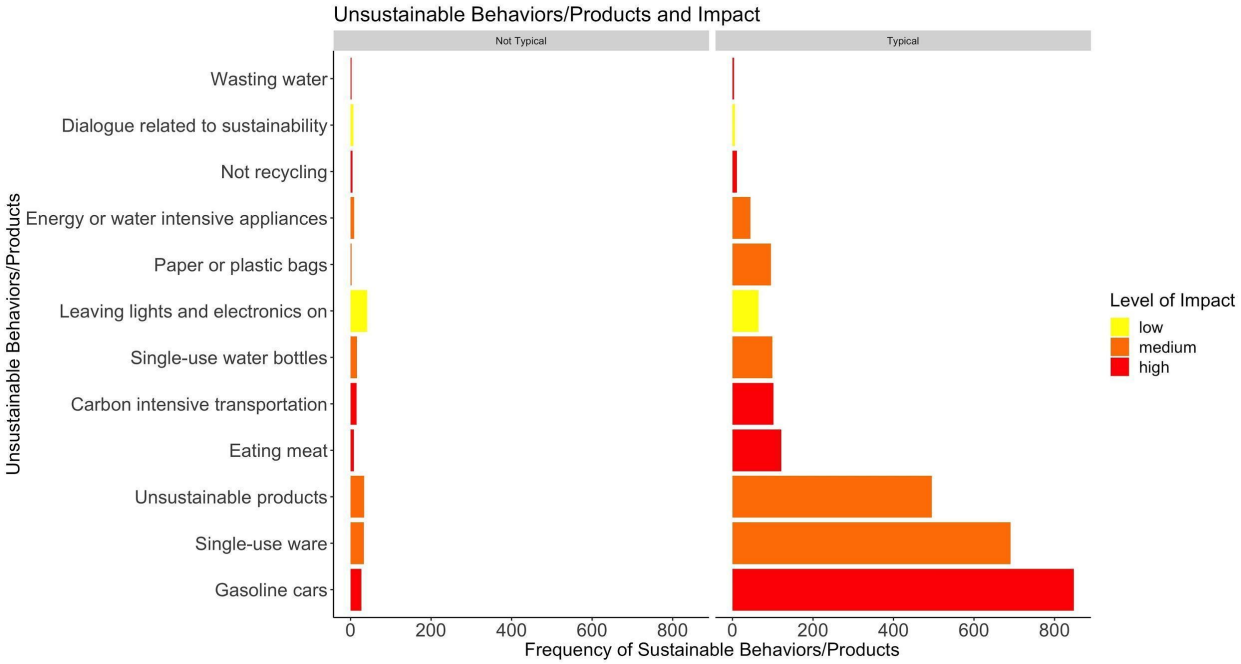


Figure 3. Number of the most frequent unsustainable behaviors and their impact, comparing typical and non-typical behaviors

After meticulously coding 425 hours of the most popular shows, we can definitively conclude that very few sustainable behaviors or products are featured on television. Further, sustainable behaviors in television remained stagnant over the time periods we considered (Figure 4). The sustainable behaviors that do appear are generally typical and would occur regardless of environmental intention (or lack thereof). The main instance of this was with reusable ware, which was our most common sustainable behavior. Reusable ware is a typical behavior is homes and restaurants, some of our most common settings, and not an intentional sustainable behavior. Out of 2725 sustainable behavior instances, 82 of them were coded as not typical. The vast majority of unsustainable behaviors are typical as well (Figure 3).

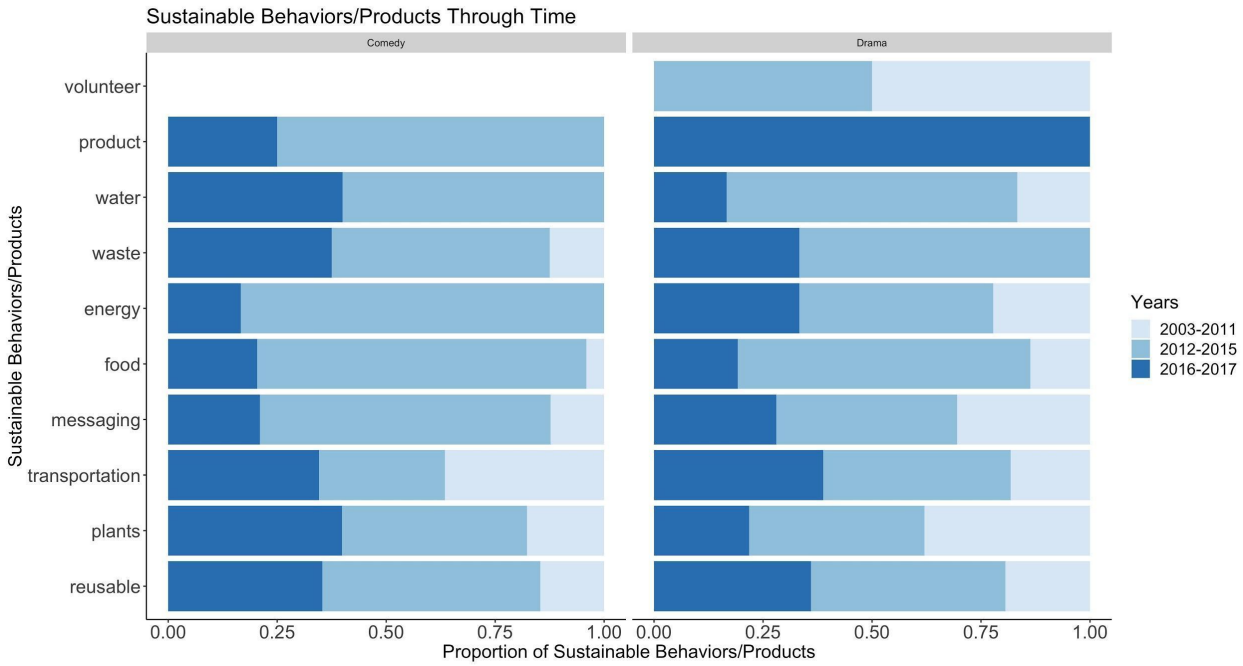


Figure 4. Proportion of sustainable behaviors through time

The most common settings for sustainable behaviors were the home, office, restaurants, and outside. These include both typical and not typical, and, again, the results reflect the high frequency of reusable ware. Behaviors in most categories were mainly medium environmental impact, with the exception of outside having mostly high impact behaviors because transportation-related behaviors occur outside (Figure 5, Figure 6).

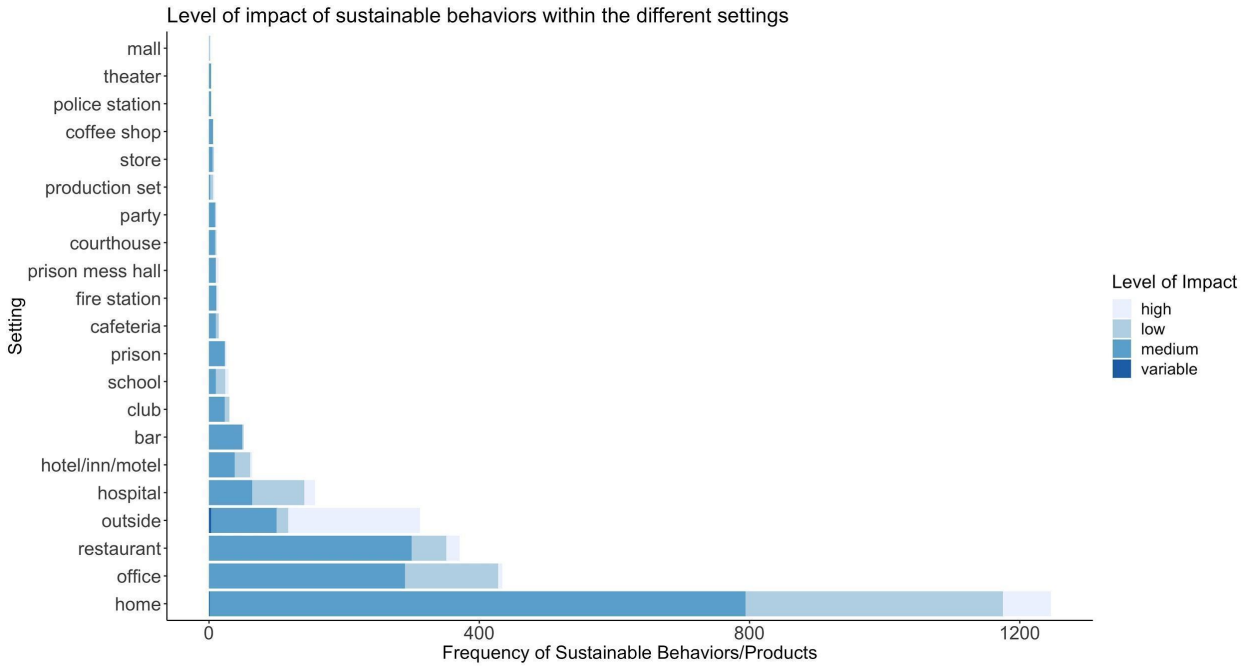


Figure 5. Frequency and level of impact of sustainable behaviors in each setting

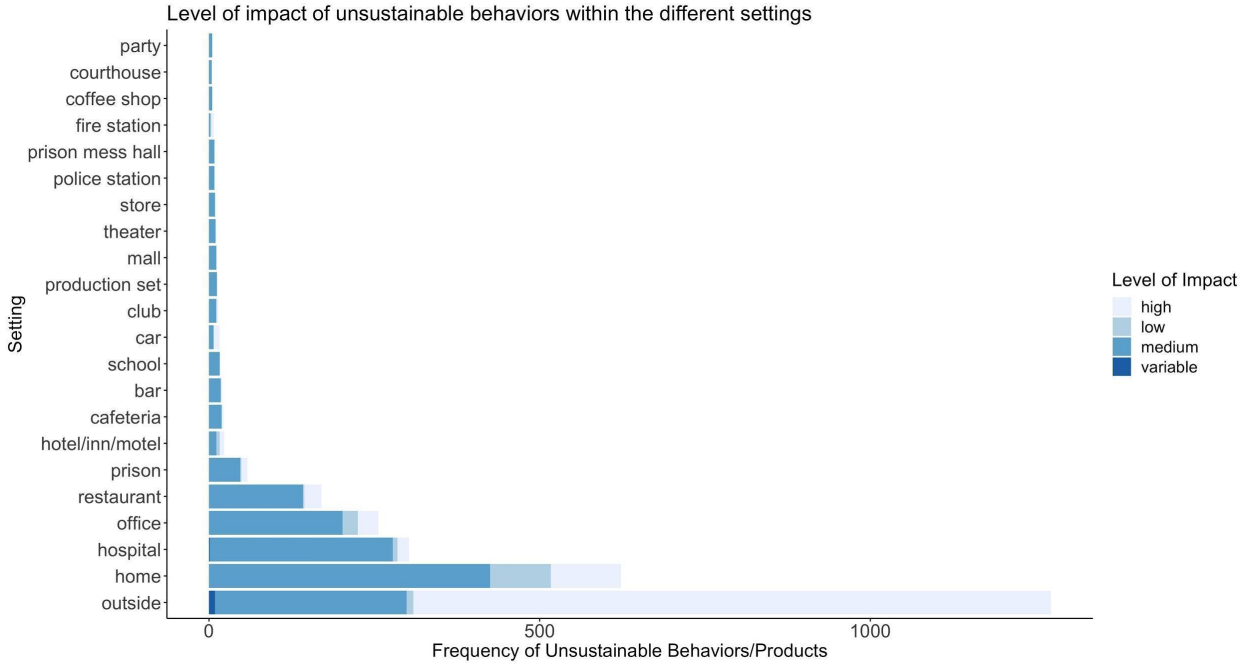


Figure 6. Frequency and level of impact of unsustainable behaviors in each setting

Sub-Questions

1. Are women or men more often shown engaging in sustainable behaviors?
2. How does representation of environmental behaviors vary by race?
3. How does representation of environmental behaviors vary by social class?
4. How does representation of environmental behaviors vary by age?
5. How does representation of environmental behaviors vary by size of a character's role?
6. What are the demographics of sustainable behaviors that are portrayed negatively?
7. Are protagonists or antagonists more likely to be shown performing sustainable or unsustainable behaviors?

We found no trend for sustainable or unsustainable behaviors varying by demographics, as demographics were relatively consistent across shows. For sub-question #1, we found that 60% of men and only 50% of women are shown to be engaging in sustainable behaviors, which differs from our team's initial expectations in that we thought female characters would be the gender predominantly engaging in sustainable behaviors (Figure 7). Table 3 reveals that, among behaviors performed by characters, males performed more behaviors overall than females.

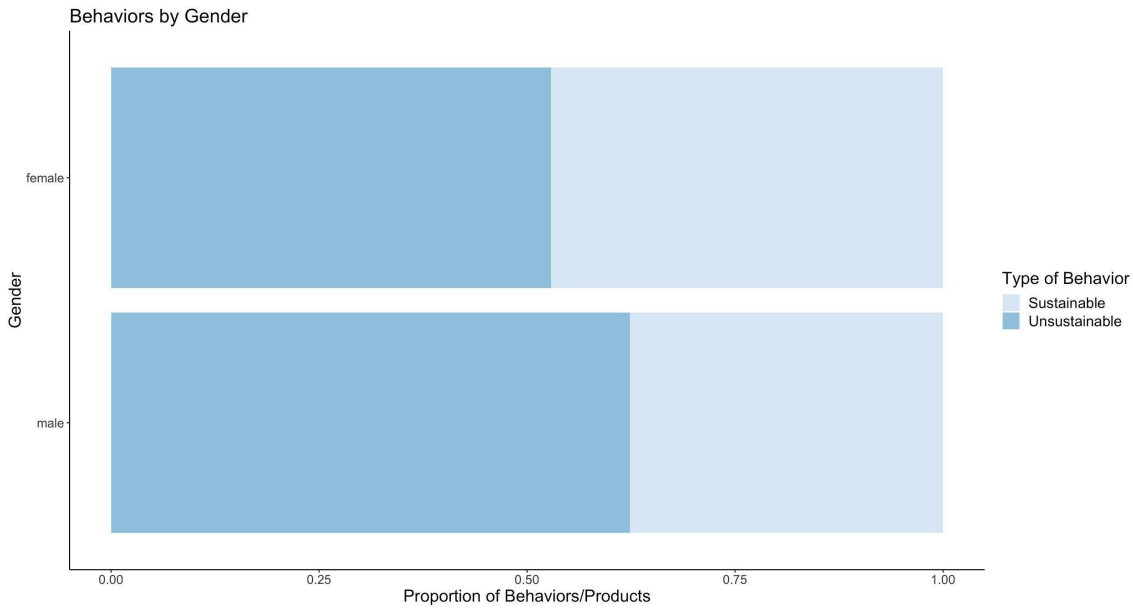


Figure 7. Proportion of sustainable versus unsustainable behaviors by character gender

Table 3. Frequency of sustainable and unsustainable behaviors by character gender

Gender	Sustainable	Unsustainable
Female	720	809
Male	780	1292
Unknown	0	2

We hypothesized that there would not be much variance in terms of representation of environmental behaviors by race/ethnicity because character roles ranging from main characters to supporting characters are usually portrayed by Caucasian actors. Our notions were confirmed as the Caucasian has the highest frequency by far, significantly more frequent than any other race we coded for (Table 4). There is no obvious pattern that appears, showing that race may not be a significant factor in determining whether behavior is sustainable or unsustainable. Through all race categories, there was a higher proportion of unsustainable behaviors than sustainable, except for mixed-race and unknown, although there was an extremely low sample size for these groups.

Table 4. Frequency of sustainable and unsustainable behaviors by character race

Race	Sustainable	Unsustainable
American Indian or Alaska Native	3	17
Asian	83	84
Black or African American	135	211
Hispanic or Latino	94	102
Middle Eastern	1	3
Mixed	3	1
Native Hawaiian or Other Pacific Islander	2	16
White	1182	1674
Unknown	1	0

We hypothesized that middle-class characters would be most likely to exhibit environmental behaviors since most television characters tend to be portrayed as middle-class. The middle class category has the highest frequency and confirms our original thoughts (Table 5). Looking at proportions, no significant difference was found between groups, all performing between 39.5%-44% sustainable behaviors. The upper class category had the highest proportion of sustainable behaviors, however, the sample sizes of the different groups also vary significantly.

Table 5. Frequency of sustainable and unsustainable behaviors by character social class

Social Class	Sustainable	Unsustainable
Lower Class	57	87
Middle Class	1136	1607
Upper Class	302	400

Our team hypothesized that young adults would be the most likely to exhibit environmental behaviors than other age groups. We found in our results that adults performed the most sustainable behaviors based on overall frequency (Table 6), but based on proportion of total behaviors, other age groups exhibited more sustainable behaviors than unsustainable behaviors, with young adults having a similar ratio as adults (Figure 8).

Table 6. Frequency of sustainable and unsustainable behaviors by character age

Age	Sustainable	Unsustainable
Child	33	22
Teenager	90	99
Young Adult	186	260
Adult	1144	1678
Elder	57	60

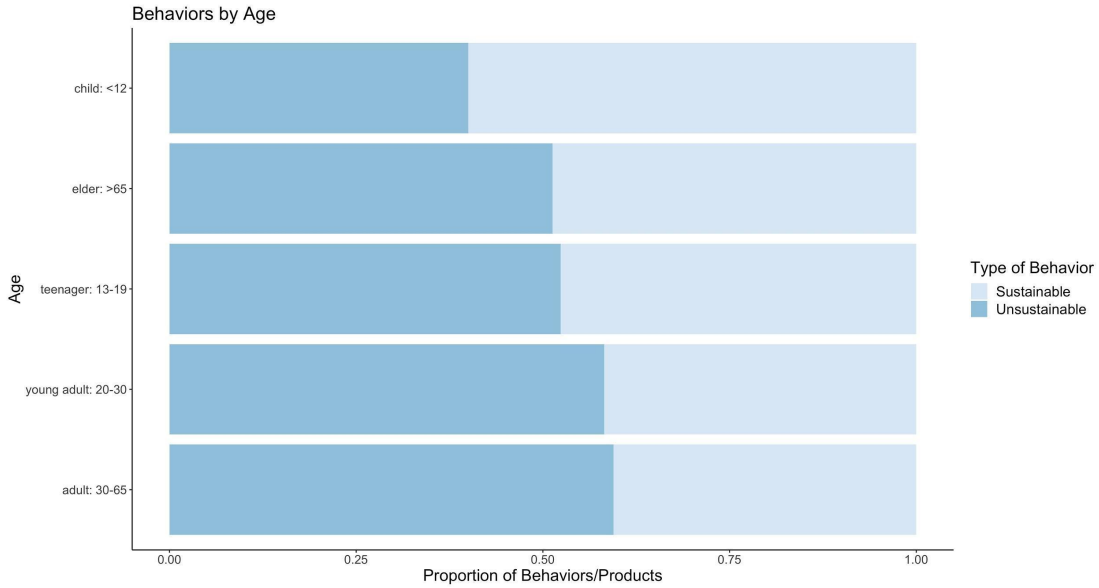


Figure 8. Proportion of sustainable versus unsustainable behaviors by character age

Our team actually could not come to a consensus as to whether or not environmental behaviors would vary by the character's role size— some of us thought that the main characters would be most likely to display environmental behaviors because they are generally protagonists and have more screen time than other character role sizes. But some of us also thought that role size would not matter because recurring and supporting characters usually partake in whatever activity the main characters are engaged in; moreover, most behaviors and placements would not be performed by characters, but would rather occur in the background. It seems as though both of these notions are correct as the main characters performed the highest proportion of sustainable behaviors, although there was not a drastic difference between the role size groups (Figure 9).

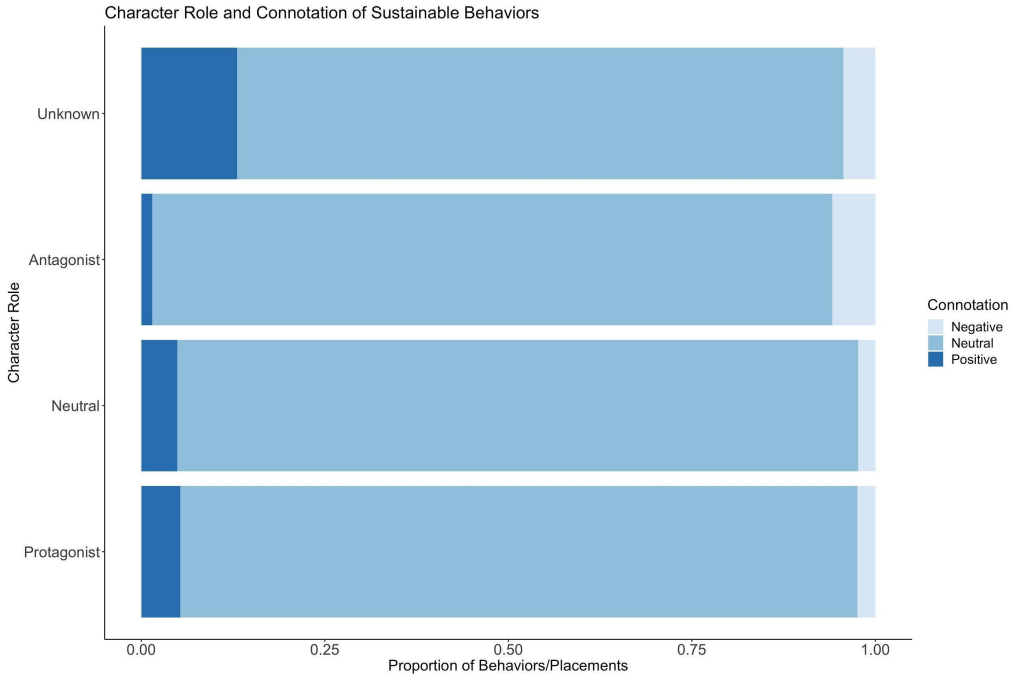


Figure 9. Proportion of sustainable behaviors performed by character roles and the connotation

In regards to whether protagonists or antagonists are more likely to be shown performing sustainable or unsustainable behaviors, we hypothesized that it would depend on the genre of the show, but in general, antagonists were most likely to fall within the demographic of sustainable behaviors portrayed negatively. We found that antagonists had the largest proportion of sustainable behaviors that were coded as having a negative connotation, compared to the other character role categories of protagonist, neutral, and unknown (Figure 10).

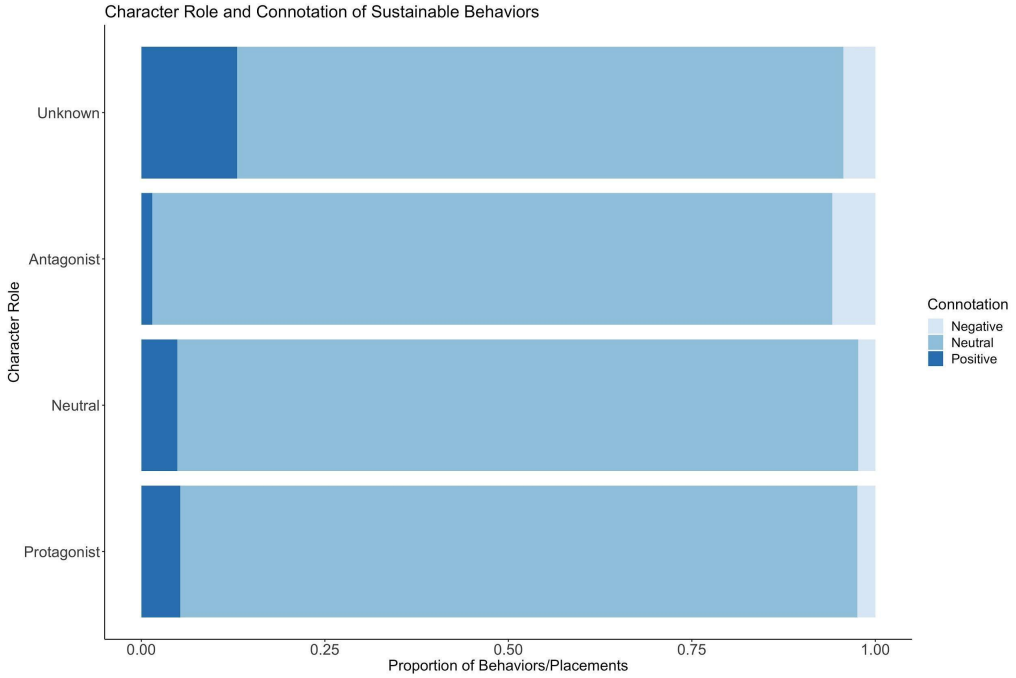


Figure 10. Proportion of sustainable versus unsustainable behaviors by character roles

Our team figured that, once again, the answer to this question depends on the genre and theme of the show in question, but that in general we could expect protagonists to be associated with sustainable behaviors more than antagonists would. Protagonists performed a higher proportion of sustainable behaviors than antagonists, but the difference was not large (Figure 11).

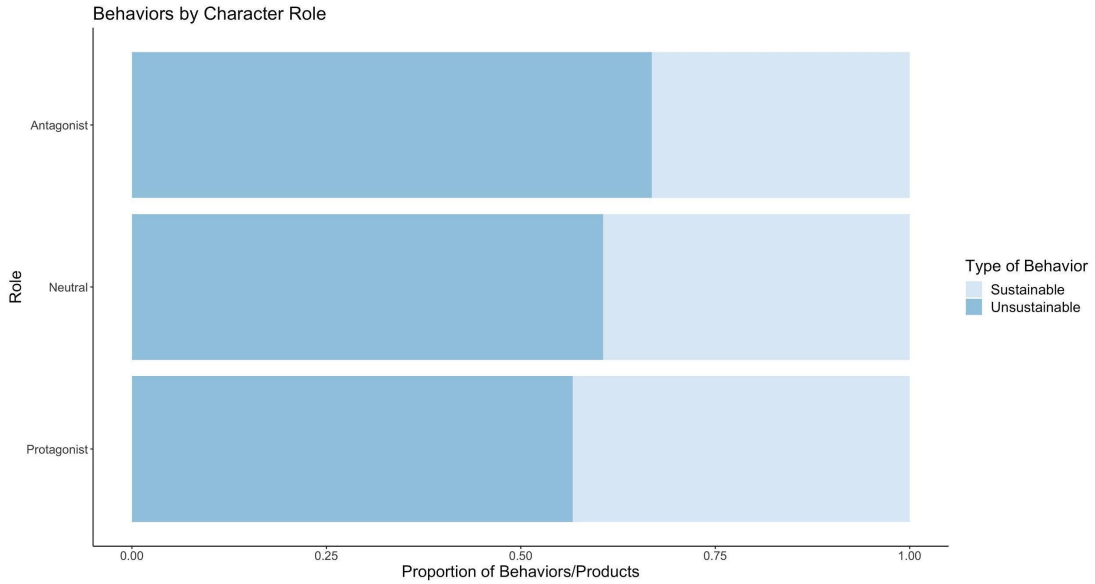


Figure 11. Proportion of sustainable versus unsustainable behaviors performed by different character roles

LIMITATIONS OF STUDY

Our team encountered limitations to our research which restricted the scope and reach of our results. Our data collection process was designed in a way that coders primarily observed categories, settings, and other variables present on the coding instrument, which affected their ability to observe variables that were not on the instrument to begin with. To address this, a future research team should make sure to list every single possible behavior that could be associated with being environmentally sustainable and unsustainable (i.e., having a pool, running a bath etc.). Another limitation of our study was the lack of data regarding the viewing numbers of shows from streaming services, which meant we were unable to definitively determine the most popular shows produced by modern streaming services, such as Netflix. But we evaluated top streaming shows using award recognition, social media analytics, and number of reviews.

DISCUSSION

Many of our results matched our initial hypotheses that character demographics would not strongly affect sustainable behavior frequencies. The one finding which contradicted one of our hypotheses was the lack of trends toward more sustainable behaviors over time. This indicates that sustainability depictions on television are falling behind public opinion as more and more of the public is expressing environmental concerns (Howe 2015). If content creators want to be accurate to current social and environmental norms, they should be increasing sustainable placements as these norms have progressed over time.

Many of PGA Green's recommendations focus on "easy" changes which may be seen as symbolic, such as avoiding disposable straws and single-use water bottles. Yet, even with these efforts, we still noticed many missed opportunities to switch out single-use products for reusable ones. For example, we saw twice as many single-use water bottle placements compared to reusable bottles, and six times as many paper or plastic bag placements as opposed to reusable bags. Increasing these types of switches in television is important, since it is relatively easy to do and easy for viewers to spot. But there is a greater opportunity for television to advance sustainability norms by portraying more high impact environmental behaviors behaviors such as driving electric vehicles or eating meatless meals.

Based on our findings, we have developed a set of recommendations for production studios:

- Products and environmental behaviors must be placed appropriately with the show's content
- High and medium impact behaviors (reusable ware, eating meatless) can be swapped with their unsustainable counterparts for the show's protagonist if this is fitting with character persona
- If sustainable behaviors seems out of context for a particular character, then those behaviors or placements can instead be incorporated into the background

We developed a tiered approach to incorporating sustainable behaviors. On screen behaviors should genuinely reflect the storyline and themes. Tiers are based on incorporation of environmental issues in the story based on the shows themes and characters.

Tier 1: For shows with environmental themes, we recommend incorporating high impact behaviors, like eating meatless meals, carried out by the protagonist, or main characters that are environmentally conscious. Most behaviors are already associated with the protagonist, and as we found that character demographics have no influence on environmental actions, these placements can be incorporated into diverse storylines.

An example of a Tier 1 incorporation is the following scene from Season 1 Episode 2 of "One Day at a Time." This show discusses many relevant contemporary issues, particularly through Elena's character who is depicted as very progressive. For a show like this, where environmentalism would be genuine to the storyline and character, we recommend focusing on high impact behaviors such as composting. Simple swaps from single-use items to reusable items including reusable water bottles and bags can also be considered for Tier 1, as we found in our data that there are many missed opportunities to do this.

Tier 2: For shows without environmental themes or where behaviors could appear disingenuous, we recommend incorporating high and medium impact behaviors in the background of the show.

An example of a Tier 2 incorporation is the following scene on the next page from Season 1 Episode 1 of "Haters Back Off." This show does not incorporate environmental themes into the storyline, so we recommend a more subtle approach to including sustainable behaviors. We recommend including high and medium impact behaviors in the background, such as the composting and recycling bins shown in the background of this scene. More examples can be found in Appendix 4.

We found very few intentional sustainable behaviors and products; television norms for sustainability actually lag behind public norms. Thus, there is significant room for improvement: popular television shows can portray more high impact environmental behaviors and products to advance sustainability norms. For example,where appropriate to the particular show/character, a character might mention how they are changing their behavior to reduce their carbon footprint like using public transportation, eating less meat, or voting for environmental candidates. A future research team could analyze the efficacy of environmental message placement in television to evaluate whether depicting sustainable behaviors or products impact viewers' behaviors. Psychology and marketing research may be helpful in answering this question, and focus groups of television viewers may be useful for qualitative feedback.

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APPENDIX 1: FULL LIST OF OBSERVED BEHAVIORS

Table 7: Number of Sustainable Behaviors and Impact Level

Sustainable Behavior	Count	Impact
Reusable ware	1623	Medium
Indoor living plants	628	Low
Green transportation	217	High
Meatless meals	118	High
Environmental art	79	Low
Reusable water bottles	68	Medium
Dialogue related to sustainability	43	Low
Turning off lights and electronics	35	Medium
Gardening	30	Medium
Reusable bags	22	Medium
Eco-messaging on ads/posters	13	Low
Reusable products	13	Low-Medium
Turning off water	10	Medium
Recycling	7	High
Unplugged electronics/appliances	7	Medium
Hang-drying clothes	6	Low
Other food	4	Variable
Green slogans on clothing	3	Low
Reducing energy use	3	Medium
Reselling or donating items	3	Medium
Composting	2	High
Other waste	2	Variable
Repurposing clothing	2	Medium
Volunteering	2	Variable
Other eco-messaging	1	Low
Other water	1	Variable

Table 8: Number of Unsustainable Behaviors and Impact Level

Unsustainable Behavior	Count	Impact
Gasoline cars	912	High
Single-use ware	804	Medium
Unsustainable products	551	Medium
Plugged in electronics	148	Medium
Meals with meat	144	High
Single-use water bottles	138	Medium
Carbon intensive transportation	129	High
Paper or plastic bags	125	Medium
Leaving lights and electronics on	122	Low
Energy or water intensive appliances	65	Medium
Food waste	20	High
Dialogue related to sustainability	19	Low
Not recycling	17	High
Water waste	11	High
Energy waste	10	Medium
Litter	7	Variable
Throwing away donatable items	7	Medium
Running water when brushing teeth/washing dishes	7	Low
Other waste	4	Variable
Paper waste	4	High
Other water	4	Variable
Water pollution	4	Variable
Swimming pool	4	High
Other pollution	3	Variable
Air pollution	2	Variable
Other energy	1	Variable
Improper waste disposal	1	High

Sustainable Behaviors List (Broader Categories)

Energy
- Turning off lights or electronics when leaving a room
- Unplugged electronics and appliances (toaster, coffee maker, etc.)
- Energy Star appliances
- Solar panels
- Hang clothes on line to dry
- Eating meatless

Messaging
- Eco-messaging on buses, billboards, posters
- Environmental art
- Clothing with green slogans
- Line related to sustainability/environmentalism

Plants
- Plants inside (potted plants, etc.)
- Backyard gardening

Product
- Eco-pet food
- Green cleaners/soaps

Reusable
- Bag use or placement
- Water bottle use or placement
- Ware over other disposables: plates, utensils, silverware, tupperware, cloth napkins, etc. (please specify)

Transportation
- Walking, biking, carpooling, electric/hybrid vehicles, etc. (please specify below)

Volunteer
- Character participates in a “green” volunteer activity: planting trees, community gardens, etc. (please specify below)

Waste
- Garage sale, donating items
- Recycling
- Composting

Water
- Turn off water when brushing teeth or washing dishes

Other

Unsustainable Behaviors List (Broader Categories)

Energy
- Leaving lights and electronics on when leaving a room
- Plugged in electronics
- Appliances that use a lot of water/energy (washers, dryers, etc.)
- Wasting energy in yard

Food
- Eating meat

Messaging
- Line related to sustainability/environmentalism

Single-use
- Paper or plastic bag use or placement
- Water bottle use or placement
- Plates, utensils, containers, etc (please specify below)
- Unsustainable products (balloons, etc. - please specify below)

Transportation
- Gasoline car
- Airplane, trains, ships, etc (please specify below)

Waste
- Throwing away recyclables into trash can
- Throwing away things that could be donated
- Food waste

Water
- Wasting water in yard
- Water running when brushing teeth or washing dishes

Other

APPENDIX 2: CODING INSTRUMENT

The following lists the information we recorded using our coding instrument via Google Forms.

Page 1

- Name Code
- Season and Episode
- Time of Appearance
- Sustainable Behaviors (see Appendix 1 for full list)
    - Add details or specify the behavior if applicable
- Unsustainable Behaviors (see Appendix 1 for full list)
    - Add details or specify the behavior if applicable

Page 2

- Level of Inclusion
    - Background
    - Touched
    - Mentioned
    - Incorporated in plot
- Is the behavior typical?
    - Yes
    - No
    - Unknown
    - N/A
- Connotation
    - Positive
    - Neutral
    - Negative
- Setting
    - Home
    - Office
    - Hospital
    - Outside
    - Restaurant
    - Other (Fill in)
- Character Role
    - Protagonist
    - Antagonist
    - Neutral
    - Unknown
    - N/A

- Character Role Size
    - Main character
    - Supporting character
    - Background character
    - N/A
- Character Age
    - Child
    - Teenager
    - Young Adult
    - Elder
    - N/A
- Character Gender
    - Male
    - Female
    - N/A
    - Other (Fill in)
- Character Race
    - American Indian or Alaska Native
    - Asian
    - Black or African American
    - Native Hawaiian or Other Pacific Islander
    - White
    - Hispanic or Latino
    - N/A
    - Other (Fill in)
- Character Social Class
    - Upper Class
    - Middle Class
    - Lower Class
    - N/A
- Comments/Other Relevant Information

APPENDIX 3: IMPACT ASSESSMENT

High Impact Examples

Sustainable

- Household solar panels
- Meals without meat
- Recycling
- Composting
- Green transportation

Unsustainable

- Carbon intensive transportation (Gasoline cars, Airplanes, Ships, etc.)
- Meals with meat

Medium Impact Examples

Sustainable

- Energy Star appliances
- Turning off water
- Reuse of clothing
- Reusable bags
- Unplugging electronics & turning off lights
- Reusable ware
- Line-drying clothes

Unsustainable

- Single-use ware
- Single-use shopping bags
- Leaving on lights or electronics when not in use

Link for Impact Categorization Compared to Expert Opinions

High Impact: Explanations

Eating meatless: Eating meatless is one of the most high impact individual behaviors we encountered on-screen, and is ranked as the 4th most important action by Drawdown. It has been estimated that climate change mitigation costs could be reduced by up to 50% if a global shift to low-meat diets occurred (de Boer et al., 2013).

Green transportation: In California, transportation accounts for more greenhouse gas emissions than any other sector (California ARB 2018). Our sustainable transportation category includes walking, biking, driving electric vehicles, carpooling, and public transport, which we have determined to be high-impact behaviors due to the IPCC's conclusion with high confidence that a "modal shift" in transportation, together with avoiding journeys, "offers high mitigation potential" (Sims et al., 2014). Electric vehicles are ranked as solution #26 and mass transit is ranked at #37 in Drawdown's top 100 solutions (Drawdown Solutions).

Rooftop solar panels: Use of solar photovoltaic (PV) panels on rooftops has major renewable energy generation potential, which then reduces greenhouse gas emissions by offsetting fossil fuel energy generation (Chapman et al., 2016 and Panwar et al., 2011). Installing solar panels on residential rooftops is ranked as the 10th most important behavior on Drawdown's list (Drawdown Solutions).

Composting: Composting ranks as #60 on Drawdown's list of 100 most important behaviors for mitigating climate change, although it requires high expertise in the home to avoid anaerobic conditions (Colon et al., 2010). In comparison to landfills, composting emits less methane when aerated correctly, and Colon et al. found home composting to be an environmentally suitable method for disposing of organic and food wastes (Colon et al., 2010 and Drawdown Solutions).

Recycling: Our literature review examined the impacts of electronics, metal, plastic, and paper recycling. Recycling metal can reduce energy consumption by up to a factor of 10 or 20 (Reck and Graedal 2012). Technical issues have been observed when considering plastics recycling, but one life cycle analysis found that use of 100% recycled PET (polyethylene teraphthalate) over 100% virgin PET causes a 27% reduction in CO2 emissions (Hopewell et al., 2009). Paper can be considered a renewable, and the most sustainable practice for paper disposal is a combination of both recycling and energy recovery to minimize the overall fossil fuel emissions (Virtanen and Nilsson 1993). #55

Medium Impact: Explanations

Garage sales/donations: Much attention has been given to the environmental impact of the fashion industry. Clothing and textile waste accounts for over 5% of US municipal solid waste, and only about 15% of post consumer textile waste is not sent to landfills (Norum 2015). We extend this examination of clothing to resale or reprocessing of other consumer goods through garage sales or donations.

Single use bags: In the United States, 100 billion plastic bags are used annually, requiring 12 million barrels of oil, and less than 5% of these bags are recycled (Clapp and Swanston 2009). Plastic is also a low value recyclable. Reusable bags can be made from either renewable or non-renewable materials, so it is important to be aware of the manufacturing processes involved in their production (Jalil et al., 2013). Use of a reusable bag alone cannot serve as a guarantee of sustainable behavior, as how bags are disposed of, and potentially reused or recycled, is essential to understanding their overall environmental impact (Muthu et al., 2011).

Reusable ware: Results of life cycle analyses suggest that reusable cups have less of a climate change impact than single-use cups in over ⅔ of cases in the United States, although an up to date and comprehensive study for the United States has yet to be performed (Woods and Bakshi 2014). Reusing products keeps solid waste out of landfills and avoids the cost of recycling (Manuel et al., 2007).

Unplugging or turning off lights and electronics when not in use: Home energy use accounts for about 21% of United States energy demand, and electronics have been recognized as one of the most quickly growing areas of home energy use (Pierce et al., 2010). Unplugging electronics and turning off lights or electronics are examples of habitual energy reductions, but home energy consumption also depends on purchasing activities which alter the efficiency of appliances (Barr et al., 2005). Studies have shown a potential 10–20% energy savings by changing daily behaviors (Carlsson-Kanyama and Linden 2007).

Energy efficient appliances: We coded for Energy Star appliances to represent all energy efficient home appliances since they have a recognizable logo. A 2011 review of household appliances found there is a potential for up to 50% energy usage reduction in homes by using more efficient appliances (Bansal et al.)

Turning off water: 40% of Americans leave water running while brushing their teeth, which wastes up to 8 gallons per day (Nguyen 2018). While household water waste has some impact, research suggests that the most effective changes for conserving water in the home are retrofitting appliances with more efficient products (Attari).

Reusable water bottles: PLA (bioplastic/biopolymer) versus PET bottles life cycle assessment of resource use, energy, and fuels (Papong et al., 2014). The environmental performance of cassava-based PLA bottles was better than PET bottles in terms of global warming, reduction of dependency on fossil energy, and human toxicity, but worse for acidification and eutrophication potential. (Papong et al., 2014)

Line drying clothes instead of machine drying: Line-drying clothing, although never observed in our research, may offset between 2 and 3% of household energy usage (Pedersen et al., 1988).

Backyard gardening: Traditional backyard gardening relies on industrial fertilizers and pesticides, and can also harm the natural environment by establishing non-native species and wasting water (Clayton 2007). Potential exists for gardening to contribute to conservation efforts but social awareness of this fact is limited (Clayton 2007). About 69 million acres are managed urban and suburban landscapes in the United States, which can be used to restore biodiversity and native species in addition to offsetting carbon dioxide through photosynthesis (Kiesling and Manning 2010).

Low Impact: Explanations

Indoor plants: Indoor plants contribute to health and air quality, but most potted plants cannot effectively offset the impact of air conditioning systems (Burchett et al., 2011). Living plants must exist at a much larger scale on buildings, such as green roofs, in order to impact carbon dioxide emissions (Burchett et al., 2011).

Green cleaners: Green cleaners are much more important from a health perspective than necessarily climate change mitigation (Senier et al., 2007).

Messaging: A pro-environmental message does not itself directly mitigate climate change, so we chose to assign environmental messaging as low impact. The messaging category includes clothing with green slogans, environmental art, eco-messaging on buses, billboards, or posters, and lines related to sustainability/environmentalism.

Unsustainable Behaviors

As our researched focused on positive recommendations and best practices, our list of unsustainable behaviors largely mirrors the sustainable impacts. For example, eating meat, driving gasoline cars, and taking airplanes are labeled high impact unsustainable behaviors. The rest of the behaviors fall into the medium impact category, and no negative behavior is labeled low impact. The medium impact behaviors are wasting water in the yard, leaving water running when brushing teeth or washing dishes, leaving lights and electronics on when leaving a room, using appliances that use a lot of water or energy (washers, dryers, etc.), wasting energy in the yard, single use paper or plastic bag use or placement, single use plates, utensils, or container use, single use water bottle use or placement, single use unsustainable products such as balloons, and throwing away items that could be donated.

APPENDIX 4: EXAMPLE SCENES OF BEHAVIORS

Tier 1 Example

An example of a Tier 1 incorporation is the following scene from Season 1 Episode 2 of "One Day at a Time." This show discusses many relevant contemporary issues, particularly through Elena's character who is depicted as very progressive. For a show like this, where environmentalism would be genuine to the storyline and character, we recommend focusing on high impact behaviors such as composting.

Tier 2 Example

An example of a Tier 2 incorporation is the following scene from Season 1 Episode 1 of "Haters Back Off." This show does not incorporate environmental themes into the storyline, so we recommend a more subtle approach to including sustainable behaviors. We recommend including high and medium impact behaviors in the background, such as the composting and recycling bins shown in the background of this scene.

Sustainable Behaviors

Composting

Gilmore Girls: A Year in the Life Season 1 Episode 2 (05:55)

Meals Without Meat

This is Us Season 2 Episode 3 (10:24)

Green Transportation

13 Reasons Why Season 1 Episode 2 (35:55) - Character rides bike instead of driving

Unsustainable Behaviors

Meals with Meat

Fuller House Season 1 Episode 2 (03:10)

Wasting Energy in Gasoline Car

Gilmore Girls: A Year in the Life Season 1 Episode 1 (1:26:35) - Car is left idling

Food Waste

Gilmore Girls: A Year in the Life Season 1 Episode 1 (47:20) - Throwing food into the sink

Throwing away recyclable items

Blue Bloods Season 3 Episode 3 (02:00) - Papers in trash can

Plastic Straw

Two and a Half Men Season 10 Episode 4 (10:59)

APPENDIX 5: GRAPHS & TABLES

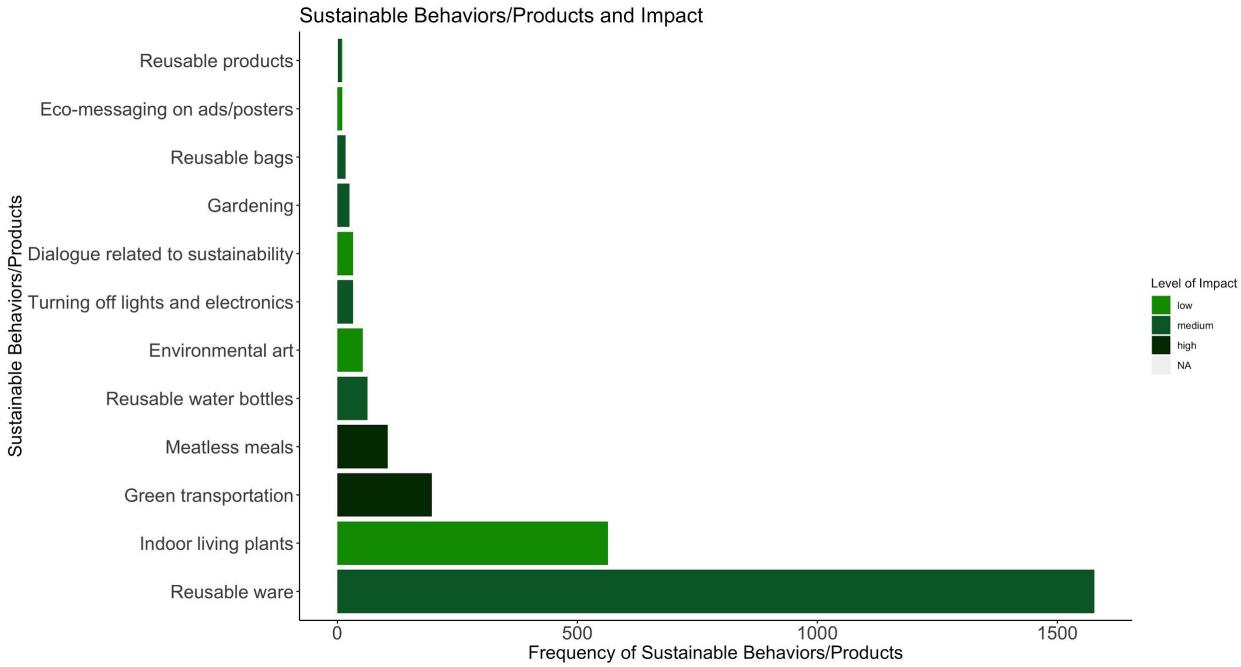

Figure 12. Number of the most frequent sustainable behaviors and their impact

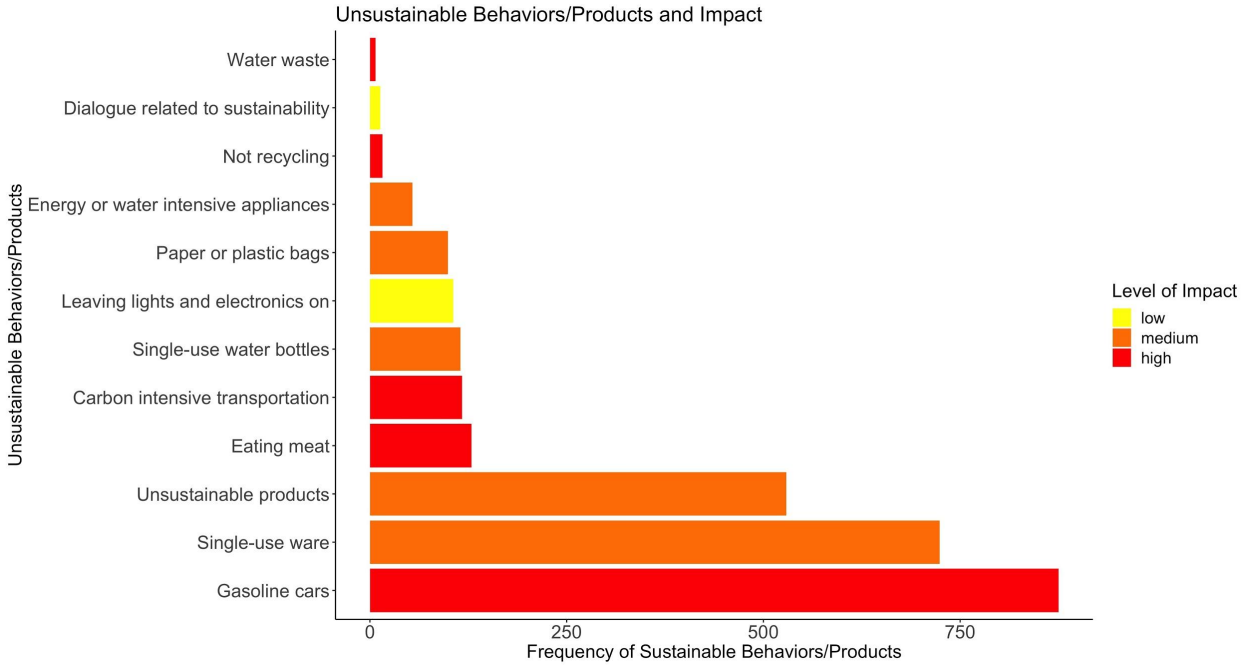

Figure 13. Number of the most frequent unsustainable behaviors and their impact

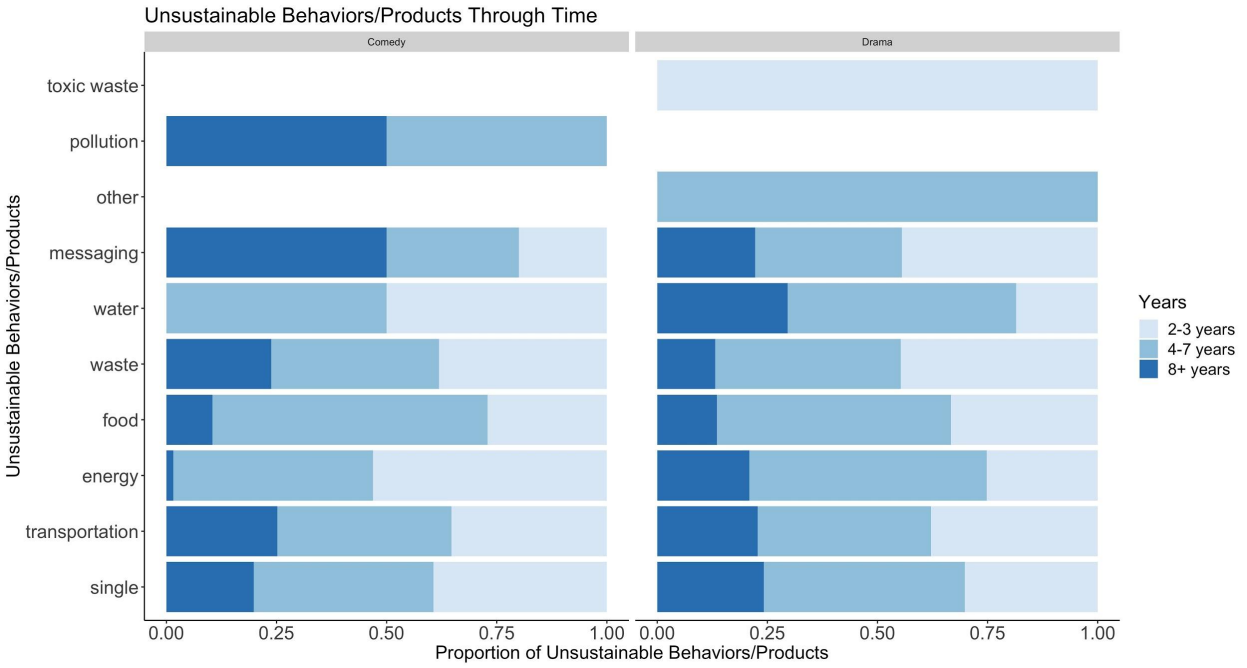

Figure 14. Proportion of unsustainable behaviors through time

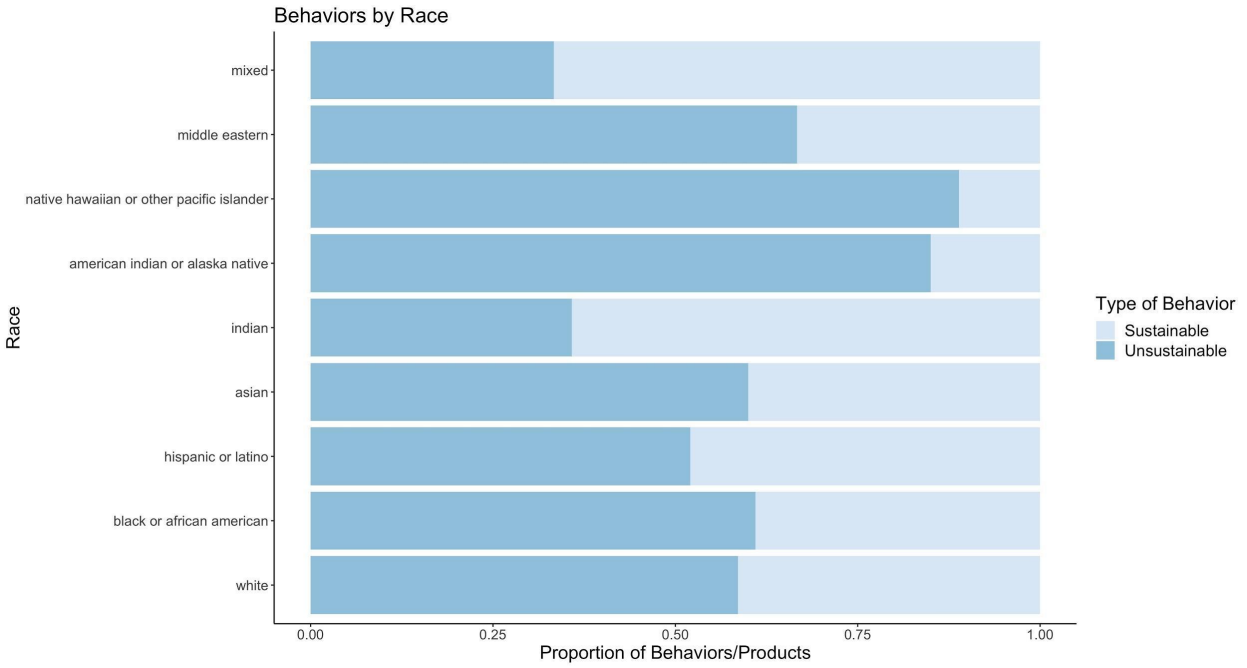

Figure 15. Proportion of sustainable versus unsustainable behaviors by character race

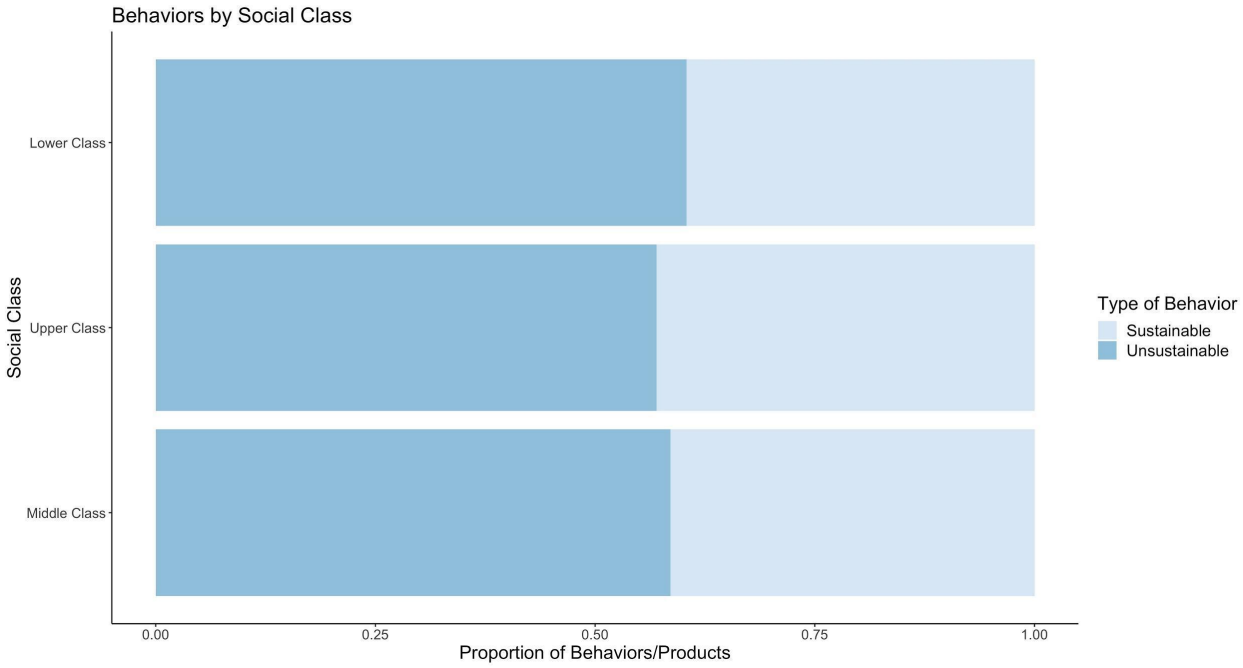

Figure 16. Proportion of sustainable versus unsustainable behaviors by character social class

Table 9. Frequency of sustainable and unsustainable behaviors by character role size

Role Size	Sustainable	Unsustainable
Main	903	1174
Supporting	484	726
Background	128	224

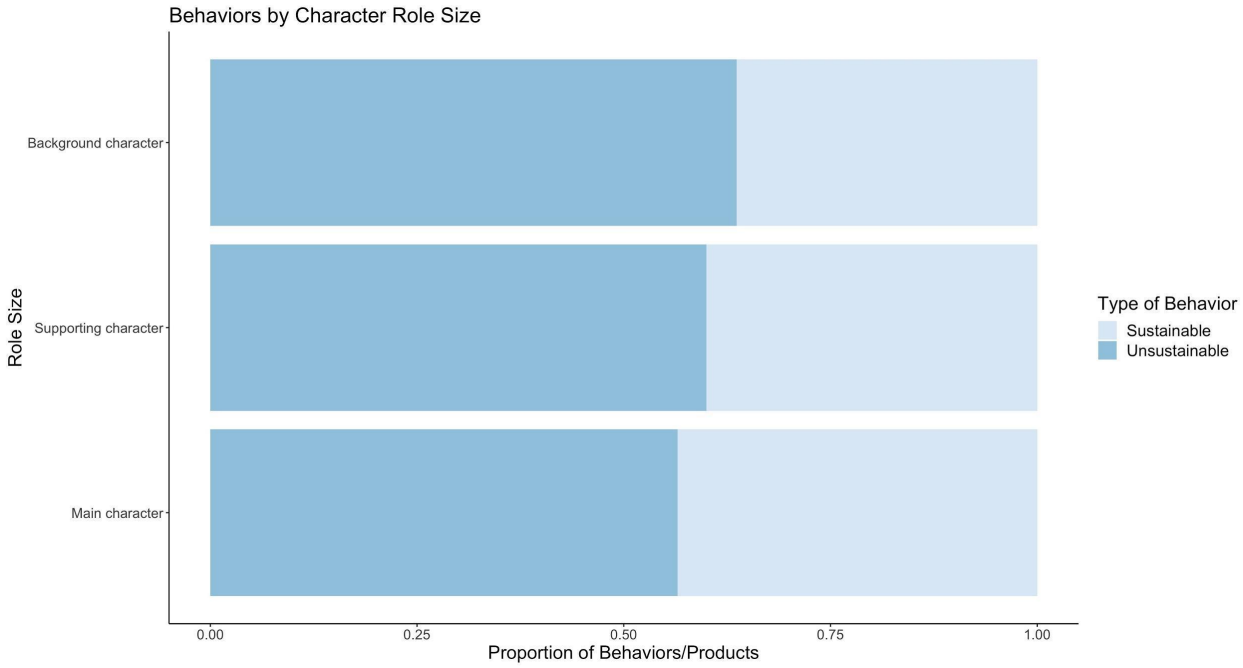

Figure 17. Proportion of sustainable versus unsustainable behaviors by character role size

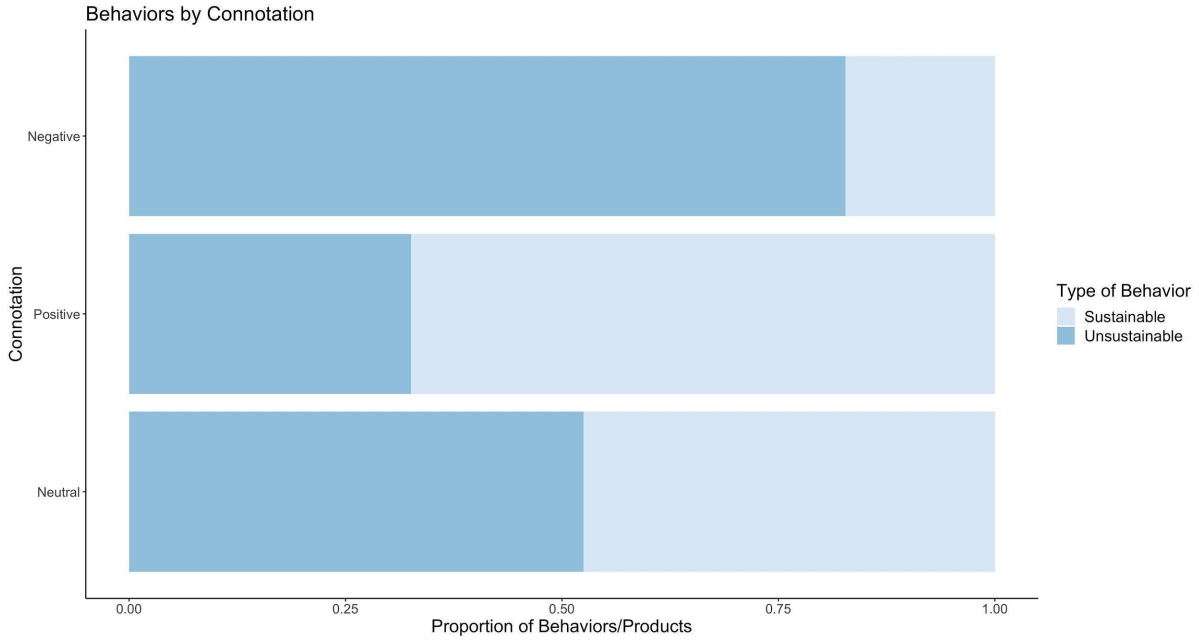

Figure 18. Proportion of sustainable versus unsustainable behaviors by connotation

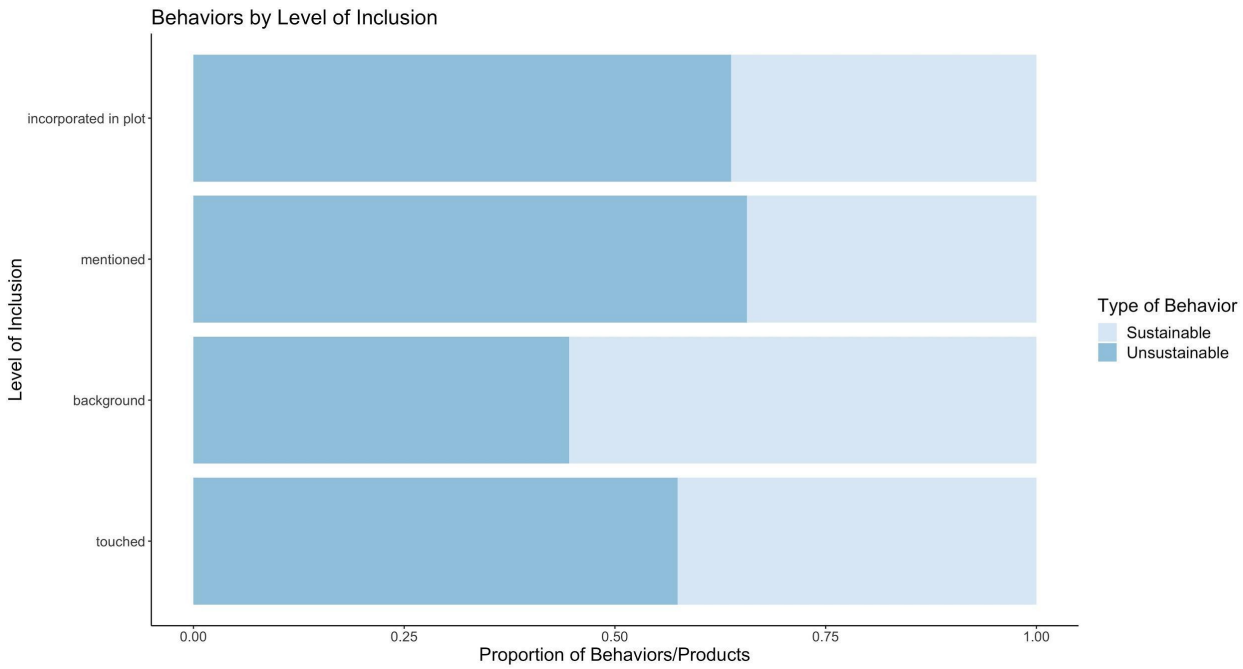

Figure 19. Proportion of sustainable versus unsustainable behaviors by level of inclusion