Gamified apps for sustainable consumption: A systematic review

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Abstract

Mobile apps are ubiquitous, affecting our everyday practices because "there is always an app for that". In this vein, there have been a significant number of apps devised to support people's lifestyles to make them more sustainable. This study aims to draw an overview of gamified mobile apps for sustainable consumption. Following a systematic process, this study analyzes 67 gamified apps' sustainability approaches and gamification concepts. It was found that (1) sustainable consumption is generally presented as the efficient use of resources to impact the environment positively, rarely addressing societal impacts or economic gains from shifting consumption practices. Other findings include (2) a lack of diversity in gamification characteristics, given the prevalence of direct communication with the user, the absence of virtual identities, and most apps targeting behavior change without attitude change. A potentially problematic design choice is (3) the presence, in some cases, of external rewards that are often contradictory to the message of sustainable consumption as they lead to more consumption. Nonetheless, based on most apps embedding sustainable consumption activities in the gamification concept and having a large number of users, it is possible to conclude that gamification has the potential to motivate shifts in their users' lifestyles.

Keywords

Mobile apps, sustainable consumption, gamification, review

1. Introduction

Nowadays, it seems there is "an app for everything" and sustainable living is not an exception. As research addressing how apps can lead to forming new habits grows [1, 2] most of the findings concur on the importance of contextual cues and design elements that make the app interactive and more engaging, covering a wide range of areas that touch upon sustainable lifestyles [3]. Regardless of their potential environmental or social impact [4], a way these apps can motivate users to act towards more sustainable ways of living is through gamification [3, 5, 6, 7], understood as the transformation of a system to provide game-like experiences and facilitate behavioral or cognitive changes,

including, e.g., the use of games for learning [8]. Despite the increasing corpus of studies about gamification as enablers of new habits across different lifestyle areas [9], there is little evidence on what kind of gamification concepts, or the design choices adopted to provide game-like experiences and utilitarian outcomes [10], are used in the broader area of apps for sustainable consumption (SC), and for what purpose. Therefore, practitioners and researchers may lack a clear perspective on what sustainable lifestyle areas to target and how, and what the current offer is for users seeking to live more sustainably. This study aims at answering the following:

RQ1. "How do gamified mobile apps present sustainable consumption and related actions to motivate lifestyle practices?"

RQ2. "What are the gamification characteristics used in these solutions?"

An overview of current gamification for SC is a novel addition to this research field, as we review the state of the art and provide a reasoned critique of some of the problems intrinsic to existing trends, such as a focus on efficiency as a prevalent approach to sustainability and the use of physical rewards. Researchers and developers can benefit from this analysis of pre-existing attempts to learn and avoid repetition. Additionally, this study's analytical framework can be used to facilitate app co-creation between SC experts and gamification practitioners. This paper first presents the study's theoretical background (Section 2), followed by the research method and app analysis process (Section 3). Section 4 outlines several findings answering the research questions, which are discussed in Section 5. Section 6 summarizes the conclusions.

2. Theoretical background

"In an increasingly hyperconnected world, sustainability smartphone apps have the potential to increase the feedback from distant consumers around the globe on the stewardship of natural resources" [11, p. 390]. There is a need for novelty and development of approaches to address ongoing global issues, and gamification can support motivation and user engagement [8]. The potential of mobile technology for sustainability aspects has been long recognized, focusing on capabilities such as ubiquitous internet access and location tracking [12]. Recent reviews found apps to favor educational and behavioral outcomes, like mobilizing social influence and providing explicit and attainable goals [13]. Apps have been used in areas such as transportation, air quality, waste management and water conservation, and have brought positive outcomes in energy reduction [13, 14], although with less certain long-term effects [13]. There is also evidence of positive, significant relationships between app use, awareness of consequences and ascription of responsibility for "environmental citizen behaviors" [15]. Apps for pro-environmental behavior mentioned in existing literature include both single-player [16, 17] and community-supported systems [18, 19]. Although most gamification and games for environmental topics such as climate change, or domestic energy consumption are not typically apps [14, 20, 21, 22], these seem to be popular approaches to

enable gamified sustainable consumption [7, 13, 14]. They also tend to be the ones with shorter lives and to only address environmental issues [7].

Research on gamification approaches to motivate sustainable consumption (SC) highlights that designers tend to focus on the behavioral-motivational and functional aspects [17, 23], while research on SC brings about challenges such as the long-term maintenance of everyday practices (turned into habits) and increases in resource consumption [6, 7]. This study considers gamification and SC within the context of lifestyles and apps that help guide consumption practices with the following core concepts:

i) Sustainable lifestyles, i.e., a "cluster of habits and patterns of behavior [...] that frame individual choice, in order to minimize the use of natural resources and generation of wastes, while supporting fairness and prosperity for all" [24, p. 3]. Sustainable consumption behavior are individual choices that satisfy needs through three consumption stages: acquisition, use, and disposal of goods and services, without compromising the ecological and socioeconomic conditions of people today and in the future [25]. The disposal stage includes activities such as exchanging, recycling and bartering, often using circularity strategies that prevent goods from ending up in landfills. The lifestyle areas examined in this study are based on [26] and refer to clothing, personal care, mobility, recreation, feeding and living, with the latter including energy, waste, and water management.

ii) Approaches to sustainable consumption are impact-focused and based on practices and behaviors, since "measurement scales have to concentrate on the ecologically and socially most impactful behaviors" [25, p. 20]. The resulting areas of expected impact are environment, society, economy, personal wellbeing, sales, and secondary impact. While the first three refer to general sustainability dimensions [25], the final three represent a narrower impact on the individual consumers of goods, their providers, or a cause, respectively. Figure 1 summarizes the approaches to SC considered for the app analysis: resource efficiency [27], degrowth [28, 29], mindfulness [30], collaborative schemes [31, 32] and sufficiency [33].

iii) Gamification, defined as "an intentional process of transforming any activity, system, service, product, or organizational structure into one which affords positive experiences, skills, and practices similar to those afforded by games [commonly but optionally] with an intention to

facilitate changes in behaviors or cognitive processes" [8, p. 1]. While gamification can also refer to the emergent process by which games and play are becoming more prevalent in human lives [8], this analysis focuses on the intentional gamification of SC through apps, acknowledging that gamification for SC is co-evolving with emergent gamification as part of ongoing societal and cultural transformations.

1. Search and select apps for practices of sustainable consumption / lifestyle; and,
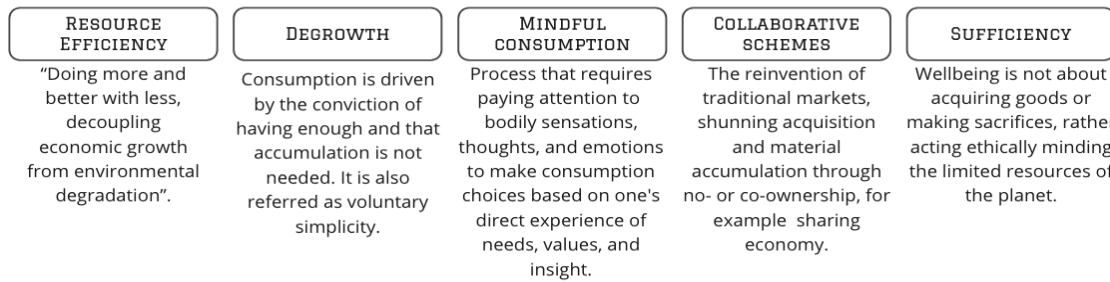2. Test and analyze the selected apps.

RESOURCE EFFICIENCY	DEGROWTH	MINDFUL CONSUMPTION	COLLABORATIVE SCHEMES	SUFFICIENCY
"Doing more and better with less, decoupling economic growth from environmental degradation".	Consumption is driven by the conviction of having enough and that accumulation is not needed. It is also referred as voluntary simplicity.	Process that requires paying attention to bodily sensations, thoughts, and emotions to make consumption choices based on one's direct experience of needs, values, and insight.	The reinvention of traditional markets, shunning acquisition and material accumulation through no- or co-ownership, for example sharing economy.	Wellbeing is not about acquiring goods or making sacrifices, rather acting ethically minding the limited resources of the planet.

Figure 1: Approaches to SC

iv) Gamification concepts for mobile apps, an adaptation of a 12-dimension taxonomy [10] to identify and understand how gamification is designed and implemented in mobile apps. The dimensions (and characteristics within) are: 1. gamification concept-to-user communication (direct or mediated); 2. user identity (virtual character or self-selected), 3. rewards (internal, internal and external, none), 4. competition (direct, indirect, none), 5. target group, 6. collaboration (cooperative, supportive only, none), 7. goal setting (self-set, externally set), 8. narrative (continuous, episodic), 9. reinforcement (positive, positive-negative), 10. level of integration (independent, inherent), 11. persuasive intent (compliance, behavior, attitude), and, 12. user advancement (presentation, progressive, none). [10] note that the taxonomy, originally created for health apps, is partially transferrable to other contexts. Therefore, while it was chosen because it allowed us to focus on larger dimensions than gamification elements, we made several adaptations to the area of SC and our sample before and during the analysis. These adjustments are explained in the next section.

3. Methodology

This study collects descriptive data complemented with qualitative observations to identify and analyze gamified apps for users willing to shift their consumption practices. We followed a systematic approach to:

3.1. Online data collection and app selection

As this study aims to provide a wider overview of apps for sustainable consumption, the search keywords used the most common definitions of SC found in the literature of gamified SC [7] in a string: ("sustainability" OR "sustainable consumption" OR "sustainable lifestyles" OR "green lifestyles" OR "green living") AND (game OR gamification OR apps). In Google Play and the App Store, the terms were "sustainability", "sustainable consumption", "sustainable lifestyles", "sustainable lifestyle", "green lifestyles", "green lifestyle", and "green living". These keywords encompass actions related to different approaches to sustainable consumption, excluding more general terms like "wellbeing", "inclusion", "social" or "mindfulness" which could return apps focusing on issues other than consumption choices.

The online search for mobile apps took place on two dates: February and May 2021. The earlier version contained websites that enlisted solutions for sustainable lifestyles from which mobile apps were extracted. The second search was focused solely on apps and, in addition to Google, included searches in the App Store and Google Play. Both databases were cross-referenced to remove duplicates and create a single database of apps labeled as enablers of sustainable consumption/lifestyles, ending with a total of 1082 apps. Browser navigation was done in

private mode to minimize technology-side biases. Google searches stopped when the displayed entries in a page did not point to new potentially relevant apps. The selection of apps was carried out through three steps as shown in Figure 2.

Step 1. Removal of irrelevant apps based on their intended purposes. Apps deemed irrelevant were designed for events, fitness and diets (most of them focused on health and not consumption), local projects and businesses, store loyalty programs, restaurants and recipes, employees and suppliers of companies and organizations, camera filters, fan groups, and TV shows.

Step 2. Removal of apps in languages other than English, German, or Spanish (the languages spoken by at least two of the researchers), apps that did not present any of the gamification dimensions explored in the study, and apps that required payment to use their main functions (premium or freemium content). To ascertain these, the authors read the store descriptions and, if necessary, downloaded the apps and used them to find if any of the gamification dimensions (section 2.iv) featured in the app.

Step 3. Three researchers analyzed the apps that qualified for this round, each app being tested by two people. The results were then compared to agree on a unified result, and the third researcher was involved where disagreements arose. 35 apps were removed due to issues that ranged from no longer being available online or being under development, glitches (not responsive past the registration page, blank pages) and location specific access. For the latter, it is important to differentiate between access to the app functions and the apps' intended service. While we could download and test the functions of some apps linked to specific locations by introducing a zip code or just browsing through its features, some apps that passed through the filters in steps 1 and 2 did not work once downloaded. The analysis of the apps took place with the researchers located in Germany, Finland and Spain, so these apps were mainly outside of Europe. However, some location-bound apps such as [34, 35] allow the users to see all their functions even if not being in the country. In the end, a total of 67 apps [36] were tested and analyzed.
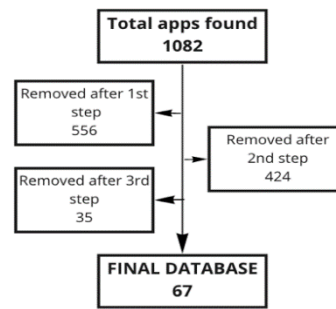

Figure 2: Selection process

3.2. Testing and analyzing the apps

To facilitate the systematic analysis of the apps, an analytical framework was developed. Besides context-providing metrics (i.e., release year, user downloads) the framework also brings together the lifestyle areas [26] expected impact and consumption phases [25], the approaches to SC, and the gamification dimensions for apps [10] introduced in Section 2. The proposed taxonomy, although created from health apps, refers to broad gamification dimensions, and initial small-scale testing proved it to be applicable for SC apps.

Before the analysis, we adapted the target group (consumers at the household level instead of patients, health professionals, and healthy individuals); then, during the analysis, other adjustments were made based on the data found. This concerns types of narrative (we found some apps that present both episodic and continuous elements, which was not the case in the original, and mutually exclusive, taxonomy); goal setting (some apps allow for self- and externally set goals); and persuasive intent (in our study, we refined the definition of the three types of intent, which are also non-exclusive. Compliance change is following an externally set rule for a determined time, attitude change aims to nurture awareness, and behavior change encourages to engage in activities without suggesting strict rules).

This framework (Figure 3) allowed us to screen the apps and develop a quantitative (descriptive) analysis; that, complemented with qualitative observations, permitted us to understand how app developers portray SC and what gamification concepts they build in their efforts to shift every day's consumption practices.
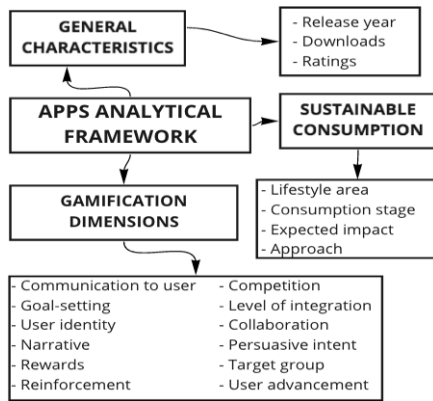
Figure 3: Analytical framework elements

4. Results

The discussion rounds between the researchers crystallized into a final classification for each app. The results are clustered according to SC elements and gamification dimensions. Of the 67 apps [36] analyzed, 55% were launched in 2019-2020. Also 9% have more than 100,000 downloads on Google Play, making them quite popular.

4.1. Sustainable consumption

The apps are classified in terms of their suggested approach to sustainability (the perceived philosophy promoted by the app). Combinations are common, as less than a half of the apps focused on a single approach. The most popular is resource efficiency, while sufficiency is barely featured.

The apps' area of impact is determined according to their purpose, either described in the app or marketing material or observed from the actions proposed to users. All but two apps aim to have an environmental impact and include statements such as "you stay on top of everything you can do to lead a sustainable life and save the planet" [37]. The apps with a societal impact focus on sustainable practices in the communities and the SDGs. None of the examined apps aim to impact society alone. Economy and personal wellbeing are equally represented. Apps with an impact on personal wellbeing are those focused on bringing positive effects for the individual consumer, i.e., [38] states "stay off your phone, clear to-do lists, and build positive, life-changing habits". Apps that consider economic impacts include statements regarding, for example, "the impact the action has on your wallet and the environment" [39].

The apps marked as sales aim to sell products through internal or external shops. The apps that have a clear sales function present these online shops as an alternative to acquire eco-friendly (and sometimes socially responsible, fair-traded) products to facilitate the transition to less environmentally harmful items. A few apps provide additional aims such as giving money to charity or supporting reforestation projects.

As all lifestyle areas are connected to each other, the analysis of apps shows very strong links between some areas, denoting the perceived problematic that lies within the most common consumption practices. Waste management is the most addressed one. Of the 88% of apps targeting waste management aspects, 64% have a full life cycle approach, meaning that they address all three consumption stages. Disposal, or end of cycle, is the most common one. Apps propose different approaches to manage waste, from taking pictures and tagging maps of littered areas or facilitating waste separation to do-it-yourself tips for upcycling or repurposing materials.

Just over half of the apps, feature personal care, which covers practices that range from beauty treatments to mental health and new habit formation (i.e., [38, 39]). Table 1 is an overview of the SC elements found in the apps.

Table 1

Sustainable consumption elements

Approach	Apps n (%)
Resource efficiency	53 (79%)
Mindful consumption	33 (49%)
Collaborative schemes	23 (34%)
Degrowth (voluntary simplicity)	12 (18%)
Sufficiency	7 (10%)
Single approach	29 (43%)
All approaches	1 (1%)
Area of expected impact	**Apps n (%)**
Environment	65 (97%)
Society	26 (39%)
Economy	15 (22%)
Personal wellbeing	15 (22%)
Sales	11 (16%)
Secondary impact: charity/donation/planting	4 (6%)
Single area of (primary) expected impact	30 (48%)
All areas of (primary) expected impact	1 (1%)
Lifestyle area	**Apps n (%)**
Waste management	59 (88%)
Food	44 (66%)
Personal care	35 (52%)
Mobility	34 (51%)
Energy	34 (51%)
Clothing	29 (43%)
Recreation	27 (40%)

Water management	27 (40%)
Single lifestyle area	14 (21%)
All lifestyle areas	13 (19%)
Consumption Stage	**Apps n (%)**
Disposal	57 (85%)
Use	51 (76%)
Acquisition	49 (73%)
Single consumption stage	15 (22%)
All consumption stages	38 (57%)

Level of integration	**Apps n (%)**
Independent	16 (24%)
Inherent	52 (78%)
Persuasive intent	**Apps n (%)**
Compliance change	12 (18%)
Behavior change	55 (82%)
Attitude change	27 (40%)
User advancement	**Apps n (%)**
Presentation only	36 (54%)
Progressive	22 (33%)
No	10 (15%)

4.2. Gamification dimensions

Table 2 presents an overview of the gamification dimensions and characteristics within; as many apps feature multiple characteristics for a single dimension, some results add up to more than 100%.

Most apps convey the information directly as text (direct communication) without the mediating layer of a fictional character. In two cases [42, 43], users engage in actions with real-world impact.

Table 2

Gamification dimensions

Concept-to-user communication	Apps n (%)
Direct	59 (88%)
Mediated	8 (12%)
User identity	**Apps n (%)**
Virtual character	4 (6%)
Self-selected	63 (94%)
Rewards	**Apps n (%)**
Internal	36 (54%)
Internal and external	17 (25%)
No	14 (21%)
Competition	**Apps n (%)**
Direct	1 (1%)
Indirect	20 (30%)
No	47 (70%)
Target group	**Apps n (%)**
Individual consumer	67 (100%)
Other	7 (10%)
Collaboration	**Apps n (%)**
Cooperative	13 (19%)
Supportive only	24 (36%)
No	31 (46%)
Goal setting	**Apps n (%)**
Self-set	48 (72%)
Externally set	24 (36%)
Narrative	**Apps n (%)**
Continuous	37 (55%)
Episodical	43 (64%)
Reinforcement	**Apps n (%)**
Positive	54 (81%)
Positive-negative	13 (19%)

Specifically, [43] combines real cryptocurrency mining with quizzes about sustainability. Nearly all apps present user identity concept as self-selected, meaning that users have a personal profile instead of a virtual character different from themselves. In some cases, users do not even have a personal profile where they can state a name and simple customization elements such as a picture. In three cases where users do have a virtual character different from their own identity, they were characters in a game. In another case, users have a username and a picture, and are also given a virtual character (e.g., an avocado, a banana) symbolizing their reported carbon footprint.

Most apps offer only internal rewards (such as badges and points for use within the app itself), while a minority also adds external rewards (points and vouchers that can be used as discounts on real-world purchases) or have none.

While most apps include no competition features, 30% include indirect competition by comparing the user's overall performance to others' through point systems and leaderboards.

When it comes to goal-setting, users of 72% of the apps can set the goal they want to reach, either by choosing from a predefined list or setting them individually; of these, five apps have both self-selected and externally set goals. Meanwhile, 28% of the apps present externally set goals only.

Most apps include an episodic narrative, or clear stages that indicate partial progress, while half of the apps have a continuous narrative, meaning that the user advancement is not reset at any point and there are no stages. 19% presented both types of narrative, as the users can choose whether they want to follow a specific type of challenge to level up and start over when a new challenge comes up, or keep engaging in activities for which they can see their progress with no differences in terms of difficulty or changes to their scores, for example.

Most apps use positive reinforcement (encouragement), while a minority, mostly full-fledged games, uses both positive and negative reinforcement, including penalties such as losing a life or failing the mission.

The question "would the app still function in the same essential way, fulfilling its core goals, if the gamification concepts were removed?" helped to enable the separation between gamification as an addendum – independent – for (intended) increased engagement, though the app could fulfill its objectives without being gamified; and apps where the content and actions could not be experienced without the gameful design – inherent. Examples of the former include those that provide information and suggested tasks, or that reward isolated behaviors that can be done without an app (e.g., picking up litter, consuming eco-friendly goods). Games (17 apps) are the most obvious example of an experience where playful elements are intrinsic to the artifact, but this numerous group also includes apps that propose challenges where progress, points, rewards, etc. are seamlessly integrated in the app's discourse.

The most common persuasive intent (type of change the gamification concept in apps for SC aims to evoke) among the analyzed apps is behavior change, in some cases accompanied by attitude change.

User advancement in the examined apps is either presented to the user (via progress bars, stats, charts, points, scores, ranking, levels, etc.), found in over half of the apps, or it additionally utilizes users' progress to adapt the gamification concept to their skills (e.g., climbing up through levels and stages to reach more difficult or challenging content), presented in a third. Of the 22 apps with progressive advancement, 9 are games. 10 apps do not provide mechanisms for user advancement.

5. Discussion

This study aims to identify how gamified mobile apps present SC, their expected area of impact and gamification characteristics used to motivate SC practices. We summarized the general performance indicators from the apps and tested them to identify the lifestyle area they focused on, the consumption stage addressed, approach, their expected impacts, and gamification concepts.

Our findings suggest that most apps aim to address several lifestyle areas, mainly waste management. This, combined with the prevalence of the disposal stage, suggests that consumers are routinely encouraged to consider the waste that their choices generate, although acquisition and disposal are often addressed too.

The predominant promise of "doing something good for the environment" suggests that sustainability is still not understood as a holistic way of living, a notion emphasized by the strong orientation towards resource efficiency, an approach that is not about changing lifestyles as much as improving existing ones to make them less damaging. This is dissimilar from previous research on sustainability games, where most were found to address multiple sustainability dimensions [44], but reinforces the observation that gamified sustainability apps tend to have a strong environmental focus [7], rarely addressing societal impacts or even economic gains from shifting consumption practices.

The variety of SC areas addressed suggest that developers see the potential of mobile technology and gamification [8, 11] although incremental and often technology-oriented effort is a much more popular approach than these that aim at reducing consumption (sufficiency) or radically transforming it (simplicity). This is unsurprising, considering the definition of the SDG 12 where consumers (at all levels and scales) play a pivotal role to shift wasteful production processes and lifestyles into practices of better resource management and less harm to people and ecosystems.

Regarding gamification concepts, we observed a lack of diversity in gamification strategies. The analyzed apps are quite homogeneous in various aspects. While almost nine in ten convey messages directly, avoiding balancing their credibility and the use of fictional narratives and contexts, gamification could look at the engaging potential of fantasy [45], as traditional serious games do, perhaps highlighting their connections to the player's reality and goals. This is also connected to the fact that 94% of the apps do not offer a virtual character separate from the real user. More apps could explore the possibilities of having a character to inspire the player in their quest towards a sustainable lifestyle.

Another common aspect is the absence of negative reinforcement (78%), that is, mentioning failures or penalizing the user. While this is more common in full-fledged games, the almost ubiquitous encouraging tone in gamified apps may be due to underlying positive psychology theories such as self-determination theory [46]

and flow [47], which focus on aspects of human experience such as enjoyment and self-actualization. However, the lack of specific punishment does not negate the emergence of potentially negative experiences, for, in zero-sum competitive arrangements such as leaderboards, it is entirely possible to not win.

Most apps allow users to set their own goals, although not all offer the opportunity to track the user's advancement. Self-set goals support the users' autonomy, but the lack of guidance may hinder the sustainability of the users' effort. Also, only a third of the apps unlock content progressively, therefore most do not present activities progressively based on the level of effort required (from easy/simple to hard/complex). This may result in the user not seeing a clear path from smaller to bigger actions, although open designs allow players to select actions freely, discarding what they already do.

We also found 17 apps that offer external rewards that contradict the message of sustainable consumption. In most cases, these promote further consumption and not necessarily from "sustainable" stores only. Some even advocate for more purchases (i.e., [48]) with premises that can lead to attitudes such as "I am donating so I can keep buying since I have coupons to do so." Many of the apps excluded from the sample had a similar approach to rewards: offering coupons with discounts for all sorts of stores. Apart from potential implications regarding sustainability, tangible rewards typically undermine intrinsic motivation, as do punishment threats or imposed goals [49]. However, the perception of game elements is user-specific [50]. Few studies [17] address the perception of tangible rewards and possible interactions with motivation towards sustainable behavior in the context of SC.

Given our observations, future studies could survey app designers to ascertain whether their choices, either leading to or deviating from the most typical elements observed here, result from implementation costs, the existence of an assumed success formula, or other reasons. All in all, a positive observation is that only a minority of the apps use gamification superficially, given that four out of five apps integrated gamification inherently. Thus, the gamified SC app space seems to take advantage of the possibilities of gamification, proposing courses of action that apps without gamification could not easily imitate. Future studies could examine different forms of user advancement to see if they are connected to, e.g., user satisfaction or retention.

The conducted analysis provides various contributions for designers and scholars. Designers can benefit from knowing the state of the art of this area to detect opportunities, as well as a contextualization of certain content choices with implications in terms of sustainability and user experience. Scholars interested in SC and gamification can have a more nuanced understanding of the mechanics of gamified apps to consider whether these are appropriate for their efforts to reach out to consumers and communities. Given that researchers often create their own solutions, this analysis can help them avoid unsustainable repetition when their ideas significantly overlap with existing designs.

This study also contributes to the emerging field of gamified SC literature, presenting a way to continue developing research on both fields as a unified discipline. As part of our analysis, we elaborated further on the taxonomy from [10], adapting it to the context of household-level consumers, addressing some ambiguities, and presenting examples of elements that could be inclusive. The analytical framework developed for this study can be used to facilitate the understanding of gamified sustainable consumption among researchers and practitioners, as it provides a blueprint that enables co-creation of apps that cover SC holistically in effective, engaging, and resilient ways.

We also acknowledge some limitations of this study. First, the analysis focuses exclusively on the apps' content, rather than their actual use; although available user reviews were routinely read to gain a broader idea of the user experience, this was not intended as part of the analysis. Second, the frequent disappearance of apps, which even became unavailable between analysis stages, makes this field a changing one. Third, the study excluded apps about sustainable consumption/lifestyles that included external rewards (i.e., discounts and coupons) but were not gamified. Contrariwise, some of the apps that are known to facilitate SC were not included because either they were not gamified or did not appear with the search terms used. Fourth, including additional keywords often associated with sustainable lifestyles and social aspects (i.e., wellness, mindfulness) may have provided additional relevant apps to analyze.

6. Conclusion

The world of apps keeps morphing and adapting to trends. This study shows the need for a more holistic understanding of SC and a more critical approach to certain gamification dimensions, such as rewards, that could undermine not only intrinsic motivation but also the very sustainability that the apps promote.

Future research could investigate the effects of gamification design choices identified here, including both the most and the least common, i.e., the effects of different persuasive intents (compliance, attitude, and behavior change). The results of this study can be strengthened through interviews with app developers, cross-checking their user data with user experience reports collected through workshops or surveys, for example. Overall, given that four out of five of the apps integrate gamification inherently, we can conclude that most existing gamified apps in this space can support sustainable consumption. If these practice shifts become habits that last, is still to be seen.

7. Acknowledgements

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