# Hedonic recycling: Using gamification and sensory stimuli to enhance the recycling experience

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## Abstract

INTRODUCTION: Recycling is not commonly perceived as hedonic, fun or experiential. While previous studies have emphasised the importance of functional attributes and solutions for improving waste recycling in bins, the potential for recycling as an experience has not been explored thoroughly.

OBJECTIVES: This study employs the perspective of gamification, environmental psychology and sensory marketing to provide new perspectives on hedonic recycling.

METHODS: A focus group design was used to explore how experiential cues may influence cognition, emotion and behaviour when recycling waste in bins. Four focus group discussions were employed and analysed thematically.

RESULTS: Findings show that while utilitarian attributes were most critical for participants, there are solutions that can be experientially modified to not disturb the waste separation process. These modifications include digital feedback and information of one's impact on the environment. Other sensory and gamified modifications were discussed with their potential effects on emotion and behaviour in mind.

CONCLUSION: A new conceptual framework was developed, which combined mechanics from gamification and sensory cues as experiential cues. This framework was used to explore various different responses. The model indicates potential relationships between recycling and experiential cues that can be empirically investigated.

## 1. Introduction

This study addresses recycling behaviour in an experiential context, namely with the perspectives of gamification, environmental psychology and sensory marketing. The goal is to explore how gamification mechanics and sensory cues can be used to separating waste in bins as more experiential and fun. To illustrate the disparity between consumption and waste, picture a consumption journey of a man that identifies the psychological need for consuming chocolate. Regardless whether he desires to consume the sweets on the spot or take it home, he is constantly subjected to various fun marketing activities, stimulus and tailor-made strategies, trying to

impact his behaviour. Every aspect of the branded chocolate journey is well-thought through: how to purchase it, open it, consume it and remember it. That is until it is time to throw away the plastic wrapping which is less fun. Will he recycle the wrapping or throw it on the ground?

Recycling has conventionally not been seen as a hedonic or a fun activity. Waste management has repeatedly been treated and assessed from a utilitarian perspective, namely in terms of effort, distance and resources. While it is evidenced that these functional properties are important [1, 2], it has also been shown in research that other psychological and social predictors also impact recycling behaviour, such as commitment, knowledge, and social pressure [3]. These psychological factors, situational characteristics and

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environmental values have been shown to impact behaviour [4]. It has also been discussed that knowledge, the consequences of not separating, and habits are crucial for sorting behaviours [5]

While there are policies, rules and waste management organisations in place, there is room for improving recycling with incentives. Furthermore, internal driving forces can be seen as intrinsic motivation, potencies that are not uniform, but can explain and predict many different outcomes [6].

Two theoretical concepts that are somewhat similar in portraying how people can be persuaded to engage in services and processes are sensory stimuli and game mechanics. Both concepts affect different cognitive and emotional states that mediate behaviours. Firstly, gamification has through several studies emphasized how mechanics affects various psychological states [e.g. 7, 8, 9].

Secondly, research in consumer psychology and some studies in sensory marketing have been inspired by the stimuli, organism and response model (S-O-R) in environmental psychology which illustrate, how persuasive sensory stimuli impact on internal processes of an organism, such as a consumer and the subsequently facilitated approach- or avoidance- behaviours [10-12]. Both logics are similar and deal with the effects of mechanics and stimuli.

Gamification as a subject has matured over the last years [13] and has been empirically and theoretically explored. A widespread explanation of gamification is how game mechanics can be implemented in non-game contexts to engage, involve and motivate people in different tasks [14, 15]. A common misconception is that by transforming an otherwise functional process into a gamified one guarantees success [16]. While the perspective of gamification has in many studies shown to evoke intrinsic motivation and engagement [17, 18], there is also a need to recognize the difficulties of implementing gamification in various processes and services as the domain is rather broad and many situational variables influences the success [13].

As such, we argue that it is crucial to understand the relevant *hedonic* elements and how stimuli and mechanics may function, without being forced upon. The same problems occur regarding the congruence between stimuli, setting or offering which are emphasized in various marketing studies [10, 19, 20]. To illustrate, the use of incongruent (non-fitting) colours or scents may impact emotional attributes differently [21-23]. With respect to these problems it is imperative to consider how people feel and react, to modify the processes.

While serious games and gamification in recycling and waste management has been explored [e.g. 24, 25-29], much more is needed to understand how these can be used in recycling processes. The lack of feedback from recycling behaviour [30] and the lack of space to recycle well are known hurdles for increased recycling rates [31]. The same research gaps exist on how sensory stimuli can impact behaviours through different emotions. The current literature has emphasized the challenge of understanding which mechanics mediate on what psychological factors and on what outcomes [13]. Therefore, there is a need to understand motivations behind recycling behaviour, what is important or challenging and what the participants feel when recycling. It

is necessary to consider these factors to improve recycling rates. To address these issues this paper aims to answer the research question:

*How can experiential cues be used to improve recycling behaviour?*

The first part of this study will discuss the current issues and two theoretical frameworks that explain how people react to various mechanics and stimuli and their effects. To answer the research question it is necessary to study the opinions and feelings of people, thus, a qualitative method is used consisting of four focus groups, such as in Helmefalk and Rosenlund [32].

## 2. Theoretical framework

## 2.1 Recycling as an experience?

Consumers, especially GenY and millennials, demand more than ever before as they seek emotionally pleasing experiences [33]. At the same time, it is normal that people react more favourably to entertaining activities. The pursuit of pleasure and a hedonic lifestyle has for example been the subject of philosophical schools such as epicureanism and hedonism. An integration between gamification and sensory marketing can contribute to both research and practice in terms of new knowledge about how to make recycling hedonic.

This study recognizes that recycling is part of the consumption process. The journey of consuming products and services, does not end after the consumption, but rather extends and includes the behaviours conducted after [34]. Some studies emphasize that consumption experiences do not truly end there, but continue through a post-consumption experience, is memorized and may impact future intentions [35, 36], the same perspective may be assumed to exist within the everyday activities of recycling and waste management.

For some manufacturers the recycling process is ignored or simply beyond their control and responsibility. In these cases, the waste is a problem for consumers in a linear economy. A linear take, make and dispose way of consumption is straining on the earth's resources however. In the alternate circular economy there is no waste or most of the waste is at least recycled to keep the materials within society [37, 38]. Here economic and environmental issues are intertwined, which necessitates interdisciplinary approaches for example from marketing and environmental science.

While there is no doubt that the functional and utilitarian functions, such as distance and time are most important for improving recycling behaviour [2, 39-41], there is a gap in the literature regarding the experiences. The effects of context and socio-cultural values are important to consider in regard to socially responsible behaviour of people [4], especially when lot of green consumerism have put pressure on brands to be sustainable and environmentally friendly [42].

Research show the shift to a more emotive and experiential business perspective, where the need to think in terms of experiences and senses is emphasised [43-46].

Shobeiri et al. [47] employed the experiential marketing concept to explain the motivations for socially responsible consumption and found out that among think, feel, sense, relate and act, act was the strongest element for responsible consumption. Their study demonstrated that the perspective of experiential marketing can be used to analyse responsible consumption and to use experiential measures to enhance the understanding of responsible behaviours regarding consumption.

Other studies have created apps as a waste recycling support tool [48] and shown that subjective and personal attitudes predict various intentions to behave [4]. Further, studies have shown that modified bins with eco-feedback increases recycling activity [49]. Still there more is needed for the design of the physical bin [50]. Chappells and Shove [51] emphasize that although waste bins are a part of every-day routines, its role as predictor for behavioural change is less researched. Their review puts the waste bin as a central point in the otherwise complex process of consumption where the past and future is discussed. One point and discussion about the future is stated "Paralleling the 'normal' bin for mixed and central collection, we can imagine a range of different coloured bins brightening up our kitchens, gardens, kerbsides and shopping centres" (pp. 279). It is the point of seeing the bin as a mediator for changed behaviour that is central and needed in research, especially in regard to experiences.

Moreover, the study by Keramitsoglou and Tsagarakis [50] raised a notion that the mere visual impact of bins functions as an advertisement and an invitation to recycling. They identified and designed possible solutions for bins. The study concluded some important variables and showed that users preferences do not always correspond to existing bins. Lastly, they state that involving users in designing a bin may also impact participants willingness to recycle. One other study by Thieme et al. [52] applied the aspect of guilt by taking pictures of everything that has been thrown out by showing pictures in social media. In this case the feeling of social pressure and self-reflection were increased when recycling.

## 2.2 Gamification and sensory stimuli approach to recycling

### 2.2.1 S-O-R: The role of the senses for behaviour

For a person to have fun the senses need to be stimulated by something. Environmental psychology, also used in various marketing and retailing studies, considers the relationship between an external stimuli (S) in an environment or setting, the organism (O), explicitly the feelings and thinking processes of the subject and the responses (R) which the causative chain of (S) and (O) facilitates. The model have since Mehrabian and Russell [53], been widely adapted where various stimuli, including sensory ones have examined and their effects on people.

A common definition of sensory marketing is the one by Krishna [54] that define it as "marketing that engages the consumers' senses and affects their perception, judgment and

behavior." (p. 333). This definition highlights the importance of human perceptions and how these can be "manipulated" by either combining or removing stimuli. Sensory marketing provides a perspective of separating these cues and their effects by the basis of the five human senses. Some research streams are however, emphasizing the difficulties of separating stimuli, and means, in line with the gestalt approach [55, 56], that there are too many interactions that interfere and that it is better to examining the outcomes, rather than trying to separate stimuli, one by one [55].

To discuss the role stimuli (S) for experiences, it is important to delimit the definition of a stimuli. In some studies, sensory cues are intermittently included in atmospherics or ambient cues [57-59]. Needless to say, in many cases, cues or stimuli are accordingly separated into to the five senses and then studied. It is relevant to emphasize that there is a distinction between a semantic and purely physical properties of stimuli coming from objects and settings. For atmospherics, as seen in Turley and Milliman [57], elements in the setting can consist everything from layout, design, music, lightning and many other variables, where the review draws parallels to the S-O-R framework.

One other crucial aspect in many studies is the aspect of fit, correspondence, also defined as congruency or semantic overlap [22], and is also explained and discussed in Maille and Fleck [60]. This element considers the relatedness of two or more attributes of a stimuli, semantic meaning, setting or/and object. In sensory marketing and other experiential research, these elements are considered on a stimuli level, such as how well colours correspond to the investigated setting [61], or what music fits what scent in a retail setting [62], and many other [see also 10, 12, 63, 64].

Research also show that the effects of mismatching two or more elements also can be beneficial to raise the attention, such as in the contexts of ad-brands [21]. In a recycling context this would indicate that strong colours that diverge from the background or strong contrasts improve the identification of the utilitarian function of the bin.

In summary, there is a bulk of literature that emphasize how stimuli impact on people and how they respond in the given context. It is not always evident that the cause and effect chain always occur from organism to response, but can also be inverted. In Krishna [54], that discuss grounded cognition, emotion, and bodily states as well as that conducting behaviours itself can impact on cognitive and emotional states.

### 2.2.2 Gamification: Mechanics that motivate

Gamification has during the last years grown exponentially and matured as a theory [13]. It mainly describes how otherwise non-game contexts and processes can be altered and modified with game mechanics and dynamics [65, 66]. While ordinary games and educational games, may be games in themselves, gamification means enhancing another process [67]. It is not uncommon that employers, services and other actors, use extrinsic motivation, to motivate change behaviour, such as money or other resource saving factors. The same is argued to occur in the recycling context where

time and distance have shown to predict recycling behaviour [2, 39, 40].

Mechanics can be everything from badges, points, progress mechanics, leaderboards and other [68]. While for instance badges, points and leaderboards may often be used to gamify processes, there are concerns of the fit of mechanics to the core function, as they are highly dynamic and contextual [69, 70]. However, it must be noted that there are various types of mechanics and perspectives on the matter. For instance, in Sicart [71], an interesting distinction between rules and mechanics are elevated. The author emphasises rules as normative, while mechanics are performative. In waste separation contexts, rules are both socially constructed including laws and rules, which more or less force people to separate waste, while mechanics, being performative, improves the performance of it by intrinsically motivating waste separation behaviour. It is also crucial that implementing mechanics can also be a barrier, regardless it being needing to afford or having technical knowledge, such as navigating a smartphone in order to consume a service, or other physical constraints hindering elderly or disabled people.

In order to understand how users become engaged and entertained, it is crucial to have users as a starting point when designing gamified services. Dale [72] emphasizes that "Good gamification design should be user-centric and not mechanism-centric" (p.85). Thus, it becomes important to understand the user, the relevance of the mechanics in the processes and how internal elements predict behaviours. This is however still scarcely evidenced. Alahäivälä and Oinas-Kukkonen [73] agrees with this scarcity "There is not yet a clear, generally accepted vision of the relationships among the contextual factors, gamification strategies, and study outcomes." (pp. 69).

A common theory used in explaining how users gets impacted by mechanics is self-determination theory (SDT), which is a theory that depicts intrinsic motivation and is often employed within the gamification literature, where psychological needs, joy, the feeling of control and competence engage people in different activities and tasks [74, 75]. However, as research has shown, there are a myriad of other cognitive and emotional variables that can be influenced by mechanics [see 72, 76].

Furthermore, the notion of causality and to which extent mechanics impact users inner cognitive and emotional states and the subsequent outcomes, have been discussed. To illustrate, Hamari et al. [77] emphasizes services and gamification can be perceived in three steps, more specifically mechanics, psychological outcomes. This notion is also conceptualized in Helmefalk [78], which reviews gamification literature across seven domains, and categorizes them into mechanics, psychological mediators and outcomes. The review highlights aspects of congruency, the role of the aim and goals of gamifying processes and how internal psychological mediators impact various outcomes. The irregularity of outcomes is also seen in that some studies measures and refer to outcomes as being psychological [7], which makes it difficult to pinpoint whether, for instance engagement should be a psychological mediator, or a final outcome stemming from other psychological mediators. This present study views outcomes as behavioural, more specifically, recycling behaviour.

Although there are studies that confer gamification in sustainability contexts [79-84], much more is needed in identifying and showing long-term use of which mechanics are appropriate in recycling literature, especially in bin-contexts.

## 2.3 Synthesis of gamification and S-O-R

Both gamification and S-O-R based frameworks have been discussed in explaining how stimuli and mechanics can influence behaviour through psychological mediators as in Helmefalk [78]. To deconstruct these and provide a starting point for analysing the findings, these will be synthesized into one model of which will encompass the theoretical discussion.

The theoretical framework consists of a model developed to guide the structure of the analysis and findings. Experiential cues are defined as mechanics and sensory cues, which are discussed to influence positive/negative cognitive and emotional responses. These perceptive states impact positively or negatively how people reflect on their past/future behavioural intent and their actual recycling behaviour. While being an exploratory study, other variables are of consideration, which can explain other outcomes and provide deeper understanding of the research question. Figure. 1 illustrates these stated relationships where the links will be analysed and discussed. The relationship between cognitive and affective responses and behaviours are argued in this study to be interrelated, as in line with the theoretical discussion [e.g. 54], and may change during the actual task activity, regardless if considering a memory, evaluation, judgement or emotion.
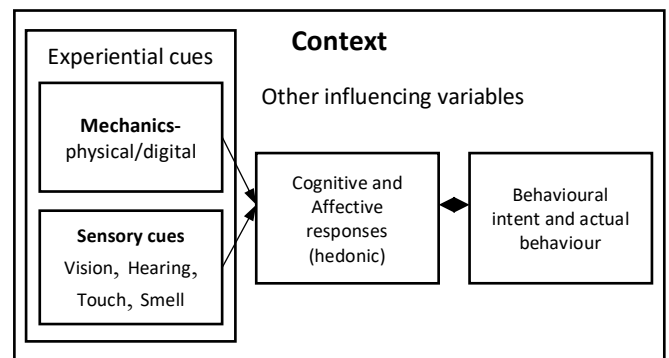


\*Note that the double-pointed arrow indicates that behaviour also impact on cognition and emotion.

Fig 1. Explorative framework for experiential cues

## 3. Method

A focus group design was used in this study as in line with Hennink [85]. To explore and capture participants reasoning and thinking of bins, these groups were structured according to the phenomenological approach as described in Calder [86]. As the study were partly explorative, focus groups was deemed as reasonable since it gives participants ability to discuss and elaborate on the given topic [87, 88].

Literature on sensory stimuli and gamification has shown to discuss the problems of constructing appropriate mechanics and sensory stimuli, thus it was important to let participants discuss these topics and inspire, question or complement each other. As the study aims to conceptualize and provide further research on the matter, discussions are fruitful in creating new propositions while at the same time being theoretically driven.

The structure of the guide, followed a semi-structured scheme and was operationalized according to the gamification literature and sensory marketing literature to provide some credibility to the discussion. The operationalized sensory marketing scheme followed core questions of visual-, scent-, auditory-, haptic-cues and congruency, how it makes the participant feel and think, as well as their behaviours, which was inspired by Spence et al. [89] model. Behaviours were discussed in terms of recycling. The gamification themes were separated in mechanics, psychological mediators and outcomes and the discussed mechanics were used from Helmefalk [78]. Several sub questions for each subject were formulated where participants thoughts and feelings about the subject were captured. The overall structure of the discussed themes can be also seen in the synthesis, figure. 1.

While both of these frameworks were discussed simultaneously in the same focus groups, some of the gamification issues are touched upon in the proceeding of Helmefalk and Rosenlund [32]. However, this study includes both gamification and sensory stimuli, and extends the perspective with new and extended analyses using both frameworks. In order for participants to gain a context, pictures of the bin were introduced. The bin had compartments with coloured stickers and a picture showing the type of waste for that compartment and a list of different gamification mechanics for inspiration. When possible, the physical bin was present for participants to get a context from which to discuss, and could also be compared to the groups answers when the bin was un-available. No noticeable anomalies were found between the groups with only the picture and the ones with the physical bin.

In line with suggestions of Hennink [85], the groups' arrangement were homogeneous to provide richer answers. Consequently, it becomes necessary to include several groups, not only to contrast the findings to each other, but rather to explore whether the outcomes of the answers were vastly different. Moreover, as it has been discussed in theoretical section that there can be moderating effects of age, lifestyle and other, heterogeneity between groups were considered.

Four focus group discussions (FGD) were conducted. G1: Six male, older, mixed occupation, foreign background. G2: Six female, younger adults, mixed occupation, Swedish. G3: Seven students, similar age with mixed backgrounds, Swedish. G4: Six male and female, younger and elderly with mixed occupations, Swedish.

The participants were ensured anonymity and were audio and video recorded with their consent and were offered snacks and water. Each FGD was about 50-80 minutes and was moderated to be welcoming. Empirical saturation was reached during these four FGDs. The design of the study is as in Helmefalk and Rosenlund [32]

The FGD were analysed with a thematic approach where the FGD were theoretically driven and sufficiently closed to find patterns or themes in the answers in relation to the research question [90].

## 4. Findings and discussion

Following the synthesis in figure. 1, findings were structured and categorized into three topics, which will aid in answering the research question. These were 1. Issues when recycling and elements for positive recycling behaviour. 2. Experiential cues and their effects in a recycling context and, 3. Framework for experiential cues in recycling.

## 4.1 Issues when recycling and elements for positive recycling behaviour

The focus group discussions (FGDs) showed variations in how participants preferred and discussed waste recycling. Participants preferred feedback and information of recycling through the channels and media they already use. They also emphasized life-situation as a central determinant for the type of communication. Life situation could be anything from living in an apartment or house, age and having children. Depending on this, information can be provided both physically and digitally. The FGDs also saw time as a crucial component, which is related to the life situation. This confirms the literature which state that distance and time are important for recycling behaviour [e.g. 41]. Families with small kids mentioned having less time while retired persons have more. Thus, it can be speculated that lack of time, and stress impacts negatively on cognitive and emotional states which mediate on recycling behaviours.

Interestingly, it was emphasized that dog owners had to go on frequenter walks and had more opportunities to go out with organic waste, hence was speculated to influence having less trash at home and increase waste separation. A good living standard was also linked to positive recycling behaviour. Some discussions arose which emphasized the feeling of disconnectedness to society and environment could be factors that impacted negatively on recycling behaviour. Additionally, it was discussed that those with difficult

economic life situations may not have the same motivation to recycle appropriately as other urgent matters becomes prioritized instead.

From the findings, it can be argued that the sense of purposefulness and focusing on contextualizing people in relation to nature and the visible effects are important for enhancing motivation for recycling behaviour. However, these otherwise utilitarian arbitrating elements, such as time and money are also discussed to be symptomized on peoples cognitive and emotional states, which in turn impact recycling behaviour.

Other variables that were importance for participants when recycling was the aspect of middle waste management, more specifically, the bins inside the house, which is later carried out to the bin outside. Issues were highlighted that lack of space under the sink, as in Sörme et al. [91], for different waste compartments, and the need to wash out some consumption packaging could contribute to careless waste separation. To overcome these issues, it was especially important to be intrinsically motivated. Participants had developed their own systems for middle waste management and desired more aid from different stakeholders in solving this issue.

In regard to the semantic overlap, or congruency [22], participants emphasized these elements as important for the bin, with two aspects. The first one is in regarded to enhance utilitarian aspects of the bin, such as lighter lids, or distinct and clear colours for different compartments which match the expected colour of the waste. Waste-congruent compartment colours increased attention and eased identification, which is also discussed in Keramitsoglou and Tsagarakis [50] who mention the effort and time spent people sort waste can be minimized by appropriate colours. Participants in the FGDs also emphasized that it is not as necessary when the bin is at home, which can instead be learned through time, in contrast to for instance, when separating waste at less frequently visited facilities.

The second one is connected to the hedonic and enjoyable factors, which motivate them to put extra effort in separating waste correctly. These factors were related to the symbolic act of recycling, but also as the role of one self in relation to a greater context. To exemplify, experiential consideration, such as the congruence between the bin and house, which to an extent is connected to self-identity. The desires of the bin to match the outer aesthetics of the house, were important factors for participants. Moreover, congruency was emphasized also between the bin, it's made-of materials and what the material symbolizes, which was suggested to be made of recyclable plastic which corresponds with sustainability.

Consequently, the concept of congruence has shown itself to represent a larger entity, a holistic picture of sustainability, where cues and mechanics represent and relate to each other in the recycling context, regardless if it is a green colour, awards that are in line with sustainable behaviours, or simply matching their expectations. When expectations are in line with their perception, trust is facilitated which they state can enable recycling behaviour.

## 4.2 Experiential cues and their effects in a recycling context

### 4.2.1 Sensory cues and the effects
Stimuli - Vision
The majority of the FGDs emphasized utilitarian aspect of sensory cues and their effect for easing the recycling process. Darker colours of the bin were preferred to hide the dirtiness and lessen the maintenance of the bin's exterior. However, there was a controversy in the discussions in regards of the colours and the emotional aspects of it. While some perceived the bin to be purely utilitarian, other emphasized the hedonic aspects of it, such as the desire for the bin to fit into the design choices of the garden and house, similar to the concept of congruency [60].

The bin that otherwise is sometimes associated with negative attributes, such as trash and bad scent, had according to participants a great opportunity to be better integrated with the aesthetics of the house. Instead of the bin being an isolated and incongruent component outside the building, it was suggested to match the expressive presentation of the house. The FGDs emphasized that waste bins can be more considered with appearance and design in mind as suggested by Keramitsoglou and Tsagarakis [50]. These findings support the need for a hedonic perspective on recycling, where waste can be primed to be more desirable and wanted. This is also in line with literature that show the effect of positive emotions on behaviour [see review 89].

Modifying the bins as more aesthetic and a part of the surrounding environment may, according to some in the FGDs, enhance the perception of the bin as a symbol or a metaphor for a sustainable planet and hence let the bin have a more central role in ones' every-day lives. Whether these hedonic and experiential factors contribute to actual behaviour, remains untold, however, if following the framework of S-O-R [53], emotions and affect can predict various behaviours [89]. Thus, these visual and aesthetic variables should not be neglected. The FGDs also highlighted that people have different preferences and that providing them aesthetical choice personifies the bin, which can increase emotional attachment, increase engagement, and behavioural change. Moreover, visual cues, also functioned in terms of identification, for instance identifying the appropriate waste-compartment with specific symbols and colours.

While these entities are of utilitarian nature, FGDs also emphasized possibilities to add various information channels on the bin, such as with stickers, QR codes, links or pictures. Participants highlighted that information may provide the beneficial and positive effects when recycling and that it would influence their self-esteem and certainty about the waste procedure, hence impact on recycling behaviour. This relates to literature showing the impact of knowledge and commitment on recycling behaviour, such as in Hornik et al. [3]. An important variable for improving waste recycling was lighting. FGDs highlight the difficulties of recycling when its dark outside increases the error rate when waste separating

Most aspects of waste separation are dependent on proper lighting to identify and navigate the waste to the bin. Participants stated that it can be very dark during winters and that homes may lack sufficient lighting. According to participants, motivation is decreased to recycle when fundamental properties are not met, which is similarly conducted when concerning subjects such as visual information, distances or other utilitarian properties [92]. Some creative ideas were generated, such as battery driven lamps inside the lid, reflex-stickers on the bin, even solar-powered lamps.

### Stimuli – scent

In regards to hedonic experiences and emotions, the associated scent of bins was negatively impacting on emotions, which illustrates the organism in the S-O-R model [53]. As with the rational of the model, participants emphasized the causal chain. FGDs emphasized that negative scents were a factor that was mainly discussed in twofold. Firstly, the overall negative smell experience from old waste and that the bin could evoke emotions of disgust, which made some participants to hasten the waste recycling process, in line with the avoidance behaviours discussed in Chebat and Michon [59]. In this analysis, avoidance behaviour is speculated to increase the rate of recycling error. Secondly, surprisingly, negative smell may also have a positive effect on recycling behaviour. When recycling indoors, organic waste is decomposing and gathering bad smell, which instead motivates participants to throw away this type of waste frequenter, in contrast to other waste.

### Stimuli – sound

In regards to sounds, there were no notable findings, except that throwing glass tends to be loud and discomforting. Some solutions were presented, such as softer compartment for glass, but no more substantial input was given.

### Stimuli – Touch

In regards to touch and texture related stimuli, there were two main aspects. The first one, being of utilitarian nature, considered the lid it as heavy, especially for kids. Participants emphasized that every second was crucial when recycling, especially during winter months when already holding waste in the hands. They were required to put the bags down, open the lid, throw the waste and then close the lid again. Some participants emphasized that in stressful situations this can become a burden. The second one was the FGDs discussion of the material of the bin. While no participants viewed problems with plastic, they emphasized that the bin would be made from recyclable plastic.

### 4.2.2 Game mechanics and the effects

The participants preferences of game mechanics varied. One central feature, regardless for which mechanic was chosen, was the instant feedback feature. The findings from the FGDs showed that people are somewhat interested in statistics and information of their waste behaviour. Although they recognize that it is difficult to implement these solutions directly, they highlight that they would find this interesting and that this can influence how they recycle. Everything from points or virtual recipes were suggested to reward the user when recycling correctly. Instant feedback was suggested to

be implemented either on the physical bin, or through a digital application that will deliver (weekly) statistics for comparison. Stickers or QR codes were recommended to remind and engage users in using the app.

In many games or gamified processes, central elements are competition or/and collaboration [93], which participants in FGDs signify can be implemented by comparing statistics between areas. This would also according to them, stimulate collaboration in the near living area, whilst facilitating competition between areas. This element is discussed in FGDs, which facilitates peer-pressure, that has already in literature shown to have a great effect on recycling behaviour [4]. Peer pressure are in FGDs discussed to facilitate vigilant recycling, both of fear what the neighbour would think of them, but also strengthening the sense of community through motivating each other's positive recycling behaviour. However, as some participants state, integrity and anonymity can be an issue, both in regard to rules for waste companies to gather individual data, but also to not point out individuals.

The aspect of statistics is also discussed to enable goals, which is a requirement for using progression as a mechanic. Setting goals can be either formulated rules for winning, hence facilitating competition, or increasing the difficulty. If looking from a theoretical viewpoint, winning, progression, competition and collaboration are elements that can facilitate engagement [93].

Points were suggested that can be transferred into either extrinsic rewards, such as discount on waste collection services or exchanging points to environmentally friendly products. Additional suggestions were provided such as visualize progression as the growth of something. However, this was suggested to be implemented digitally as not to interfere with the every-day waste separation process. The visualization of one's actions are according to some participants perceived as fun and can motivate to keep on recycling to create growth, or progression as seen from the perspective in gamification research [94]. The chance of winning something was also discussed, a mechanic that could be implemented to engage participation in recycling events.

Regardless whether FGDs discussed sensory cues or game mechanics, an important element was unsurprisingly constantly reoccurring. Feedback, which was instant, had according to participants a big impact on future behavioural intent. Such as literature show that knowledge and information predict sustainable behaviour [3], the same discourse occurred during the FGDs. Many participants emphasized that they do not know what is happening with the waste after its collected and that this uncertainty can facilitate mistrust. Some mentioned that the media showed that all trash was incinerated in the same oven, which is not occurring anymore. Despite this, people may feel uncertainty and would like their effort to be meaningful. Thus, FGDs emphasized the desire to receive feedback about what happens with the waste afterwards and the expected effects. Many wanted to instantly see effects of their recycling behaviour, which is otherwise difficult to see during the task of separation. As the effects of sustainable behaviour is not always immediately noticed, gamification and sensory cues may provide ample opportunities to illustrate and visualize instantly which effect

recycling behaviour contributes to. This aspect is in line with the element of meaningfulness and relatedness [6, 74], being in relation to the environment.

Despite the fact that correct recycling takes more effort, many participants in the FGDs showed a willingness to contribute to something, to make a difference, regardless of the impact.

## 4.3 Framework for experiential cues in recycling

Findings signify that hedonic and experiential predictors were categorised as mechanics or sensory cues. For the mechanics ones these were found as appropriate in the bin:

- *Instant feedback (information), points, virtual recipes, competition/collaboration, goals, progress, Growth (visual), Chance*

The findings have showed various cognitive and affective responses that are impacted by hedonic /experiential mechanics and cues.

- *Peer-pressure (fear/sense of belonging), Fun, Intrinsic Motivation, Trust, Meaningfulness, Interesting, Desire,*

*Pleasantness, Emotional attachment, Engagement, Self-esteem, Attention, Awareness, Expectations*

The last outcomes are often illustrated in various types of behaviours which have been discussed as being:

- *Behavioural intention, Recycling behaviours, Behavioural change, Frequency, Error-rate*

Other variables that had an overall impact on different aspects of recycling in bin contexts were:

- *Life situation, Rules, Knowledge, Age, Habits, Congruency (house aesthetics-bin; bin-environment), Time, Distance, Financial situation, middle waste management*

The links between the discussed elements and concepts are elaborated upon in figure 2, illustrating where these fit within the new developed conceptual model. All mentioned elements are not necessary influencing each other, but the model portrays how bins can be improved and the discussed effects of these. For closer explanations of the relationships, see the discussion above.

Findings show the potential to consider recycling from a hedonic and experiential perspective which raises the notion of developing the concept of hedonic waste management.
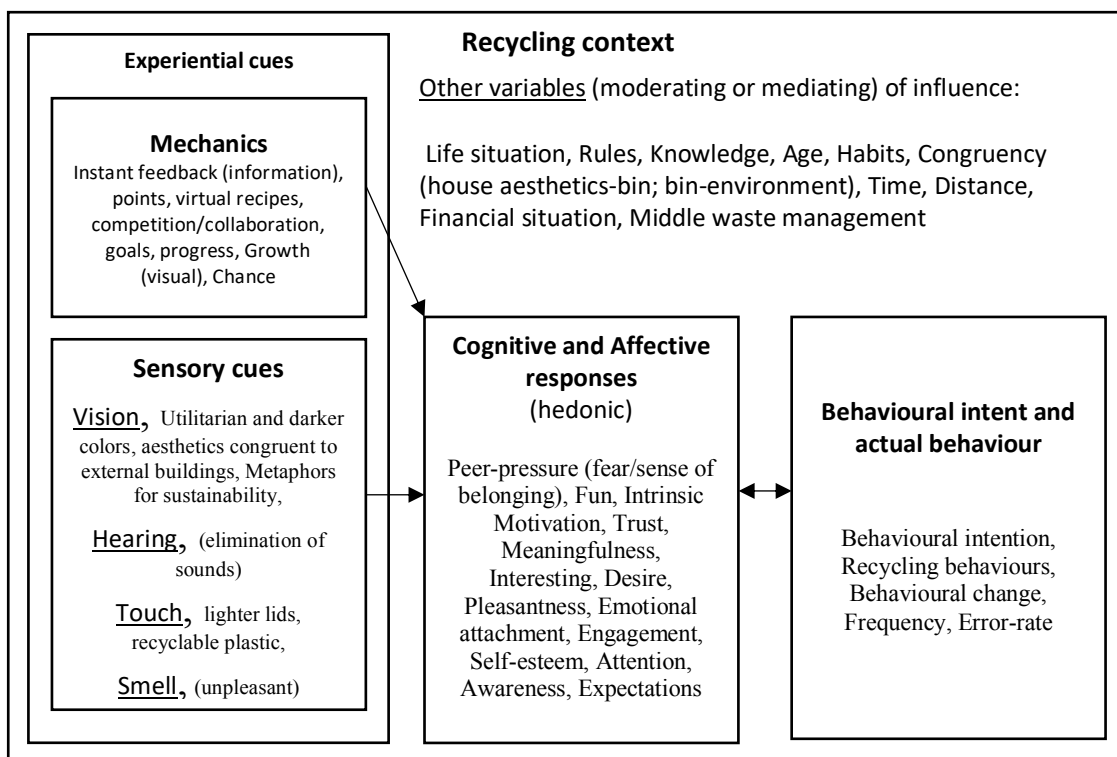


Fig 2. Framework for experiential cues in recycling

# 5. Findings and discussion

In this study we have addressed the issues of experiential and hedonic cues in recycling contexts and conceptualized a model that can be further elaborated on. More specifically, we aimed to answer how experiential cues can be used to improve recycling behaviour. Findings indicates that recycling is not perceived as a hedonic or fun process and that there is room to modify existing solutions. One central aspect is that regardless whether participants suggests various improvements, it is not a desired to sacrifice the utilitarian aspects of recycling. These include the basic functional properties when recycling for example the distance to the bin.

The findings suggest that there are opportunities to modify the recycling experience by adding non-disturbing cues and mechanics. This can be done by adding an additional digital channel such as apps or other services that can provide feedback and information about the recycling process. Furthermore, aesthetical elements were discussed in terms of congruency and how well some aspects fit to each other, such as the design of the bin to the house and other considerations. By carefully considering function versus form, there is opportunity to enhance the experience of the bin to motivate and engage people in the recycling process.

From the theoretical framework and the analysis, a new model was developed showing what experiential cues can be added or modified to facilitate hedonic responses, which are argued to influence positive recycling behaviour. Although these links are not completely evidenced, they provide opportunities to further investigate the relationships between experiential predictors and outcomes. However, this study has provided a foundation for testing how recycling bins can be modified to engage people in recycling more, and with less errors. Similar to Keramitsoglou and Tsagarakis [50] study, which involved participants in designing bins that encourage recycling. This study further elaborated on how certain sensory cues and gamification mechanics can be used to facilitate recycling behaviour. Findings signify that emotion and cognition is in fact mediating recycling behaviours, but that some of the effects from experiential considerations may indeed work, when the utilitarian ones are fulfilled.

For a waste management organization wanting to make recycling a more hedonic experience, we suggest a careful examination of their existing bins and thinking beyond utilitarian services. It may be worth understanding the middle waste management system and how this contributes to managing waste correctly, as this can increase recycling rates.

# 6. Limitations and future research

Although a mixture of focus groups was used, the study is limited to Swedish contexts. Results may differ in other countries and cultures. Moreover, the study may indicate relationships, but these should not be generalized without further empirical evidence. However, the links that are shown can be studied further regarding the connection between experiential cues and recycling behaviour. The framework in figure 2. can assist further research in choosing some aspects of the model to focus on. These cues and mechanics can be developed and hypothesized to examine and generalize research in bin contexts.

There are also ethical concerns when implementing tools that engage people in different tasks, thus there needs to be transparency or opt-out tools that can give people chance to inactivate or remove features that are encouraging mental, emotional and behavioural engagement.

We recommend to explore the possibility of using this model for improving recycling rates, for example by making recycling hedonic by means of gamification and sensory stimuli. If recycling behaviour and other pro-environmental behaviour becomes a fun experience for people, there is a potential to improve local and global communities in the face of environmental challenges. Moreover, there is room to investigate different technologies (such as VR, AR, IoT and others) that can be applied to enhance hedonic experiences. For instance, QR codes could be implemented, as suggested in FGDs, and be used to quickly launch information and provide feedback with AR on the bin.

# References

[1] Dahlén, L. and Lagerkvist, A. (2010) *Evaluation of recycling programmes in household waste collection systems.* Waste Management & Research, 28(7): p. 577-586.

[2] Reid, D.H., Luyben, P.D., Rawers, R.J., and Bailey, J.S. (1976) *Newspaper recycling behavior: The effects of prompting and proximity of containers.* Environment and Behavior, 8(3): p. 471-482.

[3] Hornik, J., Cherian, J., Madansky, M., and Narayana, C. (1995) *Determinants of recycling behavior: A synthesis of research results.* The Journal of Socio-Economics, 24(1): p. 105-127.

[4] Barr, S. (2007) *Factors influencing environmental attitudes and behaviors: A UK case study of household waste management.* Environment and behavior, 39(4): p. 435-473.

[5] Avfall Sverige, *Beteendeförändring i mångfaldsområden.* 2017, Avfall Sverige Utveckling: Malmö.

[6] Deci, E. and Ryan, R.M. (1985), *Intrinsic motivation and self-determination in human behavior.* Springer Science & Business Media.

[7] Dichev, C. and Dicheva, D. (2017) *Gamifying education: what is known, what is believed and what remains uncertain: a critical review.* International journal of educational technology in higher education, 14(1): p. 9.

[8] Hervas, R., Ruiz-Carrasco, D., Mondejar, T., and Bravo, J. (2017), *Gamification mechanics for behavioral change: a systematic review and proposed taxonomy.* in *Proceedings of the 11th EAI International Conference on Pervasive Computing Technologies for Healthcare.* 2017. ACM.

[9] Johnson, D., Deterding, S., Kuhn, K.-A., Staneva, A., Stoyanov, S., and Hides, L. (2016) *Gamification for health*

*and wellbeing: A systematic review of the literature.* Internet Interventions, 6: p. 89-106.

[10] Mattila, A.S. and Wirtz, J. (2001) *Congruency of scent and music as a driver of in-store evaluations and behavior.* Journal of Retailing, 77(2): p. 273-289.

[11] Donovan, R. (1994) *Store atmosphere and purchasing behavior.* Journal of Retailing, 70(3): p. 283-294.

[12] Spangenberg, E.R., Grohmann, B., and Sprott, D.E. (2005) *It's beginning to smell (and sound) a lot like Christmas: the interactive effects of ambient scent and music in a retail setting.* Journal of Business Research, 58(11): p. 1583-1589.

[13] Nacke, L.E. and Deterding, C.S. (2017) *The maturing of gamification research.* Computers in Human Behaviour: p. 450-454.

[14] Deterding, S., Dixon, D., Khaled, R., and Nacke, L. (2011), *From game design elements to gamefulness: defining gamification.* in *Proceedings of the 15th international academic MindTrek conference: Envisioning future media environments.* 2011. ACM.

[15] Werbach, K. and Hunter, D. (2012), *For the win: How game thinking can revolutionize your business.* Wharton Digital Press.

[16] Burke, B. (2014) *Gamify: How Gamification motivates people to do extraordinary things. Bibliomotion.* Inc., Apr.

[17] Feng, Y., Ye, H.J., Yu, Y., Yang, C., and Cui, T. (2018) *Gamification artifacts and crowdsourcing participation: Examining the mediating role of intrinsic motivations.* Computers in Human Behavior, 81: p. 124-136.

[18] Hanus, M.D. and Fox, J. (2015) *Assessing the effects of gamification in the classroom: A longitudinal study on intrinsic motivation, social comparison, satisfaction, effort, and academic performance.* Computers & Education, 80: p. 152-161.

[19] Demoulin, N. (2011) *Music congruency in a service setting: The mediating role of emotional and cognitive responses.* Journal of Retailing and Consumer Services, 18(1): p. 10-18.

[20] Knasko, S.C. (1995) *Pleasant odors and congruency: effects on approach behavior.* Chemical Senses, 20(5): p. 479-487.

[21] Dahlén, M., Lange, F., Sjödin, H., and Törn, F. (2005) *Effects of ad-brand incongruence.* Journal of Current Issues & Research in Advertising, 27(2): p. 1-12.

[22] Bosmans, A. (2006) *Scents and sensibility: when do (in)congruent ambient scents influence product evaluations?* Journal of Marketing, 70(3): p. 32-43.

[23] Spangenberg, E.R., Sprott, D.E., Grohmann, B., and Tracy, D.L. (2006) *Gender-congruent ambient scent influences on approach and avoidance behaviors in a retail store.* Journal of Business Research, 59(12): p. 1281-1287.

[24] Berengueres, J., Alsuwairi, F., Zaki, N., and Ng, T. (2013), *Gamification of a recycle bin with emoticons.* in *2013 8th ACM/IEEE International Conference on Human-Robot Interaction (HRI).* 2013. IEEE.

[25] Briones, A.G., Chamoso, P., Rivas, A., Rodríguez, S., De La Prieta, F., Prieto, J., and Corchado, J.M. (2018), *Use of gamification techniques to encourage garbage recycling. a smart city approach.* in *International Conference on Knowledge Management in Organizations.* 2018. Springer.

[26] Menon, B.M., Unnikrishnan, R., Muir, A., and Bhavani, R.R. (2017), *Serious game on recognizing categories of waste, to support a zero waste recycling program.* in *2017 IEEE 5th International Conference on Serious Games and Applications for Health (SeGAH).* 2017. IEEE.

[27] Morganti, L., Pallavicini, F., Cadel, E., Candelieri, A., Archetti, F., and Mantovani, F. (2017) *Gaming for Earth: Serious games and gamification to engage consumers in*

*pro-environmental behaviours for energy efficiency.* Energy Research & Social Science, 29: p. 95-102.

[28] Ibánez, J.d.J.L.G. and Wang, A.I. (2015) *Learning recycling from playing a kinect game.* International Journal of Game-Based Learning (IJGBL), 5(3): p. 25-44.

[29] Shearer, L., Gatersleben, B., Morse, S., Smyth, M., and Hunt, S. (2017) *A problem unstuck? Evaluating the effectiveness of sticker prompts for encouraging household food waste recycling behaviour.* Waste management, 60: p. 164-172.

[30] Hamari, J. and Koivisto, J. (2013), *Social Motivations To Use Gamification: An Empirical Study Of Gamifying Exercise.* in *ECIS.* 2013.

[31] Ordoñez, I., Harder, R., Nikitas, A., and Rahe, U. (2015) *Waste sorting in apartments: integrating the perspective of the user.* Journal of Cleaner Production, 106: p. 669-679.

[32] Helmefalk, M. and Rosenlund, J. (in press), *Make waste fun again! A gamification approach to recycling.* in *proceedings (eds. A. Brooks & E. Brooks) Interactivity, Game Creation, Design, Learning, and Innovation: 8th EAI International Conference, ArtsIT 2019, and 4th EAI International Conference, DLI 2019, Aalborg, Denmark, November 6-7, 2019. Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering Proceedings, Springer.* in press.

[33] Smilansky, S. (2017), *Experiential marketing: A practical guide to interactive brand experiences.* Kogan Page Publishers.

[34] Wheeler, K. and Glucksmann, M. (2015) *'It's kind of saving them a job isn't it?' The consumption work of household recycling.* The Sociological Review, 63(3): p. 551-569.

[35] Mano, H. and Oliver, R.L. (1993) *Assessing the dimensionality and structure of the consumption experience: evaluation, feeling, and satisfaction.* Journal of Consumer research, 20(3): p. 451-466.

[36] Triantafillidou, A. and Siomkos, G. (2014) *Consumption experience outcomes: satisfaction, nostalgia intensity, word-of-mouth communication and behavioural intentions.* Journal of Consumer Marketing, 31(6/7): p. 526-540.

[37] Stahel, W.R. (2019), *The circular economy: A user's guide.* Routledge.

[38] Ghisellini, P., Cialani, C., and Ulgiati, S. (2016) *A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems.* Journal of Cleaner Production, 114: p. 11-32.

[39] Rousta, K., Bolton, K., Lundin, M., and Dahlén, L. (2015) *Quantitative assessment of distance to collection point and improved sorting information on source separation of household waste.* Waste management, 40: p. 22-30.

[40] Schultz, P.W. and Oskamp, S. (1996) *Effort as a moderator of the attitude-behavior relationship: General environmental concern and recycling.* Social psychology quarterly: p. 375-383.

[41] González-Torre, P.L. and Adenso-Díaz, B. (2005) *Influence of distance on the motivation and frequency of household recycling.* Waste management, 25(1): p. 15-23.

[42] Strong, C. (1996) *Features contributing to the growth of ethical consumerism-a preliminary investigation.* Marketing Intelligence & Planning, 14(5): p. 5-13.

[43] Pine, B.J. and Gilmore, J.H. (1999), *The experience economy: work is theatre & every business a stage.* Harvard Business Press.

[44] Schmitt, B. (1999) *Experiential marketing.* Journal of Marketing Management, 15(1-3): p. 53-67.

[45] Hultén, B. (2015), *Sensory Marketing: Theoretical and Empirical Grounds.* Vol. 1. New York: Routledge.

[46] Holbrook, M.B. and Hirschman, E.C. (1982) *The experiential aspects of consumption: consumer fantasies, feelings, and fun.* Journal of Consumer Research, 9(2): p. 132-140.

[47] Shobeiri, S., Rajaobelina, L., Durif, F., and Boivin, C. (2016) *Experiential Motivations of Socially Responsible Consumption.* International Journal of Market Research, 58(1): p. 119-139.

[48] Bonino, D., Alizo, M.T.D., Pastrone, C., and Spirito, M. (2016), *WasteApp: Smarter waste recycling for smart citizens.* in *2016 International Multidisciplinary Conference on Computer and Energy Science (SpliTech).* 2016.

[49] Mozo-Reyes, E., Jambeck, J.R., Reeves, P., and Johnsen, K. (2016) *Will they recycle? Design and implementation of eco-feedback technology to promote on-the-go recycling in a university environment.* Resources, Conservation and Recycling, 114: p. 72-79.

[50] Keramitsoglou, K. and Tsagarakis, K. (2018) *Public participation in designing the recycling bins to encourage recycling.* Sustainability, 10(4): p. 1240.

[51] Chappells, H. and Shove, E. (1999) *The dustbin: a study of domestic waste, household practices and utility services.* International Planning Studies, 4(2): p. 267-280.

[52] Thieme, A., Comber, R., Miebach, J., Weeden, J., Kraemer, N., Lawson, S., and Olivier, P. (2012), *We've bin watching you: designing for reflection and social persuasion to promote sustainable lifestyles.* in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems.* 2012. ACM.

[53] Mehrabian, A. and Russell, J.A. (1974), *An approach to environmental psychology.* Cambridge: the MIT Press.

[54] Krishna, A. (2012) *An integrative review of sensory marketing: Engaging the senses to affect perception, judgment and behavior.* Journal of Consumer Psychology, 22(3): p. 332-351.

[55] Parsons, A.G., Ballantine, P.W., Ballantine, P.W., Jack, R., and Parsons, A.G. (2010) *Atmospheric cues and their effect on the hedonic retail experience.* International Journal of Retail & Distribution Management, 38(8): p. 641-653.

[56] Lin, I.Y. and Mattila, A.S. (2010) *Restaurant servicescape, service encounter, and perceived congruency on customers' emotions and satisfaction.* Journal of hospitality marketing & management, 19(8): p. 819-841.

[57] Turley, L.W. and Milliman, R.E. (2000) *Atmospheric effects on shopping behavior: a review of the experimental evidence.* Journal of Business Research, 49(2): p. 193-211.

[58] Baker, J., Parasuraman, A., Grewal, D., and Voss, G.B. (2002) *The Influence of Multiple Store Environment Cues on Perceived Merchandise Value and Patronage Intentions.* Journal of Marketing, 66(2): p. 120-141.

[59] Chebat, J.-C. and Michon, R. (2003) *Impact of ambient odors on mall shoppers' emotions, cognition, and spending: A test of competitive causal theories.* Journal of business research, 56(7): p. 529-539.

[60] Maille, V. and Fleck, N. (2011) *Perceived congruence and incongruence: Toward a clarification of the concept, its formation and measure.* Recherche et Applications en Marketing (English Edition), 26(2): p. 77-113.

[61] Hinks, D. and Shamey, R. (2011) *Review of retail store lighting: implications for colour control of products.* Coloration Technology, 127(2): p. 121-128.

[62] Imschloss, M. and Kuehnl, C. (2017) *Don't ignore the floor: Exploring multisensory atmospheric congruence between music and flooring in a retail environment.* Psychology & Marketing, 34(10): p. 931-945.

[63] Hultén, B. (2012) *Sensory cues and shoppers' touching behaviour: the case of IKEA.* International Journal of Retail & Distribution Management, 40(4): p. 273-289.

[64] Knoferle, K.M., Spangenberg, E.R., Herrmann, A., and Landwehr, J.R. (2012) *It is all in the Mix: The interactive Effect of Music Tempo and Mode on in-store Sales.* Marketing Letters, 23(1): p. 325-337.

[65] Deterding, S., Sicart, M., Nacke, L., O'Hara, K., and Dixon, D. (2011), *Gamification. using game-design elements in non-gaming contexts.* in *CHI'11 extended abstracts on human factors in computing systems.* 2011. ACM.

[66] Helmefalk, M., Lundqvist, S., and Marcusson, L. (2019) *The Role of Mechanics in Gamification: An Interdisciplinary Perspective.* International Journal of Virtual Augmented Reality, 3(1): p. 18-41.

[67] Huotari, K. and Hamari, J. (2012), *Defining gamification: a service marketing perspective.* in *Proceeding of the 16th International Academic MindTrek Conference.* 2012. ACM.

[68] Sailer, M., Hense, J.U., Mayr, S.K., and Mandl, H. (2017) *How gamification motivates: An experimental study of the effects of specific game design elements on psychological need satisfaction.* Computers in Human Behavior, 69: p. 371-380.

[69] Harwood, T. and Garry, T. (2015) *An investigation into gamification as a customer engagement experience environment.* Journal of Services Marketing, 29(6/7): p. 533-546.

[70] Burke, B. (2016), *Gamify: How gamification motivates people to do extraordinary things.* Routledge.

[71] Sicart, M. (2008) *Defining game mechanics.* Game Studies, 8(2): p. n.

[72] Dale, S. (2014) *Gamification: Making work fun, or making fun of work?* Business information review, 31(2): p. 82-90.

[73] Alahäivälä, T. and Oinas-Kukkonen, H. (2016) *Understanding persuasion contexts in health gamification: A systematic analysis of gamified health behavior change support systems literature.* International journal of medical informatics, 96: p. 62-70.

[74] Deci, E.L., Ryan, R.M., Gagné, M., Leone, D.R., Usunov, J., and Kornazheva, B.P. (2001) *Need satisfaction, motivation, and well-being in the work organizations of a former eastern bloc country: A cross-cultural study of self-determination.* Personality and social psychology bulletin, 27(8): p. 930-942.

[75] Gagné, M. and Deci, E.L. (2005) *Self-determination theory and work motivation.* Journal of Organizational behavior, 26(4): p. 331-362.

[76] Hofacker, C.F., de Ruyter, K., Lurie, N.H., Manchanda, P., and Donaldson, J. (2016) *Gamification and Mobile Marketing Effectiveness.* Journal of Interactive Marketing, 34: p. 25-36.

[77] Hamari, J., Koivisto, J., and Sarsa, H. (2014), *Does gamification work?--a literature review of empirical studies on gamification.* in *System Sciences (HICSS), 2014 47th Hawaii International Conference on.* 2014. IEEE.

[78] Helmefalk, M. (2019) *An interdisciplinary perspective on gamification: Mechanics, psychological mediators and outcomes.* International Journal of Serious Games, 6(1): p. 3-26.

[79] Gamberini, L., Corradi, N., Zamboni, L., Perotti, M., Cadenazzi, C., Mandressi, S., Jacucci, G., Tusa, G., Spagnolli, A., and Björkskog, C. (2011), *Saving is fun: designing a persuasive game for power conservation.* in *Proceedings of the 8th international conference on advances in computer entertainment technology.* 2011. ACM.

[80] Geelen, D., Keyson, D., Boess, S., and Brezet, H. (2012) *Exploring the use of a game to stimulate energy saving in households*. Journal of Design Research 14, 10(1-2): p. 102-120.

[81] Knol, E. and De Vries, P.W. (2011) *EnerCities-A serious game to stimulate sustainability and energy conservation: Preliminary results.*

[82] Salvador, R., Romão, T., and Centieiro, P. (2012) *A gesture interface game for energy consumption awareness*, in *Advances in Computer Entertainment*. Springer. p. 352-367.

[83] Gustafsson, A., Katzeff, C., and Bang, M. (2009) *Evaluation of a pervasive game for domestic energy engagement among teenagers*. Computers in Entertainment (CIE), 7(4): p. 54.

[84] Berengueres, J., Alsuwairi, F., Zaki, N., and Ng, T. (2013), *Gamification of a recycle bin with emoticons*. in *Proceedings of the 8th ACM/IEEE international conference on Human-robot interaction*. 2013. IEEE Press.

[85] Hennink, M.M. (2013), *Focus group discussions*. Oxford University Press.

[86] Calder, B.J. (1977) *Focus groups and the nature of qualitative marketing research*. Journal of Marketing Research: p. 353-364.

[87] Malhotra, N. and Birks, D. (2007), *Marketing Research: an applied approach: 3rd European Edition*. Pearson education.

[88] Stewart, D.W. and Shamdasani, P.N. (2014), *Focus groups: Theory and practice*. Vol. 20. Sage publications.

[89] Spence, C., Puccinelli, N.M., Grewal, D., and Roggeveen, A.L. (2014) *Store Atmospherics: A Multisensory Perspective*. Psychology & Marketing, 31(7): p. 472-488.

[90] Patton, M.Q. (2014), *Qualitative research & evaluation methods*. 4th ed. London: SAGE Publications Inc. 806.

[91] Sörme, L., Voxberg, E., Rosenlund, J., Jensen, S., and Augustsson, A. (2019) *Coloured Plastic Bags for Kerbside Collection of Waste from Households—To Improve Waste Recycling*. Recycling, 4(2): p. 20.

[92] Miller, N.D., Meindl, J.N., and Caradine, M. (2016) *The effects of bin proximity and visual prompts on recycling in a university building*. Behavior and Social Issues, 25(1): p. 4-10.

[93] Robson, K., Plangger, K., Kietzmann, J.H., McCarthy, I., and Pitt, L. (2015) *Is it all a game? Understanding the principles of gamification*. Business Horizons, 58(4): p. 411-420.

[94] Sailer, M., Hense, J., Mandl, J., and Klevers, M. (2014) *Psychological perspectives on motivation through gamification*. Interaction Design and Architecture Journal, (19): p. 28-37.