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CONCEPTION AND ASSESSMENT OF A DEVICE FOR VOLUNTARY SELECTIVE COLLECTING: AN URBAN LUDIC INTERVENTION

CONCEPÇÃO E AVALIAÇÃO DE UM DISPOSITIVO DE COLETA SELETIVA VOLUNTÁRIA: UMA INTERVENÇÃO LÚDICA URBANA

CONCEPCIÓN Y EVALUACIÓN DE UN DISPOSITIVO PARA LA RECOGIDA SELECTIVA VOLUNTARIA: UNA INTERVENCIÓN LÚDICA URBANA

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Abstract

Objective: This research presents the construction and evaluation of a recycling device designed based on the Theory of Fun to collect plastic waste.

Originality/relevance: This device consists of an instrumented "dump," which, after its use, communicates with the user, thanking the deposition of the waste and offering content in the form of audio about issues involving the theme of sustainability.

Methodology: To evaluate the prototype, generic brands were attached to it as the device's sponsors. A QR code system was also implemented in the prototype, which, after being accessed by the user, would lead the user to a website in which objectives of the project were reported. The prototype was set in public squares and places strategically chosen due to people's traffic. After installation, the artifact was monitored, and its efficiency was evaluated concerning the impact caused on the prospected local community. To verify users' preference, the device was installed in each studied location, next to a conventional wastebasket provided by the city.

Main results: Through the analyses, it was possible to verify the preference for using the prototype concerning conventional dumps. Users were also attentive to the brands disclosed, which indicates that the device under study

Theoretical/methodological contributions: This way, it can be figured out that the obtained data are adherent to the Theory of Fun postulates, and the studied bin can realize as an example of equipment designed for interaction with the users and, at the same time, disclosing to them information about sustainability

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Social/management contributions: The prototype can also be used as an educational tool in elementary schools.

Keywords: Selective Collection; Creative Economy; Solid Waste; Sustainability, Theory of Fun.

Resumo

Objetivo: Esta pesquisa apresenta a construção e avaliação de um dispositivo de reciclagem projetado com base na Teoria da Diversão para coleta de resíduos plásticos.
Originalidade/relevancia: Esse dispositivo consiste em um “lixão” instrumentado que, após seu uso, se comunica com o usuário, agradecendo a deposição do resíduo e oferecendo conteúdo em forma de áudio sobre questões que envolvem o tema da sustentabilidade.
Metodologia: Para avaliar o protótipo, marcas genéricas foram anexadas a ele como patrocinadoras do dispositivo. Também foi implementado um sistema de QR code no protótipo, que, após ser acessado pelo usuário, levaria o usuário a um site no qual os objetivos do projeto eram relatados. O protótipo foi montado em praças públicas e locais estrategicamente escolhidos devido ao trânsito de pessoas. Após a instalação, o artefato foi monitorado e sua eficiência avaliada quanto ao impacto causado na comunidade local prospectada. Para verificar a preferência dos usuários, o dispositivo foi instalado em cada local estudado, próximo a uma lixeira convencional fornecida pela prefeitura.
Resultados principais: Através das análises, foi possível verificar a preferência pelo uso do protótipo em relação aos lixões convencionais. Os usuários também ficaram atentos às marcas divulgadas, o que indica que o aparelho em estudo
Contribuições teóricas/metodológicas: Desta forma, pode-se perceber que os dados obtidos são aderentes aos postulados da Teoria da Diversão, e a caixa estudada pode se apresentar como um exemplo de equipamento projetado para interação com os usuários e, ao mesmo tempo, divulgar a eles informações sobre sustentabilidade
Contribuições sociais/de gestão: O protótipo também pode ser usado como ferramenta educacional em escolas de ensino fundamental.

Palavras-chave: Coleta Seletiva; Economia Criativa; Lixo sólido; Sustentabilidade, Teoria da Diversão.

Resumen

Objetivo: Esta investigación presenta la construcción y evaluación de un dispositivo de reciclaje diseñado con base en la Teoría de la Diversión para recolectar residuos plásticos.
Originalidad/relevancia: Este dispositivo consiste en un "vertedero" instrumentado que, después de su uso, se comunica con el usuario, agradeciendo el depósito de los residuos y ofreciendo contenido en forma de audio sobre cuestiones que involucran el tema de la sustentabilidad.
Metodología: Para evaluar el prototipo se le adjuntó marcas genéricas como patrocinadoras del dispositivo. En el prototipo también se implementó un sistema de códigos QR que, luego de ser accedido por el usuario, lo conduciría a un sitio web en el que se informaban los objetivos del proyecto. El prototipo fue instalado en plazas públicas y lugares elegidos estratégicamente debido al tránsito de personas. Después de la instalación, se monitoreó el artefacto y se evaluó su eficiencia en relación con el impacto causado en la comunidad local prospectada. Para verificar la preferencia de los usuarios, el dispositivo se instaló en cada lugar estudiado, junto a una papelera convencional provista por la ciudad.
Resultados principales: A través de los análisis, fue posible verificar la preferencia por el uso del prototipo con respecto a los botaderos convencionales. Los usuarios también estuvieron atentos a las marcas divulgadas, lo que indica que el dispositivo en estudio
Aportaciones teóricas/metodológicas: De esta forma, se puede constatar que los datos obtenidos se apegan a los postulados de la Teoría de la Diversión, y el bin estudiado se puede realizar como un ejemplo de equipo diseñado para interactuar con los usuarios y, al mismo tiempo, revelarles información sobre sustentabilidad.
Contribuciones sociales/de gestión: El prototipo también se puede utilizar como herramienta educativa en las escuelas primarias.

Palabras clave: Recogida Selectiva; Economía Creativa; Residuo sólido; Sostenibilidad, Teoría de la Diversión.

1 Introduction

The fast growth rates of consumption favored by the economy and manufactured products getting cheaper every day have led to the production of significant amounts of Urban Solid Wastes (USW) and several other types of environmental impacts (Paschoalin Filho & Graudenz, 2012).

To Deus, Afonso, and Afonso (2014), modern society is based on a consumption premise. The authors state that different industrial sectors are taking advantage of this situation, however, the consumption growth may bring about many environmental concerns. With the consequence of an increase in consumption at the society level, many solid wastes are produced by people around the world. This situation leads to a global environmental problem that is getting more difficult to solve by the day and can be linked mainly to a lack of environmental awareness. Thus, an available tool to mitigate the environmental impacts caused by consumption must be based not only on economic aspects but also on peoples' awareness of the environmental, considering that they are the only ones responsible for consumption.

Streimikiene and Kacerauskas (2020) notice several necessary studies dealing with Creative Economy (CE) and its implication to sustainable development. As quoted by the authors, economic sustainability is closely related to creative industries. Even established companies must perform their practices fitting on the triple bottom line concepts, as argued by Elkinton (1997). Gouvea et al. (2020) who state that environmental and social well-being must be addressed through business practices.

In recent years, the CE concept has been gathering the attention of policymakers, entrepreneurs, and academic researchers. Much of this interest comes from two linked ideas: that the creative activity clusters into creative urban neighborhoods; and that urbanized culture and creativity provide local economic wealth (Kemeny, Nathan & O'Brien, 2019). Many scholars have suggested that entrepreneurship may enhance sustainable development because entrepreneurship offers solutions to environmental matters and leads to sustainable economic growth (Sun et al., 2020).

The Creative Economy concepts can provide many more business opportunities related to jobs and the generating of wealth. Even small actions can provide a better occupancy of urban space, changing the cities into better structured communities. As mentioned by Florida (2017), creative business can be seen not only as an economic theory; but also as a tool for urban development.

It is essential to realize that the link between environmental concerns and CE concepts does not depend only on economic and ecological aspects but also on consumers' behavioral changes. People must feel responsible for their consumption and their solid waste destinations. This way, an innovative product must be designed to meet all of these concerns.

As to consumers' awareness and behavior change, the Theory of Fun concept addresses the idea that it is easier to change a person's behavior for the better by using fun tools and methods. As quoted by Montazeri et al. (2013), the Theory of Fun was presented first by Volkswagen Corporation and was used on a marketing campaign. According to the authors, the Theory of Fun encourages behavior change by allowing people to see the fun side of mundane, everyday activities.

According to Chapell (2015), a product developed under Theory of Fun concepts must call on the user's emotional response. The user must feel motivated to keep using the product because the enjoyable and fun moments it gives to him or her. This phenomenon is known as "emotional engagement" (Chapell, 2015). The user's emotional engagement can lead the user to a significant behavior change (Chapell, 2015).

To Donoff and Bridgman (2017), humans have an innate playfulness, which extends throughout our lifecycle. Urban Ludic Interventions (ULI) challenge standard approaches to environmental design by acknowledging the fundamental connections between physical environments and our mental, physical and social selves. As quoted by Donoff (2014, p 66): *"Urban Ludic Intervention describes a design or addition to the urban form that provides an alternative to adult pedestrian conventions by inspiring happiness and playful interaction with the urban environment."* Urban Ludic Interventions (ULI) may inspire social connections between people who share the same urban space.

Waern (2016), Janson (2016), Nijholt (2017), and Donoff and Bridgman (2017) notice the Urban Ludic Intervention called Piano Staircase. This intervention has encouraged subway passengers to use the stair as a way in and out of a station instead of the escalator. The intervention has led the users to an idea of the need to practice more physical exercises. Each stair step worked as a piano key, and every time a passenger stepped on the stair, a musical note was heard.

The "world's deepest trash bin" was another urban intervention stated by Janson (2016) and Montazeri et al. (2013). This intervention was the primary goal to stimulate pedestrians to throw recyclable waste into proper trash bins. When a user disposed of his garbage into the

trash bin, a sound like waste falling into a deep abyss was heard. Sometimes, an explosion sound also could be heard by the users.

Nijholt (2017) talks about another intervention performed in the German town of Hildesheim. In that city, pedestrian traffic lights have been equipped with devices that allow the pedestrians to play a game of "Pong" while waiting for the green light to cross the street. The game device was attached to the pedestrian traffic light posts. The device had a touch screen that allowed the player to interact with the game with his finger, playing against another player who is also waiting to cross the street on the opposite side.

It must be pointed out that many of these urban interventions have been part of the ad campaign of many companies such as Volkswagen (Montazeri et al., 2013), Daimler (Nijholt, 2017), Toyota (Montazeri et al., 2013) and others.

Gamification is about taking the essence of games – fun, play, transparency, design, and challenge – and applying it to real-world objectives rather than pure entertainment. In business contexts, gamification refers to design products and services to provide game-like experiences to create value and to prompt more positive responses from consumers.

Janson (2016) points out another device, called "the Bottle Bank Arcade" (Figure 3). This device was a bin for recyclable glass waste collection. It was equipped with lights that blinked each time a bottle was thrown into the container. The more glass waste the user dumped into the bin, the more points he earns. The authors noted that in only one night there was collected about 19kg of glass wastes. In contrast, usual bins set near the device collected less than 2,0kg each.

For this research, an electronic bin for plastic solid waste collecting was designed and assembled based on the Theory of Fun, Gamification, and ULI concerns. The device was set in public areas such as parks, bus terminals, and squares. When a user threw his plastic waste into the bin, the device automatically performed a prize drawing. The electronic bin also disclosed sustainable messages in its led display. To get people's attention, the electronic bin played known music such as movie soundtracks pieces.

To fit the electronic bin into the Creative Economy concepts, hypothetical sponsor brands were represented on the device. A QR code for a website was also created and displayed on the container. On the website, information about the research and the importance of selective collecting and recycling was posted. The daily amount of collected solid plastic wastes through the bin and their destination were also presented on the website. The hypothetical sponsors' brands were disclosed on the website.

To get the opinion about the electronic bin and how the experience of interacting with it was, interviews were performed with the users. The answers were transcribed later and analyzed by statistical qualitative and quantitative methods.

2 Materials and methods

2.1 Interviews and Analysis Performed.

For the interviews, supporting a script was defined early on by the researchers. The questions had as its goal the users' opinion about their interaction regarding the electronic bin, if they took notice of the sponsors' brands, and if they used the QR code. The interviews were recorded (with user's authorization) and later transcribed. The interview script is shown in the following table.

Table 1

Interview script

Questions	Main Goal
1. What motivated you most to use the bin?	Identify what highlighted most with regards to the electronic bin compared to the regular trash bins.
2. What trash bin's characteristic got your attention most?	Check which items were more efficient in attracting the users' attention.
3. What do think about performing unusual acts to disclose sustainability information?	Identify whether the user understood the purpose of the trash bin.
4. What trash bin's characteristic got your attention less?	Identify points that could be changed in the electronic bin design.
5. After using the bin, do you intend to comment on it to your relatives and friends?	Check if the interaction between the user and the electronic bin has aroused interest.
6. Did you enjoy the interaction with the electronic bin?	Get an overview of the experiment.

Source: The Research.

Once transcribed, the contents of the interviews were analyzed using the computer software Iramuteq. Iramuteq is a free software developed under open-source software licenses (Ratinaud, 2014). According to Ratinaud (2014), the dichotomy between qualitative and quantitative analysis does not exist in Iramuteq since this software uses statistical calculations on the texts, which are qualitative materials. This program is anchored in the R software and

the python language's statistical environment. The following analyses were performed with Iramuteq:

a) Basic Lexicography - classic textual statistics: the frequency of words in the text segment was analyzed. A vocabulary was constructed, including the words' frequency, and then subjected to statistical analysis (Ratinaud, 2014). Searches for words which relied on stemming (Ratinaud, 2014).

b) Descending Hierarchical Classification (CHD): the words found in the text were organized in classes according to their common themes, giving rise to dendrograms. Iramuteq analyzes the text segments to identify different vocabulary and to know which ideas are transmitted by the textual corpus. The analysis is done through statistical logic, taking into account the words' root in a lexical way. The classes are presented in different colors, where the lilac color represents the active shapes, the blue color represents the supplementary forms, and the red color represents the explanatory variables.

c) Similitude Analysis: This analysis resembles a tree root, with words in their branches, close to the words found in the content. This analysis depicts a graphic representation of the connections between words in the textual corpus. With this analysis, based on graph theory, it is possible to visualize how often the word appears in the text together with its relationship with the sentence structure. This can assist the researcher in distinguishing between the standard and non-common parts of the texts.

2.2 Electronic Trash Bin Description

The electronic trash bin was painted red, and on each side was fixed one box to contain prizes. On the cover of the bin, a led display was positioned. On this display, messages about sustainability and the importance of recycling and selective collection were showed to the users. The display also informed the users if they had won a prize from the drawing and noted the total amount of plastic waste collected up to the interaction moment. On the back of the bin, a sound box was set to play funny sounds during the drawings and some music to catch the pedestrians' attention. Every ten minutes, the bin's recorded message was played, inviting people to interact with it. An electronic sensor installed on the bin-cover pointed out to the user

when the device was full. After that, a message asking the user to inform the bin maintenance staff appeared on the led display.

Aiming to verify if the users would notice possible sponsorship of companies. Some spaces were available on the bin, and different hypothetical company brands were fixed on it, pointing out that brands were sponsoring the bin. A QR code was also created to be used by the users. When someone took a picture of the QR code, a website was automatically opened on the cellphone. Several pieces of information about the research, the bin's goals, the total amount of collected waste, and their destination could be found on the website. A space for the sponsors' disclosure was also presented on the website. The user could register some information (name, age, gender, phone number, and email) to get news about sponsor's promotions, updates of the research, etc. Figure 1 and 2 shows the device on location and the research path used to perform the studies.

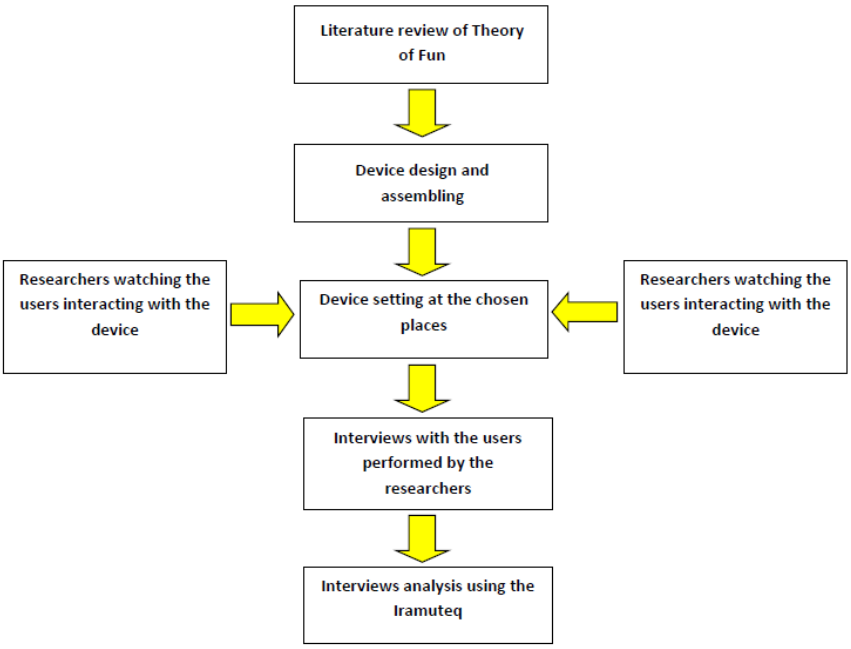
Figure 1

Electronic trash bin positioned at a Public Park

Source: The Research.

Figure 2

Research path



Source: The Research.

3 Results and discussion

The interviews were performed between July and November of 2020 with 51 users. Concerning gender, the majority was male (63%), with ages between 5 to 78 years old. The number of interactions at each place that the device was positioned is shown in the following table:

Table 2

Number of interactions for each place that the electronic bin was installed

	Local/Date	Staying time	Number of people	Number of people who interacted	Number of prize drawings	Mass of collected waste (g)
1	Bus Terminal. City of Jandira - 07/13/2020	10:30am to 11:30am	210	12	4	9
2	Elias Barjud Square – City of Jandira 07/17/2020	09:50am to 11:30am	136	75	21	962
3	Elias Barjud Square – City of Jandira 07/25/2020	09:50am to 11:50am	208	116	17	1633

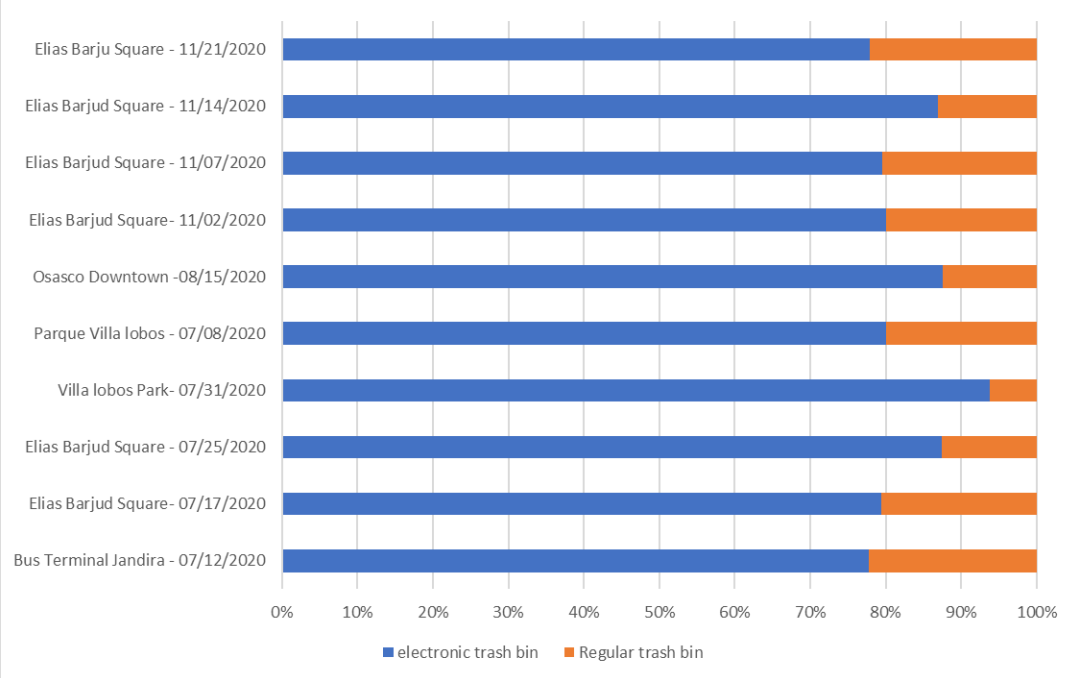
	Local/Date	Staying time	Number of people	Number of people who interacted	Number of prize drawings	Mass of collected waste (g)
4	Villa Lobos Public Park – City of São Paulo 07/31/2020	10:30am to 12:30am	41	2	1	13
5	Villa Lobos Public Park – City of São Paulo 08/0/2020	3:50pm to 4:50pm	82	8	0	25
6	City of Osasco Downtown 08/15/2020	1:30pm to 3:00pm	380	36	19	262
7	Elias Barjud Square – City of Jandira 11/02/2020	09:00am to 11:00am	48	6	2	120
8	Elias Barjud Square – City of Jandira 11/07/2020	9:30am to 11:00am	140	36	1	36
9	Elias Barjud Square – City of Jandira 11/14/2020	2:00pm to 4:30pm	288	75	37	1853
10	Elias Barjud Square – City of Jandira 11/21/2020	12:25 to 14:30	416	163	64	1316
	Total		1.949	529	166	6.229

Source: The Research.

As noted in Table 1, 1949 people passed by the places where the electric trash bin was set. Regarding this amount, almost 530 people interacted with the studied device, and the performed drawings giving out 166 prizes. The total amount of collected plastic waste was 6.22kg. The electronic bin was set near regular trash cans provided by the local government. The following chart shows that the percentage of mass waste thrown into the electronic bin was many times superior to the percentage of waste dumped into the regular trash cans.

Figure 3

Comparison between percentages of plastic waste through into electronic trash bin and regular ones

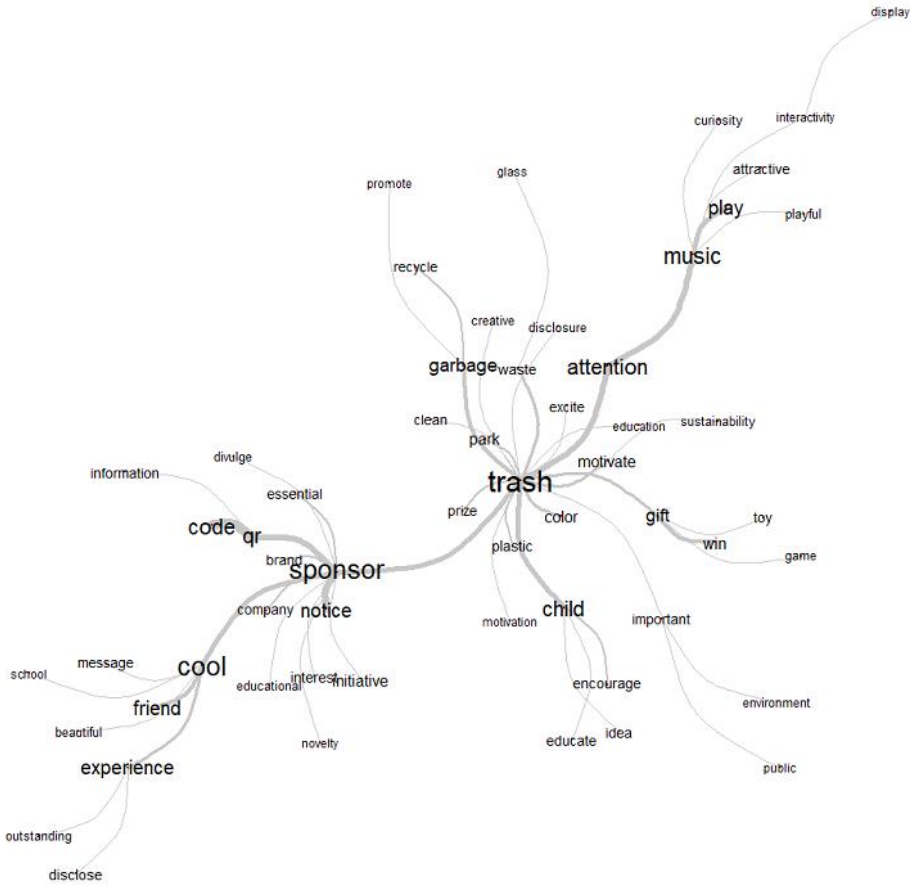


Source: The Research.

The results of the analysis of the transcribed text of the interviews show that the words that were most often mentioned were, "trash," "sponsor," "attention," "music," and "cool." Figure 4 represents an analysis of similitude carried out to obtain a correlation between the interviewee's words.

Figure 4

Similitude contents analysis of all interviews considering words' interrelation -The thickness of the connecting lines indicates the strength of the interrelation between words



Source: The Research.

The most central word in Figure 4 was "trash." It may be observed that this word has lots of correlations (with different intensities). The strongest observed interrelation was between the words: "attention," "music," and "sponsor," pointing out that the music played by the device caught the users attention and the sponsor's brand was also perceived.

The word "sponsor" showed correlations with "QR code", "notice", "company", "essential", "educational", "novelty", "initiative", "brand", "interest", and "divulge". These words' association can show that the users perceived the sponsorship and highlighted the device as an educational initiative. The words "QR code" and "information" were also linked to

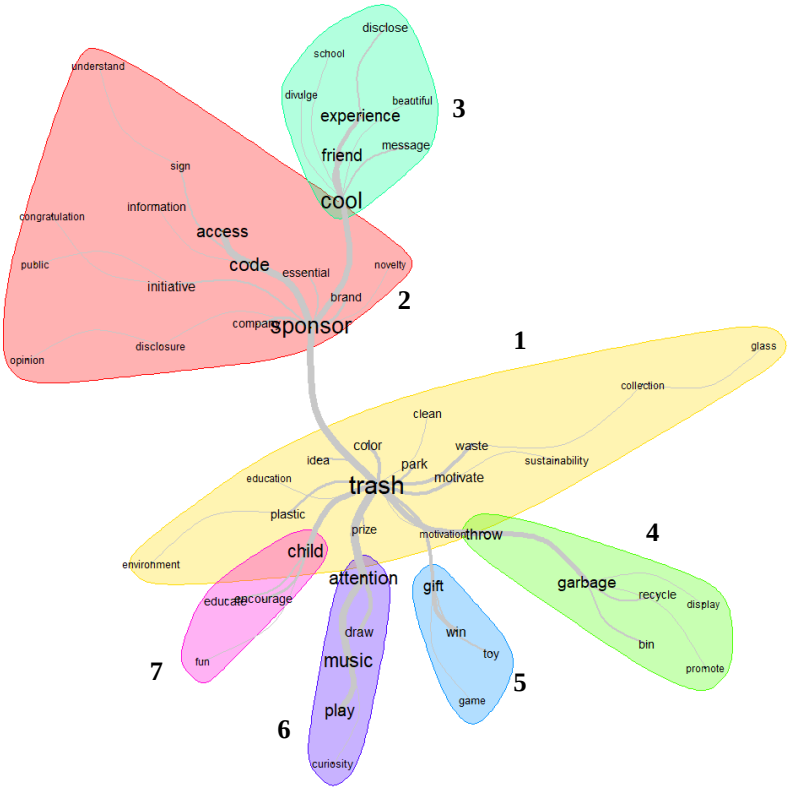
"sponsor," showing that the users perceive the QR code as a tool to get more information about the disclosed brands and other kinds of information.

About the word "cool" (that presented a strong relation with "sponsor), the main words that it is linked to are: "friend" and "experience," other words like "disclose," "message," "school," are also linked to "cool"; however, with less intensity. Based on this, it can be perceived that the users saw this as a cheerful way for the device to disclosed the messages.

Among many words, the main ones that are related to the word "trash" are: "plastic", "color", "waste", "prize" and "gift". This relation reveals that the users formed a relationship between the role of the device and the opportunity to win prizes by dumping their plastic wastes. Although the words "recycle" and "sustainability" were linked to the word "trash," this relationship was not strong. This way, it could be stated that the users were more highly motivated by the gaming aspect provided by the device than by a sustainablity awareness. Figure 5 presents the similitude analysis performed by Iramuteq, made by clustering the analyzed words.

Figure 5

Similitude contents analysis of all interviews considering words' clustering



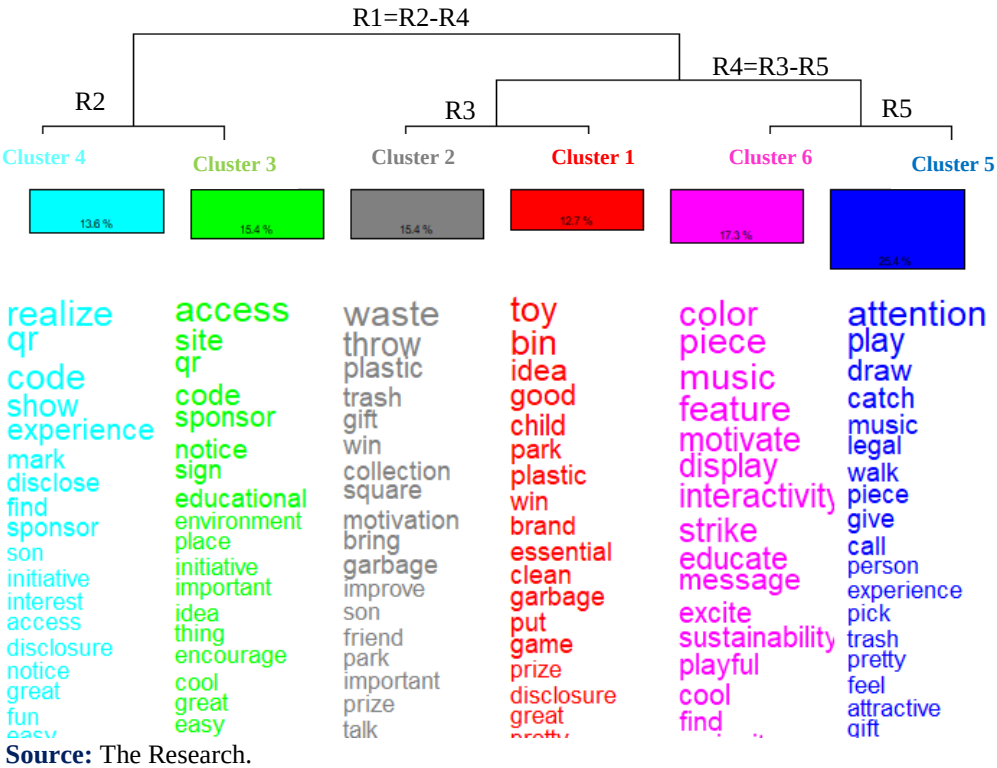
Source: The Research.

As shown in Figure 5, the words "sponsor," "trash," and "cool" were stated more than the others. The more prominent the word, the more representative it was in the analysis performed. It can also be stated that the relationship between them was more substantial as well. The analysis obtained seven clusters, and each one joins words that had the most relationship with the highlighted words in the cluster. The clusters represented by the words "sponsor" and "trash" were got a bigger size when compared to the others. These two clusters are also bonded with other minor clusters, which shows a relationship among them. Cluster 2 had a relationship with cluster 3. This relationship points to the device's importance for the sponsors' disclosure in a "cool" way. Cluster 1 is linked to clusters 4, 5, 6 and, 7. These relationships point to the use of the device for plastic waste dumping, the importance of the electronic trash bin as an educational tool for children's awareness, and the fun aspects of its usage, represented by the music played and the prize drawings performed.

Figure 6 shows word grouping by different clusters according to their meaning using the Reinert's method performed by Iramuteq. Below each cluster, the more prominent words correspond to those that were mentioned more frequently. To create the dictionary of words used in each cluster, Iramuteq has performed the chi-squared statistical test (chi2), revealing the associated strength between words and their respective cluster.

Figure 6

Cluster analysis by Reinert's method performed by Iramuteq



Source: The Research.

The relationship between clusters 5 and 6 (R5) was presented as the most representative in comparison to the other clusters (R5=42.7%; R3=28.1%; R2=29%). The words gathered in clusters 5 and 6 can be seen as the motivations noticed by the device users. Although the device had disclosure messages about the importance of recycling and environmental concerns, the word "sustainability" showed very little relevance. The relationship R2 (between clusters 4 and 3) was the second most representative. The words joined by R2 can be realized as the sponsors' role and how it performed its brand disclosure. Words such as "access", "QR code", "disclosure". "educational", "environment", and "notice" bring to light that the users viewed the sponsors as someone that provided a different mean for environmental tips. This way, it can be realized that the users linked the sponsor to the idea of environmental care. The words gathered by the relationship R3 (waste, toy, bin, plastic, throw, and others) tell how the users characterized the device. The most representative words of R3 describe the device's usage and its physical characteristics. This way, taking into account the analysis described above, the relationship R4 (R3-R5) notice the device's physical characteristics and the motivation aspects that influenced the people to use it. The design of the device and the places where it was set up were essential for the people to notice the device and use it to dump their plastic wastes. People were more interested in using it for the game and music than from environmental awareness. The R1 (R2-R4) relationship brings to light that the user highlighted how the messages disclosing were performed by the device. Figure 7 shows a cloud word analysis based on the users' speeches. The more the word is repeated, the more prominent the word is within the cloud.

Figure 7

Cloud word analysis

Source: The Research

As shown by Figure 7, the words "trash," "sponsor," and "cool" were the words repeated most. Other words were also boldened but on more diminutive size, pointing out their importance. On the whole, it can be shown that people were engaged to use the device (dumping their trash into it) due to its music and gaming (prize drawings), which led the users to a "cool" experience. The people also noticed the sponsors and pointed the importance of them on making this initiative possible. Once again, even the people feeling motivated to dump their wastes into the device, this behavior can be linked more to interest to join the game itself than by environmental awareness. Even with users realizing the importance of selective collection and recycling, they were engaged more by the device's novelty than by their awareness about sustainability concerns. This situation can be stated by verifying that the word "sustainability" was the one that presented less relevance within the cloud word chart.

The Theory of Fun seems to be effective even while the product is novel and intrigues the users' curiosity. When the intervention is removed, people may return to their previous behavior (Montazeri et al., 2013). Keeping the user's highly motivated could be difficult. Without incentives, the user might stop using the product, losing its characteristic as an innovative product. Once the device is permanently fixed in different public places such as

plazas, parks, bus stops and other locations, this will surely be considered an example of Ludic Urban Intervention based on the characteristics quoted by Waern (2016), Janson (2016), Nijholt (2017), and Donoff and Bridgman (2017). Facing this situation, gamification as part of urban interventions as an incentive for its use can be highlighted.

During the tests, 51 interviews were conducted, most of them showed positive opinions about the device, stating that they found the equipment interesting. According to the opinions presented in the interviews, music was the main factor that caught the public's attention. Some users also highlighted the importance of initiatives like this being promoted through public agencies or sponsored by companies. According to some, companies need to demonstrate that they are also concerned with consumers' quality of life and not only with their profits.

> "The most prominent feature is the color, which is very striking and very beautiful. I found interacting very cool, especially for children. The most striking feature was the songs. I noticed the sponsors, I don't know them, but it is very good that companies sponsor this type of initiative. I think it's important that companies begin to realize the importance of environmental concerns and how it can influence the standard of living of our society." #**Interviewee 32 - Man.**

> "The display and the songs. The most striking features are music and the colors of the trash bin. This playful interactivity encouraged our son to pick up trash and bottle caps to throw it in the trash. The most attractive are the songs and the drawings". #**Interviewee 39 - Woman.**

> "The most attractive feature is the display (I had not seen anything like this. It's very different). I will show it to my friends and family. I found it to be a sensational experience, very cool. I saw that there were sponsors on the trash can lid; I don't know them. However, I think their initiative with this project is very important. I will try to get to know them better". #**Interviewee 50 - Man.**

Most respondents reported that they did not know any device like the device presented. Both adults and children returned to the device more than once to play again with the incentive of winning a gift, making it clear that the theory of fun and gamification was efficient in motivating these users.

> "The songs are cool; I've never seen anything like this before. The colors also made it very different. Cool, winning prizes was very smart and caught a lot of attention. I will tell my friends and I even took pictures. I saw that it had sponsors, but I don't know them". **Interviewee #19 - Man**

At some point, some people spoke up, showing their intention to separate materials in their homes to return to use the device again. According to some of those interviewed, this type of equipment should be installed in different locations of the cities, replacing part of the dumps currently used by the municipal government, mainly in public places of leisure, like squares and parks.

"It was the songs that caught my attention. Music is the most interesting feature. I think the sweepstakes are cool. I think the playful way it is presented is exciting. I wish there were others like it in other places in the city". **Interviewee #45 - Man.**

"I found the experience to be very technological, and it should be done in more places. It should be placed all over the city because people have nowhere to throw garbage, and that is why we have garbage scattered around." **Interviewee #25 – Woman.**

4 Conclusions

The concept of the Creative Economy could be verified in the relationships that the users showed interest in the sponsoring brands and the curiosity to know more about them. In this way, these factors are an indication that the device could become a product available on the market, in which, through the commercialization of spaces for disclosure, both on the website and on the device itself, can generate financial value to booster continuity and expansion of the project in other places.

Furthermore, as shown in the analyzes, there is also the possibility that the sponsoring companies have their images linked to the concern with the adoption of principles based on the concept of sustainability, such as selective collection, waste separation, and concern with regards to waste disposal.

The device managed to attract users' attention. It made it possible in all the places where it was installed, for greater masses of plastic waste to be collected compared to the nearby conventional trash bins installed by local government, demonstrating a preference for the studied prototype.

However, according to the analyses, users' preference in using the prototype was much more motivated by the music, fun appearance, and the performed games (prize drawings) than by an environmental motivation reason. Based on this, it is concluded that rewarding the user for action was efficient, highlighting the importance that gamification used by the equipment had on the users' action. However, it should be noted that the electronic device was designed so that, through its fun aspect and interaction with the user through music and games, it could function as a vehicle for the dissemination of messages that encourage the use of positive attitudes concerning selective collection and recycling. It is noteworthy to point out that the change in an individual's behavior, mainly dealing with broader environmental issues, is a holistic process, which is also based on cultural, educational, and economic aspects, among the users.

This way, it can be realized that the observed behavior of the users about the prototype and their motivation for using it was adherent to the Fun´s Theory postulates. In the first

moment, the users were encouraged to use the prototype due to its fun aspect and interaction facets; at the same time, the users described (as pointed out by the interviews) the importance of recycling and waste selective collection. The regular trash bins placed in all of the studied locations were less preferred than the studied prototype because of the fun interaction provided by the prototype to the users.

It was also found that the equipment can be a promising tool for propagating the concept of Urban Ludic Interventions since users, in addition to highlighting the playful character of the equipment, suggested installing it in different locations in the city. It is noteworthy that, more than scientific research, this project has a high profile of technological innovation, presenting a potential to be explored.

Authors' contributions

Contribution	Paschoalin Filho, J. A.	Bottan, G. T.	Mesch, G.	Guerner Dias, A. J.	López-Peréz, J. F.	Silva Neto, W. L. B.
Contextualization	X	---	---	---	---	---
Methodology	X	X	---	X	X	X
Software	X	---	---	---	---	---
Validation	X	---	X	X	X	X
Formal analysis	X	X	---	---	---	---
Investigation	X	X	---	---	---	---
Resources	X	X	---	---	---	---
Data curation	X	---	---	X	X	X
Original	X	X	---	---	---	---
Revision and editing	X	---	X	X	X	X
Viewing	X	---	X	X	X	X
Supervision	X	---	---	---	---	---
Project management	X	---	---	---	---	---
Obtaining funding	X	---	---	---	---	---

References

Chapell, B. (2015). Sustainability + fun = a change in behavior. Environment, Ethics, and Cultures. *Sense Publishers*, p.271-284. https://doi.org/10.1007/978-94-6209-938-8_18

Deus, F.G.S, Afonso, B.P.D.,Afonso T. (2014). Environmental awareness, attitudes, and intention to use non-recyclable plastic bags. *Revista de Gestão Ambiental e Sustentabilidade*, v. 3, n. 1, p. 71-87, 2014. https://doi.org/10.5585/geas.v3i1.112

Donoff, G, Bridgman, R. (2017). The playful city: constructing a typology for urban design interventions. *International Journal of Play*, v.6, n.3, p.294-307. DOI: 10.1080/21594937.2017.1382995.

Donoff, G. (2014). Plan for a playful city: A typology of ludic ways to increase pedestrian activity (Master's thesis). Department of City Planning, University of Manitoba. Retrieved from http://mspace.lib.umanitoba.ca/handle/1993/23953. Accessed in February 2021

Elkinton, J. (1997). *Cannibal with forks: the triple bottom line of 21st-century business*. Oxford: Capstone.

Florida, R. (2017). *The new urban crisis. How our cities are increasing inequality, deepening segregation, and failing the middle class and what we can do about it*. Nova York, Basic Books, 2017.

Gouvea, R., Kapelianis, D., Montoya, M.J.R., Vora, G. (2020). The Creative Economy, innovation, and entrepreneurship: an empirical examination. *Creative Industries Journal*. https://doi.org/10.1080/17510694.2020.1744215

Janson, M. (2016). The Gamification of Recycling Behaviour. (Master's Thesis) The University of Waikato, Hamilton, New Zealand. Retrieved from https://hdl.handle.net/10289/10875

Kemeny, T., Nathan, M., O´Brien, D. (2019). Creative differences? Measuring Creative Economy employment in the United States and the UK. *Regional Studies*. https://doi.org/10.1080/00343404.2019.1625484

Montazeri, S., Finkbiner, P., Papalambros, P., Gonzalez, R. (2013). Save a napkin, save a tree: The role of metaphors in product design to change behavior. *International Conference on Engineering Design*, ICED 13. Korea. 10p.

Nijholt, A. (2017). Playable cities: A short survey. 6th International Conference on Informatics, Electronics, and Vision and 2017 7th *International Symposium in Computational Medical and Health Technology*, ICIEV-ISCMHT 2017. 6p.

Paschoalin Filho, J.A., and Graudenz, G.S. (2012). Irregular disposal of construction and demolition waste (CDW) and its impacts on public health. *Revista de Gestão Social em Ambiental*, v.6, n.1, p.127-142. https://doi.org/10.24857/rgsa.v6i1.421

Paschoalin Filho, J.A.; Ghermandi, A.; Guerner Dias, A.J.; Luz, E.G.; Cortese, T.T.P (2020) Stakeholder views of source separation collection programme in East São Paulo, Brazil. *Waste Management & Research*, v.39, n.01, p.1-8. https://doi.org/10.1177/0734242X20972774

Ratinaud, P. (2014). *Iramuteq: Interface de R pour les Analyses Multidimensionnelles de Textes et de Questionnaires* - 0.7 alpha 2. Recuperado de http://www.iramuteq.org

Streimikiene, D., Kacerauskas, T. (2020). The Creative Economy and sustainable development: The Baltic States. *Sustainable Development*, p.1-10. https://doi.org/10.1002/sd.2111

Sun, H., Pofoura, A.K., Mensah, I.A., Li, L., Mohsin, M. (2020). The role of environmental entrepreneurship for development: Evidence from 35 countries in sub-Saharan Africa. *Science of the Total Environment*. https://doi.org/10.1016/j.scitotenv.2020.140132