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How to Gamify E-Government Services?: A Taxonomy of Game Elements

Keywords

Gamification, Taxonomy, user profile, Game elements

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How to Gamify e-government services?

A Taxonomy of Game Elements

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Abstract—Gamification has been employed in e-government services domain over the past twenty years. The literature shows that gamification still lacks formal definitions to support the design of gamified strategies in e-government platforms and services. This document displays a taxonomy of game elements for e-government services. Authors first identified and analysed the game elements commonly employed by gamification frameworks and models focused on e-government services. Next, researchers determined a taxonomy composed of gamification elements for e-government services. The gamification elements are: Reputation, Competition, Cooperation-Team, Social interaction, Progress bar, Reward-prize, Level, Badge, Point, Ranking-Leaderboard, Mission, Puzzle, Goal, Customization, Emotion, Vote, User profile, Player roles, Stories, Avatar, Rule, Lifetime, Economy, Imposed Choice-Action, Forum, Chat, Share, Post, Emoticons and Location tagging. All these game elements were collected from the literature. Next, to evaluate the taxonomy, the authors conducted workshops, in 3 rounds, with 19 gamification experts to evaluate the taxonomy. The proposed taxonomy, with 30 game elements, was well accepted of the experts because helps to standardising the game elements employed in e-government services. Authors also believe that the taxonomy created can be used within most existing frameworks, since its definitions cover most of the elements that exist in previous frameworks in e-government services.

Keywords: gamification; taxonomy; user profile; game elements; e-government

1. Introduction

E-government is the way of providing services via online platforms to the citizens and the e-participation facilitate the communication between citizens and public administration. It is divided between political participation, where citizens engage in public affairs with the aim of influencing political outcomes (Brady, 1999), and civic participation where citizens act for the public good (Thiel, 2017). In general, success of the platforms dependent on the goals and objectives of participation, for that reason gamification as a strategy has been used in e-government (Hollebeek, 2011), but before has been used successful in many domains such as healthcare (Johnson, Deterding, Kuhn and Staneva, 2016), education (Nah, Zeng, Telaprolu, Ayyappa and Eschenbrenner, 2019), transportation (Yen, Mulley and Burke, 2019), among others, where gamification components can be integrated into platforms or services.

One of the main goals of gamification in e-government services is to increase user motivation and engage citizens as active players through actions that facilitate activities such as to take part in the public conversation, give feedback to possible local government decisions or actively meet common objectives. Because gamification in the context of civic engagement is a possible means to positively influence active participation on online civic platforms (Coronado Escobar and Vasquez Urriago, 2014).

The review of literature highlights that the majority works focused on the inclusion of gamification in e-government services does not follow a methodology in order to quantify the impact of the implementation of gamification elements, but even, gamification elements selection depends on the designer's expectations (Contreras-Espinosa and Blanco, 2021). Gamification is still a relatively emergent area of scientific enquiry, and consequently there is a lack of understanding of how such goals could be materialized (Hassan, 2016). For example, Bista, Nepal, Paris and Colineau (2013) proposed the implementation of game elements over an online community for young people that are transiting from parental support towards economical emancipation in an e-government interaction and service called Next Step. Next Step is a service provided by the Australian Department of Human Services that allows enables transactions between citizens and the management of the service itself. The designers and authors of this work included basic game elements as points and rankings, but without a previous analysis to select the elements or any post-analysis to evaluate the game elements in the service. The designers were who define the game elements. This is an example of the present demand for a taxonomy or tools that can suggest the gamification elements more appropriate to public services, since a variety of elements were chosen without establishing an explicit relationship with the objectives to be achieved and on the designer's expectations. Another example is Blazhko, Luhova, Melnik and Ruvinska (2017) who addresses citizen stimulation to understand available open government data. The objective of this service is to show the citizens different information that allows to teach concepts and indicators, such as pollution, death rates, etc. The main goal is to improve citizen's information level to encourage and facilitate informed decision-making during elections or other democratic processes like a referendum. To motivate the user, the researchers gamified the service including game elements as points, ranking and rules. In this work occur also a lack of formal criteria to determine which gamification elements to use and what indicators could be useful to assess the utilization of game elements. Once again, this is a confirmation of the lack for a taxonomy of gamification elements and tools to use those elements.

Public servants have interest in using gamification in e-government services, but does not have time or resources to understand the differences and similarities in deciding which game elements are appropriate (Al-Yafi and El-Masri, 2016). Can be noted that a clear distinction between and definition of individual game aspects is still missing (Thiel, 2017) or gamified e-participation is misunderstood in practice, implicating its potential (Hassan, 2016). In consequence, in this chapter researchers present a taxonomy of game elements for e-government services. The authors proposed a taxonomy that was evaluated for gamification experts. Gamification experts participated in the study as a first step towards identify the best game elements for a gamification strategy for e-governments services. According to Ryan, Rigby and Przybylski (2006) gamification is useful as part of the motivational design and can

influence the behavior of the users based on the incentive players receive; therefore, having information regarding motivators can help us with an effective gamification design proposal.

The research starts from the premise: On the fact that there are various gamification frameworks and definitions of game elements, can there be a consensus with gamification experts to construct a taxonomy of game elements for e-governments services? So, the researchers proposed a taxonomy to analyse and evaluate gamified e-government services. The contributions of this chapter include:
-Creating a taxonomy, providing details on the concept, comprehensibility, use and scope of game elements;
-Proposing how to organise game elements semantically, to be used by public servants, designers or other stakeholders.

The main conclusions of this study are implemented in the development of the CO3 project platform that will be tested in three city pilots in Athens, Paris and Turin. This European research project aims at assessing the benefits and risks of technologies in the co-creation, co-production and co-management of public services with citizens and Public Administrations. The project addresses gamified strategies for engage citizens. Citizens will use a platform with different services. Some of the main results and phases of the CO3 project have been published previously, with an extensive literature review on gamified e-government services (Contreras-Espinosa and Blanco, 2021), showing a first draft of the gamification strategy to use (Frisiello, Nhu Nguyen, Chiesa, Contreras-Espinosa, Blanco, 2022) or the participatory design-oriented approach to engage stakeholders in the definition of public services augmented by technologies and gamification in the Athens (Pautasso et al, 2021), but it is necessary to provide more details on the concept, comprehensibility and use of game elements used in the CO3 project.

The chapter is structured as follows. The section two introduces related work. Section three, the materials and methods to conduct the study. Section four describes the results. Section five presents the discussion. Finally, section six shows the conclusions and future works.

2. Related works

2.1 Gamification frameworks

Gamification of e-participation induce increased user engagement with the government as is intended from the introduction of the e-participation (Devisch, Poplin and Sofronie, 2016). So, to facilitate the design of gamified systems, studies have proposed different gamification frameworks. The most well-known are:

- **Mechanics-Dynamics-Aesthetics (Hunicke, Leblanc, & Zubek, 2004):** A model composed by the game mechanics, which are the basic actions that players can take in a game, responses, algorithms, stored data, etc. Game dynamics are the run-time behavior of the previously defined mechanics in response to the player input and to the interaction among other types of mechanics. Lastly, game aesthetics are the emotional responses produced in the player.

- Six Steps to Gamification (Werbach & Hunter, 2012): Based on six points; (1) define the objectives that you want to achieve, (2) delineate the target behaviors that you expect from the users, (3) describe your players' profile (interest, what drives them), (4) devise activity loops (the process that the users have to follow), (5) don't forget the fun (think what make your users return) and (6) deploy the appropriate tools (how the interaction will be measured, score systems, badge assignments, etc.).
- Gamification model canvas (Jiménez, 2013): Gamification Model Canvas is a flexible and agile tool that enables representing in a single page all the necessary elements, tasks and expected results of the gamified environment.
- GAME (Marczewski, 2013): The framework has four components: (1) gather what information will be collected, (2) design the best solution for your goals and the experience of your users based on the information that you have (3) monitor the user activity and goals, iterate improvements and (4) enrich your solution over time to match the changes in society. This methodology evolved into the RAMPS motivation model and, later, into the User Types Hexad Scale, which is used to identify the types of users.
- Octalysis (Chou, 2015): This Framework focuses on human design rather than functional design. This framework is depicted in an octagon shape determined by the core drivers. According to the author, the right side of the octagon reflects intrinsic motivation factors, and the left side, the extrinsic motivation.

Some of these frameworks are aiming to help designers choosing which game elements must be employed in gamified strategies. Thiel (2017), mentioned the different core drivers of the Octalysis model were associated with the game elements used in initiatives and projects like mySidewalk, using points and rewards, equivalent in octalysis as accomplishment and ownership, or Love Your City, using points, profile and statistics equivalent. But use frameworks is not an easy task, because many of them present limitations, ranging from their purpose (Dichev and Dicheva 2017), to the number of definitions of game elements used or have no common understanding of the set of game elements that can be used by gamified systems and the knowledge (Mora, Riera, Gonzalez and Arnedo, 2015) which can confuse inexperienced designers who wish to gamify experiences (Savignac, 2017). Even, the lack of general frameworks to help us understand and define gamification (Hollebeek, 2011), as well as initiatives that could serve as a starting point for a successful implementation, hacen difícil la tarea de usar gamificación en public services and applications.

But the first drawback encountered by them is which gamification elements are appropriate for their users. There are no naming conventions and the process to support which elements belong to gamification are other issues found in the literature, as they use different synonyms for the same game element (Koivisto and Hamari, 2019). The two most used gamification elements in the literature in e-governments services are: points and badges (Contreras-Espinosa and Blanco 2021) and leaderboards amongst others (Koivisto and Hamari, 2019). Points or score are the main element, because designers considered as the basic game element on which other elements calculations are based. Points give the quantification of the user's progress,

and without this game element it is unreasonable for the user to obtain badges or arrive to levels or leaderboards.

2.2 Motivation

Intrinsic motivation is an internal motivational drive to behave in a certain way for the sake of the behavior itself and the internal reward it provides (Hassan, 2016). Extrinsic motivation, for their part, is the pursuit of a behavior for some other extrinsic reason, conditional to the conduct of the behaviors (Rigby, 2015). In the design of a service, both of the motivational affordances are used with the intention of affecting the intrinsic and extrinsic motivation of the users. In consequence, it can affect the directional expression of this motivation in terms of a behavioral change or increased engagement of the user with the service (Coronado Escobar and Vasquez Urriago, 2014; Hamari and Koivisto, 2019).

The gamification based in give rewards or badges is effective for a quick behavioral change, but it only lasts for as long as the rewards are availables (Rigby, 2015). The organismic integration theory emphasizes the negative correlation between intrinsic and extrinsic motivations (Deci and Ryan, 2004). If the gamification is introduced as a mechanism of reward then long-term levels of intrinsic motivation are adversely affected (Rigby, 2015), but if the goal is a longer-term change, then rewards may be less adequate (Hamari, Koivisto and Sarsa, 2014) because it would be an instability to replace intrinsic rewards for behavior with an increasing dependence on extrinsic rewards.

The sustained engagement is a consequence of the fulfillment of three basic needs (Rigby, 2015) proposed in the Self-determination theory, a theory of motivation. The first basic need is the core psychological needs in intrinsically motivated behavior. Free choice and the potential to behave in accordance with one's own personal wishes. As the basic need number two, the drive to learn new skills to the point of excellence, and finally, number three, feeling that all are part of a community. But, the perception of the psychological experiences provided by gamification and that lead to intrinsic motivation, still remains a subjective matter (Rigby, 2015).

3. Materials and Methods

In a first phase and after extracting frameworks and game elements from the literature, the authors analysed the terminology and classification of other researchers related to the gamification frameworks used in e-governments services. The gamification elements selected are: Reputation, Competition, Cooperation-Team, Social interaction, Progress bar, Reward-prize, Level, Badge, Point, Ranking-Leaderboard, Mission, Puzzle, Goal, Customization, Emotion, Vote, User profile, Player roles, Stories, Avatar, Rule, Lifetime, Economy, Imposed Choice-Action, Forum, Chat, Share, Post, Emoticons and Location tagging. Based on the study of Toda et al (2019), the authors used a semantic analysis to define the conglomerate of game elements that could be used and designed an evaluation focusing on the next characteristics: Concept: the description of every game element.

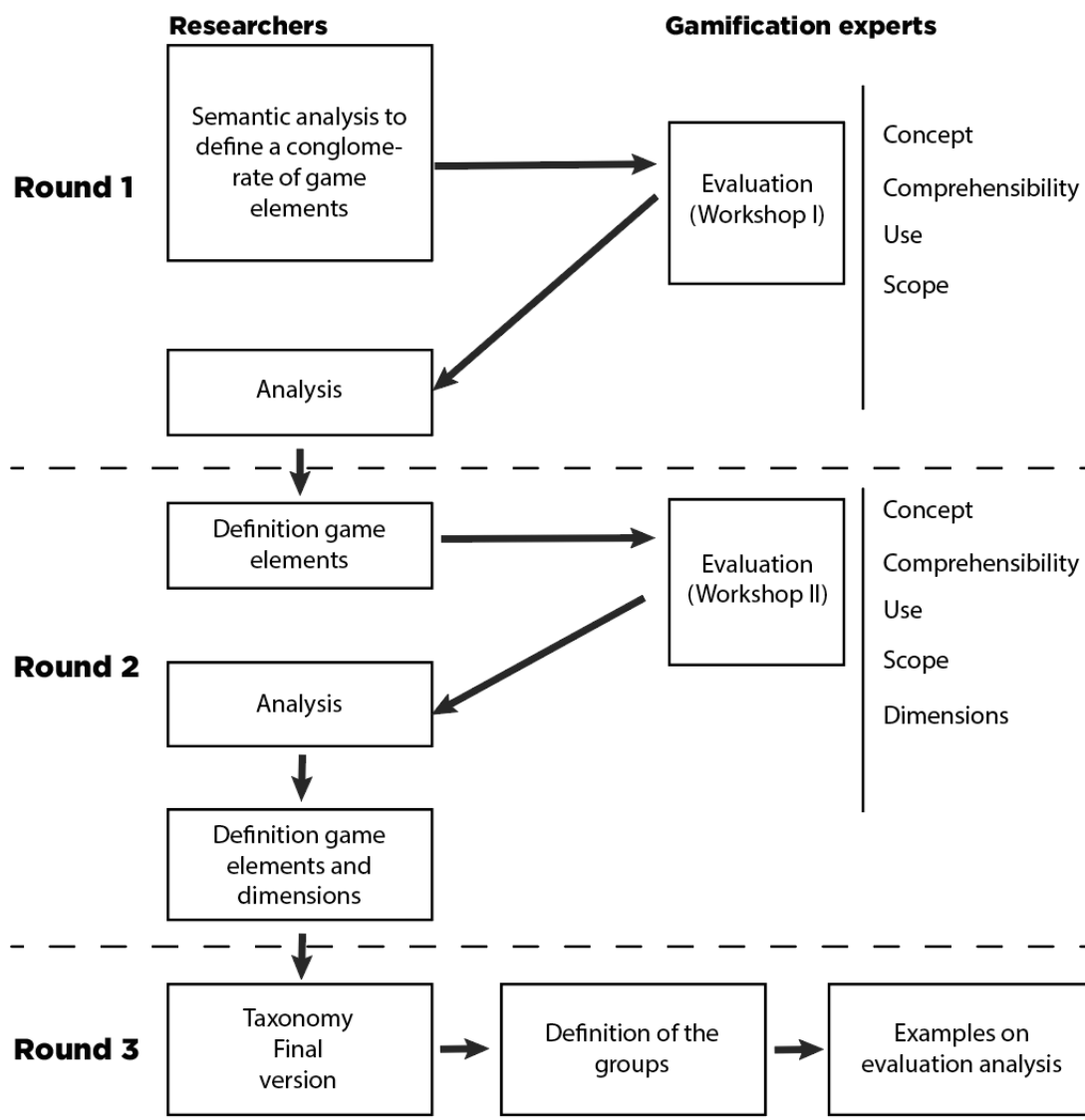
Comprehensibility: the regulated concept for every game element. Use: examples to understand the use, based on the presence in research papers. Scope: the representation of a set of game elements in a taxonomy. The set cover the needs for e-government services.

The authors concentrated to describe the concepts. The design of the first game elements in literature was supervised by experts on gamification working in practical European research projects. The authors proposed a classification for the game elements, that experts reviewed in a first round in a workshop. Los criterios para la elección de los expertos provienen de tres conceptos: 1) Se ha buscado una afinidad entre los expertos y el objeto de estudio; 2) Se ha tenido en cuenta el prestigio de los expertos o de las instituciones o empresas donde trabajan; 3) Se buscó formar un grupo heterogéneo para potenciar el discurso. Los expertos trabajan en ACCIÓ, Programa VALORTEC, Programa EMPENTA, KIC Innoenergy, Institut d'Investigació en Ciències de la Salut Germans Trias i Pujol, Universitat de Lleida, Universitat La Salle, Universitat Pompeu Fabra, Università di Torino, Università degli Studi di Milano-Bicocca, University of Helsinki, Tecnológico de Monterrey y empresas privadas.

In a second round, and with a second proposal of the game elements, researchers extended the first draft proposed in a second workshop, adding dimensions to group the game elements in a second workshop. Experts agree that this second proposal can support stakeholders to choose the best game elements to use with gamification strategies in e-government services.

In the third round, the concepts were analysed on a semantic level and discussed with the experts in order to have final definitions for game elements, groups of elements and dimensions. Finally, examples were added, discussing advantages and disadvantages in employing them in every case. This process results in the final version of a taxonomy that authors present in this chapter. The process is described in figure 1.

Figure 1. Process followed by authors



4. Results

4.1 Taxonomy

The main aim of a taxonomy is to identify, classify, and give names to elements, game elements in this case, according to its characteristics. The authors propose a taxonomy explaining the game element, the concept, if the motivator is extrinsic or intrinsic, and their dimension (table 1).

Table 1. Taxonomy

Game element	Concept	Motivation	Dimension
Reputation	It is related to titles, classification or status that a citizen may gain and accumulate. Represents a social status which not reflect the citizens' skills. Are used to create a hierarchy in the environment or	Intrinsic	Social

	communities.		
Competition	When two or more citizens compete against each other towards a common goal. It is related to a task where citizen must collaborate. It is the opposite of cooperation, but both elements can be used together.	Intrinsic	Social
Cooperation-Team	The combined action of a group of players, especially when efficient and effective.	Intrinsic	Social
Social interaction	This element is relating to interaction with other players, especially for pleasure.	Intrinsic	Social
Progress bar	This allows players to locate themselves (and their progress) within a game with progress bars, maps, steps.	Extrinsic	Achievement
Reward-prize	A consequence that happens to a citizen as a result of a behavior. Given for some special action, such as the return of a lost article.	Extrinsic	Achievement
Level	Hierarchical game layers, providing a gradual way for players to obtain new advantages upon advancing; examples: character levels, skill level.	Extrinsic	Achievement
Badge	Elements that symbolize rewards given to players for their achievements. Whether who hit the sales targets or a player who aced a skill, badges help they feel recognized for their efforts.	Extrinsic	Achievement
Point	Unit used to measure users' performance; examples: scores, number of kills, experience points.	Extrinsic	Achievement
Ranking-Leaderboard	Related with the visual information provided by the environment to the citizens, where can see their completed actions or tasks or overall stats.	Extrinsic	Achievement
Mission	Provides the citizen an end or a purpose to perform tasks, as obtaining a certain score in a task to receive a discount. Also known as quests, side-quests, to dos, milestones or objectives.	Intrinsic	Particular
Puzzle	Related to the activities that are implemented within the service, they can be fixed or considered as learning challenges or cognitive tasks, because provide a cognitive challenge to the citizen. Also present through quizzes.	Intrinsic	Particular
Goal	The object of a person's ambition or effort; an aim or desired result.	Intrinsic	Particular
Customization	The action of modifying something to suit a particular individual or task.	Intrinsic	Particular
Emotion	This is a visual or sound stimulation. It is related to the use of citizen's senses to improve their experiences using Virtual Reality Augmented Reality, or dynamic interfaces.	Intrinsic	Particular
Vote	Vote an online comment, article, etc. by clicking on an icon to participate in city hall decisions.	Intrinsic	Particular

User profile	A collection of settings and information associated with the citizen. The user profile associate characteristics with citizens and help in ascertaining the interactive behaviours along with their preferences.	Intrinsic	Particular
Player roles	The citizen assumes or acts out in a particular role defined previously for the game designer.	Intrinsic	Imaginary
Stories	Order of events happening; i.e., choices influenced by player actions, as strategies the player uses to go through a level (stealth or action), also the influencing the ending.	Intrinsic	Imaginary
Avatar	The avatar allow personalisation. In this case, a citizen may adapt its appearance.	Intrinsic	Imaginary
Rule	A statement that tells players what is or is not allowed in a particular situation.	Extrinsic	Context
Lifetime	It is related to time itself, and used to pressure the citizens' actions. In e-government services can be represented as deadlines (to use coupons), countdown timers or clocks.	Extrinsic	Context
Economy	This concept is related to any transaction that may occur in the platform (transactions, exchange, crowdfunding, market, etc.). Trading points for advantages related to the content, etc.	Extrinsic	Context
Imposed Choice-Action	Appears when the user fronts an explicit decision that they must make to advance. Example: Show the citizen two different options and make them choose one or another, blocking their advance until the citizen pick one.	Extrinsic	Context
Forum	The citizen exchange ideas and discuss issues, especially important public issues with other users, in one space as the repository for the messages in a space like a list.	Extrinsic	Media
Chat	The citizen talks to others who are using the service or platform at the same time. This action is the exchange of typed messages in one space as the repository for the messages and with a group of citizens who take part from anywhere.	Extrinsic	Media
Share	Social share describes when citizens broadcast content on a social network to their friends, groups, or specific individuals. User enjoy sharing content to their connections.	Extrinsic	Media
Post	The citizen post ideas, information and discuss issues in a message entered into a service or platform such as a discussion group or online forum.	Extrinsic	Media
Emoticons-emojis	Emoticons (punctuation marks, letters, and numbers used to create pictorial icons) are display for citizens to express an emotion or sentiment. Emoji (pictographs of faces, objects, and symbols) has the same objective but showing faces with various expressions, as well as buildings, animals, food	Extrinsic	Media

	objects and more.		
Location tagging	It is the process that a citizen does in order to attach location information in the form of geographical metadata. The Geo-tags may be used to digital output, for example as tweets or posts updates on social media.	Extrinsic	Media

4. 2 Dimensions

Extending the taxonomy, researchers, propose a classification using six different dimensions to group the game elements defined. The dimensions are: Achievement, Imaginary, Context, Social, Particular and Media. As was mentioned, each game element was analysed with gamification experts to put each element in an appropriate dimension. The definition of each dimension is explained in table 2.

Table 2. Dimensions to every game element

Dimension	Description
Achievement	Game elements that reveal to the situation of the user and can be used to provide feedback. The absence of this dimension may result in a user feeling missing, because their actions does not have clear feedback. In this dimension we can find Points or Levels.
Imaginary	It is the dimension that reveal to the user the habitat, with storytelling and connecting their experiences with the context. Fictional elements can be used to give context or give an immersive experience. The citizen may complete tasks following stories and influence in their game experience. It includes Player roles, Stories or Avatar as elements.
Context	This dimension is related to the environment that the gamification is being implemented. The game elements can be represented as properties. Examples of elements in this dimension are Economy or Life Time. The lack of Context elements makes the game environment feel boring.
Social	Related to the interactions between citizens and the environment. Elements in this dimension are Reputation, Competition or Cooperation-Team. Without social elements, citizens can stay isolate or not be able to interact with other users.
Particular	Related to the citizen using the environment. The lack of Particular elements can make the citizen feel demotivated because the service does not provide context for the user. Elements in this dimension are Missions or user profile.
Media	Related to the interactions of citizens with social media and other technologies to chat, share, post, write, etc. With media elements, citizens say to public administrations or other citizens what they feel, think, vote, etc.

4.2 Examples of use

To demonstrate the analysis and evaluation of these elements, we choose two examples of services and platforms in the literature. In () it is mentioned the dimension in the taxonomy presented in this chapter.

Thiel and Frohlich (2017) created an interface with gamification elements in order to evaluate the impact of gamification to motivate citizens to improve their city. The gamified application provides the possibility to report issues in the city to the public administration, like as damages or improvements required in public services or areas. Game elements used in this mobile application were: Lifetime (Context), Missions (Particular), Points (Achievement), Leaderboard (Achievement), User Profile (Particular), Ranking (Achievement), Social interaction (Social), Emoticons and comments in Posts, and Location tagging (Media). When analysing these elements, it is possible to observe that various elements from the taxonomy are presented but also, there are common elements presented in other works. For example, Posting and sharing comments are used also in other services proposed by Bianchini, Fogli and Ragazzi (2016) and Devisch, Poplin and Sofronie (2016) or using Rankings in services proposed by Kazhamiakin, Marconi, Martinelli, Pistore, Fondazione and Kessler-Trento (2016) or Lindley and Coulton (2015).

Besides these elements, we can observe the Particular dimension since the service provide to the users a clear Goal to report issues in the city, achieved through posts (Media) and following rules (Context). By using the taxonomy, we can observe that this service presents 12 game elements in 5 different dimensions. A solid Achievement (3) game elements) and Particular (3) dimension, using also the Context dimension (2) Media (3) and Social (1).

The Lifetime is used to pressure the citizens' actions in this service, Missions are used to provides the user purposes to perform the tasks, as reporting problems in the city. The Square meters or points are assigned based on app and user activity. Leaderboard is used to provide a visualitation of the completed tasks made by the citizen and the user Profile show to the citizen their personal informationa and characteristics. Rankings are used to create a competition amongst the users and to see the user progress vs. other user progress and social interaction, is used in this service as the possibility to interact with other citizens, in order to discuss, where the user can find issues in their city (cracks in the roads, big bumps in the road, etc.). Finally, the use of Emoticons in order to citizens say to public administrations or other users what they feel.

The second example is an application that aims two key aspects: competition and reward. It was designed to helps to the public administrations to report events for citizens, cultural festivals, even seminars taking place across in the city and to promote the tourism. By the other hand, the pplication allows to the user to report anomalous situations they encounter in their city, see situations reported by other citizens and confirm that the situation was solved. The prototype requires the establishment of communications between a mobile application and a central web server that is the provider of all the necessary information for the correct operation of the application

(Rodrigues, Monteiro, Fernandes, Silva, Analide and Santos, 2019). The authors shows a gamification framework especially for Smart Cities. In this prototype, the game elements used are: Rewards (Achievement), Rules (Context), Progress bar (Achievement), points (Achievement), missions (Particular), objectives or goals (Particular), and story elements (Imaginary). The prototype also presents elements in the Personal Dimension, achieved through tasks with Puzzles and Imposed Choice-Actions (Context) and the user can vote (Particular) or participate taking decisions.

It is possible to observe in this example other elements from the taxonomy are presented, as story elements with stories or characters, that are common and basic elements presented in other works. For example, Devisch, Poplin and Sofronie (2016) and Kazhamiakin, Marconi, Martinelli, Pistore, Fondazione and Kessler-Trento (2016) explain 2 projects using story elements. Even more, Olszewski, Turek and Łączyński (2016), Devisch, Poplin and Sofronie (2016) and Gnat, Leszek and Olszewski (2016) are using Location tagging as game elements.

Through the presented taxonomy, we can observe that this second example contain an example with 11 game elements and 6 dimensions. With 3 solid dimensions: Achievement dimension with 3 elements, Context dimension with 3 elements and Particular with 3 game elements. The last dimensions are Imaginary with 1 element and Location tagging with 1 element.

The content is presented similarly as the first example where the service provide to the citizens a clear Goal, to report anomalous situations in their city, and following rules (Context). Throughout the process, users can get rewards that they can trade in the application's store for available products, and can, with their vote, rate events and participate in city hall decisions (Rodrigues, Monteiro, Fernandes, Silva, Analide and Santos, 2019). The gamification is based on: citizens' being exposed to "collect" anomalous situations in the city and gaining points for their interactions (Point), and users being challenged to attend to cultural events and fulfil challenges at specific touristic places through missions. So the user must choose an activity to continue using the system (Imposed Choice-Action). The users' can see their progress in the application through points (Achievement) and gain rewards based on their interactions, these users can also see an overall of their progresion in Progress bar (Achievement).

5. Discussion

The taxonomy presented, is a first step to standardising the game elements employed in e-government services, and the dimensions presented here might provide a way to give support to designers or public administrations that want to design a gamified e-government service. With an initial generalisation of game elements and adapting them to e-government services, it is possible to assume that designers, public servants or researchers find it useful to analyse existing systems and extract the gamification elements within it. This proposal it is also aligned with the suggestions made by Koivisto and Hamari (2019) which states that gamification studies should give more attention to various types of feedback, and as well, studies should explore and incorporate the context defining universal taxonomies. And the proposal of Hassan

and Hamari (2020), who suggest to develop a broader understanding of practices in gamification. Because the types of gamification seen in the literatures varied, but points, leaderboards, missions and competition are the most popular game elements used.

As was described, in the **Social dimension**, the Dimension is related to the interactions between citizens and the Social aspects of the environment. The elements connect people and can influence in their behaviour into a task, that is the reason that it must be used carefully. Concerning each element, Reputation is the social status the citizens can obtain in the service or platform. The better citizens in the city obtain better reputation and a good status. Without reputation or a good reputation, the user can feel the lack of acknowledgment, and the user may feel their actions are not meaningful (Dignan 2011). Competition can create an active environment where citizens try to beat other users to obtain a prize. To design a good competition, it is important not to tie it to any content-based activity (Papadopoulos, Lagkas and Demetriadis, 2016). In contrast to Competition, Cooperation is seen as a positive addition in e-government environments, although its application is not too easy to apply. Cooperation-Team, is the combined action of a group of players to do something together. The absence of actions in the group may lead to segregation and may present the odds of disengagement of the user. If the element, Cooperation-Team is used, can lead the citizens to share actions, information and work together. Helpful for social connectivity, group challenges, and remote or direct competition (Foxman and Forelle, 2014). Finally in this dimension, Social interaction, is relating to interaction with other players, especially for pleasure. Assigning activities, by the service, might also imply social interactions.

The **Achievement dimension** must always be present in order to the citizens may receive feedback in every action. In the Achievement dimension it is possible to find Points, Levels or Badges. The absence of this dimension may result in a user feeling lost or frustrate, because their actions and interactions are not being recognised, and they do not have clear feedback provided for the service or platform. Then, if the citizen finishes a mission but did not receive information in the progress bar, or not earn badges or points, he can be may be felt lost and it may cause unexpected outcomes. So, Progress bar, is considered a highly relevant element to citizens that are learning something. Lack of progression might lead the user to a feeling of frustration and anxiety (Dignan 2011). Another basic and highly relevant element is the Reward-prize. Motivations for gameplay include the addition of extrinsic rewards, for example vouchers or coupons for reduced bin charges, parking coupons, reduced entrance fees to public amenities (Crowley, Breslin and Corcoran, 2012). But, if the element is tied to a financial award in a company, the perception of the gamification as a controlling activity by a user is greater than if the same element leads to nothing more than a badge or listing on a leaderboard (Deterding, 2011). As for Level, it is considered a significant element. Is the relative position in relation to others using the service or platform. Toda et al. (2019) said that the lack of levels may lead the users to think that they did not advance at all in their skills, or in their actions. Finally, Points and Ranking-Leaderboard are presented in almost all gamified platforms and services, as basic elements. For some users, a point system attached to public status is important enough to them to perform a dull task, but for others a leaderboard is meaningless

and the task itself needs to be transformed through gameful activities to provide that connection (Nicholson, 2012). So, it's important to think the use of a scoring system with points, has to have a deeper connection with the activity to make a meaningful connection with the experience. And providing multiple ways to achieve points within the gamification system can allow users to select those methods most meaningful to them (Nicholson, 2012). In the other hand, Badges. These game elements are features that can be incorporated and use similar concepts to reward users. Badges normally are connected with ranking systems. A ranking system can be implemented using badges and gives users access to promotions or new features. Ranking-Leaderboard are also included in services as each check-in made for users accumulates points. In addition, users can acquire free stuff or discounts through check-ins, often by repeated check-ins in the same place (Crowley, Breslin and Corcoran, 2012).

The **Particular dimension** is related to the citizen using the environment. The lack of Particular elements can make the citizen feel demotivated because the service does not provide context for the user. Examples of intrinsic elements in this dimension are Missions or Puzzles that the user might not perceive as game elements. On one hand, Missions provides the citizen an end or a purpose to perform tasks. Also known as quests, side-quests, to dos, milestones or objectives. The mission breaks down the objective and provides a set of related tasks designed to achieve the objective. It can have different levels, and players can be rewarded for completion of each level or mission (Shah, 2012). Puzzles are represented through challenges. It is activities that are implemented within the service, they can be fixed or considered as learning challenges or cognitive tasks, because provide a cognitive challenge to the citizen. Goal is showed in all environments with a gamification strategy, without a goal the user may feel lost or confuse, but as designer its necessary to be cautious not to encourage undesired actions. For example, many goals at the same time may lead users to complete various of those without pursuing to complete them accurately. It is a basic game element and it is crucial to identify the objective in order to know what the organization is trying to achieve. For example, the goal may be to improve adoption rates, to encourage employee learning, to improve brand awareness, to shorten processes and so on (Shah, 2012). Customization is an intrinsic game element. It is the action of modifying something to suit a particular individual or task. As for Emotion, is considered a highly relevant element (Toda et al., 2019), but they called the element Sensation. This is an intrinsic element, a visual or sound stimulation. It is related to the use of citizen's senses to improve their experiences using Virtual Reality Augmented Reality, or dynamic interfaces. But the major issue is the privacy while the user is interacting, for example, with the AR marker in public and providing sensible personal information, like username access (Contreras-Espinosa, Blanco-M, Eguia-Gomez, 2021). It can be solved, informing the user about what personal data is used and what type of processing is performed (Kotsios, 2015) and considering user privacy during service design, which means delegating data storage and management to a certified service (Perera, McCormick, Bandara, Price and Nuseibeh, 2016). Finally, Vote is an action, as such an online comment, article, etc. by clicking on an icon to participate in city hall decisions. Vote could be seen as a spin-off from decide, as by voting people essentially decide on a matter but on a single occasion (Thiel, Reisinger, Röderer and Fröhlich, 2016). In e-platforms, citizens are empowered to participate and select an

option to be implemented. So, the objective is not to collect input from users, the objective is involved citizens in decisions, and rather serve the aspiration to receive qualified proposals and requests (Bohøj et al., 2011).

The **Imaginary dimension**, is the dimension that reveal to the user the habitat, with storytelling and connecting their experiences with the context. Normally, it is not common when designing e-government environments. This occurs because public administrations do not make a differentiation between Narrative different layers and Storytelling. If it is designed correctly, it can help the user to focus on the content because fictional elements can give an immersive experience. The citizen may complete tasks following stories, and it can influence positively in their game experience. In addition, the player roles, and the compelling narrative that can encourage user's participation are all factors that improve the process and the results (Abu-Shanab and Al-Sayed, 2019). Stories are the way to materialise a narrative, and using text, music, audio-visuals or another technologies, it can be stylish how a story is told. The Stories may affect the user' engagement because they can be used to give a context (what happen in an exact point in the history if the service is used to promote tourist places) or explain in other way tasks that the user have to resolve. Finally, Avatar is not a common element when designing e-government environments, but can be powerful to connect with storytelling.

The **Context dimension** is related to the environment that the gamification is being implemented. The game elements can be represented as properties. The lack of these game elements makes the game environment feel boring. Gartner Group (2011) has clarified a number of principles that are required for the successful engagement of users, and clear rules is one of this. It improves the success of gamification. Lifetime is a key factor for the success of gamification platform, such as setting customer's expectations (Abu-Shanab and Al-Sayed, 2019). In the other hand, Economy is related to any transaction that may occur in the platform, so transactions, exchange or crowdfunding can be connected with blockchain. It is possible to overcome the qualitative limitations with blockchain technology to make possible to overcome the quantitative barriers because of the interest of the users to participate. Finally Imposed Choice-Action element give options to the user and citizens have to take a decision. So, designers have to give clear information of each option.

The **Media dimension** is related to the interactions of citizens with social media and other technologies. So is necessary to give the user possibilities to chatting, sharing, posting, sending emoticons or emojis, or tagging a location. The implementation of these technologies will enable not only the improvement of spatial planning process but also to develop an open society that will create smart cities (Gnat, Leszek and Olszewski, 2016).

6. Conclusions

This work shows a taxonomy to analyse and evaluate gamified systems. Researchers, with the help of gamification experts, developed the details on the concept, comprehensibility, use and scope of game elements. Even researchers organized game elements semantically, and classify the game elements into Six Dimensions, which can

provide reinforce to public servants, designers or other stakeholders. Finally, the authors introduced examples of use to demonstrate the analysis and evaluation of these elements and considered some suggestions of using each dimension.

The limitations of the ongoing work are that we did not evaluate the taxonomy with more experts due to time constraints. As future work, the authors plan to test the taxonomy with public servants. This study is implemented in the development of the CO3 project platform that will be tested in three city pilots in Athens, Paris and Turin, and it is important to test with a group of persons interested to use gamification in e-government services. Even, the authors contemplate to analyse the users' perception of this taxonomy to describe the use on how to use the game elements accurately. The researchers believe that it is possible to find guidance in this information in order to describe more guidelines to public servants, designers or other stakeholders that can help to design e-government services.

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