Public Services Innovation Through Gamification. From Concept to Implementation

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Abstract. The present work focuses on gamification applied to public service innovation, with a specific focus on the commoning paradigm as an alternative form of collaboration among citizens and public administrations.

In the proposed innovation scenario, gamification – the use of game elements for non-game contexts – is proposed and investigated as a strategy to promote the citizens' active engagement in the co-management and co-creation of novel public services. The paper outlines the core elements of the strategy, co-designed with the stakeholders. Moreover, the implementation of the "Gamification Engine" is presented as a building block enabling an open-ended gamification strategy to be applied to innovative public services.

Keywords: Gamification · Commoning · User engagement · Public-service innovation

1 Introduction

In recent years, the relationship between public institutions and citizens is changing, also due to novel socio-technical paradigms that facilitate public engagement and participation. Commoning, as defined by Ostrom (1990), is an emerging approach focused on common goods (both urban spaces and immaterial resources), where communities can arise. Solidarity, inclusion and public-private cooperation are the values that enable new forms of welfare through the co-creation and co-management of public services. In such a scenario, technology is a crucial infrastructure to connect people, places and services. Commoning is the context in which the H2020 research project CO3[1] aimed to introduce and assess some disruptive technologies for public service innovation along with citizens. Five disruptive innovations were identified: blockchains, augmented reality,

[1] CO3 stands for: Co-design, Co-produce, and Co-management of innovative public services along with citizens. H2020-SC6-Transformations-2018–2019-2020, Socio-economic and cultural transformations in the context of the fourth industrial revolution). Grant Agreement n. 822615. www.projectco3.eu.

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civic social networks, liquid democracy tools and gamification, with the latter aimed at enhancing the active role of citizens as co-creators and co-producers of public services.

This work outlines the gamification strategy designed within the H2020 research project CO3-Codesign, Co-produce, Co-management of Innovative public services along with citizens.

2 Background: Gamification and Design Approaches

According to literature and market research, the application of gamification is growing in several public domains, such as healthcare (Johnson et al. 2016), education (Nah et al. 2019), transportation (Yen et al. 2019), government (Contreras-Espinosa and Blanco 2021), among others. One of the goals of gamification is to engage citizens as active players through micro-actions that facilitate entering and taking part in the public conversation, giving feedback to possible local government decisions, and actively meeting common objectives, like reducing the level of energy or water waste. Gamification is nowadays known and applied as the use of game elements and game thinking in non-game environments to increase target behaviour and engagement (Deterding et al. 2011). Gamification, as a nudging approach, aims to encourage desired behaviours and positive change, by designing interesting experiences and positive reinforcements. In practice, gamification intentionally applies game elements in non-game tasks and contexts. This is possible by adding an actionable layer to services, which leverages motivational drivers of specific target communities and facilitates desired positive behaviours (Robson et al. 2015).

Leveraging individual motivations, gamification aims at promoting positive decisions and behaviours, by enriching the user experience. For this purpose, gamification design incorporates and implements motivational drivers into the experience flow (Sailer et al. 2013). Several psychological theories foster the gamification design (Krath et al. 2021), among which prevail the Self Determination Theory (Deci and Ryan 2008) and the Theory of optimal experience or Flow (Csíkszentmihályi 1975). The first one provides a model of human motivation as a continuum ranging from intrinsic to extrinsic motivation, where the poles refer to the diverse origin of the motivation. The extrinsic motivation grounds on external regulations, the person accepts to follow; inversely, the intrinsic motivation grounds on the internalization of rules, that are perceived and followed as personal values. According to the authors, internalization of the rules depends on the satisfaction of three fundamental psychological needs: the need for autonomy, the need for competence and the need for relationship. On the base of this background, different models have been defined to map the motivational drivers and gamification elements. One of the most known is Bartles' matrix (1996), which identifies four main player types based on four fundamental motivations. Bartles specifies that the players' profiles (Achievers, Explorers, Socializers, Killers) are never "pure": in every player, as in the wide audience, the different motivations are all present snd active at the same time, but to a different extent. The matrix allows designers to develop a multi-dimensional description of their targets. A more recent and wider motivational model for gamification is the Octalys (Chou 2016). The model identifies eight motivations, for each of them specifies gamification techniques to activate them. The core dimensions of the framework

are further organized into intrinsic and extrinsic drivers (vertical axis) and positive and negative motivators (horizontal axis).

The theory of Flow (Csíkszentmihályi 1975) is a core reference of the gamification design, to identify the expected result of successful gamification: the optimal experience as a state in which the person experiences a full "sense of enjoyment", laying in a balance between the person's capabilities (sense of mastery) and the level of difficulty of the challenge. This construct is core to designing engaging and lasting experiences.

As a design approach, gamification leverages a multidisciplinary background, combining psychology, human-computer interaction and design, in a set of pillars that identify the main steps of a gamification design process:

1. The users' characterization, their mental model, motivations, and goals.
2. The challenges definition, including goals and desired actions.
3. The design of system capabilities, to convey useful information and mechanisms, sustaining the experience over time, including quests, feedback, and rewards.

3 Gamification of Innovative Public Services

The intersection of gamification and public services is not new. In the field of E-government and the civic sphere, gamification and serious games are systematically experimented with for various purposes (transparency, security, accessibility), to improve active citizenship and the relation between civil society and institutions. In particular, gamification is applied to engage people in concrete actions for common objectives or public interests, promote social inclusion in civic life, and share common resources, both tangible and intangible ones. These applications highlight a cultural layer that gamification must include to promote either personal or community benefit. These practices take also inspiration from European policies[2], promoting the empowerment of citizens and active engagement in new forms of participation, including the design, production and delivery of public services.

This was the focus of the H2020 research project CO3 – Co-design, Co-produce, and Co-management of innovative public services along with citizens[3]. The project aimed to develop and assess an innovative model of interaction and collaboration between Public Administrations (PA) and citizens. The innovation the project focused on refers to a phygital ecosystem able to reframe the role of citizens in the public service creation, production and management together with public servants. The digital layer of the ecosystem was predefined by a set of technologies (Blockchain, Augmented Reality, Geolocation in Social Networking, Opinion Formation) identified as enablers of site-specific service innovation collaborative practices. Concerning gamification, it is not technology nor a service per se. It was defined as an additional experience level to be built onto the services entailing local purposes, values, and experiential cues, through meaningful

[2] eGovernment action plan: https://digital-strategy.ec.europa.eu/en/policies/egovernment-action-plan.

[3] H2020-SC6-Transformations-2018–2019-2020, Socio-economic and cultural transformations in the context of the fourth industrial revolution). Grant Agreement n. 822615.www.projectco3.eu.

narratives, engaging challenges, and motivating rewards, experienced through the CO3 technologies.

A high-level scenario describes what we called the "Augmented Common". Inspired by the Ostrom definition of the Common (1990), it refers to a real place, both physical and digital, where new forms of collaboration among Public Administration (PA) and citizens give rise to and co-manage the common good through disruptive technologies, like Augmented Reality, Blockchain and Civic Social networks (Fig. 1). The CO3 meta-scenario includes gamification as a socio-technical paradigm that aims to promote and foster social interactions and exchanges among commoners, coherent with the values and functioning of the commoning theory. In particular, the gamified CO3 services have to: (1) foster common interest and cooperation over competition; (2) facilitate positive and proactive behaviours, aware of the possible impacts on both individuals and groups/communities; (3) interoperate with other technologies, encouraging digital adoption and inclusion.

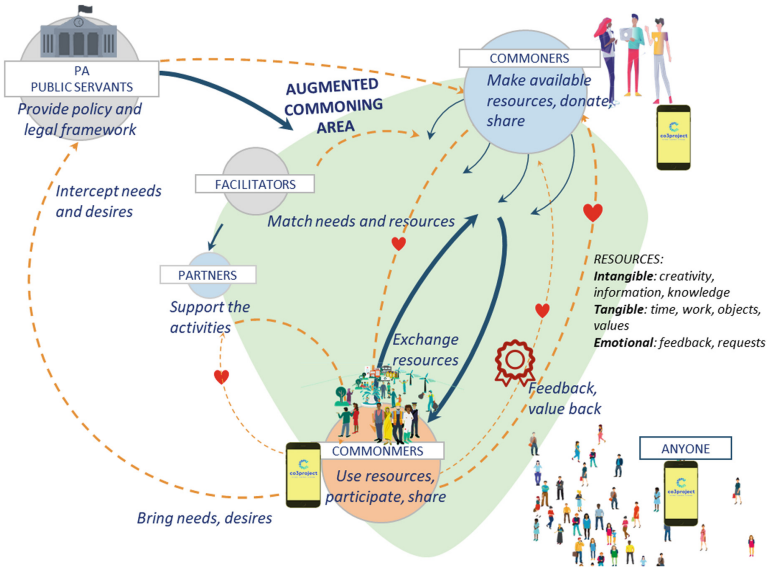

Fig. 1. Augmented commoning scenario map.

3.1 The Gamification Concept

To engage people as active players in the co-creation and co-production of public services, the CO3 gamification strategy was designed as a path in which participants evolve from bystanders to active commoners. In this concept, the common-oriented goals are reached by both individual and group gamified activities and acknowledged both as personal and collective achievements. Starting from the evolution path shown in Fig. 2 four types of desired action sets have been identified:

– *Access:* actions that guide the citizens to onboard the Augmented Common.
– *Discovery:* actions that acknowledge the curiosity and interaction with the Augmented Common (initiatives, contents, …), allowing to be informed about activities and groups as well as to share information and leave comments.
– *Participation:* actions enriching the active role, rewarding behaviours such as attendance to initiatives, co-management of services, collaboration in places- maintenance, and decision-making on topics of common interest.
– *Co-creation:* actions that acknowledge citizens proactively launching initiatives, and challenges and taking part in the creation of new services.

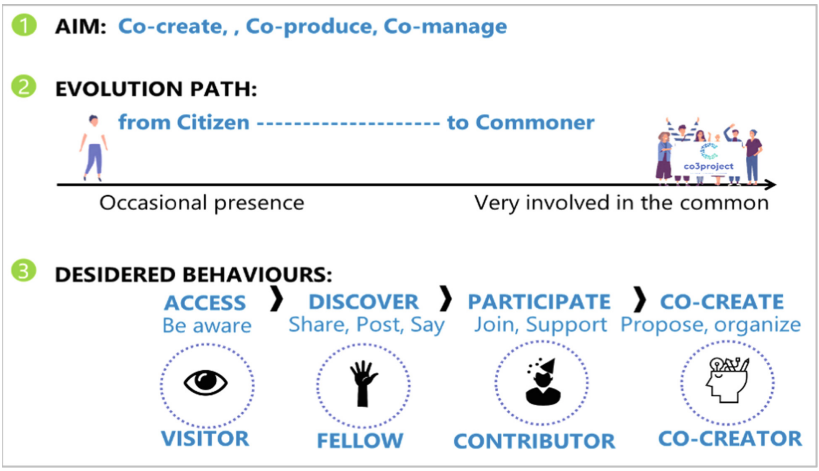

Fig. 2. CO3 gamification strategy.

The four steps include specific actions promoting desired behaviours and different degrees of engagement to be acknowledged with specific mechanics, enabled by CO3 technologies, to be experienced both in the presence and remotely.

4 Gamification Co-design Methodology

The CO3 gamification has been part of a wider co-design process, that involved a heterogeneous panel, including public administration, technology experts, local associations and citizens in the collaborative definition of commoning solutions and implementation. Inspired by the most known human-centred approaches applied in Service design, such as the Design-Thinking (Zhang and Dong 2008) and Platform Design (Cicero and Heikkilä 2020), the CO3 design process is organized in steps and iterations, starting from building a knowledge base, including background and user needs, that proceed with participatory activities, where participants collaboratively concretize their ideas (Fig. 3). Figure 3 collaborative design phases.

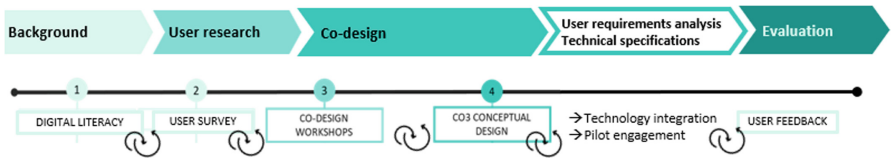

Fig. 3. Collaborative design phases.

The participatory process was applied also to the service design and the gamification design for CO3 services, through the following steps.

Background Phase. Dedicated meetings and internal dissemination activities allowed to build a common background on gamification, provide examples, and reply to questions and barriers of stakeholders.

User Research. In parallel, an online survey investigated target users, in terms of motivations and preferences, as a base to identify core elements such as mechanics, rules, and measurable variables. The data collection method was adapted for the CO3 context and based on studies by Yee (2006), including variables such as country, age, gender, media consumption and favourite games, and the gamification questions to capture the citizens' profile[4].

In total, 138 complete answers to more than 46 questions were received. Of these 46 questions, 39 are of the Likert scale type, asking to agree with statements on a range from 1 to 5.

Three game elements were preferred: "Teamwork", "Roleplay", and "Achievement" since these are where more users overlap and with higher intensity. Table 1 shows the game elements most appropriate for the gamification strategy, based on the stakeholders' responses. Those elements were elaborated in terms of user engagement via posterior data analysis.

Table 1. Recommended elements for CO3 implementation

Types	Gamification elements
Role-play	Dialogue choices, Story, Experience points, Levels, Avatars, Personal profile page
Achievement	Achievements, Challenges, Missions, Badges, Experience points
Teamwork	Leaderboards, Achievements, Real-time information, Personal profile page

Picking the best cluster for each gamification element and the statistics of the game genre played by the user, we can determine one preferred gamification element for each citizen type. To start the analysis, we picked up the best cluster determined individually

[4] The online form is available in 5 languages at: https://www.projectco3.eu/wp-content/gamificationformv4.

for each gamification element and value. Those scores are the response rates facilitated by the users from the form questions. The best cluster is composed in theory, with the users that most agree with the questions related to the current gamification element.

For each of those clusters, we collected the statistics about the game genre that the participants inside each cluster play. The main results have been previously published, extensively describing the clustering technique that enables the mapping of different user profiles in relation to their preferred gamification elements (Blanco et al. 2021) based on one taxonomy of game elements (Contreras-Espinosa and Eguia-Gomez 2022).

Co-design. The gamification co-design and implementation activities followed a well-established process to progressively specify the gamified path to the commoning. Some key questions have driven this phase involving public servants and commoners of the three pilot cities, which worked both collaboratively and asynchronously. Brainstorming sessions, idea clustering and other traditional UX methods were applied, driven by a few key questions (Table 2).

Table 2. Gamification key questions

Goals	Key questions
Raise, selection and priority of goals	What do you want to achieve through gamification?
Identify the desired actions	What participation activities are relevant to the goals?
Mapping actions on technology capabilities	What measures will be taken to achieve this objective?
Definition of rewards and rules to get them	How to recognize the actions performed?
Tuning of the loop engagement	Which steps will make the trip more interesting?
Aesthetics	Which metaphor or theme best connects the elements of the experience?

A level system setting rules, barriers, and rewards were designed, to outline the progress path towards the objective of both individuals and groups. For each desired user behaviour, detected by CO3 ecosystem, different rewards (levels, points, badges) were defined, according to the specified rules.

The focus on the stakeholders' needs brought us to define a specific type of reward, complying with the request to maximize and promote collaborative social dynamics instead of competition. For this purpose, we invented specific cooperative badges, that are rewards assigned to all members of the augmented common as a result of all the single actions performed. These inclusive mechanisms are intended to highlight the collective dimensions, introducing and supporting the community as a user, in line with the commoning principles.

A scaffolding set of challenges, actions, rules and rewards was defined, to showcase an ideal gamified path to the commoning. Once implemented, it worked as an extendable and customizable sandbox to play with and start gamifying the local public services. On this base, 3 site-specific gamification systems, for the local services were created with the public servants that selected specific elements, point systems, rewards and metaphors, co-designed to strengthen the connections between the digital contents and local contexts (see Fig. 4).

Fig. 4. CO3 gamification levels and badges (default set)

Evaluation. Iterative evaluations were conducted for testing the design process. In particular, the gamification default set allowed to progressively collect the user feedback and refine the overall gamification strategy. The overall evaluation of gamification was then carried out in the field during the pilot evaluation of the CO3 project.

5 Implementation of the Gamification Dashboard

The CO3 gamification lies on a combination of Points-Badges-Leaderboard, which are basic game elements known in the literature as PBL framework. The PBL system allowed to set the rules to implement the gamification path, that we structured to promote the use of a set of CO3 features and not to introduce penalties or barriers. In order to encourage participation through the CO3 ACA technologies, all the features are available anytime, from the beginning. In respect of Gamification aims, the overall CO3 approach in logging activities is to count rather than track events, preserving as far as possible the users' privacy. Counters are the core tools to manage and store the points achieved by each user, according to a set of rules and rewards definitions (different types of badges) that allow managing properly the gamified experience. Every time a gamified event is detected within the system, the counters are updated, but not all the events generate a notification to the user. Counters are not visible to the end-users.

The implementation of gamification elements and mechanisms is based on two main prerequisites, in order to allow the CO3 ecosystem to work properly and consistently:

– the ability of the CO3 sub-systems to detect and recognize a defined set of events;
– the ability to log and store event-related information, as previously detected and recognized.

The OnToMap Logging service and Data Hub (CO3OTM), working as a cross-application logger of user actions and as a data hub for all the applications, offers support to fulfil both. The CO3 mobile app and all the other available touchpoints, as defined within each pilot, contribute to and use data stored to update the user's gamification elements and personalize the user experience.

At the beginning, an extensive set of events is defined to support the mechanics and rules definition across all the pilots and to test possible conflicts and constraints as well as the implementation over the different subsystems. The set includes several subsets; one includes events applicable to all pilots, plus others with events specific to each pilot, and others for intermediate testing activities.

A dedicated online dashboard was developed allowing to set up and control the gamification elements within the CO3 technological ecosystem. In particular, the dashboard allows to customize the following elements:

– the rules to be triggered when defined activities (within specific conditions) are performed within the CO3 ecosystem;
– the points to be assigned when rules are triggered;
– the badges to be achieved accordingly to their type, structure and preconditions;
– the badge types (individual, collaborative or competitive) and timeframe (weekly, monthly or permanent) for each badge;
– the badge structure (or organization into levels) for each badge;
– the preconditions (points or other badges) needed to progress into badge achievement.

Born to implement and test the gamification during the project pilot, the CO3 gamification dashboard has been then adapted to concretize an opportunity that emerged during the co-design phase. With some adjustments, it was delivered as a tool for end-users enabling them to actively control some elements of the gamification of the local public services. The CO3 gamification dashboard can be managed by public servants (in the first stage), without specific IT skills. It provides templates to simplify the process of rules and badges definition, that resemble most common activities and conditions. Changes to the gamification can be done at any time while the service is in operation, preserving all the information and data about disabled rules or badges, to maintain consistency and accountability of previous achievements and corresponding activities.

6 Discussion

CO3 gamification is aimed to facilitate communing as a social paradigm, encouraging citizens and PA to collaborate and socially embrace beneficial collective actions. Nevertheless, a gamified approach is not easy to introduce to stakeholders, both citizens and PA. During the process, a strong effort was put to explain gamification paradigms, and distinguish between gamification and videogames, often confused. Moreover, some risks

and biases were identified, such as the focus on the performance not on the goal; or the competition changing the nature of the activities. Some countermeasures were implemented, like the selection of a limited number of desired behaviours to avoid massive gamification of the whole service. To this extent, a flexible management tool was implemented, enabling commoners to directly add and customize challenges, rules, badges and rewards.

In addition, an important implementation has been realized, to make the gamification approach open, that is not predefined in all its components, but enables the commoners to directly add and customize challenges, rules, badges and rewards. The CO3 gamification dashboard has allowed also the introduction of qualitatively different rewards, i.e. based on long-term challenges and more intrinsic motivation drivers. This is a relevant and unexpected result of the gamification design process applied in the CO3 project, turning end-users into co-creators.

7 Conclusion

The paper presents the early concept of a gamification strategy applied to the commoning, aimed at engaging people in co-management and co-creation of public services. The proposed gamified approach is conceived as a path, where the individuals can experiment with their routes to become commoners. A survey on interests and motivations suggested some specific gamified elements, for more meaningful experiences.

To create a gamified experience coherent with the commoning principles, the proposed strategy was only partially predefined: participants can add and launch new challenges as individuals and groups, promote on-spot local initiatives and co-created services.

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