



Improving Quality of Interaction with the Mobility Services Through the Gamification Approach

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Abstract. The evolution of mobility sector towards a multimodal and multi-service approach enables new possibilities of interaction for travellers. At once it creates a complex ecosystem where the final users are one of the main key components for the effectiveness and the success of the deployed mobility strategies and solutions. It implies that, both for academic and commercial purposes, a remarkable attention should be put on the design approaches focusing on human aspects in interactive systems. Moreover different methods aiming at enhancing the user experience should be exploited, in order to trigger desirable and worthy innovations. So in this paper we focus on gamification for improving the quality of interaction with the mobility services. In effect, mobility represents a more and more promising domain for the application of playful solutions, although in this field it is nowadays employed mostly for incentivizing smart and sustainable behaviours, also in combination with crowdsourcing. However we can suppose a wider use of this approach in the mobility services, e.g. to improve the overall traveller experience and to increase an active collaboration among the stakeholders. In detail, in this paper we will discuss three main variables to identify which possibilities can emerge in future mobility services by applying a gamification approach: the different stages of a journey, for better knowing the contexts of action and the needs of people potentially interested in; the devices to be exploited, for better accomplishing gamification purposes; the game components, for better understanding how they contribute to fulfill the traveller objectives.

Keywords: Gamification · Mobility services · Quality of interaction

1 Introduction

Mobility services require more attention with regard to the user interaction processes. In particular, it is fundamental improving the overall experience of people, by focusing not only on the efficacy of the transport services but also on the more general feelings of the users before, during and after the travel. The definition of “Mobility as a Service” (MaaS) well represents this concept. According to Kamargianni et al. [1], it refers to an

approach which considers mobility solutions as a more complex field, by taking into account the point of view of the final users. It means that all the touchpoints between the user and the mobility service (e.g.: the involved transportation means, the employed interactive technologies, the devices that allow the access to the transport service, etc.) aim for the general comfort of people and for the related efficacy and effectiveness in the different stages of the travel experience. This approach requires to consider different variables, that is to say economic factors (e.g.: the possibility of using a unique payment method for different section routes), environmental factors (e.g.: the possibility to access to shared transport means instead of the private car), healthy factors (e.g.: the possibility of using safe and sustainable means of transport), etc.

In this field, the role of academic and non-academic research is to identify the most effective methods that are able to improve the quality of user interaction with the mobility services. In particular, we explore how the gamification approach, defined as “the use of game elements in non-game contexts” [2] and generally employed to encourage voluntary behavioral changes [3] and cooperation and self-organization [4], could be applied in the mobility sector with the aim to enhance the traveller experience. In effect, if at a surface level gamification simply consists in applying elements, such as points, badges, levels, and rankings, in order to make more attractive different human activities [5–7], at a deeper view it offers the opportunity to create more pleasant and engaging services [8–10]. An example is the possibility to improve the participation and the engagement of users [11].

The paper is organized as follows. In the Sect. 2, related works that have already explored the application of the gamification approach, especially in the mobility field, are presented. In the Sect. 3, we focus on three main possible variables to consider in order to improve the quality of user interaction with the mobility services: the stages of travel experience, the characteristics of the involved interactive devices, and the game components. In the Sect. 4, a discussion on new possible applications of the gamification approach is presented. In the Sect. 5, conclusions and future works.

2 Related Works

Academic research on gamification has focused its interest on several aspects of this approach, starting from the definition of the term to the analysis of its main elements, from the study of the psychological motivations that stimulate the user to the improvement of the interaction design. Many authors pay their attention to the different fields of application of gamification [12–14], asserting that gamification can be a motivation structure more effective than traditional ones, such as monetary prizes [7]. Many application fields for gamification can be identified. In the education sector it is used in order to maximise the interest of students [15]. Similarly, in the marketing field it is used to improve the interaction and collaboration between customers and companies [16, 17].

Going further, Werbach [18], in connecting gamification to service marketing through the service marketing theory, consider every game as a service. In this regard, Huotari and Hamari [19] give a particular relevance to user experience in gamification, due to the importance of individual player’s subjective perception in game service and,

in general, in gameful experiences [17]. Also Seaborn and Fels [12] highlight the importance of users by sustaining that “gamified systems may need to be selectively designed given the individual make up of the end-user population or even be designed flexibly and inclusively, allowing for personalization and customization, to accommodate individual users”. So, for gamification too, there is a need for “a user-centred approach, characterized by a focus on the needs and desires of the end-users in the design of systems” [12]. In the same way, Nicholson [20] emphasizes the benefits deriving from the adoption of user-centered design to build meaningful gamification services, as this approach places the user, whose needs and requirements exceed those of organizations, at the center of experience and design.

All these insights lead to a more specific focus on Human-Computer Interaction (HCI) in gamification. In detail, in this paper we take as reference point the researches of Seaborn and Fels [12] and Huotari and Hamari [17], as they analyze the gamification from the point of view of user experience and service. In effect, in the past, the academic research seldom focused on the analysis of the topics of the HCI applied to the gamification field. On the contrary, Seaborn and Fels [12] examine the characteristics that affect the user engagement and the quality of interaction with gamified systems. Also the work of Huotari and Hamari goes in this direction by deliberately emphasizing the goal of gamification, i.e. the experiences that it attempts to give rise to, rather than its methods [17]. Moreover, according to the authors the emergence of a gameful experience is enabled by affordances (e.g.: badges, points, or more implicit cues) that attempt to encourage the users towards a more valuable interaction [17].

Starting from this assumption, we focus on the improvement of quality of interaction through gamification in mobility services. The mobility field represents a more and more promising domain for the application of gamified interactive solutions [4, 21]. In effect, ICT has important implications on the behaviors of travellers and we suppose that gamification can influence such behaviors in a more valuable way. In detail, technologies already improve the accessibility [22] and the user experience with public transport, especially by enhancing the perception of safety, and they make travel time more productive [23]. Moreover, they improve affective (e.g.: emotional aspects of transportation), symbolic (e.g.: social position and self presentation aspects) and instrumental (e.g.: the ease of use of public transport based on travel information and intermodal integration) values [21]. Likewise, the use of the elements of gamification affects motivation, attitude and enjoyment, and invokes behavioral outcomes [10].

Very often the aim of gamification in the mobility field, is to encourage smart and sustainable behaviors [24–26] and active collaboration among the customers of a mobility service, especially if combined with a crowdsourcing model [27, 28]. However, despite the overwhelming attention given to the fostering of sustainable behaviors, a lot of studies usefully focus on the user requirements in gamification solutions for mobility. For example Huber and Hilty [29] define four requirements for a Gamification-based Approach to Sustainable Consumption: (1) Respecting consumers as individuals (the users are social actors, to be involved during the preliminary studies, to understand their differences), (2) Respecting the consumers’ autonomy (without predefined paths but allowing a customization), (3) Introducing the social level (allow social interaction to promote experiences sharing), (4) Enabling collective action (game elements on a group

level). In this respect, our purpose in this paper is to contribute to the identification of insights that designers should consider in realizing gamified system according to a user-centered design approach.

3 Quality of Interaction of Mobility Services Through the Gamification Approach

The assumption at the basis of this work is that the gamification approach can offer wider possibilities in order to improve the quality of interaction with mobility services. In effect, the gamification can be more likely considered as “a subset of a larger effort to improve the user experience of interactive systems through gameful design” [12] or even “a process of enhancing a service with affordances for gameful experiences in order to support user’s overall value creation” [19].

If in the previous section we focused on the possibilities actually existing, in the next sections we are going to show the other possible uses of the gamification approach for the interactive services in the future mobility services scenarios. In effect, an use of gamification that overcomes its usual application might aim at improving the whole user experience and encouraging an active participation of people, especially as mobility is considered as a complex field that affects different issues and that is influenced by instrumental and objective variables (e.g.: costs, vehicle quality, information provision, etc.) and non-instrumental and subjective factors (e.g.: safety environment). In this field, the gamification approach can enable a system of interaction dynamics that makes more appealing different user activities in the travel experience.

In order to widen the vision on how the gamification approach can improve the quality of interaction in the domain of mobility services, we will discuss three main variables, which are: the stages of travel experience, that focuses on the different moments of the whole travel experience that the gamification approach can improve; the characteristics of the involved devices, that focuses on how the new interaction dynamics enabled by the gamification also require new digital touchpoints; the game components, that focuses on the identification of different game elements in order to realize a better user experience in the mobility field. In the next sections we are going to explore these possibilities, offering the related insights.

3.1 Stages of a Travel Experience

In order to improve the quality of interaction in the domain of mobility services we consider the whole user experience and the related activities of a travel as part of an extend context of interaction, which may be well expressed through the concept of “journey”. It is a needed assumption that we adopt in consideration of the transformation of the mobility field towards a multimodal approach that leads to consider mobility more as a service, rather than a simple moving from a place to another. In effect, in respect to a stage considered as a continuous movement with one mode of transport/vehicle (including any pure waiting times immediately before or during that movement) and in respect to a trip considered as “a continuous sequence of stages between two activities”,

“the traveller experience is a much broader concept” that “usually starts when the individual begins to consider making a trip, which could happen a long time before the trip actually takes place, and concludes with arrival at the final destination” [30].

In this respect, we observed how there is an increasing interest from both researchers and companies in enhancing the quality of this extended experience. For example, the EU METPEX (A MEasurement Tool to determine the quality of the Passenger Experience) project [31] developed a tool to measure the perceived quality of mobility services throughout the whole traveller experience, therefore not exclusively focusing on a specific service of the trip. In detail, the project emphasizes the contribution to the overall quality perception from different phases of such experience, including pre-trip activities and the eventual joint use of different services, especially for multimodal trips. That is to say that mobility is a complex system which affect different human activities as part of the same experience, which in turn is part of individual daily lives [30]. Moreover, this experience is characterized by different phases which compose a journey. These phases are not fixed entities and may change depending on the different types of the used services. However it is possible to identify some common stages applicable to a generic journey experience. According to a user-centred approach, by knowing the peculiarities of these stages and the related user needs derived from a specific context of use, it is possible to improve the user experience and interaction with the service. In detail, for the purpose of this paper, the focus is on the gamification of mobility services, achieved thanks to a proper design of the service elements, which includes its different phases. So in this paper we consider some studies about mobility referring to the whole journey experience of travellers, that are divided into different stages.

A generic and large subdivision that reflects the different moments of a service experience may concern the stages of pre-trip, on-trip, and post-trip, but it is possible to identify a greater level of detail. Diana et al. [31] in considering the variables that affect the quality of a whole traveller experience identifies four different phases of the journey experience: (1) pre-trip (e.g.: looking for timetables, buying tickets in advance, preparing to leave the origin), (2) walking from/to a point where a travel means is taken (it includes also “walking” as a separate trip leg or stage, or even as the unique mode used for the whole journey), (3) waiting for a travel means before boarding it (excluding waiting on-board before the departure), (4) travelling on-board a given means (public or private, motorised or not). In detail, they use this classification, combined with other ones, for identifying appropriate indicators and variables in order to fill some of the research gap, such as the proper consideration of the whole journey experience. In this regard, a more extensive list of phases of the traveller experience identified for the METPEX projects includes: (1) Trip-related information retrieval, (2) Trip-related decision making process, (3) Leaving from the trip origin, (4) Walking to the pickup point of the first mode of travel (if not a walking trip), (5) Waiting for the travel mode (for public transport trips), (6) Boarding the travel mode (if not a walking trip), (7) Departure, (8) Travel, (9) Arrival, (10) Alighting (if not a walking trip), (11) Transfer to the pickup point of the second mode of travel (for trips with more than one stage) (12) Repeat points 5–11 for all trip stages, (13) Walking to the trip destination [30]. Otherwise, the EU MASAI project about seamless travel, that takes into account a multimodal-multi-services approach in the travel and tourism fields, gives a more ancillary service compliant

(and with a higher level of abstraction) vision about the traveller journey. In detail, it identifies six wide-range iterative stages of travel: (1) Dreaming, (2) Planning, (3) Booking, (4) Anticipating, (5) En route, (6) Destination; in addition to them there is the seventh stage of “after-sales” [32]. Of course by considering a specific context, all these phases may assume a further connotation and show a wider range of correlated activities and sub-activities. For example in the phase of anticipating, or more in detail of waiting for a public transport trip by bus, the phase or activity of checking time and the sub-activities of looking at timetable, looking for a seat at the bus shelter, etc. may be included. So, although it is a useful analysis of tasks in designing a specific service, as shown for example in the Rail Europe service experience map realized by the Adaptive Path company [33], here the interest is, at an higher level of abstraction, on how the analysis of these stages is functional to the design of gamified solution that could improve the traveller experience.

According to this purpose, a reconsideration of the traveller goals to reach during the journey may be a more likely step from which to move in our analysis. In this regard, Foth et al. [34] identify some interventions for all aspect of the journey with a local public transport service, from the planning, the waiting at the platform or bus stop, being on board during the journey, and the time after the journey. Their aim is creating meaningful and enjoyable experiences for passengers, rather than faster stages, by providing social, civic or entertaining applications and content, specially based on games, social networking and information sharing. The interventions described by Foth et al. [34] provide several interactive systems aiming at: influencing the planning phase, such as real-time information about other people travelling intentions; to offer more pleasant individual or collective entertainment and to foster social connections in the waiting time before the travel or along the route; and finally to more effectively engage the traveller on the basis of individual or collective past trips experiences and post-journey data analysis and comparison, such as sharing information about the overall impact of a service or applying an achievement system (e.g.: person’s level of expertise in using public transport). Other examples of the use of gamification in the different travel phases for redefining the traveller goals are the gamified solutions aiming at influence the choice and the effective use of a specific type of transport means, generally for a sustainability purpose [25, 26, 35, 36]. In conclusion, looking at the current use of gamification from the point of view of the stages of a travel experience, it likely aims to provide a sense of playfulness for all the phases and to encourage towards the uptake of more sustainable mobility services, from the planning to the return of the information about the environmental impact of individual or collective mobility behaviours.

3.2 Devices

Nowadays the majority of devices used in mobility services has the function of collecting and managing data or the purpose of spreading the gathered information among users. Therefore, devices can be seen or as sensors and back-end devices (i.e. structural elements of the considered systems), or as front-end devices (i.e. interactive elements between systems and users).

The concept of “hybrid space”, provided by de Souza e Silva [37] refers to the possibility of bringing together these two categories of devices in an efficient context. On the one hand, it implies a redefinition of the relationships between physical and digital spaces, a process started with the diffusion of the Internet in public spaces (especially through the mobile Internet connection and the location-based services); on the other hand it leads to a different perception of the space where people live. The “hybrid space” concept is crucial especially for the mobility domain [37]. The access to mobility services is nowadays made possible mostly through mobile phones [38]. These devices allow to improve the overall travel experience or to engage people in particular tasks. The integration of location-aware features, for example, enables services with various objectives (e.g.: suggesting the fastest way to reach the destination, assisting people in order to never get lost, entertaining travellers during transfers, etc.) that give the space new meanings. In such a way, the aforesaid devices and technologies improve the overall legibility of the spaces [39]. However, in the mobility field, the front-end devices consist not only in personal mobile phones, but also in interactive screens, panels, totems, and other public devices, so creating an hybrid public space.

The project of a real-time information system deployed by the TransLink Transit Authority across all of South East Queensland in Australia [34] offers a suitable example of this kind of space. In detail, the overall system is based on GPS technology to provide accurate telemetry on the location of transport vehicles; however its ultimate goal is to build a digital ecosystem of mobile applications, urban screens, web systems, and locative media as communication devices to support the exchange of real-time information. This digital ecosystem plays a significant role in improving the quality of interaction with the mobility services, as the purpose of the project is not only giving passengers information about the mobility services or entertaining them in a proper way, but also taking advantage of the knowledge about the surrounding places that travellers places that traveller have and to connect them together with dedicated design solutions.

The new interaction modes enabled by hybrid public spaces are made evident by the emerging discipline of Urban Interaction Design. In detail, its focus is not only on the transformation of the urban environment, but also on the different user experience that this transformation creates and create and on the identification of the better design solutions. Moreover, in the Urban Interaction Design field, the collaborative approach, that is based on the contribution of all the stakeholders of the community, is essential to tackle complex issues in the networked city from a human and societal perspective [40]. According to this approach, De Luca et al. [41] provide a framework to better identify the processes behind Urban Interaction Design based on three design elements: urban data visualization, participatory urbanism, and urban gamification. Each of them contributes with specific insights and mechanics to re-define the urban interactions. In detail, urban data visualization refers not only to the possibility of making data on the urban environment visible and accessible, but also to the importance of making people aware of potential urban problems. The other two design elements are equally crucial aspects for modern cities. Participatory urbanism, enabled by the spread of self-built devices for data collection and based on open-source platforms, facilitates the design activity on collaborative systems. Lastly, urban gamification is a powerful tool for engaging people in profitable tasks for cities.

So, the interconnection between digital and physical environments, mainly possible thanks to the widespread of Internet of Things paradigm [42], and the link between back-end and front-end devices open new ways for human interactions with spaces and technologies. Specially in the mobility field, digital environments made of interconnected devices are widely used to provide many kind of services [32]. This trend has to be taken into account and properly exploited by gamification solutions aimed at improving the quality of interaction in the travel experience. In detail, the huge number of devices implemented in mobility services should be considered as a whole in supporting the travellers expectation of a seamless travel experience that connects different services in an enjoyable and undemanding way.

3.3 Game Elements

The third variable we consider in focusing on the improvement of the quality of interaction in mobility services domain consists in the game elements. In detail, this paragraph is focused on the behaviors that game components, game mechanics, and game dynamics can activate. A useful framework for the design of solutions based on the gamification approach is the Gamification Model Canvas of Jiménez [43]. This tool presents all the possible game elements that can be used to change user behaviors or to encourage their active participation in different kinds of platforms. Mobility is one of the field of application of the gamification approach, as it requires many behavioral adjustments to maximize its efficiency.

Wells et al. [35] discuss about the creation of a gamification model useful to encourage sustainable multimodal urban mobility in European cities. According to their framework, making users available to track their own behaviors, setting their own goals, managing their own progress towards the set goals, and responding to challenges, mainly through points, badges, and competitions, is an effective way to incentivize sustainable behaviors. In detail, they identify two core approaches to gamify an interaction: metri-fying the existing tasks and modifying them with proper game-mechanics. The first approach links to the existing tasks some goals to achieve, without modifying the tasks. The objective is encouraging some specific behaviors in return of something, through the dynamics of points, badges, levels, trophies, or prizes as a reward (or a sanction) for the individual performance. The use of leaderboards represents an additional challenging element to apply: it can create a sense of belonging to a community, by enabling users to compare their performances. In the second approach, by associating points to specific tasks and “by carefully balancing which tasks are gamified with those tasks that aren’t, the interaction can be designed to favour particular behaviours” [35].

Weiser et al. [14] discuss about the possibilities of using scores through ICTs to help people in adopting more sustainable behaviours. In details, score is made by the points assigned (or subtracted) to users for every behavior tracked by the system and recognized as sustainable. Points can be assigned both measuring an activity or reaching a goal set by designers. Goals may include both external goals (i.e. the system designer’s perspective) as well as user goals (i.e. set by the user itself) and they may conflict on various hierarchical levels. The challenge in designing a scoring dynamic is to create a meaningful tool to communicate possible future or alternative behaviors, or even evaluations

for past behaviors. In fact the ultimate aim in this kind of solutions is allowing users to internalize externally intended behaviors [44]. Once the scoring architecture is properly designed, the motivational impulse lies in leaderboards, social comparison, and peer pressure, as well as setting objectives and goals that influence user's motivation both towards using the system and changing the behavior.

Frith [45] analyzes the impact of gamification in people's mobility choices and will of participation. In detail, he studies the effects of a Location Based Mobile Game (LBMG) like Foursquare on people's mobility decisions. Foursquare creates what is called an hybrid space [37], that enables a ludic layer with its own game rules, achievements, points, badges and statuses. Moreover, a lot of people are motivated to change their mobility habits and usual patterns to collect virtual objects, like badges, and to give a contribution to the community at the same time. Mayorship instead is a status that only one user at a time can hold making the biggest number of check-in in one place over time. This game element creates a competition among users that improves the participation of the community and modifies the users' habits pushing them to repeatedly visit some places or areas.

Thus, the huge engaging potential of game elements is mainly used to produce changes in users' mobility habits and to increase their attitude to participate in a community. In this regard, Brito et al. [24] warns about the risk of losing the primary focus of gamification - pushing people to collaborate - when creating a competition with points and rewards that is an end in itself. To avoid this, Brito proposes a conceptual framework to guide the design of gamification in crowdsourcing-based systems designing player-centric applications.

The provided examples show some weaknesses related to the application of game elements in the mobility field. The purpose is to investigate further uses of gamification, in order to take advantage of its full potential, especially as regards the aforesaid concept of Mobility as a Service.

4 Discussion

On the basis of the information gathered through the studies reported in the previous sections we elaborate three main questions, i.e.: in which travel stages gamification can be useful and how? Which devices are more suitable in terms of user experience to support a gamification approach in the field of mobility? How the different gamification components contribute to fulfill the traveller objectives? These questions guided the discussion on how the gamification approach may improve the quality of interaction with the mobility services and help to define which objectives related to the travel should be achieved through a gamification approach and how.

Referring to the first point of discussion, in this paper we look at the overall experience of the traveller in the terms of a system of connected services that can be likely enhanced by some affordances for gameful experiences. Indeed, both the travel and the services can be divided into different phases through which the user experience evolves and takes shape. In this sense the different stages of a travel experience are the first variable to consider in order to improve the quality of interaction of a mobility service.

In detail, this first variable is fundamental in defining the kind of objective associated to the different parts of the travel and in defining the related user needs. In fact a deep analysis of the characteristics of these single stages is essential to better know the contexts and the needs of people potentially interested in gamified solutions. On this basis also the goals to pursue through the application of gamification to the mobility services change, so requiring tailored designed solutions. Of course there are differences from person to person and from context to context, also due to the different typologies of mobility services and the peculiar activities related to specific services, but it is possible to identify some common aims and requirements for each stage that let to define some cross-cutting phases of the traveller experience. Each of them may be placed before, during or after the time of trip, although the cyclical and iterative nature of the travel experience led to a more blended situation. So to place each phase in a specific moment may not always be so easy, if not referred to a specific scenario. On the contrary, it may be simpler to consider generic goals - or functionalities if referred to digital systems - for the mobility services, such as purchase and payment, information research, etc. Anyway, also in this case, such goals could better inform about the design of a gamified solution only when put in a specific phase. An equivalent reasoning could be made about the devices and the gamification elements, in order to identify which ones are more appropriate to fulfill the traveller goals and how these components should be implemented in a travel context, depending on the different travel stages and their respective peculiarities. However we tried to generalize and define a possible use of gamification approach in before, during and after the travel, letting more specific application of gamification for particular goals related to the micro-activities of single stages to a proper and effective service design process.

Following on from the analysis of the contribution gathered in the previous section, we observe that in the before moment, gamification is often used to influence the decision-making process of the traveller and to promote the uptake of specific mobility modalities or services. In the during moment gamification can exploit the fact that travellers are sharing their experience, as well as space and time, with people with similar interests or goals, or that they are interacting with different city elements. In the after moment gamification can help to keep involved and informed the traveller in order to influence future travel decisions. Moreover it can provide for the overall journey better information and ample notification for preparing the traveller to upcoming events, avoiding the frequent unpleasant feelings due to the uncertainty of travel related activities [34].

Going further, as regards the suitability of devices in terms of user experience with gamified solutions in the mobility field, it is crucial to consider each device as a part of an interconnected environment that gives to travellers a new overall point of view on the entire service. In detail, not only the personal devices can be seen as interfaces with the mobile services, but also public screens and other devices implemented in mobility infrastructures. The idea of an hybrid space, well expresses the kind of environment in which the journey takes place. In detail, it is a space that combines social connections, digital data, and physical locations through the use of mobile technologies and their “always-on” connections. All this enhances the spatial legibility of places, as the mobile technologies increase the legibility of real spaces by adding new messages, patterns, and

knowledge to them [46] and by creating new spatialities of urban space, which also include a ludic layer [45]. This kind of environments brings to the mobility sector new possibilities that go beyond the mere infomobility and give to the travellers new ways to make travels more enjoyable, productive, social, and meaningful. In particular, it enables opportunities to take advantage of social interactions and shared knowledge among travellers.

In respect to the last point of discussion, game elements have many application in the mobility sector in relation to the fulfillment of many travellers' objectives. Nowadays points, rankings and badges are mainly used to change behaviors and push people towards collaborative dynamics, but they must be reconsidered for purposes more relevant to the domain of service design. In effect, gamification can help users to better understand the proper functioning of mobility services and to make them more enjoyable or profitable, linking together the travellers and their own knowledge. In this regard, the adoption of a user-centered approach in the design of gamified solution helps to improve travellers collaboration activities [24]. Moreover, since in the measurement of the travel experience the traveller satisfaction depends on the whole journey rather than only on the attitudes towards trip legs [30], the use of gamification could be a decisive element in improving the overall traveller perception of the service quality. Of course to be successful gamification have to be part of a user-centered and user experience design process for the development of new interactive systems in the urban environment.

5 Conclusions and Future Work

In this paper we focused on improving the quality of interaction with the mobility services through a gamification approach by discussing about three main elements: travel stages, devices involved in mobility, and game elements used in gamification solutions. In discussing this three variables we came to consider an ecosystem of mobility services better connected and jointed together thanks to gamification. In detail, we argued that the travel itself must be considered as a whole and consistent journey experience. Then we highlighted how nowadays the potential of single devices is strongly tied to the interconnected environments in which they are implemented and we illustrated how the concept of hybrid space enabled a lot of new possibilities in mobility field. Finally, we stated that the majority of the existing solutions that apply game elements to mobility services mainly aim to induce sustainable and collaborative behaviors. Therefore, other purposes that gamification can achieve can be identified besides sustainability and generic collaboration, as the gamification approach enables a system of interaction dynamics that makes more appealing the user activities.

In conclusion, we suggest that the use of gamification should not be limited only to incentivize the choice of sustainable mobility solutions, but it should be used also to facilitate the traveller experience in the specific phases of his or her journey, for example by assisting the users in demanding activities, such as gathering travel-related information, or by making urban interactions related to the travel more enjoyable and meaningful. In general, we see gamification applied to mobility services as a way to improve the quality of interaction in two main directions. The first one is addressed to the journey

in its entirety and aspires to provide consistency for the whole traveller experience in a multimodal transport context. In this sense we see as gamification may create connections and interplays between the different stages of a journey, enhancing the overall service. The second one offers a new and different point of view through which to consider each stage of the journey and in this sense it has a fundamental impact on the goals of the travel. In detail, since each stages entails different activities and relies to some other collateral aspects of the travel, gamified solutions may favour these other aspects of the journey, in order to give a richer experience to the traveller. Some possibilities concern: journey pleasantness; exploration of unknown places along the travel route; promotion of the territory heritage; creation of a sense of community, etc. In this case gamification may mainly affect a single phase, still having effect on the overall traveller experience, such as in the case of planning travel to have more fun during the journey, similarly to the project presented by Foth et al. [34].

In order to create this experience both device and game elements have to interplay with the goals associated to each stage of the travel. In fact, digital technologies blur the lines between the different stages of a travel experience, significantly affecting the travellers attitudes. However, the fundamental moments that identify the travel as an extended service, i.e. before, during, and after the time of trip, remain and become multiplied and superimposed layers of the traveller journey. This make the travel experience very complex, so requiring new design interventions and approaches, such as gamification, in order to facilitate the interaction between the traveller and the mobility services providers. In this regard, a possible intervention could be considering all the different stages of a travel - and not only the movement from a place to another - as part of a game dynamic, rethinking the traveller as an actual player that can be engaged in mobility tasks. So gamification could embrace the entire process of service and user experience design and not only be a tool to achieve single goals during the different travel stage.

Future works of this contribution will be focused on some qualitative studies that will be addressed to the identification of specific insights that gave greater value to the findings of this study. They will also allow to define more specific design solutions useful for the identification of future mobility services.

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