Sustainable interaction for mobility system

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DESIGNING SUSTAINABILITY FOR ALL

Edited by Marcelo Ambrosio and Carlo Vezzoli

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SUSTAINABLE INTERACTION FOR MOBILITY SYSTEM

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ABSTRACT

Many studies report that the results of top-down policymaking approach are not enough and suggest that "sustainable development cannot be imposed from above. It will not take root unless people across the country are actively engaged" (UK DEFRA, 2002). The goal of this research is to combine the interaction and gamification strategy with a set of personal data in order to increase the users' awareness of the impact of each action. The research context is the mobility system in which the increase in road congestion and the risk to compromise human well-being are just some of the critical points to be faced in the future. Possible solutions to these problems already exist, such as shared mobility and autonomous cars, But the change to be fostered is not only about business or technology, it must involve the citizens who will influence the future through their decisions and behaviour. The experimentation focuses on a case study useful for obtaining and analyzing the qualitative and quantitative research results. In particular the case study concerns the design of an interactive augmented reality game, that plays on board of a full self-driving car, in which user takes decisions as the leader of his fictional world; as result of his decisions the environment around him changes. The game continually reconfigures itself taking advantage of users' personal information and data collected through different ways. Gestures, copywriting and other elements will follow the needs of each user. Instead of a more traditional approach that results frustrating and not very involving for the user, the game uses an ironic, surreal, and funny language in order to be more engageable, instead of a more traditional approach. The goal is to make conscious users towards the environment that surrounds him and his ability to affect positively or negative the system in which he lives.

1. INTRODUCTION

The efforts of all world's institutions compared with the pessimistic data concerning global environmental change has pushed the institutions to consider 'citizen–consumers' as key environmental actors. In fact actions of each citizen are crucial; thus, the citizen must be encouraged to make responsible choices and positive behaviors regarding sustainability. (Johnston, 2007; Spaargaren & Mol, 2008). Many studies report that the results of top-down policy-making approach are not enough and suggest that "sustainable development cannot be imposed from above. It will not take root unless people across the country are actively engaged" (UK DEFRA, 2002). Many researchers would suggest the necessity of creating a new approach to address behavior change. This new approach should consider and connect better sets of practices; "researchers should engage and work with practitioners to explore the practicalities of using alternative approaches that rely on complex and shifting understandings of behavior and practice" (Barr, S., Shaw, G. et al., 2011). According to that, the project aims to experiments an alternative strategy to engage people with sustainability issues. Those strategies involve the use of gaming elements, as fun, and an ironic language to engage and motivate people to act responsibly. The research context is the mobility system, and, the project is thought to be part of the user experience of the autonomous vehicle. Autonomous vehicles will provide many opportunities and advantages to users. The experience inside the vehicle will be completely different because users will be free from driving and will interact with the vehicle, the context and with other possible actors. One of the goals is to evaluate new technological integrations as a means and an opportunity for improving both individual and collective wellbeing. Starting from this concept, the research team develop an interactive augmented reality game, which the main purpose of engaging users into sustainability issues. This game will be played during part of the traveland will interact with each user differently. The game will change contents and configuration according to many factors, as the context of use and the characteristic of specific users. In order to achieve a very personalized experience, we acknowledge that collecting data from users could be a valid solution to learn more about them in order to create specific profiles that answer specific needs.

2. BACKGROUND

2.1 Behavior changes in the sustainability context

Sustainability is a big and very complex issue that involves three dimensions (Economic, Environmental, Social), "those dimensions are tightly coupled, and their interplay cause global systemic effects that cannot be fully understood or predicted based on local events" (Fabricatore, C. & Lopez, X., 2012). Addressing the complexity of sustainability requires equally complex strategies, it is difficult to define a unique way to face it. In this project we considered a voluntarist approach, it argues that, although attitudes and behaviour are driven by deep structures (for example economic structures), the structures are determined in part by how we live our lives. This approach opens the possibility to achieve sustainable development also through behavior change (Dobson, A., 2007). There are many forms to address behavior change and encourage people to acts into environmentally beneficial, for example educating them or offering them financial advantages and penalties, but those latter strategies although could change behaviour very fast (Dobson, A., 2007), may not make people aware of real problem, and so do not solve the problems in long terms. In the process of behavior change design should educate people "for sustainability-related values (e.g., ethics, cooperation, respect for the environment, etc.) to influence individual decisions" (Bolis, I., N.Morioka, S. et al., 2017). In attempting to integrate these values in our society should be considered that our current development model encourages individualism (based on monetary evaluation), then one of the first ambitions for practitioners should be promoting societal values focused on improving the welfare of society rather than only the individual welfare (Bolis, I., N.Morioka, S. et al., 2017). Hence, communicating value as the respect of the natural environment, quality of life, altruism and sense of community could be the base to build sustainable development. In order to engage people with those values, they needed to feel involved and informed about the issue. The values, however, cannot be imposed, in this way, it would be detrimental (Bolis, I., N.Morioka, S. et al., 2017).

2.2 Autonomous cars and Sustainable mobility

The relevant interest of the scientific community and the world's most significant technological brands about autonomous cars lets us imagine that this kind of technology will become more widespread in the near future (Bishop, R., 2005). The autonomous vehicle probably will change the way we live the movement and experience the vehicle, they will also influence widely the whole mobility system. Many researches have analysed, for example, the efficiency of this technological shift regarding the sustainability of the mobility system, as an example the decrease of both accident and congestion (J.Fagnant, D. & Kockelman, K., 2015). Probably, the most important revolutionary factors remain the lack of human drive control in fully autonomous vehicles, this disruptive element will influence directly the in-vehicle experience offering an exploration of new forms of connectivity, as well the integration of entertainment and gaming contents (Meschtscherjakov, A., Tscheligi, M. et al, 2015). It will not just be a question of quantity of information and connections that system could provide to users that will enhance the whole user experience inside the vehicle, it is more about the quality and value of those contents and interactions. Relationships and interactions between user and vehicle will work very differently into the autonomous vehicles. The vehicles will

turn smarter than ever, their capacity to perform a lot of connections, elaborate information and take decisions it may cause a feeling of lack of control for passengers, and then ruins their experience. This trouble, however, is a big challenge for interaction designers, they have the responsibility to transform this safe technology in a cooperative and assistant system rather than reduce it as a distant and pragmatic autonomous driving system.

2.3 Learning sustainability through gaming

Numerous empirical studies confirmed the effectiveness of games as educational tools in the last recent years. The reason why games are so important to cover this role are multiple: "the intrinsic motivation stimulated in games (Dieleman & Huisingh 2006); the presence of pedagogic principles in game design (Becker 2007); and the access to shared social practices for the construction of knowledge (Gee 2007; Steinkhueler 2008)"(Fabricatore, C. & Lopez, X., 2012). In the context of sustainability learning, the element of fun in games could be very beneficial to decrease emotion like stress or frustration, supporting knowledge and skills learning.

Moreover, educating for sustainability demands approaches that support system thinking and complex environment, games in that way are perfect because they address complexity and push the user to face unpredictability and nonlinear development of the event (Fabricatore, C. & Lopez, X., 2012).

Improving the capacity to collaborate with a system of actors is crucial to achieve sustainable development, "games foster the collective construction of knowledge, collaboration and sense of belonging by stimulating players to discover and discuss within the gaming community how to tackle game mechanism, quests, rules and stories that define the game world (Steinkuehler 2008)" (Fabricatore, C. & Lopez, X., 2012).

Finally, games enable users to understand better phenomena through the process of "learning by doing", the players can see just-in-time the feedback, affording a situated and systemic understanding of the consequences of their actions (Fabricatore, C. & Lopez, X., 2012).

3. PROJECT

3.1 Experimenting a new education approach: a game for sustainability learning

There is an urgent need to develop and experiment with new approaches for sustainability communication and learning. The direct approach that communicates to people what they do, or they do not in term of sustainable behavior, most of the time appear frustrating and annoying for them. We can suppose that people avoid some sustainable communication contents because they are not engaged in several ways with them. Our contribution consists in revalue actual approaches and try to communicate sustainability through an indirect way emphasizing fun as a lever for engaging people. Gaming environment is one of the famous places where people are engaged with fun, it is probably one of the most suitable mean means to transfer this kind of contents; games are also important in this context because they have the power to engage people in the long term. The literature analysis highlighted the lack of effectiveness for sustainable communication to engage people in the long term. For example, a team of researcher analyzed the impact of the film "The Day after Tomorrow" and discovered that this Hollywood disaster blockbuster "raised awareness of climate change and triggered anxiety among some viewers about the possible impacts as well as about other environmental risks." (Lowe, T., Brown, K. et al., 2006). However, as their study has shown, "the effects upon the public psyche may be brief and quickly overtaken by more pressing day-to-day issues" (Lowe, T., Brown, K. et al., 2006). Games, differently from films, if they are engaging enough, they could keep the level of interest high over time because they involve users frequently and establish a more interactive relationship between users and contents. Furthermore, the game is designed to enrich a highly interactive environment as that of an autonomous vehicle. The cabin of a digital car for us is a powerful place where experimenting new interaction between human, machine and environment (both inside and outside the vehicle). Considering the element of the environment, in particular, the environment outside the vehicle, is crucial, because one of the significant risks, when we talk about the digital car, is that the digital contents immerse users in a virtual dimension that detaches them from the real world. The digital experience should instead exalt reality and help the user to understand it better rather than completely detaching him from it. This capability of digital cars to perform deep connection with the real context through smart technologies represents an excellent opportunity to strengthen the sense of belonging of the user towards a system of which he is a part and of which he too is responsible for the conditions.

3.2 Methodology

The project is based on the use of systemic methodology, especially because the topic of sustainability cannot be addressed without considering relations between all the actors, if the goal is to generate significant changes. Eeconomic, environmental and social actors are strongly interdependent, and they represent multiple nodes of a complex network that needs to be considered as a whole. (Bolis, I., N.Morioka, S. et al., 2017). Systemic thinking is helpful to emphasize the connections and relationship between those different contexts, in a way that users can understand better how their impact act and influence through several contexts. In order to apply all these concepts to our project we started with a preliminary holistic investigation in the world of digital games and beyond, the purpose of understand state of the art and the relationship between sustainability and games. Many essential results come out from this first research; in particular, one important reference has strongly influenced the structure of our project.

This main case study is about "Reigns", an award-winning digital video game set in a fictional medieval world where the player has the role of a monarch who rules the kingdom by accepting or rejecting suggestions from advisors.

A lead developer has claimed that the team wanted to "mock the way our societies tend to deal with complexity". They used the swipe interaction to make people feel the disconnect between this simple gesture of answering to suggestions and the complex consequences of their decisions. Additionally, to that idea, we consider extremely important to immediately communicate to the user the importance of balance between the three dimensions of the system. In our project each action has consequences on all three dimensions, in this way, the system design combined with the interactive and game dynamics can trigger a self-reflection even in the face of unethical choices.

3.3 The game

The game immerses the player in a mixed world with elements of fiction and elements referred to reality. The main task of players is to take decisions interacting with this world in a several ways and experiencing a different kind of reaction as results of the interaction between him, the vehicle and the environment. The team created several fictional characters for this world, and the personality of each one is the result of field research. The field research qualitatively underlined the reactions of people in front of generic sustainability issues. A matrix with four variables (Active-Passive /Expert-Inexpert) has been created to characterize several kinds of people, based on their attitude. These characteristics have been used to create the characters. Those characters are significant for the game because their role is an advisor for the players. The player experiences this world as a leader, and he is the main responsible for the conditions of this world. The advisors ask, with an ironic tone of voice, to take decisions about matters that can appear strange, absurd o nonsensical. The suggestions will be customized for each user, as a result of the elaboration of personal data principally collect through the previous journeys. By the consequence of user's choices the whole system changes constantly, and the player can monitor this changing, positive or negative, through many signals. The most important signal that player have to follow during the game to avoid the "game over" is the state of three bars that represent the three dimensions of sustainability. If one of this bar go over the maximum or minimum limits the game ends.

Others aspect that communicates the changing of the world are visible through augmented reality and involving the outside environment mixing virtual and real elements in order to create a specific effect, as an example environment deteriorates by a human-made disaster. The game is subdivided into levels, and the player should be motivated to overcome them discovering new characters, effect and additional element until to complete the game.

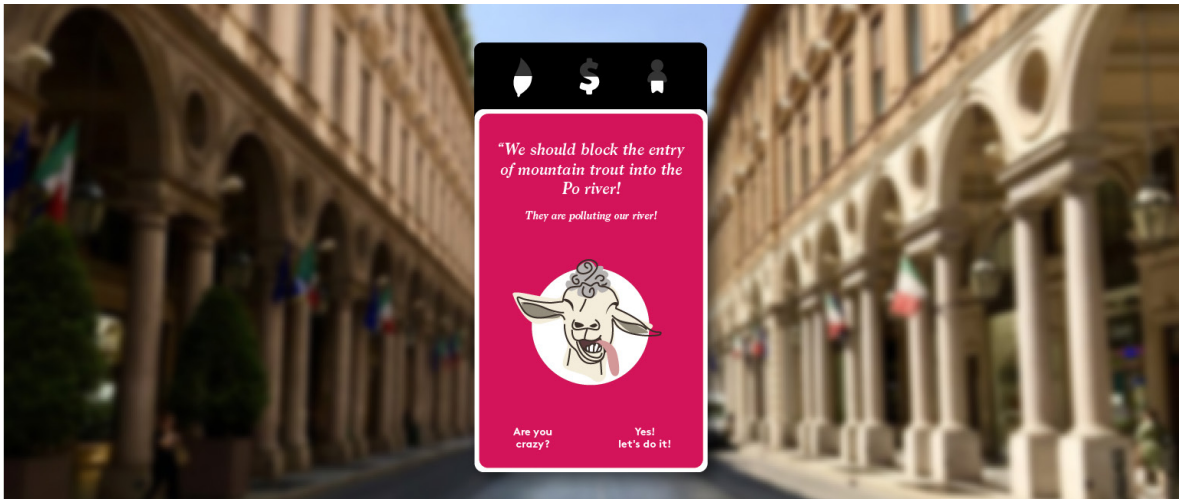
This strategy should principally have the user's fun and stimulate their sense with special effects that connect him also with the outside environment. At the same time, the game pushes the player to think about complexly in front of suggestions avoiding the destroying of the balance system and overcome the levels to complete the game.

3.4 Prototyping

Considering the amount of complexity and technologies involved in this project we planned three-step of prototyping in order to have the possibility to experiment the concept more and more time improving and correcting the elements through user tests.

The three steps comprehend;

- First prototype [Figure 1]: consist in a basic interactive mock-up build with assembled screen composed by a limited series of cards (simulation of the first level's game). Inside of each card a character suggests something to the player who has to decide between two answers. Our expectation for this prototype is to understand the effectiveness of the general approach and if this strategy could be both engageable and educative.



[Figure 1] Screen of the first prototype showing one of the cards of the game.

- Second prototype: the upgrade compared to the prototype is mostly about the interaction and the environment. If the prototype is thought to be experienced through a display, the second one will be tested in Virtual Reality (VR). The VR technology allows us to understand better how the game could work inside the autonomous vehicle context.

- Third prototype: the last version of the prototype will be very near to the real game. Now it is complicated to plan how to build it because it will be a result of previously experimentation. Our idea is to test the last one directly inside the autonomous vehicle and use all technologies we mentioned above.

3.5 Experimentation

The first experimentation was based on the first prototype and consisted in a user test followed by a survey.

As we explained in the prototype section, our main expectation for this experiment is to understand the effectiveness of the general approach, measure the engagement and the education capability of the game through a professional consult. We selected a sample of experts because we intended to obtain a technical and no-technical response. The users represent category of designers, and most of them are involved in the sustainable research field. We asked the user to test the prototype and answer to the survey about many game's aspects.

The survey was composed by eleven closed question and one open question for more consideration.

3.6 Results

For the users, the game appears easy enough to learn, but the objective is a little vague and not very understandable. Despite the firm limits in terms of interactivity, the prototype seems to have actively involved most users, some of them recognize these limits and consider that the application of other interaction modalities in future prototypes could improve the experience making it more engaging. The type of communication approach to the theme of sustainable education appears to be quite innovative for most users, although many of them can not define whether this strategy is counterproductive or supportive. In general, the sample has divergent opinions about the ability of the game to reflect on sustainable issues, but almost everyone agrees that the implementation of the structured game and the improvement of language can help achieve better this goal.

4. CONCLUSION

The response obtained by the expert users provided us with many insights for improving the prototype and the game as a whole. This first experimentation helps us to understand that the objectives of the game should be clearer for the users, and even if the suggestions by characters could appear deliberately no-sense, maybe the pattern of the questions should be more strategic. Another factor that influenced the test was the poorly interactivity of the prototype respect to the concept. Consequently, in the next prototype, we will concentrate our effort to implement this aspect including also more immersive technologies. Concerning the effectiveness of the education approach, we discovered that, although we involved expert users into the test, they were not able to evaluate precisely this aspect. Maybe in the next experimentation, the sample should also be extended to the non-expert users and should be taken into consideration the impact of the game in long terms to understand better the influence of these stimuli in everyday life.

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