

## Participatory co-design approach for Greencoin educational tool shaping urban green behaviors

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**Abstract**—Our main goal is to prepare assumptions of the Greencoin (GC) cybernetic system, implying pro-ecological attitudes and behavior of city residents. We used qualitative methods, including a literature review and action research - workshops attended by academics, representatives of private and business sectors, urban movements, municipal institutions' partners, and residents. Our results defined functionalities of the GC, identified main climate challenges, and confronted city's possibilities and expectations of its residents. Application modules were proposed to help shape pro-ecological attitudes and behaviors of city residents. The modules include educational solutions fitting into the circular economy, and metabolic approach, enabling broader inclusion in the community. Our studies contribute to and fill the gap in the stream of research and knowledge on implementations in the co-creation of application solutions that promote pro-environmental attitudes and behavior.

**Keywords**—adult education; circular economy; co-design; community currency; economic/urban development; participatory design; urban adaptability; urban education

### I. INTRODUCTION

Looking for new educational solutions to shape the pro-environmental behaviors of urban dwellers is a challenge for city authorities, stakeholders, and residents alike. We consider ways to stimulate 'green urban behavior', which means pro-ecological and prosocial behavior that manifests positively. These behaviors benefit others prompted by empathy, moral values, and responsibility rather than a desire for personal gain [1]. Involving residents in the designing a learning environment process, especially one based on developing information and communication technologies (ICT), is a crucial component of process aimed at its efficient implementation in real-life conditions. The participatory design actively involves stakeholders in the design process to ensure that the result meets their needs and is beneficial [2].

The paper introduces the Greencoin (GC) cybernetic system, which can become an educational tool for strengthening the implementation process of adaptive urban policies tailored to the needs of its residents. The following research questions guide presented study:

Q1. What should be the solutions for designing a cybernetic system that effectively implies pro-ecological attitudes and behaviors of the city's residents?

Q2. How to engage residents and keep their motivation and shared responsibility for climate change mitigations?

Q3. How can the GC cybernetic system shape pro-ecological attitudes and behaviors?

In the next part of the paper, we briefly introduce the co-design concept, theoretical background, and the Greencoin description. Next, we depict our research methodology (objectives, research methods adopted, study process data). Next, we describe the organization of participatory co-design workshops and their findings, discuss the results, and formulate conclusions. The last sections are acknowledgments and a list of references.

### II. THEORETICAL BACKGROUND

The term 'co-design' is defined diversely in the literature. It is understood as "the creativity of designers and people not trained in design working together in the design development process" [3]. A definition proposed in [4] states that co-design is a process of knowledge sharing, knowledge creation and integration, and the use of the design process by representatives from different backgrounds and disciplines. The concept is rooted in private sector business innovation studies, and it was further developed in the public sector research [5]. Co-design is perceived as a promising method for policy-making. It allows to improve the responsiveness of city dwellers, develop more comprehensive solutions, and integrate strategies for urgent urban needs [6]. Co-design boosts collaboration and shortens the distance between different citizen groups, city authorities, policymakers [2]. Co-design in urban planning allows for higher transparency, and, as a consequence, it increases the responsibility of citizens and their support for changes in urban policies [7]. However, there is little empirical evidence for the real impact of a co-design method on effective public policy development and implementation [7], also various barriers to reaching a shared understanding in co-design projects [4].

Performed literature review shows a lack of joint academia-public research on pro-environmental urban ICT solutions for Eastern European cities. The GC research project focuses on the effective ICT tool creation, an application intended to co-educate, empower and boost pro-environmental actions among dwellers of the selected city through an alternative currency. The Greencoin application will facilitate the process of rewarding the environmentally friendly behavior of city residents. The collected points

(green coins) can then be used to support pro-environmental actions, either collectively (e.g., donating to an eco-fund) or individually (e.g., renting a city bike).

### III. METHODOLOGY

The research methodology is based on the defined phases presented in Figure 1. Our main aim is to prepare the assumptions of the GC cybernetic system, which implies the pro-ecological attitudes and behavior of city residents. Three formulated specific objectives support this main goal:

O1. To identify the needs of residents to shape their behavior towards pro-ecological counteracting climate change.

O2. To present and test tools for shaping and consolidating attitudes, pro-ecological behavior, and joining the pro-ecological process among the city's inhabitants.

O3. To co-create the GC system by project team and end-users.



Figure 1. Research framework. Source: Authors' own elaboration.

The methodological approach to the working and upscaling phases was based on participatory co-design, aiming to involve various stakeholders and the potential system users in its design development process [2]. However, it also included additional components drawn from other approaches. Firstly, we used a design thinking methodology (1) putting the users and their needs at the center of the process, (2) allowing the problem to be analyzed from different perspectives, sometimes not noticeable, (3) based on frequent feedback [8]. Secondly, we used elements of the World Café methodology (1) to facilitate discussion in heterogeneous groups, (2) to stimulate genuine and constructive engagement, (3) to build relationships [9]. Thirdly, as we aimed to observe participant behavior, we used the Action Research methodology [10].

One of the basic assumptions of designing a system functionality based on the activity of its future users was to involve them in the process from the earliest stage. In fall 2021, we held a series of workshops with various groups of stakeholders to integrate the local community into project activities. The first workshop, which served as an example here, held in the city of Gdańsk (Poland), was attended by 15 external participants, four moderators (including one prominent leader), four facilitators, and four observers – the project team members. External participants included people representing the municipality, key institutions (e.g., municipal water suppliers, oil companies, municipal sports centers, information and education center), private businesses, local social networks, startups, and non-governmental organizations (NGOs). All participants are also residents of the city.

### IV. PARTICIPATORY CO-DESIGN WORKSHOP

After introducing guests, hosts, workshop objectives, and the idea of alternative community currencies, the workshop's participants were divided into three working groups. Each group contained representatives of different sectors and disciplines, assisted by three project team members. The workshop proceeded according to the following sessions: (1) identification of existing challenges, (2) identification of good practices, (3) working out solutions addressing diagnosed challenges, optimal from the point of view of participants, (4) proposal of application functionalities and benefits for users, (5) the strengths and weaknesses analysis. After each round, there was a summary of the session.

### V. FINDINGS FROM THE WORKSHOPS

#### A. Existing Challenges Identification

Among the most significant challenges, stakeholders identified the expectation of efficient urban transport. There is a need to develop a comprehensive system that allows flexible combinations of different, more efficient urban transport solutions, including enhancing alternative modes of transportation such as bicycles and scooters. It does not mean creating a new system but integrating and improving existing ones. On the other hand, there is a need for education to identify optimal transport connections allowing individual users to reduce air pollution and gain economic and time benefits. The GC should help to shape walkable cities.

Although city officials are taking numerous actions to address waste management issues, the problem is visible at every level, from residents to city authorities. The development of efficient solutions should take place as soon as possible. City residents should be aware of how important they are in the chain. Participants also focused on the need to reduce consumption and promote a metabolic approach, including energy, water, food conservation. The GC should support circularity, engage small entrepreneurship as part of a rewarding system and diminish the risk of greenwashing.

#### B. Existing Good Practices Identification

The mentioned solutions included local practices undertaken by individual residents, friends, neighbors, but also examples taken from other world cities. An undoubted advantage of the participatory approach was the stimulating atmosphere releasing existing practical knowledge among workshop participants. The joint discussion made it possible to realize and understand different perspectives: residents, officials, and the city authorities. The teams focused mainly on how existing solutions could be embedded in the GC cybernetic system. Many of the good practices found by the stakeholders tackled the challenge of waste management. For example, the free canoe rental in exchange for collecting garbage from the water was mentioned.

#### C. Suggestions and Discussion on Solutions

We based the workshops and discussions among their participants on the assumption that the cybernetic system and its specific applications and functionalities can change the behavior of residents [11]. The team's discussion tackled the



challenge of integrating existing applications into the GC system or taking a step further by developing their functionalities. A similar approach was recommended by researchers in the scientific literature using different systems [12]. Interactive dashboards and real-time competition between users and educational tips were found as solutions keeping the motivation of end-users, which may also enhance the educational value of our GC portal [13]. The issue discussed widely was the security allowing to diminish fake behaviors. They found that the users should be involved in the verification process and a part of the rewarding system. This conclusion also is in line with the views of other authors stating that the importance of the human factor in information security management cannot be underestimated [14]. The GC should include solutions supporting eco-living choices and helping to make smart decisions allowing climate change mitigation. Behaviors like, e.g., using public transportation should result in discounts or free travel. This proposal is in line with the evolution of the integration of spatial and energy planning, perceived as supportive for local development [15].

## VI. CONCLUSIONS

The functionalities of the GC system address issues of an integrated urban transport system to reduce the share of cars that generate significant pollution and traffic jams. Workshop participants also refer to the need to reduce consumerism and promote a metabolic approach: energy, water and food saving, and rational waste management. To a large extent, a GC cyber system should not be a new creation but rather integrate and support existing solutions currently highly fragmented and inefficient when used in isolation.

The model for engaging and motivating users is to operate the GC cybernetic system as an application that integrates the "future green" creative community, bringing together companies, local governments, and users. Users engage both in initiatives proposed by the local government or sponsoring partners but also in bottom-up initiatives based on the electronic circulation of the alternative currency.

Proposed application modules shaping pro-ecological attitudes and behaviors of city residents include education related to urban mobility, solutions that fit into the circular economy, metabolic approach, enabling broader inclusion in the community, and counteracting social exclusion, e.g., the elderly or disabled. The operation of the GC cybernetic system should be based as much on instrumental conditioning, through a system of rewards, as on educational activities that increase users' knowledge of the risks of climate change and mitigation.

The results are planned to be implemented in other cities worldwide, especially in Eastern European countries. At this stage, the primary beneficiaries are the authorities and local communities of Gdańsk. The limitation of our research was that it was conducted only in Poland. In addition, the research was qualitative. It would be worth further enriching the study with a quantitative approach in the future, allowing the researchers to reach more stakeholders.

Our study contributes to existing research and knowledge on implementations of participatory design with application

solutions promoting pro-ecological attitudes and behavior. To the best of our knowledge, there are not too many publications that could bring added value to the existing knowledge pool. The study results could be beneficial for researchers examining participatory co-design, ICT tools for inclusion and urban adaptability topics, local authorities, policymakers, businesses interested in community involvement opportunities and cooperation, NGOs engaged in social inclusion, ecology, and circular economy topics.

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