

## Empowering Cities for Sustainable Wellbeing

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**Abstract.** Quality of life in cities can be improved through reshaping and advancing urban spaces with seamless persuasive and socially influencing strategies for empowering people to succeed in achieving better lifestyles. This vision aims at helping people to acquire healthy and resource-efficient everyday routines, thus leading to prosperous and sustainable societies. Urban engineers and technology developers are oftentimes unaware of how diversely their innovations will affect lives of many people. Therefore, this research is focused on investigating and designing ways how urban environments can be retrofitted and complemented with persuasive technology and socially influencing systems to facilitate societal changes at scale. Outcomes of this research are instrumental for various contexts, including health, mobility, education, energy and water conservation, safety, emergency management, ecology, and economy. Ultimately, more refined scientific knowledge on how to design empowering cities has to be generated and translated into applicable guidelines for practice to foster their emergence.

**Keywords:** persuasion, empowerment, socially influencing systems, wellbeing, mobility, behavior change, sustainability, gamification, persuasive technology

### 1 Motivation

Future cities will reshape human behavior in countless ways. Persuasive urban systems will play an important role in making cities more livable and resource-efficient by addressing current environmental problems and enabling healthier routines. Therefore, future research should be directed towards exploring how urban design might be combined with persuasive technology [3] and socially influencing systems [4-5] to encourage healthy behaviors at scale.

More effort has to be put into studying how quality of life and the health of the individual and communities might be improved through the creation of empowering

cities, streets, buildings, homes, and vehicles. Information technology and computer systems are increasingly designed to support everyday routines and advance user experience in multiple ways [2]. Novel computer systems can be also intentionally designed to influence how users think and behave. Theories of persuasion and social influence provide various strategies for the developers of such systems to facilitate desired effects on users.

Research on empowering cities seeks to advance urban spaces to facilitate societal changes. This research is primarily focused on socially engaging environments for supporting entrepreneurship and innovation, reshaping routines and behavioral patterns in dense urban districts, intelligent outdoor sensing for shifting mobility modes, enhancing environmentally friendly behaviors through social norms, interactive public feedback channels for affecting attitudes, engaging residents through socially influencing systems [4-5], exploring methods for designing persuasive neighborhoods, testing agent-based models and simulations of persuasive interventions, and fostering adoption of novel urban systems.

## 2 Importance

The proposed research direction is highly important, as it will directly influence everyone living in future cities. Environmental, personal, and behavioral factors are locked into triadic reciprocal determinism [1], meaning that all three are strongly interconnected and continuously reshaping each other. Thus, environmental design is strong influencer on human behavior and attitude. In other words, quite often it is merely sufficient to improve urban spaces to help people become healthier and to create sustainable communities. This is very powerful vision as it encompasses transformation of human behavior and urban environments at scale. Moreover, since persuasion sometimes has a negative connotation, we will explore new ways to empower communities and cities.

The proposed research will reflect on novel ways of how socially influencing systems [4-5] enable perpetual mechanisms to foster user motivation as compared to conventional methods, such as those that are based on the principle of carrots and sticks. Earlier research on motivation discusses methods that have substantial limitations. For example, monetary incentives are mostly effective only as long they are provided, so people tend returning to their earlier behavior after the motivators are taken away. Instead, persuasive urban systems harness social influence from crowd behavior to craft influential messaging aimed at shifting behavior and attitude of an individual, who naturally is an integral part of the same crowd. Such continuous interplay can ultimately result in an ongoing process that reshapes communities and societies without any other incentives.

## 3 Agenda

The empowering cities research agenda is focused on reshaping and redesigning three main urban areas: outdoor environments, indoor environments, and mobility in cities.

Public spaces can be advanced in many ways, e.g. supermarkets can project a portion of how many healthy products have been purchased that day, week, or month. Responsive environments can use ambient lights to provide feedback about behavioral patterns of crowds. For example, streetlights can change color depending of how many joggers have been on that street on that morning. The window frames of residential buildings can be illuminated for those apartments, which have changed regular light bulbs to energy-efficient ones.

Computer-supported strategies [4] can be implemented indoors to motivate using stairs instead of an elevator. For example, a situated display that represents various comparisons of what can happen when stairs or an elevator is chosen. Strategies can be introduced to increase water intake in offices. For example, a situated display can present an increase of water consumption, which can be used to compete with other offices. New ways can be designed for office workers to increase socializing among individuals from various groups and departments. For example, specific game-like activities can be set up for employees to promote socializing.

Mobility within dense urban districts can be reshaped in multiple ways, for example, by introducing influential strategies to facilitate bicycle commuting. Street signage can be used to display how many bicyclists have ridden over a bridge today, for instance. Mobile apps can be developed to engage bicycle riders in reporting experiences with bike lanes and their quality in a selected urban area. Electric bicycles can be complemented with influential strategies to attract more riders and persuade them to pedal.

## 4 Application

There are various ways how the concepts of empowering cities can be designed and applied in urban contexts to support wellbeing. For example, it is necessary to design interventions for promoting bicycling and walking, because these mobility modes are carbon neutral, provide major health and financial benefits, and require less space for parking. Besides investing in infrastructure, cities can work on shifting mobility patterns towards bicycling and walking through publicly engaging urban interventions, especially designed leveraging persuasive technology [3] and socially influencing systems [4-5].

Earlier research traditionally reports how various interventions to promote modal shift can be effective. However, most of them rather follow one of the traditional approaches like publicity campaigns, engineering measures, or financial incentives. Therefore, more research should be done with regards to how behavioral and attitudinal changes can be achieved through persuasion and social influence [6]. Empowering cities have potential to significantly contribute to this effort, for example, through publicly displayed street signage with interactive computer-supported [4] social comparisons of cars versus bicycles.

To promote walking, city planners can potentially make many modifications to the urban environment. Besides meeting the requirements of safe walking pathways, there are other proven methods of fostering behavioral and attitudinal changes through

social influence [5]. Persuasive urban systems can leverage the principles of normative influence, social learning, and social facilitation to affect the way people think about walking, which might presumably lead to increased physical activity. The principles of recognition, competition, and cooperation can be incorporated to build on the initial levels of walking and promote sustainable adoption.

Empowering cities can make walking experience more engaging, for example, by combining a mobile phone app that interacts with retrofitted traffic light junctions. So, when waiting at traffic light junctions, people would be invited to do certain meaningful activities. To represent the level of activity at each junction, each traffic light can be overlaid with an interactive color strip, which would display rankings on a particular day or week.

## 5 Future

Fundamentally new strategies must be found for creating the places where people live and work, and the mobility systems that connect these places, in order to meet the profound challenges of the future. Novel models for urban architecture and personal vehicles should be more responsive to the unique needs and values of individuals through the application of disentangled systems and smart customization technology. Technology has to be designed to understand and respond to human activity, environmental conditions, and market dynamics. The design of future cities requires optimal combinations of automated systems, just-in-time information for personal control, and interfaces to persuade people to adopt sustainable behaviors.

Drawing on socio-psychological theories [1] and integrating them with new concepts for urban design and technology [3], the proposed empowering cities research aims at advancing livability in future cities.

## 6 Literature

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