



# Intelligent Playful Environments in New Urban Social Landscape

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**Abstract.** The concept of Smart Cities are giving lots of opportunities for using technology to make citizens healthier and happier in the future cities. Recent development of artificial intelligence and its capacity to support people in creative and learning processes can be crucial factor in changing social landscape and lead to novel social innovations. In this paper, we are presenting art/research projects, and design experiments of interactive designer Predrag K. Nikolic exposed in various public spaces within the period of last ten years. The conceptual idea behind the projects has been to affect human behavior through novel interactions within playful mix realities and lastly in artificial reality (AIR) as new user experience phenomena in a new urban social landscape.

**Keywords:** Smart Cities · Playful environment · Smart living environments · Intelligent interface design · User experience design · Mix reality · Artificial Intelligence Reality · Robot-robot interaction · Robot creativity

## 1 Introduction

Smart Cities as a concept for better quality of citizens' life is facing lots of challenges and has many different aspects to encompass to offer sustainable solutions in the future. One of the most important issues to consider is happiness of the people who are living in the cities. Interactive media art and design together with the uprising sensor and detection technologies, vast data collection and artificial intelligence, could give significant contribution to social development and innovation in smart living environments. Moreover, robot creativity development can encounter humans with the intelligent entities who will not be only replacement for human tasks but rather equally important for social interactions, beside human to human, in the urban social landscape [1].

In his design experiments and interactive media artworks, Predrag K. Nikolic focus is on how to offer to the citizens' playful environments where they can experience new interactions and establish communication between each other, machines and responsive public spaces in more engaging way. Through his creative practice, he found that artistic pretenses and context can have a crucial role in developing pleasurable feelings, spontaneous reactions and more intensive effect on participants' behavior during the engagement.

In the background section of the paper, we are going to present eight interactive media artworks relate to different research topics he intended to explore within the project agenda. We will describe the type of the interactions investigated, desirable experience intended to trigger and conceptual decision which was made to achieve that. Then we will present the concept of the Artificial Intelligence Reality (AIR) through description of three related art/design projects. Lastly, we will conclude and specify potential directions of using Artificial Intelligence Reality (AIR) concept to design intelligent, playful interfaces for better citizens' quality of life in future cities.

## 2 Background

For the last ten years, Predrag K. Nikolic is actively investigating new techniques and interaction design methods which could contribute to the smart cities concept development. In his art and design works he is using playful environments to provoke human behavior changes and offer new approaches to social innovation in urban communities. In this section, we will describe eight interactive media art/design artefacts with different user experience design approach and used interactive tactics. The aim was to trigger various participants' reactions which will eventually lead to long lasting behavioral changes and improve of a social well-being.

### 2.1 MindCatcher

The MindCatcher is an interactive installation where the central part for interaction and playful experience is floor interface. Users are using their body movements to step on and interact with sensitive floor switches. The visitors were stepping on coloured circles switches and creating so called audio-visual sentences projected on a wall in front of the floor interface (see Fig. 1).

The users created the patterns of the audio-visual sentences, but the author of the installation defined the basic rules (grammar). That gave us possibility to change the visualisations and challenge the participants' creativity and abstraction more intensively. Special attention was given to multiple meanings of the visual images generate as result of synergy between the humans and the system. We wanted to arouse intrinsic and emotional triggers which will entice creative immersion and temporary release of repressed emotions [2].

### 2.2 Ciklosol

In the interactive installation Ciklosol exercise bicycle is used as medium between participants and the dynamic visualisation projected on the screen (see Fig. 2). The speed of paddling is in direct correlation with the movement of the screen projected animated sunflower.

The conceptual idea for this public installation was routed into environmental message intended to be communicate with the visitors and affect their behavior. Furthermore, to emphasise importance of human role and invested energy in preservation of



**Fig. 1.** Mother and daughter in the collective creative session, interacting together on the floor interface. (© Predrag K. Nikolic. Photo: Predrag K. Nikolic)



**Fig. 2.** The Ciklosol Bike Interface where paddling is trigger to the system (© Predrag K. Nikolic. Photo: Predrag K. Nikolic)

Earth resources and living environment. The important issue was to extend existing functions and embed additional meanings to the used object for the interface, fitness bicycle. Additionally, to make possible effective transmission of ideas implemented in installation narrative, educate users and enhance their experience. Hence, we used paddling as a trigger for the system input-output communication [3].

### 2.3 Vrroom

The installation Vrroom is playing with the childhood memories to provide immersive mix reality experience and trigger suppressed emotions. In particular, an experience is built upon sonic interaction between visitors and the system by mimicking sounds of various vehicles to simulate movement like we used to do during our childhood. Visitors are invited to simulate sound of car engine in the microphone and start moving on the road projected on the screen. Depending on sound intensity, they were able to regulate their speed along the road (see Fig. 3).

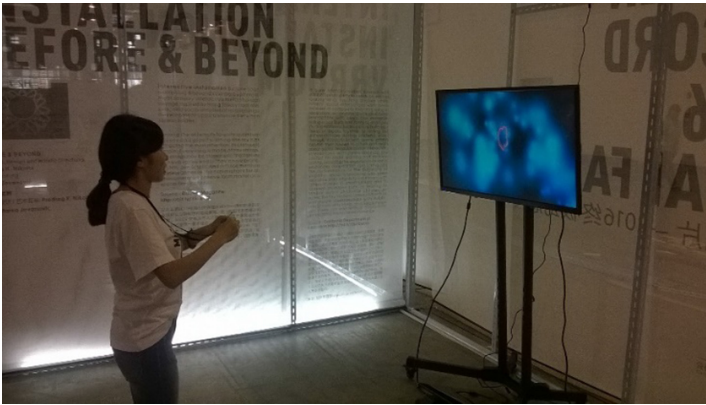


**Fig. 3.** Interacting with the road in virtual environment and controlling movement by making sound of car engine and modulating its intensity. (© Predrag K. Nikolic. Photo: Predrag K. Nikolic)

Metaphors related to the road signs and arrows, in the context of decisions and choices we are making in our life, we used as genuine narrative language. As such, visitors are not exposed only to experience of virtual road trip controlled by the intensity of their voice but also they are in the middle of the visual story which goes on the road surface [4].

### 2.4 Before & Beyond

In the installation, Interactive Before & Beyond visitors are having physical interactions which are stimulating their internal processes such as motivate them to collaborate, interact with bodies and communicate. The installation space is enhanced with the Kinect and location based sensors which are tracking visitors' body movements, direction of walking and interpersonal distance. After entering the installation, participants are getting visual representation of their presence in the virtual world as audio-visual "String of Energy" projected on the screen in front of them. Every string has a characteristic color and sound which are used to induce feeling of personal attachment between visitors and the generated string. To increase tracking accuracy and level of intimate relationship between participants and the projected strings we are using sensory based technologies,



**Fig. 4.** After entering the installation space, every participant gets his String of Energy projected on the screen (© Predrag K. Nikolic. Photo: Predrag K. Nikolic)

Kinect movement detection placed on the wall and beacons integrated in the medallion around the neck of the participants (see Fig. 4).

With interactive installation *Before & Beyond* the aim was to challenge visitors to contemplate about their virtual existence and the way they share it with others. In the playful integrative environment, they are enhanced with new personal properties such as colour, shape and sound attached to their string. With those features, they can interact with other in novel way, such as making group composition, which allows them to enjoy in authentic experiences and novel multisensory communication with others. Physical and virtual space of the artwork are becoming a place for body and social interactions as well as the place for establishment of a new relationships between participants [5].

## 2.5 InnerBody

*InnerBody* is an interactive installation where visitors are interacting with the human-heart look like the interface to take a fake medical exam. The visitors are exposed to life-threatening diagnosis to provoke positive health related behavioral changes. The installation was set in public spaces. The central space of the installation consisted of the tactile human heart-shaped interface, the audio-visual projection of vital human functions and the odor made of iodoform and coal tar, typical smells we are experiencing in hospitals (see Fig. 5). Intention was to use expressive metaphorical and sensory stimulation to impact the experience of death anxiety by exposing them to fake medical exam with life treating results as the outcome [6].

To avoid potential ethical consideration, after the completion of the fake exam session, the visitors were informed that projected data were not real either related to them. The look and feel of the “Human Heart Interface” has been one of the crucial elements used to design visitors’ experience in a way to trigger desirable health concerns.

In the installation, interactive media artists and designer Predrag K. Nikolic is using multisensory model of digital storytelling where the sound of heartbeats, textual messages, and visual representation of the human body vital functions, are all together part



**Fig. 5.** The Inner Body installation space and set up. (© Predrag K. Nikolic. Photo: Predrag K. Nikolic)

of the narrative employed to achieve desired behavior change. The installation positive and educational role starts with the textually introduced which describes the nature of a so-called Preventive Diagnosis by an Infrared Scanner and ends with the explanatory message on the which we both used as instrumental to design behavioral change.

### 3 Artificial Intelligence Reality (AIR)

The concept of Artificial Intelligence Reality, presented by Predrag K. Nikolic at the Smart360 Summit 2019, is novel reality paradigm designed with robot creativity and artificial intelligence processed data, collected via sensors from the environment. Beside textual, numeric and sound analysis, we are using users' facial recognition features and emotional data as inputs for artificial intelligence to design new reality and immerse users in it. Eventually based on their features, they are becoming part of the artificial intelligence created reality.

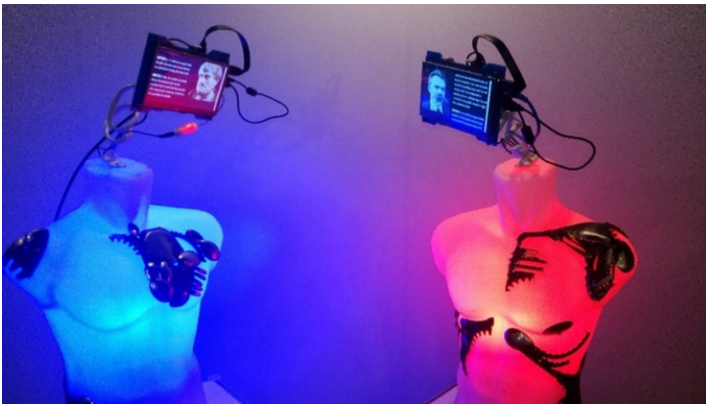
In the first part of our investigation of AIR systems, we are using independent neural networks to create machine made content and arouse robot creativity. As part of that, four artificial intelligence philosopher clones (Aristotle, Nietzsche, Machiavelli and Sun Tzu) are created till now as part of the installations Robosophy Philosophy and Botorikko, Machine Created State. Besides that, with inclusive game In\_Visible Island, we explored potentials of using AIR, multisensory and intelligent interfaces to join together sighted and visually impaired children in playful experience. Further, we will describe in more details all mentioned projects and core conceptual ideas.

#### 3.1 Robosophy Philosophy

The artwork Robosophy Philosophy is authentic example of using robot-robot interaction as novel interactive design technique worth of exploring further in AIR contexts.

The installation is conceptualized as philosophical discussions between two artificial intelligence philosopher clones, Aristotle and Nietzsche. The content they are creating is generated based on the initial algorithm, which triggers the conversation and artificial intelligence internal processes. As result, we are getting completely genuine machine-made content, with minimum of human interference and maximum employment of robot creativity. The installation has two aims, to setting up a model for future content creation based on machine mindfulness and to question ongoing cultural and social changes which are results of interactions between people and technology [7].

The Aristotel's Ethical Robot is fed with knowledge collected from Aristotle's Nicomachean Ethics, Poetics, Politics, Metaphysics and Nietzsche's Overman Robot from Nietzsche's Thus Spoke Zarathustra, The Antichrist, Beyond Good and Evil, The Gay Science, The Birth of Tragedy and Ecce Homo [8]. The two robots are pseudo-robots and they do not have movable part for any assistance in human tasks as we wanted to emphasise potentials of their mental processes (see Fig. 6).



**Fig. 6.** Aristotel's Ethical Robot and Nietzsche's Overman Robot (© Predrag K. Nikolic. Photo: Predrag K. Nikolic)

### 3.2 Botorikko: Machine Created State

The Botorikko, Machine Created State [9] is an interactive installation made of two to bicycles construction, two computer monitors and two pseudo robot manikin figures. For this artwork, we developed two artificial intelligence philosopher clones representing Machiavelli and Sun Tzu. They are discussing about social, historical and philosophical standpoints related to politics, diplomacy, strategy, wars and conflicts. Furthermore, we designed sentiment analysis algorithm capable to interpret sentiment from the authentic machine-created content and move the robots' head accordingly. The sentiments analysis algorithm is using typical human head-movement behavior based on six basic emotions anger, happy, sad, fear, surprise, disgust.

By pedaling bicycles, visitors are starting sword fight between Machiavelli and Sun Tzu manikin figures look robots, placed at the front part of the bicycles (see Fig. 7).

The installation is a unique example of human-robot-robot interaction which tends to become genuine social phenomena of our and future time. Moreover, sentiment analysis of the authentic machine made content is giving us opportunity, based on multiple data types used in AIR, to follow AI agent interpretations of given knowledge and emotional gesture based data.



**Fig. 7.** Interactive Installation Botorikko, human-robot-robot interaction (@ copyright photo: Predrag K. Nikolic)

### 3.3 In\_Visible Island

In\_Visible Island is smart, collaborative platform where visually impaired children can play with their normal peers [10]. It is AIR based platform which consist of multisensory storytelling system made of multilayered main board, central computer powered by artificial intelligence agent and multisensory disks with the story characters placed on its top. Participants are choosing the characters and place them into three different environments on the main board (see Fig. 8). Based on those choices, the artificial intelligence agent is choosing piece of the predefined narrative content based on the designed software criteria and creates storyline which will fit the players' decisions during the creative session. The platform is supporting multisensory experience (visual, audio and tactile). Players can touch the grass, rocks, water, cuddle the animal character and hear their specific sounds as well as feel shaking vibration if they are afraid of something. None visible experience is specially created for the visual impaired children so they can be equal in perception of that part of the platform with sighted kids during the play. By doing that we gave them multiple options for interactions and social relationship development between each other, and the most important is that they can play together and override physical differences.



**Fig. 8.** In\_Visible Island, three different environments placed on the main board (forest, river, and mountain) and placements for the multisensory disks (@ copyright photo: Predrag K. Nikolic)

The central artificial intelligence unit is collecting various types of external data related to players' sensibility and choices such as animal character or environment and generates audio-tactile responses and authentic narrative in artificial intelligence generated reality (AIR).

## 4 Conclusions and Future Directions

In the presented projects we are trying to employ together smart environments, multisensory interaction, intelligent interfaces, concept of playful cities and artificial intelligence toward idea of novel social landscape where humans and robots will coexist and share the same reality.

In our further research and development of the Artificial Intelligence Reality (AIR) systems, we will focus on emotional and machine created content analysis toward a better understanding of robot data interpretations and achieved abstraction. Moreover, to find opportunities to increase variety of data categories collected and implement it in new urban reality created by artificial intelligence agent.

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