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# Connect or Not: Exploring Seamless Infrastructures through Out-Bodied Interaction

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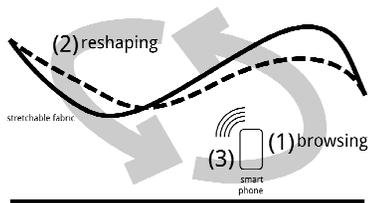
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## **Abstract**

Wireless communication relies on high-frequency signal transmission between communication nodes. The signals are at the same time the message and the infrastructure for communication. Questioning the current wireless signals space occupancy in a playful way, *Connect or Not* is an exploration that shifts the utilitarian debate on seamless infrastructures towards architectural and urban design discourse. It fosters an awareness of wireless infrastructure through design of tangible interaction with wireless network signals. A series of interactive installations were designed and tested in different spatial and social contexts. The installations juxtapose people's physical presence and their activity within the wireless communication layer. This research contributes to a growing discourse on situated computer-human interaction and design research methodologies. It explores the possibility for a design practice to advance acquiring of knowledge, through new insights in the constitution and perception of environments.

## **Keywords**

Infrastructure; Wireless; Invisible; Tangible interaction; Experience; Foreground; Defamiliarisation;



General interaction diagram. Loop chain reaction between the shape (or another physical system) and the browsing activity of a visitor



We assume that the smartphone is a significant source of network traffic, so significant it can be used to get a picture of the general network activity around us. ConnecOrNot is an Android application that actively captures smartphone usage of cell towers and WiFi traffic exchange. It does not record or save any personal information. It only records the quantities of data exchange. It is using the phone as a electromagnetic metering device. Developed by Louis Magarshack in collaboration with Selena Savic

## ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

## Introduction

We rely on a large network of antennas and mobile gadgets connected through wireless infrastructures to provide us with a seamless flow of information. While carrying a mobile device, we call it 'being' online or 'having' signal. What this actually means is that our device is able to receive and extract meaningful information from electromagnetic signals that propagate through the air, and represent it to us in a human-readable form. In the sense of Heideggerian *Vorhandenheit*, the performance of this infrastructure only catches our attention when it fails the expectations of availability or speed. We are rarely aware of it the rest of the time.

According to numerous technical reports, the existing spectrum is used about as efficiently as possible. Thus, one of important contemporary challenges in urban environment is what kind of changes will the satisfaction of forecast needs for wireless communication bandwidth bring.

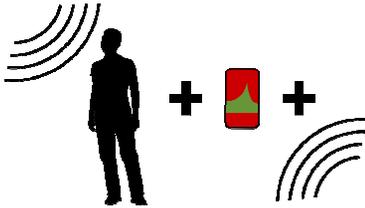
## Wireless Infrastructure

Wireless communication infrastructure is an accumulation of devices and signals which act at the edges of telecommunications infrastructure. It connects cable networks, devices and users by high-frequency waves transmitting data through air [10]. These waves are at the same time the message and the infrastructure for communication.

*Wirelessness*<sup>1</sup> bridges the computer industry and the telecommunications industry, both of which have a strong impact on the design and experience of urban spaces.

Today, wireless communication bands are used in their near-maximum capacity (for example [2,9,11]) causing an intense debate on the forecast needs for future wireless communications, in technical as well as cultural, philosophical, urban planning, architectural, design and artistic circles. Numerous proposals have been put forward by communication engineers, from use of existing networks ('subverting' the existing Wi-Fi infrastructure for EDGE 3G communication) to completely new technologies and bandwidths. The current trend is to think about multiple wireless technologies working together, so one can move seamlessly from place to place [11]. A group gathered around the "All-in-One" research project is debating replacement of all disparate utility infrastructures which we have currently [7]. Designers, and science fiction writers have been debating the meaning and social implications of these trends on society at large and on urban space. The problem is that, except for utilitarian aspects (e.g. capacity, signal strength, area coverage), it is hard to measure the impacts wireless communication development can have on us and our experience of the city. The way infrastructures are mostly dealt with, according to Paul Graham Raven [5], is as enabler of technology, setting it in the background of objects we operate on its account.

<sup>1</sup> Adrian Mackenzie defines *wirelessness* as "a sensibility attuned to a proliferating ethos of gadgets, services, opportunities, and enterprises that transmit and receive information via radio waves using Internet-style network protocols" in his book by the same name (p. 29).



Out-bodied interaction. Interaction between the body and a system through an external object or device (in this case, a smartphone)

Wireless communication infrastructure is no different in this respect - it is considered 'invisible', 'immaterial' and 'seamless' although its physical properties are well known and its 'seams' are experienced time and again. Because we can't perceive it with our senses, it is often associated with the digital. By foregrounding wireless communication networks, the work presented here attempts to bridge the ideological divide onto physical and digital. It offers a physical experience of the activity within the wireless communication layer. While promoting observation and understanding of insensible (invisible, inaudible, intangible) infrastructures, it regards waves as *actants* - with a potential to act within a network of relationships between humans and "things". How do these signals actually propagate in urban space? How do they perform? What happens when we bring the signals to the foreground?

### The Approach

The investigation of wireless communication signals space occupancy is strongly linked to a design practice. It incorporates an iterative process of design prototypes which act as playful interfaces for interaction with wireless network infrastructure.

For over a decade artists and designers have been absorbed in experimentations with this material. Some really interesting work came out of these explorations [1,4,12,13,15]. Their contributions bring out the physicality of this invisible material, and raise awareness on its presence. The design practice I will discuss applies a similar approach to a systematic exploration of interaction with wireless signals questioning the resulting experience of space.

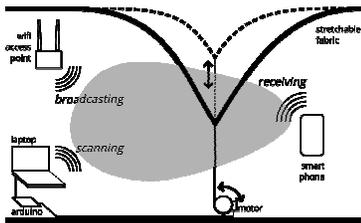
When making visible something that is normally invisible, the act of estrangement is more important than that of visualisation. Something that appears at the periphery of attention is liberated from habitual routines of its use by defamiliarisation (*ostranenie*) [14]. This opens a design space at the edges of utilitarian and familiar [3], enabling critical approaches to future design of technologies for connecting people and things in urban space.

### The Prototypes

The investigation of wireless signals interaction potentials went through several iterations of prototypes. They propose an out-bodied interaction model - using mobile devices to measure, analyse and relate wireless network traffic to different physical systems. The physical systems reconfigure according to the presence and activity within the wireless network layer. This structure offers an immersive experience of the wireless communication infrastructure, while rendering the properties of this invisible space into a tangible experience.

The design of interactive installations accounts for a *mashup* space made of different types of wireless networks (WAN,LAN,NFC) and the physical space they propagate through. Space is engaged as one of the *actants* in this play, its role shifting from the typically modernist container towards an active entity that can have influence on our actions. Both physical barriers and people's (bodily and communication) activity are explored here.

The first series of prototypes involved experiments with stretchable fabric and different movement systems that changed the form and the encompassing space defined

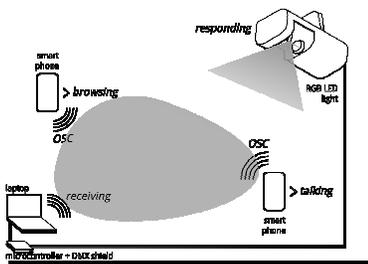


Quadricone interaction diagram. User, Wi-Fi enabled device, Wi-Fi router, computer, and stretchable fabric

by the fabric. These experiments offered one-on-one interaction between people and the structure. The second series of prototypes includes light-based interactive systems, exploring the use of different light qualities (intensity, colour, position of the beam) to describe the activity of wireless networks.

### Quadricone

The first series of prototypes were based on structural and material similarities. All structures used stretchable fabric as the form giving element, because it can easily attain to any shape and accommodate deformation. The fabric could be stretched and pulled up to certain limits but it allowed for a sufficient degree of change. This change was a linear movement propelled by motors that were attached to the structure.



Connect or Not interaction diagram. User, Wi-Fi enabled device, computer, RGB LED lights



Figure 1. Quadricone, Espace Arlaud, Lausanne; November 2012

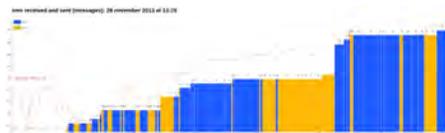
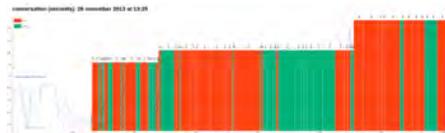
### Connect or Not

Further design research involved a development of more complex language of reactions and a more realistic image of the activity within the wireless layer. On the structural side the setup was made lighter and more universal. RGB LED lights were chosen to perform changes in the activity with colour and movement. The colour of the light was perceived on the bodies of two performers who were at the same time interacting with the system. Data acquisition was also improved - a mobile application was used to acquire data on both EDGE/3G and Wi-Fi traffic.



Figure 2. Connect or Not, MMC K6/4, Ljubljana; February 2014

Connect or Not offers an atmospheric experience of wireless communication, rendering the presence and



Visualisation of traffic logs (conversation minutes, Internet traffic and sms) received through the Connect or Not Android application. Data recorded on November 28<sup>th</sup>, 2013 at 13h25 in Zurich, Switzerland during the Stage Digital II symposium.

the intensity of traffic (both GSM and WiFi) into an *interactant*. The interaction is manifested in the dynamic behaviour of lights (change of position, colour, flickering). It was closer to a performative tool, its design more contained. However, interaction with it was rather consuming as one had to make a lot of effort (create a lot of traffic) in order to perceive a change, and then was too busy interacting to be able to enjoy it.

All prototypes were tested with different audiences, in academic setting of research symposia and public presentations at cultural venues. The presentations were points of collecting data from observations on user behaviour, channelled discussion and quantitative data on network usage.

## Conclusions

To discuss infrastructure, we need to be able to perceive it. In some ways, Connect or Not is a network diagnostic tool, using contemporary tools of interactive art and performance in a playful way. OSC communication, mobile application, Wi-Fi triangulation, etc are brought together to defamiliarise our experience of networks. The innovation here is not so much in the invention of singular technological elements as it is in creative aggregation and poetic application of technology [6]. The outcome of such critical thinking is a discussion on actual and potential wireless infrastructure systems.

These prototypes gave insight into new participatory possibilities: an interaction between digital data, physical structures and human actions. They are at the same time a tool for scanning the electromagnetic environment and a tool of design research which can be

used for provoking a digital intrusion into architecture and urban design. We could say that architecture's resistance to the digital was already broken by numerous interactive augmentations and the notion of 'smart'. The work described here aims to take a step towards the next generation transition, from wired architecture to wireless architecture. Escaping the expectation that this will reconfigure the way we interact with each other or with urban space, we are looking at roles *wirelessness* will play in the design of future urban interactions.

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