**The Coerced User and the Era of Smart City Dissonance**

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**Abstract.** This paper discusses the societal impact of increased connectivity and innovation on the smart city’s inhabitants and its effect on the definition of usability. We start by discussing the smart city’s connectivity revolution and the way it affects the perception of usability. In so doing, we eliminate the concept of Non-Users and employ instead Coerced and Unwitting Users, who do not wish to use the innovation, but are coerced into participating—providing it with physical space and data—and therefore enjoying the services returned in the form of city optimization. We then discuss the need for new design approaches addressing these users that may be translated into innovation *acceptance*. We present a human-centered design study on the Coerced Users of shareable electric scooter services in Tel Aviv. It demonstrates the importance of Coerced User design and its impact on the inhabitants’ wellbeing. We found that the Coerced User’s rejection of innovation is due mostly to low-value technology implementation in the complex smart city structure, creating a feeling of injustice in public goods distribution and an ambiguous feeling of “Smart City Dissonance” that affects the inhabitants’ relationship with the public sphere.

**Keywords:** Smart City, Coerced User, Innovation Acceptance Life Cycle, Micro Mobility, User Experience

# Introduction

We, as consumers of the public space, are currently exposed to a large amount of technology. This is due to the so-called “smart city revolution” which uses connectivity technologies and data-optimization software to make our city safer and more efficient [1], thereby increasing our wellbeing [2-4]. Since the smart city is based on data and connectivity [2-5], it requires a societal change in order to provide the public with its promised value. The city’s inhabitants (its residents, workers and visitors) have to be digitally connected—a change that impacts their way of life. In return, however, they enjoy the city’s optimization and benefits. With the exponential pace of technological advancement [6], this informed transaction will likely become a core assumption of participating in a city’s ecosystem—a new rule that connects personal connectivity with being a part of the city.

We are interested in the impact of such innovation entering the public sphere on the relationship between technological advancement, public space, and inhabitants’ behavior. The main problem we examine occurs when technology is adopted [7] without the public’s consent—in many cases imposed on inhabitants as a kind of new, unwritten set of smart city rules. The public Wi-Fi pole, CCTV cameras, and shareable electric scooters are redesigning the public space; all of these solutions are designed and produced according to the needs of their *Active Users*—users who operate these solutions. But being placed in the public space, they have an impact on all city inhabitants—users and non-users alike. As consumers of public space, inhabitants cannot avoid these technologies; and, like passive smokers, they cannot avoid their impact. Gradually, the public loses its option to opt out and “not use.”

The connected inhabitants of the smart city are not just losing their ability to stop using, but actually provide the city’s ecosystem with data and physical public space exploited for the very services impeding their desired consumption and use of city space. These inhabitants are coerced into participating in the process, becoming what we will call *Coerced Users* of this innovation; they are forced to provide it with resources even while suffering from its existence. They are not willful adopters of the technology, but are compelled to accept its existence as part of the *Innovation Acceptance Life Cycle*; this could lead either to acceptance or to protective behavior, such as active protest and civil resistance [13-14].

They are still considered “users,” however, because some of the data collected by negatively impacting services might in turn be used—by such services as these same Coerced Users employ as *Active*, *Passive* [8-12], or *Incidental* [12] users—and therefore indirect value is created that may have a positive impact on their wellbeing overall.

This conundrum generates many challenges, but it also elicits a better, more inclusive design for the future city. In our research we use a human-centered approach to examine the smart city promises and problems which create the Coerced User. Empathizing with Coerced Users and designing products that are not disturbing and even generate direct value for them will become an important part of design for the connected world, generating inclusive innovation and technology that will reduce, rather than increase, inhabitant anxiety and stress.

In elaborating on the Coerced User we will review the current literature’s definitions of users, expounding upon the adoption, acceptance and rejection of innovation and technology. We will then proceed to an empathic and contextual design investigation, using shareable electric scooter services as a case study. This human-centered work includes field observations; an electronic poll (68 participants); eight in-depth interviews with experts in innovation adoption, public space design and UX; and twelve in-depth interviews with Coerced Users. The paper concludes with insights and directions for follow-up research.

# The Smart City and the Always-Connected Inhabitants

The “smart city” is a city ecosystem that uses Information and Communication Technologies (ICT), Internet of Things (IoT) sensors, and optimization software to make itself cleaner, safer, and more efficient and connected [1-5], thereby providing value-added features for different city services and generating an elevated wellbeing for its inhabitants; i.e., its residents, workers and visitors. Today, in order to enjoy and benefit from many innovative services, inhabitants must be digitally connected; and, knowingly or not, they share ever more information about themselves with the city’s services, revealing their locations, habits, and needs.

As we move toward a realization of the smart city vision, it becomes ever more difficult to enjoy the city’s benefits without being connected; and, eventually, the unconnected may find it impossible to live in the smart city at all. This increased connectivity and the obligation to share information—the new, unwritten rule of smart city optimization—raises concerns regarding privacy, data security, safety, and ethics. Prior work suggests that these problems should be addressed via holistic co-design approaches for city services, involving all city stakeholders [3]. Our research raises a different question, however: As a precursor to the design process, in this era of always-connected and self-optimizing cities, we must first understand the identity and characteristics of the “smart city users.”

# Usability Definitions

Current designations of users relate to the “activeness” dimension in user-technology interaction. Four kinds of users have been defined: (1) *Active*; (2) *Passive*; (3) *Incidental*; and (4) *Non-User* [8-12]. Users are divided into “active” and “passive” process operators [8]. An active process operator’s work differs from that of a passive operator by the predominance of monitoring [9]. The user’s “activeness” is a result of task allocation between herself and the technology [10]. *Active Users* have different kinds of interactions with the technology, from operation to maintenance, while *Passive Users* merely monitor the technology and lack control over it. The *Incidental User* has an interest in the information output of the technology but has no control over it [11-12]; her communication with the technology is mediated by an Active User. Finally, the *Non-User* simplydoes not use the technology—she either does not want to, does not know about it, or uses a competitor instead. For example, during an Ultrasound the doctor operating the machine is an Active User. The senior doctor monitoring the operator is a Passive User. The watching parents are Incidental Users. Parents who distrust the modern medical system and do not use these tests are Non-Users.

# The Extinction of Non-Users

Today, when individuals choose to opt out and not to use a technology, they can easily become Non-Users. This situation is changing, however, as city services become fully and perpetually connected, disallowing individual non-use. In the not-too-distant, fully-realized smart city, all inhabitants will be connected and share data with the system, enjoying the optimization of services enabled by the city’s connectivity regarding traffic, bureaucracy, and more. Inhabitants supply data to all services, even the ones they do not use; and they enjoy the optimization derived from that data which is the source of the same un-used services. They can simply no longer not-use; they are part of the optimization ecosystem, and even if they do not want to actively use a technology, they are coerced into using it as part of the city system. This situation brings about the extinction of Non-Users who, consequently, become what we have termed *Coerced Users*.

# The Coerced User and the Unwitting User

The Coerced User is a connected inhabitant of the smart city and—willingly or not—provides it with data while enjoying its optimizations. Even if she decides not to use some of the city’s innovative services, she cannot avoid being part of its ecosystem. First, because these services are in the public sphere, and she cannot escape their indirect influence—just as with a passive smoker. Second, because she cannot stop providing the city ecosystem with information that might benefit these unwanted services, and she cannot choose not to benefit from the optimization generated by the data these services provide, which might be translated into optimization of the services she does consume.

For example, a Coerced User cannot simply opt out and not use shareable electric scooter services—to both her disadvantage and advantage. On one hand, the scooters still occupy her space, and she needs to dodge them in the street. On the other, she also benefits from the data they provide the city about the most populated routes—data that might influence the city’s public transportation schedule or infrastructure maintenance timeline, and thus have a positive impact on her life.

Unlike Coerced Users, who are aware of the technology they try to avoid, some users may not be aware, but still provide data and enjoy the general optimization results. These we have termed *Unwitting Users*—those who, for example, unknowingly utilize public Wi-Fi signal while providing it with information, such as their location.

# Designing for Coerced and Unwitting Users

As the city’s inhabitants become more connected and public space more occupied by antennas, security cameras, shareable scooters, drones, and more, it becomes ever more crucial to understand Coerced Users and to design the city experience accordingly—using a human-centered perspective. Today, city technologies are designed according to a design methodology “correct” for Active Users, based on principles of *Desirability* (attracting users), *Feasibility* (being capable of production by the manufacturer), and *Viability* (being economically viable and generating value for both users and suppliers) [16]. But since these technologies are deployed in the public space, they need to address Coerced Users as well, answering their needs and improving their wellbeing.

# Coerced Innovation Acceptance

In Coerced User design it is important to understand that—unlike for Active Users—service value does not translate into *Adoption*. For Coerced Users, rather, it translates into *Acceptance.* Presently, designers need to account for the different kinds of Active User—Innovators, Early Adopters, Early Majority, Late Majority, and Laggards—identified in Rogers’ *Innovation Adoption Life Cycle* [7]. Each of these Active Users must be addressed accordingly; a designer cannot approach a solution for Millennials in the same way she approaches one for Baby-Boomers.

The same is true for Coerced Users; the designer must be empathetic to all the kinds of Coerced User for whom she designs. Coerced Users do not actively use a product: they either reject it, if they find it disturbing, or they accept it as possibly beneficial for others, while consciously choosing not to use it themselves. The designer should aim for these Coerced Users to *accept* her product.

Here we may define a tool that can assist designers with this mapping. The *Innovation Acceptance Life Cycle* analyzes Coerced Users according to the following spectrum of acceptance: (1) *The Supporter*, who supports the innovation but does not use it; (2) *The Indifferent*, who accepts it without supporting it; (3) the *Soft Rejecter*, who rejects the innovation but not actively; and (4) the *Hard Rejecter*, who actively rejects the innovation. Each of these must be approached differently. Bad design will cause a Coerced User to incline toward rejecting the innovation and thus the value it might entail for the city ecosystem. For better Coerced User design, it is therefore important to understand factors that lead to innovation rejection or acceptance.

# Innovation Rejection and the Social Amplification of Risk

The social, psychological, cultural, and economic background of a person, as well as media coverage and gut feelings, have an impact on her perception of technology as a risk, or as something of value [17-21] and these lead to acceptance or rejection. Instead of occurrent probability and causal intensity, the individual analyzes risk according to her psychological and cultural filters, using only a fraction of the information she receives. To these filters she adds possible consequences of the risk, and then designs a mechanism to cope with it. This private and irrational action can then become a public approach leading to public actions [13].

The *Social Amplification of Risk* theory suggests that an individual’s risk perception might have an amplified impact. In a ripple effect, she influences her family’s and community’s perceptions of risk [14]. The “risk signals” are passed from “mouth to ear,” adding to other personal perceptions that reframe the risk. This amplification can impact social, political and economic structures. In only a short time, innovation is framed as risky or otherwise; after this, the window of opportunity for acceptance closes. It is important to take this into account when designing for the Coerced User; for once the public shapes its perception, it is difficult to change it.

# Contextual Field Research Methodology

# Contextual Case Study: Shareable Electric Scooters in Tel Aviv

Enriched by relevant academic sources and interviews, and having established the *Coerced User* and *Technology Acceptance Life Cycle* theories, we will now turn to a contextual field study in order to validate our theories. This contextual field study was designed to understand Coerced Users in a transitional, semi-smart city environment, using a defined case study representing connected technology in the public space. We chose shareable electric scooters in Tel Aviv: last-mile transportation vehicles spread throughout the city, aiming to provide clean and cost-effective urban public transportation.

These scooters are not a disruptive technology, but a unique business model of “use and discard:” the user finds a nearby scooter, unlocks it using an app, rides to her destination, relocks it, and pays according to the time used. The scooters do not require an anchoring station; they can be left anywhere. Thus, this service represents the main characteristics of connected technology in the public sphere: it is (1) an innovative intervention in a public domain, which (2) forces the user to be connected, since it cannot be used without a smartphone and credit card, and (3) is now in the interim period that will define its future.

These scooters also represent an interesting case study for Coerced Users, as there is a growing, worldwide public debate about them. They are implemented without any change to the city’s infrastructure and therefore impact the way pedestrians need to act. As the Active Users of the scooters can leave them wherever they want, they sometimes create obstacles on the sidewalks. These issues generate rejections leading to active protest and, in some cases, vandalism of the equipment. In Tel Aviv, shareable scooters came on the scene in 2018 and their numbers are growing monthly: from ~300 in late 2018 to ~2,000 in Feb 2019.

# Contextual Field Study Structure

Our study consists of interviews, observations, and a digital poll. **In-depth interviews** were held with eight professionals from the fields of innovation adoption, public space design, and UX. We discussed innovation in the public space, human-centered design, and the phenomenon of Micro Mobility. **Observations** in Tel Aviv included participatory scooter usage and shadowing Active Users. We also conducted a Coerced Users’ observation, learning how they handle / avoid Micro Mobility solutions. **A digital poll** was conducted on the way 68 early adopters,aged 27-50, perceive Micro Mobility. This also served as the basis for selecting interviewees. **In-depth interviews** were subsequently held with twelve Coerced Users about their perception of smart city, public space innovation and Micro Mobility services.

# Findings

The Coerced Users supported the vision of Micro Mobility. This is partly due to a general consideration of Israelis as early adopters, positive feedback from the Israeli media, and the scooter services’ promises to be easy to use, affordable and “green.” Nevertheless, these “supporters” of the vision reject its implementation, which is imposed on them, invades their public space, and negatively impacts their way of life . Our research is reflected in the six main themes which follow.

# Theme 1: “One fits all” solution

To date, the Tel Aviv municipality does not require the scooters’ providers to modify their product with regard to speed, quantity, and location of operation. Accordingly, the providers deploy scooters in a “one fits all” approach; some have not even translated the safety instructions into Hebrew. This situation creates an overload on the city’s crowded infrastructure: 91% feel that the municipality and providers do not care about the inhabitants. The providers “invade” city space without talking to the inhabitants or modifying the product according to their needs. This creates the impression of an unsuitable and dangerous solution.

# Theme 2: Exclusion of Significant Inhabitant Populations

83% perceive these services as inaccessible to various inhabitant populations based on age, weight, connectivity, and address (i.e., living where services are blocked due to fear of vandalism). This lack of justice in public goods distribution inherently creates Coerced Users. Such populations cannot use these services but still have to pay a *Public-Space Tax*—providing services via sacrificing pedestrian public space, without getting anything in return.

# Theme 3: Lack of Enforcement

As these services are owned by private, profit-driven companies, 83% feel that providers desire only that as many people as possible use their services, no matter the risk. There is almost no safety enforcement by the providers with regard to inhabitants that misuse their platform, and they do not prevent underage inhabitants from using the system. The safety measures and restrictions presented by the providers are perceived as “Kastach”—mere prevention of formal liability. 75% feel that the providers’ method of operation is: “if it is not forbidden, it is allowed.” Moreover, there is little municipal enforcement, leading Coerced Users to suspect a secret deal benefiting the municipality and providers at the expense of the inhabitants.

# Theme 4: Feelings of Alienation

75% of Coerced Users say the scooters arouse feelings of alienation. This finding expresses feelings of anxiety and a lack of connection between human and space. In the words of our interviewees: (1) “It creates a feeling of alienation. What is it? Who owns it? It’s just spread everywhere.” (2) “People just leave it in the street, not caring what it does to the relationship between human and space. It scares me, this disconnection between us and our tools, we design them and then they design us.” (3) “Wherever we go, when my daughter sees a scooter, she turns and says ‘Hey dad, here is your scooter. And here, and there….’ This mismatch and inability to connect to a tool depresses me deeply.”

# Theme 5: A Modern “Tragedy of the Commons”

81% of Coerced Users feel that the sharing model encourages Active Users to behave in an irresponsible manner that harms their welfare; they ride on the pedestrian side, park on the sidewalk, block people with disabilities, and disturb pedestrians. Coerced Users believe this behavior is an outcome of both the lack of connection between the Active User and the scooter, and the lack of enforcement. Active User’s aspire to maximize the paid service and, as there is no enforcement, they misuse this service to the point of harming Coerced Users’ ability to consume public space. The “tragedy of the commons” describes a self-interest behavior, contrary to the common good, that spoils a public resource. We may describe the above as a *modern* “tragedy of the commons.”

# Theme 6: Mental Workload

75% of Coerced Users describe a feeling of stress when talking about Micro Mobility. The service which is supposed to engender productivity, reduced friction, and reduced anxiety for the Active User, has created a mental workload for Coerced Users. Pedestrians that once wandered the sidewalk with ease must now be on constant alert not to be hit by a scooter. Drivers must also worry about a scooter popping up, hitting their car, and getting them into trouble with the law.

# Discussion

From the above research and described contextual study themes we have extracted three main insights regarding Coerced User design.

# Insight 1

**Coerced Users’ main problems are due to a lack of communication and synchronization among members of the triangle of city stakeholders**—**municipalities, service providers, and inhabitants**—**leading to poor implementation.** (1) The disconnect between municipality and service providers, together with the lack of regulation, creates a burden on the city infrastructure, which is already crowded even without scooters. The service provider’s data is not shared with the municipality and thus allows neither optimization of public transportation where scooters do not operate nor investment in infrastructure where usage is greatest. (2) The disconnect between municipality and inhabitants makes the Coerced User feel that the city is incompetent in dealing with the service providers, due to weakness or corruption realized by collaboration with the private service providers. Coerced Users feel that they are excluded from the public space, and that the city—with minimal municipal enforcement on misuse of scooters—cannot help them. It creates a sense that “what is not forbidden is permitted.” In addition, there is an ongoing struggle between service providers and the municipality over the “ownership” of public space. This conflict comes at the expense of the inhabitants, transforming the city from a place that is intended to increase the inhabitants’ welfare, to one that is exclusionary, disturbing, and dangerous. (3) The disconnect between service provider and inhabitants allows misuse by the Active Users and makes it difficult for Coerced Users to complain or understand where potential solutions might originate. Service providers do not have a screening process for users, so there is no connection with them when they start using; moreover, there is no enforcement of responsible usage, so there is also no relation with violators of the law.

# Insight 2

**Rejection of the innovation is driven primarily by a sense of injustice regarding public goods distribution; this is reflected in the exclusion of various inhabitants who cannot use these services, but nevertheless pay a *Public-Space* and *Head-Space Tax*.** The exclusion of inhabitants from these services due to age, connectivity, or residency seems unfair and raises questions regarding the motives of the service provider and the municipality, as well as the ownership of public space. These inhabitants cannot use the service, but must give up their public space, wandering the streets alertly and anxiously while getting nothing in return.

# Insight 3

**The smart city era is accompanied by a *Smart City Dissonance*: an ambiguous feeling with regard to belonging, and a double-edged sword with regard to efficiency and stress reduction.** These affect Coerced Users’ “head-space.” The first, *Belonging Dissonance*, is that feeling of uncertainty with regard to the belonging of public space and shared tools which—together with a “use and discard” business model—encourages irresponsible behavior, leading to a modern “tragedy of the commons.” The second, *Efficiency Dissonance*, is the negative correlation between service effects which are (1) supposed to make Active Users more effective (and therefore reduce their tension), but (2) by their very existence increase the anxiety and stress of Coerced Users.

# Conclusion and Future Work

Coerced Users and the impact of smart city connectivity on their lives were at the core of this paper. We found that increased connectivity and innovative intervention in the public sphere obligates us, as designers, to change the ways we view and define *Usability* and *Users* in the smart city, and the experiences that will position users on the right side of the *Innovation Acceptance Life Cycle*—providing them with direct and indirect value and increasing their wellbeing.

Our results taught us that technology is not the barrier, but rather its implementation in the complex, smart city structure. Most of the frictions experienced by Coerced Users stem from disconnections between the stakeholders of the “city triangle:” the municipality, the service providers, and the inhabitants. The primary point of discomfort is the feeling of injustice in public goods distribution, realized in the exclusion of many populations from these services. They cannot use these services but nevertheless pay a *Public-Space* and *Head-Space Tax*—giving up their space and feeling anxious in the public sphere without getting anything in return.

This paper also indicates that the smart city era comes with a *Smart City Dissonance*, an anomalous situation that affects our feelings when going out into the open. First is *Belonging Dissonance*, leading to a modern “tragedy of the commons;” second is *Efficiency Dissonance*, whereby a service intended to reduce Active Users’ stress has the opposite effect for Coerced Users.

These findings regarding new, smart city users and their spectrum of acceptance, together with the insights of field research, emphasize the importance of a holistic and inclusive structure of design for the complex smart city ecosystem, and the need for a Coerced User design approach and ethic. This design challenge is an opportunity to fulfill the promises of a harmonious smart city ecosystem providing benefits, value, and wellbeing to all its inhabitants. It is hoped this paper may form the basis for future work in this field.

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