MAPPING THE WALKABILITY OF INFANTS, TODDLERS, CAREGIVERS, AS AN INDICATOR FOR THE PERFORMANCE OF URBAN SPACES: THE ITC-FRIENDLY ROUTE

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ABSTRACT

In this paper, we frame the walkability of Infants, Toddlers, and Caregivers (ITCs) as an indicator for the quality of urban spaces. We aim to visualize walkability through a geo-referenced platform. It introduces a set of indicators aimed at ITC, which serve to interpret the vastness sea of information (Big Data). In order to have a clearer lens, the indicators are interpreted through their relationship with walkability. We define walkability for ITCs through five categories (air quality, noise, shading, lighting, obstacles).

The platform is visualized through heat maps for the five categories, and a map of the ITC-friendly route. We acknowledge that data needs to be backfilled by recurrent surveys with the citizens. We propose that the platform can eventually encourage participatory approach and facilitate urban decision making.

KEYWORDS: Data package, GIS, ITCs, Performance Indicator, Walkability.

INTRODUCTION

This study aims to provide the methodology for analyzing and visualizing the experience of walkability for Infants, Toddlers, and Caregivers (ITCs). The analysis is based on a data package proposed by a local NGO. The target group for the indicators are children aged 0-5, an age when they are most vulnerable, therefore the built environment has long lasting impressions.

In the age of the 4th Industrial Revolution, data is the most relevant currency. According to a report for World Economic Forum, 2013, the volume of digital data in the internet was 4.4 zettabytes (4.4 trillion gigabytes). By 2020, the internet will contain more than 44 zettabytes (Robb, 2015). In 2011, the data of the construction industry accounted for 51 petabytes (51 million gigabytes) of the whole volume (McKinsey Global Institute, 2011). The abundance of data allows for a detailed look on commuting patterns: this is the case of Baidu, a chinese search engine that used their "Big Data Lab" to map commuting patterns of over seven hundred million users, to establish drastically underpopulated cities, known otherwise as "Ghost Cities", the aftermath of drastic urban migration in China (Stott, 2015). They defined the indicator of populated urban areas, building on an existing definition from the Chinese Ministry of Housing and Urban-Rural Development, as 10'000 residents per square kilometer. The Baidu team factored seasonal influences, filtering out cities that appeared empty for most of the time, but are major tourist destinations.

It is evident that this volume of digital data can only be managed and translated into something legible, if it's funneled through the filters of specific indicators. Indicators help describe a wholesome context. An algorithm cannot run without specified variables and a set course of action. Similarly, any analysis of the built environment isn't reliable without a specific set of indicators.

This is the same approach of Urban95: funneling the interventions of the built environment through the lenses of a specific audience: the Infants, Toddlers, and Caregivers (ITCs) (Bernard van Leer, 2019). Urban95 is an initiative of Bernard van Leer foundation that creates a finer lens in the context of decision making in urban planning: "If you could experience a city from 95cm — the height of a 3-year old — what would you change?" The project is a data-driven project, which aims to improve the urban environment in the cities, to comply to the needs of children 0-5 years old.

THE IMPORTANCE OF EARLY CHILDHOOD DEVELOPMENT

Why infants and toddlers specifically? During the first 1000 days of life, human brains are highly sensitive to external experiences and reactive to environmental changes (Cusick & Georgieff, 2016). Early Childhood Development, a relatively new branch of brain development, is still struggling to answer the question: How much does the environment affect a child's well-being (UNICEF, 2019)? A child's brain grows most rapidly during this critical time-period, and the efficacy of this growth determines lifelong physical and cognitive capacities for language skills, learning capabilities, mobility, and emotional regulation.

Supportive relationships and environmental conditions help infants and toddlers build strong brain architecture and resilience to stressful situations, while pervasive negative experiences (e.g., chronic abuse, neglect, malnutrition, stress) prevents strong brain architecture from ever taking hold. Ensuring that a baby's physical environment isn't harming her is crucial for establishing lifelong wellness.

If a city can provide qualitative urban spaces that shelter the infants and toddlers during the first 1000 days, it is creating healthy citizens that support a healthy society.

Data Package for ITCs

How can you quantify urban spaces? What is a qualitative park? "Qendra Marrëdhënie", an urban consultancy NGO based in Tirana, has proposed a data package to evaluate the quality of urban spaces, monitoring urban features of the city (built environment, planning, and maintenance, to name a few) that affect ITCs, and have a significant contribution in early childhood development.

From total volume of motorized traffic, monitoring of air and noise quality indicators, to the presence of street attractions and frequency of maintenance of parks, the indicators have benchmark values for whether a neighborhood is equipped for the walkability needs of ITCs.

In the vast ocean of information surrounding us, the data package offers indicators that evaluate the physical features of urban spaces, and consequently the urban experience, and how ITC friendly it is.

Table 1: Indicator layout, and benchmarking values for noise levels in the ITC neighborhood

5.1 Percentage of streets with decibel levels above 55 dB		
Definition Number of streets with decibel levels above standard 55 dB as of a percentage of total number of streets inside the ITC neighborhood.	Rationale ITCs are very sensitive to noise. WHO has set the adequate noise limit at 55 dB during the day and 45 dB during the night. Evidence shows that higher levels of noise can induce emotional distress at infants and toddlers. Neighborhood streets must provide protection from noise and the necessary intimacy from traffic.	
Benchmark Value		
Thriving	Striving	Surviving
There is less than 5 percent of streets with decibel levels above 55 dB.	There is less than 15 percent of streets with decibel levels above 55 dB.	There is less than 25 percent of streets with decibel levels above 55 dB.

The Platform for the ITC-Friendly Route

We propose the creation of an urban information platform, with the information gathered from the data package, that calculates the most ITC-friendly route to get from point A to point B. Better than a navigation platform, it will equip the users with the knowledge of the route that offers the more qualitative walking experience, exempt of pollution and other environmental threats for ITCs. There is an existing repertoire of walkability assessment method: estimations using data from GIS (Frank, Schmidt, Sallis, Chapman, & Saelens, 2005), Google-based Walkscore and citizen surveys such as NEWS (Saelens, Sallis, Black, & Chen, 2003), and systematic pedestrian and cycling environmental scan (SPACES) (Pikora, et al., 2006). Aschwanden et al, 2012, note the nearsightedness of GIS usage nowadays: GIS is still used as a data management and visualization tool, instead of an information platform, because there are missing methodologies set in

place, which would interpret the implicit meaning of data (Aschwanden, 2012). On a similar note, Pak & Verbeke, 2015, stress the importance of creating a finer lens through which the indicators can be interpreted (Pak & Verbeke, 2015). Moreover, the data needs to be constantly backfilled with learning from the experience of local citizens. In the case of the platform, the data from the indicators need to be bolstered by constant feedback from the citizens. Otherwise, the validity of data can be questioned.

The platform maps the route that ensures the best possible walking experience of an ITC unit, based on five categories: air quality, noise quality, shading, lighting, obstacles. It calculates the possible outcomes, based on the indicators from the data package, and produces a single outcome — a route on a map — and grades for the five categories.

Walkability

The urban platform we propose tackles walkability. Jane Jacobs, the mother of urban planning, was one of the first advocates of street life and walkability. (Jacobs, 1961) Similarly, Gehl, 2010, recognizes the value of walkability in the quality of an urban space, and fervently urges planners and architects to shift their focus towards the human dimension and pedestrianization (Gehl, 2010). Gehl notes that the dominantly modernist approaches shifted the focus away from pedestrians, and lost touch of the city space as a meeting space (Gehl, 2010). The challenge that naturally arises is: how do you visualize the ITC-friendly route?

We aim to make walkability informative and transparent: we provide not only a route, but also the rationale for picking that specific route. We break down walkability in five categories: air quality, noise quality, shading, lighting and obstacles.

Air Quality

The most serious threat to a newborn is air pollution; a toddler's mouth is on the same level as the exhaustion pipes of a vehicle. ITCs are unwillingly exposed to air and noise pollution: they don't register that the exhaust fumes are bad for them, and they don't know they should hold their breath. Furthermore, early life exposure to air pollution makes children prone to ADHD (attention deficit and hyperactivity disorder) (Myhre, et al., 2018). The ITC friendly route has low levels of air pollution. The data is visualized after the model of World Air Quality

Index, a website that offers live data on air quality monitoring (World Air Quality Index, 2019). The indicators from the data package of the NGO will retrieve the data from "Green lungs for our cities", a platform by Co-PLAN (Co-PLAN, 2019). Co-Plan currently has air quality monitoring devices placed in key intersections of Tirana. Furthermore, the monitoring process is set in motion: we need to tap in the existing data source, not create a new one from scratch.

Noise Quality

High levels of noise are linked to auditory loss and elevated levels of stress (Gupta, Jain, & Gupta, 2018). Naturally, the ITC friendly route has noise buffers, which propagate noise pollution. On Average, Tirana's daytime noise level is 70 dB, while in the night it measures 55 dB (Pojani, 2012). These values have been monitored from the Albanian Institute of Public Health, which has 15 monitoring locations in Tirana (Pojani, 2012). We plan to use the data gathered from the Institute of Public Health, filter them through the data package benchmarking values, and offer the resulting information to the users.

Shading

In the hot days of summer, it is almost impossible to walk in the city of Tirana during the day. The presence and trees and shading devices is an important element for a city with a rather hot, humid climate. There are two ways to keep track of the shading elements in the city: desk mapping, or on-site visits. The Municipality has recently set up a department that analyzes GIS data. We plan to ingrain them in the process. The methodology we provide is: primarily, desk mapping on GIS, based on the most recent orthophoto. The following step is on-site confirmation: we propose to the department to organize visits at least once in every three months. These expeditions provide information on the details and elements so small in scale, they can't be seen in the orthophoto.

Lighting

It is not safe for toddlers and their caregivers to walk in a path that is not adequately lit. It is unsafe, an open invite to robbers, muggers and other urban life offenders. The GIS department of the Municipality can track the existing streetlights (this information exists, as the city is

currently switching the streetlights to LED) and keep track of the additions and the few removals of the streetlights.

Physical obstacles

Curbs are not an easy feat for toddlers: the 15 cm change is a small step for adults and children, but for toddlers, it's a giant leap. Caregivers with strollers have a hard time pushing the strollers up and down, when there are no ramps. All obstacles in the built environment should be a smooth transition, facilitated by ramps. Jan Gehl, in cooperation with Bernard van Leer foundation, produced a survey "Public Space Public Life" (PSPL), which measures the quality of an urban space, to accommodate and facilitate the needs of ITCs (Bernard van Leer, Gelh, Urban95, 2018). We plan for a trained group (volunteers, or students) to have expeditions where they provide information on the quality of urban spaces through the PSPL surveys. These expeditions ought to be biannual, or at least three times a year.

Visualization of Data

All the information gathered will be visualized and geo-located in GIS. The platform has live city-level information on the five categories. The information is shown in heat maps (Figure 1), because they provide a dynamic visualization of three-dimensional data (two dimensions are Cartesian coordinates, while the third dimension is the respective category information). The product is a map showing the best route. The other categories are visualized in a bar, with a grade from 0-5 (0 being the lowest, 5 being the highest). Because of the different nature of the categories, it is futile to have an accumulated value with the average of all the categories. The platform can be accessed in a computer or a phone.

Figure 1: Tirana noise map, 2011, visualized in a heat map (The Municipality of Tirana; Stefano Boeri architetti; UNLAB, 2017)

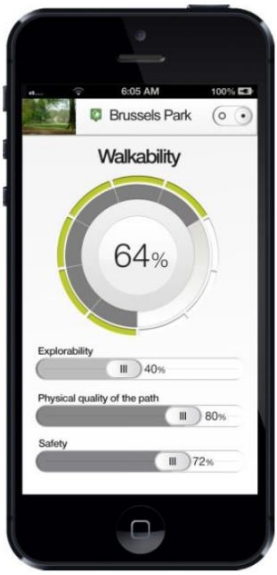

Figure 2: Conceptual interface proposed by Pak & Verbeke, 2015

DISCUSSION

The platform is based on the indicators from the ITC data package. However, information from the experience of the citizens are the backbone of data. Pak & Verbeke, 2015, stress the importance of the testimony of the user's experience. Their proposed methodologies are based on Lynch's interpretation of public spaces, and citizen involvement in walkability evaluation (Pak & Verbeke, 2015). In their case, the proposed methodologies justify the complex walkability indicators (such as explorability). We make the case that the five categories are quantifiable, and straitforward, i.e.: the data gathered from the indicators leaves almost no room for interpretation. Noise pollution, for instance, is graded based on the benchmarking values set for the indicator of noise levels in the street. The value cannot be rebutted, as its basis is entirely scientific. However, the user surveys offer substantial information that would be otherwise un-quantifiable. The user survey information serves as the backbone, and audits the validity of the ITC friendly route, only if it is periodically updated.

CONCLUSION

In conclusion, we support and motivate the creation of a platform that contributes on the phenomenon of "a safe city for all". The platform

offers live information which would be instrumental in the amelioration of the quality of ITC life.

For further research, one should keep in mind the potential the platform has as an urban planning tool encompassing, but not limited to, distribution of public spaces, parks and educational facilities, traffic planning, and building an online catalogue which will help city planners and implementers deal with any urban infrastructure "conundrum" (Schmidt-Beltz, Vos, Coulon, & GMD, 2012). The factors which would be taken into consideration, closely correlated to the well-being of ITCs, will be air quality, noise, lighting quality, paving, parks and schools or kindergartens. We propose that on the later stages, the platform can be used to encourage participatory design, and to engage people in the process of urban decision making.

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