***Quotidian Record*: The Musical Interpretation of Mobile Phone Location Data** (preprint)

Brian House

As I slip the record out from its sleeve, I examine the diagram on the surface of the vinyl. I place the stylus at the mark that indicates where "one year" begins. After I hit start, the hours of a "day" pass by with each turn of the record, which I hear as a musical pulse. Over this regular meter is a bouncing melody played on a dirty synth. The phrases become familiar even though the melody never quite repeats and occasionally makes excursions into more dynamic variations.

Figure 1 Quotidian Record sleeve. Photo credit: Brian House.

This is *Quotidian Record* (2012), an artwork which interprets one year of my location data as music. Captured via an app on my phone, each place I visited—from home to work, a friend's

apartment to a foreign city—becomes a musical note; each revolution of the platter corresponds to a day of lived time. As the record turns, the sound suggests that our habitual patterns have inherent musical qualities. Hearing our daily rhythms in this way is an alternative sort of data science, one in which the abstractions of digital data, so essential to their use by the corporation and the state, are eschewed in favor of this paradigmatically analog form.

Mapping the Everyday

In April of 2011, the American public first became aware that the new smartphones they'd been carrying with them—everywhere, at all times—were logging their latitude and longitude coordinates along the way. Dubbed "Locationgate," this small scandal would result in both a Senate hearing and an episode of *South Park* sending up Apple as Big Brother.[1] It had been just three years since the best-selling iPhone 3G introduced the Global Positioning Service (GPS) to the mainstream and moved location-based media from speculation to everyday reality.

Prompted by this public discussion, my colleagues and I at *The New York Times* Research and Development Lab created an iPhone app called *OpenPaths*, which I used log my own latitude and longitude coordinates every few minutes.[2] Through projects such as *Yellow Arrow* (2004)[3] and *Hundekopf* (2005),[4] I had previously explored how digital communication might reframe our encounter with the urban environment, whether by creating "hyperlinks in the real world" or by layering a fictional reality over the mundane one. However, continuous location tracking offered something perhaps even more potent, the ability to analyze the patterns and variations of everyday life that were already there but were previously hard to capture. It felt like

an artistic imperative to explore what could be done with these data other than what was in the minds of Big Brother / Big Business.

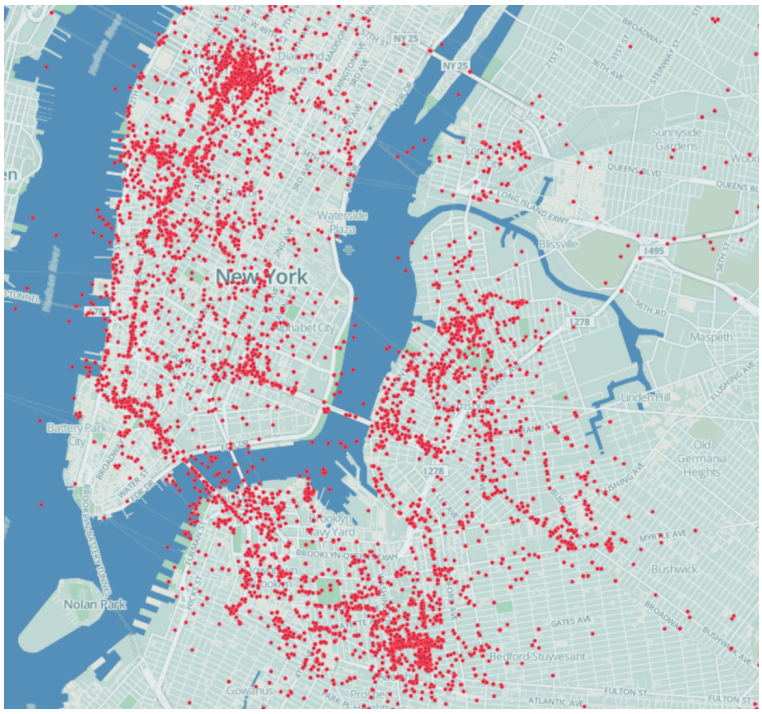

Figure 2 One year of location data plotted on a map of NYC.
Photo credit: Brian House.

So, with phone in pocket, on a typical day I'd set out by bicycle from my home in Brooklyn, make my way across the Brooklyn Bridge, and head up the West Side of Manhattan to Times Square, perhaps stopping at a favorite fruit stand along the way. After leaving work at the *Times*, I'd head back down to my studio at Eyebeam Art and Technology Center in Chelsea before returning home. Every day was different, of course, and if the weather kept either the fruit guy or me off the street, it was just one of the contingencies of life that made my patterns recognizably mine but ultimately unpredictable. *OpenPaths* dutifully recorded these movements.

Coordinates are designed to be viewed, and so I plotted this activity on top of a map of New York's streets. Here was my life, presented as a personal topography. I could trace the braided paths with my finger and tell their stories as my memory was prompted by the map. But this simple act also revealed what the production of a map had left out. As Michel de Certeau beautifully explains, a map

> transforms the *temporal* articulation of places into a spatial sequence of points. A graph takes the place of an operation. A reversible sign is substituted for a practice indissociable from particular moments and "opportunities" ... it is thus a mark *in place* of acts, a relic in place of performances: it is only their remainder, the sign of their erasure.[5]

As informative as the map was, the unfolding of my everyday was nowhere to be found on its surface; only when re-temporalized by my narrative did it take on the added resonance of subjective experience.

As it happens, holding the map still has been one of the major endeavors of Western colonial, military, and economic history.[6] Look at old European cartography: the wild longitudinal distortions are what happens when as yet inaccurate clocks are used to account for the rotation of the Earth relative to the stars. Centuries later, we have an artificial constellation of GPS satellites which broadcast atomic time to the mobile phones triangulating their positions below. The scale of this temporal engineering suggests that the stable coordinate space that results, for all its usefulness, is a contrived way to understand the *where* of the world without the *when*.

For Henri Lefebvre, it is a form of false consciousness when relationships that emerge over time—"presences"—are perceived as static *things* that are merely "present." Real places are composed of presences, that "are the facts of both nature and culture, at the same time sensible, affective and moral rather than imaginary."[7] But a dot on the map is the fantasy of an immobile present, and the digital data behind that dot are an even more perfect fiction. "40.747174, -74.006954" may represent a place in an ostensibly objective form, but the pure abstraction obfuscates the complex interrelationships that produce both the place and the designation.

Lefebvre calls for abstractions to be put back in relation to the body and its rhythms. When it came to my location data, this suggested that working with music might offer something that couldn't be found on a map. For one, as Brandon Labelle writes, "sound is intrinsically and unignorably relational."[8] It is indivisible from the acoustic space in which it resonates, a space defined by the contact—presence—of vibrating bodies. Further, it takes time to listen to something. Using data, could such duration be made analogous to the tempo at which I moved through the city?

To turn the rhythms of everyday life into sound would, perhaps, make explicit something that already exists implicitly in all music. Again, Lefebvre: "Musical rhythm ... has an ethical function. In its relation to the body, to time, to the work, it illustrates real (everyday) life."[9] The habitual gestures of the body, the passage of seasons, the polyrhythms of relationships, and the regimentation of the (capitalist's) clock are, arguably, the fundamental basis of musical aesthetics. We are already attuned, then, to the dynamics of repetition and difference and the micro-political negotiations that they comprise.

Musicking with Data

By May of 2012, I had collected a year's worth of my location data. To make it into music required an act of reverse engineering to recover from the encoding whatever feeling might remain. I started, therefore, with data science, programming, and visualization before progressing to the aesthetics of sound.

Each point in my dataset consisted of a latitude / longitude pair along with the time it was recorded. Rather than naively correlate these coordinates with musical features, I began by examining their relationships for any implicit structure. Using Python, an open source programming language commonly used for analyzing data, I first identified individual "trips" that were taken between discrete locations. Any two points in geographic succession within a few minutes of each other were marked as part of the same journey.

Subsequently, what became more interesting was where the trips left off, that is, the places where I was doing the things that I do. Subtracting all but these endpoints, I could readily identify my home, work, studio, laundry, practice space, and other places of day-to-day activity. By employing a clustering algorithm at approximately the resolution of a single address, I ensured that all trips arriving or departing nearby reinforced the importance of a single place.

At this point in the exploratory process, geolocation coordinates had been transformed into a sequence of places. Trading the spatial map for a timeline, I was then able to visualize my behavior as a progression of color bands, where each color represented a different place and was sized in proportion to the amount of time I spent in that location. Rhythms immediately became apparent in this image; my daily commute emerged as groups of five repeating stripes, for example, which were interrupted by more chaotic bursts on the weekends and much looser

formations when I traveled to cities in which my life was unstructured. To find correlations between days, I plotted this strip as concentric circles, with each circle corresponding to the twenty-four hours of a single day (See Figure 3). Diurnal, weekly, and monthly structures materialized.

Figure 3 Location data visualized as places over the twenty-four hours of the day. Photo credit: Brian House.

Looking at this intermediate stage of visualization was when it hit me. For all of my interest in working with sound, it was not until I saw the isomorphic relationship of the visual spiral to the grooves of a vinyl record that the project took on its material form. I found the circumstances of

this discovery apropos. Analogous to Lefebvre's move from thing to process, the musicologist Christopher Small famously proposed that we ought to replace the term "music" with "musicking."[10] This verb would include not only playing an instrument but also activities like listening to the radio, selling tickets to a show, designing a band logo, or even appreciating the form of a vinyl record, all of which contribute to the meaning of the cultural form. Finding my way to sound through the physical properties of a recording medium safeguarded what followed from being just another form of abstraction and instead grounded it in the actual practice of music.

The dimensions of the record also provided a basic musical structure. Keeping my spiral diagram intact, one day of lived time as captured in the data could now be scaled to one full rotation of the platter: at 33 1/3 revolutions per minute—the standard speed for a 12-inch LP—one day became 1.8 seconds, more or less the duration of a measure in an upbeat pop song. Data from 365 days then computes to very nearly eleven minutes of music: a reasonable if concise length for a side (before you ask, the outer edge of the record takes the same amount of time to rotate as the inner one, it just covers more ground and therefore has greater fidelity).[11]

To come up with the pitches, I first separated all the places into cities and randomly assigned each one to a musical scale, such as C major. Next, I matched the places within that city to intervals within the scale; more consonant intervals correspond to more frequently visited locations. My apartment, for example, is the most frequent location, and so it is interpreted as a major third. In contrast, places I visited only once produce the outer jazz harmonies. The melody of the composition follows this intervallic play, moving between notes as I travelled between places. A second voice pulses on the root of the scale every 150 milliseconds, or twelve times a

day, which serves as a temporal reference. The realized sound also includes a filter sweep on this pulse at 1.8 hertz, which further orients the listener to the diurnal cycle.

That this approach is unabashedly tonal is a reflection of various influences. First, I wanted to use inexpensive hardware synthesizers and repurposed guitar pedals to realize the timbre of the piece, rather than computer-generated audio. Such a setup, inspired by the post-punk and noise scenes of Brooklyn and Providence, embodies an imprecise grit that resists the polished aesthetic of computation. The stalwart MIDI protocol, developed in the 80s but which remains a standard, drives the synths according to the composition; MIDI is strongly biased toward tonal music due to its roots in early electronic keyboards. The setup—and the resulting aesthetic—also echoes Laurie Spiegel's pioneering album *The Expanding Universe*, created at Bell Laboratories in the 1970s, in which she wrote algorithms for a computer to control hardware synthesizers and incorporated traditional harmonies from folk music into her compositions.

Figure 4 Synth and guitar pedal setup. Photo credit: Brian House.

In addition, consonance is associated with American minimalism and composers such as Steve Reich. In his 1968 manifesto, Reich states "What I'm interested in is a compositional process and a sounding music that are one and the same thing."[12] This ethic dictates that an initial set of composed conditions is left to play out over time without the arbitrary intervention of the composer. The intent is that this process is accessible to the listener, and the appeal of a minimalist piece comes from the textures and rhythms that emerge from the unfolding of its immanent logic. Similarly, I wanted the variation in my music to be the result of differences in the data as they are enumerated and transformed according to a consistent—and audible—set of rules.

I performed and recorded the music in my studio, tweaking the settings on my gear over a couple of takes until things felt right. That the result turns out to be musically interesting ties directly to the musicality of my behavior in the world, just as Lefebvre anticipated. Refrains of my regular working life provide a dominant theme, and modulations signify the drama of travel and life decisions. And while it's difficult to capture a sense of the habitual, the evolving, or the unexpected on a visual map, these qualities are emphasized and intuitive here. The music makes possible what Lefebvre called a "*rhythm*analysis" rather than just a spatial one.[13]

However, hearing it was just the beginning, as how it is heard is of equal importance. To transfer the music to vinyl, I called on the artist Ted Riederer. His *Never Records* project is a pop-up recording studio and record shop that travels to communities and records and releases one-off performances by local artists.[14] Ted cut ten records for me (an exception for *Never Records*, but my piece shares its hyper-local ethos). Unlike commercial record production, which stamps records instantaneously from a master mold, Ted uses a lathe which cuts them one at a

time into polyvinyl chloride (PVC) blanks at the speed the music plays. It's the same technique used by Jamaican producers in the late 1960s and 70s to make "dubplate" remixes on acetate for their sound system parties. While the term "dub" ostensibly references the new mix as a "double," Lee "Scratch" Perry famously said that dub music is "the ghost in me coming out,"[15] a resonance which I like when applied to the reanimation of location data.

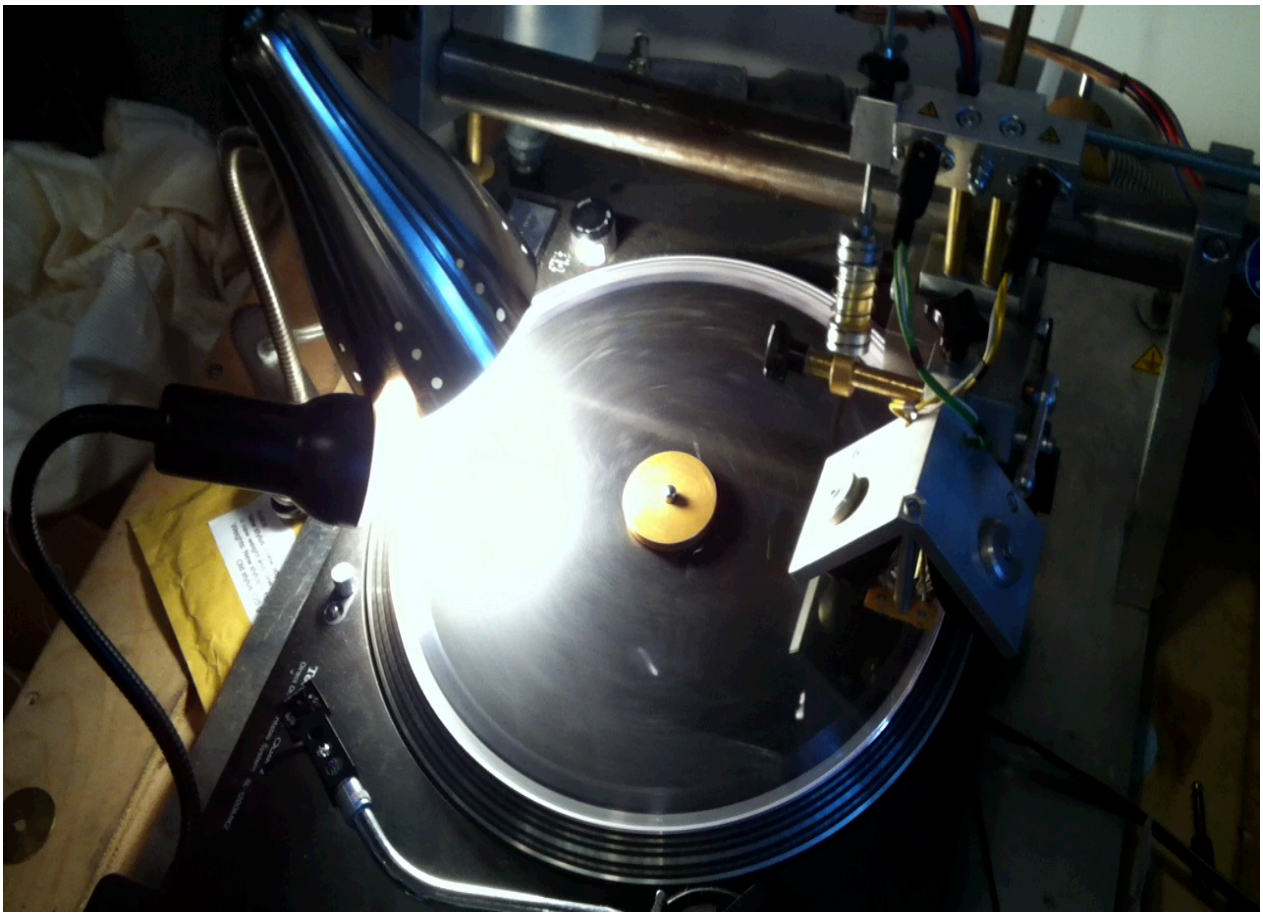

Figure 5 Lathe cutting at *Never Records*. Photo credit: Brian House.

Etching a clear vinyl disc with a rhythm in time with its rotation had an unexpected effect: the diurnal pulses were physically visible as light-diffracting spokes radiating out from its center. I had planned to reproduce some version of my original spiral visualization on the record itself, but on its own the surface was already a visual index to its audio content. Nonetheless, the designer Greg Mihalko and I proceeded to design graphics that indicated how the record could be understood as a 24-hour clock.[16] Likewise, we showed how moving the stylus inward from the edge traverses across days and we set concentric bands to indicate those grooves that match my travels to cities other than New York. We printed these graphics on the reverse of the records so that they show through the clear vinyl. As a result, listeners can select a particular time in a particular place by moving the tonearm to the appropriate position.

Figure 6 Quotidian Record exhibited. Photo credit: Brian House.

I called the result *Quotidian Record*.[17] After premiering the piece in the summer of 2012 at Eyebeam, which had supported the project, the record began circulating through art and technology exhibitions, including the annual Ars Electronica show in Linz, Austria. For each of the shows, it was essential that the piece be presented on a turntable with which the audience could freely interact. Playing the record, positioning the stylus, and even "scratching" the surface of the vinyl are all gestures of a performance that is as much a part of the work as the object itself. Subsequently, as each of the ten cuts have been exhibited and listened to, they have degraded according to the unique wear of their individual histories; though derived from the same data, they now sound distinctly different. In this respect, the piece also echoes Christian Marclay's *Record Without a Cover* (1985), which purposefully incorporates damage to the disc into a particular copy's unique content.

Figure 7 Listeners at Eyebeam. Photo credit: Brian House.

The Physical Digital

By engaging with its own material qualities, *Quotidian Record* inevitably arrives at the question of what it is to inscribe digital data within an obsolete, and quintessentially analog, medium. Of course, "analog" originally referred to the functional "analogy" between a mechanism, such as the grooves of a record, and some phenomenon, like the vibrations of sound through the air. Today, however, "analog" is just as likely to be used to describe anything in the "real world" as opposed to the online, digitally mediated one. The retro appeal of a vinyl record thus has as much to do with it being "post-digital" as it does with any intrinsic quality of LPs.

However, this dualistic thinking is a bit of a red herring. As Wendy Chun puts it, "Information—if it exists—is always embodied, whether in a machine or an animal. To make information appear disembodied requires a lot of work, work that is glossed over if we just accept the digital as operating through 1s and 0s."[18] For *Quotidian Record*, what is at stake is not analog versus digital, but the levels of interpretation through which my location dataset has passed: from a lived experience that was sampled by a mobile device (itself an extension of geosynchronous satellite infrastructure), to the proprietary networks through which it was transmitted and the data centers in which it was stored, to my musical composition, the synthesizers and the vinyl lathe, the stylus in the groove, and, finally, to the listener's ear. The path comprises both symbolic translations and material transductions, each of which speaks to a specific set of cultural practices and political entanglements.

Therefore, to the extent that *Quotidian Record* is a response to a more mainstream data science, it points to how alternative aesthetics can foreground what's missing when we take data to be virtual, ephemeral, or neutral. Ultimately, the form of the record is not so different than that

of the hard disk, but whereas we go to great lengths to enclose the latter within computers or keep them hidden away in data centers, the former makes itself heard in the pops and hum of a tangible mechanism that we can appreciate for its aesthetic warmth. According to Friedrich Kittler, the advent of the gramophone meant that no longer could the world only be represented with symbolic language, it could now be recorded with all of its "real" sound intact.[19] Data may be symbolic, but they, too, make a noise that is evidence of the conditions through which we receive them.

In that sense, *Quotidian Record* not only makes audible the musical qualities of my particular location data, it emphasizes all data's audibility. After all, just like music might be better understood as musicking, data might also be better used as "dataing."[20] This perspective opens a dataset up to creative acts of reinterpretation, just as, for example, Grandmaster Flash and other early hip hop DJs physically manipulated the medium to reframe the mass-produced music cut within.

A limited-edition record-cum-artwork is, of course, a commodity, one as personal and as precious as any record might be. This form imparts location data with a tangible sense of value, whereas corporations that would profit from them have a vested interest in data being perceived as abstract. For if the mobile phone has become a constant companion in everyday life, its capacity to deliver information to us in situ is surpassed only by its potential to gather data for the platforms that would profit from them. Further, by making this record playable and invoking the cultural modes of music, I hope *Quotidian Record* works against an interpretation of these data as deterministic and instead offers a qualitative means for my daily rhythms to be heard in time as a relatable "presence."

Urban Rhythms

In the years since the release of *Quotidian Record*, the use of location data from mobile phones has grown rapidly. Not only have new location-based services such as Uber reshaped what it is to move through the urban environment, initiatives like Google's Sidewalk Labs are designing cities built from "the internet up" with the assumption of pervasive tracking.[21] These developments proceed despite how we now know, thanks to whistleblowers like Edward Snowden, that the US government has illegally used location data for surveillance worldwide, and that platforms like Facebook abet the spread of location-targeted disinformation.

A common question that I have received in response to *Quotidian Record* has been whether I changed my behavior in anticipation of the musical result. To do so would be quite a commitment, as the rhythms emerge from the overall structure of my life rather than any particular decision made during the day. For this same reason, it is difficult to resist the machine learning systems that work to discover patterns in the data that we generate. These practices of the corporation and the state are akin to Lefebvre's rhythmanalysis insofar as they are concerned with the temporalities of everyday life, but they serve instruments that would exploit that life and estrange us from it rather than broaden our sensitivity to its possibilities.

Quotidian Record was the first attempt in my own practice to engage with questions of digital media through attention to the musical qualities of its material. For one, the work's presence in my collection is a reminder of a particularly generative time in my practice and in my life. And if its use of data is anachronistic next to the increasingly powerful and pervasive technologies that map our behavior today, perhaps it is an imagined media history for a better sounding—and still possible—future.

Endnotes

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[3] See https://brianhouse.net/works/yellow_arrow.

[4] See https://brianhouse.net/works/hundekopf.

[5] Michel de Certeau, *The Practice of Everyday Life*, translated by Steve Rendall (Berkeley: University of California Press, 1984), 35.

[6] Peter Galison, *Einstein's Clocks, Poincaré's Maps* (New York: W. W. Norton, 2003).

[7] Henri Lefebvre, *Rhythmanalysis: Space, Time and Everyday Life*, trans. Stuart Elden and Gerald Moore (London: Continuum, 2004 [1992]), 23.

[8] Brandon LaBelle, *Background Noise: Perspectives on Sound Art* (New York: Continuum International, 2006), ix.

[9] Lefebvre *Rhythmanalysis*, 1992, 66, emphasis removed.

[10] Christopher Small, *Musicking: The Meanings of Performing and Listening* (Hanover: University Press of New England, 1998).

[11] Bill Watterson, "Record Play," *Calvin and Hobbes*, 5 June 1990, https://www.gocomics.com/calvinandhobbes/1990/06/05.

[12] Steve Reich, "Music as a Gradual Process," in *Writings on Music* (Oxford: Oxford University Press, 2002 [1968]), 34–36.

[13] Lefebvre *Rhythmanalysis*, 1992, 9.

[14] Visit http://neverrecords.samexhibit.com/pages/about for more on Never Records.

[15] John Corbett, *Extended Play: Sounding Off from John Cage to Dr. Funkenstein* (Durham: Duke University Press, 1994), 129.

[16] See Greg's work at https://partnerandpartners.com.

[17] Listen to the result at https://brianhouse.net/works/quotidian_record.

[18] Wendy Hui Kyong Chun, *Programmed Visions: Software and Memory* (Cambridge: MIT Press, 2011), 139.

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[21] Sidewalk Labs, "Visions Sections of RFP Submission, *Sidewalk Toronto*, October 27, 2017, https://storage.googleapis.com/sidewalk-toronto-ca/wp-content/uploads/2019/06/13214331/Sidewalk-Toronto-Backgrounder.pdf.