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How can urban planning leverage crowdsourced fitness activity data?

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Résumé de l'article

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Strava Metro Data: how can urban planning leverage crowdsourced fitness activity data?

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Abstract

The widespread adoption of mobile phone and other location-tracking devices, and the enormous amounts of data they produce, has provided municipalities with the opportunity to automate previously time-consuming and labour-intensive data collection processes. Municipal planners, in particular, have begun to integrate the aggregated data sets of private urban technology platforms into active transportation and broader infrastructure planning initiatives. To date, however, there has been limited research on the implications of this integration for municipal decision-making and governance processes. Using the Strava Metro data stream and its free-access model as a case study, this paper explores both the motivations behind municipal adoption of the Strava platform and the benefits that accrue from its usage. Through the application of a mixed methods approach, including the building of a use case database via a search of internet and academic literature sources and qualitative interviews with municipal planning staff, our research examines how Strava data is used to support the work of municipal planners and evaluates the strengths and weaknesses of that use. Our study finds that Strava Metro data aided municipal staff in the planning of cycling and pedestrian infrastructure, complementing available in-house data sets; helped spur new active transportation initiatives; and enabled innovation and professional curiosity on the part of planners. The paper concludes by exploring the ramifications of Strava data for community wellness and broader public realm improvements, as well as extending a discussion with respect to the platform's sociodemographic representativeness and related limitations.

Résumé

L'adoption répandue de téléphones cellulaires et d'autres dispositifs de localisation, ainsi que le montant énorme de données que ceux-ci produisent, ont fourni une occasion pour les municipalités d'automatiser des processus de collection de données qui prenaient du temps et demandaient une forte intensité de main-d'œuvre. Les aménageurs municipaux, en particulier, ont commencé à intégrer les données agrégées de plateformes privées de technologie urbaine dans le transport actif et les initiatives d'aménagement d'infrastructure. Jusqu'à présent, par contre, la recherche sur les implications de cette intégration pour la prise de décisions municipales et les processus de gouvernance est limitée. En utilisant les données de Strava Metro et son modèle en accès libre comme une étude de cas, cet article explore à la fois les motivations derrière l'adoption municipale de la plateforme Strava, ainsi que les avantages de son utilisation. À travers d'une approche à méthodes mixtes, incluant la construction d'une banque de données en faisant une recherche de ressources savantes et sur Internet et d'entrevues qualitatives avec des aménageurs municipaux, notre recherche examine comment les données Strava sont utilisées afin d'appuyer le travail d'aménageurs municipaux et évalue les forces et les faiblesses de cette utilisation. Notre étude révèle que les données Strava Metro ont aidé les employés municipaux avec l'aménagement d'infrastructure cyclable et piétonne, complémentant les données internes disponibles; ont aidé à stimuler de nouvelles initiatives de transport actif; et ont permis l'innovation et la curiosité professionnelle de la part des aménageurs. L'article conclut en explorant les ramifications des données Strava sur le bien-être communautaire et sur l'amélioration du domaine public, ainsi qu'en poursuivant une discussion sur la représentativité sociodémographique de la plateforme et les limites qui y sont associées.

Keywords:

Data, platformization, evolving technology, Strava

Mots-clés:

Données, plateformisation, évolution de la technologie, Strava

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Introduction

The modern practice of planning and design of cities has become increasingly evidence-based and data-driven. Over the past 20-plus years, the datafication of everyday life through residents' widespread adoption of mobile phone and other location-tracking devices provides an opportunity for municipal governments to automate many forms of data collection that were previously time- and labour-intensive. More recently, private sector urban technology platforms have emerged as significant players in large-scale data collection and aggregation, triggering a robust critique of their role in supporting and influencing the mechanisms of municipal governance and decision-making (Wilson, 2015; Barns, 2020; Leszczynski, 2020). As third-party data collection regimes become more expansive, outstripping the ability of governments to collect similar types and quantities of data (Johnson & Scassa, 2023), it is critical that governments be proactive in determining whether and how to incorporate this data into existing or modified processes of decision-making.

To date, limited research has been conducted on how data from these platforms can or should be used to inform municipal planning and decision-making processes. One reason for this research gap is that many of these platforms, including, most notably, Airbnb, have put in place proprietary and legal barriers to prevent governments from accessing their data (Sadowski, 2020a). In marked contrast, Strava, a fitness and activity-tracking application, in 2020, converted their subscription data service to a free-access model for municipal government usage through its Strava Metro data stream. This was an intentional change from their previous model of charging municipal users for data access. At the time, Strava's CEO, Mark Gainey, said: "We always believed there were special ways in which the Strava community could contribute to the world at-large. Strava Metro was one such way. And given the growing need for bicycle and pedestrian infrastructure, we felt Strava Metro was too valuable and important not to make available to any organization attempting to make a difference in designing the cities of the future" (Strava, 2020).

With Strava as a case study, we take a mixed methods approach, including use case analysis and key informant interviews with municipal staff, to better understand how planners use this data. We evaluated the motivators and drivers behind the use of this data, with the following question guiding our research: How has Strava Metro data informed municipal decision-making? We present evidence of how the data stream from a fitness platform—Strava Metro—might be a useful tool for planners, within the specific instance of active transportation planning. We wanted to understand how Strava's activity platform data is currently being used to support municipal planners, and also to assess the strengths and weaknesses of that use.

Literature Review

Specialized sources of data are important inputs into urban planning, design, and operations efforts. The last two decades of technological innovation (e.g., broadband, remote sensing, mobile technology, Internet of Things) have resulted in data gathering at ever-increasing scales (Townsend, 2013). Planners' access to and use of these large data sets is important to understand both in the context of active transportation planning, and also more broadly as the practice of planning evolves in an increasingly technologically complex urban landscape.

Data Gathered from Urban Technology Platforms

Planners have long been engaged in decision-making about the physical infrastructure of the city. This includes traditional built infrastructure, such as the location and capacity of sewers, water, electricity and mobility infrastructure, as well as digital

infrastructure, including information about resident movement, service usage, and access to information. As digital infrastructure has evolved, we have seen an expansion of urban digital technology platforms that both gather data and provide city residents with information about their day-to-day lives (Helmond, 2015; Klein, 2021; Srnicek, 2017). Technology companies, through the creation of urban technology platforms, play a significant role in the "datafication" of the city (Mayer-Schönberger & Cukier, 2013). Apps such as AirBnB, Uber, Lyft, Nextdoor, Bang the Table, and fitness apps like Strava, among others, comprise a suite of urban technology platforms that extract data from people as they go about living their lives in cities (Barns, 2020; Sadowski, 2021). Platform urbanism research examines the impacts of these data collection and sharing regimes on the pattern of the city, urban economies, democratic processes, and the rights of residents in the city. Within this domain, scholars, including Barns (2020), Leszczynski (2020), and Kitchin (2023), have raised concerns about how urban technology platforms have the potential to gather and hold highly valuable data, with limited to no access granted to the municipalities in which they operate. For example, Airbnb has been widely criticized for profiting from the data it gathers in cities without having a reciprocal and fair process for sharing that data back with local governments (Tusikov, 2023). The ways in which data gathered from urban technology platforms informs urban planning practice requires public oversight (Van der Graaf & Ballon, 2019). In the context of planning practice, further research is required to understand the veracity and appropriateness of this data, how planners are mitigating data limitations and extracting value from data, and to which types of projects these data sets are being applied.

Adapting Fitness Platform Data to Planning: From Strava to Strava Metro

Strava is a mobile application that uses GPS technology to track movement that is then translated into data points and shared via an online social network (Rich Roll, 2019). The launch of the mobile Strava application in 2011 was made possible largely through the availability of both GPS-integrated smartphones and the desire of the public to share

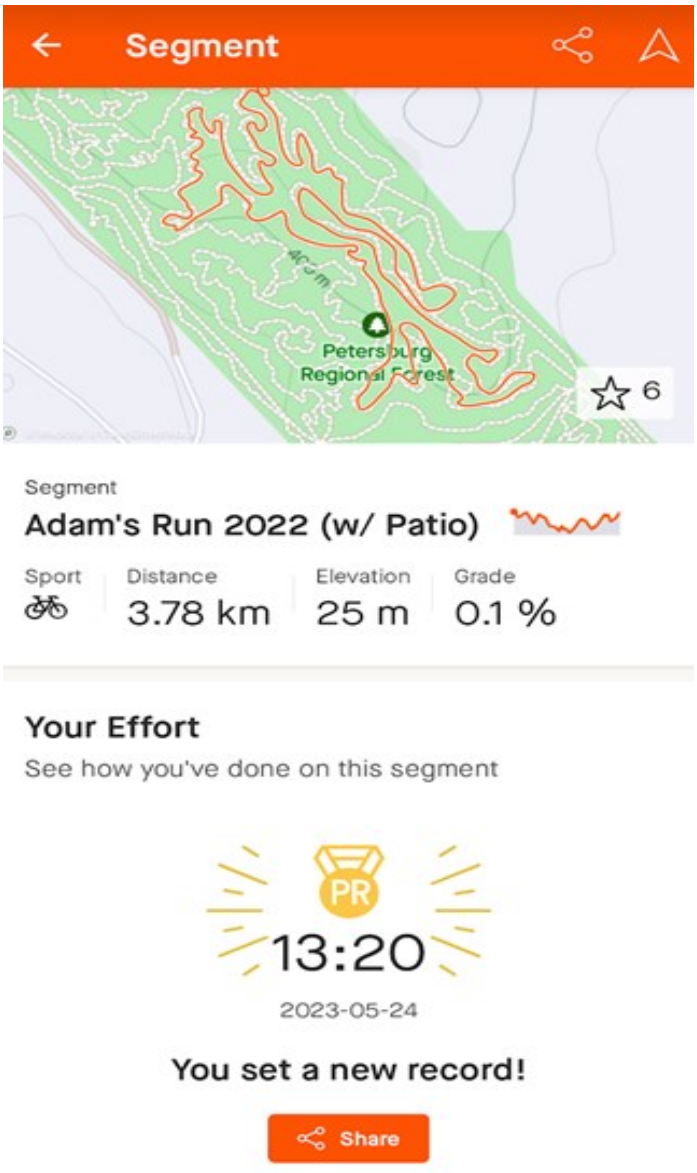

Figure 1. Sample screen shot of Strava cycling segment (author provided).

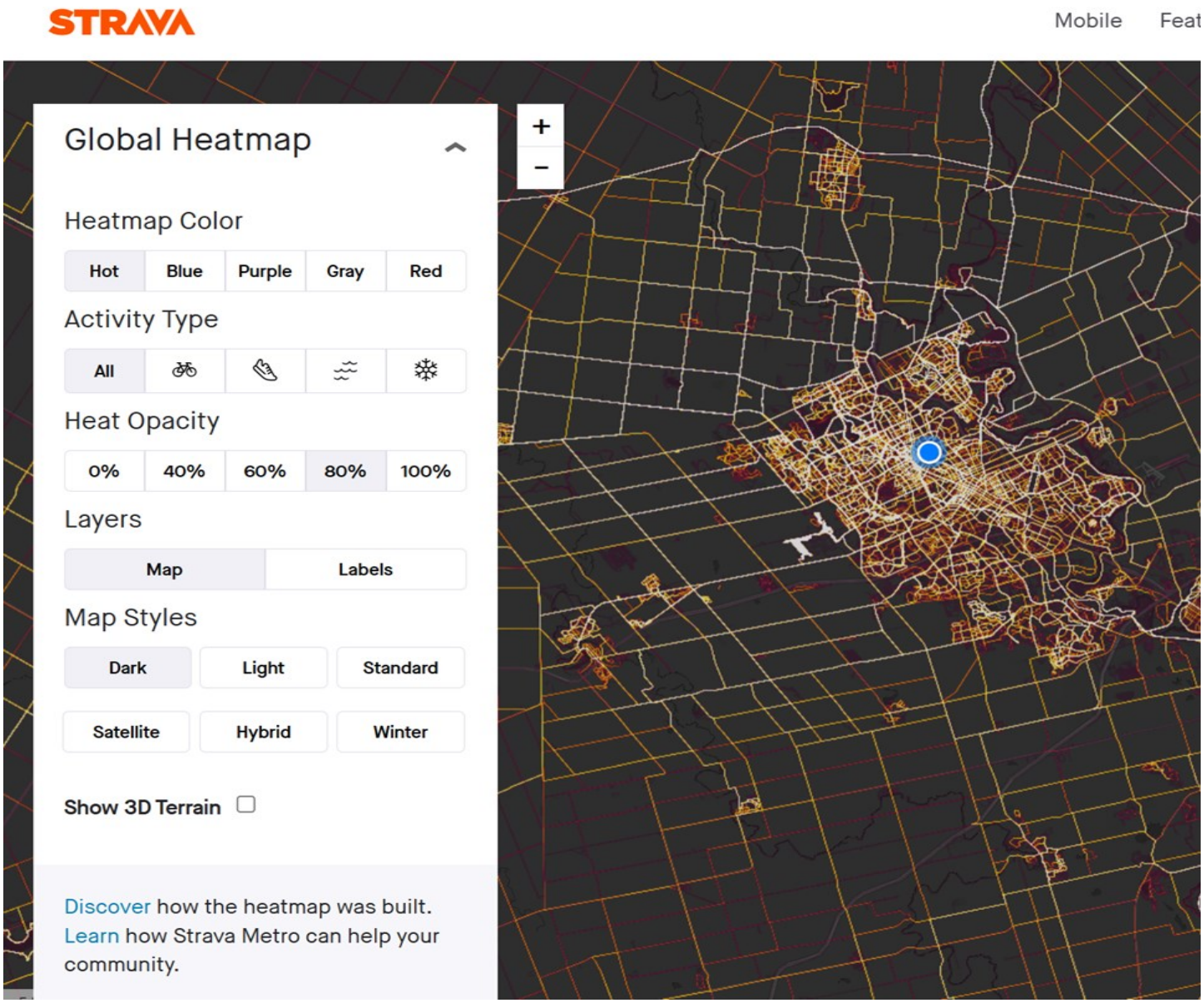

Figure 2. Sample screen shot of Strava cycling segment (author provided).

information through social media (Bailey, 2018; Fischer et al., 2022). The data the platform collects includes counts of user activity on road and trail segments that are packaged into temporal sections (Figure 1). Strava users can then share this data through social network features that stimulate interaction and competition through online clubs, challenges, and events (Rich Roll, 2019).

In 2023, Strava reported that it had reached over 100 million users, with half of them joining in the last two years (Velo News, 2023). As mobile and geospatial technologies evolved, Strava's importance as a technology platform grew. Strava users, who at the time were largely cyclists and runners, tracked their routes, producing a crowdsourced data set mapping the trails and roads they were using (Figure

2). In 2013, Strava converted over one billion data points submitted by their app subscribers into a series of accessible interactive heatmaps, sharing where Strava users were riding (Campbell-Dollaghan, 2017). These heatmaps proved to have value beyond providing a simple descriptive account of popular routes to other Strava users. Municipal planners started to contact Strava about the data because they saw value in its application for active transportation planning, as it provided greater temporal and geographic resolution compared to the static manual or in situ automated count data municipalities typically use (Campbell-Dollaghan, 2017; Jestico et al., 2016; Ray et al., 2020).

The Strava Metro data set is created through the use of the Strava app. Using a smartphone or smartwatch, users record a variety of physical activities and sports, including walking, running, cycling, rolling, swimming, tennis, golf, and kayaking. The Strava Metro data set collects a subset of all Strava activities and presents these as cycling or walking/running activities within an online dashboard that provides segment-by-segment user counts. Dashboard access is given to municipalities, allowing them to view and download information related to trip count, trip waiting time, and trip purpose. These user counts are available for specific days, and can also be aggregated in weekly/monthly/annual summaries. It is important to note that the Strava Metro data set does not represent all Strava users, as individuals (both paid and free app users) can opt out of having their Strava activities included within the Metro data set. Strava Metro is used by municipalities around the world, as well as in Canadian municipalities such as Victoria, Ottawa, Oakville, and Durham Region, to understand active transportation patterns (Lee & Sener, 2020; Jestico et al., 2016).

As the use of Strava Metro's data grew, researchers began evaluating Strava Metro data as an emerging active transportation data source (Alattar et al., 2021; Milne & Watling, 2019). For example, in their extensive literature review of applications of Metro data related to cycling, Lee and Sener (2020) identify a range of municipal use categories, including travel pattern identification, travel demand estimation, route choice analysis, infrastructure investment, preventing collisions, and air pollution exposure assessments. As municipalities began to use Strava Metro data to inform decision-making, researchers such as Conrow et al. (2018) and Livingston et al. (2020) scrutinized whether the data could be used as a proxy for actual cyclists on a given route. Both studies found that Strava Metro data only captures a particular demographic of riders, one that is generally more male, white, and affluent than the general population. Recognizing these limitations, Sanders et al. (2017), Ferster et al. (2021), Dadashova and Griffin (2020), Hochmair et al. (2019), and Jestico et al. (2016) created ways of supplementing Strava Metro data using alternate sources, such as municipal count data, to more robustly capture cycling patterns.

Contextualizing how Strava Metro is being used by municipal governments, including its successes and limitations, enables more informed questions to be asked about how Strava data can contribute to the implementation of specific municipal plans. In the field of active transportation, significant focus is placed on supporting and expanding opportunities for active transportation, which leverages active mobility infrastructure to reduce time spent in motorized vehicles (Brown et al., 2017; Grant, 2019). Developing and expanding active transportation infrastructure is a major area of study where planners are currently working to create new mobility options. To justify public investment in active transportation infrastructure, planners have leveraged data from a variety of sources, including the data collected from strategically positioned bike count stations (Brown et al., 2017). While count stations provide a baseline

metric for cyclists, the spatial and temporal complexity of the data is limited (McAndrews et al., 2017). In practice, not all municipalities can afford robust count station research in terms of time, equipment, and data analysis. It is therefore not surprising that access to third-party, real-time data is appealing to local government staff in their active transportation planning efforts.

Strava's shift to free municipal access, as well as significant growth in its user base as a result of the COVID-19 pandemic (Woods, 2021), has made adoption of the Strava Metro platform and its associated data stream appealing to many municipalities. However, little is known about what motivates municipal staff to use these data and even less is known about how these Strava Metro data are used in practice. This research project begins to fill these gaps in knowledge.

Method

This project began with the research team questioning how data gathered from a fitness app could inform municipal decision-making and infrastructure investments. To better understand how municipal staff were making use of Strava Metro data in their decision-making, our research team took a mixed methods approach, beginning with the building of a use case database. We began with the Strava Metro blog (https://metro.strava.com/) and other social media posts from the company (https://medium.com/strava-metro) to assemble a list of preliminary use cases. The examples Strava would choose to highlight would clearly be best-in-show examples and our goal was to move beyond exemplary cases to ordinary examples too.

To gather this use case data, we conducted an environmental scan of internet sources using terms such as "*Strava in municipal governance*"; "*Strava in active transportation*"; *"Strava tracking cycling"*; *"Strava in transportation master plans"*; *"Cities use of Strava"*; *"Open cycling data in cities"*; *"Mapping cycling ridership"*; *"Using Strava data for investment"*; *and "Community use of Strava data in cities".* Then an academic literature search was also conducted using the Toronto Metropolitan University (TMU) library search engine. Key phrases employed in the library search mirrored those used in the Google search. This search process resulted in a mix of academic, government, and popular press sources. In total, we reviewed 39 research papers, 57 media reports, and 74 municipal reports that specifically identified using Strava Metro data in their efforts: 37 from Canadian municipalities, 26 from American municipalities and states, and 11 from UK and Australian municipalities and states. Our search also uncovered six podcasts featuring the Strava founders and senior leadership team (e.g., the CEO, board chair, and director of engineering and growth), comprising six hours and 52 minutes of discussion about the company's approach to working with data, including the evolution of the Metro data stream.

These research inputs helped us build a more specific understanding of the kinds of municipal active transportation projects being informed by Strava Metro data. In the findings section below, we make reference to a variety of Strava Metro use cases. These use cases led us to consider additional research questions with implications for Canadian planning practice, including identifying why planners are using this data, and the challenges and opportunities generated by its use.

To more fully respond to these questions, we selected six municipalities for further study, from a cluster of Southern Ontario municipalities. We selected these municipalities because they were all long-standing users of Strava Metro data, and additionally, they all function within the same provincial land use planning regime in Ontario. In trying to understand the motivations for turning to Strava Metro data, holding the planning jurisdiction

as a constant allowed us to better compare variability between cases. Finally, Robinson is a registered professional planner in Ontario and Vernooy practises planning in Ontario, and this professional experience was an important asset in our capacity to evaluate the research findings.

The six municipalities include three cities (Brampton, Oakville, and Ottawa), two rural counties (Simcoe and Grey), and one upper-tier municipality (Durham Region). In Summer 2022, we interviewed nine staff over five hours and 50 minutes regarding usage of the data and its outcomes and the opportunities and limitations of the data sets. The research questions can be found in Appendix 1. The two lead authors participated in all of the interviews, which were recorded and transcribed. All interviews were coded using a predetermined set of 19 codes which informed the research findings presented here. These codes can be found in Appendix 2. Each lead author separately and manually coded the interview transcripts and then a merged data set was created. The research findings in this paper draw attention to data use and the ways in which planners work with these data.

What is Strava Metro being used for and what do municipal staff think about its utility?

To investigate the use of Strava Metro by municipal planners, we draw on two different sources of evidence: first, the use case inventory of published work describing the various municipal uses of Strava Metro; secondly, as a follow-up to this foundational data gathering, we conducted qualitative interviews with select municipal planners who have direct experience using Strava Metro, in the context of their active transportation planning efforts. We interviewed these municipal governments to understand not only what they are using Metro for, but why and the strengths and weaknesses of that use.

We present results on the use of Strava Metro data as an input into transportation and active transportation plans, as well as an input into other municipal plans, such as tourism or economic development. We then present results from both the use case inventory and qualitative interviews that highlight the benefits and challenges of the use of Strava Metro, as identified by municipalities.

What are municipalities using Strava Metro for? Results from both use case analysis and interviews

There are many traditional approaches to gathering data to inform active transportation planning. These include manual data counts, permanent or temporary in situ sensors, video traffic collection, transportation surveys, and the purchase of data from third-party data resellers, such as Streetlight Data (https://www.streetlightdata.com), which repackages travel data collected from smartphones and connected vehicles. The practical flaws of traditional data collection methods are well known, such as limited numbers of count stations or manual counts, their sometimes-faulty nature that renders data unusable, and their inability to collect information from diverse spatial and temporal scales (Ray et al., 2020). Third-party data, such as Streetlight Data, can solve many of these issues by providing wide geographic and temporal coverage, but it is also associated with a high purchase cost. Additionally, reliance on third-party data and analytic services may compromise the ability of municipalities to conduct their own analysis to support decision-making (Johnson & Scassa, 2023). In comparison, Strava Metro data provides a zero-cost, continuous stream of data over a wide geographic and temporal scale (Milne & Watling, 2019). Strava Metro has the potential to fill gaps and augment existing data collection efforts, particularly in rural municipalities, with low populations dispersed over larger geographic areas (Camacho-Torregrosa et al., 2021, Hochmair et al., 2019).

Each of the municipalities in the use case inventory used Strava Metro data as a tool to inform active transportation analyses. Most commonly, the Strava Metro data about ridership patterns of cyclists provided planners with feedback about where, when, and how frequently riders used particular routes. For example, municipal staff used Strava Metro data to help identify the real-time behaviour of cyclists (Lee & Sener, 2020; Robinson et al., under preparation). Metro data was also used as a supplemental data set, filling in gaps in existing municipal data sets; this data provides a benefit by filling in data gaps. This data also helps municipal staff communicate active transportation trends through visualizations of ridership patterns and areas popular with participants. For example, in Ottawa-Gatineau, visual representations of increased ridership after a bridge reconstruction were referenced by planners to justify future investment (Boss et al., 2018). In Oakville, Strava Metro data was used to identify spaces where there was a discrepancy between cyclist volume and the quality of recreation infrastructure, including areas with a high cyclist volume and poor infrastructure or spaces with few cyclists and extensive infrastructure (Town of Oakville, 2017). Reproducing Strava data as a graphic is also beneficial for the public as the once technical information becomes digestible and relatable. Szczepańska et al. (2021) identified how imperative visualization techniques are to participation in the planning process as they reduce communication and professional barriers that may otherwise limit public engagement. For the City of Brampton, the most pragmatic function of Strava is its contribution towards government transparency and cooperation. This is accomplished through the sharing of Strava Metro data via Brampton's public data portal, which is used to collect, store, and share popular cycling routes and hotspots captured on Strava to encourage engagement in, and development of, safe cycling infrastructure (Montgomery, 2017).

This research has identified municipalities currently using Strava Metro data for work beyond active transportation planning. For example, in 2018, Grey County, a largely rural area in Ontario, Canada, received a grant to develop a master plan that outlined objectives for improving cycling and pedestrian routes, including the creation of 22 kilometres of paved shoulders and 334 kilometres of trails (Golletz, 2020). Strava Metro data was used to generate movement hotspot maps of where cyclists were riding throughout built-up areas, conservation areas, and regional trail systems to direct reconstruction (WSP et al., 2020). A neighbouring rural municipality, Simcoe County, Ontario, used the data in a similar way (Interviewee 3).

Strava Metro as an Input into Transportation and Active Transportation Plans

The Strava Metro data set provided unique perspectives on geographically dispersed phenomena, especially for some aspects of active transportation planning that were difficult to address using traditional methods. One interviewee indicated that: "*without that (Strava Metro) we would be sitting in our cubicles making judgments on what we think might be happening or anecdotal evidence about what's happening out in the rural areas*" (Interviewee 5). Interviewees noted that Strava Metro data contributed to transportation master plans (Interviewee 4) and active transportation master plans (Interviewee 6 and Interviewee 7). This use of Strava Metro underlines how staff saw traditional in situ methods of gathering data as expensive and time consuming, limiting their use to a narrow selection of geographic locations. Strava Metro was a valid input used to support specific plan formation components. For example, as highlighted by a municipal government interviewee: "*...from Strava, we can see where people are actually choosing to ride and adjust our network to reflect that. In one way or another, either by recognizing that these are quiet routes that*

people have chosen to ride on themselves, or that maybe this is where the people are riding. So let's give them a facility when we next resurface" (Interviewee 5). One key application of the data was determining approximate levels of use of specific routes when considering upgrading the shoulders of rural roads from gravel to paved surfaces, as a way to support both existing and future demand. Paved shoulders make a road safer and more enjoyable for cycling, and this initiative connected the tourism master plan to economic development priorities. Additionally, as described by one municipal interviewee: "*...we've been updating our active transportation plan. So we have a network in the rural area [where] we decided which roads might get paved shoulders at the time of resurfacing those roads. But like, again, we don't spend a lot of time out counting bikes in the rural area, the numbers are generally quite low, we have a huge geographic area. So we try to use Strava data to make educated decisions about which roads might get paved shoulders when they are up for reconstruction*" (Interviewee 3).

Staff used Strava Metro to overcome data gaps that were present for many areas. Given that transportation planning can, by its nature, be very data-driven, municipal staff used Strava Metro, despite its identified shortcomings, to make the case that cyclists were using particular routes. One municipal interviewee indicated that: "*...you know, they can say, anecdotally, there's not a lot of cyclists on this road. Well, we can actually use this strategy to say, well, there actually is, we can prove it, you know, we have that metric now"* (Interviewee 3). These findings are replicated in use case research that found contributions from Strava Metro within the transportation or active transportation master plan process across dozens of municipal governments.

Strava Metro Data as an Input into Other Municipal Plan Making

Other municipal plans, such as tourism and broader regional economic development plans, also incorporated Strava Metro data. One tourism planner interviewee indicated that: "*...we've been able to quantify. And it's not anecdotal information, we're able to actually prove that cyclists are riding on these roads and that improved infrastructure is necessary. And that there's a return on investment, as well, for cycling, right? You know, the average [visiting] cyclist spends $316 per trip. So it's just nice to be able to, to provide that economic impact stat"* (Interviewee 3). Tourism plans also leveraged some of the demographic data provided by Strava Metro, allowing for comparisons between visitors and local residents. This provided an advantage over conducting traditional tourism intercept surveys. Additionally, Strava Metro data was used to justify the insertion of cycling infrastructure into broader infrastructure plans, providing evidence to support community advocacy around cycling infrastructure (Interviewee 1 and Interviewee 2). The overall theme here was of a pragmatic use of Strava Metro as a complementary data stream to support existing infrastructure development activities.

Interviewees also found alternate uses for Strava Metro data, covering a wide range of cycling and related topics. For example, Interviewee 3 described a situation where Strava Metro was used to provide data on cycling volume, as a way of leveraging money to support municipal applications for infrastructure project funding from government agencies. Strava Metro data also acted as a historical proxy for cycling use and demand, demonstrating how demand changed over time, especially in areas where a municipality may not have had robust monitoring. For example, one of the municipalities in this study used Metro data to evaluate the impact of federal government funding of a multi-use trail: "*we got the*

federal grant for [a] trail but we didn't have an opportunity to do the before [use] counts. So Strava data was one thing I used to try and illustrate how many more users were using [...] the corridor after we paved it and widened it" (Interviewee 1). This ability to reach back and access longitudinal data for an area, even if the extent and representation was imperfect, proved to be a valuable characteristic of Strava Metro. Use case research applied Strava Metro data in a similar fashion, using it to identify not only popular historical routes but to assess pre-/post-construction changes to cycling demand and usage.

Municipal Benefits Related to Strava Metro Use

These interviews revealed a nuanced set of motivations. First, Strava Metro data complemented or augmented other data sets available to municipal staff, offering something new and valuable. Staff combined the Metro data with other in-house data sets, allowing them to build a "*comprehensive data collection*" process (Interviewee 2). Strava Metro data enabled longitudinal comparison, a characteristic our interviewees found useful (Interviewee 3). Second, Strava Metro data helped municipal staff make a business case for municipal priorities. Our interviewees pointed to examples of how the Metro data helped staff make compelling data-backed arguments in support of municipal priorities, demonstrating the value of this data source as an input to municipal decision-making. The third and perhaps most interesting driver of adoption was that municipal staff, who were Strava users in their personal lives, saw potential for innovation at work by working with the Strava data. When Strava began sharing their heatmaps, municipal staff saw high value in this new source of detailed ridership data. For example: "*back in 2016, [...] [the heatmap] was the hot thing. [...] those heatmaps represented so much, and they [Strava] had the greatest sales pitch ever*" (Interviewee 6). Four of the interviewees shared that they were Strava users in their personal lives and saw potential for its use at work: "*I always joke, I always say I'm fighting the man from the inside. Because I'm a dad, I'm a cyclist, right? We're cyclists*" (Interviewee 3). Municipal staff working on developing cycling infrastructure acted as early champions of Strava Metro data. But not everyone in the early days was convinced of the value in the data. One interviewee saw great potential in the heatmaps for his municipal work: "*I thought I'd raise it with the Active Transportation Group [...] . And they're like 'oh, yeah, you know, big deal', they couldn't really care less*". *Yeah, I was like, 'Okay, you really don't understand what you can do with this'*" (Interviewee 1). This interviewee started working for a new municipality and found more receptivity there to Metro data use.

When considered collectively, municipal staff sought to use Strava Metro data because it had value in terms of offering access to more data than they previously had, and the data could be used to inform their professional recommendations for new municipal actions. This positioning of Metro data as additive to existing data collection efforts by our interviewees mirrored how other municipalities reported using the data. In this sense, the data provided insight that either complemented existing data sources or filled in gaps in their data collection. The use of this data also provided opportunities for innovation, which mirrors early research findings about how open data programs began with municipal employees working "off the side of their desk" on projects, driven by personal and professional interest in the topic (Robinson & Johnson, 2016; Sieber & Johnson, 2015).

Municipal Challenges Related to Strava Metro Use

Several challenges were identified that could impede the use of Strava Metro by municipal governments. The inherent biases in Strava data were frequently cited throughout policy documents, council meetings, and blog posts that referenced the data in decision-making processes. Strava data is typically used by more committed cyclists who typically log their rides to monitor their fitness progression over time and compete within the online community (Jestico et al., 2016). Thus, the sampling process in obtaining the data is not random and the users are not representative of the broader community of cyclists (Hochmair et al., 2019; Milne & Watling, 2019). Similarly, the coverage of Strava Metro data is not even across all areas. This led to challenges for Durham Region, Ontario, in using Strava Metro to support their goal of improving cycling infrastructure in eight low-income neighbourhoods, as Strava Metro coverage was not available for those areas (Durham Region et al., 2021). It is possible that lack of Strava use in low-income communities is due to the costs associated with the application, including the base user fee, the cost of cellular data to operate the app, as well as the requirement of a mobile device. Thus, those who do not have the capital to purchase and operate the application are inherently excluded from the platform and their voice is not captured in the data (Alattar et al., 2021). Robinson et al. (2024), in their study of how planners work with Strava Metro data, found that municipal staff were well aware of the limitations of the data set and took care to use the data when its application was warranted.

The Strava Metro data stream has proven useful to planners engaged in active transportation planning and infrastructure changes. Community groups have also found the data stream useful as a tool to inform their own advocacy. As a crowdsourcing tool, Strava puts municipalities in direct contact with a selection of community members, creating a better understanding of unique trends and needs (Lee & Sener, 2020; Jestico et al., 2016). While Strava Metro data presents clear opportunities, there are limitations to the data's use as well. The environmental scan of previous research conducted for this study signals that municipal staff working with this data were aware of these limitations and took mindful steps to work with these data responsibly. In the sections that follow, we discuss the implications of these findings, research limitations and recommendations for future research.

Discussion

In 2020, when Strava took the decision to make their Metro data stream available for municipal staff and community groups, they explained their motivation for free data access in this way: "By making Strava Metro free to organizations that share its mission to make cities better for cyclists and pedestrians, Strava hopes to power smarter and more sustainable design of the world's cities" (Reid, 2020). The optimistic thinking that making data free will lead to change is a common aspiration that predates urban technology platform data. Urban planners have long struggled with the adoption of technologies, from the large-scale models of the 1970's (Lee, 1994), to more modern technologies such as online mapping (Johnson et al., 2015; Sieber et al., 2016), open data (Sieber and Johnson, 2015), and participatory processes, such as civic hackathons (Robinson & Johnson, 2016); research clearly reminds us that access to data is only one part of city building practice process — the data actually needs to used by decision-makers. Understanding why and how data is used is important and so is understanding the limitations of the data sets. Our research builds on this sentiment through revealing important take-

aways for planners using Strava Metro data in municipal decision-making.

Third-party data in some cases can supplement municipal data

First, Strava Metro data provides municipal staff with a window into active transportation activities that are not robustly captured through traditional means, helping to improve, expand, or simply offer an alternate lens on activities of interest to municipal staff. The research results shared here build on Lee and Sener's (2020) literature review of specific use cases for Strava Metro, providing examples from government planners who worked with the data and sharing their reflections on what the data allowed them to do. Within our case study, we identified the use of a data fusion approach (Lee & Sener, 2020) in applications of Strava Metro data, with staff supplementing or extending other sources of data within the context of active transportation infrastructure planning, design, and implementation.

Second, from the perspective of municipal staff, generating benefits from the Strava Metro data requires negotiating a series of tradeoffs. The wide geographic and temporal scope of Strava Metro sits in tension with the extent to which the data is a representative sample of sociodemographic characteristics of the target community. As well, interviewees acknowledged the discrepancies between the system counts provided by Strava Metro and the site-specific use counts provided through traditional in situ methods. Importantly, none of our interviewees used Strava Metro exclusively, instead adopting a data fusion approach (Lee & Sener, 2020). Our interviews demonstrated that municipal staff found value in Strava Metro, as its integration helped to inform both municipal plans and concrete actions, despite the imperfect nature of the platform's data.

The main expectation of integrating big data into planning is that it will replace traditional data collection methodologies (Milne & Watling, 2019). Traditional data collection methodologies in active transportation planning are costly, timely, and disruptive, and typically capture data for a limited duration (Ray et al., 2020). While Strava Metro data clearly has value as an input into active transportation planning and design efforts by serving as a potential workaround to many of the challenges of traditional collection methodologies, providing greater spatial and temporal granularity, Strava Metro data sets are not complete and do not capture recreation patterns in their entirety (Fischer et al., 2022; Milne & Watling, 2019). The interviews we conducted demonstrate that municipalities can consider blending traditional and Strava data sets to complement one another but Strava data is not replacing other data sets. Cross-referencing Strava data with multiple sources of count data allows municipal staff to evaluate the utility and appropriate use of the platform data as the user base grows (Proulx & Poznukhov, 2017, as cited in Lee & Sener, 2020).

Planners need to continue to be vigilant about whose data is represented and about relationships with a private technology platform provider

One of the challenges of using Strava Metro data to inform active transportation efforts is tied to whose data the platform portrays and shares. One of the obvious concerns about Strava Metro data use is privacy. Danielle Caldwell, a Data Protection Officer at Strava, explained that Strava does not share any personal data with organizations they partner with; only the user can opt in to share their personal information directly with third parties (Ramsdell, 2020). The Metro data that cities receive includes information that has been de-personalized and is in an aggregate form, meaning that municipalities can

only see quantitative data, such as how many cyclists travel through an intersection. Strava also only shares public activity data where their members have opted in to share in that specific way, including taking strict measures to mask or exclude those who record activities in rural settings, where data points may reveal personal information. Planners need to proceed with caution when sourcing large data sets from private sector corporations as it raises several challenges, including privacy permissions, equitable access, and lack of transparency and accountability. Creating frameworks and agreements that address these challenges opens the door to creating public-private partnerships that improve the efficiency of data collection for municipal decision-making, while simultaneously supporting the success of a private sector business (Scassa & Perini, 2022). Even with Strava's privacy measures, citizens may be apprehensive about recording their movement data and sharing it with those in their community. Professional planners with an ethical obligation to work in the public interest must carefully consider these tensions before adopting any data source.

Conclusions

The data gathered by platform technology firms has the potential to add value to municipal planning efforts. This research focuses on municipal government use of Strava Metro platform data to inform their active transportation planning processes, exploring how government staff negotiate the adoption of platform data and navigate constraints relating to data quality, representation, and fit. Our interviews with municipal staff in Southern Ontario yielded Strava Metro use case examples that mirrored similar scenarios across the 74 other use cases we reviewed. Our analysis provides insight into municipal governments' approach to platform data. These findings build on important previous work that assesses the quality and appropriateness of Strava Metro data for specific types of transportation planning analysis (Lee & Sener, 2020), municipal government interaction with third-party data providers (Johnson & Scassa, 2023), and the impacts of urban technology platforms on cities (Leszczynski, 2020).

This research focuses on responses from planners with long-standing experience using Strava Metro data both as a paid and free service. Given the research objective to explore how and why this data is used, these key informants provided valuable insights based on their first-hand experiences. In light of Strava Metro's international scale, future research could explore the experiences of other municipal staff in other jurisdictions. In Southern Ontario, municipalities' planning efforts are required to conform to higher-order government priorities (e.g., *Provincial Policy Statements*). This could implicitly result in a higher series of expectations and accountabilities for municipal staff in terms of how data sets are used. Future research could explore the extent to which similar uses and care are taken in municipal settings that have less higher-order government oversight.

Based on the increased growth of Strava's usership, Strava subscribers also clearly find value in its use as a fitness app. There is a connection between Strava users, who record their movement as individuals, and Strava's gathering of those individual experiences into a collective data stream that can inform planning efforts to support their activities. There is a future research opportunity in this data stream being put to a broader collective use: one in support of community wellness. The interviews we conducted demonstrated how municipal planners have used this supplemental data stream to support active transportation. As awareness of the interdependence between health and the public realm grows, alongside the rise in chronic disease across many sectors of the population, the Strava Metro data set may present an opportunity for planners to diversify their role, supporting healthy cities in both active transportation planning and

wellness interventions. Future research could explore the extent to which Strava Metro data might also serve a broader wellness agenda (Vernooy, 2023).

As the datafication of the city increases, there is a strong likelihood of further efforts from private sector companies to not only increase data collection but to further search for opportunities to monetize that data (Sadowski, 2020b). These opportunities may come in the form of further expansions to location-based advertising, demographic profiling for marketing research, and precision analysis of urban social, health, and economic factors. One only needs to consider how networked personal health monitoring devices (for example, smartwatches with step counters and heart rate monitors) could be used to inform products such as third-party health or life insurance rates, to recognize that micro-level, near-real-time data will have a substantial impact on human activity within cities. For municipal planners and governments in general, a critical question will be whether those data sources are available to support the development and protection of the public good, or whether they will be reserved for the use of private sector interests only (Johnson & Scassa, 2023). How can governments ensure that they have access to the best data to support critical decisions if they aren't either collecting the data themselves or procuring access to that data from third parties?

In the context of Strava Metro, this raises the important issue of whether municipal governments, once using Strava Metro, would continue to use this source if it becomes a paid product. Even regardless of cost, purchasing data for municipal use would need to conform to government procurement processes. Given this, no assumption should be made that Strava Metro would remain as a long-term free data source, leaving municipalities to decide if any future cost is worth the trade-off in decision-making support. Future research should also track and evaluate government reliance on third-party data and whether this reliance leads to a reduction of government capacity to gather and own high-quality data. In the cases we studied here, Strava Metro was a supplementary data source to other data sets, but moving forward, as local governments once again are confronted with austerity measures, this tension between shrinking budgets and the temptation to rely on free data needs research attention.

Finally, and more broadly, this research was motivated by the objective of understanding how planners are working with third-party data. Schweitzer and Afzalan (2017) raise this issue, asking the American Institute of Certified Planners to consider the ethics of open data. The complexities of professional planners working with technology and data have grown considerably beyond open data to include challenges with data scraping and generative artificial intelligence (e.g., see Robinson, 2022), yet Canadian professional planners have no professional guidance in our Code of Practice that specifically speaks to these ongoing changes. The time has come for professional planners to collectively consider how to reconcile their obligation to work in the public interest with the professional challenge posed by data that is gathered and, most commonly, owned by private sector firms. In the meantime, planners working with third-party data sets need to be vigilant about tracking changes to the platforms from which this data is generated and actively consider how these changes may or may not make these kinds of data sets acceptable for professional planning use.

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Appendix 1. Sample screen shot of Strava cycling segment (author provided).

Subset of Relevant Interview Questions to the Findings Presented Here

1. Can you tell us the story of how your municipality started using Strava Metro data.

Motivations: why are you using Strava Metro data?

2. We are interested in learning more about what drove your municipality to seek access/use the Strava Metro data.
3. What goals did your municipality have? What changes were you hoping this platform could assist with?
   - PROMPT: to support, to replace, to fix efforts already underway
4. Were these goals connected to any municipal plans (e.g., Official Plan, social development strategy, transportation plan)?
   - PROMPT: did you acquire the Strava Metro data with the intent of decreasing automobile reliance and increasing active transportation?

Adventures in implementation

5. What data sources did your team use for active transport planning before you started using Strava Metro? How was this data collected, how was it analyzed, what types of output were produced? How were these results used to support decision-making?
6. Since being introduced to Strava Metro, how has your team's planning approach changed? Has Strava Metro impacted data collection, analysis, output, or the process of decision-making?
7. Compared to other data sources, what does Strava Metro provide that is different or unique?
8. How is the use of Strava Metro going so far? Any evaluation? Outcome? Any surprises?

Impacts and outcomes from implementation

9. Are there any demonstrable impacts or outcomes resulting directly/indirectly from Strava Metro's use? What, if anything, has changed? Is anything better?
10. Have you made any legislative changes, created any programs, or updates to or introduction of infrastructure based on the Strava Metro data you acquired?

Data governance

Challenges to Strava Metro adoption

11. Can you describe any costs (for example, staff time, training, financial), that have resulted from using Strava Metro? Benefits?
12. Have there been any technical challenges or issues in using Strava Metro?
13. How representative do you feel Strava Metro is of active transportation use in your city or community? Do you have concerns about what type of activities (recreational vs. enthusiast) are being recorded?
14. In what ways does Strava Metro enhance your existing active transportation data, or does it replace it?
15. Has your team faced any issues with working under the Strava Metro Terms of Use?
16. Do you or your team have any privacy concerns about using Strava Metro data? Have any residents contacted you about privacy concerns?

Partnership/Procurement/Purchase (how do we frame Strava Metro-Municipal relationship)

17. When you acquired the Metro data from Strava, was it contingent on the number of users in your area? Does Strava ask you to help increase users?
18. Were there any other contingencies that Strava asked of you?
19. Did your municipality use Strava Metro prior to it being given for free in 2020?
20. We are keenly interested in learning more about how working with third-party, private sector data works within the context of your organization's open data/open government strategy. Has your unit used other third-party data sets for active transportation? Which ones? Did you pay etc. ... How does Strava Metro compare?
21. Have you been promoting the use of the Strava app to those within your municipality to increase the breadth of the data?

Appendix 2. Codes used for interview responses.

Code	Code meaning
UC	Use case example
MOT	Motivation to use Metro/goals/desired outcomes
FREE	Discussion about it being free/not free Also use for procurement
BACK	Background history of adoption/use
PLAN	Connections drawn to bigger plan/policy agenda
preData	Data use before Metro
CHA	Changes to practice resulting from Metro use
PRO/CON	Pros and cons of Metro use
OUT	Outcomes and impacts from use
COST	Costs of use
TECH	Technical challenges

Appendix 2. Codes used for interview responses.

Code	Code meaning
REP	How good is the data?
ADD	How is data blended/replacing other data
SPY	Any privacy issues
THIRD	Use of other data sets
COM	Community use of data
HQ	Discussion about working with Strava the corp
OT-US	Other interesting and unexpected details that emerge as we question
OT-THEM	Other interesting and unexpected details that emerge from respondents