Webinar Questions answered by Dr. Trisalyn Nelson (BikeMaps.org, Chair of Geography UC Santa Barbara):

- *How does BikeMaps deal with fraudulent data or vandalism ?*
    - We curate the responses very carefully. Initially, we were quite worried about people putting up false or misleading information but we have found very little misuse and the data rolls in at a speed where we can check most reports. We also clean the reports prior to analysis.
- *For Dr. Nelson, Have you compared your data to the injuries reported to the police (ISWITRS in CA)?*
    - We have compared reports on BikeMaps.org to official reports. We found that relative to official reports from insurance, crowdsourced collision reports were more likely to be associated with peak traffic hours, nonintersection locations, and locations where bicycle facilities were present. Our mapping has also shown that BikeMaps.org reports are more common in areas with lots of bikes, whereas oficial reports occur where there are lots of vehicles.
    - Branion-Calles, M., Nelson, T., & Winters, M. (2017). Comparing crowdsourced near-miss and collision cycling data and official bike safety reporting. *Transportation research record*, *2662*(1), 1-11. https://journals.sagepub.com/doi/abs/10.3141/2662-01
- *Can you speak to the challenge of calculating expansion factors for regional / intercommunity trips from bike counter data that is largely available for urban cycletracks? Can we reasonably expect an expansion factor calculated with recorded urban trips to be accurate for rural areas?*
    - When mapping all bicycling with Strava, accuracy is related to how representative the training data (i.e., bike count data) are. Ideally, some bike counts will be from cycletracks and others from rural, residential, commercial areas. Another way to think of it is that a model only works for conditions you teach it. If you only have data from cycletracks, the model will not have the information it needs to build the relationship between Strava and all bicycling in other conditions.
- *I am with Bike Ottawa (specifically the Data Working Group). Happy to see the professor worked with the City of Ottawa for the bias correction work. Can she share who specifically she worked with as we were trying to recreate this wheel.*
    - We have worked with several folks through the years and have done a lot of work in Ottawa. Happy to connect and help out however we can. Here are a few Ottawa papers.
    - Boss, D., Nelson, T., Winters, M. and Ferster, C.J., 2018. Using crowdsourced data to monitor change in spatial patterns of bicycle ridership. *Journal of Transport & Health*, *9*, pp.226-233.
    - Ferster, C., Nelson, T., Laberee, K., & Winters, M. (2021). Mapping bicycling exposure and safety risk using Strava Metro. *Applied geography*, *127*, 102388.
    - Brum-Bastos, V., Ferster, C. J., Nelson, T., & Winters, M. (2019). Where to put bike counters? Stratifying bicycling patterns in the city using crowdsourced data. *Transport Findings*.

    - Nelson, T., Roy, A., Ferster, C., Fischer, J., Brum-Bastos, V., Laberee, K., ... & Winters, M. (2021). Generalized model for mapping bicycle ridership with crowdsourced data. *Transportation research part C: emerging technologies*, *125*, 102981.
- *Could I hear more about how the mean temporal profile helps us figure out where to put counters? Maybe a general example could be helpful.*
    - We have a blog post on the method for sighting counters that will hopefully help.
    - https://medium.com/strava-metro/using-strava-data-for-active-transportation-planning-2fe764469450
    - Brum-Bastos, V., Ferster, C. J., Nelson, T., & Winters, M. (2019). Where to put bike counters? Stratifying bicycling patterns in the city using crowdsourced data. *Transport Findings*.
- *How does the ridership correlation pan out within city areas where there are geographical lines of difference along socio-economic grounds?*
    - We don't really have a good answer on this and know this needs to be the next phase of our work. We do know that if the training data is good and representative of the range of conditions the model is usually accurate. But, we anticipate that streets in communities with different socio economics may need different variables to inform the bias correction.
- *How does one interpret the data dump for a specific City within Metro Vancouver?*
    - There are many ways to interpret the data for a specific city but the first step is to look at high level trends using the Metro dashboard. You can also download data for specific streets/segments that you're interested in. If you're downloading a large amount of data, we have methods that we apply in GIS and open source software like R Statistics for cleaning and summarizing Metro data for a specific geography. Sometimes it requires ancillary data like administrative boundaries and specific data cleaning tasks such as filtering out mountain biking trips. We are working now to create a toolkit to streamline these processes for researchers and practitioners so stay tuned.
- *Just curious, could you all specify what is the process of decreasing the average error for the areas you specified, so that the correlation between Strava data and observed counts is more related? You mentioned bringing in safety cycling and income levels by census block, so how did you use this data?*
    - We have a research paper and a blog post that we hope answers this question. Basically, we build a statistical model that predicts total bicycling ridership based on Strava data and several other covariates. The covariate that work well generally are income and safety. Local models with data relevant to the conditions of a specific city can make the model more accurate.
    - Nelson, T., Roy, A., Ferster, C., Fischer, J., Brum-Bastos, V., Laberee, K., ... & Winters, M. (2021). Generalized model for mapping bicycle ridership with crowdsourced data. *Transportation research part C: emerging technologies*, *125*, 102981.
    - https://medium.com/strava-metro/using-strava-data-for-active-transportation-planning-1d6bc63e0e77

- *Are you determining commute/leisure rides with counters based on time of day and day of week? Versus individuals selecting "commute" on ride type when saving their Strava ride?*
    - We use the attribute provided in the Strava Metro data download to identify commute vs leisure trips.
- *What is the sample size of cities seeing the Strava data correlation with general ridership? Are there key metrics to look for to validate this positive correlation?*
    - We are still testing this, but we think that if 7% of bicycle trips are captured on Strava you will have stronger correlations. We use R values as our metric when we compare all bicycling to Strava sampled bicycling in a particular location.
- *What are the greatest leverage points in using Strava Metro to add bicycle infrastructure to an area?*
    - In some cases we have seen cities trying to decide between two parallel streets and using Strava can help them inform this decision by where there is already ridership. We mostly use Strava though to model exposure and to monitor change in ridership.
- *How much base data (strava and/or counts) does a City need to reasonably extrapolate against strava data?*
    - This depends on the size and heterogeneity of a city. However, a good guide would be to aim for 10-20 continuous counters. Or, 30-50 locations where short term counts have been measured. Make sure you get a representative sample. In other words, you need to have counts in high, medium, and low ridership areas.
- *I heard something about crash data, is this available to users?*
    - BikeMaps.org is a website for crowdsourcing bicycle crashes, near misses, and hazard data. It can be used anywhere in the world. You can request the data from the BikeMaps.org team anytime. Ideally, someone locally promotes the tool to their bicycling community and the data grows becoming a useful tool for planning and advocacy. Depending on the city you're looking at, you may also be able to get a hold of crash data through police or insurance records.
- *Counters: can anyone on the team point us to comparative analysis of the various counter technologies which is a key part of this data capture challenge? We want to add more to our region, but are at a loss on what the best ones are?*
    - We would love this too! We usually work with data that the cities have.
- *For Dr. Nelson - do you know of any rural community studies that analyze Strava usage and actual ridership?*
    - Not specifically, but would be delighted to partner with any rural community that has counts and is interested in this.

Questions answered by Jaimy Fischer (PhD Candidate,Simon Fraser University):

- *I'd like to know if weather impacts have also been analysed for the changes noted in ridership.*
    - Generally, better weather correlates with more people riding bikes, and this is true in Vancouver and Victoria. While we didn't control for weather in our change analysis, we made comparisons for the same time period, considering peak season when ridership in both cities is highest. We looked at April - October in both years.
- *Is the change in correlation between strava and counts from 2019 to 2020 likely due to changes in why people are bicycling (e.g. shift from commute to recreation)? How does this impact the conclusion that the representativeness is improving?*
    - The change in correlation in Vancouver is likely due to more people using the app to track their rides. In Victoria, correlation was already high and shifted minimally. At the city level we interpret this to mean that Strava is generally representative of all ridership, but correlation will always vary spatially across different routes and infrastructures so we would still model the data to correct bias.
    - We do see hints that correlation is reflecting the kinds of rides that Strava users tracked in 2020, with correlation highest on recreational routes and during the times that we would expect more leisure/recreation trips to be made (later in the day, outside of peak commuting hours, and on weekends). If we were trying to model ridership in 2020 we might use the leisure sample or the woman sample since these were the most representative that year.
    - We also think that representativeness is improving in our study cities because more women and adults over 55 are being represented in the data; most analyses have found that Strava data have been contributed primarily by men and people who are younger—who tend to have different risk tolerance and route preferences than women and people of varied age.
- *In your opinion what is the best way small cities or rural areas could use Strava Metro data?*
    - We haven't looked at this closely, but would be delighted to partner with small and rural communities to investigate this further. Ideally, we need communities that have or are interested in gathering some bike counts that we can compare to Strava.
- *Many designated Bicycle Friendly Communities in Canada have gaps in data collection, especially to show increases in ridership over the pandemic. The models that you've designed are valuable, thank you! Does your published paper include a list of recommended supplementary data needed to strengthen the analysis?*
    - We have a paper and a blog post that outlines our methods, including data. The main thing to keep in mind is that the more representative your bike counts are the better the modelling will work. If you are setting up bike counts, try and get some on high, medium, and low bicycle ridership streets. Also try to get a mixture streets with some used for recreation, commute, and leisure riding.

    - Nelson, T., Roy, A., Ferster, C., Fischer, J., Brum-Bastos, V., Laberee, K., ... & Winters, M. (2021). Generalized model for mapping bicycle ridership with crowdsourced data. *Transportation research part C: emerging technologies*, *125*, 102981.
    - https://medium.com/strava-metro/using-strava-data-for-active-transportation-planning-1d6bc63e0e77
- *What recommendations / guidance do you have in the use case where we are trying to advocate for a brand new route where obviously there would be little / limited existing ridership.*
    - This is a challenge. We have worked on analysis of latent demand modelling, which models where there are likely people interested in ridership.
    - Thigpen, C., Fischer, J., Nelson, T., Therrien, S., Fuller, D., Gauvin, L. and Winters, M., 2019. Who is ready to bicycle? Categorizing and mapping bicyclists with behavior change concepts. *Transport policy*, *82*, pp.11-17.
    - Another way to build the cases is if there is a comparable area, in your city or another, that has built a bike lane and increased ridership. The challenge is that this type of monitoring is not always done so it can be hard to find good comparisons.
- *What analytical programs were used to analyze metro data?*
    - We used a variety of software including: Esri products, R, and python. One challenge is that the tools needed to do this analysis still require a lot of customization. Our team is working on a python toolbox which will hopefully make it easier for practitioners to use these tools.

Webinar Questions answered by Strava Metro Team (support@stravametro.zendesk.com):

- *Can we download historical data for a city through Strava Metro for free? Is there any restriction for research (e.g publications)?*
    - Historical data is available for download in our Metroview web application. Data can be downloaded for an entire area of interest or for selected segments and can be aggregated for a desired time frame. Counts are available in hourly, daily, monthly, and yearly formats.
    - Strava Metro partners with a small number of researchers and we review these requests on a project-by-project basis, based on the bandwidth of our small team. At this time, we're focusing on research proposals that have a specific commitment to antiracism, transportation equity, and/or addressing environmental racism.
    - We also ask that all publications/reports are shared with our team for a review and approval no less than 30 days in advance. This is a part of our terms of use and we look forward to reading your reports and learning more about your projects.
- *With the proliferation of ebikes, in particular, for replacing vehicle trips and transportation, when will that data set be added to local Strava Metro data?*

    - Presently, E-bikes are not a part of Strava Metro Data but we are seeing increased usage and tracking of E-Bike activities within the core Strava application. The Strava Metro data team is actively looking at ways to include this important data in a meaningful way that benefits our partners and their projects.
- *Are you determining commute/leisure rides with counters based on time of day and day of week? Versus individuals selecting "commute" on ride type when saving their Strava ride?*
    - We have developed a model to detect and identify commutes, in addition to using the commute tag used by Strava members as a ground truth. In our model, “commuting” refers to all non-leisure trips. As a result, it is not necessary for a Strava member to mark their activity as a commute in the app in order for it to be included in commuting analyses on the Metro platform. However, it is very helpful that many Strava members do mark their activities as commutes, and we hope to make the commuting experience on Strava more rewarding and exciting in the future.
- *I would also be interested to hear more on how the variables for commuter / recreation and the 'tourism' metric (I think tourism is only provided in the dashboard, not the raw data) are inferred... thanks!*
    - Tourism in the Strava Metro dashboard is defined according to the boundaries of your area of interest – usually a city, county, state or equivalent. A person’s home location is set by the place they have been most active in the last six months. We are working on offering more granular options related to this data.
- *Will Strava add Utilitarian rides vs. commutes as options?*
    - For the purposes of Strava Metro, “commutes are defined as all utilitarian or non-leisure trips.”
- *We have found some early, interesting stories in the Strava Metro data and would love to include some of those insights in our 2021 Annual Report. What are rules governing using this data for publication in a report such as this?*
    - It is exciting to hear that you would like to share your findings in this Annual Report and we look forward to seeing that work. We do ask that all Strava Metro partners share their reports 30 days in advance for a short review process by the team.
- *The Metro data / tools appear to be geared primarily to paved routes. We also look to advocate for natural surface trail bike access. Have you looked at trail data and will the tools evolve to make this type of application of the data easier?*
    - Strava Metro includes paths and trails data wherever Strava members have uploaded activity. We have many existing partners who have utilized Metro data for analysis on trails including a recent example with Headwaters Economics estimating trail usage in Montana, USA. You can read more about their research here.
- *How hard is it for a not particularly technical user to make use of the temporal data, I would like to produce a heatmap for my city looking at the temporal distribution?*
    - Our web platform, Metroview was built for users of all backgrounds to be able to quickly interrogate active transportation data in their area. In Metroview, you can

select date ranges when interacting with selected street segments and corridors. Metroview and Strava do provide access to a heatmap, highlighting areas of higher activity as well. To generate additional custom maps with a temporal focus, we would recommend exporting your Metro data for use in a GIS software. For additional information, please check out the linked getting started guide and FAQ's

- *How often do you pull OSM updates? Nationally? or state by state?*
    - OSM updates are pulled periodically to update the coverage of Strava Metro. This is done for all areas where we have data. We aim to update to the most recent version of OSM in the near future.
- *Has Strava reached out to any regional planning organizations to potentially partner with events like bike to work week?*
    - Many current Strava Metro partners are cycling advocacy groups. Raising awareness through events like a bike to work week is something our team would like to learn more about. Please reach out to our team if you have any events in the works!