

RESPONSE TO REVIEWER COMMENTS

We would like to thank the editor and two reviewers for their constructive comments. In broad terms, the reviewers were in consensus that the paper is interesting and the methods appropriate, but that there was a need to sharpen the introduction and discussion, clarify previous research that informed this paper, re-format the positioning of photos in the resubmission, and to better explain the methodological and practical contributions of the findings. In what follows, we respond to the reviewers in turn and describe how the paper was revised (our responses are in blue). The suggestions from the reviewers helped to improve our manuscript, and we believe it is a stronger paper as a result. For ease of rereading, we have highlighted all substantive changes in the resubmission in yellow. Revisions have been made to the manuscript, highlights, and cover letter.

Reviewer #1

Overview:

The authors do a good job of explaining the research, and findings. I see their contribution as being the application of a modified SPACES instrument, and the contributions to the ongoing efforts to center the cycling experience in creating cycling networks. This is very useful information for researchers, as the photos provide a lot of contexts to interpret the findings. The background literature is adequately addressed, however, I think there could be a broader discussion of the literature in light of the findings presented. I have detailed my comments below. Ultimately, given these revisions, this manuscript would be ready for publication.

1. The authors categorize Hamilton as a “developing” city, but it is developed. The wording here is important. Developing in what way? Something such as a mid-sized, post-industrial, or growing city would be better suited. I understand that they wanted to make note of the progress in infrastructure development and that the city is going through a transition from car-centric to cycle-friendly, but this is quite a loaded term and often associated with developing countries in the literature. It is also hard to discern that they are in any way at their “mid-way point” in cycling network development because this will continue for many years, even after these plans come to fruition. The city is growing and developing their cycling network, but is by no means completed and has a lot of work to do before the city becomes a truly cycle-friendly city.

We categorize Hamilton as a “developing cycling city”. The city is also mid-sized, post-industrial, and growing, as you have noted, which certainly affects its development in other ways, but we focus specifically on its development as a cycling city. This term has been used in recent literature (see Liu et al 2020), but other terms have also been used recently to describe cities that are going through a transition from car-centric to cycle-friendly. This includes “low-cycling maturity” cities (Felix et al 2019), “emerging cycling cultures” (Clark et al 2019), and “starter cycling cities” (see Meireles & Ribeiro 2020). This terminology has been clarified in the *Introduction*. We emphasize the “mid-way point” in the City’s planned cycle infrastructure development, not the “mid-way point” in cycle culture development. We recognize that additional work will take place for many years, perhaps even decades, to become a truly cycle-friendly city.

This will have to include other interventions to change land use planning, as well as behavioural change strategies or programs. But we emphasize the “mid-way point” for a reason – the City of Hamilton has built nearly 50% of its planned cycle infrastructure. We now wish to understand how the City’s efforts to date are perceived. We hypothesized that there would be a range of elements that cyclists perceive well or poorly with respect to the city’s current infrastructure. This was found to be true through the photo activity and the interview findings. Investigating cyclists’ perceptions can help to validate current approaches to infrastructure design or it can point to improvements that are needed to ensure that the final 50% of the cycle network fully meets cyclists’ needs and preferences.

This has been clarified in the *Introduction* (Lines 59-61) and in the *Study Setting* (Lines 110-120).

2. There needs to be a comment on why being a mid-sized city is unique to the process of building a cycling network. What makes the problems they have in this city different than larger Canadian cities?

This is an interesting point and one that is certainly worth discussing. Thank you for the suggestion to consider this in our paper. One of the other reasons that we categorize Hamilton as a “developing cycling city” is because it is a mid-sized city and because of the unique investments that have taken place over the past decade. Hamilton is one of six Canadian cities with a public bicycle share program (i.e., Montreal, Toronto, Vancouver, Victoria, and Ottawa/Gatineau). It is the only mid-sized city in Canada with a public bicycle share program, and one with over 900 operational bikes. Therefore, the City has invested substantial effort in the potential for Hamilton to become a mid-sized cycling city in North America.

We have addressed this suggestion in further detail in the *Study Setting* (Lines 121-128), by discussing challenges facing mid-sized cities like Hamilton and additional literature on cycling in mid-sized cities.

3. The authors refer to their study as a qualitative descriptive study, but the abstract refers to it as mixed-methods. Also, on page 4, line 63, the authors describe the study as a “qualitative descriptive study” comparing objectively measures attributes and cyclists perceptions. The objectively measured attributes do not evoke a qualitative methodology. In the next sentence, they describe the study as mixed-methods. I do think that this research would be better described as a “sequential explanatory mixed-methods design”. You can consider this work: Leech, N. L., & Onwuegbuzie, A. J. (2009). A typology of mixed methods research designs. *Quality & quantity*, 43(2), 265-275.

This study does indeed have a sequential explanatory mixed-methods design. This paper is the third and final paper from this project. We referred to it as a qualitative description study because of the thematic analysis of the interview findings, but we have clarified its mixed methods design (see Line 89).

4. Pg 4. Line 65-67. What is meant by the “quietest distance route”? The routes with the lowest amount of decibels or the routes with the least distance? This should be clarified. Perhaps use some of the information given on pg. 5 to describe this tool upfront in the paper.

The *quietest distance* route is one of six types of routes that were inferred in the spatial interaction model. This work is described in a paper that was submitted to *Transportation*. Simply put, *quietest* refers to the type of route that minimized both distance and interactions between cyclists and other road users. *Quietest distance* routes that were inferred in the model, and audited for this paper, also typically feature cycle infrastructure and residential streets as noted in the *Discussion* section.

While we are limited by the word count and cannot explain this to the fullest extent in the *Introduction*, we have added more information upfront and to *Previous Research* (Lines 148-158) where we explain the issue in what we hope is sufficient detail.

5. For the methodology section, there was very little spoken about the photos used. In qualitative research, this is called “photovoice” or in your case, “photo elicitation” which is used as a tool in interviews to elicit responses. The authors should reference some of this work such as Harper, D. (2002). Talking about pictures: A case for photo elicitation. *Visual studies*, 17(1), 13-26.

Thank you for drawing our attention to “photo elicitation”. We have referenced this work throughout the paper.

6. Pg. 11 and 12 figures. Figures 4 and 5 are the same figure. Although the authors discuss different aspects of the same figure in both cases, the repetition of the figure seems unnecessary and they should refer to figure 4 when talking about the lack of the left turn. The authors decided to place some of the photos in-text and others at the end of the paper is inconsistent and a bit confusing. I suggest staying consistent with either including all the figures in-text when referencing them first or including all figures at the end of the paper. For typesetting this article, I suggest that the photos are made smaller so more could fit on one page. Going back and forth from page to page does not read very nicely and the reader could always zoom into specific features if necessary.

Thank you for this helpful suggestion. In the revised manuscript, we have made the photos smaller and have tried as much as possible to make them fit on the relevant page to avoid going back and forth. Duplicate photos have been removed. It is important to note that the final placement of the figures will be done by production if and when the paper is accepted for publication.

7. There should be further literature in the discussion section in light of the findings. The topics and associated literature to be incorporated include:
 - a. Cyclists perception of road space

- i. Mertens, L., Compennolle, S., Deforche, B., Mackenbach, J. D., Lakerveld, J., Brug, J., & Rutter, H. (2017). Built environmental correlates of cycling for transport across Europe. *Health & place* 44, 35-42.
 - ii. Fishman, E., Washington, S., & Haworth, N. (2012). Barriers and facilitators to public bicycle scheme use: A qualitative approach. *Transportation research part F: traffic psychology and behaviour* 15(6), 686-698.
 - iii. Cervero, R., Caldwell, B., Cuellar, J. (2013). Bike-and-ride: build it and they will come. *Journal of Public Transportation* 16(4), 83-105.
- b. Importance of a truly bicycle-friendly cycling network
 - i. Pucher, J., Buehler, R., & Seinen, M. (2011). Bicycling renaissance in North America? An update and re-appraisal of cycling trends and policies. *Transportation research part A: policy and practice* 45(6), 451-475.
 - ii. Mayers, R. F., & Glover, T. D. (2019). Whose Lane Is It Anyway? The Experience of Cycling in a Mid-Sized City. *Leisure Sciences*, 1-18.
 - iii. Handy, S. (2020). Making US cities pedestrian-and bicycle-friendly. In *Transportation, Land Use, and Environmental Planning* (pp. 169-187). Elsevier.
- c. Discussion of the potential for app-based route selection and the gap in safe, widespread “formal” route planning for cities that incorporates some of your participants’ more “informal” routes.
 - i. Meireles, M., & Ribeiro, P. J. (2020). Digital Platform/Mobile App to Boost Cycling for the Promotion of Sustainable Mobility in Mid-Sized Starter Cycling Cities. *Sustainability*, 12(5), 2064.
 - ii. Cellina, F., Castri, R., Simão, J. V., & Granato, P. (2020). Co-creating app-based policy measures for mobility behavior change: A trigger for novel governance practices at the urban level. *Sustainable Cities and Society*, 53, 101911.
- d. The idea that was mentioned “superhighways for bicycles” and what it means to create these in a city and for the cycling network.
 - i. Agarwal, A., Ziemke, D., & Nagel, K. (2020). Bicycle superhighway: An environmentally sustainable policy for urban transport. *Transportation Research Part A: Policy and Practice*, 137, 519-540.

[Thank you for suggesting these articles. We have reviewed them and referenced them where appropriate in the discussion.](#)

8. Place the study limitations prior to the conclusion.
 - a. A limitation of this study is the focus on regular cyclists. This is not necessarily the experience of the general population of cyclists, those who are more risk-averse, women, elderly, marginalized communities, children, etc.

The study limitations have been moved prior to the conclusion. We have also elaborated on the emphasis on the experiences of regular cyclists and how this may not reflect the experiences or preferences of other types of cyclists (see Lines 468-471).

Reviewer #2

This is an interesting paper that addresses the important issue of how infrastructure relates to perceptions of cyclability in developing cycling cities. Most of my comments relate to improvements to the text to make it easier for the reader to follow.

From the perspective of the reviewer, may I suggest that this task would be made easier by double or 1.5 line spacing of the manuscript. The other issue I came across is that there was considerable variability in the size of letters within paragraphs which was distracting at least. I don't know whether this was a poor interaction between the submitted font and the pdf process used by the journal, but I recommend that the authors check this out before resubmission. The JTH author guidelines also ask that text justification and hyphenation be disabled.

We believe that this was the result of a poor interaction between the submitted font and the pdf process used by the Journal. We do not see any variability in the size of letters within paragraphs. We have checked this and hope that it is no longer an issue with resubmission.

Text justification and hyphenation disabled in the revised manuscript.

I would encourage the authors to make it more explicit what the contribution of this paper is to the literature, particularly given that many of the findings were expected. In my view, the main contribution is methodological, but the authors might disagree. The main contribution should also be clearer in the Conclusions section.

Thank you for this helpful comment. We believe that the paper makes both methodological and practical contributions; the approach taken for this research could be implemented by transport planners or health professionals who wish to survey their communities and centre the cycling experience more explicitly through changes or interventions. We have emphasized the main contributions of this paper in the *Conclusion* section.

Highlights

The mention of "inferred" cycling routes was puzzling in the Highlights, given that I (like many readers) read the Highlights before the main paper. The Abstract uses the word "select" instead and perhaps this would be a better choice in the Highlights as well.

The term "inferred cycling routes", as described in the *Highlights*, has been included in the *Abstract* since it is more accurate.

Introduction

lines 65-70 imply a relationship with previous research by the authors but this needs clarification

This relationship is clarified under section 6.2. (Previous Research). We have added a few lines in the *Introduction* to connect the two sections.

Figure 1 needs more explanation of what the numbers 109 to 20 refer to

The caption has been revised to explain the what the numbers refer to, namely the number of cycle trips reported in each traffic analysis zone using trip data from the 2016 Transportation Tomorrow Survey.

On lines 108-110 and 114 the meaning of the sentences are unclear. I think that it is crucial for the reader's understanding of the remainder of the paper to know what "underestimated" really means. What was compared with what to do this? It is not clear to the reader.

We have clarified this aspect of the model in the paper.

Method

The photographs are very helpful but it was very time-consuming to rifle through the manuscript to find the relevant picture and then go back to the text. I think that you need to reduce the size of the pictures to allow them to be closer to the text that they relate to.

We have reduced the size of the images to allow them to be closer to the text that they relate to.

While some of the photos show the speed limit, the photos can't show the actual speed of vehicles which will also influence the cyclist's choice in real life. Was there any rationale to the time of day/day of week that the photos were taken? Does this reflect prime cycling times and the likely traffic volumes, presence of parked cars etc that would be expected at those times?

The photos were taken from Google Street View. As such, we have no control of the time of day or day of the week that the photos were taken. However, we did select the most recent photos taken from Google Street View and ensured that they matched the current streetscape as much as possible. The photos may not reflect prime cycling times and likely traffic volumes expected at those times. But one of the benefits of using photos in empirical research is their ability to prompt memory, experience, or feelings. As noted in the paper, participants were familiar with many of the routes that they reviewed, and their comments or perceptions were informed by their own experiences. Therefore, the photos were useful for eliciting comments of what cyclists liked or disliked, as well as comments of their own travels which can help to contextualize and describe how the routes are actually cycled and experienced. We discuss this in the manuscript (Lines 203-214).

Discussion

One of the clear findings was that your cyclists disliked left turns, particularly across multi-lane roads. It would be valuable for you to point out that perceptions of routes are directional - a route may be much less preferred for travel in one direction than the other (because of L and R turns). Do the algorithms such as cyclestreets include L vs R turns or do they assume non-directionality?

This is a good point. Thank you for noting this. We have highlighted that directionality is important when exploring perceptions of routes (Lines 242-244). Some of the routes are unidirectional, meaning that they include a significant portion of one-way streets. The route in the opposite direction would not be the same.

The algorithm used by *CycleStreets* does take left and right turns into account. Only one of the routes (route 2B) required a left turn across a multi-lane road, which participants reported that they would never

do. All other routes that were audited and reviewed by participants made more sensible turns, as evidenced by the fact that many participants reported cycling part or all of these routes (i.e., route 1A, 2A, 3B). The City of Hamilton's cycling network is still under development but many left turns featured along the routes (e.g., Figure 13 and 15) are not likely to be improved any time soon. The City of Hamilton prefers to implement bike boxes (see green paint on road in Figure 15 and Figure 30) to facilitate turns.

An author contribution (CRediT) section should be added.

A CRediT statement has been added at the end of the paper. Please see section 8. CRediT Statement.

Minor comments

In Figure 30 there appears to be one or more words missing from the caption.

Thank you for pointing this out. The caption has been revised.

Line 345 - "about for"?

This sentence has been revised.