The Impact of Cycling Research: Connecting Science and Practice

Allegro*

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1. Introduction

The bicycle is a sustainable (urban) transport mode. In the past decade, research efforts have led us to better understand the complex relations between the different modes of transport, and thus the role of cycling in the radically changing urban landscape. Some scientific findings and contributions have already been impactful for practice, while others are expected to be more relevant in the near or far future.

One of the programs contributing to this research is the Allegro Program¹. This program has started about 5-years ago, where the overall aim is the development of theory, mathematical and simulation models for individuals and aggregate motion of pedestrians, cyclists, and mixed flows, as well as understanding the mechanism behind the main aggregate patterns characterising these flows.

The last decade has seen a steady rise in bicycle research. This rapid development makes the old argument that bicycle research is receiving little attention outdated. Yet, a clear and concise overview to identify (practically) relevant current or new bicycle research does not exist. Consequently, there is a need to synthesize and generalize the most relevant results to a unified and integrated bicycle framework, that helps identify new challenges for bicycle research in the next decade.

With this work we aim to pinpoint central themes of cycling research, that are expected to have a large impact on the bicycle society of the future. Questions that help us identify these themes are: Which research efforts have been relevant for the current state-of-the-art, and an inspiration for future? Where should we direct our research efforts to ensure that cities will be more livable, inclusive, and healthy places to live, work, and play in? Do we need more collaboration within academia, or is a stronger connection between academia and practice needed to identify and analyse future bicycle problems? We aim to answer these questions by surveying leading experts.

Therefore, the main research question can be phrased as: “Which topics within cycling research have had an impact on bicycle mobility in the past and which are expected to have an impact in the future?” The aim of this research is to identify where science can make an impact in bicycle mobility based on expert opinions.

In the remainder of this extended abstract, the research approach is described in section 2. In section 3 expected results are presented and explained. Finally, section 4 concludes this research.

2. Research Approach

To achieve strengthened alliances (i.e. collaborations) and facilitate knowledge transfer to practice [CRB 2019], impacts of past research activities on bicycle mobility, and future expectations need to be identified. Therefore, differences and similarities of research fields, as well as impacts are compared between different leading experts from both science and practice. The goal is to establish a widely accepted roadmap and interdisciplinary overview of the current and future state of cycling research. An expert based questionnaire

¹ Visit this webpage to read more about Allegro [http://www.allegro-erc.nl/](http://www.allegro-erc.nl/)
will be designed and distributed from June 2019 to (approximately) September 2019\(^2\), based on in-depth interviews with a focus group of experts from various backgrounds within cycling mobility.

Step 1. Five focus group interviews based on the different fields of expertise.

Step 2. Expert survey based on a snowball design.

1. Field of expertise:
   a. Academia (social, technical, health), Government/Municipality, Corporate/Consultancy
   b. What is your core research field or expertise? (traffic flow, …, other:)
   c. In which cities or countries do you mainly conduct your bicycle related research/practices?
   d. Which societal and/or scientific problems related to cycling mobility need to be understood and solved in the coming 10 years?

2. What had the most impact on cycling mobility the past 10 years? (think about method, design, model, topic, innovation, data)
   a. Why? What problem did it tackle? What was the solution? (optional)
   b. Was this based on scientific papers? If yes, which ones? (optional)

3. What will have the most impact on cycling mobility the coming 10 years? (think about method, design, model, topic, innovation, data)
   a. Why? What problem will it tackle? What is the solution? (optional)
   b. Was this based on scientific papers? If yes, which ones? (optional)

4. Please provide us with the contact details of three other scientists or practitioners that in your opinion have a pivoting role in cycling research and planning.

An a priori selection of 100 people with strong track records in the bicycle mobility community in academia, government, and corporate institutions are invited to join the expert based survey. If they choose not to participate, they are asked to provide one other expert in a similar research field. The number of experts is organically expanded using a snowball design, as each participating expert provides three other contacts, that according to them, have a pivotal role in the cycling community. This process is stopped when organically selected experts have already been contacted at an earlier stage. With this approach, thanks to the six-degree of separation law [Barabási 2016], we expect to reach a representative sample of bicycle experts worldwide.

3. Expected Results: Correspondence Triangle & Connection between Science, Practise, Past and Future

To have a comprehensive overview of past and future impacts of science on cycling mobility, three approaches are used to analyse the experts’ responses.

1) The correspondence between science and practice, research fields, and most important problems in the future (Figure A). This allows to cluster research topics and to identify which of these clusters has, in accordance to experts’ opinions, the highest impact for society. Furthermore, this helps determine whether the societal role of experts influences which problems are most important in the future, and differences and similarities between research fields.

2) Secondly, the Expert Relevance Index (ERI) is developed to assess the impact of the submitted documents, based on the frequency of submission and citations in other submitted documents. Paper citations are a

notoriously well known way of measuring impact in science. This measure, however, doesn’t seem suitable to assess impact on urban mobility. Therefore, a more practical and expert based index is required. To build up such a qualitative index, we interviewed leading experts in the cycling domain, leading to an expert based database of the most relevant research and practise from the last decade.

3) Finally ERI is used to identify possible connections between past and future research activities (Figure B). Based on this approach, differences of the research impact in the past and expectations for the next decade are discussed, as well as cross-disciplinary collaboration. Combining approaches 1, 2 and 3, research gaps with high societal impact will be identified when there is a discrepancy between expected future problem by experts, and a lack of related systematic research.

![Figure A. Correspondence between societal role, research field, and future of the experts included in this study, B. Interactive graph depicting the relation between science, practise, past and future using the Expert Relevance Index (ERI).]

4. Outlook

Academic cycling research has received unprecedented attention all around the world in the past few years. The results will explain how different fields can strengthen alliances and facilitate knowledge transfer to deal with the most relevant challenges for bicycle research for the coming decade. Allegro, an European Horizon2020 project that started in 2015, aimed to fill the lack of knowledge about this sustainable traffic mode. With the results of the expert based survey, we can evaluate the effectiveness of the research done within this project, and provide a map to evaluate other programs.

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References