

**Redefining Active Transportation Infrastructure Can Lead to Planning Processes With a
Greater Focus on Equity**

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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“We envision a city in which active, healthy children choose to safely walk and bike to school, supported by a community that is more aware of alternative transportation modes and served by infrastructure that better connects home and school” (SRTS Activities and Programs Plan, 2016, p. 5)

Introduction

According to Safe Routes to School (SRTS), the number of children walking and biking to school has decreased by nearly 60% over the last five decades. This shift has occurred despite the fact that many students still live within walking distance of their school (Safe Routes to School Guide, 2021). The SRTS movement encourages families to start walking and biking to school again by helping “schools and communities make walking and biking to school a safe, convenient, natural activity” (Virginia Department of Transportation, 2022). The goals of SRTS may be school-focused, but the themes of safety and practicality are what many planners have in mind when it comes to active modes of transportation. Talen and Koschinsky (2013) define a walkable neighborhood as one that provides a safe walking experience, where “streets, sidewalks and paths (pedestrian routes) are comfortable and interesting” (p. 43). These features - along with bike lanes, shared use paths, crosswalks, etc. - make up a type of infrastructure referred to as active transportation infrastructure. This term encompasses any built features that support active modes of transportation such as walking and biking.

Active transport is becoming increasingly widespread - according to Braun et al. (2019), “federal spending on active transportation steadily increased from \$6 million in 1990 to \$835 million in 2017” (p.1). The growing prevalence of active transportation infrastructure has raised concern that current planning approaches do not prioritize equity appropriately given the lasting impact this type of infrastructure can have on communities and individuals. Manaugh et al.

(2015) point out that “social equity goals are in many cases not translated into clearly specified objectives” (p. 12), and as a result, equity is often overlooked.

In this paper I will explain the current landscape of active transportation infrastructure and investigate equity concerns in current planning approaches. I utilize Claudia Schwarz-Plaschg’s theories on analogies to redefine how we see active transportation infrastructure. My argument is that active transportation should be seen not just as infrastructure, but also as a product and a resource. Further, adopting a perspective that broadens the definition of active transportation infrastructure can lead to a planning system that devotes more energy to achieving equitable results.

Problem Definition: Current Planning Approaches Limit The Potential That Active Transportation Infrastructure Has to Improve Lives

As Talen and Koschinsky (2013) point out, infrastructure that makes neighborhoods more walkable “is now regarded as a key factor in the promotion of health, economic, and communitarian goals”. However, most people do not think about the process behind constructing and maintaining such infrastructure. In this section I will establish the current landscape of active transportation infrastructure, give a brief description of my technical work, and discuss the issues with current planning approaches.

The Benefits of Active Transport Are Not Distributed Equally

There is a large body of research that indicates the benefits of having access to and engaging in active modes of transportation. Lee et al (2017) claims that these benefits are both personal and societal, and include increased rates of physical activity, better health, lower vehicle dependency, and less congestion on roadways. In general, those who use active transportation are

at lower risk for health issues. According to Reynolds et al.(2010), “several studies have shown direct links between transportation-related physical activity and health outcomes. All-cause mortality, disease-specific mortality, and cardiovascular risk are lower among groups who use active transportation” (p. 2). These authors also point out that active modes of transportation have the potential to “reduce emissions and improve air quality on a neighborhood or regional scale” (p. 4).

Active modes of transportation have been proven to be healthy, but there is evidence that people of lower socioeconomic status are less likely to benefit than those who are more privileged. One study found that while overall walking and cycling were both positively associated with higher health, the health benefits were significantly lower for some populations of color compared to white users. Barajas and Braun (2021) suggest that this finding could be related to inequity in access to active transportation in the US, noting that “neighborhoods of color are less likely to have bicycle and pedestrian facilities funded and built” (p. 9). The League of American Bicyclists have observed the same issue, noting that “low-income and minority populations” lack adequate access to active transportation infrastructure despite the fact that they “experience disproportionately high cycling fatality rates” (Braun et al., 2019, p.1). Disparities in access to a resource that should be provided equitably are concerning, especially due to the monumental impact that good infrastructure can have on quality of life. According to Agyeman and Doran (2021), those who do not have access to adequate infrastructure “are less able to fully participate in their everyday spatial practices, which deepens their economic isolation and social exclusion” (p. 1).

Although the positive impacts of active transportation infrastructure are well-defined and widely documented, many communities that are already socially vulnerable and underserved do not see these benefits.

Approaching Planning in My Technical Project

My technical team recognized the importance of active transportation infrastructure and aimed to create a new planning methodology for the city of Charlottesville to use when prioritizing pedestrian infrastructure projects. The city is specifically interested in an approach that will increase the number of students walking to school.

Through working with several city coordinators we determined that a focus on equity would be a critical component of the approach, as there are several historically underrepresented communities in Charlottesville. The prioritization tool should also yield measurable insights that inform decision makers on how specific infrastructure projects could have a positive impact on school walkability. Ultimately, a three step process was developed based on prior work and stakeholder input in order to meet the City's goals and best serve the community. The three steps are as follows:

1. *Identify areas of highest need*

Visually assess walkability and equity needs throughout the city to choose projects to prioritize within areas of highest need in the city of Charlottesville. The map shown in Figure 1 will be used by decision makers in this step.

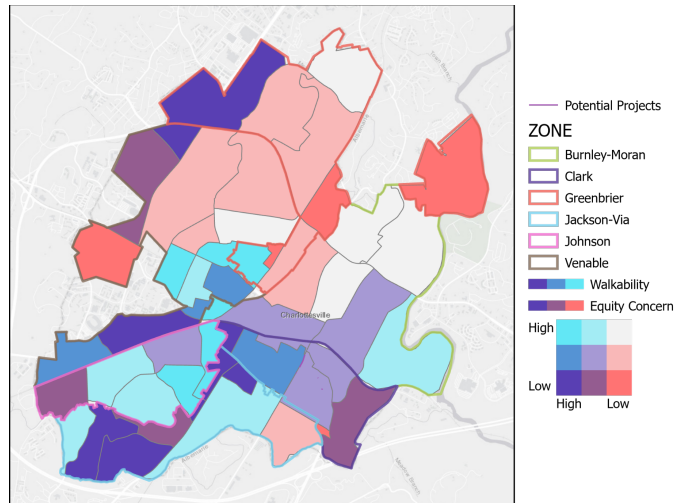


Figure 1: Heat Map of Walkability and Equity Concern in Charlottesville. (Created by Technical Team) Walkability and equity are each represented on their own color axis. The dark purple overlap shows areas of highest equity concern and lowest walkability.

2. *Rank projects within areas of highest need*

For all possible infrastructure projects within the highest need areas from Figure 1, input project data, calculate prioritization scores based on their benefits (i.e., the potential impact on walkability) and their proximity to schools, and rank projects.

3. *Visualize project rankings in context*

Display the top scoring projects from Step 2 to characterize their benefits in the context of cost and other factors. Figure 2 shows the visualization provided in this step.

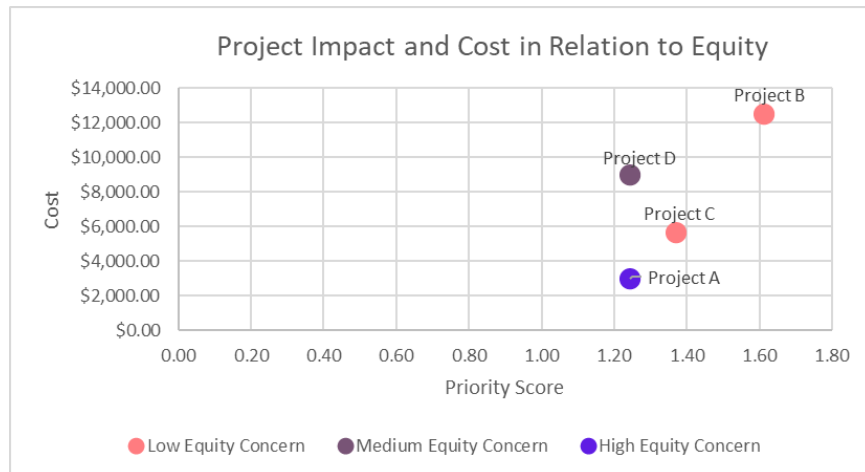


Figure 2: Graph of Project Impact, Cost, and Equity. (Created by Technical Team) The priority score shown on the x-axis is generated in Step 2, and projects are graphed against their estimated cost. The color of the dot represents the area of the City the project is located in.

This approach was designed to be school-focused, equitable, transparent, and results oriented. One of our main goals was to give decision-makers a tool that helps organize their knowledge of the City and directs attention towards areas of Charlottesville where residents have been underserved in the past. We also did our best to avoid the most common pitfalls seen in other planning approaches, which I discuss in the next section.

The Problem with Current Planning Approaches

In the US, planning and prioritization for improvements in transportation infrastructure occurs at the state, city, and neighborhood levels. This means that there are a variety of approaches used around the country to achieve the same goal: improve transportation infrastructure. Depending on the community, to “improve” could have different meanings: making travel safer, more environmentally friendly, faster, etc. The way that decision-makers define improvement will guide their planning process.

One analysis of current planning approaches comes from the Metropolitan Planning Council in Chicago (2021) - this document outlines the current process used by the state of Illinois to prioritize funds for transportation projects, and compares against other states. Some

“cons” identified in the current process include: too many goals (no clear direction), little stakeholder involvement, and “no ongoing scientific measurement of effectiveness of investments” (p. 5). This last problem reflects a flaw in many approaches - the results aren’t being measured, and if they are, they aren’t being measured comprehensively. Manaugh et al. (2015) see a similar issue in their analysis of 18 different transportation plans across North America, pointing out that “more easily quantified goals can be – and are – prioritized at the expense of the “intangible” objectives” (p. 4).

Equity in particular is often seen as a factor that is difficult to quantify. As a result, some plans do not consider it at all. Instead, most plans have “an overwhelmingly stronger focus on environmental rather than social justice goals” (p.11), and many transportation plans that focus more heavily on environmental concerns “are likely to do little to alleviate social inequities” (Manaugh et al., 2015, p. 5). The themes that emerged from the literature that examined a variety of planning approaches are that many plans lack coherency and direction, and measurement of results is often inadequate. As a result, equity is rarely a primary concern.

This research paper fills a gap in knowledge by offering a new perspective on what active transportation infrastructure is - which I will establish in the next two sections. As the review of the literature illustrates, there is currently a lot of inequity in active transportation infrastructure, and there are fundamental flaws in most planning processes that stand in the way of these inequities being corrected.

Methods: Schwarz-Plaschg's Theories on Analogies Provide a Framework to Redefine Active Transportation Infrastructure

In “The Power of Analogies for Imagining and Governing Emerging Technologies”, Schwarz-Plaschg (2018) analyzes analogies as tools for presenting and exploring ideas. I apply Schwarz-Plaschg's ideas in my work to illustrate an alternative way of looking at active transportation infrastructure, and to argue that this shift is necessary in order to make the infrastructure planning process more equitable.

Describing Schwarz-Plaschg's Approach to Analogy

An analogy is created by mapping information from one area (the source) onto another (the target). Analogies can be used to give meaning, as well as convey the relevance of something new or unfamiliar. In her paper “The Power of Analogies for Imagining and Governing Emerging Technologies”, Schwarz-Plaschg (2018) first introduces analogies as tools to stimulate imagination. She then argues that analogies can also be used to shape imagination, if constructed in the right way. Finally, her paper details how analogies can be persuasive in debate, specifically when it comes to discussing emerging technologies.

Schwarz-Plaschg sees two main gaps in the current research on this subject. The first is how analogies can be used to investigate societal implications of new technology. To fill this gap she plans on developing the “concept of analogical imagination” (p. 2). The second is looking at an analogy not just as a tool to explain unfamiliar phenomena, but also as a persuasive device. To address this Schwarz-Plaschg uses an “alternative rhetorical lens” (p. 2) to show another way of interpreting analogical arguments. Her main argument is that expanding the way that analogies are used can strengthen the responsible research and innovation model (RRI) - a science policy framework used commonly in Europe. As described by Responsible Research and

Innovation in Practice (2022), RRI “ seeks to align technological innovation with broader social values [and] aims to engage publics and responsible actors in the science and innovation field to produce ethically acceptable, sustainable and socially desirable research and innovation outcomes”.

Using Analogies as Tools of Exploration

The goal in her first argument is to explain how analogies can be used to explore ideas and anticipate outcomes in emerging technologies. In my research, I used this concept to investigate alternative perspectives on infrastructure planning. Schwarz-Plaschg emphasizes that the act of building analogies in and of itself can be very important. This process necessitates a deep dive into the subject of interest and forces one to explore the “various characteristics and possible implications of a new technology” (p. 3). It also helps clarify the historical and social context conditions that this technology exists in. She explains that in order to use analogies to fully explain an idea, it is usually necessary to create multiple analogies. The author also explains that analogies should be dynamic (not static) and flexible to change. There is no one perfect analogy, rather; multiple analogies produced collaboratively with the intention to foster an open dialogue will be much more effective in creating understanding of a complex topic. I found this to be true in my research - using more than one analogy allowed me to explore active transportation infrastructure from different angles, and the process of generating a variety of ideas expanded my perspective on how this type of infrastructure can serve a community.

How Analogies Can Function as Persuasive Devices

Her second argument explains the weight that analogies can hold as persuasive tools - I applied this idea in my research to argue that active transportation infrastructure should be thought of as more than just infrastructure. Schwarz-Plaschg claims that whether or not an

analogy is persuasive depends on context – there are social, political and cultural factors at play when it comes to whether or not an analogy will be accepted. It is also important for the analogy to be built from something familiar, that ideally has a “widely shared meaning” (p. 10). The more the audience can relate to the source, the better. She goes on to point out that we can use analogies to change the “frame of comparison... [which is] an effective way to shift attention away from one set of values to another” (p. 6) This type of persuasion was particularly relevant to my work, and led me to use analogies as a tool to argue that we should devote more energy to re-defining active transportation infrastructure.

Application to Infrastructure Planning

To summarize, Schwarz-Plaschg first aims to explain a new way to use “the imaginative power of analogies”. There are several characteristics that Schwarz-Plaschg identifies that make analogies effective – in her words, “the power of analogies lies in generating open-ended, explorative discourse” (p. 11). She then aims to explain what the purpose of an analogy is. She does this by presenting a rhetorical lens that reveals how analogies can function as devices for framing and persuasion. Finally, Schwarz-Plaschg believes RRI can be bolstered by the use of analogical imagination and analogical sensibility (analogical sensibility is defined as the result of analysis and reflection on framing and persuasion attempts in analogy).

“The Power of Analogies for Imagining and Governing Emerging Technologies” can help justify the discoveries that I have made about methods in infrastructure planning by establishing connections between my work and ideas that are well established and easily accessible. Schwarz-Plaschg argues that analogies “restrict [the imagination] by framing emerging technologies in specific ways” (pp. 1). The idea of framing became especially

important in my results as I tried to redefine the way that active transportation infrastructure is viewed.

Part III - Results: Expanding The Definition of Active Transportation Infrastructure Will Help Bring Equity Into The Planning Process

As it stands, the built features that allow for active transportation are seen just as infrastructure, which can limit the planning process. In this section I use analogies as a framework to suggest a change in the way that we define active transportation infrastructure, with the goal of making the planning process more equitable.

Combining Perspectives

There is a theme in transportation infrastructure as a whole that areas of lower socioeconomic status are underserved. Unfortunately, the niche of active transportation is not an exception to this trend. Active transportation has the potential to improve quality of life, and should be available to all who wish to engage with it. The next step to making this a reality is for infrastructure prioritization and planning tools to better incorporate equity into their approach. There is a fair body of research that analyzes how equity has been considered in the planning process of transportation infrastructure as a whole, but not specifically in active transportation. There also seems to be a lack of focus in measuring results when it comes to equity, largely because equity is a notoriously difficult factor to measure.

This paper aims to change the current understanding by using analogies to look at active transportation through multiple lenses. First, as infrastructure that can improve health and overall quality of life for both the individuals engaging with it as well as society as a whole. Second, as a public resource that is currently not being distributed fairly to people and communities of all backgrounds. And third, as a product that can and should be analyzed and measured based on

user needs following its implementation. The table below summarizes the key insights from the two analogies I use to justify the resource lens and the product lens, which I will explore in more detail in the paragraphs below.

Lens	Analogy	Main Takeaways
Resource	Public library	<ul style="list-style-type: none"> - Emphasis on benefiting those in need - Catering to a variety of users - Importance of providing equal access
Product	iPhone	<ul style="list-style-type: none"> - Designing with users in mind - Ensuring user satisfaction <ul style="list-style-type: none"> - offering customer support

Figure 3: Analogy Summary Table (Created by Author)

The Resource Lens

It may seem obvious that active transportation is a resource - and it definitely becomes clear once it is built that it is. The problem is that in many cases, it does not appear to be developed with this in mind. Something that is a resource should be developed with all users in mind, and if a certain user group needs more help than another, this should be a consideration. Think of a public library - this is a resource that's goal is to provide knowledge and information to the community. Now consider which would be a better resource: a library with a large collection of books on a diverse range of topics, or a library that provides access to audiobooks, braille, and language resources along with a solid book collection. The first library may have more to offer to one type of user, but the second caters to a variety of users (some who may be in great need) and tries to provide everyone with something.

In active transportation, it would be beneficial to consider need as a more influential factor in determining where infrastructure is built. In some cases, where projects take place is determined with the goal in mind to increase overall walkability or bikeability. However, from a resource lens, the goal is to give equal access to a valuable resource. In this case, it would be

more important to engage in infrastructure projects that improve the walkability of an area that historically has been underfunded. There might be less overall change than if the project was built with the sole purpose of increasing walkability, but the change that does occur will be benefiting people who need it the most.

The Product Lens

Active transportation is a product, and as a product funded by the public's tax dollars, it should be made for public consumption. If we consider infrastructure as a product that is being designed for a set of users, it makes sense that we would consider effectiveness as well as user satisfaction following the end result. Think about another product that requires ongoing care and occasional maintenance - the iPhone. Now we will look at the experience provided by Apple for the people that use their iPhone and products like it. Steve Jobs is quoted as saying "you've got to start with the customer experience and work backwards to the technology" (Gautam, 2017). This philosophy is clear in several of Apple's practices today. Every Apple store also has a Genius Bar, where customers can go to receive free help and support for their products. Apple also allows users to schedule appointments with a professional if they are having an issue with a device - the goal of this is to make sure customers are satisfied and feel like their problems are being taken seriously.

To translate this analogy back to infrastructure, in many prioritization approaches, a lot of consideration is given to what projects to invest in. But once these projects are completed, there isn't much follow up on how they are affecting the people that use them - especially when it comes to factors like equity. Whether or not a project improves the safety of an area can be measured by accident rates in the area, but outcomes related to equity are often much harder to assess. This is the problem with the way that equity is included in many prioritization approaches

for new infrastructure: planners try to include it on the front end, but once a project has been completed, there is rarely an analysis of whether the desired effects were achieved. Just as you might offer customer support to someone using your product, there should be follow-up once new infrastructure is put in to make sure that users are happy with the end result. The figure below is a visual representation of multiple lens approach.

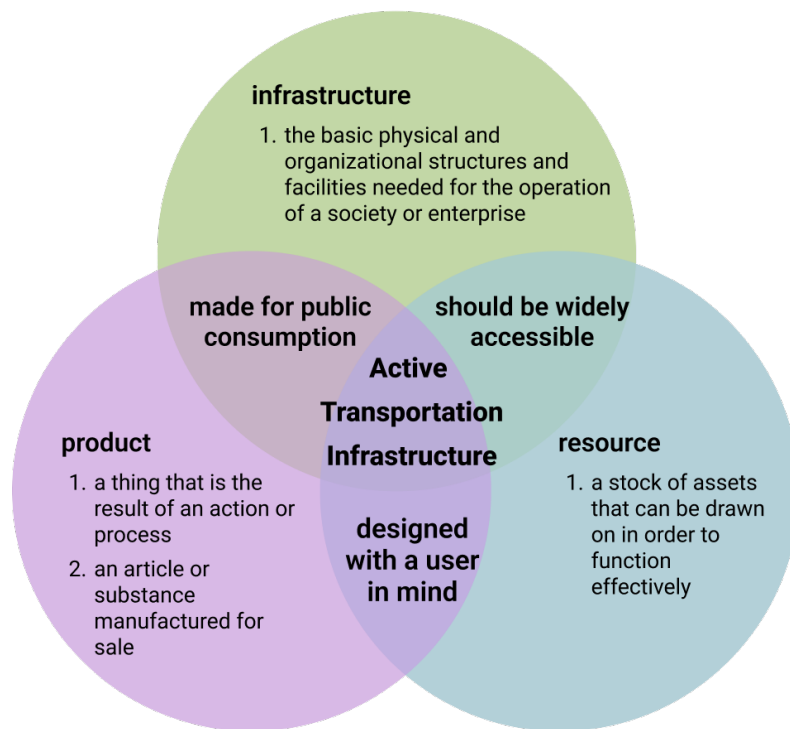


Figure 4: Venn Diagram of The Lenses With Which to View Active Transportation

Infrastructure. (Created by Author)

Right now, the built features (sidewalks, bike lanes, etc.) that encourage active transportation are just seen as infrastructure - and it usually stops there. But if we expand the definition of what active transportation is, or should be, we start to see what needs to shift in order to bring equity into the picture.

Summary

If we see active transportation as more than just infrastructure, but also as a product and a resource with the potential to change lives, it shifts the intention behind creating it in the first place. This is something that should not be built just to increase the number of people who walk to the grocery store instead of drive. That may have been a good starting place, but the focus now should shift to providing people and communities who are less privileged and underserved with a tool to improve their health and better their environment, without risk of displacement or fear of exclusion. In order to achieve this it will be important to do two things. First, plan with equity in mind from the beginning, and establish clear metrics that will be used to target the right areas and measure results that relate to equity. Second, adopt a results-oriented planning approach, where a project is deemed a success only if it is assessed against criteria that were established from the beginning to make sure that the desired outcome is achieved.

Conclusion

Most of the issues with the current state of active transportation infrastructure (ex: lack of access, not accounting for all types of users) can be traced back to a failure to account for equity in the planning process. Active transportation infrastructure is not just another bike lane or pedestrian crossing sign - it can and should be seen as more. It represents the potential for a healthier community and an environment with less pollution. The fact that active transportation can have such a great impact is why it must be made available in a way that is equitable, and expanding the way that we define it is one way to achieve results that better serve communities.

In order to bring equity into the foreground of active transportation planning, I recommend shifting the lens with which we view infrastructure that supports active transport.

Using Schwarz-Plaschg's analogy theories, I argue that active transportation infrastructure is not just infrastructure - it is a valuable resource to the people that can access it, and it is also a product that should be made with a diverse group of users in mind. A broader definition of this type of infrastructure could result in a better planning system that improves quality of life for a wide variety of people.

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