

**CORPORATE ENGINEERS AND CONCERNED LOCAL DADS: IDENTIFICATION
OF CHARLOTTESVILLE STAKEHOLDERS IN A MULTI-USE PATH**

A Research Paper submitted to the Department of Engineering and Society
Presented to the Faculty of the School of Engineering and Applied Science
University of Virginia • Charlottesville, Virginia
In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science, School of Engineering

By

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March 28, 2022

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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HUMAN IMPACT OF CAR-CENTERED CITY DESIGN IN THE UNITED STATES

Eighteen percent of commutes in the city of Charlottesville are taken on foot or by bike, and the city has a stated goal of increasing this number as it aims to limit the share of single-occupancy vehicle commutes to less than 50% (City of Charlottesville, n.d.). Charlottesville's goal necessitates a focus on promoting bicycling and walking which is complicated by the reality that the city's transportation infrastructure is centered around cars. If one were to walk or bike around the city, one might notice large gaps in sidewalks or a scarcity of bike lanes along major traffic arteries (Gillikin, 2022; Paschall, 2021; Virginia Department of Transportation [VDOT], 2021). This lack of pedestrian and cyclist facilities is illustrative of the broader issue that cyclists and pedestrians are systemically overlooked when engineering traffic flow in U.S. cities.

Within the United States, car-centric city design has deadly impacts on non-vehicular transportation. The International Traffic Safety Data and Analysis Group (IRTAD) is a subsidiary of the Organization for Economic Co-operation and Development (OECD) International Transport Forum (International Transport Forum, n.d.) and it found in 2020 that between 2010 and 2018, while European countries saw a decline in cyclist and pedestrian death, pedestrian death rates increased more than 40% and cyclist death rates increased more than 80% within the U.S. In his 2008 book, *Fighting Traffic*, Peter Norton provides a historical analysis of U.S. cities as they evolved to place cars at the forefront of traffic design decisions. Examining this evolution through the Actor Network Theory (ANT) framework (Latour, 1992) illuminates the mechanisms by which traffic infrastructure has become a means to discriminate against bicyclists and pedestrians and supplementing ANT with the Ethnography of Infrastructure (EI) framework (Star, 1999) shows how mindful development of technology can be used to remedy this discrimination.

The technical research project, completed in December of 2021, addresses the lack of bicycle collision notification systems in the market through designing and prototyping a device to alert cyclists of cars approaching from the rear. The device, developed in collaboration with Brandon Brnich, Julia Graham, Julia Rudy, and Rex Serpe, consists of a display mounted on a bike's handlebars which is powered by a solar-rechargeable battery. The display flashes with increasing urgency as vehicles approach from behind the cyclist to restore agency to cyclists in avoiding collisions arising from their blind spots. The final prototype was submitted to technical advisor, Professor Harry Powell.

The STS research paper explores potential stakeholders in the installation of a multi-use path in Charlottesville for use by cyclists and pedestrians alike. Reducing the overall rate of car usage in the city will necessitate centering human-powered transportation in infrastructure development to overcome the long-standing practice of designing U.S. cities to maximize automotive efficiency. The city of Boulder, CO has successfully centered pedestrians and cyclists within its urban infrastructure by creating multi-use paths completely separated from automotive roadways (Taylor, 2016). Through studying the stakeholders involved in Boulder's multi-use path development, this report will identify the analogous actors within Charlottesville to make a recommendation for voices that should be included in Charlottesville's development of a multi-use path to increase the accessibility of human-powered transportation in commuting trips.

Taken together, the technical and STS research of this capstone reflect a larger systemic problem: U.S. traffic infrastructure, because of its overwhelming focus on automobiles, creates an ecosystem that harms and even kills cyclists and pedestrians. These theses are tightly coupled through their shared focus on human-powered transportation technology development.

Expanding the body of work supporting pedestrian and cyclist mobility is critical in bringing the U.S. up to par with its European counterparts and for protecting cyclists and pedestrians alike.

IDENTIFICATION OF KEY STAKEHOLDERS IN THE INSTALLATION OF A MULTI-USE PATH IN CHARLOTTESVILLE, VA

CAR-CENTERED DESIGN AS OBSTACLE TO A BIKE-AND-PEDESTRIAN-FRIENDLY CHARLOTTESVILLE

Car-Centered Design as Structural Harm to Cyclist and Pedestrian Safety and Mobility

Latour's (1992) Actor Network Theory provides an analytical framework that can be used to describe how traffic infrastructure in the U.S. evolved to prioritize cars through an inscription of human values into technological artifacts. Furthermore, understanding the relationship between human and non-human actors within a network illuminates the way that values are instilled in technology and how technology can be used as a mediator to affect change within a system. Application of ANT to the study of traffic systems design shows multi-use paths can act as a mediator to break the cycle of car-centered design by instilling values of supporting human-powered transportation in traffic infrastructure.

Actor Network Theory places human and non-human actors on the same plane of morality wherein non-human actors can hold moral values and prescribe human behavior much in the same way that humans are assumed to do. ANT breaks interaction between human and nonhuman actors into several distinct categories including programs of action, prescription, and discrimination. In ANT, a program of action is an installation of values within technology through delegation of process or function. Prescription describes the way in which non-human actors push human actors to behave within a sociotechnical system. Discrimination is the result of a translation of values which rigidly prescribe human action that consistently and adversely affects specific groups of people. Programs of action, prescription, and discrimination can all be

identified in a historical examination of U.S. traffic infrastructure and provide a means of identifying opportunities for technical mediation to remedy the harm done to cyclists and pedestrians by car-centered design.

In Peter Norton's 2008 book *Fighting Traffic* provides a historical analysis of U.S. cities as they evolved to place cars at the forefront of traffic design decisions. Norton is an associate professor of Science Technology and Society at the University of Virginia (University of Virginia [UVA], n.d.) and his work is consistently centered around urban mobility and sustainable infrastructure. The relationship between Norton's narrative of traffic evolution and ANT is summarized in Figure 1 on page 5. Norton writes that, prior to the advent of the "automotive city" (Norton, 2008, p. 1), streets were public utilities wherein children played, horses rode, and only the occasional car passed. In the 1920s, however, traffic engineers shifted from prioritizing public interest to holding efficiency as their guiding principle, placing a monetary rather than human value on the efficacy of city streets (Norton, 2008, p. 105). This shift in cultural values necessitated a program of action that centered cars in roadway design through delegating the responsibility of commercial development to car mobility. The inherent danger of cars to pedestrians based on physical size meant, even before responsibility for avoiding crashes was delegated to pedestrians by law, traffic systems prescribed that pedestrians give way to cars for their own safety (Norton, 2008). The programming of values dictating that cars should have free movement through cities and the safety necessity prescribing that pedestrians give way to cars eventually culminated in Jaywalking laws that codify the discrimination against pedestrians in traffic (Norton, 2008). These codifying elements, in turn, cemented the belief that roads are meant for cars. This cycle, illustrated in Figure 1, perpetuates

exclusion of pedestrians and cyclists from roadways meaning those who venture to use the road in conjunction with cars are often at risk of bodily harm.

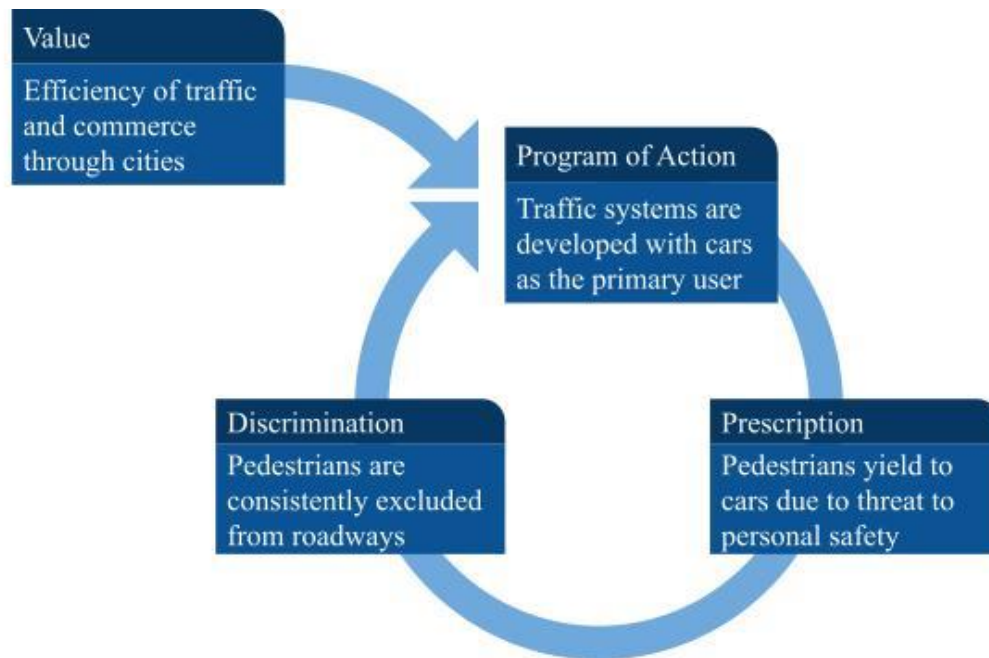


Figure 1. Actor Network Theory Characteristics of U.S. Infrastructure. This figure shows that car-centered design in the U.S. is a self-reinforcing cycling (Cuddeback, 2022a).

Manifestation of Car-Centered Design in Charlottesville, VA

While Charlottesville has a Bike and Pedestrian Master Plan (City of Charlottesville [CoC], 2015), the city has much to accomplish to make the city friendly to bikes and pedestrians. Most of the projects in the master plan surround baseline infrastructure than developing dedicated technology to support cycling and walking. Many of Charlottesville major multi-lane arteries lack bike lanes (Paschall, 2021; Virginia Department of Transportation [VDOT], 2021). Bike lanes that do exist are often ill-marked and abused by motorists (CoC, 2019; Gillikin, 2021). Matthew Gillikin (n.d.) is a Charlottesville resident who frequents city council meetings to document proceedings and advocate for affordable housing and walkable/bikeable city infrastructure. On November 8, 2021, Gillikin tweeted a photo of a University of Virginia

[UVA] police car parked in a bike lane that lacked bike-specific markings with the caption “[s]o many of our city’s problems in one photo” (Gillikin, 2021). Earlier this year, Gillikin also highlighted the lack of walkable infrastructure in the city tweeting a photo of a sidewalk disappearing along a shoulder-less road captioned “Where the Sidewalk Ends: The Charlottesville Pedestrian Story” (Gillikin, 2022). This visual evidence is just one example of the lack of walkable infrastructure that led to the creation of the Charlottesville sidewalk mapping project (Code for Charlottesville [CFC], n.d.). Code for Charlottesville’s sidewalk mapping project takes crowd-sourced data to map accessible walking routes around the city and, though incomplete, is the only comprehensive catalog of sidewalks within the city. Most of the information on the lack of human-powered transportation technology in Charlottesville is from records of individual people like Matthew Gillikin and the sidewalk mapping project rather than governing bodies. The very fact that there is no government-wide catalog of issues with bike and pedestrian infrastructure within the city is an illustration of the Ethnography of Infrastructure principle of visible when broken (Star, 1999), namely: the Charlottesville city government does not view the system as broken enough to document its shortcomings.

Multi-Use Paths as Mediators for Discrimination Against Bicyclists and Pedestrians

Because technology can prescribe human action, it can be used as a mediator to interrupt the structure of an existing system through the installation of values alternative to those governing said system. Human actors can diminish discrimination in a system by designing technology instilled with values unique to those that created the discrimination initially. As shown in Figure 2 on page 7, the multi-use path as a mediator can disrupt the cycle of car-centered design by intentionally shifting the balance of values in favor of cyclists and pedestrians through creation of channels through which human-powered traffic can flow safely. In this

paper, the term multi-use path refers to a pathway for bicycling, walking, and other human-powered forms of transportation, for example, rollerblading.

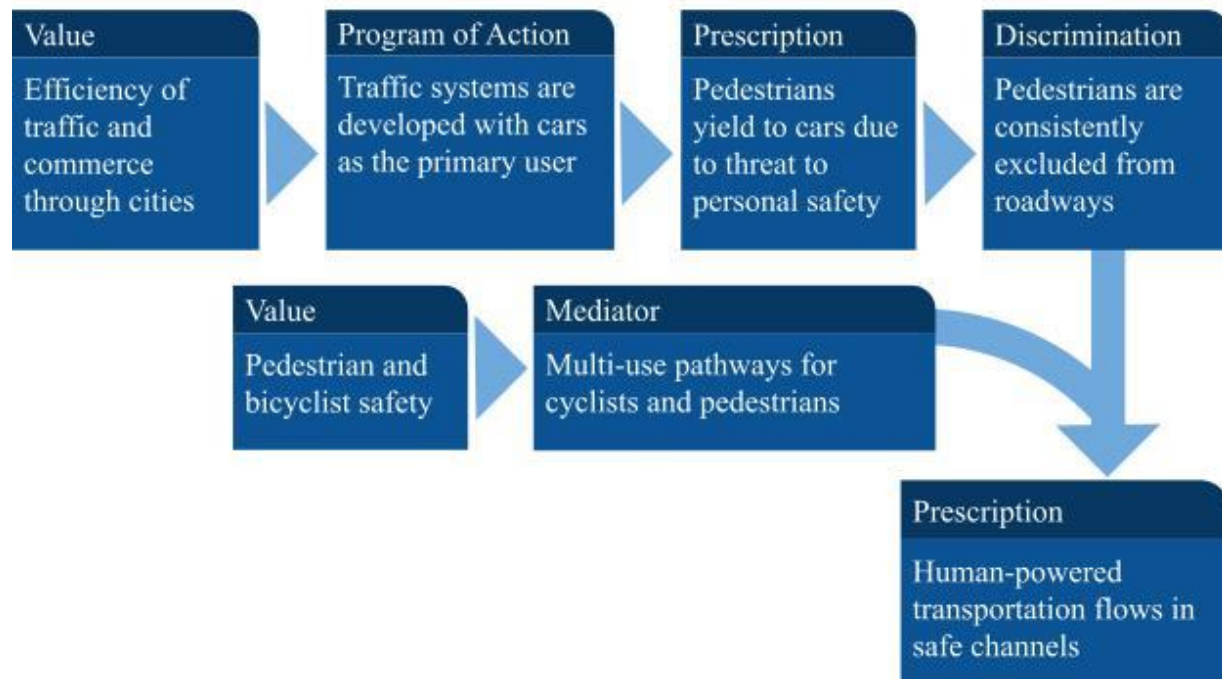


Figure 2. Multi-Use Paths as Technological Mediators in Traffic Infrastructure. This figure shows that the introduction of multi-use paths in traffic infrastructure disrupts the cycle of car-centered design (Cuddeback, 2022b).

Before technology can be identified as a mediator in a broken system, that brokenness must first be identified. Susan Leigh Star (1999) says a defining characteristic of infrastructure is that it is only visible when broken. Technical mediation to remedy discrimination against specific populations is inherently difficult as this discrimination is often the result of a value set that does not preclude the specific discriminatory behavior. It follows that the first step in effective technological mediation is to identify discriminatory behavior and the second step is to identify the actors who will be responsible for the installation of values to combat that discrimination. This observation forms the basis of the two categories of stakeholders explored in this paper: those who identify discrimination within the system and those who combat that discrimination through the installation of novel thinking and novel technology.

BOULDER, CO AS A MODEL FOR HUMAN-POWERED TRANSPORTATION INFRASTRUCTURE DEVELOPMENT

Validity of Boulder, CO as a Model for Charlottesville, VA

Boulder, CO serves as a model for Charlottesville both because of the quality of its infrastructure and because of the comparable characteristics of the two cities. Boulder is one of 5 cities in the U.S. to have obtained a platinum rating from the League of American Bicyclists' Bicycle Friendly Community (BFC; 2020). The League of American Bicyclists (n.d.) is a bicycling advocacy, education, and promotion group dedicated to making bicycling safer and more accessible nationwide. In contrast to Boulder's platinum rating, Charlottesville has a silver designation with the report card citing a lack of dedicated bicycle infrastructure as a barrier to gold status (BFC, 2018). While Charlottesville and Boulder are both listed as gold-level walkable cities by Walk Friendly Communities (Walk Friendly Communities [WFC], n.d.a), Boulder is explicitly listed as a city with exemplary characteristics in the WFC assessment guide (WFC, n.d.b). Charlottesville is, admittedly, half the size of Boulder but their population densities are very comparable at 4,543 people-per-square-mile (World Population Review [WPR], n.d.a) and 3,980 people-per-square-mile (WPR, n.d.b), respectively. Moreover, both cities have independent governments embedded within a larger county government, and serve as the home to their state's flagship educational institution. All these facts considered, Boulder is a good model for Charlottesville both because of the quality of its transportation technology and its structure and character as a city.

Identification of Stakeholders in Boulder's Multi-Use Path Infrastructure

Recognizing that infrastructure is inscribed with human values to shape human attitudes and behavior (Star, 1999), the stakeholders in a multi-use path will be identified in two parts: actors for actors that shape values and actors that shape infrastructure once those values have

been defined. As Boulder has been designing transportation infrastructure for dedicated use by pedestrians and cyclists for the better part of a century (Taylor, 2016) and human-powered transportation is at the forefront of city planning, it is insufficient to merely examine contemporary infrastructure development to determine which stakeholders would be necessary to spearhead new transportation technology in Charlottesville. This section will begin by examining the historical figures responsible for illuminating the need for infrastructure supporting human-powered transit and conclude by recounting the actors responsible for building that infrastructure now its necessity and values have been cemented.

Dedicated bikeways first entered public consciousness in Boulder in 1968 when Al Bartlett submitted a proposal to the city titled “Bikeways for Boulder” (Harberg & Weise, 2018). Al Bartlett, a Boulder resident, first advocated for pathways separating human-powered transportation from car roadways because he was worried about the safety of kids traveling to and from school by bike or by foot (Taylor, 2016). Bartlett employed his daughter’s Girl Scout troop to catalog biking routes in the city and presented their findings to the mayor to push for the expansion of safe routes for pedestrians and cyclists within the city (Taylor, 2016). These original Boulder Bikeways were merely pre-existing roads that were marked as designated bike routes within larger traffic flow. Bartlett was aided in his advocacy efforts by citizen-led public interest group Plan Boulder, newly elected city councilwoman Karen Paget (Taylor, 2016). Additionally, student protests at the University of Colorado Boulder aimed at reducing motor vehicle traffic on campus underscored the importance of Bartlett’s efforts and the University itself was critical in negotiating land deals to make infrastructure development possible (Smith, 1984). Because of this local activism, Boulder city released the Boulder Bikeway Plan in 1977 (Smith, 1984) and eventually installed the city’s first multi-use path, the Boulder Creek Path, in

1984 (Harberg & Weise, 2018). Boulders original bikeways illustrate that community-member input is critical for creating multi-use paths as technical mediators.

Because records surrounding the planning and construction of the Boulder Creek Path are not digitally archived, Boulder Canyon Trail will serve as a model to examine the stakeholders involved in responsible construction once the value of bicycle and pedestrian safety is embedded in city design. The construction of Boulder Canyon Trail, also called the Boulder Creek Path extension, was first proposed in 2014 (Autar, 2014), examined in 2016 (Fuhr, 2016) and relayed to the public for feedback in 2017 (Barth, 2017). The project was proposed by Boulder County and funded in part by a Colorado Department of Transportation [CDOT] (Autar, 2014) and in part by Boulder City and Boulder County taxes (Boulder County, n.d.). In 2016, Karen Fuhr, representing Muller Engineering Company, identified key environmental impact and budgeting facets of the project, including the fact that parts of the project bordered public property and required interfacing with residents. Before construction began 2019 by contractor Zak Dirt (CDOT, n.d.), Boulder County presented final plans for community feedback before submitting to contractor bids (Barth, 2017). Ultimately, the construction of the path in Boulder was a deeply community-engaged process, much like the process that that made Boulder's original bikeways.

The stakeholders necessary to create Boulders multi-use paths are summarized in Table I. County, city, and state governments, concerned citizens, bicyclists, pedestrians, lobbyist organizations, civil and environmental engineers, and residents adjacent to proposed development areas were all critical in the completion of Boulder's projects. Moreover, every step of the process included feedback from groups who are disadvantaged by car-centered design to ensure their needs were met.

Table I. Actors in Boulder's Multi-Use Path Infrastructure and Their Roles

Stakeholder	Role
Al Bartlett	Ideating Boulder Bikeways, organizing local efforts (Taylor, 2016; Harberg & Weise, 2018)
Bartlett’s Daughter’s Girl Scout Troop	Gathering data on existing bike and pedestrian infrastructure (Taylor, 2016)
Plan Boulder	Funding Al Bartlett’s educational and outreach material production, organizational support and feedback (Taylor, 2016)
City Councilwoman Karen Paget	Representing cyclist interest in council meetings (Taylor, 2016)
University of Colorado Student Protestors	Voicing need for alternative transportation within the city (Smith, 1984)
University of Colorado	Land use negotiation (Smith, 1984)
Colorado Department of Transportation	Funding (Autar, 2014; Boulder County, n.d.)
City of Boulder	Funding (Autar, 2014; Boulder County, n.d.)
Boulder County	Planning and funding (Autar, 2014; Boulder County, n.d.; Barth 2017)
Muller Engineering Company	Feasibility & Environmental Impact Study (Fuhr, 2016)
Zak Dirt	Contractor (CDOT, n.d.)
Residents adjacent to development	Input on the use of/around their land (Fuhr, 2016)

IDENTIFYING KEY STAKEHOLDERS IN CHARLOTTESVILLE THROUGH ANALOGY TO BOULDER

Boulder, CO demonstrates the necessity of community stakeholders in human-powered transportation projects and this section seeks to identify these community stakeholders. In addition to work by the City of Charlottesville, Albemarle County, and Virginia Commonwealth governments, input from the Charlottesville Bicycle and Pedestrian Advisory Committee (City of Charlottesville, n.d.), and individual Charlottesville residents like Jay Hightman is essential for addressing discrimination against pedestrians and cyclists. In 2020, Jay Hightman saw one daughter in a car-bicycle crash and saw another injured by a distracted driver (Wyant, 2020). In 2021, Jay’s daughter Rachel spoke to local news outlets advocating for more bicycle infrastructure along Emmet Street (Paschall, 2021). UVA students like Rachel and people like Matthew Gillikin are the Charlottesville equivalent of University of Colorado students and

residents like Al Bartlett. Table II identifies examples of Charlottesville community stakeholders and their Boulder counterparts. Its is voices like these that will illustrate the need for multi-use paths and instill human-centered values in Charlottesville city design.

Table II. Actors in Boulder’s Multi-Use Path Infrastructure and Their Roles

Stakeholder	Role
Al Bartlett	Matthew Gillikin (n.d.), Jay Hightman (Qyant, 2020)
Bartlett’s Daughter’s Girl Scout Troop	Charlottesville sidewalk mapping project (CFC n.d.)
Plan Boulder	Charlottesville sidewalk mapping project (Code for Charlottesville [CFC], n.d.)
University of Colorado Student Protestors	Rachel Hightman (Paschall, 2021) and other University of Virginia Students
University of Colorado	University of Virginia
Residents adjacent to development	Charlottesville residents adjacent to development

RECOMMENDATIONS FOR CHARLOTTESVILLE STAKEHOLDERS IN A MULTI-USE PATH

Matthew Gillikin’s twitter profile describes him as a “concerned local dad” (Gillikin, n.d.) which summarizes the essence of successful community development in Charlottesville: residents who push for positive change because they care about the wellbeing of current and future generations. Multi-use paths serve as a key technological mediator in Charlottesville’s landscape as it hopes to increase rates of cycling and walking within the city. This paper has identified community stakeholders as essential to defining the mechanisms by which traffic infrastructure in Charlottesville will be instilled with values that keep cyclists and pedestrians safe. The successful installation of a multi-use path will obviously necessitate engineers, contractors, and government officials, but community stakeholders will draw the bottom line underscoring its importance and continue to push human-centered values as the city continues development in the future.

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