City Cyclists Ride More Safely:

An Observational Study of Biking Behavior in Lower and Central Manhattan

Conducted by Students at Hunter College,
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Introduction

During the last decade a large number of towns and cities across the country have undertaken major initiatives to promote cycling. One of the most prominent examples of this trend is New York City which has devoted enormous resources to encourage cycling. In just the time span from 2006 to 2012, the city has installed over 300 miles of additional on-street bike lanes bringing the total to 573 as of March 1, 2013 (New York City Department of Transportation, 2013). And starting at the end of this month on Memorial Day, May 27th, the city will inaugurate the largest bike share program in the nation. The program will begin with 6,000 bikes located at 330 docking stations and eventually include 10,000 bikes at 600 stations (Wall Street Journal, May 4, 2003).

Several factors are contributing to the movement to increase cycling as an alternative means of transportation. City officials view cycling as a way to alleviate traffic congestion, to reduce both air and noise pollution, and to encourage a type of physical activity with multiple health benefits. Yet despite these laudable objectives, the initiatives to promote cycling in the city have met with stiff resistance on the part of some New Yorkers (Goodman, November 22, 2010). Motorists, for example, complain that too much street space is being allocated to cyclists, thus making streets even more treacherous on which to drive. They also lament the elimination of parking spaces because of the installation of bike lanes and bike share kiosks.

Part of the opposition to pro-cycling initiatives is rooted in a perception that some cyclists have a holier-than-thou attitude toward other road users, show contempt for the rules of the road, and pose a danger to drivers, pedestrians, and themselves (Goodman, September 18, 2010; Cassidy, March 8, 2011; Walsh, July 3, 2012). According to this view, a number of cyclists run red lights, traverse the wrong way down streets, ride on sidewalks, are distracted because of the use of electronic devices and, in terms of their own safety, don't bother wearing helmets.

Surprisingly, though, little systematic study has been carried out on the behavior of urban cyclists. Little inquiry has been directed at the extent to which cyclists adhere to traffic laws, use electronic devices which might reduce their concentration, or wear helmets as a protective measure.

One study which did address these issues was carried out four years ago by the authors of this current study (Tuckel, Milczarski, 2009). The previous

research was based on observing both the type of cyclists and their riding patterns in mid-Manhattan.[2] One of the findings which emerged from this earlier study was a noticeable sex disparity in ridership. The overwhelming majority of riders (91%) were male. With respect to obeying traffic laws, the study uncovered the following: (1) more than a third of cyclists did not stop at all at a traffic light, (2) among cyclists observed at a street with a bike lane, 29.3 percent did not use the dedicated lane, and (3) 13.2 percent of cyclists were observed riding against traffic. In terms of helmet use, less than a third of riders were observed wearing helmets. This last-mentioned figure varied considerably by type of rider. Female cyclists were far more likely to wear a helmet (50.8%) than either male recreational/commuter cyclists (32.2%) or male commercial cyclists (23.6%). Finally, the study revealed that approximately 10 percent of all riders used an electronic device such as a cell phone or music player.

A principal objective of the present study is to identify what changes, if any, have occurred in both the composition and riding behavior of cyclists over the course of the last four years. During this time span the number of cyclists in New York City has continued to rise. Figures provided by the New York City Department of Transportation show that the number of cyclists entering and leaving Manhattan grew from 28,300 to 32,200 in just the three years from 2009 to 2012 (New York City Department of Transportation). Furthermore, as mentioned above, there has been a large-scale expansion in the number of bike lanes. Both the upsurge in the number of cyclists and the expansion of the biking infrastructure may have had an impact on the composition of cyclists and their riding behavior.

Methodology

The results of this study are based upon observations of 2,521 bicyclists at 104 different intersections in New York City. The intersections were chosen from all intersections spanning the area from the southern tip of Manhattan up to 86th Street (south to north) and bounded from east to west by the East River and the Hudson River. This area constitutes a broad swath of Manhattan and comprises what can be thought of as lower Manhattan and a large portion of central Manhattan.

The intersections were randomly selected from four different strata encompassed within this area. The four strata consisted of: (1) streets/avenues without any bike lane, (2) streets/avenues with an unprotected bike lane, (3) streets/avenues with a protected bike lane, and (4) bikeways running alongside the East River and the Hudson River.[3]

All observations were carried out by Hunter College students enrolled in one of four different courses. Two of the courses were offered in the Department of Urban Affairs & Planning (Urban Data Analysis, Quantitative Approaches to Urban Analysis) and the other two were offered in the Department of Sociology (Introduction to Research Methods, and Research Practicum/Honors Seminar).

Students were given strict methodological guidelines in carrying out their observations. Importantly, students had to choose cyclists they observed at a given location on a random basis without employing subjective criteria and they had to remain as inconspicuous as possible.

Students were assigned to conduct observations at one of the 104 intersections (sites) located within the geographic boundaries of the study. Each site was visited for a period of one hour in duration. The hours were staggered across the seven days of the week and ranged from 7:30 am to 8:30 pm.

Students were instructed to record observations for *every* cyclist who passed them by within each hour interval with a few exceptions. The exceptions were as follows: First, no more than one observation could be recorded by a student within the same minute of time.[4] Second, for cyclists riding in parallel fashion, observations were to be carried out on the cyclist in closest physical proximity to the student. Third, no information was to be gathered on the same cyclist more than once. And fourth, no information was to be gathered on any cyclist who had an "intimidating presence."[5]

The above methodology was designed so that intersections that had more cyclists traversing them would have greater representation in the sample. Thus, the study is based upon a self-weighted sample of observations.

With respect to biking behavior, students gathered data on the following variables: (1) stopping/pausing at a red light, (2) going in the same direction as traffic, (3) using the designated bike lane (if applicable), (4) use of a helmet, and (5) using a cell phone or other electronic device while cycling.

For commercial cyclists, information was also gathered on whether they had proper upper-body apparel.[6]

In addition to these variables, students collected the following demographic information on each rider: (1) his/her sex, (2) whether the rider was under 14 years of age, and (3) for adult riders (14 years of age or older), whether they were commercial cyclists (e.g., messengers, food delivery workers) or non-commercial cyclists.

Also, information about the site of the observations was appended to each record. Site attributes included whether the observations were carried out on a street or avenue, the number of vehicular lanes of the street/avenue, whether the street/avenue had a designated unprotected or protected bike lane, and whether the site was on a bikeway.[7] Finally, the calendar date and day of the week on which observations were conducted were recorded.

All observations were carried out between April 12 and May 3, 2013.

Findings

Overall Profile of Riders

A large segment of the riders observed in this study were recreational or commuter cyclists (70.7%), followed by "delivery riders" (25.9%), with the remainder (3.3%) being riders whose status could not be determined.

As might be expected, children under the age of 14 constituted only a minuscule proportion of the riders (1.2%). Also, as was the case in the study of cyclists in mid-Manhattan conducted four years ago (Tuckel and Milczarski, 2009), there was a sizable disparity in the sex of the riders (78.9% male vs. 18.2% female).[8]

While this disparity is still large, it should be noted that the "gender gap" among cyclists in the present study is considerably narrower than was found in the earlier study. The proportion of female riders appears to have almost doubled in the last four years.

Part of this growth in female ridership is attributable to the different geographic areas covered by the two studies. The present analysis includes three areas that were not part of the earlier study: the area from the southern tip of Manhattan to 14th Street, 59th Street to 86th Street, and the East River and Hudson River bikeways. As will be shown below, the bikeways

included a disproportionately large number of female riders. If just the same geographic area employed in the earlier study is used in the present study, and the indeterminate sex cases are omitted, the percent of female ridership is 16.7 percent. This figure still represents an increase of 7.3 percentage points in the number of female cyclists over the course of the last four years.

Type of Cyclist by Street Environment

Pronounced differences exist between the type of rider (based on a combination of sex and commercial/non-commercial status) and the different street environments in which they are observed. Table 1 shows the relationship between the street environment and three types of riders: male commercial cyclists, male non-commercial cyclists, and females.[9]

The data indicate the following with respect to female cyclists: (1) they are more likely to ride on streets than avenues, (2) they are more likely to ride on a street/avenue with a bike lane (protected or unprotected) than a street/avenue without any bike lane, (3) and finally they are more likely to ride on a bikeway than any other type of street environment.

By comparison, there doesn't appear to be any discernible pattern between the type of street environment and the ridership of male cyclists except that male commercial cyclists were virtually absent from the bikeways.

Table 1: Type of Cyclist by Street Environment*

	Street No bike lane	Street Unprotected bike lane	Street Protected bike bike lane	Avenue No bike lane	Avenue Unprotected bike lane	Avenue Protected Ted bike lane	Bikeway	Total
Male Commercial cyclist	33.2%	25.2%	32.9%	36.0%	27.1%	29.9%	0.4%	27.1%
Male Non-commercial cyclist	52.4%	52.6%	45.7%	56.6%	55.1%	52.1%	72.0%	54.9%
Female Non-commercial cyclist	14.3%	22.2%	21.4%	7.4%	17.8%	18.0%	27.6%	18.0%
Total Percent	328 100.0%	365 100.0%	140 100.0%	297 100.0%	303 100.0%	618 100.0%	243 100.0%	2294 100.0

*Includes only individuals estimated to be 14 years of age or older.

Stopping at Red Lights

At intersections at which there was a red light for both motor vehicles and cyclists, students observed the extent to which cyclists obeyed the traffic signal. The data displayed in Table 2 shows that slightly more than a third of cyclists (34.3%) do not stop or even pause at a red light. This figure is slightly lower than the comparable figure presented in the 2009 study in which the geographic areas are the same.[10, 11] As was true in the 2009 study, female cyclists tend to be far more law abiding than male cyclists. Interestingly, male commercial cyclists tend to run a red light *less so* than male non-commercial cyclists (34.2% vs. 40.3%).

Table 2: Stops at Red Light by Type of Cyclist*

	Male Commercial Cyclist	Male Non-Commercial Cyclist	Female Non-Commercial Cyclist	TOTAL
Stops fully when the light is red	30.2%	27.2%	47.2%	31.7%
Pauses when the light is red then goes through the light while it is still red	28.7%	25.3%	30.4%	27.2%
Does not stop or pause when the is red	34.2%	40.3%	16.8%	34.3%
Not sure	6.9%	7.1%	5.6%	6.8%
Total Percent	202 100.0%	367 100.0%	125 100.0%	694 100.0%

*Includes only individuals estimated to be 14 years of age or older.

Use of the Unprotected Bike Lane

Another facet of riding behavior observed by students was the extent to which cyclists rode on the portion of the street or avenue that was dedicated as a bike lane. The data exhibited in Table 3 shows that two-thirds of the cyclists (67.4%) rode only in the dedicated bike lane and an additional 11.1 percent rode in both the motor vehicle and the bike lanes. Only about a fifth (19.1%) rode exclusively on lanes intended for motor vehicle use. What is noteworthy is that the percent who are observed riding only on the street in the current year is considerably less than the corresponding percent riding only on the street in 2009 (19.1% vs. 32.1%). This reduction in the numbers who ride only on the street applies to both commercial cyclists and male and female non-commercial cyclists.

Female cyclists tend to ride more in the bike lane than male cyclists. Also, male general cyclists tend to ride in the bike lane more than male commercial cyclists.

Table 3. Use of Unprotected Bike Lane by Type of Cyclist*

	Male Com-mercial Cyclist	Male Non-Commercial Cyclist	Female Non-Commercial Cyclist	TOTAL
Rides only on bike lane	58.7%	70.0%	74.5%	67.4%
Rides only on street	25.3%	18.5%	10.6%	19.1%
Rides both on bike lane and street	11.6%	10.7%	11.3%	11.1%
Not sure	4.4%	0.8%	3.5%	2.4%
Total Percent	225 100.0%	383 100.0%	141 100.0%	749 100.0%

*Includes only individuals estimated to be 14 years of age or older.

Rides With or Against Traffic

Overall, only 4 percent of cyclists were observed riding against traffic on the street and another 4 percent of cyclists were observed riding against traffic in the bike lane (see Table 4). Importantly, riding against traffic seems to have declined somewhat during the last four years when altogether 13 percent of the cyclists were observed riding the wrong way.

As was true with stopping at a red light or riding in the dedicated bike lane, female cyclists were observed to be more law-abiding with respect to riding with traffic than either male general riders or male commercial riders.

Table 4: Rides With or Against Traffic by Type of Cyclist*

	Male Commercial Cyclist	Male Non-Commercial Cyclist	Female Non-Commercial Cyclist	TOTAL
Rides with traffic on street	45.3%	39.6%	33.0%	40.2%
Rides against traffic on street	5.7%	3.5%	1.8%	3.9%
Both rides with and against traffic on street	0.8%	1.7%	0.0%	1.1%
Rides with traffic on bike lane	41.5%	51.6%	61.7	50.3%
Rides against traffic on bike lane	6.4%	2.7%	3.2%	3.9%
Not sure	0.2%	0.8%	0.3%	0.5%
Total Percent	609 100.0%	1073 100.0%	339 100.0%	2021 100.0%

*Includes only individuals estimated to be 14 years of age or older.

Use of Helmets

Altogether, 58 percent of the cyclists were observed wearing helmets. This represents a steep increase from the figure for 2009 in which only 29.9 percent of cyclists were recorded wearing helmets. Most impressive is that the use of helmets soared for each of the three groups of riders. The data in Table 5 show that among male commercial cyclists, male general cyclists, and female cyclists, the number wearing helmets now stands at 70.4%, 51.3%, and 61.2%, respectively.[12]

Table 5: Helmet Use by Type of Cyclist*

	Male Commercial Cyclist	Male Non-Commercial Cyclist	Female Non-Commercial Cyclist	TOTAL
Helmet	70.4%	51.3%	61.2%	58.2%
No helmet	29.4%	47.9%	38.6%	41.2%
Not Sure	6.2%	0.8%	0.2%	0.5%
Total	622	1260	412	2294
Percent	100.0%	100.0%	100.0%	100.0%

*Includes only individuals estimated to be 14 years of age or older.

Use of Electronic Devices

Table 6 shows that while only a small fraction of cyclists were observed texting when riding their bikes (0.9%), close to 13 percent were observed using some other electronic device (mainly smart phones and music players). This represents an increase of approximately 5 percentage points over those who were using an electronic device in 2009.[13] The data also show that recreational or commuter cyclists of both sexes were more disposed towards riding with an electronic device than commercial cyclists.

Table 6: Use of Electronic Devices by Type of Cyclist*

	Male Commercial Cyclist	Male Non-Commercial Cyclist	Female Non-Commercial Cyclist	TOTAL
Texts while riding	1.0%	0.9%	0.7%	0.9%
Does not text but uses electronic device	7.8%	15.5%	12.9%	12.9%
Does not text or use and electronic device	85.4%	79.0%	81.5%	81.2%
Not sure	5.8%	4.7%	4.9%	5.0%
Total Percent	618 100.0%	1259 100.0%	410 100.0%	2287 100.0%

*Includes only individuals estimated to be 14 years of age or older.

Use of Apparel with Business Name by Commercial Cyclists

New York City traffic laws mandate that commercial cyclists wear "upper-body apparel with the business' name (*sic*)." In 2009, only a minority of commercial cyclists displayed the name of their company either on their clothing or their bikes (27.3%). As the data in Table 7 reveal, this percent has risen sharply. Now over half (51.6%) comply with the law, even including 12.5 percent of cases where a firm determination could not be made.[14] If those cases where it could not be determined if the cyclist was wearing appropriate attire are excluded, the percentage wearing increases to 58.9%.

Table 7. Use of Apparel with Business by Commercial Cyclist

	Frequency	Percent
Yes	330	51.6
No	230	35.9
Not sure	80	12.5
Total	640	100.0

Summary and Conclusions

This study has examined the riding behavior of over 2,500 cyclists in lower and central Manhattan. While the study's results cannot be directly compared to those of a similar study conducted four years ago, even when the coverage areas of the two studies are aligned, the findings from both studies strongly suggest that a change has occurred in the demographic composition of cyclists and their behavior patterns.

It appears first of all that the percent of cyclists who are female has grown significantly. One possible reason for this growth is the expanded network of bike lanes. Women are more likely to be found riding on streets than avenues, more likely to ride on a street/avenue with a bike lane than a street/avenue lacking a bike lane, and even more likely to ride on a bikeway.

One disturbing finding which emerges from this study is that while riding with one earbud is not unlawful, the data in this study demonstrate an increased use of electronic devices on the part of cyclists. The figure now stands at approximately 14 percent who use some sort of electronic device compared to 10 percent four years ago.

The results of this study also point to a substantial increase in the use of helmets. Almost three-quarters of commercial cyclists now wear helmets. Just four years ago, the number of commercial cyclists observed wearing helmets was less than a quarter (23.6%). Nor is this increase in helmet use confined to commercial cyclists. The percent of both male and female recreational or commuter cyclists who wear helmets also has climbed appreciably in the last few years.

Finally this study has produced evidence that a larger proportion of cyclists are adhering to the rules of the road. More cyclists are riding in the same direction as traffic and riding on the dedicated bike lanes where these lanes have been installed.

To what can we attribute the greater use of helmets and greater compliance with traffic rules? One factor certainly is the efforts which have been expended by bike clubs, bike organizations, and government agencies to promote safe cycling. Bike clubs, bike advocacy groups, organizers of bike-a-thons have all launched educational campaigns encouraging cyclists to wear helmets and engage in other safe cycling practices. The New York City

Department of Transportation also has been a strong proponent of safe riding behavior and the City Council has passed several new legislative initiatives aimed at curbing unlawful behavior (particularly among commercial cyclists).

Yet beyond this factor it is probably the case that the increased volume of cyclists by itself has created a new definition of the situation on city streets. Commuter cyclists are no longer an anomaly. They are increasingly becoming a fixture of urban life. As the number of cyclists grows, both motorists and cyclists are becoming more mindful of the presence of the other and the need to adjust their behavior accordingly. This period of adjustment will likely continue for several years, be characterized by tension and conflict, but also marked by a growing recognition that there are multiple users of the city's streets each with legitimate rights.

Notes

1. Both authors made an equal contribution to this study.

2. The geographic scope of this earlier study included the area extending from 14th Street to 59th Street (south to north) and from 1st to 10th Avenues (east to west). This area comprises the central business district of Manhattan.

3. "Intersections" at bikeways were approximated at the point where the nearest street would bisect the bikeway were that street to extend further east or west.

4. To comply with this guideline, students were told to record observations for every *first* cyclist who passed them after the beginning of a "new" minute on their watches/cell phones.

5. Fortunately, there were no reported cases where a student observer could not collect information due to the presence of a cyclist with an "intimidating presence."

6. Specifically, NYC DOT regulations require businesses that use bicycles for commercial purposes to provide their delivery cyclists with "retro-reflective upper-body apparel with the business name and bicyclist's three-digit ID number on the back."

7. The term "unprotected bike lane" refers here to a portion of a street or avenue which is used by cyclists and is designated by two parallel lines with an image of a bicycle imprinted on the pavement. A protected bike lane is defined as a portion of a street or avenue which is used by cyclists and is separated from vehicular traffic by a physical barrier such as a raised curb or street parking. Bikeways (or greenways) are defined as paved areas that are totally separated from vehicular traffic and are used exclusively by cyclists or sometimes shared with pedestrians.

8. These figures don't add up to 100 percent because there were a few instances in which the sex of the rider could not be ascertained (2.9%).

9. Since females constituted only a small fraction of commercial cyclists (3.7%), they were not included in this typology.

10. Unless otherwise stated, differences in the results reported in this study from those found four years ago are not largely attributable to the different geographic areas covered by the two studies.

11. It should be noted that there was a greater tendency for cyclists to pause when the light was red and then continue through the red light at intersections in which there was a special traffic signal for cyclists compared to intersections in which there was only a traffic signal for both motorists and cyclists. Here the sample size (n = 186) was relatively small.

12. On April 23, 2013, a new law took effect in the City of New York with the aim of strengthening existing ordinances requiring commercial cyclists to wear helmets. The implementation of this new law, however, does not appear to be the reason for the upswing in the use of helmets by commercial cyclists observed in this study. Helmet use had already attained a much higher level before these new regulations went into effect.

13. It is permissible in New York City for cyclists to wear one earbud. Nevertheless, the City's Department of Transportation encourages cyclists not to wear earphones because it compromises their safety.

14. Often, outer garments or backpacks obscured the ability of students to determine if a commercial cyclist was wearing clothing which identified the name of his company.

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