Breaking into bicycle theft: Insights from Montreal, Canada

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ABSTRACT

Many cities have adopted policies that promote walking and cycling because of their positive environmental, economic, and social benefits. As bicycles become a more popular form of transportation and more bicycles are out on the road, planners and transportation researchers will have to consider not only how to create urban spaces that encourage cycling, but also how to discourage bicycle theft. Currently, bicycle theft often goes unnoticed and is largely unchallenged. The present research brings attention to this issue by providing a narrative on bicycle theft in Montreal, Quebec, Canada. A bilingual online bicycle theft survey was designed for this purpose and answered by 2,039 Greater Montreal residents. Summary statistics address ‘who’, ‘what’, ‘where’, ‘how’, and ‘when’ questions, a logit model determines variables associated with theft, and thematic maps compare experienced and expected theft between sub-regions. Half of respondents have had at least one bicycle stolen. Cyclists most frequently had their bicycles stolen in the downtown area. While, bicycles locked with U-locks, expensive bicycles, and those owned by women, are less likely to have been stolen. Satisfaction with bicycle parking availability and security tends to be low, and many cyclists are willing to pay for improved secure bicycle parking. Findings from this study can not only be useful to better understand and ultimately decrease bicycle theft in Montreal, but can also be beneficial for cyclists, police, and policy makers in other cities aiming to decrease bicycle theft as it highlights new findings in this unexplored area of research.

Key words: cycling – theft – victimization – Montreal – bicycle parking – logit – cycling facilities
INTRODUCTION

Planners and transportation specialists are aiming to improve pedestrian and cycling infrastructure in an attempt to promote urban futures that are not heavily reliant on the personal automobile. Many cities have adopted policies that promote active modes of transportation such as walking and cycling due to their positive environmental, economic, health and social benefits (1-2). While much of the recent research in active transportation aims to understand cyclists’ experience and satisfaction with the built environment, few studies evaluate their opinions about the security and availability of bicycle parking facilities. Facilitating an increase in bicycle mode share requires planning both terminals (parking facilities) and cycling networks (paths and lanes). This research aims to better understand bicycle theft and tries to fill the gap concerning the safety and availability of bicycle parking facilities. As bicycles become a more popular form of transportation, planners and transportation researchers will need to consider how to create urban spaces that encourage cycling and discourage bicycle theft.

This paper recognizes that a major concern for cyclists is bicycle theft and therefore seeks to answer five basic questions: 1) who are the victims of bicycle theft; 2) where does bicycle theft occur most frequently, and where is it perceived to occur most frequently; 3) what kinds of bicycles are most commonly stolen; 4) how are bicycles most commonly stolen; and 5) when are bicycles most likely to be stolen; as well as examining trends. The data for this research is a result of a detailed online survey conducted in Montreal, Quebec, Canada specifically for this purpose. The survey included demographic, travel and parking behavior, theft history, and spatial questions to better understand the factors influencing bicycle theft in Montreal. Although the paper answers specific questions in relation to bicycle theft in the Montreal region, transportation planners in other cities can benefit from the findings as it gives some insights about the nature of bicycle theft as well as the attitudes of cyclists towards this issue.

LITERATURE REVIEW

As cities continue to propose transportation plans that encourage the use of bicycles as a sustainable alternative to the automobile, and bicycles become an increasingly popular form of transportation, planners and transportation researchers need to be aware of the growing opportunities for bicycle theft. The monetary value, availability, and utility of the bicycle have made it become a popular target for theft. Findings from the International Crime Victim Survey (ICVS) indicate that bicycle theft is the highest per bicycle owner in cities where bicycles are most popular and that from the 30 cities included in the study, cyclist are (slightly more than) four times as likely to be victims of bicycle theft than are automobile owners to be victims of automobile theft (3).

Gamman, Thorpe, and Willcocks (4) claim that thefts are not properly recorded to the police because they are often seen as being a low crime priority. Johnson, Sidebottom, and Thorpe (5) state that bicycle theft is a crime that frequently goes unnoticed and is largely
unchallenged. Although no academic attention has been given to the underreporting of bicycle theft in the literature, many respondents in the Montreal Bicycle Theft Survey indicate that they did not report the crimes due to doubt that police would act on these instances of crime. While there is little academic research about bicycle-related crime, several studies have identified that bicycle theft is a problem for cycling communities (4, 6-8).

Within a Chinese context, Zhang et al. (7) used data collected in the city of Tianjin to explore social and legal aspects of bicycle theft victimization. The authors focused on neighborhood deviance and crime levels, and found that neighborhood poverty level is a significant risk factor in bicycle theft victimization. Gamman et al. (4) focused on the need for bicycle-specific and theft-preventing urban design in the UK and elsewhere in Europe. These authors suggested best practice policies to increase the security of bicycle parking facilities. Meanwhile, Sidebottom et al. (6) conducted a study in London and Brighton, UK, aiming to understand whether instructional stickers placed on bicycle parking facilities would encourage cyclists to park and lock their bicycles more securely in public spaces. Bachand-Marleau et al. (8), in their research on bicycle and transit integration in Montreal, found that 20% of surveyed Montreal cyclists reported a lack of appropriate parking facilities or mentioned fears about theft.

Many studies have assessed cycling behavior and cyclists’ preferences of bicycle specific infrastructure (such as bicycle lanes, boulevards, and paths) (9-14). However, the abovementioned studies are unique in identifying that with a rise in bicycle mode share comes and increase in the opportunity for bicycle theft, thereby increasing the need for secure bicycle parking facilities. This study specifically contributes to the literature by providing a narrative on bicycle theft in Montreal and by evaluating cyclists’ opinions about the security and availability of bicycle parking facilities in the region.

DATA AND METHODOLOGY

The City of Montreal endeavors to increase cycling mode share in the region by developing bicycle facilities throughout the area (15). According to the 2008 Origine-Destination (OD) survey, which is a regional transportation survey that is conducted every five years, the mode share for cycling in the region of Montreal is 1.2% of all trips (16). This mode share resembles the national average. To increase the overall mode share of bicycle trips, Montreal’s 2008 Transportation Plan encourages cycling for basic transportation as a part of the development program for reinventing Montreal within the next ten years (15). The city’s transportation plan includes goals that involve interventions for both increasing the bicycle path network and improving bicycle parking facilities. These goals include doubling the length of the cities’ bicycle paths, updating the existing cycling network, and increasing the number of bicycle racks by 500% by means of public-private partnerships.

According to the Service de police de la Ville de Montreal (SPVM), the city’s police department, an average of approximately 2,500 bicycles are reported stolen every year. The
SPVM believes this number represents only a small proportion of all bicycle thefts taking place in the region (17).

To better understand bicycle theft in and around Montreal, a bilingual online survey was conducted in the region. Given the limitations of online surveys, particularly for overrepresentation of certain groups, a variety of media were used to ensure a broad cross-section of the public was reached. The survey was publicized through a combination of email newsletters, mailing lists, several newspaper articles in French and English, a radio interview, and various social networking media. Flyers advertising the survey were distributed to several bicycle shops throughout the region. These measures, as recommended by Dillman, Smyth & Christian (18), allowed for a broader exposure and reduced sample bias, thus minimizing the bias that can be associated with online surveys. The survey was available online for approximately one month in the late spring of 2012, and it yielded a total sample of 2,039 individuals. This is approximately equivalent to the number of home-based cycling trips recorded in the regional travel survey, which covers 5% of the region’s population (16).

As mentioned earlier, this paper tries to answer several questions in relation to bicycle theft. The first question asks who the victims of bicycle theft are. This question is answered through a description of the survey participants and the differences between cycling theft victims and non-victims. Basic socio-demographic information about the survey participants is presented through a series of summary statistics. This is followed by a binary logit model, which incorporates variables pertaining to socio-demographic status, commuting habits, and bicycle and lock characteristics, and which is used to demonstrate which of these factors most influence survey participants’ likeliness to have had their bicycle stolen.

The second question concerns where bicycle theft occurs most frequently, and where is it perceived to occur most frequently. Answering this question involves using a geographic information system (GIS) software to highlight experienced and expected bicycle theft locations on the Island of Montreal. This is followed by a short discussion about the differences between actual and perceived instances of theft. Cyclists’ perceptions and preferences about bicycle parking facilities are also analyzed.

The third, fourth and fifth questions attempt to understand what kinds of bicycles are most commonly stolen, how bicycles are most commonly stolen, and when bicycles are most likely to be stolen, respectively. These questions are answered through a series of descriptive statistics. Figures are used to highlight key findings and to better understand relationships between variables. Also, a brief examination of bicycle recovery is included as are suggestions to improve the security and availability of bicycle parking. The paper concludes with recommendations and suggestions for further research.
WHO

Montreal bicycle theft survey participants

The respondents’ ages range from 18 to 85. However 68.9% are 40 years old or younger. Men, accounting for 58% of the respondents, are slightly underrepresented, compared to OD survey figures. The majority of respondents are employed full-time and have completed at least an undergraduate degree. Participants generally live in two person households and 82.3% of participants live in households with fewer than four people. Almost all survey participants (98.7%) have made at least one commuting trip by bicycle in Montreal during the last year. Around 50% of the participants were subjected to a bicycle theft in their life time as active cyclists. This finding resembles previous studies’ (19).

Factors associated with theft

The binary logit model below is used to further understand how individuals’ habits, choices, and socio-demographic status relate to the likeliness of having been a victim of a bicycle theft. The output of the logit is reported in Table 1.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Coefficient</th>
<th>t-stat</th>
<th>Odds Ratio</th>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used bicycle</td>
<td>-.227</td>
<td>.761</td>
<td>.797</td>
</tr>
<tr>
<td>Value between $500-$1500</td>
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<td>85.065</td>
<td>.083</td>
</tr>
<tr>
<td>Value more than $1500</td>
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<td>21.816</td>
<td>.105</td>
</tr>
<tr>
<td>Registration:</td>
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</tr>
<tr>
<td>Chose not to register</td>
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<td>4.028</td>
<td>.442</td>
</tr>
<tr>
<td>Did not know about registering</td>
<td>.142</td>
<td>.145</td>
<td>1.152</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U-lock</td>
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<td>107.765</td>
<td>.005</td>
</tr>
<tr>
<td>Cable lock</td>
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<td>18.931</td>
<td>.120</td>
</tr>
<tr>
<td>Chain lock</td>
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<td>21.790</td>
<td>.076</td>
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<tr>
<td>Bicycle kept inside</td>
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<td>39.718</td>
<td>.106</td>
</tr>
<tr>
<td>Other locks</td>
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<td>36.080</td>
<td>.019</td>
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<td></td>
<td></td>
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<tr>
<td>Year round cyclist</td>
<td>.643*</td>
<td>4.275</td>
<td>1.903</td>
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<tr>
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<td>.070</td>
<td>.051</td>
<td>1.072</td>
</tr>
<tr>
<td>Commuting for 7-10 yrs</td>
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<td>2.006</td>
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<tr>
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</tr>
<tr>
<td>Constant</td>
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<td>39.216</td>
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</tr>
</tbody>
</table>

All values in Canadian Dollars

Dependent variable: stolen bicycle

*95% significance **99% significance
Since participants were not obliged to answer all questions in the survey, for the purpose of the logit model, the original data had to be scaled down to a final sample size of 1012 cyclists. If a participant’s bicycle had been stolen, the value of the stolen bicycle or the lock used to lock the stolen bicycle was input into the database; if a participant had not been a victim of bicycle theft, the value of their current bicycle or the lock currently used was input into the database. By using commensurate data describing both participants who have and have not been subject to bicycle theft, including the bicycles (and locks) that were or were not stolen (or overcome), the model is able to determine how the different factors influence a cyclist’s likeliness to have had their bicycle stolen.

The model possesses a reasonable amount of explanatory power (Cox & Snell R square = 0.54, Nalgelkerke R square = 0.73), and its variable coefficients show the expected relationship directionality (positive or negative). It indicates that bicycle value, awareness about registration, lock type, exposure, and gender are statistically significant. High value bicycles are less likely to have been stolen. This is further illuminated in Figure 1. Participants were asked whether they registered their bicycles, both stolen and current.

![Figure 1: Difference in values between stolen and current bicycles](image-url)
The model reports that cyclists who did not register their bicycles were 55.8% less likely to have been victims of bicycle theft than cyclists who did register their bicycles. This could be due to cyclists who knew about registration but consciously chose not to register their bicycles being more aware of the risk of theft, bicycle security, and locking techniques. Another hypothesis is that cyclists who did register their bicycles experienced a false sense of invulnerability and became more careless with bicycle security after registration.

The model makes very clear that using a lock significantly decreases a cyclist’s likeliness to have been a victim of bicycle theft compared to not using a bicycle lock. Of the different kinds of locks, U-locks are found to decrease the likelihood of bicycle theft more than other lock types. Figure 2 shows use frequencies for common types of locks on stolen and current bicycles. The category “other locks” accounts for the many different types of locks cyclists used, such as wheel and combination locks, not specifically named in the logit model.

Figure 2: Comparison of locks used on stolen bicycles and locks used on current bicycles

Surprisingly, around 8.5% of the survey respondents did not use a lock at the time when their bicycle was stolen. They did not keep their bicycles inside or on their porch either. In other words, these bicycles were unprotected and unlocked. Also, 10% of all surveyed cyclists did not have a lock at the time when their bicycle was stolen.

Although the model appears to rank bicycle value and lock types, it is important to understand that the likeliness for a cyclist to have had their bicycle stolen depends not only on the variables presented in the model, but also on factors not expressed by the model. Factors such as bicycle parking location, the duration that the bicycle was left unattended, and how the bicycle was locked, are not included in the model but might influence bicycle theft. Data about these factors is only available for the stolen bicycle from the 2012 Montreal Bicycle Theft Survey, and therefore cannot be included in the logit model.

Exposure is controlled for in two manners: by comparing participants who cycle twelve months of the year to participants who do not, and by reporting how many years cyclists have been commuting regularly. Year-round cyclists’ likeliness to have been a victim of bicycle theft is 90.3% higher than that of cyclists who do not cycle every month of the year. Similarly, as the
number of years that a cyclist has regularly been commuting increases, so does his or her likeliness to have been a victim of bicycle theft. These factors indicate, as expected, that the longer a bicycle is exposed, the more likely it is to be stolen.

Most notable among socio-demographic characteristics, females are found less likely to have had a bicycle stolen. Although the male-female ratio, 58%-42%, is the same for survey participants generally and theft victims, being female is shown in the model to significantly reduce the likelihood of bicycle theft. Females seem to be, then, disproportionately represented in other higher-likelihood factors, such as riding an inexpensive bicycle or using no lock. Several survey respondents wrote of women’s bicycles seeming less attractive to thieves.

Other variables that were available for both stolen and non-stolen bicycles that were not included in the model either were not theoretically meaningful, tested to be insignificant in the model, or had high levels of correlation with the existing variables in the model. While only including a small number of variables, the model does make clear that bicycle value, lock type, and exposure time are the most significant factors in determining a cyclist’s likeliness to have been a victim of bicycle theft.

WHERE

Experienced and perceived theft

Data about Montreal cyclists’ home-based bicycle trips from the 2008 Origine-Destination (OD) survey helps establish cycling frequencies that are needed in order to determine where on the Island of Montreal bicycle theft is most prevalent (16). This data provides the origin locations of 2719 cyclists and the destination locations of 2742 cyclists on the Island of Montreal. The difference between origin and destination counts is explained by cyclists commuting from areas that are located off island to the Island of Montreal.

The Montreal Bicycle Theft Survey provides data about participants’ home location and bicycle theft location. It does not, however, provide information about where participants usually park their bicycles on a daily basis. To understand the destination points of cyclists in the Montreal Bicycle Theft Survey, the ratio between the origin and destination points of cyclists in the OD survey is applied to calculate the ratio between home location and destination points of cyclists in the Montreal Bicycle Theft Survey at the police district level of analysis.

Although it is most common to collect and analyze data at the borough level, police districts have been used to analyze instances of theft because they are both smaller than boroughs and represented by SPVM stations that are responsible for handling crime within their respective police districts. While 49 police districts exist on the Island of Montreal, there are only 19 boroughs. Police districts can therefore more closely describe theft trends at the neighborhood level.

To standardize the number of thefts per police district, the z-score of the total number of thefts per police district is divided by the sum of participants’ home locations and expected
destinations per police district. The standardized thefts per police district are mapped by z-score (Figure 3).

Figure 3: (a) Bicycle thefts within the five-year period between June 2007 and May 2012 and (b) areas on the Island of Montreal known for having high instances of theft.

These maps represent bicycle theft on the Island of Montreal within the five-year period between June 2007 and May 2012 as well as the areas that survey participants identified as being
known for having high instances of theft (similarly standardized to expose differences between infrequently bicycled districts).

The highest z-score is observed in the downtown police district. This is followed by neighboring police districts and the southwestern end of the island. Actual theft counts were over twice as high in the Lower Plateau, a trendy and densely populated neighborhood bordering downtown to the north, as anywhere else, but were tempered by very high rates of bicycle use. Conversely, the high rates featured for sprawling West Island neighborhoods largely reflect very low ridership.

When asked to identify which areas of the city were known to have high instances of bicycle theft, cyclists’ responses broadly matched the measured reality, showing a degree of theft awareness, but there were some notable differences. Old Montreal, to the downtown’s east, was perceived as having incidences as high as the downtown, but suffered fewer actual thefts, both in absolute and standardized terms. This pattern of imagined theft occurring farther east (and north) than actual theft can be seen on a larger scale across the island and might reflect conceptions of higher density or lower income areas (similarly situated) as being less safe than wealthier suburbs. Most dramatically, Montréal Nord, a traditional immigrant neighborhood far north of downtown, is perceived as a high instance area (after standardization), despite a total absence of thefts reported in that district.

The apparent disconnect between actual and perceived theft locations suggest that some cyclists might underestimate risk of theft in their own neighborhoods. In general, survey participants perceive bicycle theft to occur most frequently at least 5.5 kilometers from their home location. The actual average distance from participants’ home locations to the reported theft locations, however, is 3.2km (for thefts that occurred between June 2007 and May 2012).

**Bicycle Parking**

Johnson et al. (5) claim that parking and locking habits are closely related to risk of bicycle theft. According to their report, lock type and application, as well as where and to what a bicycle is locked, are the key factors most likely to influence bicycle theft. With regard to bicycle parking, Sidebottom et al. (6) claim that there is a need for increased locking facilities based on the observation that nearly half of the parked bicycles in their study were ‘fly-parked’. Fly-parking, a term coined by Adam Thorpe, refers to the securing of bicycles to street furniture not intended to function as parking facilities (4). It reflects the appeal of being able to move through the city freely and experience parking near destinations, eliminating the spatial restrictions that are often attributed to the automobile (4). The data in our survey corroborates Sidebottom et al.’s (6) finding that nearly half of all stolen bicycles were stolen from fly-parking locations. There appears to be, therefore, a need for an increase in bicycle locking facilities in Montreal.

The Montreal Bicycle Theft Survey asked participants to evaluate six different types of bicycle racks with regard to security (Figure 4). While racks one to five are found in Montreal, rack six is not publically available in the city. Rack four has the lowest ranking; it has visibly thinner metal bars and is not secured to the sidewalk. Rack six has the highest ranking; it
functions as a bicycle locker in which the entire bicycle is stored. In response to a question about which factors cyclists look for when they are locking their bicycle, ease of locking and proximity to destination point are the most highly regarded factors. A place being officially designated as bicycle parking is also deemed important. Cyclists who value parking places that are well lit so that their bicycle is easy to see tend to rank racks two and three higher than the other available rack types in terms of security. In Montreal, these racks tend to be located on the sidewalks of commercial streets, in areas with high levels of pedestrian and cyclist movement.

Figure 4: Bicycle racks

As well as rating bicycle rack types, survey respondents characterized general bicycle parking security and availability at five types of locations: at metro stations, near home, near work or school, in the downtown area, and by grocery stores. Parking security near work or school appears relatively good, with 60% of responses favorable (either “satisfied” or “very satisfied”), compared to rates around 30-35% for other location types. Even work or school locations, however, show room for improvement, with 20% “unsatisfied” or “very unsatisfied” responses. Parking availability, similarly, appears better at work and school than elsewhere: about 55% favorable compared to corresponding scores around 25-35%. As with security, work and school parking availability could be improved, though. Nearly 30% of respondents were “unsatisfied” or “very unsatisfied”.

Thirty-five percent of written suggestions at the end of the Montreal Bicycle Theft Survey involve parking racks. A factor that might inform decisions about new bicycle parking is
cost, and relatedly, cost sharing. Many people were unwilling to pay for secure bicycle parking, for reasons such as cost (39.0% of those unwilling), felt necessity (34.9%), or principle (19.4%). “The goal of biking, among others, is to save money”, wrote one study participant. A large minority of respondents (37.2%), however, indicated that they would pay something for such improved facilities. Responses suggest that either $1.00 or $2.00 would be ideal rates, at 29.8% and 16.0% acceptability, respectively. Popularity appears to drop off immediately as each dollar value is exceeded, at only 18.4% willing to pay $1.25 and 7.0% at $2.25. These rates are low in comparison to those paid for automobile parking, and secure bicycle parking, such as that pictured as Rack 6 in Figure 4 would likely require some subsidy. Compared to automobile parking, however, secure bicycle parking takes much less space per vehicle, and it encourages use of the preferred transportation mode, working to reduce costly traffic congestion while contributing to an active, healthy population and workforce.

WHAT

Stolen bicycles and bicycle parts

The most frequently stolen bicycles are new bicycles that at the time of the theft were valued between $150 and $500 (27% or 256 of 961 total stolen bicycles). Used bicycles in the same price range (15%) and new bicycles valued between $500 and $1000 (16%) were the second most frequently stolen. Many more used bicycles priced at under $150 (28%) were stolen compared to new bicycles (1%) in the same price range. Around 36% of participants claimed that they did report their thefts to the police. Of the participants who did not report their theft, the majority reported that they did not think it was worth the effort. Only 8.5% of bicycle theft victims had registered their bicycle, and of these people 26.8% did not record the serial number (which would allow victims to positively identify their bicycle on sight). The survey asked participants if they had photos of their bicycle that they could give to the police to assist in an investigation; merely 27.8% of participants reported that they possessed photos for this purpose. Johnson et al.(5) also report that the majority of bicycle owners cannot provide enough supporting documentation to support in an investigation. The proof-of-ownership problem must be addressed to improve the police’s likeliness to recover stolen bicycles and return them to their legitimate owners. Only 2.4% of survey respondents’ stolen bicycles had been recovered.

Not only do victims rarely recover their bicycles, but they often have replacement bicycles stolen as well. While only 961 respondents (about 50%) had been victims of bicycle theft, the total number of bicycles stolen was at least 1890, owing to high numbers of multiple theft victims and thefts from some victims. A majority (525 respondents) had only once lost a bicycle to theft, but nearly 20% had been victims three times or more. Theft of bicycle parts is about half as frequent overall, but displays a similar pattern of multiple theft victims. The most frequently stolen parts are accessories (40.3%), seats (30.1%), and wheels (20.1%), with handlebars, frames, pedals, breaks, and other parts each stolen in less than 5% of cases.
HOW

Theft technique

Most bicycle theft victims surveyed (52.3%) do not know the means by which the most recent theft occurred. A sizeable minority (20.5%), however, report that their bicycle was simply picked up and moved, echoing the importance of locks evidenced by the logit model. Other commonly reported means include bolt cutters (10.3%), hacksaws (4.5%), and crowbars (2.3%). As was mentioned earlier, 8.5% of victims did not lock their bicycle.

The theft of bicycle parts can be more easily explained. Only 27.6% of responding victims of parts theft do not know how it happened. Screwdrivers (8.5%), wrenches and Allen keys (4.1% each) are the leading part theft tools reportedly used, but 51.5% of parts theft events described required only pulling the part(s) off. Unfortunately, 60.6% of respondents currently leave removable bicycle parts unlocked. Substantial reduction in theft of removable bicycle parts might be achieved if locking them becomes the norm.

WHEN

Seasonality and time of day

Cycling and theft are both most frequent in summer months. Considering all bicycle thefts reported in the survey, findings illustrate that every calendar month between 2 – 10% of cyclists on the road had been victims of bicycle theft. Survey participants could report multiple months for riding, but they could not for theft, as detailed information was only collected on the most recent bicycle theft event and / or bicycle part theft event, as applicable. The actual rate for cyclists ever having had a bicycle stolen is about 50%, roughly double the rate for bicycle parts. Figure 5 makes clear that a greater number of bicycles are stolen in months when more bicycles are being used. The size of the circle illustrates the number of thefts while its position indicates the number of participants who cycle in a given month. Theft of bicycle parts shows a similar pattern.
Figure 5: Number of cyclists and number of thefts per month

Bicycles are more frequently stolen during the night (37.0%) than in the morning (9.0%), afternoon (32.3%) or evening (21.7%). In the comment section at the end of the survey many people state that bicycles should not be left on the street at night. One participant claimed that her “last bike was locked to a bike rack outside [her] apartment with a high security U-lock, yet it was stolen overnight. [Now, she is] forced to bring [it] into [her] apartment every night, which is a nuisance”. Almost as frequent, however, is afternoon theft (the most frequent time for bicycle parts theft), and over three fifths of bicycle thefts happen at some point during the day, when bicycles are likely to be parked at a destination other than the rider’s home and are presumably visible to passers-by. There is, therefore, substantial potential for theft reduction by improving bicycle parking facility provision and locking habits.

Before and after bicycle theft

Many current cyclists have at one or more times been victims of bicycle theft, rarely to see their rides returned. While this fact is itself unsettling, it is possibly more problematic, for those attempting to increase regional bicycle commute mode share, that some victims do not replace their stolen bicycles (7.3%). An interesting counterpoint is that among those who do, or who have their stolen bicycle recovered, 24% report increased cycling, compared to 15.5% who cycle less and 60.5% who report no change. One explanation is that replacements for both new and used stolen bicycles are more often new than used, and are possibly better suited to riders’ travel needs, enabling use for longer or more difficult trips. Unclear from this study (because the vast majority of respondents do commute by bicycle or have done so), is the degree to which rampant theft discourages non-riders from attempting bicycle commuting.
Bicycle theft victims who continue cycling appear to make efforts to adapt and reduce their risk of further theft. Around 61.1% of theft victims subsequently change the type of lock that they use. Of bicycles that were replaced or recovered, only 3% are usually left unlocked and 71.1% are currently locked with U-locks. Less than a quarter of parts thefts motivate a lock type change, but this does not necessarily indicate irresponsiveness, as victims might improve technique, fastening some removable parts and taking others with them into destinations.

Bicycle registration, although shown in the logit model to relate positively with stolen bicycles, stays at 8.5% for both stolen bicycles and theft victims’ current bicycles. However, only 40.2% of those who had registered their stolen bicycles chose also to register their current bicycles, evidencing a lack of faith among those who have had personal experience with registration.

**Bicycle recovery**

Of all stolen bicycles, as mentioned above, only 2.4% had been recovered. This small sample size reduces the reliability of information that characterizes recovered bicycles in comparison to unrecovered bicycles. However, some statistics appear relevant and bear mention. Two thirds of recovered bicycles were reported stolen, compared to only 34.8% of unrecovered bicycles. Recovered bicycles had been photographed 37.5% of the time and 12.5% were registered, in contrast to unrecovered bicycles (26.8% photographed and 8.2% registered). Reporting a bicycle theft should, and does, substantially improve the likelihood of recovery (testing significant at the 99% confidence interval), if still to a very low rate. photographing and registering bicycles also appear to have some positive effect, although the numbers involved are too low to make a strong claim. It is interesting that a third of recovered bicycles were not reported stolen: perhaps respondents recovered them on their own. Most compelling, however, is the evidence that, while measures such as reporting, photographing, and registering bicycles might improve chances of recovery, they offer little assurance that a bicycle will be returned. While only 22 stolen bicycles (2.3% of most recent thefts) were reported stolen, registered, and photographed, indicating substantial room for improvement on the part of owners, not one of these bicycles had been recovered at the time of the survey, suggesting currently insufficient police attention to bicycle theft that is echoed in 24% of written comments.

**DISCUSSION**

This research makes clear that public agencies should act to prevent theft by adding bicycle parking capacity and ensuring that parking facilities are strong (thick metal well-anchored), easy to properly use (locking to bicycle frame and removable parts), visible, and located near destinations such as work, school, shopping, and recreation. Improvements to bicycle parking facilities should also include removing unsafe racks and installing alternative racks that are secured to the ground and feature thick metal bars at an appropriate height for easy and effectual locking. Another action that public agencies can take to help reduce bicycle related
crime, is to fit both new and existing racks with prominent signage showing proper locking
technique, and to offer workshops or audio-visual materials to schools and other organizations
that provide information about bicycle theft prevention, stolen bicycle recovery, and registration.
Locations most in need of bicycle parking improvements were areas known for high rate per
rider. It is important to note that bicycle parking improvement should be determined based on
field observations of existing rack quantity, quality, and vacancies, not only base don theft
statistics.

Theft can likely be reduced by using better locks, securing removable parts, and
practicing safe locking techniques. Although public agencies in cities are advised to take leading
roles in bicycle theft prevention, cyclists must recognize that bicycles are likely targets of crime,
and take preventative actions by always locking their bicycle and ensuring that frames, as well as
easily removable parts, are secured. While the police should improve the transparency of bicycle
theft investigation procedures, cyclists should register and photograph their bicycles, and report
instances of theft to the police to improve the chance of recovery.

CONCLUSIONS
This research has attempted to understand bicycle theft by asking 1) who are the victims of
bicycle theft; 2) where does bicycle theft occur most frequently, and where is it perceived to
occur most frequently; 3) what kind of bicycles are most commonly stolen; 4) how are bicycles
most commonly stolen; and 5) when are bicycles most likely to be stolen. With regard to
understanding who the victims of bicycle theft are, the most striking finding is that over 50% of
participants were subjected to a bicycle theft in their life time as active cyclists. The logit model
makes clear that the monetary value of a bicycle, lock type, and a cyclist’s gender influence his
or her likeliness to have been a victim of bicycle theft. Thematic maps make clear where thefts
occur, and where thefts are perceived to occur. The maps illustrate that theft rates are, and are
perceived to be, most prominent in the downtown police districts. However, there appears to be a
disconnect between actual and perceived theft locations in many regions, which suggests that
some cyclists might underestimate risk of theft in their own neighborhoods.

The majority of theft victims had only once lost a bicycle to theft, but nearly 20% had
been victims three times or more. Theft of bicycle parts is about as frequent overall, but
displays a similar pattern of multiple theft victims. Concerning what kinds of bicycles are mostly
commonly stolen, the results show that the most frequently stolen bicycles are new bicycles,
which at the time of the theft were valued between $150 and $500. Many more used bicycles
priced at under $150 were stolen compared to new bicycles in the same price range. Although
cyclists are generally aware of how parts were stolen from their bicycles, the means by which the
most recent theft of a whole bicycle occurred is unknown for the majority of victims.

With respect to understanding when bicycles are most likely to be stolen, theft evidently
occurs most frequently in months when more bicycles are being used. Because the majority of
thefts occur during the day, when bicycles are likely to be parked at a destination other than the
rider’s home and presumably visible to passers-by, there is substantial potential for theft
reduction by improved bicycle parking facility provision and locking habits. Pertaining to
bicycle parking facilities, respondents are largely unsatisfied with current parking facility
security and availability at most destinations, and some rack types are perceived as being more
secure than others.

In future studies it would be interesting to track changes in theft frequency from year to
year. In the current study, over a quarter of both complete bicycle thefts and partial bicycle thefts
were reported to have occurred in 2011 and 2012, despite theft events being mentioned as long
ago as 1990 or earlier. However, because respondents only detailed the most recent theft (as well
as noting the number of thefts they have experienced), previous incidents for victims of multiple
thefts are not dated and underrepresented. Additionally, people who had been bicycle theft
victims in Montreal in the distant past are more likely than recent local victims to have since
moved out of the region and not filled out the survey. Subsequent bicycle theft surveys might
benefit by including questions for timing of all thefts, rather than just the most recent, as well as
amount of time having lived in the chosen region and at the current address. Future research
should also include putting the collected data to more extensive use, by modeling the
relationships between the characteristics of the victims, as well the observed differences between
the reported and perceived locations of bicycle theft.

This research, based on a survey of cyclists in Montreal, Quebec, Canada provides new
insights into understanding bicycle theft. The main findings from this study can not only be
useful to better understand and ultimately decrease bicycle theft in Montreal, but can also be
beneficial for cyclists, police, and policy makers in any city aiming to decrease bicycle theft. The
creation of urban spaces that encourage cycling and discourage theft nurtures Montreal’s cycling
culture and encourages the use of the preferred transportation mode, working to reduce costly
traffic congestion while contributing to an active, healthy population and workforce.

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1 REFERENCES


