The Oxford & Cambridge Cycling Survey

A large-scale study of bicycle users in two major UK cycling cities

Published by Oxfordshire County Council, 13 June, 2005

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1. Introduction

The Oxford and Cambridge Cycling Survey was commissioned by Oxfordshire County Council and conducted by Dr Ian Walker from the University of Bath in Spring 2005. The survey was a preliminary step in a programme to improve the cycling experience in Oxford and had two primary aims: first, to fill important gaps in our knowledge of UK cyclists' experiences and practices; second, to compare cycling in the cities of Oxford and Cambridge prior to an intervention aimed at reducing conflict between cyclists and bus drivers in Oxford, in which Cambridge would act as a control city. Partners and stakeholders in this project included:

- Oxford University
- Oxford Brookes University
- Cambridge University
- BMW
- Oxfam
- Oxford City Primary Care Trust
- CTC, the national cyclists' organization
- Oxfordshire County Council
- Oxford City Council
- Cambridge County Council
- Cambridge City Council
- ROSCO
- John Radcliffe Hospital Trust
- Oxford Bus Company
- Stagecoach Oxford

2. Methodology

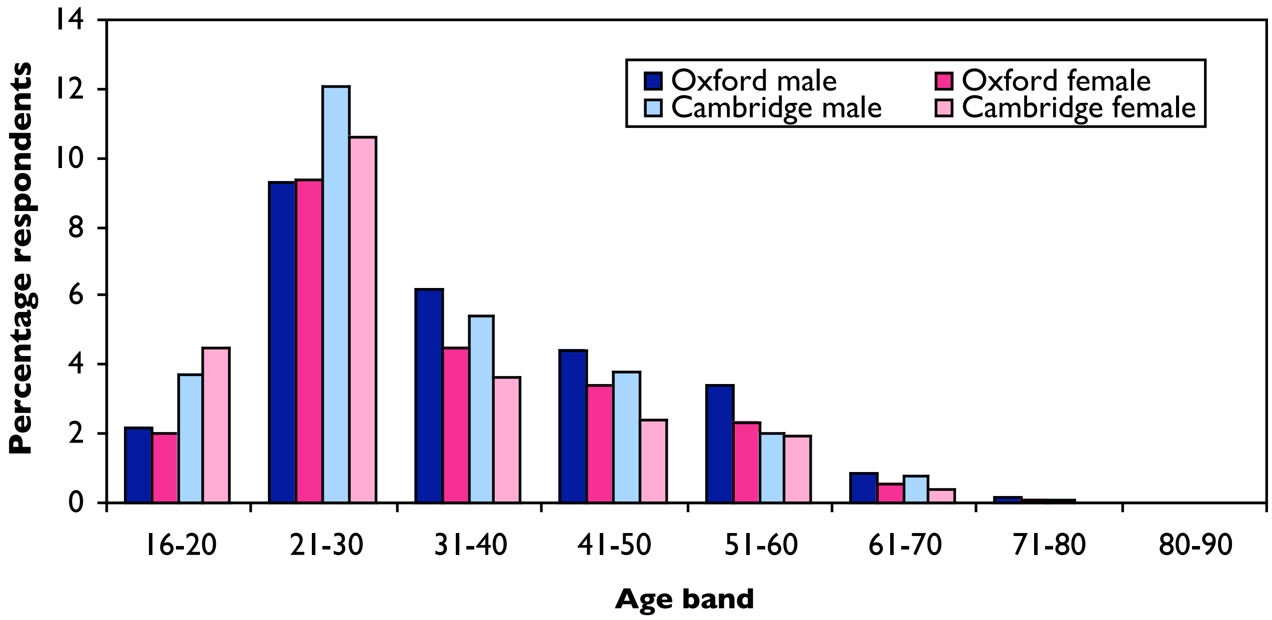
The survey was conducted using both Web-based and paper versions of the same questionnaire. Paper questionnaires and/or information about the on-line survey were distributed to a range of workplaces, including those named above, chosen to cover a representative sample of the cities' cyclists. Questionnaire items were chosen based on an analysis of existing literature and statistics (including police road accident data) and expert consultation. The survey collected data over a period of approximately 5 weeks.

The questionnaire was divided into eight sections: (1) people's general experiences of cycling; (2) information about the bicycles people use and (3) how they maintain them; (4) bicycle handling skills and (5) traffic skills; (6) accident statistics; (7) frequency of and reasons for illegal cycling behaviours; and (8) demographic information.

In total, there were 42 questions on the survey. As an incentive for participants to complete the form, everybody who returned a questionnaire was entered into a draw to win one of 10 record vouchers. Although this draw necessitated people providing contact details, these were removed from the form as soon as it was received so that the questionnaire responses remained anonymous.

Key findings

- Close to 5,000 people returned a survey form. The peak age range of respondents was 21-30.
- The most common reasons for bicycle trips were commuting and shopping.
- The longest journey a person regularly made by bicycle was, typically, 3.3 miles.
- The clear majority of bicycles were traditionally framed, with derailleur gears, rim brakes, and battery lamps front and rear.
- Men were substantially more likely than women to carry out routine maintenance on their bicycles.
- One-third of respondents had experienced an accident in the past year, 72% of which resulted in no actual injury.
- 61% of seriously injurious accidents (and 93.8% of all accidents) were not reported to authorities. Even for serious accidents caused by a motorist, less than one-third were reported.
- Women have been found more likely than men to experience certain types of serious accident; accordingly, they reported being substantially less able to look back over their shoulders and to tell when it is safe to pull into traffic.



3. Results

A total of 4,771 responses were received, which is an excellent response for a survey of this type. These data therefore provide an important and reliable snapshot of how bicycles were used at the time of the survey. Of the 4,771 responses, 2,433 (51%) came from Cambridge and 2,338 (49%) came from Oxford. As the great majority of responses (92.5%) came from the on-line version of the questionnaire, it seems that any future survey of this sort would likely most efficiently be conducted on-line only.

3.1. Demographics

The percentage of respondents by gender and age band is shown in the graph above. From this figure we can see that more men returned a questionnaire (54.4%) than women (45.6%). There was a peak of responses from the 21-30 age group which presumably reflects a greater tendency for this age group to cycle, as well as a possible response bias caused by people of these ages being most likely to have easy Internet access in their places of work or study.

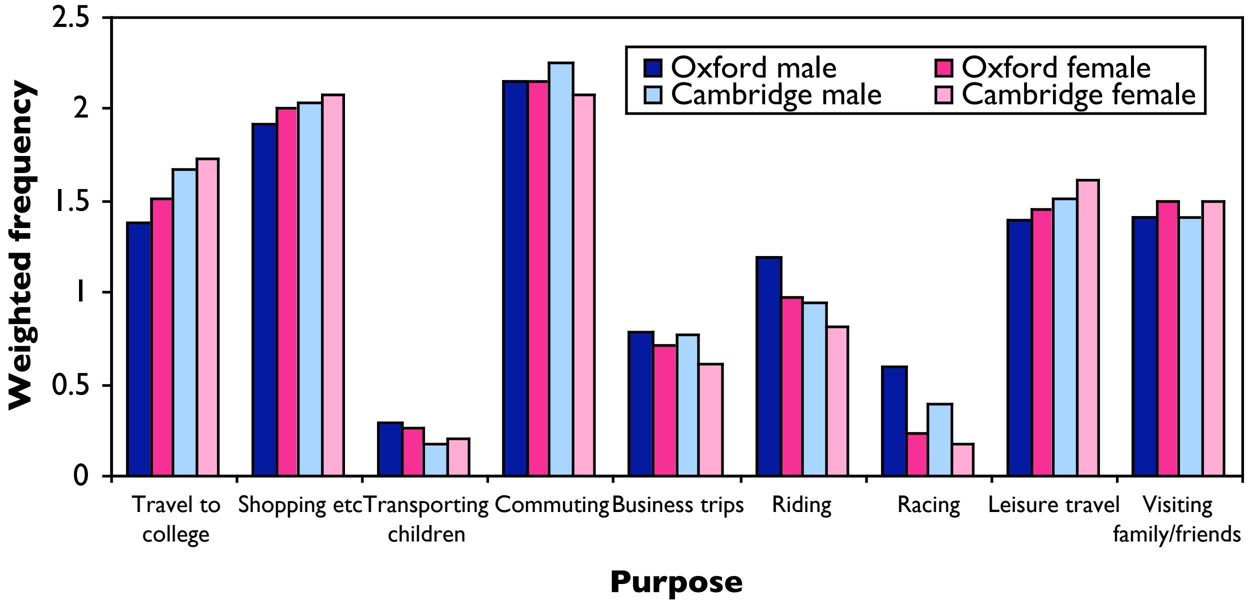
The graph seems to suggest that Cambridge's cyclists tend to be younger, on average, than the cyclists of Oxford. However, this may be due to a higher response from Cambridge University undergraduates.

3.2. The experience of cycling

3.2.1. Purpose

The graph overleaf shows how often respondents reported using bicycles for various purposes. The scores were calculated by weighting responses to reflect how often bicycles were used for each task. People who reported using a bicycle for a particular purpose "daily" contributed three points, people who used a bicycle for a particular purpose "weekly" contributed two points, and people who used a bicycle "occasionally" contributed one point. Total scores were then averaged by the number of respondents in each category.

From this graph we can clearly see that bicycles tend to be used as a means to an end rather than as an end in themselves. That is, they are mostly used for commuting, shopping, travelling to college, travelling to leisure destinations (e.g., gymnasia, cinemas, pubs), and visiting friends and family. It seems that overall, men are more likely then women to make business trips by bicycle, to ride for pleasure and, particularly, to



race. Women are more likely than men to use bicycles for shopping, leisure travel, and visits to friends and family.

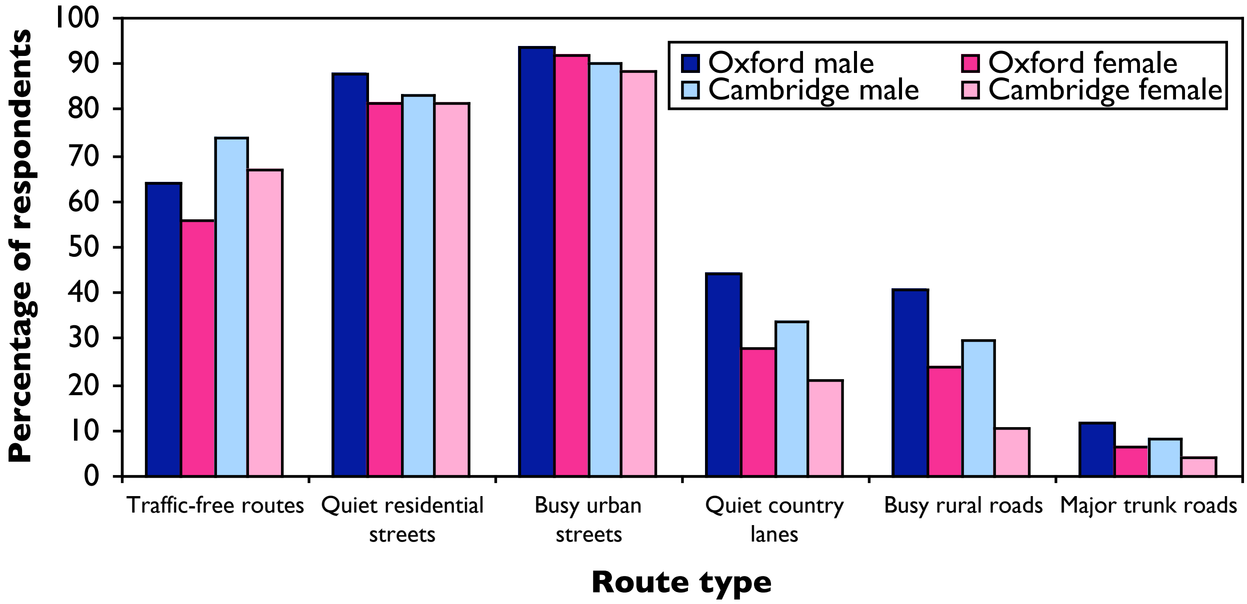
Cambridge residents cycle to college, to shops and to leisure destinations more than Oxford residents whereas Oxford residents appear more likely than their Cambridge counterparts to use a bicycle as an end in itself, reporting substantially more recreational riding and racing.

3.2.2. Route choice

Respondents were asked about the routes they generally used for cycling. The results are shown in the graph below, which reveals how often each category of cyclist reported using each type of route. The results are probably what we should expect given the utility focus of most journeys. That is, because people are usually cycling to get to places rather than for pleasure, routes are chosen for speed and convenience rather than their appearance or traffic status. This is shown by the frequent use of busy urban streets, for example, and by the tendency for rural riders to use busy roads almost as much as quiet roads.

3.2.3. Distance

Participants were asked to estimate the furthest distance they regularly travel in a single trip. Distances ranged from fractions of one mile to as much as 850 miles. The distance data were highly skewed, which



means that mean averages are misleading. Median distances are therefore presented here instead.

The median distance overall was 3.3 miles, although the answers to this question varied by city and gender: The median distance for Cambridge men was 3.3 miles, the median distance for Oxford men was 5.0 miles, the median distance for Cambridge women was 3.0 miles and the median distance for Oxford women was 3.3 miles.

3.2.4. The best part of the journey

Cyclists were asked to describe, in their own words, the best part of their usual journey. Responses were coded into 9 categories as shown in the table below.

Category	Oxford male	Oxford female	Cambridge male	Cambridge female	Average
Type of road (e.g., country lane)	32.5%	35.8%	22.2%	27.5%	**29.5%**
Specific place/street	16.2%	19.8%	21.3%	24.1%	**20.4%**
No best bit/no response	13.2%	15.9%	16.7%	9.9%	**13.9%**
Intrinsic satisfaction	13.9%	12.1%	14.1%	12.6%	**13.2%**
"Relief" comment	12.6%	10.6%	12.2%	10.3%	**11.4%**
Physical characteristic (e.g., downhill)	5.0%	8.2%	8.3%	9.6%	**7.8%**
Other	3.0%	2.9%	4.3%	4.4%	**3.7%**
Negative comment (e.g., "it's all bad")	1.1%	1.7%	0.8%	1.4%	**1.3%**
Extrinsic satisfaction	0.2%	0.4%	0.2%	0.2%	**0.3%**

Note. *Extrinsic satisfaction included comments like "knowing I'm saving money" or "knowing I'm not polluting". Intrinsic satisfaction included comments about enjoying the ride, getting exercise, or generally enjoying the experience of cycling. "Relief" comments included "getting there", "surviving", "not being knocked down", and "getting home".*

3.2.5. Top tips

In an open question, each respondent was asked about the best piece of advice they had ever been given on cycling. The 3,805 responses were reduced to 23 categories as shown in the table below.

Category	Oxford male	Oxford female	Cambridge male	Cambridge female	Average
Warnings about other road users	25.6%	26.1%	22.9%	19.3%	**23.8%**
Advice about wearing helmets	9.8%	15.7%	9.9%	20.2%	**12.7%**
Advice about positioning on the road	10.9%	9.7%	13.0%	11.0%	**11.1%**
Technical/technique advice	8.2%	4.1%	8.4%	4.2%	**6.3%**
Other	6.6%	6.4%	5.8%	5.2%	**6.1%**
Clothing tips re visibility	4.8%	6.0%	4.2%	7.7%	**5.5%**
Advice about using lights	6.1%	7.0%	2.9%	5.2%	**5.4%**
General positive comments on cycling	3.9%	3.2%	7.0%	4.8%	**4.6%**
Advice on dealing with buses	2.4%	2.5%	3.7%	5.6%	**3.4%**
Never received any advice	1.8%	1.5%	2.8%	4.3%	**2.4%**
Advice on route selection	2.5%	2.6%	2.0%	1.8%	**2.3%**
Advice about giving signals	2.0%	2.9%	1.5%	1.7%	**2.1%**
Facetious comments	2.9%	1.4%	2.2%	0.4%	**1.8%**
Advice on locking bike	2.6%	1.6%	1.1%	1.4%	**1.7%**
Negative comments re specific places	0.5%	0.7%	2.5%	2.2%	**1.4%**
Other clothing tips	1.3%	0.9%	2.0%	1.3%	**1.4%**
Buy good (quality) equipment	1.5%	0.9%	1.9%	0.5%	**1.2%**
Mechanical advice	1.2%	0.7%	1.1%	0.9%	**1.0%**
Warnings about other cyclists	1.3%	1.0%	0.2%	0.4%	**0.8%**
Affirming cyclist's right to use the road	0.6%	0.6%	1.2%	0.8%	**0.7%**
Totally negative comments	0.4%	0.9%	0.7%	0.4%	**0.6%**
Advice on carrying luggage	0.2%	0.4%	0.1%	0.6%	**0.3%**
Antagonistic comments	0.0%	0.0%	0.3%	0.1%	**0.1%**

It is notable that by far the most common type of advice involved warnings about the dangers of other road users. Another interesting finding is the different emphasis seen between men's responses and women's:

Women were much more likely to give responses concerned with passive safety advice (e.g., using lights, making oneself visible, and wearing helmets) than men were, whereas men were more likely to comment on cycling technique than women. It is worth remembering that more men than women engaged in racing, which would explain this last finding.

3.3. Bicycle characteristics

Participants were asked about the frame, gear system, brake system, and lights on their bicycles. They were also asked how they usually carried luggage.

3.3.1. Frames

As shown in the graphs below, the clear majority of riders are using standard types of bicycle, with men favouring a diamond frame and women a step-through frame (there were no differences between the two cities). Most of the responses in the "other" category were specific classes of machine (e.g., racing bike, front-suspension mountain bike, Dutch bike) and should perhaps more properly have been included in the "diamond frame" category. However, there were a small number of genuine "other" responses including BMXs, recumbent bicycles, unicycles, and Raleigh Choppers.

3.3.2. Gear systems

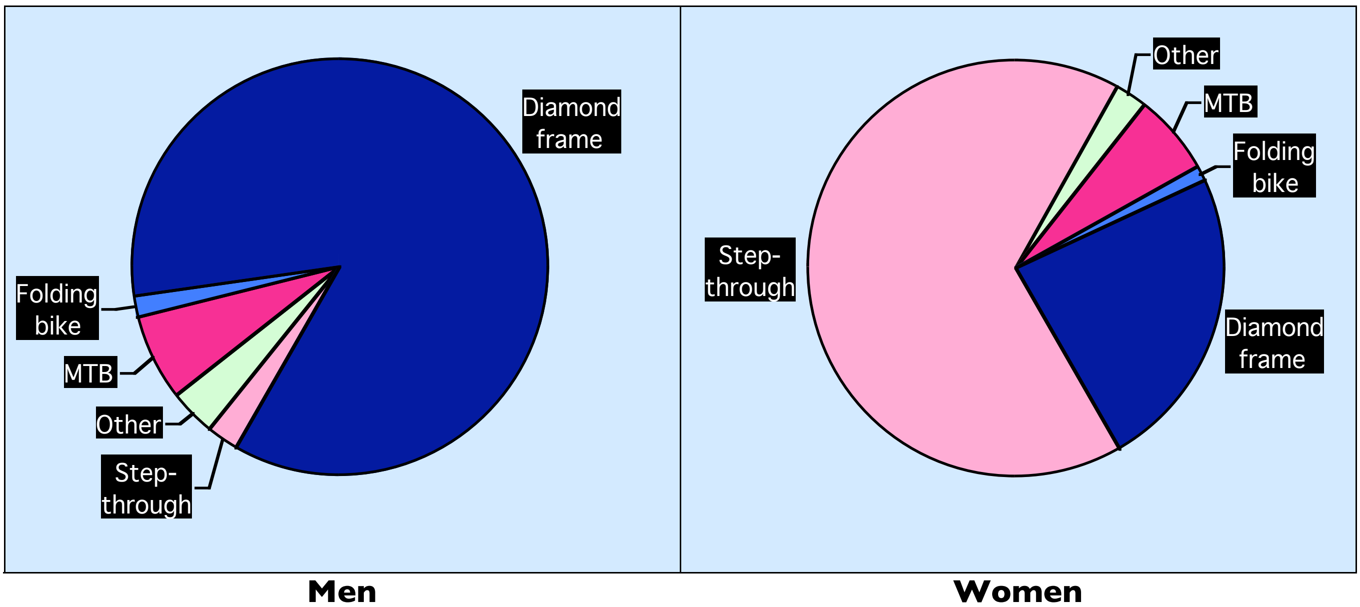
The gear data showed that 89% of bicycles used derailleur gear mechanisms. Another 7.2% had hub gears, 1.7% a fixed-gear mechanism and 1.5% a single-speed freewheel mechanism (these will mostly be the BMXs). There were no differences as a function of gender or city.

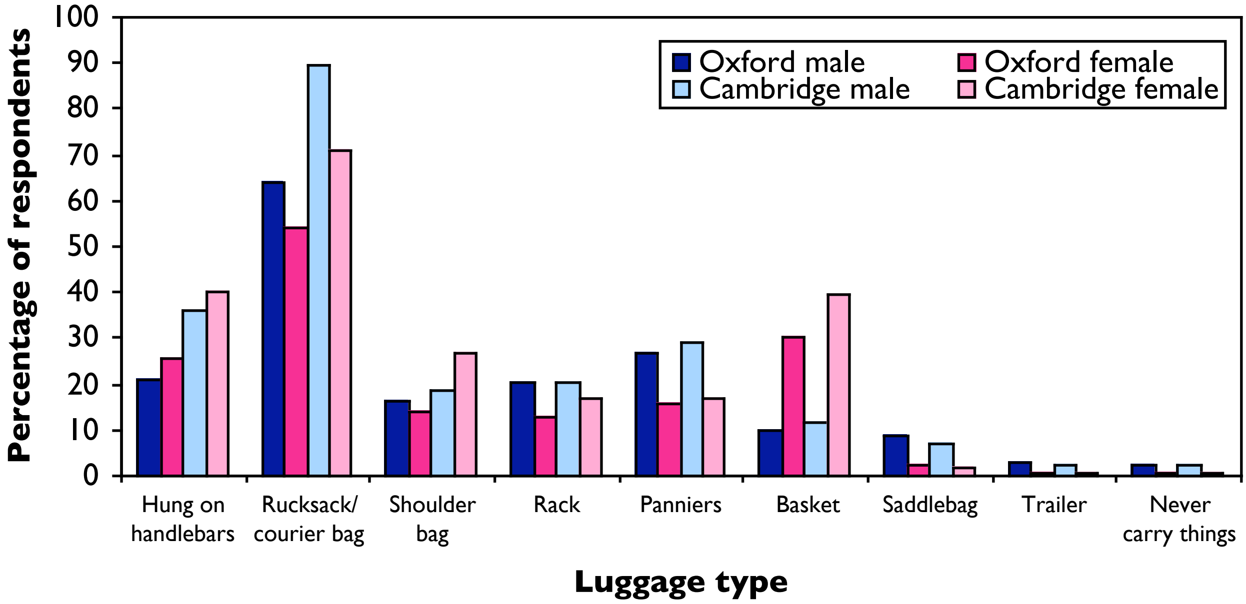
3.3.3. Brakes

Like the gear system question, the question about brakes provided straightforward responses. Leaving aside responses from people who did not know what sort of brakes they had, 92.1% of respondents' bicycles had rim brakes front and rear, another 3.1% had disc brakes and 2.8% had a hub brake at the rear and a rim brake at the front. A few people reported combinations of a single disc brake with a rim brake, or a hub brake at the front and a rim brake at the rear. There were also a small number of other responses such as hub brakes front and rear, as well as rarer modern systems (hydraulic brakes) or older mechanisms like roller brakes and coaster (back-pedal) brakes.

3.3.4. Lights

The question about bicycle lights allowed people to describe many different permutations of battery- or dynamo-powered front and rear lamps, as well as additional rear lamps (e.g., LED lamps). By far the most common combination was a battery-powered lamp at the front and rear (71.4% of respondents, with a fur-





ther 6.5% supplementing this combination with an additional rear light). 4.6% of respondents had no lights; 8.1% had dynamo lights front and rear. The remaining respondents had various other combinations.

3.3.5. Luggage carrying

Respondents were asked how they carried luggage whilst cycling. Overall, 43.1% of cyclists reported using only one method to carry things, and the full breakdown of how the various categories of cyclist carry luggage is presented in the graph above. Clearly, bags carried on the body are the most popular method, presumably because rucksacks and the like are also useful for non-cycling activities, or because people tend to own them before coming to cycling. Of the bicycle-specific luggage arrangements, baskets are clearly much more popular amongst women than men—the opposite pattern to panniers and saddlebags.

3.4. Bicycle care

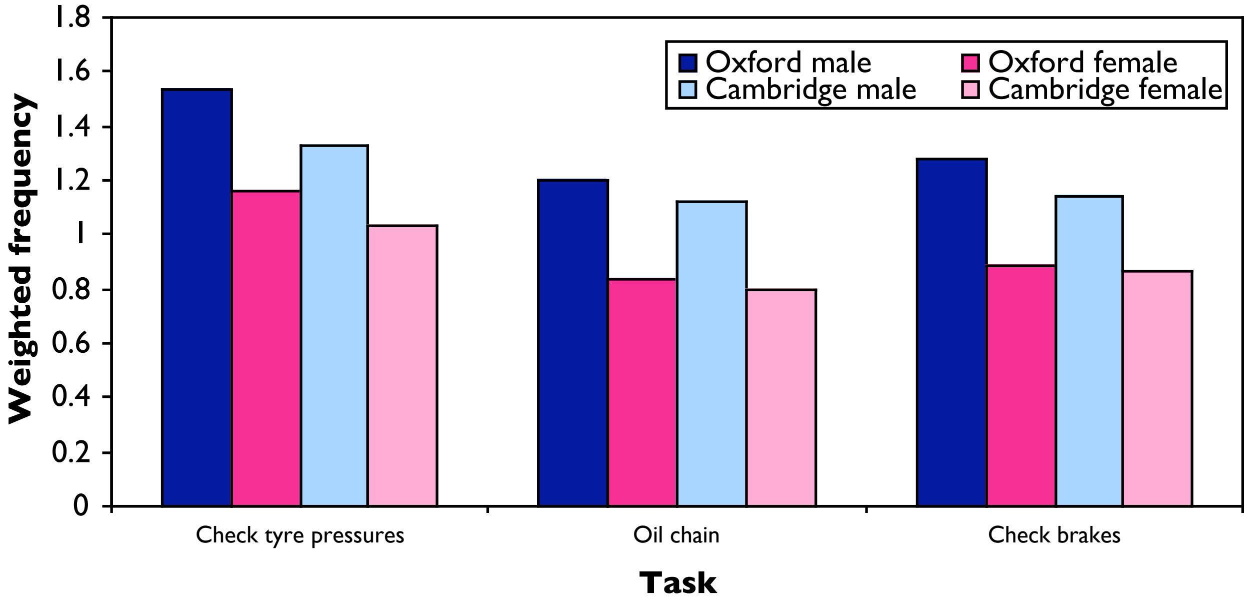
Respondents were asked how often they checked and maintained their tyres, chains, and brakes. These responses were weighted according to the same method as in section 2, whereby frequent actions contributed more to the score than infrequent actions, and the average data are presented in the graph overleaf.

It is clear that women are much less likely than men to maintain their bicycles. There is also a tendency for Oxford cyclists to perform more maintenance than Cambridge cyclists, which again might reflect the greater incidence of leisure riding in Oxford compared to the greater utility focus of Cambridge cycling.

3.5. Bicycle handling

Respondents were asked a range of questions about their bicycle handling skills. The first asked whether they could slow down their bicycles by gently applying the brakes. Overall, 90.1% of people chose the option "yes, always", 8.9% chose "usually okay, but sometimes make the bike wobble or stutter", and 1% responded "not at all". There were no real differences as a function of gender or city. It seems slowing down their bicycles is not a problem for the clear majority of riders, although the finding that as many as 45 people said they could not slow down with their brakes "at all" is still worrying. The 400 or so whose brakes sometimes stutter are likely to find it harder to control their speed and to stop safely in an emergency.

When asked how they generally deal with downhill slopes there was a clear gender difference: 27.9% of men chose the option "pedal as fast as conditions permit" compared to only 5.9% of the women. Conversely, 25.8% of the women selected "ride down cautiously with brakes most of the way" but only 9.9% of



the men chose this option. For the option “freewheel down, applying brakes from time to time” there was no real gender difference, and overall the bulk of respondents—64.1%—chose this option. There was also no gender effect on the response “get off and walk down”, which was chosen by just under 1% of respondents, many of whom were presumably the people who said they could not brake.

Asked whether they ever practiced an emergency stop on a bicycle, 21.1% of participants said they did, 67.9% said they did not but sometimes had to do a real one, and 11% said they had never done an emergency stop. The only gender difference was amongst the people who said they practiced emergency stops, with men more likely to do this than women (62.8% of respondents compared to 37.2%).

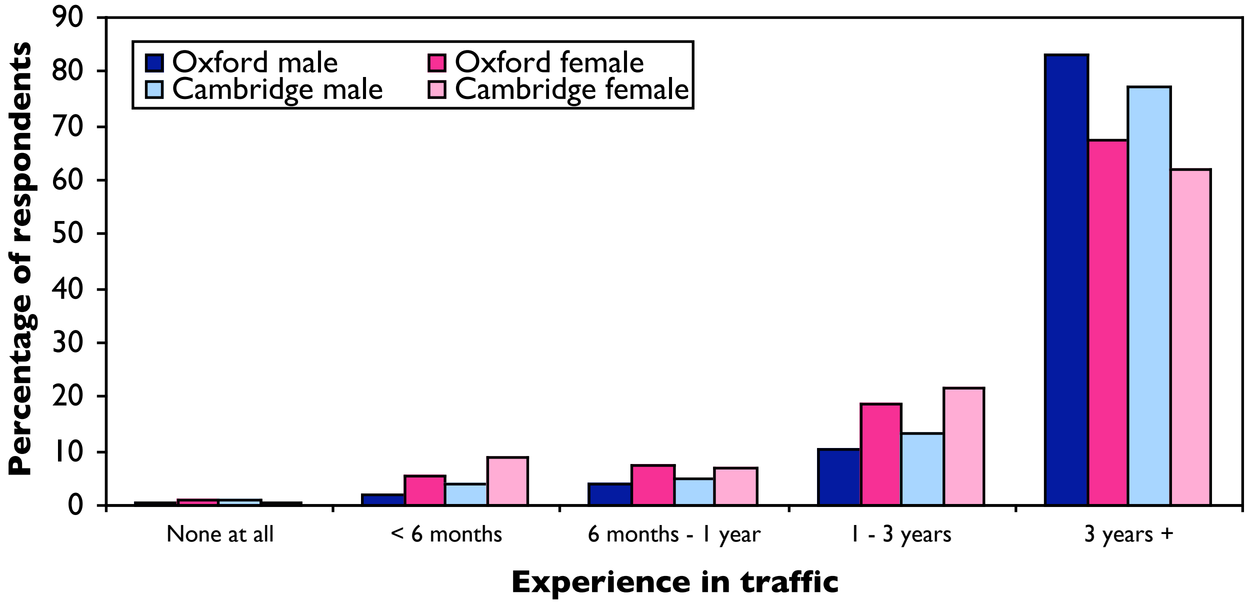
Another clear gender difference emerged when respondents were asked whether they could ride without their hands on the handlebars. When carried out under controlled circumstances away from other road users, riding without hands can be a useful test of balance on the bicycle. Overall, 25.2% said they could do this easily, 31.2% said they could do it for a short time, and 43.6% said they could not do it at all. However, of those who said they could easily ride without hands, 84.9% were male.

3.6. Riding in traffic

Respondents were asked a series of questions about their experience of riding in traffic, whether they had ever been trained to do so, how they dealt with buses stopping in front of them, and their ability to look around and signal on the road.

The riding experience data, shown in the graph overleaf, clearly show a tendency for men to be more experienced than women in both cities; Oxford cyclists also seem slightly more experienced than their Cambridge counterparts. In addition to recording their levels of experience, respondents also answered a question about the training they had received for riding on the road. Thirty-four-point-four per cent said they had received no training at all. Ten-point-five per cent said they had learnt tips from books and magazines, 22.9% had been instructed by a friend or relative, 42.7% had been taken cycle training at school, and 4.9% had received formal training elsewhere. Overall, then, a surprisingly high proportion had received formal cycle training of some sort.

Asked how they act when a bus stops in the road ahead of them, only 15.4% of respondents said they wait for it to pull off again; the remaining 84.6% said they would try to pass it if the traffic permitted. When asked how they pass buses at bus stops, 91.9% said they would generally pass the bus on the right; 3.8% said they would generally pass the bus on the left, remaining on the road; and the remaining 4.3% said they would cycle onto the pavement and pass the bus there before rejoining the road.



When respondents were asked whether they could look back over their right shoulder while cycling, 76.9% said they could with no problems, 19.2% said they are usually alright but sometimes wobble, and 3.2% said they always feel wobbly looking around. Less than 1% of respondents said they cannot look back at all. However, there was also a gender difference in these data: 83.8% of men said they could look back without problems compared to only 68.7% of women; 25.9% of women said they sometimes wobble compared to 13.6% of men.

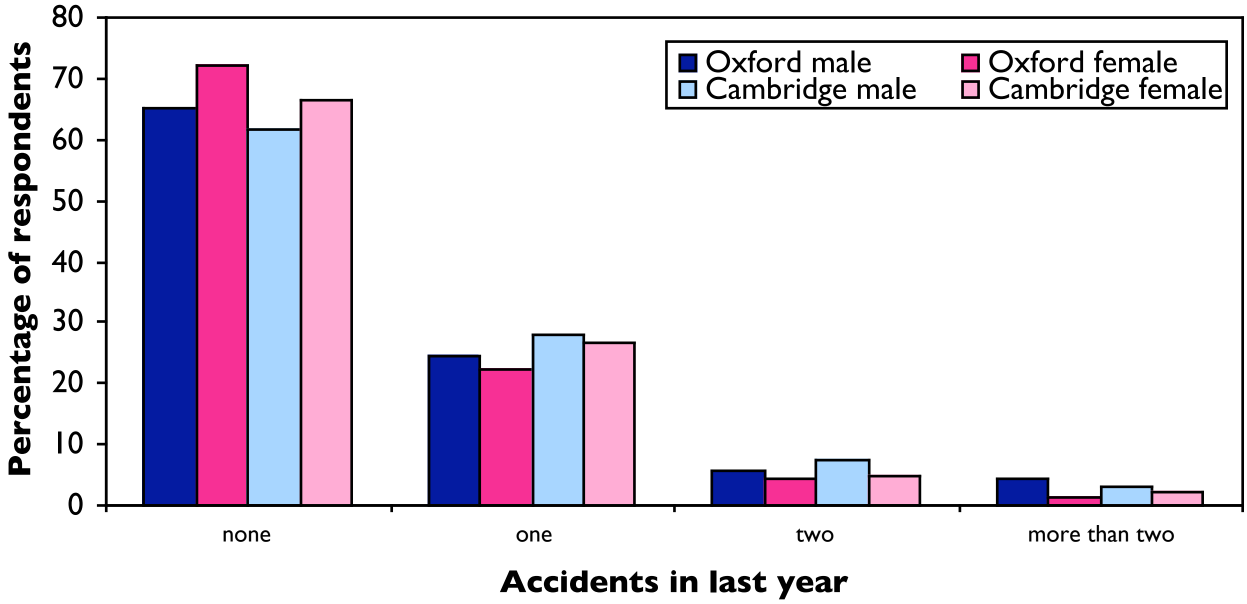
Sixty-two-point-three per cent of respondents said they could apply their brakes whilst signalling right without problems. However, 27.8% said their bicycle sometimes wobbled or stuttered, 6.3% said they always wobbled, and 3.6% said they could not signal whilst braking at all.

Finally, participants were asked whether they could tell when it was safe to pull out into a stream of traffic. Eighty-eight-point-two per cent said they can generally tell this, 6.3% said they sometimes cannot tell, and barely any said they generally cannot tell. Five-point-one per cent said they normally don't attempt to pull into traffic. However, these data again showed a gender difference: men were more likely than women (92.7% compared to 82.9%) to say they can generally tell when it is safe whereas women were more than twice as likely (9.2% compared to 3.9%) to say they sometimes cannot tell when it is safe. They were also more than twice as likely as men (7.6% compared to 3.0%) to say they generally do not attempt to pull into traffic.

3.7. Accidents

3.7.1. Incidence

Respondents were asked whether they had fallen off or crashed their bicycles in the past year. The responses are shown in the graph overleaf, from which it appears that men have more accidents than women and that overall, Cambridge cyclists seem to have slightly more accidents than Oxford cyclists. The overall proportion of people who reported experiencing an accident in the past year was 33.9%. Assuming that the year prior to the survey had not been abnormal in some way, this suggests that one-third of a cycling population can be expected to have some sort of accident or spill each year. Although, as demonstrated below, this does not imply that all cyclists are at equal risk of an accident, we perhaps need to see falling off as a relatively normal aspect of bicycle use. It must be stressed, however, that the great majority of these incidents are relatively trivial spills involving no, or slight, injury.



3.7.2. Circumstances of accidents

Respondents who had experienced an accident in the past year were asked to describe the circumstances of the accident and to say whether the police had been involved. From the accident descriptions, the estimated severity of each accident was classified with a code ranging from 0 (no apparent injury), through 1 (slight injury) and 2 (serious injury), to 3 (involving death). There were no real differences in accident severity as a function of city or gender, and overall 72% of accidents involved no apparent injury, 23.4% seemed to involve slight injury, 4.5% involved serious injury, and one accident led to a death (of the cyclist's unborn child).

From the participants' descriptions, the accident descriptions were sorted into 40 different categories. These were then combined to form 18 broader categories, making the results more comparable with an earlier accident analysis by Cross and Fisher [1]. The categories are shown in the table below along with a measure of how often they were mentioned in this survey. Additionally, where possible, the incidence from a recent analysis of the police STATS19 data, carried out by Celia Jones of Oxfordshire County Council, is also provided. This allows a partial comparison of the survey's estimate of accident type incidence and the police STATS19 data's estimate.

			Severity			
Category	Incidence	STATS19	0	1	2	3
Cyclist skidded due to problem with surface	**32.0%**		80.9%	15.2%	3.9%	0%
Cyclist not in control of bicycle (including drunkenness)	**13.6%**		82.8%	14.6%	2.5%	0%
Miscellaneous/weird	**11.2%**		78.8%	17.7%	3.5%	0%
Cyclist-cyclist collisions	**9.6%**		76.8%	21.2%	2.0%	0%
Cyclist-bus collisions	**7.0%**		59.2%	30.6%	10.2%	0%
Motorist error at priority junction or when joining road	**6.5%**	**32.9%**	45.9%	49.5%	4.5%	0%
Cyclist fell due to problems with bicycle	**5.4%**		79.0%	12.9%	8.1%	0%
Cyclist hit an obstacle (including car doors opened in path)	**3.6%**		54.0%	34.9%	11.1%	0%
Motorist error when passing cyclist	**3.4%**	**12.7%**	50.9%	43.6%	5.5%	0%
Cyclist-pedestrian collisions	**3.3%**		78.4%	16.2%	5.4%	0%
Motorist error when moving into path of bicycle	**3.2%**	**11.5%**	33.9%	50.9%	13.2%	1.9%
Cyclist negotiated intersection with motorist and collided	**0.5%**		0%	100%	0%	0%
Cyclist bailed out deliberately	**0.4%**		85.7%	14.3%	0%	0%
Deliberate attack on cyclist	**0.3%**		40.0%	60.0%	0%	0%
Cyclist error when moving into path of motor vehicle	**0.2%**	**9.6%**	33.3%	33.3%	33.3%	0%

We can see from this table that the clear majority of cyclists' accidents happened in the absence of other road users, a finding in line with previous studies. However, there was still a substantial number which involved other people and which were outside the cyclists' control—at least 13.1% were due to motorists' driving errors, for example. Our estimate of how many accidents were outside the cyclists' control would rise still higher if we were to include skids due to reasonably unforeseeable problems with the surface (e.g., untreated icy surfaces, shallow kerbs and inappropriate manhole covers).

There was a slight gender difference in these data such that overall, adjusting figures to allow for baseline differences in respondent numbers, the percentage of accidents reported by men (52.8%) was slightly above the percentage reported by women (47.2%). Moreover, the percentage of accidents reported from Cambridge (52.3%) was slightly higher than the percentage of reports that came from Oxford (47.7%). However, the finding that Cambridge cyclists reported slightly more accidents per capita cannot be simply interpreted, as there were also between-city differences in the reporting of specific types of accident. For example, adjusting for baseline differences in respondent numbers, Cambridge residents reported 57% of the accidents in which two cyclists collided. It is difficult to know whether this unexpectedly high proportion of cyclist-on-cyclist accidents in Cambridge is a product of the higher number of cyclists in that city or something to do with the infrastructure or conditions there, although the idea that it is something to do with conditions/infrastructure is perhaps supported by the finding that Cambridge residents were also more likely to report skidding accidents (56.8%), hitting-the-kerb accidents (60.0%), drivers' failures to give way at junctions (57.1%), and incidences of simply losing control of the bicycle with no obvious cause (55.2%). Oxford cyclists, on the other hand, were over-represented in the categories of "weird" accidents (61.7%), sports/acrobatics accidents (84.3%), and motorists' overtaking errors (79.6%), although this last category included only a small number of responses and so the bias might well be coincidental. The high proportion of sports/acrobatics accidents in Oxford is presumably linked to the higher amount of sport and leisure riding in that city, which has already been commented upon.

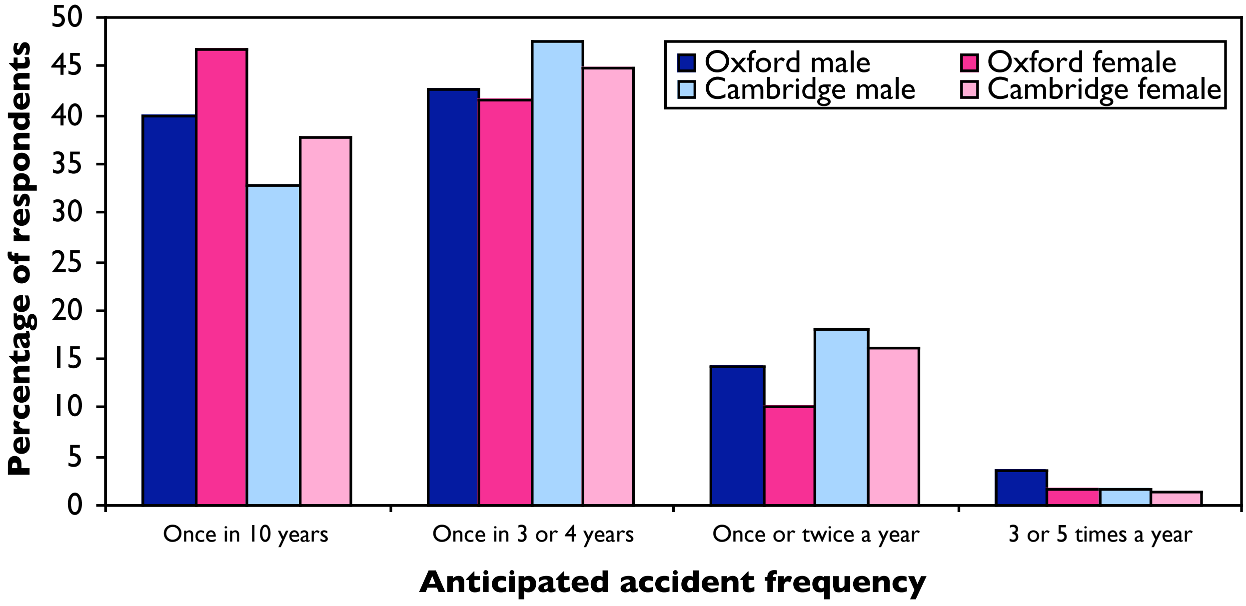
3.7.3. Accident reporting

As might be expected given the high proportion of solo accidents and accidents involving no injury, only 6.2% of all the accidents mentioned in this survey were reported, either to the police, a bus operator, or university authorities (a further 1.3% were not reported but ended with compensation or apology from the driver). Of the incidents judged from their descriptions serious enough to merit a report to the police (19.2% of the total accidents), as many as 60.8% were not reported. Several respondents' replies suggested they believed that reporting the incident would not result in action being taken (typical responses included "I thought nothing would come of it", "pointless", "police not interested", and "ha!").

To analyse the issue of reporting further, we looked at how often serious accidents (i.e., severity 2 or 3) were reported as a function of their type. These data, where there were sufficient incidents to make analysis possible, are presented in the next table. The percentage refers to the proportion of the accidents which seemed serious enough to warrant a report that actually were reported. It can be seen that the proportion of serious accidents which were officially reported is rather low, even in incidents where a motorist was in error.

Category	Reported
Motorist error at priority junction or when joining road	**36.8%**
Motorist error when moving into path of bicycle	**33.3%**
Motorist error when passing cyclist	**31.4%**
Cyclist skidded due to problem with surface	**31%**
Cyclist-bus collisions	**27.8%**
Miscellaneous/weird	**33.3%***
Cyclist hit an obstacle (including car doors opened in cyclist's path)	**32%***
Cyclist not in control of bicycle (including drunkenness)	**25%***
Cyclist-pedestrian collisions	**0%***

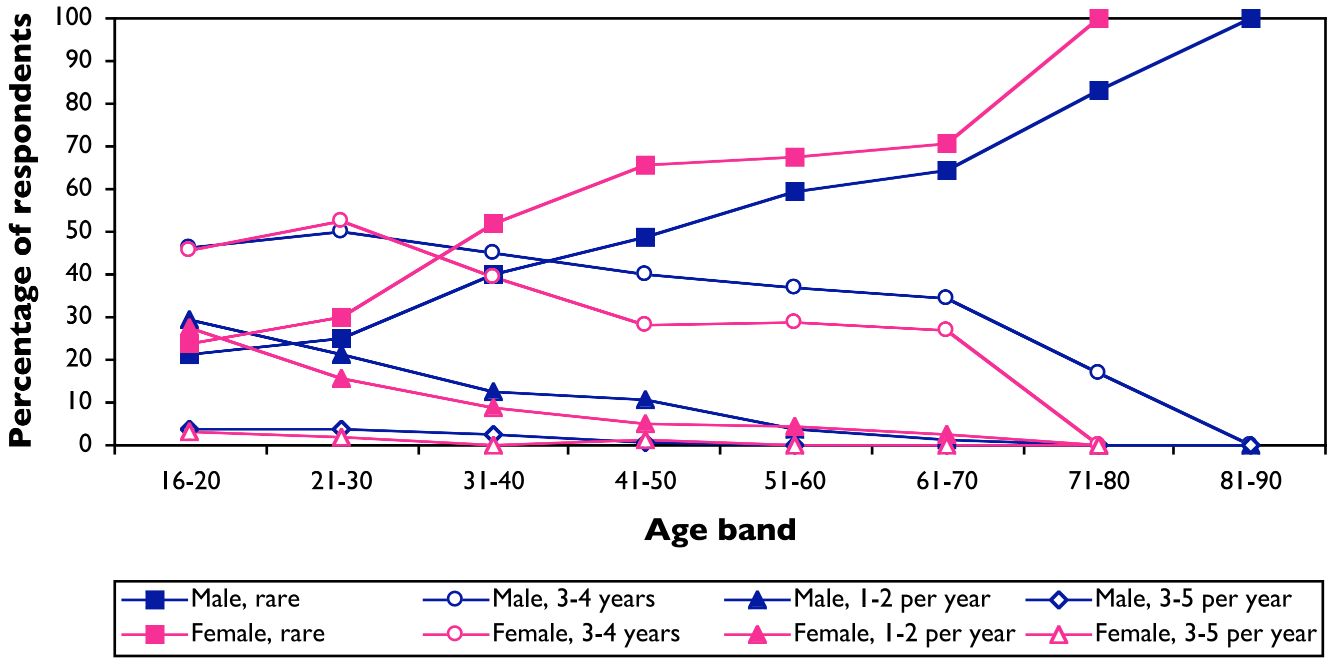
Note. *An asterisk means the percentage was calculated from a small sample of incidents and so should be interpreted with caution.*



Whilst on the subject of accident reporting, we must mention the dramatic difference between the incidence data obtained in this survey and the incidence records in the police STATS19 data shown in the table on page 10. It is not surprising that the police accident record will be biased towards emphasizing certain types of accident, as only some types of incident (namely, incidents involving a motor vehicle) are likely to draw police action. Nevertheless, the data presented here clearly show that the police STATS19 record cannot be used as an index of the overall relative frequency with which cyclists experience various types of accident (cf. reference [2]).

At the end of the questionnaire's accident section, respondents were asked how often they would expect to fall off their bicycle, riding the way they do. Overall, 39% of respondents selected the option "Maybe once in 10 years or less often", 44.1% selected "Maybe once every 3 or 4 years", 14.8% selected "Once or twice a year" and 2.1% chose "3 or 5 times a year". A demographic breakdown of responses is shown in the graph above, from which we can see that men seem to be expecting accidents more than women and that Cambridge cyclists seem, correctly, to be anticipating slightly more accidents than Oxford cyclists, with the notable exception of a cluster of Oxford men who expect to have a substantial number of accidents in the upcoming year, presumably sport or off-road riders.

The graph below breaks the anticipated accident responses down by age and gender. We can see



that older people generally expect fewer accidents than younger people. Men and women seem to differ less when they are young than when they pass 30, after which men seem to expect substantially more accidents than women.

Overall, the data on people's expectations seem generally to fit with the accident incidence data reported above. They show that the majority of cyclists expect to fall over at some stage every few years, with one-third indeed doing this each year (often, it seems, the same people). However, a substantial minority of cyclists—over one third—are more successful in avoiding accidents. Where they reported an accident but also rated their expectation as "once in ten years or less often" some explained the apparent contradiction by adding, for example, "my first spill in sixteen years".

3.8. Rider behaviours

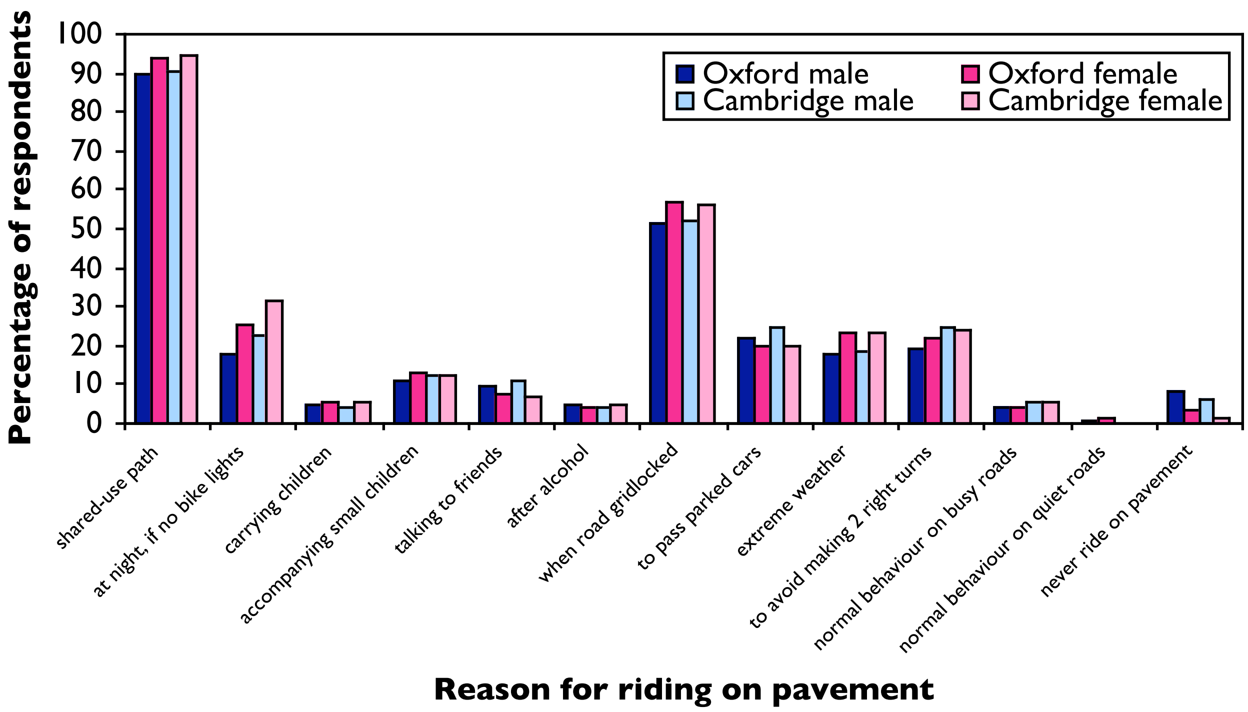
Cyclists completing the questionnaire were asked three questions about the circumstances in which they would (a) ride on the pavement, (b) ride through a red traffic light, and (c) ride without lights during darkness.

The data on pavement riding are presented in the graph below. It is clear than most respondents will cycle on pavements when these are marked for use by cyclists as well as pedestrians, although there is a tendency for men to use such routes less than women. Other than this, the most frequent reason people gave was to pass cars when these have gridlocked the road; no other reason was cited by more than a quarter of the respondents. Incidentally, it is perhaps notable how few people described cycling on the pavement as their normal behaviour, even on busy roads.

The finding that so many cyclists use shared-use paths is interesting, as a good amount of research (e.g., references [3-7]) has suggested that such paths are probably detrimental to cyclists' safety because although they reduce the risk of the relatively rare overtaking collision, they do it by increasing the risk of the more common junction collision [8-10]. It would therefore be unfortunate if the high proportion of cyclists who reported using shared-use paths/divided pavements in this survey was taken as a general endorsement of their implementation. The respondents may well have had in mind one or two specific pavement cyclepaths which they find useful, whilst spurning others which they regard as dangerous.

Asked about the circumstances in which they would ride through a red light, 31.6% of cyclists said they would never do this and another 52.2% said they would ride through a red light if the system was broken such that the lights wouldn't change. However, the percentage of people who selected *only* this latter option was 18.7%. Adding this to the 31.6% of the sample who would never ride through a red light, we arrive at a figure of 50.3% of cyclists in this survey whom we might categorize as completely law-abiding.

Another 33.4% of the sample said they would ride through a red light at a pelican crossing when no



pedestrians were present. The percentage of cyclists who said they would ride through any junction if no other vehicle were present was 16.5% and the percentage who would ride through a pelican crossing when pedestrians were using it was 2.8%.

Moving on to the issue of riding without lights at night, 72.8% of respondents said they never get caught by darkness without working lights or that they would not cycle if they were so caught. However, another 8.6% of respondents said they often travelled on the road without lights in low-light conditions, 5.8% of people said they often rode without lights but only on the pavement and 4.4% said they often travelled on off-road routes without lights. Only 3.3% of respondents said that they never travelled after dark and so did not come across this situation. It is important to note that many respondents complained about the wording of this question, which unfortunately gave only the options "often" or "never", but not "occasionally".

4. Discussion

4.1. accident reporting

A key rationale for this survey was to fill gaps in our knowledge about cyclists, and a point of particular interest was to seek a better understanding of cyclist accident reporting. Langley et al. [11] compared hospital admission records with official road-accident reports in New Zealand and found that only 22% of the cyclists who were admitted to hospital had their accidents recorded. Of course, many of these accidents involved no other road-user and so are perhaps not of real interest to the authorities. Nevertheless, when Langley et al. focused only on the incidents involving a cyclist and a motor vehicle, still only 54% appeared to be recorded.

The survey reported here expanded upon Langley's work by looking also at incidents not involving hospitalization and accordingly our estimate of the number of unreported accidents was higher, at 60.8% of the incidents which apparently involved serious injury. If we ignore severity and look at all incidents, we find that as many as 93.8% are missing from official accident records. This is a ratio of 15 unreported incidents to every one reported incident, a figure close to the 13:1 estimate which has been cited in the past by Sustrans.

Clearly, then, the accident reporting data presented here reinforce the implication of Langley's study, that we cannot rely on police statistics properly to understand the frequency of cyclists' accidents (cf. the comprehensive analysis of police STATS19 data by Stone and Broughton [2]). Whilst the STATS19 record is probably adequate as a record of how often the most serious accidents occur, it will clearly underestimate the incidence of other accidents. Indeed, the survey reported here is perhaps the best guide currently available to the relative frequency with which various types of accident really occur in the UK. Unlike the police records, these data show that skidding and slipping accidents are by far the most common type of incident and so this seems to be the area where action might do the most to reduce the number of cyclists experiencing accidents. Even though these are not usually particularly dangerous incidents, reducing their frequency should help encourage people to begin and/or continue travelling by bicycle. Accordingly, we return to the issue in the Recommendations section below. Incidentally, we should note that efforts to reduce the incidence of skidding and slipping accidents for bicycles should also have the happy effect of reducing such accidents for other single-track vehicles like motorcycles.

A final point of interest is the relatively low incidence of accident reporting seen in this survey. As shown by the table on page 11, only around one-third of incidents leading to non-trivial injury are reported to an authority, and perhaps surprisingly the likelihood of reporting does not seem to vary much between self- and driver-initiated accidents. The reasons for this are not clear, although as noted earlier, respondents' comments in this survey suggested that some were sceptical about the efficacy of reporting accidents to an authority such as the police. A surprising finding was that serious accidents involving buses were even less likely than other types of serious accident to be reported to police.

4.2. Accident types and avoidance

There were three other main questions we wished specifically to ask of the accident data from this survey. We now address these in turn.

4.2.1. Can cyclists avoid accidents, including those which are not, strictly speaking, their fault?
The two most common classes of accident—skids and other losses of bicycle control—together accounted for close to half (45.6%) of the 1,731 incidents reported in this survey. So to what extent can a cyclist avoid these? It is probably fair to say that a careful cyclist should be able to avoid all the "cyclist not in control of the bicycle" incidents, which accounted for 13.6% of crashes, as an accident was only placed into this category if it clearly seemed the cyclist was going too fast for the prevailing conditions or was otherwise acting carelessly.

For the more frequent skidding accidents, on the other hand, the answer is less clear. As we argue below, once informed that manhole covers (for example) are a skidding hazard, cyclists should often be able to avoid the crashes they cause (although it is debateable whether the real responsibility for preventing such crashes should be placed on the cyclists or not). On the other hand, however, we would suggest that many skidding accidents, e.g., those involving diesel spills and inappropriate or badly maintained road surfaces, cannot reasonably be prevented by the cyclist.

For accidents caused by the errors of other road users, it might seem that the cyclist is helpless to avoid them. However, this survey shows that cyclists do use a number of strategies to counter threats such as motorists who pass too close, open doors without looking, or pull out inappropriately from side streets. Popular "top tips" from the respondents in this survey included riding a metre or so out from the kerb, (and further out at side streets) and, above all, advocated heightened awareness and anticipation. This is not to say that the cyclist who fails to avoid such a collision is at fault, but it does mean that training may well help to reduce even these potentially serious types of accident.

4.2.2. What do these survey data tell us about cyclist–bus interactions?
In total, there were 71 reported incidents between buses and bicycles in the survey's accident data. There were no obvious differences in their incidence as a function of gender or city.

Looking again at the specific accident sub-codes, we see that 48.1% of the cyclist–bus incidents were caused by a bus overtaking a cyclist too close, forcing the cyclist off the road with no physical contact (only one of these incidents led to serious injury). Fifty per cent of incidents involved a bus hitting a cyclist (19% of these led to serious injury), and the remaining 1.9% were caused by buses pulling in too soon after overtaking a cyclist.

Other than these descriptive statistics, however, we are still in the position of being able to say little about the circumstances or causes of cyclist–bus accidents, and more work is needed to investigate their causes. The authors of this report are currently carrying out a series of interviews with bus drivers, as part of a drive better to understand cyclist–bus interactions and how these lead to accidents.

4.2.3. What do these data tell us about cyclist-moving-to-the-right accidents?
This question was a particular point of interest as the aforementioned STATS19 analysis identified a striking gender effect: women seemed more likely than men to have a (serious) accident when pulling to the right along a carriageway, e.g., to overtake parked cars or preparatory to turning right. Unfortunately, the data collected here included so few incidences of this accident type that it is not really possible to perform a useful analysis. One possible reason for this is reporting bias, and this issue is discussed further in the Caveats section below; another possible reason is that this type of incident is usually serious (and often fatal), which might further reduce the data available through survey methods.

However, the data collected in this survey *can* shed some light on this issue thanks to the questions which asked people whether they can look back over their right shoulders whilst riding and whether they can tell when it is safe to pull out into a stream of traffic. As described in the section 3.6, women were somewhat less likely than men to say they could easily look back over their shoulders and to say they could tell when it was safe to pull into traffic. These differences are intriguing and might well go some way to explaining the higher incidence of women's moving-to-the-right errors in the police STATS19 data. It seems rather more likely that the gender effect is the result of a behavioural difference rather than gross cognitive or perceptual dimorphism. For example, the difference in the looking-back data might stem from a greater willingness amongst men to make the (at first, relatively tricky) manoeuvre needed properly to see behind oneself when cycling. Indeed, it was seen that on a number of aspects of bicycle-handling skills, men tended to do better than women. The obvious conclusion is that this reflects the tendency for women to be more risk-averse, a propensity seen also in the "top tips" section. It may also be that men "play" more on their bicycles, as evidenced by the substantially higher percentage of males who practice emergency stops. Other possible factors are that women cyclists have less experience on average than men, ride less stable bicycles, and that men tend to have a subtle advantage in spatial ability.

Given that the ability to look back and to tell when it is safe to pull into traffic very likely impact on the incidence of the serious moving-to-the-right accident, further research would be most useful to investigate these gender differences in detail.

4.3. Relevance of these data outside Oxford and Cambridge

The primary purpose of this survey was to assess cyclists' experiences and behaviours in the cities of Oxford and Cambridge. However, it would also be useful to know the extent to which the findings reported here are relevant to other cities. Oxford and Cambridge see more cycling than most other UK communities, but does this make them particularly good case studies, or does it perhaps make them atypical? It seems likely that both possibilities are partially correct. It is known that as levels of cycling increase in a city, the per capita risk of being involved in a collision with a car decreases [8,13-14]. This is because as the number of cyclists rises, motorists' expectations about what they are likely to encounter on the road change, altering their patterns of attention when driving, particularly at junctions [8,10]. This implies that the accident data reported here would perhaps slightly underestimate the incidence of accidents caused by motorists' errors at junctions in cities that see less cycling than Oxford and Cambridge.

Conversely, we must be open to the possibility that the high level of cycling in these two cities overestimates the incidence of some experiences, e.g., cyclist-on-cyclist collisions. This said, however, it is notable how few substantial differences were seen between the two cities. This allows us to be relatively confident that, this last point notwithstanding, many of the data presented here are unaffected by local conditions and so should be representative of cyclists generally. Clearly, a certain amount of common-sense will be necessary when considering this survey in relation to other cities, but most of the data should be more-or-less directly applicable.

5. Recommendations

Based on the findings of this survey, particularly the accident data, we feel that the following recommendations, given here in no particular order, provide useful avenues for future action. This is, of course, by no means an exhaustive list of possible recommendations from the data presented here.

Skidding was easily the most common type of accident for cyclists in this survey, and any action to reduce the likelihood of cyclists skidding would therefore be particularly effective in reducing the total number of cycling accidents. A substantial subset of these slipping accidents (5.5% of all the incidents reported) happened on kerbs which the cyclists had seen. Although slipping and skidding accidents typically do not lead to serious injury, such that their reduction would not do as much to prevent hurt as, say, reducing collisions with motor vehicles, the issue is not only more amenable to intervention but action here also carries several other key benefits, particularly reducing the extent to which accidents are, or are perceived to be, a disincentive to the non-polluting and healthy activity of cycling. Therefore, we suggest:

5.1. Infrastructure recommendations

5.1.1. The skidding risk for single-track vehicles should be reduced through careful placement of metal road surfaces.

For single-track vehicles, such as bicycles and powered two-wheelers, a slippery or unstable surface beneath one wheel—particularly the front wheel—will frequently cause a fall, perhaps into the path of a motor vehicle. Smooth metal road surfaces such as manhole covers and drains, whilst fine for dual-track vehicles like cars, pose a particular risk for single-track vehicles, especially when they are turning or braking. Therefore, if smooth metal manhole covers and the like have to be used, it seems sensible to avoid placing them near junctions or at other places that a single-track vehicle might reasonably be expected to manoeuvre. It is acknowledged, however, that this may not be possible in practice, therefore see also paragraph 5.1.2.

5.1.2. Research should be carried out to investigate higher-friction alternatives to the smooth metal finish currently employed on inlaid road fixtures.
The tyre contact-patch of a bicycle is small [15]. As such, the friction offered by drains and manhole covers, even those with nominally bumpy surfaces, is slight. As a matter of some urgency, durable high-friction alternatives to smooth metal should be investigated.

5.1.3. The need for cyclists to cross kerbs should be minimised.
The kerb accidents in this survey tended to happen when cyclists were legitimately crossing between a road and a pavement, for example to join a pavement marked up for shared use. The "hierarchy of measures", which treats off-road provision as a last resort, should be applied strictly to avoid the need for cyclists to cross kerbs.

5.1.4. Drop kerbs should be flush with the road surface.
Drainage problems notwithstanding, drop kerbs which cyclists will cross at a shallow angle need to be flush.

5.1.5. Routine maintenance should be given a higher priority in the promotion of cycling.
The Cycle-Friendly Infrastructure "hierarchy of measures" places top priority on the improvement of conditions on the road. The improvement and maintenance of surfaces both on roads and also on paths designated as cycle routes should be explicitly included within the hierarchy, including skid-resistance, repair of potholes, and sweeping to remove silt and other debris.

5.1.6. Highways maintenance authorities should set up systems for the public to report damaged road surfaces.
Falls caused by slippery or potholed road surfaces are rarely reported to any authority. A postcard system for reporting defects direct to the Highways Maintenance Authority is already in place in some UK towns and cities. The wider use of such systems could reduce the number of spills suffered by cyclists at the same location.

5.2. Education and training recommendations

5.2.1. Cyclists should be warned of the risks posed by inlaid metal road surfaces
The risks of skidding would be reduced if cyclists were made more aware of the risks posed by such surfaces, allowing them to take preventative action before learning about the risks of such items first-hand.

Incidentally, we note that all the issues of single-track vehicles skidding on smooth metal road surfaces raised here will be of particular concern in cities with tram systems.

5.2.2. Cyclists should be warned about crossing dropped kerbs
Given the high incidence of kerb-related falls in these data, it is clear that cyclists are often unaware of the risks posed by crossing up or down a dropped kerb at an angle other than a right-angle. Recommendation 5.1.4. notwithstanding, we also recommend that educational messages and/or appropriate road markings be used to encourage cyclists always to cross kerbs perpendicularly, for maximum safety.

5.2.3. Research should address the gender difference in moving-to-the-right accidents
A previous analysis of serious accidents revealed that women were substantially more likely than men to have an accident when moving to the right across the carriageway. This survey has further shown that women are more likely than men to report having difficulty looking back over their shoulders whilst cycling, as well as having difficulty telling when it is safe to pull into a stream of traffic. Given that these two abilities

are so plausibly related to the likelihood of same-direction traffic collisions when the cyclist moves to the right, it would be very desirable to discover more about all these gender differences.

6. Caveats

As with all survey data, some of the information presented here must be interpreted with caution. We have already touched upon the extent to which the cities of Oxford and Cambridge will be representative of the UK's cities more generally. Another issue that we must address is that of the respondents' honesty and of self-serving biases in responses. Overall, given the anonymity of the questionnaire and given the number of people who reported taking part in illegal behaviours, we have no real concerns about honesty. However, we do acknowledge that there is a risk of response bias in some of the accident data, and the particular datum we feel is most likely to be affected by this issue is the incidence of accidents caused by cyclists making errors when moving into the paths of vehicles. The proportion of such accidents in this survey was only 0.2%, which seems low, and we must be open to the possibility that some cyclists who have caused a collision with a motor vehicle by manoeuvring will construct the incident to themselves in such a way as to reduce their feelings of responsibility. Accordingly, if there is a bias in the accident data, it will be an overestimation of how many accidents were caused by other road users and an underestimation of how many were caused by the respondents.

Another important caveat is that the data collected in this survey came from people who were practicing cyclists in Spring 2005. The sample will therefore miss people who have used bicycles but who have been discouraged from cycling by accidents which, as we have seen, are a relatively common occurrence. This will have various implications for the data, one of which might be to reduce the number of people in the sample who have poorer cycling skills (such as the aforementioned ability to look back over the shoulder whilst riding) to below the level of the population as a whole.

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