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Why do teens abandon bicycling? A retrospective look at attitudes and behaviors

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ABSTRACT

Bicycling as a form of "active travel" is an easy way to integrate physical activity into daily life, with many benefits for health. Yet this potential is largely untapped in the U.S., where less than 1% of workers commute by bicycle. The problem may start as early as childhood, given a steep decline in bicycling to school among children in the U.S., particularly among high school students. This paper examines childhood and teenage experiences with and attitudes towards bicycling as seen in retrospect from adulthood. The results are drawn from a larger study that set out to explore the effect of experiences throughout life on the formation of attitudes towards bicycling. Fifty-four adult participants responded to open-ended interview questions regarding their bicycling experiences throughout their life course, starting from childhood. Results show that the way in which participants thought about bicycling changed from elementary school to high school, leading to decreased bicycling in teenage years and influencing attitudes and behavior as adults. High school students, especially females, were particularly sensitive to negative images associated with bicycling. The strong influence of social norms has important implications for policy.

1. Introduction

Bicycling as a form of "active travel" is an easy way to integrate physical activity into a person's daily life, thereby helping to reduce the risk of heart disease, improve mental health, lower blood pressure, and reduce risk of overweight and obesity (Frank et al., 2004). Riding a bicycle can raise the heart rate sufficiently to improve cardiovascular fitness, which is linked to improved health outcomes for both young people and adults (Cooper et al., 2008; Hamer and Chida, 2008; Shephard, 2008; de Geus, Joncheere et al., 2009). The potential for bicycling to increase overall physical activity is especially important at a time when the prevalence of obesity has increased significantly in the United States and worldwide (World Health Organization, 2011; Centers for Disease Control and Prevention, 2010; Withrow and Alter, 2011).

Yet this potential is largely untapped in the U.S., where less than 1% of workers commute by bicycle (Pucher and Buehler, 2010). The problem may start as early as childhood. It appears that children living in bicycle-friendly countries, where bicycling levels increase over the course of childhood, are more likely to become bicycling adults (Pucher and Buehler, 2008). If so, the converse may also be true: the low level of bicycling among adults in the U.S. could in part stem from unpleasant bicycling experiences in childhood, assuming any experience with bicycling at all. Indeed, the share of children (from kindergarten through grade 8) walking or bicycling to school dropped from 47.7% in 1969 to 10.7% in 2009, with bicycling accounting for just 1.1% of school trips in that year (McDonald et al., 2011). Bicycling declined significantly from 1969 to 2001 at the high school level, mirrored by an increase in driving to school (McDonald, 2007).

To explore these potential connections, we examine childhood and teenage experiences with and attitudes towards bicycling as seen in retrospect from adulthood. The results presented here are drawn from a larger study that set out to investigate the effect of experiences throughout life on the formation of attitudes towards bicycling. Fifty-four adults living in Davis, California participated in semi-structured interviews regarding their bicycling experiences throughout their life course, starting from childhood. Our analysis of these interviews shows that the way in which participants viewed bicycling changed over the course of their youth, leading to decreased bicycling as teenagers and influencing attitudes and behavior as adults.

2. Background

An attitude is "an evaluative response to some object which disposes a person to behave in a certain way toward it" (Ajzen, 1991). Attitude formation is complex, and varies over time, across

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situations, and according to individual experiences (Krosnik et al., 2005). Social psychologists suggest that attitudes are formed through a combination of socialization experiences and cultural influences, and people may be highly conscious of their attitudes toward an object, or their attitudes may be completely outside of their awareness (Albarracin et al., 2005; Devos, 2008).

Previous work has established the important role that attitudes play in shaping decisions about daily travel (Fujii and Kitamura, 2003; Sunkanapalli et al., 2003; Parkany et al., 2005; Johansson et al., 2006; Beirão and Sarsfield Cabral, 2007; Domarchi et al., 2008). Several studies document the importance of attitudes in explaining bicycling behavior in particular. For example, a study from the Netherlands found that a positive attitude toward bicycling was positively associated with bicycle commuting (Heinen et al., 2011). Similarly, a study in Davis, California, renowned for its extensive bicycle infrastructure and otherwise supportive bicycling conditions, found a strong connection between "liking biking" and both bicycle ownership and regular bicycle use, as well as bicycle commuting (Handy et al., 2010)). Positive attitudes towards bicycling were also found to be important predictors of bicycle commuting in Portland (Dill and Voros, 2007). Jensen (2008) concluded that attitudes are an important factor in mode choice among children in Denmark.

Although few studies focus on the formation of these attitudes, those that do suggest an important role for social factors. A seminal report by Davies et al. (1997) found that attitudes towards bicycling in the UK are influenced by life stage, gender, peer pressure, societal norms, and other factors. Pucher et al. (1999) pointed out an inherent relationship between the "public image" of bicycling and the general attitude toward bicycling within a particular country or region. More recently, a study in the UK found that those who use a bicycle are likely to have a more positive view of a typical bicyclist than those who do not bicycle (Gatersleben and Haddad, 2010). Similarly, the Safe Routes to School National Partnership (2011) states that, "Bicycling may have the stigma, similar to riding the city bus, of being something that only the desperate use, or only a sport for middle class white males, or even the symbol of gentrification in some communities." Steinbach et al. (2011) suggest that the meaning people give to bicycling might resonate differently across gender, ethnic, and class identities. Aldred (2012) takes this idea further in her discussion of "cyclist identities" and the many forms of stigma associated with bicycling in the UK. In other words, individual attitudes toward bicycling are inextricably linked to bicycling image and community norms.

The few studies that focus on teenagers and bicycling suggest that image plays an especially important role at this stage of life. A study in the United Kingdom (UK) showed that for young girls in North Liverpool, "cycling has significant image problems, with many saying that they would not consider cycling as a regular mode of transport" (Cavill and Watkins, 2007). In contrast, a study in Canada concluded that teenage participants continued to bicycle into their mid-teens because early motivating factors (independence, fun, speed, and time efficiency) as well as fitness and health outweighed any negative comments from peers (Orsini, 2007). A life-course study in Australia found that bicycling as a form of mobility is often abandoned after childhood and that teenage girls abandon bicycling not because of the lack of "coolness" but because other modes of transportation are more social (Bonham and Wilson, 2012).

The way teens feel about bicycling may be confounded by prevailing attitudes towards cars and driving. Getting a driver's license at 16 years old has long been an American rite of passage. Using data from the National Young Driver Survey of 2007, the Children's Hospital of Philadelphia reports that to teens, driving is considered an essential coming of age experience, and it has become an established aspect of teens' maturation and socialization process (Children's Hospital of Philadelphia, 2007). In that regard, adolescent attitudes towards bicycling are likely to be closely and inversely related to attitudes towards driving.

This study examines childhood and teenage experience with and attitudes towards bicycling as seen in retrospect from adulthood. We address several questions in our exploration. How do attitudes towards and images of bicycling evolve from elementary school through middle school and on to high school? In high school, what is the relationship between attitudes towards bicycling and attitudes towards driving and other modes? Finally, to what degree are attitudes towards bicycling in high school tied to attitudes towards bicycling in adulthood? The following sections present our methods and results, as well as a discussion of their implications for policy.

3. Methods

This study employed a qualitative, retrospective approach to exploring experiences with and attitudes towards bicycling during youth and their influence on attitudes towards bicycling activity in adulthood.

3.1. Sample

Study participants were a convenience sample of residents of Davis, California, a small city well known for its high level of bicycling by U.S. standards (Buehler and Handy, 2008; Handy et al., 2012). We recruited participants through advertisements posted in the local newspaper and through fliers that were posted at downtown businesses and distributed at a local farmer's market. The recruitment notice solicited people interested in "participating in a study concerned with people's attitudes toward transportation"; bicycling was not mentioned in the notice. All participants were required to be English-speaking residents of Davis between the ages of 25–65 years old. Participants were offered a $20 gift card in exchange for participation. Our goal was to recruit 50 participants; after achieving this goal we recruited four additional male participants to achieve a more equal gender balance, for a final sample size of 54.

The sample of participants was fairly representative of both Davis, California as well as the U.S. population based on income and race (Table 1). The educational achievement level of the sample was significantly higher than that of the U.S. population, and somewhat higher than that of the Davis population. The 25–35 year age bracket was over-represented in the sample, and we interviewed more women than men (Table 2). Note that while all participants lived in Davis at the time of the interviews, only 5 grew up in Davis, and the average length of time living in Davis was 6–10 years. Only one participant had never owned a bicycle or bicycled.

Table 1
Comparing demographic characteristics ($n=54$).

	Participant sample	Davis[a]	U.S.[a]
Median age[a]	38	25.2	37.2
Median household income[b]	$45,000	$59,517	$51,914
Percent white[a] (%)	74	64.9	72.4
Educational achievement: bachelor's degree or higher[b] (%)	81	68.4	27.9

[a] Census 2010 (U.S. Census Bureau, 2010a).
[b] American Community Survey (ACS) 5-year estimates (U.S. Census Bureau, 2010b).

Table 2
Age and gender distribution of participants ($n=54$).

	25–35 years	36–45 years	46–55 years	56–65 years	Total
Male	9	5	4	2	20
Female	13	6	7	8	34
Total	22	11	11	10	54

Table 3
Topics covered in in-depth interviews.

Life stages	Aspects of bicycling
• Learning to ride a bike	• Nature and extent of bicycling
• Elementary school	• Experiences and incidents
• Junior high/middle school	• Family and friends
• High school	• Community norms
• Post high school/college years	• Physical environment
• Young adult	• Attitudes and feelings
• Mature adult	

3.2. Data collection

For the in-depth interviews, we chose a biographical life-course approach that produced a bicycling-focused "mobility biography" for each study participant. Mobility biographies, elicited through guided interviews, can improve understanding of the underlying meanings, motives, and values that help shape attitudes about travel behavior (Frandberg, 2006). The goal of collecting these biographies was to gain insight into how participants formulated attitudes towards bicycling from youth through to adulthood, and to inform understanding of bicycling as an active mode of transport.

Semi-structured interview guides were developed based on a review of the literature and input from the multi-disciplinary (urban planning, sociology, cultural studies, and public health) research team. Questions were designed to guide an in-depth exploration of each participant's experiences with bicycling at different stages in life. As outlined in Table 3, the interviews covered six stages of life as well as the time at which the participant learned to ride a bicycle. At each stage, questions asked about a variety of aspects of bicycling, including the nature and extent of bicycling, experiences and incidents, community norms, and feelings.

Interviews took place between July and October 2010. Prior to the interview, participants completed a self-administered questionnaire that gathered demographic information and data on attitudes, bicycling ability, and other relevant background information. After at least one practice interview each, two members of the research team (Underwood, Lee) conducted the interviews (one interviewer per interview), in roughly equal numbers. Interviews took place in quiet corners of public locations, such as parks and coffee shops, and were audio-taped. Immediately following each interview, interviewers made notes reflecting on the interview, including any issues that arose as well as impressions of the responses of the participants that might not have been obvious from their words alone. The audio-tapes were transcribed by a professional transcriber, and sections noted as "inaudible" by the transcriber were reviewed and completed or revised by the two interviewers as needed. The early interviews raised a few issues that were not anticipated in the literature review, and additional questions and prompts were then discussed among the researchers and added to the guiding questions for subsequent interviews, an accepted practice in qualitative research (Glaser and Strauss, 1967). The study was approved by the Institutional Review Board of the University of California, Davis.

3.3. Interview analysis

In this paper, we focus on experience with and attitudes towards bicycling during youth (ages 5–18). We defined three stages of youth according to school years: elementary (approximately 5–12 years in the U.S.), middle (12–14 years), and high school (14–18 years). Across these stages, differing peer groups and social contexts associated with peer involvement have been found to shape adolescent identity and attitudes more generally (Weigert et al., 2006). We characterized bicycling in each stage by whether or not participants owned a bike and by the nature of their bicycling (i.e. recreation, transportation, or both). We assessed attitude towards bicycling by asking the degree to which participants "liked riding a bike" at each stage and used open-ended questions to explore the nature of attitudes towards bicycling, as well as the contexts within which they developed.

One member of the research team (Underwood) carefully read each transcript and identified initial themes, which were then reviewed, discussed, and refined by the research team. These broad themes were then used to develop more specific sub-themes, which were incorporated into a coding template. The coding template was designed to capture the presence or absence of themes and sub-themes in each interview, as well as the stage in which they occurred (i.e. elementary, middle, or high school). Two other team members applied the coding template to a sample of transcripts, and the template was refined until an acceptable level of inter-coder reliability was achieved. The final coding template achieved 92% agreement among three researchers for a sample of interviews. Two team members (Underwood, Lee) divided the final coding for each interview between them (about 70% and 30%, respectively).

Each transcript was loaded into Atlas.ti, a qualitative analysis software program. The coding of quotes within Atlas.ti was based on whole statements by respondents (i.e. everything said between questions by the interviewer), which could range from a single or partial sentence to a series of sentences. Individual quotes were coded according to the themes and subthemes in the template, and this coding of quotes was used as the basis for coding the presence or absence of themes for each participant. In addition, individual quotes were examined in order to highlight nuances and generate further understanding of the themes. We combined the participant-level coding results with the self-administered questionnaire data and then sorted and cross-tabulated the combined dataset using SPSS to determine frequencies and identify important patterns. In our analysis, we looked for gender differences, differences by geographic location or environment type, and generational differences.

4. Results

In analyzing the interview transcripts, we focused on three overarching topics: the evolution of experience with and attitudes towards bicycling from elementary school through middle school and on to high school; the relationship between attitudes towards bicycling and attitudes towards driving and other modes in high school; and the connection between attitudes towards bicycling in high school and attitudes towards bicycling in adulthood. Many interesting themes emerged from our analysis.

4.1. Bicycling experience and attitudes

As reported by participants in the survey preceding the interviews, bicycling for transportation and recreation declined from elementary school to high school years (Fig. 1). Recreational biking was most common during the elementary school period, while transportation or utility bicycling was most common in middle school (also known as junior high in some U.S. communities). Bicycling for both recreation and transportation was least common in high school. Potential reasons for the decline in bicycling by high school emerged in the interviews.

To gauge changes in attitude towards bicycling, interviewers asked participants if they "liked biking" at different stages in life. In discussing their bicycling experiences during each stage of their youth, participants expressed many views towards bicycling that illuminated their conceptualization of bicycling. Participants expressed views on bicycling with respect to themselves, other people on bikes, or the general image of biking among their peers. The most common themes are highlighted below, along with some of the notable outlying comments. The interviews revealed few

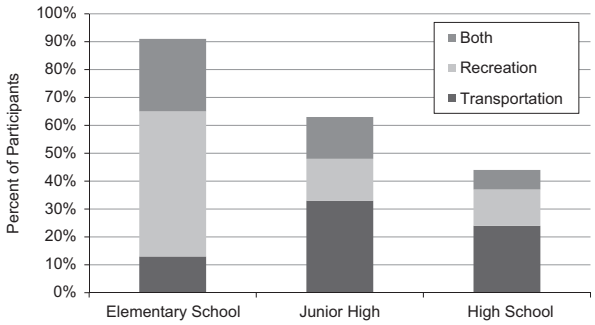

Fig. 1. Differences in share of bicycling and bicycling purpose by school level.

differences by gender or generation, but the differences by stage of youth were stark.

4.1.1. Liking biking

In general, "liking biking" decreased from elementary to high school. Thirty-eight of 54 participants indicated that they "liked biking" in elementary school. In middle school this number dropped to 21 participants and by high school only 11 participants claimed that they had liked biking. Reflecting this decline, sixteen participants, almost a third of the sample, responded to the question of "liking biking" with the response that bicycling had fallen "off the radar" by high school or even as early as junior high school, as illustrated by these quotes:

> Attitude towards bicycling? It was non-existent. It was not on the radar other than kids to go to their friend's house or whatever, at least not in my world. (female, 40)

> By junior high, I did not think about bicycling. It just was not ever something I even thought about. (male, 38)

> I definitely did not care about biking, and did not think about it much. It was off the radar. (female, 25)

4.1.2. Biking as exciting and fun

Over half of participants said that being on their bike at some point during their youth was "exciting" or "fun." Of those comments, most were made about bicycling in elementary school years. Many participants fondly reminisced about the fun, excitement, and adventure of bicycling in their childhood, for example:

> I remember going down these hills really fast and having fun, sometimes falling off, flying over the handle bars. You know when you fall as a kid it's kind of exciting. (female, 30)

Similarly, a number of participants described their bikes as fun "toys," used a source of entertainment or an instrument of play:

> Well, in my age group, and at the time, it was a toy. It was mostly entertainment for kids. (female, 55)
> I used to have a lot of fun with bicycles and my friends. We used to play games on bicycles with a soccer ball. (male, 35)

4.1.3. Independence and freedom while biking

Over half of participants talked about biking as a source of "independence" and "freedom" for themselves, and in some cases for their parents, for whom bicycling meant less need to chauffer their children around. Of these comments, over half were made in relation to the elementary school years:

> It was definitely my first experience of really being independent. After school we would go to stores and get ice cream and not have to beg our parents to let us go. We had our bikes to go there on our own. (female, 37)
> It was a way I could get farther away from the house than walking, and it was freeing for my parents. (male, 32)
> When we were in junior high, I remember distinctly when we were allowed to bike to the 7-Eleven. That was a milestone. I felt like the world was our oyster at that point. There was not anywhere we could not go. (male, 34)

A few participants even compared the independence that comes with bicycling to the independence that comes with being able to drive a car:

> I think when you are a kid…it's the closest thing you can get to having a car. You can take off and just go anywhere on your bike. Even though you really can not, but you feel like you could…and that's such independence. (female, 56)
> It's a core part of who she (my daughter) is. It's independence… it's like turning 16 and getting a car. It was that equivalent [for her]. (female, 42)

4.1.4. Biking as cool

A quarter of participants saw biking as "cool" at some point in their youth, but over half of these comments were made in relation to the elementary school years. These comments suggest a positive image of bicycling, that bicycling was both acceptable and desirable. For example:

> In elementary school I had a banana seat bicycle. It was pretty cool. (female, 44)
> We thought we were pretty cool. We were more of the little bike gangsters during that time; ride around and knock over people's garbage cans with our bikes and build jumps. (male, 34)

In contrast, just a few of participants commented on the "coolness" of biking in middle school and high school, suggesting a significant change in the image of bicycling by this age. Positive comments during this stage included:

> In 7th grade my bike was really important to me because it was brand new, and it was the type of bike that I do not think anyone on the East Coast saw. It was called a Chopper and it was cool. (male, 53)
> I wanted to ride my bike to school, I wanted that independence again. And there was a bus, but it was not cool to ride the bus. I was not old enough to get a driver's license, but it started to get cool to ride bikes, because we were all into the whole environment thing. (female, 56)

A 37-year-old woman from Palo Alto, California, another well-known bicycle-friendly city, was one of the few participants who explicitly discussed the "coolness" of bicycling in high school:

> I do remember when it was seen as cool. I really wanted to play up the environmental cred, and there was a small group that thought it was really cool that I rode my bike and they did too. (female, 37)

4.1.5. Biking as uncool

Far more participants described bicycling during middle school or high school as "uncool" or the equivalent. For example, one participant explained:

> Once I was in junior high school it was not the cool thing to do, to ride bikes. (female, 58)

Three-quarters of the comments about biking as uncool referred to high school years. These comments suggest a strong negative image for bicycling at this age:

> You would not be caught dead on a bike. It would not be cool to be riding a bicycle in high school. (male, 50)
> What were they going to say about me riding a bike? Nobody did, so why am I going to do what nobody does? (female, 55)
> If you were on your bike…especially in high school, then something is wrong with you. (male, 26)

Similarly, many participants described biking in youth as being "nerdy," "dorky," "geeky," "weird," "lame," or for "losers," reflecting a strong negative image of bicycling. Over two-thirds of these comments were made in relation to biking in the high school years, and a disproportionate share of these comments were made by women. In some cases participants described the negative image in relation to themselves, and in some cases in relation to others. Examples included:

> People that biked generally speaking were nerdier…big backpacks versus the cars with the purse and the book bag. (female, 25)
> It was not lame to do, but it was still one notch below driving and driving was like the holy grail of getting to school. (male, 25)
> If you were a teenager riding your bicycle you were probably considered a loser, because everybody drove or had a ride. It would be hard for someone to ride their bike and not get teased. (male, 50)

Ten participants described bicycling as "unfashionable" or "untrendy." Nearly all of these comments were in relation specifically to high school, and all were made by women. Examples from two women, separated by 27 years in age, illustrate this view:

> My younger brother rode a bike a lot in high school, but I did not. It was not a fashionable thing to do. (female, 52)
> In high school biking is not that cool; it did not seem trendy enough to do. (female, 25)

4.2. Bicycling versus other modes in high school

Not surprisingly, the increasingly negative image of bicycling in the high school years was clearly explained in part by the onset of driving. Nearly a third of participants highlighted the connection between their attitude toward bicycling and the acquisition of a driver's license by themselves or their friends. Examples included:

> Biking was not as cool once people started getting their own cars. It was a little bit of an embarrassment when they were in their cars, and I was on my bike. I think things starting shifting where I would rather have someone pick me up from my house and go with them in the car than on my bike. (male, 53)
> In high school I just kind of forgot about biking, I was so excited to be able to drive. (female, 48)

At the same time, a few participants indicated a clear preference for walking over bicycling in middle and high school, given a more positive image of walking among their peers:

> When you got into junior high it was almost cooler to even just walk somewhere than to pull up on your bike. I still liked biking, but it was not enough to get me through the peer pressure. (female, 56)
> At that point it was not cool to ride your bike. I liked walking around in groups. You met girls back then, so you'd walk with the girls. (male, 38)

Practical issues also made bicycling less feasible as a means of travel to school. Some participants said they abandoned bicycling because of the increased distance to middle or high school; it was simply too far to bicycle:

> Our high school was out in the middle of bean fields and corn fields and it would have been quite of a hike for anybody to ride their bike to school. (male, 50)

Several participants also mentioned that the increased demands of secondary school caused them to abandon bicycling.

> I just remember high school being an insanely busy time. And so that was not what I did as recreation, and it also did not fit into my daily life. (female, 27)

Finally, several environmental factors were cited as contributing to the abandonment of bicycling in middle or high school for other modes of transport: some mentioned hills and topography, others cited poor weather, several brought up rural roads as a problem, and others described roads with high amounts of traffic as barriers to bicycling in their middle and high school years.

4.3. Influences on attitudes in adulthood

The interviews revealed a strong connection between attitudes in high school and attitudes as adults. Of participants who strongly agreed that they liked bicycling at the time of the interview, nearly two-thirds said they liked bicycling in high school, while among those who did not agree that they liked bicycling at the time of the interview, few said they liked bicycling in high school. Those who bicycled in high school were far more likely to be bicycling at the time of the interview than those who did not.

However, the connection between a participant's attitude toward bicycling in high school and her attitude toward bicycling in adulthood was sometimes subtle. As noted above, most participants expressed negative images of bicycling in high school, yet some managed to ignore or overcome the negative stigma to continue bicycling and to continue to like bicycling during that period. Some participants succumbed to the negative stigma in high school but rebounded later to bicycle again as adults, as did this woman who now bicycles 7 days a week:

> You know, I always liked riding my bicycle as a kid, but when I got to high school it was considered dorky, so then I never rode it in high school. (female, 55)

Those who liked bicycling in high school were also more likely to have liked bicycling in elementary school and middle school, suggesting that very early influences are important to imprinting a positive attitude toward bicycling, or that some people are inherently more likely to like bicycling from the start. The interviews produced some evidence of the former. When asked what they like about bicycling now, many participants gave responses that echoed those for bicycling in childhood. Freedom, for example, was cited by nearly half of the participants (though as adults the benefit of bicycling is freedom from the cost of driving or the problem of parking or the limitations of transit schedules, rather than the freedom to travel independently). A number of participants talked about bicycling now in other ways that echoed their memories of bicycling as children:

> I feel like I'm flying. (female, 29)
> It's fun to ride fast on streets. (male, 25)
> You can join with your friends to bike together to ... explore new places… I like [bicycling] because [of] this. (female, 26)

The interviews also suggest that college experiences may help to overcome negative feelings about bicycling in high school. When asked about fond memories of bicycling, a few participants talked about the enjoyment of bicycling in college, where the social image of bicycling was much more positive than in high school, particularly for college students in Davis.

> I think my experience as an undergrad in Davis really shaped my like for biking. Biking was a really fun thing I did… it was not just a mode of transportation to campus… I have some really good memories attached to doing social activities on my bike. (female, 34)
> Fond memories? … my dorm buddies and I would just go on bike rides… getting lost on our bikes in Davis… we would just ride out and ride around with no particular destination in mind. (male, 36)

The interviews thus support the notion that early experiences with bicycling have an important influence on adult attitudes and behavior, and that positive experiences help to minimize the effects of negative ones. As one participant put it:

Good memories from childhood have a way of staying… with you until you are much older (male, 35).

5. Discussion

How participants thought about their bicycles changed over the course of their youth. While in elementary school, many participants saw their bikes as fun "toys" that provided independence and were sometimes even considered "cool." In high school, bicycles were often supplanted by cars, which became the new symbol for fun and independence. For nearly a third of participants, bicycling was "off the radar" and demoted after elementary school to something "only kids do." Bikes were abandoned for other modes of transportation, particularly walking and driving.

Participants cited numerous practical reasons for why they abandoned bicycling in high school. However, it is significant that almost two out of five participants said that bikes were "uncool" in high school, and one out of five described bicycling in similarly negative terms such as "nerdy, dorky, geeky, weird, lame, and for losers" (Fig. 2). It is also noteworthy that the majority of these comments were made by women in reference to their high school years. In our study, high school students, especially females, were particularly sensitive to negative images associated with bicycling, to the point that bicycling became stigmatized. Adolescence is a time of identity formation (Weigert et al., 2006), and transportation mode choice may be tied to self-presentation for some teens.

Cars and driving were prominent in the discussion of bicycling in high school. For some participants, the relative "coolness" of cars and driving contributed to the "uncoolness" of bikes and bicycling. Teenage car aspirations may help to explain why bicycling has historically been a less acceptable mode of transportation, especially when cars are associated with high status among peers. However, this sentiment may be changing. According to Sivak et al., over the past 25 years the percentage of young people who have a driver's license in the U.S. has declined substantially (Sivak and Schoettle, 2011). Economic barriers as well as changing attitudes towards driving and car ownership in youth could promote long-term reductions in car use and more active travel, including bicycling (St. George, 2010; Driscoll, 2011).

On the other hand, the results show that biking can be seen as "cool" by some sub-groups of adolescents. The "coolness" may be associated with the bike itself (a trendy or popular style of bike), a value (such as environmentalism or being "green"), or in some cases deviant behavior that happens while biking. For some teens, a bike can even be associated with status and self-esteem. The relative "coolness" of biking seems to be dependent upon the values and meanings ascribed by teens as a group to bicycling. In some cases, bicycling might contribute in a positive way to identity formation and self-presentation (Weigert et al., 2006).

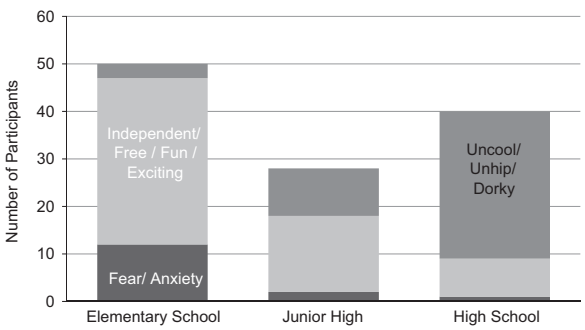

Fig. 2. Bicycling associations by school level.

In summary, these results suggest that if bicycling is not socially normalized or seen as "cool" in a community, teenagers are less likely to accept it. This is especially true for girls, a finding that may help to explain lower rates of bicycling among women in countries with low rates of utilitarian bicycling (Garrard et al., 2008). Even when teenagers themselves still enjoy bicycling, they may be loath to continue bicycling if social norms discourage them. As a 56-year-old woman said, "I still liked biking, but it was not enough to get me through the peer pressure." The supremacy of social norms over individual attitudes in relation to bicycling has important implications for policy, as discussed below. In addition, it has lasting implications for bicycling in adult years. Given the connection between attitudes in high school and attitudes as adults, social norms that dampen positive views of bicycling in high school are likely to dampen bicycling through the remainder of the life course as well.

5.1. Policy implications

Cultural stigmas can be challenging to overcome, but making bicycling "cool" may be the first step toward increasing support for bicycling as transportation for teenagers. According to the Safe Routes to School Partnership (2011), "messages about bicycling as a way for students to be active and have fun may be a better starting point than trying to start a program focused on riding to school." Similarly, Dill and Voros (2007) argued that "If planners and advocates hope that increasing cycling among children will lead to more cycling among adults as they age, efforts need to focus on cycling for all purposes for children, and not just to school." Starting a bicycling club or team might be a good way for teens to take ownership of the issue and help bicycling to be embraced as "cool" by other teens. Youth leaders could be recruited, trained, and supported to create innovative programs that will be effective with their peers. In addition, as Aldred (2012) points out, educational and enforcement campaigns need to be sensitively designed so that they do not reinforce stigma.

In some cases, stigma may be overshadowed and confounded by the issue of bicycle access. Many low-income youth in the U.S. do not have access to safe bicycles and cannot afford to get their bicycles repaired. Community bike shops located in low-income communities can help overcome this barrier. In addition to classes, used-bike sales, and self-service repair space, some of these shops operate an "earn-a-bike/build-a-bike" program geared especially for young people who learn in-depth bike mechanics and build a bike of their own by the end of the session. Another approach is to incorporate bicycle technology into the middle and high school curriculum, preparing students for careers in the bicycle industry. Some programs are tailored exclusively for girls, who tend to bicycle less than boys in adolescence. All of these efforts might also help to reduce stigma while increasing access to bicycling.

While bicycling programs are potentially important for increasing support for bicycling during the teenage years, driving policies may be equally as significant, as suggested by the experiences of European countries like the Netherlands, Denmark, and Germany, where high bicycling rates continue throughout the teenage years and into old age (Pucher and Buehler, 2008). The legal age for a motor vehicle driver's license in many European countries is 18 years, and these countries impose high fees and strict training requirements for obtaining a driver's license (Nivola, 1999; National Research Council, 2001; Buehler, 2010; Pucher and Buehler, 2010; European Union Commission, 2010). The UK Department of Transport reports that in 2009 the top three reasons teens ages 17–20 gave for not driving include the following: "cost of learning to drive," "cost of buying a car," and "cost of insurance" (Department for Transport, 2010). These policies mean that the aspirations of European teenagers to drive and own a car

are delayed relative to their peers in the U.S. In the meantime, they rely on cheaper means of transportation, including bicycling.

The U.S. has also moved toward restricting driving among teenagers, although to a lesser degree. As of January 10, 2013 the website of the National Highway Traffic Safety Administration listed 46 US states that have adopted graduated driver licensing (GDL) laws that restrict the conditions under which young drivers can drive and require new drivers to obtain a year or more of experience before receiving a regular license. Research demonstrates that GDL laws significantly reduce the incidence of teen driving injuries and fatalities (Baker et al., 2006). The benefits of this reduction are significant, given that mile-for-mile the crash rate for young drivers is more than twice the rate for 18- to 19-year-old drivers and almost 10 times the rate for drivers ages 30–59 (Williams, 2003). Evidence also suggests that these laws reduce the number of teenagers licensed to drive (Frith and Perkins, 1992; Ferguson et al., 1996). By discouraging teenagers from acquiring licenses and restricting their driving when they do, these GDL laws may inadvertently help to promote bicycling.

In addition to GDL laws, limiting student parking or charging parking permit fees at high school campuses might encourage students to use other modes of transportation. Henry M. Gunn High School in Palo Alto, California implemented a parking permit program to discourage unnecessary driving and to incentivize carpooling, public transit use, bicycling, and walking. Motivated by environmental concerns, students created the program themselves, helping to reduce social stigmas against bicycling. In Davis, however, proposed parking fees at the high school have met stiff resistance from parents and others, despite the strong bicycling culture in the city. Adopting any restrictions on driving, particularly those that do not have a direct impact on safety, remains politically challenging in the U.S.

5.2. Study limitations

Several limitations of this study should be noted. The sample was limited to 54 participants currently living in Davis, where their experiences with bicycling are not likely to be typical of other communities in the U.S. However, while 27 participants spent their youth exclusively in the western U.S., including five people who grew up exclusively in Davis, the rest spent their youth elsewhere in the U.S. or abroad. In this regard, our study drew on narratives from a much wider geographic distribution than just Davis, which may contribute to its generalizability.

The guiding questions prompted participants to reflect on their past experiences with bicycles, but reconstructing a mobility biography may raise concerns about validity due to missing, selective, or mistaken memory on the part of participants, or their own wrong assessment of their experiences (Pooley et al., 2006; Scheiner, 2007). In this regard, the analysis may have been skewed in favor of individuals who had better memory recall. However, using a systematic chronological approach to constructing a "bicycling biography" may have helped to improve memory recall for some participants.

Although the focus of the analysis was on adolescent attitudes to bicycling, we did not conduct interviews with contemporary adolescents. The accounts provided by the adults in the sample are retrospective reconstructions of their past experiences and attitudes, and they may not reflect the experiences and attitudes of today's youth (Weigert et al., 2006).

6. Conclusions

Even when teenagers themselves still enjoy bicycling, they may be loath to continue bicycling if social norms discourage them. High school students, especially females, may be particularly sensitive to negative images, even stigma, associated with bicycling. Investigating the experiences with and attitudes of adolescents towards bicycles and bicycling will improve our understanding of the conditions that contribute to negative images and stigmatization of bicycling. This understanding, in turn, provides a basis for the development of strategies to encourage more positive attitudes towards bicycling, a vital step towards increasing rates of bicycling among teenagers. Future research on adolescent experiences with and attitudes towards bicycling should address variation across community settings, racial and ethnic groups, and income groups. In addition, future studies should explore the experiences of sub-groups of adolescents known to have either decidedly positive or negative attitudes to bicycling.

Increasing the use by teenagers of active modes of travel to school and other destinations is itself an important public health goal, particularly given increasing rates of obesity at this age in the U.S. and elsewhere. But the benefits may extend into and throughout adulthood. Garcia et al. (1998) found that "Childhood and adolescence are ideal periods of development for fostering active lifestyles that can be maintained throughout life." Maintaining bicycling into adulthood could be especially beneficial given that overall physical activity tends to decline from childhood to adulthood (Corder et al., 2009). For these reasons, it is important to understand early experiences with bicycling and their connection to bicycling attitudes and activity in adulthood.

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