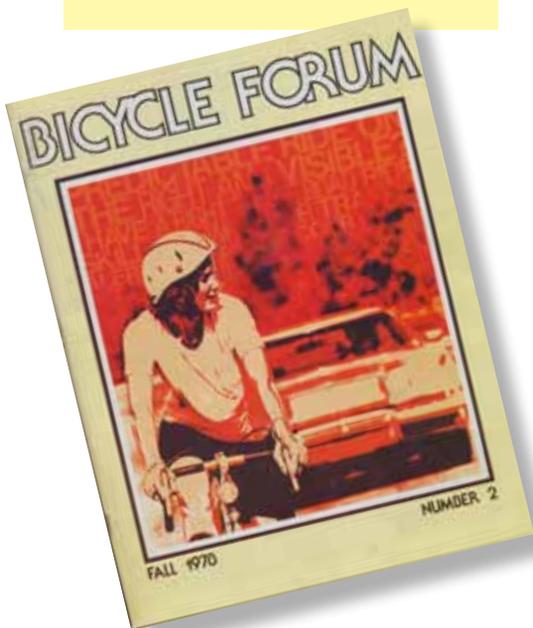




Bicycle Forum Interviews Ken Cross

“From
Countermeasures
to Conspicuity”
(1978)



KEN CROSS is best known as author of the National Highway Traffic Safety Administration's landmark study of *Bicycle/Motor Vehicle Accident Types*. This four year study examined 166 fatal and 753 non-fatal bicycle/motor vehicle accidents nationwide to identify 37 accident types, grouped into seven general classes (see “Accident Facts.” *Spring 1978 Bicycle Forum*). The study has led Cross to many provocative observations about bicycle education, safety, facilities and legislation as reported in this interview.

A research consultant for Anacapa Science of Santa Barbara, California, Ken Cross holds a PhD in psychology. He rides his ten-speed bicycle about fifty miles a month as a means of “keeping my stomach reasonably flat.” Because of his work in bicycle safety, Cross believes he knows how to ride “safely, but not expertly.”

Cross specializes in human factors work, having concentrated during the last few years on navigation studies of helicopters flying below treetop level and on traffic safety studies.

Ken Cross was interviewed in Washington, D.C., by Dan Burden and John Williams of Bicycle Forum. The interview was edited for publication by Peter Drake.

BICYCLE FORUM: Tell us how you got involved in bicycle research.

KEN CROSS: I work for a private research consulting firm called Anacapa Science. About five years ago, Clint Leffler, the transportation engineer for Santa Barbara, came up with a request for proposals to do a small study on bicycle accidents in the Santa Barbara area.

It was a competitive solicitation, with the money coming from the California Office of Traffic Safety. We bid on it and won. Quite candidly, we didn't know a single thing about bicycle accidents and very little about modern-day bicycling. We really did start from scratch.

BF: What year was that?

CROSS: That was 1973. We did a pretty conventional study of car-bike accidents, in that we examined the data one variable at a time and identified factors in accident causation. It was just about the same thing that everybody had done in the past. We didn't know how ignorant we were.

As a follow-up effort, Anacapa Science contracted with the [City of Santa Barbara] to develop a bicycle safety education program aimed at solving the problem defined by our first study. The contract wasn't very big — as is almost always the case in developing educational programs — but we thought we could use materials developed in the past.

Well, when it came right down to developing the program, I just was not satisfied with any of the ideas I had and I wasn't very satisfied with any of the materials that had been developed previously. The problem was that I couldn't define good hard definitive educational objectives. I looked at the data again and again and again and I still couldn't come out with good objectives. I went back to the raw data.

I started out classifying the accidents — literally sorting accident reports into stacks to organize the data in some meaningful way. I found that after I had classified the accidents into a relatively small number of stacks. I could break each stack up into more stacks and I ended up with a very crude accident typology. As I recall, we identified ten accident types that accounted for about 90% of all accidents.

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Now, all I had at that time was information contained on traffic accident report forms. As you know, they don't contain complete information but we had accident diagrams and narratives along with the data coded on the forms. It gave us some insight into the different types of accidents — where "type" means a group of accidents that occurred for similar reasons. We developed our first educational program from that first, fairly crude accident typology.

At about that time Al Farina from National Highway Transportation Safety Administration (NHTSA) came out with his request for proposals to do the nationwide study of car-bike accidents. He wanted an accident typology and I had a rudimentary typology. Anacapa did win that job and it went on for about three years.

***BF:** Could you describe the program you carried out in Santa Barbara, what you hoped to accomplish?*

CROSS: The course was composed of 20 one-hour training sessions. We had a couple of hours of pre-testing and a couple of hours for post testing, but that testing was not part of the course itself. There was quite a bit of material in the 'course that was in just to keep the kids interested and motivated. One of the things which I believe is important is that a technique for discussing each of the frequently occurring accident types was developed.

We spent quite a bit of time developing a magnetic board. We had magnetized components that fit on a large, flat metal sheet about three feet by four feet. The instructor could use these components to create various types of traffic contexts: orthogonal intersections, "Y" intersections, intersections of streets and driveways, straight roadways with sidewalks, or with out sidewalks, and so on. We had cars and bicycles.

All of them were designed to an approximate scale of 1 to 40. The teacher would demonstrate each of the important accident types and then hold a class discussion of the

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various factors that led up to that accident. There was no question that the kids learned a good deal about the dynamics of a traffic context. They learned where accidents occur and why accidents occur.

Another important part of the course was hazard recognition training. Because we were teaching third, fourth and fifth grade kids, we used a game where kids viewed a wide-angle slide and identified the cues to hazards. They got points if they identified the correct ones. The teacher was constantly providing feedback. A lot of training time was spent in teaching the teacher as to what were important cues to hazards and what were not.

In fact, she had lists for each slide. Also there was an indication of the number of points the student received for identifying various cues. The results were very rewarding because many people expressed the opinion that kids couldn't learn this kind of thing, that it was too complex. In fact the average kid just did remarkably well.

I would venture to say that if you took a half a dozen kids at random from the classes and they competed with an adult at this game, the kids would win. First of all, they learned to scan the periphery of a scene as well as the central portion. In the beginning, they just looked at the central portion and that was all, but they quickly learned to scan the periphery without excluding the center portion.

They learned to attend to the very small stimulus objects as well as the very big ones. In the beginning, a big truck — just because of its size — was perceived as a cue to a hazard.

In the end, it wasn't the big truck, but a bumper of a car that was almost entirely obscured by the big truck. They scanned for that kind of cue and they perceived it.

I'm really optimistic about that training approach. I think it's going to be effective. It's a skill that can be learned. Most importantly, once that skill has been acquired, it can be effective in giving the kid that extra two or three hundred milliseconds that's needed to initiate a successful evasive action in similar situations.

***BF:** What do you consider the most significant findings of your national study on motor vehicle/bicycle accident types and countermeasure approaches?*

CROSS: One thing that I think very significant is that there's not a very high correlation between ways bicyclists have assumed car-bike accidents occur and the ways they actually occur. In the past, bicycling experts and people in the safety business have made judgments about accident causation based on near misses or situations that appear dangerous.

If you talk with the typical bicyclist and ask him to describe the most hazardous situation in which he rides or the context in which accident likelihood is greatest, he will tell you it's in the context of riding down a busy street with lots of traffic, parked cars on both sides, very little space. In fact, that's simply not where the accidents are occurring.

The lion's share of the accidents occur in pretty safe-appearing areas. Actually it shouldn't be so surprising, because bicyclists are pretty smart people and so are motorists. They exercise whatever caution is needed to compensate for the heavy traffic, the limited lane width and so forth.

There are a lot of other contexts that appear fairly safe but because of some unexpected event the bicyclist gets nailed. That, of course, has very important implications for education.

BF: Yes, I see what you're saying. I know that a lot of accidents with younger kids take place on the residential streets the driveway accidents, for example. But do cyclists avoid the main roads because they don't like main roads and hence, because there are more cyclists on the other roads, accidents tend to occur there?

CROSS: This whole matter of exposure is a very important question and to my knowledge no one has developed a successful way of dealing with it. No one has any good, empirical data on exposure. All I can do is express my opinions. I think that people behave differently in different traffic contexts.

I know there is a lot of riding done, particularly by adults, on busy streets. It doesn't seem to me that accidents are occurring in proportion to the riding done in those dangerous-appearing contexts, but I can't back up that with any empirical data. I could be dead wrong.

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BF: What you are saying makes sense to me as a cyclist. If I want to get somewhere I usually take one of the main streets because I prefer the signalization. It's reassuring. If I go through an uncontrolled residential intersection anything can happen. Any other findings of major significance?

CROSS: I think the problem types that have been defined will lead to more productive discussions about this overall problem.

BF: Yes, if you were just working with enforcement countermeasures, the overtaking accident would probably be something you'd focus on — where someone just comes up from the rear and — smacko! — but the accident types that don't involve a clear violation of the law, you'd pass by.

CROSS: Well, a good example of the complexity of trying to define problem types is the "bicycle ride-out" accident. You'll recall that in the first type the bicyclist rides straight out of the driveway; in the second type, he's been riding on the sidewalk parallel to the roadway, then rides out into the roadway from a driveway apron; in the third type, he rides over a curb; in the fourth type, he rides out of a commercial driveway; in the fifth type, out of a residential driveway.

For educational purposes, you can lump all those together. If you're talking about engineering or enforcement countermeasures, you can't. You can prohibit riding on the sidewalk, which will affect one of those accident types, but not all of them. A good deal of caution has to be exercised when these typologies are used to define solutions because there is no perfect accident typology that's useful for all different purposes.

BF: Are the wrong-way riding accidents serious? Do they often result in fatalities?

CROSS: No, they don't, because the impact velocity is usually the result of the bicyclist's speed alone. The bicyclist smacks into the side of the car, or the front of the car strikes the bicycle just as it's accelerating from a stop or when exiting a driveway. There are very few fatalities resulting from wrong way riding, but plenty of injuries.

BF: Now if we could play devil's advocate for those who consider wrong-way riding to be safer. We've often heard, "If I get hit from behind, my chances of getting killed are very great, but wrong-way riding does not net that many fatalities. If I am worried about my life, aren't I indeed safer riding against traffic?"

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CROSS: As a wrong-way rider you're assuming that you're going to have time to respond once you perceive you're on a collision course with a motor vehicle. I think that if you calculate the response time that's available, you'll find that it's probably not going to be adequate.

If a car is driving down the shoulder of the roadway where you're riding and has been doing that for a long time, obviously you're going to be able to evade him. But I don't think that's the way accidents occur. I think there is a momentary veer by the motor vehicle to the motorist's right. How far in advance does that occur? It occurs about one reaction time. As soon as it happens the motorist corrects it, and he corrects it as quickly as he can unless he's drunk.

When I started talking with bicyclists and law enforcement officers about wrong way riding, they all concentrated on the fact that if a bicyclist is riding the wrong way, and collides head-on with an approaching motor vehicle, the impact velocity equals the sum of the velocity of the two vehicles and therefore the likelihood of serious injury or fatality is much greater.

People who argue in favor of wrong-way riding told me that if a car is going to hit them, they want to know it so they will have a chance to avoid the collision. The point is that all the arguments pro and con are centered on the motor vehicle traveling in a parallel path, facing approach. Well, that's not how wrong way riding accidents really occur.

They occur when the bicycle and motor vehicle are on right angle paths. They occur because motorists don't expect a hazard to be approaching from the right and the bicyclist assumes the motorist does expect him. Whether bicyclists get hit head-on or from the rear is not going to make very much difference.

BF: *Why weren't wrong-way accidents broken out into a separate type?*

CROSS: Wrong-way riding accidents occur at a variety of different locations, in a variety of different traffic contexts. Although the same training countermeasure might be effective for all wrong-way riding accidents, engineering countermeasures will change with different contexts.

BF: *It makes a lot more sense to ride with traffic in terms of being able to understand the traffic context. All of the road signs are facing you and motorists expect you on their right. The nighttime overtaking accident is one of the easiest to avoid. When the motorist is coming up from behind, I start watching my shadow. If my shadow doesn't move off to the right, I know the motorist isn't moving over as he should, and I just dive off into the bushes.*

CROSS: That's great! That's so obvious, but it never occurred to me. That could be effectively trained using a simulation device. You wouldn't have to have a car

A significant number of the left-turning accidents did occur in rural areas. It's certainly worth looking at, but I think there's also something else involved. I think it stems basically from the way our vestibular (inner ear balance) mechanisms are made. Have you tried to look behind for a substantial period of time while riding and seen what happens to your lateral control?

BF: *Sure, you could show it in the classroom. You could have a bicyclist in a dark classroom and move lights off to the side and watch what the shadow does. It's the kind of thing that would catch a young person's fancy. I'm interested in the left-turning accident type, where the left-turning cyclists were turning at a place where there was no intersection. I've noticed that some kids out in rural areas like to be on the opposite side of the road from the motor vehicle traffic. There's almost a constant jogging back and forth across the road to stay away from traffic.*

CROSS: That's interesting. A significant number of the left-turning accidents did occur in rural areas. It's certainly worth looking at, but I think there's also something else involved. I think it stems basically from the way our vestibular (inner ear balance) mechanisms are made. Have you tried to look behind for a substantial period of time while riding and seen what happens to your lateral control?

BF: *I think it's one thing to be able to see over your shoulder, but it's another to be able to do it for an extended time. I don't think you can train yourself not to swerve. I think it's a normal physiological response. I know that when I look back I'm going to move approximately eight inches farther out into the road and I can correct for it.*

CROSS: My best guess is that swerving is caused by a physiological limitation. Our vestibular system works very well when the head is tilted as it is when riding a 10-speed. Pilots of high-speed aircraft have learned never to go into a high-G turn with their heads tilted in any way. It means instant vertigo. Of course, when you're riding a bicycle you're not experiencing high G's but you are experiencing low G forces with your head tilted.

Bicyclists learn the relationship between "look behind" and lateral control and they develop a reluctance to look behind because they don't want to fall down. Most of them recognize that it's necessary to know

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what's coming from behind before they turn left, but there's a tendency to trust auditory cues.

Without being aware of it, bicyclists trust auditory cues more and more. Suppose you're on a country road, you don't hear anything coming; and you make a turn, without looking carefully. Well, youngsters probably do this properly 99 out of 100 times, but once in a while they're trusting their ears when there's a masking noise generated by the wind blowing or by a motor vehicle approaching from the opposite direction.

Once in a while, the auditory cues are not reliable because they're masked by some other noise and the bicyclist gets nailed. This is an important research issue that was not resolved by the data we collected. It's only going to be resolved through a series of carefully controlled studies of bicyclist behavior. Almost any skill is trainable if you want to invest enough time in doing it, but is it cost effective?

BF: *In designing countermeasure approaches, conflicts seem to arise between the need to protect inexperienced cyclists and children and the rights of skilled cyclists to use the road. Has your research addressed the conflict?*

CROSS: There is simply no question that controversy is going to arise. It worries me because the youngsters don't have a spokesman, while the real bicycle enthusiasts not only have spokesmen at the meetings where these decisions are made, but they are almost invariably extremely bright and extremely articulate spokesmen.

So I'm not worried too much about the bicyclists ability to protect their rights. I am concerned with kids and I am concerned with the welfare of the bicyclist who is not necessarily a regular commuter or a wild enthusiast. For instance let's talk about the controversy over bikeways. I personally don't think that bikeways are going to impact accidents very much one way or another, but they make a lot of people feel good.

They don't make an expert feel good, they make a lot of other people feel good and these people probably constitute a much larger percentage of the population than do the experts. A bikeway may make an inexperienced bicyclist feel more secure than if that bikeway weren't there. Obviously, you don't want to develop the famous "false sense of security" people always talk about.

Children in particular probably do things in bike lanes that they probably wouldn't do if there were no bike lane. I feel more comfortable riding in a bike lane than riding on a street without a bike lane, even though I consider the objective likelihood of an accident to be pretty much the same. It's an emotional thing It's more than an objective consideration, I guess.

BF: *A lot of people riding on a bikeway appreciate the difference of being on one but they can't articulate exactly what that difference is.*

CROSS: It might be something as simple as feeling that they are not encroaching on the motorists' territory.

BF: *That could be. A lot of people feel that they are getting in someone's way, even though they know they have as much right to be there as anyone else.*

CROSS: Those kinds of things are important, but even if you're willing to consider them, how do you measure their importance if there's no hard data. It's tough, and it's going to be for a long time.

BF: *Do you think bikeways represent a valid countermeasure approach?*

CROSS: I would guess that 80 to 90 percent of the people talking about the importance of bikeways as countermeasures are talking about the cases in which an overtaking motorist runs down a bicyclist. There are not too many overtaking accidents; but when they occur, they are important. It seems reasonable that we might think about bikeways as countermeasures.

It appears, however, that most of these overtaking accidents occur on rural roads where bicycle traffic is fairly low. If bikeways were built on the roads where overtaking accidents occur they could decrease the likelihood of that kind of accident. If you look at the amount of bicycle traffic on those roads, however, you could never justify putting in a bike lane.

Most overtaking accidents occur on rural roads where bicycle traffic is fairly low. If bikeways were built on the roads where overtaking accidents occur they could decrease the likelihood of that kind of accident.

If you put bike lanes where bicycle traffic is high you're not going to have an impact on overtaking accidents, but it is possible that if you put in bike lanes you might affect some of the motorist drive-out accidents and bicyclist ride-out accidents because you provide a larger buffer zone between the bike and car.

The lane provides a buffer zone of seven or eight feet between that point in the driveway where it becomes apparent to the motorist that the bicyclist isn't going to or can't stop before entering the roadway and the point where the vehicles are on a collision path.

If you're going to talk about the potential for bike lanes in decreasing accidents, there is probably more potential decrease for ride-outs than for the overtaking accidents. I'm personally not too sold on bike lanes

as a means of accident reduction; but I don't think that's the only criterion on which to evaluate bike lanes.

If bikeways result in increased use of bicycles and all their attendant benefits, that's perfect justification for building bike lanes. I certainly don't want to suggest that I'm in favor of spending all of our money on bike lanes. I think that there are a lot of other things that need to be taken care of first. Something peculiar seems to be happening.

There's money to spend on bike lanes but not on other things, and there is no way to switch that money around. Either you spend money on bike lanes or you don't spend any money at all. That's unfortunate as far as I'm concerned. You're considered an ingrate if you don't want to take money and build bike lanes with it .

BF: *Do you know of any statistically valid research that has evaluated bikeways or bicycle education programs as to their effect on accident reduction?*

CROSS: No, I don't. I've thought a good deal about how to go about that, but it's a difficult experimental design question. People don't like to spend money on evaluation, they like to spend money building things. They like to spend money doing basic research on how to build things; but they don't like to spend money in evaluation, particularly when the evaluation program might cost more than the thing being evaluated. That's almost sure to be the case with bike lanes.

You spend \$100,000 building a section of bike lane and it could very well cost \$200,000 to do a statistically valid evaluation of that bike lane. The effect of bike lanes is one of the most difficult research questions that exists in this whole bicycle safety area. I doubt if it's going to be possible to answer the question until there are more bike lanes.

That really is a paradox, because you want evaluation data to use in making decisions about whether or not to build

bike lanes and you can't really do it until you've built a number of them. Just building one bike lane is not adequate. A lot of weird things happen with one bike lane.

It's certainly not a problem that is unique to bike lanes. When they decided to build the freeways, I don't think they had good, hard data on the impact of freeways on accidents. Yet, a lot of good, analytical work was done which apparently led to the correct conclusions. There are times when research is required, and there are times when a purely analytical approach is the only solution. I think that is true of bike lanes right now.

BF: *What direction do you see bike education taking as a result of the accident study? What are some of the things considered important now that weren't considered important a couple of years ago?*

CROSS: I think there will be a movement away from training in bicycle handling skills. I think most people recognize now that it is not the problem. I'm not certain why it is not, but apparently people learning to ride are more careful than they are once they have acquired a basic amount of skill. Vehicle handling skills and deficiencies don't seem to be important problems.

I think you are also going to see people moving away from the bike rodeo approach. The vehicle handling training the people get in a bicycle rodeo does not have any impact on accidents; and even if the training content of the bicycle rodeo is changed, one day is not going to be enough to really eliminate any of the important knowledge deficiencies of the bicyclists. Bicycle rodeos may continue, but for other reasons they might register bicycles and promote interest in bicycling, which is just fine.

BF: *We keep talking about safe bicycling and bicycle safety. What do you think these phrases mean, anyway?*

CROSS: Avoiding accidents. A safe bicyclist is one who doesn't have

accidents. The importance of the question is in defining skills that must be learned to be a safe bicyclist. I think they are perceptual and cognitive skills rather than motor skills.

It appears to me that nearly everyone can acquire the motor skills of vehicle handling in pretty short order, but it takes a lot of experience and training to understand the dynamics of the traffic environment well enough so you can anticipate accident producing events far enough in advance to permit successful evasive action.

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A safe bicyclist is one who possesses perceptual and cognitive skills which require him to scan the environment for relevant information. You have to scan selectively and you have to understand the implications of certain kinds of cues. It's an anticipatory type of thing.

Children may do things that appear terribly unsafe to adults, but not because they're any more willing to accept pain than adults or to accept risk. It's risk assessment rather than risk acceptance that seems to be different for children.

BF: *What sort of perspective do you have about on-road training?*

CROSS: I personally would like to see lots of on-road training because I think it is the highest fidelity training you can get. One problem, of course, is efficiency. Our training time is limited and if you're going to expose a kid to fifty hazards, it might take fifty hours to take him to the hazard locations. The real world can be simulated in the class room using movies or slides.

In addition, there's the problem of

liability. A lot of school administrators are willing to take on bicycle safety education as an added responsibility if the community considers it important, but I don't think many of them are willing to accept legal responsibility in the event of an accident. I doubt very much that you're going to get many schools to include on the road training in any bicycle safety education program.

BF: *A certification program for the teachers is important in an on-the-road training program. If you're not absolutely positive that your teacher really knows his stuff and has demonstrated an ability to teach in the traffic context, then an on the road training program can get you into some REAL trouble.*

Can non-riding education people — people who have not had that great an amount of experience with actual bike riding teach hazard recognition and evasive action skills? Is it going to take a special course to teach instructors how to teach bicycling? How much more sophisticated do we need to get?

CROSS: One of two approaches must be adopted. Either a training program must be developed for bicycle safety education instructors or the equivalent of self-instructional materials must be developed. One thing that won't work is an abstract instructor's manual of the type that's typically developed for teachers already trained in the subject matter.

There will be few teachers in the educational system that have the fundamental training in bicycle instruction. If you must depend upon typical elementary school, junior high or high school teachers to convey bicycle information you will have to develop a teacher training program.

BF: *If a left-turning motorist is coming right at you, knowing how to make an instant turn would be a good skill to have been taught.*

CROSS: I've not placed any emphasis in the educational materials I've developed on teaching evasive

actions because I've not found that many accidents are the result of skill deficiency. I've got to admit that my data might not have revealed that kind of thing.

It's nearly impossible to make a judgment from most accident data about whether or not an accident could have been avoided if a person had possessed the skills to make emergency turns and stops. Possession of these skills is bound to have some sort of impact — an important impact — on accidents.

The instant turn, the panic stop and scanning behind are probably motor skills that are important to teach. Certainly these are three motor skills that have good potential applications that violate the general principle I made earlier about motor skill deficiencies not being a problem

BF: *What do you think the biggest stumbling blocks are for reducing bicycle accidents in the United States? How can be overcome?*

CROSS: I think education is head and shoulders above any other type of accident countermeasure. A comprehensive educational program is necessary if we are going to have any type of impact on bike accidents. The problems are time and money. There are a lot of people who could accomplish the educational task, but I think that the only way we are going to get a widespread program is to get it into the schools.

The training time available in schools is limited, so we're not going to be able to teach bicycle education for one hour a day all year long. It's simply not possible. We've got to overcome the big problem of getting a program that's both effective and yet can be taught within the time constraints. Then there is the money to think about. It's going to require money to do this.

There are some who think that schools will accept this responsibility with no additional funds, but that's not likely. It's unrealistic to approach it that way. I find it difficult to believe that

the magnitude of the problem is great enough to justify the expenditures that are going to be required to develop a program that works.

However, if we consider bicycle training, pedestrian training, and driver training as similar problem areas and develop an education program that's designed to curtail all these kinds of accidents — perhaps bus accidents as well then the program would be highly cost-effective.

If we're going to teach bicycle safety alone, I'm just not all that optimistic that anyone is going to come up with the funds that are needed to implement a widespread safety education program in the schools.

BF: *Is it realistic to ask adult bicyclists not to run stop signs?*

CROSS: It's easy to pass a law requiring all bicyclists to stop, but it's very difficult to enforce it. I have never met anyone who didn't readily admit that there are a lot of situations in which he rides through a stop sign without coming to a complete stop, or without even slowing significantly. It doesn't make a lot of sense to pass a law if you can't enforce it, and I don't think you can enforce that law.

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There is simply no question about it — ignorance of laws and ordinances doesn't cause car bike accidents. Certainly bicyclists in general, and young bicyclists specifically don't have an in-depth working knowledge of all of the traffic laws that are published but they have a functional working knowledge of the important laws that affect them.

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Our study found only one bicyclist facing traffic who was unaware that it was unlawful. We didn't find any bicyclists at all, even five-year old bicyclists, who had an accident as a result of running through a stop sign who wasn't aware that it was an unlawful act. Ignorance of the law simply is no problem...and yet now, and probably forevermore, bicycle safety programs are going to talk about laws and ordinances.

What I hope will happen is that they will stop trying to get kids to memorize laws and ordinances and try and give the kids some rationale for why certain laws were formulated.

BF: *Which laws have the greatest effect on safety? Which laws should be enforced?*

CROSS: As for existing laws, those dealing with riding against traffic and failure to yield at signed intersections should be enforced. A new law should be passed that defines how bicyclists behave when they're entering a street from a driveway. If an enforcement officer sees a bicyclist coming out of a driveway without stopping, he can't ticket that bicyclist because it's currently not against the law unless the bicyclist causes, or almost causes, an accident.

Our study also showed that bike/car accidents occurred at signalized intersections where the bicyclist entered the intersection when the light was amber, and lacked sufficient time to cross the intersection before the light controlling the crossing traffic turned green. Maybe there should be an ordinance that makes it unlawful for a bicyclist to enter an intersection on an amber light.

BF: *What about the lights and reflectors laws? I think they should be enforced.*

CROSS: I'd like to see the lighting standard defined in terms of conspicuity rather than visibility. You can see a pinpoint source of light on a dark night for miles, but that doesn't insure that it will be perceived. It's conspicuity, not visibility that is the relevant evaluation criterion for lighting.

BF: *Can you explain in some greater detail the physiology behind conspicuity...behind people actually perceiving? How is it that we can see something without perceiving it?*

CROSS: Let's talk first about some characteristics of the eye. The visual acuity of your peripheral vision is so poor that when you're viewing stimuli peripherally it takes a pretty special type of stimulus to attract your attention. A stimulus with movement, or blinking, would more likely be perceived peripherally than any other kind of stimulus.

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Colors aren't very important because color isn't seen peripherally. It's perceived by the cones and not the rods of your eye. Cones don't exist outside a very small central section of the retina. Wearing bright colors doesn't increase your chances of being perceived peripherally.

Seeing without perceiving has been termed "selective perception" in the psychological literature. Selective perception is a common phenomenon but no one is capable of explaining exactly why it occurs.

BF: *The point about color perception is important. We wear bright colors to be seen, but if someone sees us peripherally, the bright colors aren't helping at all. How many people are aware of that?*

CROSS: Probably not a lot. People that manufacture clothing are aware of it and they still try to sell clothing based upon its colors.

BF: *Conspicuity — that's probably the thing that attracted me to the French leg light that you strap underneath your knee. I've had more motorists coming up behind turn on their high beams to see what I was when I was wearing the leg light than anything else I can think of. They see a little light moving around and possibly they think it's a highway patrolman flagging them down because there's a big ten-car pile-up ahead.*

CROSS: The leg light will get their attention peripherally, too.

BF: *From the unique perspective you've gained in studying bicycle accidents and in developing and testing a bicycle education program over the last few years, what are your views on the future of bicycling and bicycle safety in the United States?*

CROSS: I'm quite optimistic about the future of bicycling and bike safety in this country. Since the new bicycle "boom" began there has been significant change in attitudes. I am pleased by the increasing rationality among those concerned with bicycle programs. There is less emotionalism and more informed discussion at bicycle conferences.

Definitive data are beginning to appear from bicycle research. Funding agencies at the national level have become aware of bicycle safety and the social benefits of bicycling. All of these changes point to a promising future for bicycling in the United States.