Keynote Address:
Rural and Urban Accidents of Young Drivers
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RECENT INTERNATIONAL RESEARCH ON THE CAUSES OF TRAFFIC ACCIDENTS OF YOUNG DRIVERS

An OECD working group has recently (September 2006) produced a report « Young drivers. The road to safety » (www.oecd.org). This report has a chapter about the causes of the young drivers crashes, but in fact these are well known in traffic safety research. The young drivers' problem resolves around three main dimensions :

- **age**; especially in North America, where, for reasons of distances and of transportation policies and of general politics (the power of the car industry!) the young people have access to car driving much more precociously than their European peers, who do not generally gain access before 18. So, access to car driving happens in this stormy decade of puberty and adolescence.

- **inexperience;** young drivers are not only young, they are also inexperienced, and whatever the starting age, we see the effects of the learning curves, the decrease of accident rates after the first years of driving.

- **sex**; the OECD report has added this third dimension, as we know that sex is a factor maybe more influent than age: young males have, according to the country, a three to four times higher involvement in fatal crashes than young females. This male vulnerability is still observed after control of exposure. This difference is not only quantitative, but also qualitative : if we refer the the Driving Behavior Questionnaire of Manchester University, we can say that young male drivers' accidents are mainly issuing from violations, whereas young female drivers' accidents are mainly issueing from mistakes and lapses.

According to the relative importance you give to these three factors, traffic safety strategy will be different, for example, concerning age of access.

The « typical » young driver's crash scenario :

In-depth analyses of accidents reveal generally the same variables in Europe and America :

- weekend nights
- coming back from leisure
- single vehicle accident
- loss of control in curve

A « non typical » young people driver's accident, might for example, include daytime, left-turn crashes with oncoming traffic, indicating an inexperience problem.

The six factors of young male adults' crashes

The first four factors are very specific to young male drivers' crashes, the two last factors are very general traffic accident factors.

1) *alcohol* (present in 45% of fatalities in the US, 35% in UK and 30% in France);

Even if there has been a decrease in the 80's and 90's, the progress is now slowing down, and alcohol is still a major stake of traffic safety action in direction of this population.

Although alcohol is not only a young people problem (alcohol prevalence is as high among 25-50 years-old), there is a young people overrisk for a given Blood Alcohol Content (B.A.C.). This comes from the inexperience and from the interaction of drinking with the five other factors listed below, and this supports for some traffic safety actors the fairness of lower B.A.C. in the first years of driving.

2) *illicit drugs*, mainly cannabis;

This is of course more specific of young drivers, as cannabis use is decreasing with age after 25 ; if cannabis is present in 8 to 20% of accidents according to the country, its causal role in fatal accidents seems less important than alcohol, as shown by a recent French important case-control study on 10 000 drivers involved in fatal accidents (comparing the driver responsible of the accident to the non responsible driver).

This study has also shown that in half of the cases of drugged drivers'accidents, alcohol was present also, and that the combination of alcohol and cannabis is a massive risk factor for young drivers.

3) *fatigue*;

Although we lack of data about the role of fatigue in accidents, we know that young people are often in situation of « sleep debt », and that the loss-of-control can reveal a vigilance and sleepiness problem, in those wee hours of the morning. Some authors attribute up to 30% to fatigue in accident aetiology.

4) *same sex and same age passengers*;

The same factor, the presence of passengers, is a protective factor for adult drivers (they drive more cautiously when they have passengers than when they are alone), and a risk factor for young drivers (they drive less cautiously when they have passengers than when there are

alone). This is particularly true for young male drivers when they have same sex passengers, the effect ranging from distraction to desinhibition of risk taking. For young male drivers, the presence of girls in the car is witthout doubt a protective factor !

5) *speed*;

As in every crash, speed may not be the cause of the crash (as we have seen above many other causes), but speed is always the cause of the severity of the lesion : at lower speed, the same crash would have produced a light injury, not a fatality. We know that young drivers like to speed, and that the proportion of drivers speeding at the time of fatal crashes is in the US of : 40% for the 15-25 years-old, 30% for the 25-35, and 20% for the 35-45 years-old.

6) *non-use of seat-belts*;

Considering the number of passengers in the young people crashes, the non-use of seat-belts, notably in the back seats, is a major factor of the severity of the crash. Young males are known to be the group which are belting the less frequently : in 40% of the fatal crashes, the seat-belt was not used.

DIFFERENCES BETWEEN ACCIDENT PATTERNS OF YOUNG ADULTS IN URBAN AND RURAL SETTINGS

Preliminary note: some epistemic questions

Are the factors associated linked to :

- accidents in rural areas/accidents in urban areas
- accidents of young people living in rural areas/in urban areas?

This is very different as young urban people can have accidents in rural areas (i.e. the weekend nights accidents, when they return from concerts or discoes), and young rural people can have accidents in urban areas!

Are the factors associated to the environment or to the culture?

In most western countries, the crash location is the criterion to define it as « rural » or « urban ». But where is the young driver's house?

This is not collected usually in Europe, but the New England Transportation Institute and its contractor Smart Mobility have collected this data for the US (highway death rate according to driver's place of residence density, see Coogan, 2006). This analysis shows that rural young males have a death rate which is five times that of their urban counterparts, and this is true for older drivers as well.

So, living in a rural environment is a risk factor in itself.

We compare rural and urban but what about suburbs and periurban? The cities are spreading more and more: so, we have invented this new concept in France : rurban! People living in

semi- rural environments and commuting everyday to the city are experiencing a traffic environment which is not totally urban or rural.

Are the teenage lifestyles and new media and communications (internet) erasing rural/urban and regional differences, notably concerning representations, attitudes and behaviors ? We'll see later that maybe not!

What is the epistemic value of the study of geographic variation? Can it help injury countermeasures?

The (considerable) rural risk, for fatalities but less for accidents

- In Nevada (Niemcryk and al., 1997), rates of injuries among chidren (0-14 years-old) are 3 times higher in rural areas.
- idem in Colorado, Connecticut
- In Alberta, the analysis of casualties and fatalities between 1997 and 2002 shows that after age, sex and calendar year have been adjusted :
    i. the relative risk of a motor vehicle crash hospitalization linked to rural areas is 3.0
    ii. the relative risk of a motor vehicle crash fatality linked to rural areas is 5.4

So, everything else equal, rural children and young people are five times more likely to die in a motor vehicle crash and three times more likely to be admitted to hospital following a motor vehicle crash. This is considerable and we see the relationship between rurality and severity of accidents, as the odd ratios differences are higher for fatalities than for casualties.

Alberta traffic fatalities (1997-2002)

		Rural	Urban	Total
0-14 years-old	Male	44	9	54
	Female	40	7	47
15-19 years-old	Male	142	41	183
	Female	85	15	97

Alberta traffic fatalities (1997-2002)

		Rural	Urban	Total
0-14 years-old	Male	81%	19%	100%
	Female	85%	15%	100%
15-19 years-old	Male	76%	24%	100%
	Female	88%	12%	100%

Alberta motor vehicle crash injury hospitalizations number (1997-2002)

		Rural	Urban	Total
0-14 years-old	Male	309	111	420
	Female	273	114	387
15-19 years-old	Male	1004	395	1399
	Female	786	375	1161

Alberta motor vehicle crash injury hospitalizations number (1997-2002)

		Rural	Urban	Total
0-14 years-old	Male	74%	26%	100%
	Female	71%	29%	100%
15-19 years-old	Male	72%	28%	100%
	Female	68%	32%	100%

France latest data available (2005)

15-17 years

	Rural	Urban	Total
Fatalities	168	92	260
Injury hospitalizations	1078	2590	3668
Light injuries	887	4454	5341
All	2133	7136	9269

15-17 years

	Rural	Urban	Total
Fatalities	65%	35%	100%
Injury hospitalizations	29%	71%	100%
Light injuries	17%	83%	100%
All	23%	77%	100%

18-24 years

	Rural	Urban	Total
Fatalities	814	408	1222
Injury hospitalizations	3830	4893	8723
Light injuries	4442	10 998	15 440
All	9086	16 299	25 385

18-24 years

	Rural	Urban	Total
Fatalities	67%	33%	100%
Injury hospitalizations	44%	56%	100%
Light injuries	29%	71%	100%
All	36%	64%	100%

All ages

	Rural	Urban	Total
Fatalities	3654	1664	5318
Injury hospitalizations	16 910	22 901	39 811
Light injuries	19 314	48 951	68 265
All	25 845	58 680	84 525
Severity (killed/100 casualties)	14.1	2.84	6.29

All ages

	Rural	Urban	Total
Fatalities	69%	31%	100%
Injury hospitalizations	42%	58%	100%
Light injuries	28%	72%	100%
All	30%	70%	100%

European comparisons

All ages

	Casualties		Fatalities	
	Urban	Rural	Urban	Rural
Germany	66%	34%	25%	75%
Austria	61%	39%	26%	74%
Belgium	51%	49%	30%	70%
Denmark	60%	40%	33%	67%
Spain	53%	47%	19%	81%
Finland	50%	50%	22%	78%
France	68%	32%	28%	72%
Greece	70%	30%	34%	66%
UK	64%	36%	34%	66%

France latest data available (2005)

Difference rural/urban concerning the vehicles involved in the crashes

	Urban	Rural	Together
Bicycles	4.3%	1.7%	3.5%
Mopeds	12%	4.3%	9.7%

Motorcycles	10.1%	9.5%	9.9%
Cars	63%	72.3%	66%

So, we see that pedestrians, bicycles and mopeds are more involved in urban areas, cars in rural areas, and there is no difference for motorcycles. The distances to run are probably the main factor of this.

But if we consider only the fatalities, the severity of accidents in rural areas lead to the higher number of two-wheels drivers killed in rural areas. This is not true for pedestrians, as the density of traffic in urban areas is a risk factor for pedestrian fatalities. It should be interesting to have US data for this.

Users status

	Fatalities	Hospitalizations	Light injuries
Pedestrians			
in urban	487	5466	7926
in rural	196	406	270
Bicycles			
in urban	72	1312	2766
in rural	115	408	278
Mopeds			
in urban	193	4416	8193
in rural	200	1193	771
Motorcycles			
in urban	359	4988	9163
in rural	554	2599	1949
Cars			
in urban	595	6776	21 235
in rural	2565	11 877	15 567

15-17 years-old

France latest data available (2005)

We see the usual correlations :

- male vulnerability
- more crossroads accidents in urban
- importance of the nightime, more so in urban

Fatalities

	URBAN	RURAL
Bicycle	5	7
Girl	0	1
Boy	5	6
In crossroad	2	3
Out of c.	3	4
Day	4	5
Night	1	2
Mopeds	46	61
Girl	6	9
Boy	40	52
In crossroad	14	8
Out of c.	32	53
Day	21	29
Night	25	32
Motorcycle	8	10
Girl	0	3
Boy	8	7
In crossroad	4	1
Out of c.	4	9
Day	4	6
Night	4	4
Car (*)	27	88
Girl	11	34
Boy	16	54
In crossroad	5	9
Out of c.	22	79
Day	5	33
Night	22	55

* car passengers because french teenagers do not drive at this age 18-24 years-old

France latest data available (2005)

Fatalities

	URBAN	RURAL
Bicycle	6	7
Girl	2	3

Boy	4	4
In crossroad	3	1
Out of c.	3	6
Day	3	4
Night	3	3
Mopeds		
Total	67	46
Drivers	62	41
Passengers	5	5
Girl	5	6
Boy	62	40
In crossroad	19	4
Out of c.	48	42
Day	20	21
Night	47	25
Motorcycle		
Total	98	119
Drivers	86	107
Passengers	11	12
Women	5	9
Men	93	110
In crossroad	28	14
Out of c.	70	105
Day	59	74
Night	39	45
Car		
Total	218	619
Drivers	120	438
Passengers	78	154
Girl	45	138
Boy	173	481
In crossroad	26	30
Out of c.	192	589
Day	49	237
Night	169	382

Severity of accidents

What is common between France and Alberta is that the fatalities risk is much higher in rural areas than in urban ones. What is different is that the casualties risk is also higher in rural areas of Alberta, which is not true in France: casualties are more frequent in urban areas.

So, to check if there was not here a french particularity, we present the E.U. comparison, which shows that there is no French specificity : in all European countries, fatalities are more frequent in rural areas, but casualties and material accidents are more important in urban areas.

This can be resumed by a simple « mirror » or « symetry » image : three quarters of accidents in urban, but three quarters of dead in rural. So, we will have to check if this indicates an Europe/North America difference.

All over Europe, it is said that urban environments generate many accidents because of the density of traffic, but not severe accidents for the same reason; and it is said that rural environments generate few accidents, but very severe, for the same reason. So, speed is advanced as the main causal factor of the rural/urban difference. Why this is not true in Alberta?

Other countries data

The initial severity of head injuries among Taiwan teenagers (mainly motorcycle accidents) is the same but the young patient outcome at discharge from hospital (as measured by the Glasgow Outcome Scale) is better in urban areas. The mean hospital stay is longer in rural areas.

The question of exposure in rural/urban comparison

It is well known that the collective transports are less important in rural areas, so, the car mobility of rural teenagers is more important, and so is their exposure.

For children, it is the mileage more than the frequency of trips which is differenciating :

- in South Carolina, in rural as well as in urban areas, the same proportion (44%) of children are driven to school in private vehicles (Sirard and al., 2005) ;
- in Georgia, the same proportion of children walk regularly to school (18%) ;
- but the distances traveled are greater in rural areas :
    - for example, an ecological analysis of NHTSA (Clark and Cushing, 2004) estimates that the vehicle miles traveled per capita in the US ranged from 10,000 to 52,500 in rural areas (median of 15,000), and from 5,300 to 12,200 in urban areas (median of 8,000);
    - for example, in Ontario, rural drivers spend 55 minutes per day on the road, compared to 47 minutes for urban drivers ; rural drivers drive 44 km per day, compared to 31 km for urban drivers;

Question: does exposure only explain the risk difference? Probably no!

The two-fold urban/rural differential in exposure cannot explain only by itself the magnitude of the urban/rural differences in crash injury rates.

What is exposure?

In addition to absolute differences, the same number of miles does not indicate always the same level of risk; a mile of rural travel is not necessarily equivalent to a mile of urban travel:

- Traffic flow characteristics have effects: volume, density, volume to road capacity ratio.

- Speed is obviously a factor which can explain a lot of the rural/urban differences, but we are still lacking of a precise analysis of the contribution of each factor on rural and urban roads.

- Samely, some road safety infrastructures are more common in urban areas : traffic control devices, graded curves, divided traffic safety.

An ecological study (Zwerling et al., 2005) has linked police reported crashes and self-reported mileage in the US to analyze in rural and urban areas :

- the fatal crash incidence density (all crashes/million vehicle miles traveled);
- the crash injury rate (injury crashes/all crashes);
- the injury fatality rate (fatalities/injury crashes).

Crash incidence density and crash injury rates are similar, but fatalities/injuries rates are from 2 to 3.5 times higher in rural areas. So, differences in crash and post-crash factors may contribute more to urban/rural differences in fatality risk than differences in exposure.

What are these crash and post-crash factors?

Crash factors

speed:

- in the US, 80% of vehicles involved in fatal rural crashes must be towed away, compared to 66% of vehicles involved in fatal urban crashes (NHTSA, 2002) ;
- in Australia, 46% of drivers report exceeding legal limits in rural areas, compared to 33% in urban areas (Mitchell-Taverner and al., 2003)

These higher speeds in rural areas are clearly the main factor of the increased severity of rural collisions, as Australian research (Kloeden and al., 2001) has precisely shown the relative risk of speed concerning injury crash involvement: on the same road, comparing the speed of drivers involved in accidents and controls, it has been shown that travel speeds 20 km/h above the average speed result in a near six-fold increase in risk.

However, the difficulty of enforcement in rural areas lead to the fact that, despite a lower self-reported prevalence of speeding in urban areas, urban drivers in Australia are more likely to have received a citation for speeding (20% compared to 15% for rural drivers).

seat-belt use:

- lower restraint use among child passengers 0-4 years in rural areas (72%) of the US compared with urban areas (96%), according to NHTSA (2003);
- lower prevalence (69%) in rural areas of Alberta, compared to the entire province (89%) in 1999;
- lower prevalence (76%) in rural areas of Alberta, compared to the entire province (85%) in 2001.

French more recent data (2005) :

Back seat seat-belt use

	Urban	Rural	Together
Adults	65.7%	73.2%	69.8%
Children	85.1%	81.6%	83.0%
All ages	75.7%	77.8%	76.9%

The differences in France do not seem very significant.

alcohol:

- impaired driving at a three-fold higher rate in rural versus urban areas of Alberta (Slavik, 1996);

But 70% of the impaired driving citations in Canada are issued as a result of collisions or erratic driving, and 11% only during police random controls (Jonah and al., 1999). So, as the probability of a random control is especially low in rural areas, the underestimation of the real impaired driving frequency is probably higher in rural areas …

French more recent data (2005):

	Casualties	Fatalities
	% with alcohol	% with alcohol
Rural	13.7%	28.4%
Urban	8%	27.4%

So, again, we find a difference between France and Alberta: the higher frequency of impaired driving in Alberta does not seem to appear so clearly in France.

Conclusion about crash factors:

The question still remaining: Why less cautious behavior and respect of the law in rural areas?

- Is it culture?

- Or is it dissuasion theory ? Lower probability of being detected?

The example of speed in Australia support the dissuasion theory: more self-reported violations but less citations in rural areas. This would be the contrary in France as the successful speeding cameras program has been developed mainly in rural areas, so, the probability of being detected could be higher in rural areas.

Another hypothesis: lack of traffic safety education in rural areas? This is not true in France!

Post-crash factors

- delayed access to emergency care, inadequate advanced trauma care, density of neurosurgical staff : these are predictive of worse outcomes for crash survivors (Grossmann and al., 1997; Muelleman and al., 1996). Rural crash victims experience longer discovery times, less advanced care, longer transport times to hospital (Esposito and al., 1995; Grossmann and al., 1997; Svenson and al., 1996).

- In Alberta … only two trauma centers for 660 000 km2!

Type of accidents

- the NHTSA (2002) showed that head-on collisions account for 12% of all rural fatal crashes, but for 7% of all urban fatal crashes.

- the head-on collisions can be reduced in rural areas: a before and after analysis on the installation of rumble strips (Persaud and al., 2004) conclude a 14% reduction in all injury crashes and to a 25% reduction in head-on collisions.

Psychological factors differentiating rural/urban

Risk taking among urban and rural young people

Risk taking is the common factor behind traffic accidents, sexually transmitted diseases, substance use, criminal violence.

Risk taking is linked to biological markers of sensation seeking: risk taking is the way to satisfy the need for sensations.

We lack of data on this.

The effect of crash experience

The recidivism of accident involvement among young people shows somewhat surprisingly that the experience of crash does not reduce subsequent risk taking. All the dimensions of recidivism (frequency of crashes, severity of crashes, time elapsed between two crashes) do not have any effect on risk taking.

Even if accident involvement increases the perceived risk of future crashes, young drivers do not adopt more cautious behaviors and do not reduce risk taking. However, in Taiwan, this is less true for rural teenagers than for urban ones.

So, traffic safety and public health campaigns which are only raising the negative consequences of dangerous behaviors may only increase the risk perception and the awareness but not have a significant effect on accident involvement.

For this, you have to reach the psychological process, mechanisms and benefits of risk taking.

Risk perception also could differentiate urban and rural drivers:

In Tanzania (Astrom and al., 2006), urban residents perceived higher risk of experiencing traffic injuries than their rural counterparts, except for being injured while traveling in a bus.

Is it lack of safety awareness of rural residents? Is it the exposure to traffic safety information? Is it limited personal risk experience? We lack of this kind of knowledge in Europe and in the US.

Public health perspective

If traffic fatalities are more important in rural areas, for other causes of death (tumours, cardiovascular, etc), it is the contrary: life expectancy is longer for rural populations (cf. works in Scandinavia, Canada, Iowa, Kentucky, etc). Except one cause: work accidents, which are more prevalent in rural areas, which relates to the traffic safety phenomenon.

Apart from public health policies, most of public policies are more directed towards the urban areas, rural areas are often neglected (for leisure, care, etc) ; so, this could have an effect on rural youth attitudes and behaviors.

Evolution of health behaviors of rural and urban teenagers in Europe between 1993 and 2003

In 1993 :

- alcohol and tobacco use were more important for rural teenagers, but not cannabis and other illicit drugs
- depression prevalence was 20% more important for rural teenagers, when social, family and school factors were controlled
- violence prevalence was 30% more important in the suburbs than in the downtowns, when social, family and school factors were controlled

In 2003:

- violence prevalence is now as important in rural areas as in urban areas
- even though some forms of delinquency are less important in rural areas:
    - to sell stolen objects (9% of urban versus 6% of rural teenagers)
    - to hit a teacher (3% of urban versus 1.8% of rural teenagers)
- cannabis use is more important among rural tenagers now
- rural teenagers go less often to psychiatric consultations, so, it's difficult to compare the psychopathology; so, when they come, it's often for hard cases, not treated early enough
- rural people go more to GP (less specialists in rural) ;
- the precocity of puberty is related to alcohol use for female teenagers in urban areas, but not in rural areas: is this because of the differential availability or access to psychoactive substances? Or is it because there is more family control in rural areas ?
- maybe there is more intergenerational continuity in rural areas: teenagers act more like their parents than their urban peers do, they contest less the parental model; though violence and cannabis use contemporary increases do not exactly support this!

Methodological problems

Underestimation

In all western countries, the police data underestimates the number of injuries ; hospital-based data reveal much higher numbers. If underestimation is lower for fatalities (around 10%), it can be important for casualties (around 50%). The underestimation may be more important in rural areas (Aptel and al. , 1999).

Ethical issue

In the comparison Europe/North America, there is an ethical issue, which has an effect on the type of variable measured : we do not collect ethnic data as US colleagues do, because we are afraid of political exploitation.

To conclude:

A lot of variables of interest are not available for the rural/urban comparison: so, the future works in this domain will be to increase our knowledge on the population-based information on the urban/rural distribution of risk factors.

PROPENSITY TO RISK TAKING AND SENSATION SEEKING

Biological factors

- maturation of the frontal cortex which controls impulsivity up until 18
- increase of testosterone for the boys (rate increase by 20 times at puberty, 4 times only for girls), strongly related to sensation seeking
- genetic factors on serotonin and dopamine thresholds, related to addictive behaviors
- genetic factors on hyperactivity/attention deficit disorders, predictive of accidents
- prenatal exposure to tobacco, alcohol and illicit drugs: not only short-term but also long-term effects

Psychological factors

Risk Taking/ Sensation Seeking

1. predictive of traffic accidents, addictions, delinquency
2. four dimensions scale by Zuckermann or two dimensions scale by Arnett (novelty/intensity) :
3. teenagers do not necessarily seek new sensations, but intense ones.

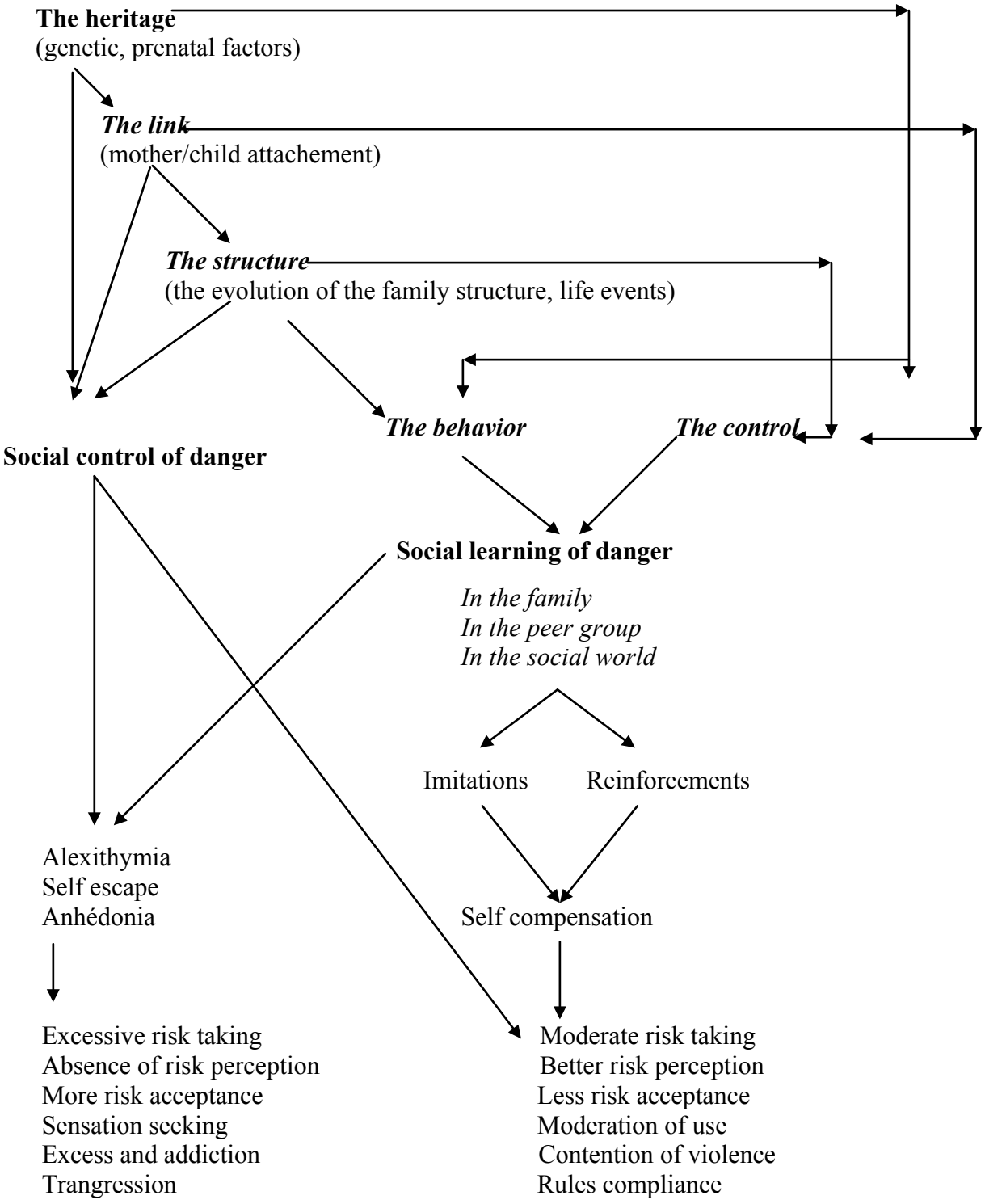
Resistance to the effect of sensations (works of Schuckit on sons of alcoholic fathers) :

- a genetic vulnerability (tolerance to the effects of alcohol) becomes an environmental effect (in the Saturdays nights, these boys have to drink one glass more, in order to be in the same mood than their peers; ten year follow-up: a majority become alcoholics).

Psychological benefits of risky behaviors:

- concrete fears better than anxieties, therapeutetical effect of risk taking
- social image, aura, popularity, dominance (ex: speed; designated driver)
- quest of autonomy, new initiation rites of passage between childhood and adulthoood, driving autonomy/licensing is one rite still working.
- gender related psychological processes, as being a boy is in itself a risk factor
- anthropological « division of work » : mastery of tools and space/mastery of relationships. This influences the sense of violence and the hard core of traffic behavior: the respect of somebody' else life on the road, the moderation of agressivity and risk taking.
- the adhesion to sex stereotypes and the parental adhesion to these sex stereotypes

The influence of the family environment, much more than the media or the peer group :



In Assailly, Jeunes en danger, PARIS, PUF, November 2007

Risk Perception

- Wrong knowledges or lack of knowledge (i.e. B.A.C. estimations, safety gaps estimations)

- The subjective underestimation of B.A.C. (see Beirness in Canada, Assailly in France) is a crash factor (hence the development of BAC self control by breathalyzers)

The subjective underestimation of safety gaps and stopping distances is one of the « big enigmas » of traffic safety researc h! It does not improve, neither with age, nor with school, nor with driver training, nor with driving experience!

Lay people seldom have statistical evidence on hand when they evaluate risks, they rely on inferences, on observations, on their own experiences. So, there are always important differences between objective and subjective risk.

- Optimism comparative bias:

    - positive events are more related to oneself than negative events

    - the illusion of control: underestimation of the vulnerability if one perceives to have control on the events.

In case of driving safety: overconfidence in driving skills, after a training or after years of experience, is one of the major causes of accidents.

- -Perceived susceptibility (health belief models)

Caucasian adolescents inaccurately perceive that they are at greater risk for motor vehicle injuries than their African-American peers in the US, so this is a protective factor ! (Ey and al., 2000).

Perceived vulnerability increases when one perceive similarity with the victims.

Sex: boys tend to underestimate risks and girls to overestimate these, which is one of the factor of male vulnerability.

Risk Acceptance

- Insufficient assertivity, caused by distorsions of risk perception:

    - the state of the driver
    - comparison of risks (i.e. accident/sexual agression for female passengers)

STRATEGY OF FRENCH GOVERNMENT AND BEHAVIORAL RESEARCH

The cost of the young drivers problem is enormous for our societies: $40.8 billions for the US, 2400 million Euros for France, 1200 million pounds for UK in 2004.

These figures are for convincing your politicians to invest in traffic safety, and not only after crashes have occured, but before they occur, in order to prevent these !

The Vision Zero supports the traffic safety policies of the « good pupils » in Europe (UK, Scandinavia, Netherlands).

We will probably all be dead here before there will be zero death on the roads … European integration has destroyed swedish alcohol policy, but there is still some interesting aspects of the Vision Zero : the diagnosis approach, the tolerance to human mistake (we should not pay for a mistake by dying).

Elements of the strategy:

Do not focus on young drivers: decrease the general level of danger on the roads ! Do general traffic safety improvements, as young people always benefit from the central tendency of their country, and their historical curves always follow the general ones! Prevention and enforcement have the same effect on young as on adult drivers!

- The greatest benefits will likely result from general road safety measures
- Safe counties have safe young drivers
- This is especially relevant in countries where road safety performance is lower
- Strict drink and drug-driving laws and enforcement, speed management, seatbelt, and vehicle engineering are all essential
- Safe infrastructure (forgiving road side/safe mix of speed/mass differences e.g well designed 30 zones)

But, targeted measures are also necessary. Especially important where young males are concerned.

The French strategy can be situated in a tryptic of the three main approaches to teenage drivers crash reduction.

The North American approach:

As long as young American people access so precociously to the road, the graduated access to driving will probably stay as the better model: restrictions allow the decrease of exposure as much as possible for these inexperienced drivers.

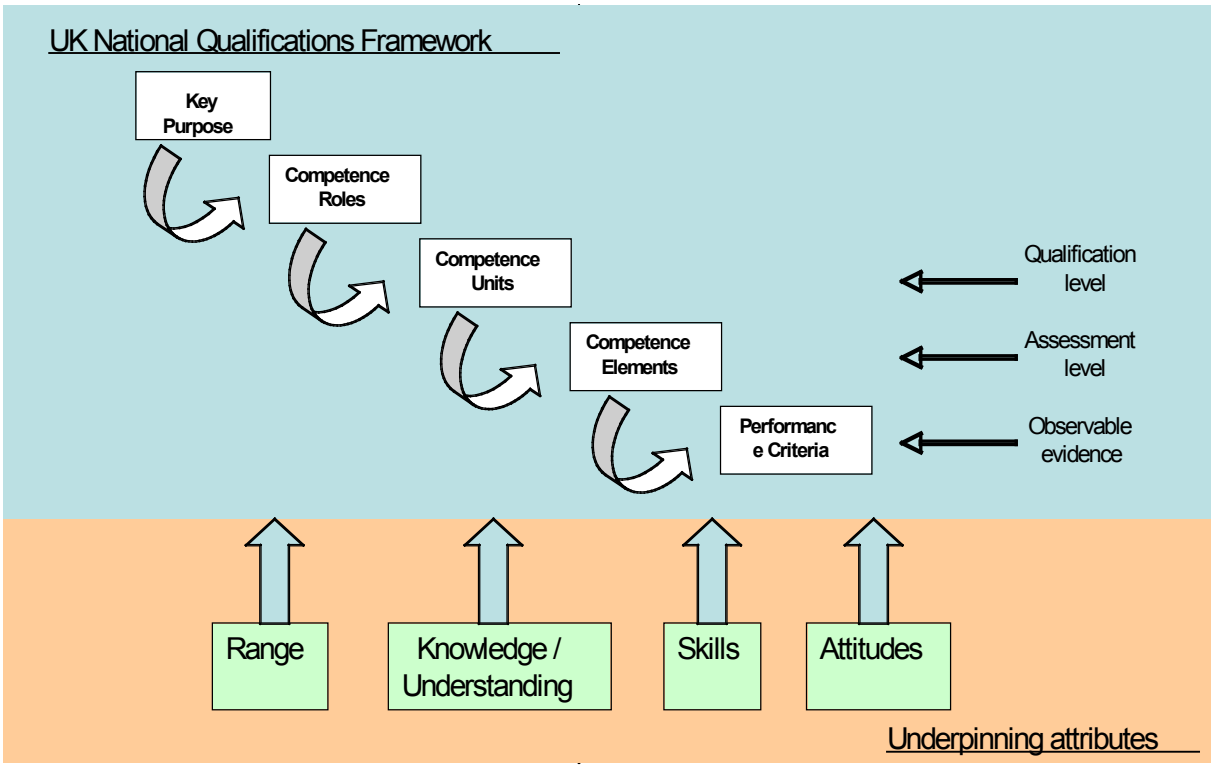
Unless sustainability and climate change raises new stakes and generate a "mental revolution" in American brains! For the difficulty of changing travel behavior according to environmental strategy, see the paper by Coogan, Karash and Adler (2006): it seems obvious that car dependency has still some good days ahead in North America! But the paper gives directions to overcome the resistance to change.

But the graduated access to driving has also a positive aspect in this domain, as it renders driving less attractive and exciting for American teenagers than it is for European ones!

The British approach

We still don't know what our British colleagues will do but they will probably do differently than the rest of European countries! For those interested in the British future approach, we strongly advise reading the Driving Standards Agency (DSA) presentation in the last CIECA (European Agency about licensing) Meeting in May 2007. DSA wants to develop a "Competence Framework for Car Drivers".

We present below a synthetic presentation of the project of framework:



The rest of Europe approach: the GDE Matrix

Most European countries are now adopting the GDE matrix in order to improve education, training and licensing of teenagers. We present the matrix below.

The strategy of the French government in the future years can be summarized by suggesting that two objectives are guiding the action:

1. To lower *absolute* risk, the number of teenagers injuries and fatalities every year in France; for this, you do not need paradoxically to change the behaviors of French young people: you may just act on their exposure and mileage, if you reduce car dependency and modify travel behavior (see above about the US situation).

2. To lower *relative* risk, the number of teenagers injuries and facilities per kilometer driven every year in France; for this, you need to change the behaviors of French young people.

Regarding this second objective, most European countries are now adopting the GDE (Goals for Driver Education) matrix in order to improve education, training and licensing of teenagers. We present in the next pages this matrix.

The GDE matrix derives from a hierarchical, cybernetic model ; the psychology theoretical models of the beginning of the last century were models "tuned" to the science of their time (a physics of energy, the thermodynamics 2nd principle ; Freud's libido or Lorenz's instinct are energies) ; today's psychology theoretical models (cognitive psychology, neurosciences) are "tuned" to the science of their time (a physics of information, the General Theory of systems, the Cybernetics, the Mind as a computer).

A hierarchical approach helps us to structure and to understand more clearly what competences a safe driver needs and thus what aspects driver education should cover. One of the important outcomes of the EU-project "GADGET" (Guarding Automobile Drivers through Guidance, Education and Technology) was a matrix for defining goals of driver education. This "GDE" matrix is based on the assumption that the driving task may be described as a hierarchy. *The idea of the hierarchical approach is that abilities and preconditions in a higher level influence the demands, decisions and behaviour on a lower level, as in any cybernetic system*. The following four levels are:

1. Goals for life and skills for living
2. Goals and context of driving
3. Driving in traffic situations
4. Vehicle control

GDE matrix

(Goals for Driver Education)
(Hatakka, Keskinen, Glad, Gregersen, Hernetkoski, 2002)

	Knowledge and skill	Risk increa - sing aspects	Self asses - ment
Goals for life and skills for living	**L**ifestyle, age, group, culture, so - cial position etc, vs driving behavio ur	**S**ensation seeking **R**isk acceptance **G**roup norms **P**eer pressure	**I**ntrospective com - petence **O**wn preconditions **I**mpulse control
Goals and context of driving	**M**odal choice **C**hoice of time **R**ole of motives **R**oute planning	**A**lcohol, fatigue **L**ow friction **R**ush hours **Y**oung passengers	**O**wn motives in - fluencing choices **S**elf-critical thin - king
Driving in traffic	**T**raffic rules **C**o-operation **H**azard perception **A**utomatization	**D**isobeying rules **C**lose-following **L**ow friction **V**ulnerable r.u.	**C**alibration of dri - ving skill s **O**wn driving style
Vehicle control	**C**ar functioning **P**rotection systems **V**ehicle control **P**hysical laws	**N**o seatbelts **B**reakdown of ve - hicle systems **W**orn-out tyres	**C**alibration of car - control skill s

The highest level refers to personal motives and tendencies in a broader perspective. This level is based on knowledge that lifestyles, social background, gender, age and other individual preconditions has an influence on attitudes, decision making, driving behaviour and accident involvement.

On the second highest level, the focus is on the goals behind driving and context in which driving is performed. The focus is on the travel situation in terms of why, where, when and with whom driving is carried out. Examples on more detailed aspects are the choice between car, bicycle or bus, day-time or night-time driving, rush-hours or not, decision to drive under the influence of alcohol, fatigue or stress etc., all in relation to purpose of the trip. The choices made on the third level have an influence on which situations that will occur in real traffic, how high the risk will be of hazardous situations and accidents and how well the driver will be able to handle specific traffic situations. These are defined on the next, second level of the matrix.

The third level is about mastering the driving in traffic situations, which are defined as more limited than the driving context above. A driver must be able to adjust his/her driving in accordance with the constant changes in traffic, for example in junctions, when overtaking or when encountering unprotected road users. To be able to identify potential hazards in traffic and to act correctly in order to avoid them is also on this level. Driver education and training is traditionally focussing on this level, when teaching traffic rules, actual driving in traffic and identifying hazards.

The bottom level is focusing on the vehicle, its construction and how it is manoeuvred. To know how to start, shift gears etc. good enough to be able to use the car in traffic belongs to this level as well as more complex evasive manoeuvres, reducing skids on low friction and understanding the laws of nature. The functioning, use and benefits of injury preventive systems such as seat belts, child restraints and airbags also belong here since they are subsystems of the vehicle.

These four levels define competences in terms of knowledge and skills that the safe driver needs. A safe driver is, however, not only skilled but also highly aware of risks that may occur on the different levels of the hierarchy. The driver must also have a well calibrated assessment of own abilities and preconditions and how they influence own decisions and driving. In order to cover these different dimensions the hierarchy was expanded to a matrix, which in addition to the four levels includes three dimensions, as follows:

1. knowledge and skills
2. risk increasing factors
3. self-assessment.

The content of the first (left) column describes the knowledge and skills that a driver needs for driving under normal circumstances, that is, on the lower hierarchical levels how to manoeuvre the car, how to drive in traffic and what rules that must be followed. On the higher levels the column relates to how trips should be planned to be as safe as possible and how a number of different personal preconditions may influence behaviour and safety.

In the second column about risk increasing factors, the focus is on awareness of aspects of traffic and life that can be associated with higher risk. On the basic level it may be worn-out tyres, poor brakes, lack of routine in performing basic manoeuvring, etc. On the second and third level of the hierarchy this column refers to excessive speeding, animals on the road, visual search deficits, mental overload, risky driving in darkness, on low friction, among unprotected road users, etc. It also relates to higher level aspects such as dangerous motives, dangerous peer pressure and risk increasing aspects of lifestyle and personality.

The last (right) column is about how the driver is assessing his/her own situation on the four levels. It points out the calibration of one's own skills in car control and in handling different traffic situations on the two lower levels and awareness of own personal preconditions and tendencies, as well as abilities in decision making about trips and in life in general on the upper levels.

The cells in the matrix thus define a framework for definition of detailed competences that are needed in order to become a safe driver. The matrix may be used for defining educational goals and educational content in driver education and training. Driver training should cover as much as possible of the whole matrix, *not only the lower leftmost cells that traditionally are being covered.*

So, to improve traffic behavior of French teenagers according to the matrix, two lines of action are in front of us:

1. for learner drivers, to increase the supervised period of driving before solo driving, as this increase would improve the automatization of the skills of the bottom row of the

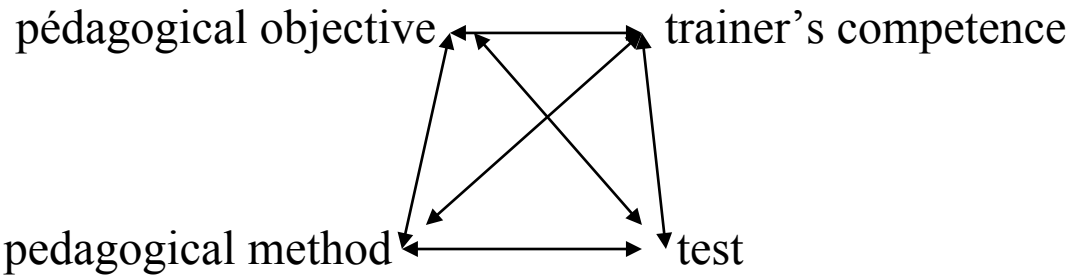
matrix, so increase the allocation of attentionnal resources on the second lowest row, in order to improve hazard perception, and give more time to the superviser to fight against the installation of overconfidence and illusion of control. From the comparison between France, Sweden and Norway, indications are to increase accompanied practice from current levels (25 ~ 50 hrs) towards 120 hrs, which could reduce young driver accidents considerably in first two years of solo driving and be cost-effective.

2. for novice drivers, to develop a harm reduction strategy, in order to reduce the risks young drivers face during initial period of solo driving. Protective measures employed could be attached to probationary licenses.

Here are a few of the suggestions recently made to the French Ministry of Transport in this perspective:

1. to suppress the licensing exam and to replace it by a continuous control, with a follow-up of the young novice driver's accidents and violations during the probatory period ;
2. to train the lay trainers (parents) in order that they do not transmit their bad habits to their children
3. to adapt the training to the personal needs of each young driver: boys/girls, rural/urban, rich suburbs/poor suburbs, psychopathology/no psychopathology,
4. to improve training techniques in order to reach the higher levels of the matrix: more active methods, adaptation of post licensing methods (coaching, group disscussions, role playing etc) in initial training, etc; as soon as there is a technical training, follow with a feedback in order to reduce overconfidence.

-for this, to develop cybernetic settings :



-to develop a better communication in direction of parents and teenagers about measures in this field (see the Australian experiences about traffic safety public consultations).

To conclude, as self-evaluation is the core of risk behavior, educational approaches are needed to help young people to gain an accurate picture of their own susceptibility to traffic accidents.