Simulating Bicycle Ride Dynamics (1st part) General Safety of Bicycles in Road Traffic

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Abstract

Tremendous climatic changes produce extreme weather conditions that cause disaster and migration in many parts of the world. In this situation, it is necessary to question thoughtless habits that waste energy – the major cause of the greenhouse effect and global warming. One such habit is refering to the 'economical motor' in political debates and the question is what can, should and will replace this buzzword that often just hides a lack of argument. This is not only a philosophical question, it is the question of responsible politicians who care for a sustainable economy. Our belief is that an answer is found in adequately appreciating non–motorized transport all over the globe.

One way to do so is to simulate bicycle ride dynamics in order to improve the general safety of soft traffic. In this first part, we motivate our research by careful reformulations of ill–assorted expressions, compare the modelling complexity with other forms of transport and seek for the scientific foundation that covers the essential artifacts necessary to achieve a realistic simulation of safety–relevant soft traffic scenarios on a computer. We investigate the once financially successful mechanisms in the automotive market in order to identify those applicable and transferable to the soft traffic market. One such mechanism is a simple measurement to estimate risks of injuries. Finally, we argue why our approach is worth continuous investigation and investment.

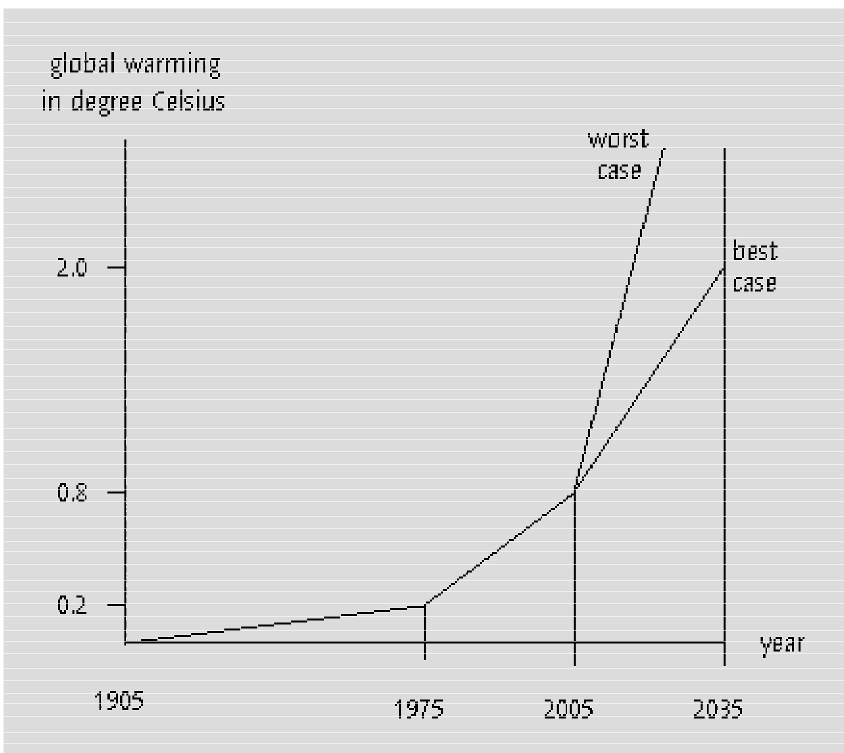

Figure 1: Global warming

1.1 Climatic changes effect wording and phrasing

Today, we are faced with abrupt never–seen creature–made shifts in the climatic development on our planet. The climatic changes, e.g. greenhouse effect, global warming (see figure 1) and extreme variations of meteorological conditions, accumulate in environmental catastrophies (see table 1 collected from radio news) that cause disaster and migration. Western life style certainly does not scale to the emerging markets in Asia, South America and Africa in regard to the climatic changes as well as the finitness and the foreseeable shortages of natural resources. The so–called civilized world has to adapt quickly to the new climatic conditions and should not serve as a model to be copied at this moment in time.

By long–established practice, Europe can neither escape the responsibility to be taken as a model in many parts of the world nor can it return to the time before its energy–euphoric and resource–wasting period at the very end of the last millenium. However, Europe can reconsider progress achieved in the past and one progressive item is the bicycle, the most energy–efficient transport innovation of all times that ekes out a wretched existence as multi–purpose vehicle nowadays, here on this continent.

year	environmental	catastrophy
2004/5/6	yes	drought in Kenia
2004	no	Zunami in the Pacific Ocean: more than 100'000 casualties
2005	yes	global warming: warmest year ever – previous maximum was year 1998
2005	yes	Hurrican Cathrina floods New Orleans: number of inhabitants dropped from 400'000 to 80'000 persons
2005	no	earthquake in Kashmir in Northern Pakistan: 73'000 casualties
2005/6	yes	lowest water–level since the beginning of measurement at the largest lake within Europe
2005/6	yes	hottest year change since the start of measuring temperature in Sydney cause vast bush fires, Australien

Table 1: Climatic change and environmental catastrophies

Accepted adaptation of human resource–wasting habits starts by questioning word choices that stem from the second half of the last century. Our linguistic practices strongly influence the way of thinking and acting unconsciously. The buzzword 'economical motor', for example, is an expression that has been shaped by the invention of the Ottomotor, which has been and still is, no doubt, a useful engine that, however, is being used way too excessively in Europe these days! Today, the buzzword 'economical motor' should ring an alarm signal and the expression should be abolished without replacement.

The naming 'safety belt' and 'seat belt' for a collision delay feature is a more subtle example. – Which choice emphasizes what fact in naming this feature? Is it the fact that a sitting passenger is protected against being slammed into what is in front of him or is it the fact that he is fastened to a seat in a sitting position? – Of course this very much depends on the perspective. In order to convince a passenger to fasten the belt that limits his personal movements, you better use the expression 'safety belt'. But which name is favourable from a cyclist's point of view? – We argue that the latter expression is more appropriate and think that the climatic changes sooner or later will let a majority of people agree with this name choice.

It does not come as a coincidence that our rewording examples emanate from the traffic vocabulary. There is a prominent example in Switzerland asserting that the climatic changes effect the vocabulary especially in the traffic sector, i.e. the word–ending of the airline company has been annihilated. But the renaming of expressions happens not only in energy–intensive industrial branches as in the transport, travel and leisure sector. All sorts of companies are restructured by merges, splits, sales and buys in diverse areas. We think that a reason is that in the civilized world, a lot of automations have devaluated body activities in daily routine work so that body strength does not stimulate the relief of the old by the young generation to the extent desirable for economical continuity! Society pays little attention to 'social–motional' activities as for example traditional and pair dancing. A negative side–effect is the 'disabilisation' of a whole generation, whose elite is being pitched onto the road desperately trying to do business with all kind of substances as medicine, alcohol, cigarettes, drugs and so on. Of course ignoring the growing generation gap that induces a language rigidity has very unpleasant consequences – but this all really is another story.

Anyway, we believe that the kind of rewording will prevail that favours persons that activate muscles in daily travel routine such as commuting to work. Hence, we propose a rewording, i.e. the main differentiation into self– and alien–driven vehicles thereby refraining the temptation to choose 'self–ridden' instead of 'self–driven' in order to distinguish riding a sports device for fun from 'self–driving' a vehicle to or for work in road traffic.

1.2 Self– and alien–driven vehicles

A *self–driven* vehicle is powered by muscles. It is also called a muscle–driven and most often a human powered vehicle. Self–driven vehicles belong to the category of non–motorised transport (NMT) means and include the bicycle, the sledge, the trottinet, the skate–board, roller–skates and diverse other sports devices as for example skis that do not necessarily count as vehicles because they are not used on roads. Further self–driven vehicles not used on roads are the dresine or the rowing–boat, which are operated on railway tracks and on water, respectively. Self–driving distinguishes itself from other forms of transport by that living–beings themselves transform internal chemical energy bound in food into kinetic energy. The operator of a self–driven vehicle is called a *self–driver* and the traffic of self–drivers is called *self* or *soft traffic*. Most often the self–drivers are human–beings, but a coach pulled by horses also is counted as a soft traffic vehicle.

Alien–driven vehicles, in contrary, are vehicles with a motor that move due to the supply of an alien energy typically in the form of a fuel as gasoline, diesel, kerosene, petrol, coal or in the form of a simply transferable energy as electricity, light or wind. The transport therefore is not based on an own effort of the transportees but on an alien power source. Often–used alien–driven vehicles are motor bikes, cars, lorries, planes, trains, steamboats, sailboats and so on. The availability and the sustainability of the fuel and energy plays an important role for a further differentiation, which however is of no concern to the more fundamental separation into self– and alien–driven vehicles. The operator of an alien–driven vehicle is called an *alien–drivenee*. The traffic of alien–driven vehicles is called *alien* or *hard traffic*.

Self–drivers are food– and liquidsensitiv. They naturally behave environmental–friendly and should be recognized as the sensors of a sustainable society of which they might be the driving force in future. The energy cycle for their displacement activity includes their food supply chain. Aware of the causal dependence of food quality and local freshness, they can not easily escape the control of the public eye. In contrary, fossil energy is a poor replacement for energy gained out of food because it is subject to poor public asset control. Deals in the petroleum, gas etc supply chain are anonymous and secret. Faced with the rapid change of our climatic conditions, we consider poor human control a major drawback in social selection. At the gasoline stations, hardly anybody asks himself, in what country and on which field the oil has been extracted or at which place the filled in gasoline has been refined – maybe the duty of such a declaration could be of help to ease the crises in the middle east and other oil–rich regions of the world.

1.3 Comparing the modelling complexity of self– and alien–driven vehicles

The other day, when I arrived at the home of an acquaintance of mine, he saw my trottinet and asked: "Are you motorized?" – Such kind of thoughtless jokes caused by the ownership of an alien–driven vehicle aim at rendering self–drivers derisory even though they are faced with much higher complexity and risk than alien drivers. This can be recognized from modelling the ride and drive dynamics of self– and alien–driven vehicles. The modelling complexity is related to the operation complexity.

The modelling of self–driven vehicles is mostly more demanding than the one of alien–driven ones. The reason is that a living–being not only must be considered for riding the vehicle but also for driving the vehicle by own strengths. Consequently, optimal energy usage is highly rated. Strong manual and mental skills are asked alone for mastering the operation of the vehicle. Thus, modelling has to cope with the presence of almost perfect skills and knowledge in the self–driver community. In order to do better than the people in action and to get useful and non–trivial results out of the modelling, ambitious scientific efforts have to be undertaken. This is a welcome challenge to computer simulation – a field which has been treated with much scepticism until recently even by its exponents [Kramer and Neculau, 1998].

A first important application is the post–simulation of traffic accidents by which the difference in the modelling complexity of self– and alien–driven vehicles can be illustrated. For that we roughly compare the two most representative vehicles of common sense with each other. These are the bicycle and the car. In this context, the physical impact of an accident to the self–drivers and alien–drivenees is of prime interest.

The bodywork of a car has a fixed form. The air resistance may simply be modelled by a constant (the cv–value), which depends on the car type. The drive has little influence on the alien–drivenee due to the passenger's cell. The driving events can be separated in ones that happen within and others that happen outside the bodywork. They can be treated most often independently of each other. The rigidness or the deformability and elasticity of the bodywork and other parts of the car are playing a role only when colliding. The intellectual task is relativized by the crumple zone and other buffer–elements as seat belts and airbags and further reduced by head restraints, such that most accidents may simply be modelled in good approximation by an inelastic collision. The costs of simplification – to be well–understood – is paid by the usage of additional space and energy which is expended for taking along the built–in 'safety features' or 'commodity features that reduce the modelling complexity' as what we would like them to be understood. Due to the idealized conditions within the passenger's cell, the effect of the collision on the alien drivenee depends on the amount of deceleration, which itself depends on the velocity and stopping distance. By the law of the conservation of the linear momentum, the deceleration is easily computed on a calculator and we can do even without computer simulation (see section 1.6).

Due to the four wheels and the low center of mass, the car tumbling over has little probability and does not even have to be considered if it collides. For bicycles, however, tumbling over is a probable accident scenario that can not simply be ignored. The falling head over heels of a human being is a complex physical event, which is difficult to grasp and which requires a proper understanding of rotational inertia, torque and angular momentum [Tipler and Mosca 2004]. The effect on the cyclist depends on many environmental conditions, so that falling can not be dealt with in a simplified isolated way because it can be influenced pivotally by external variables (see table 2).

Barely the ride on two wheels is based on a gyroscopic movement of precession. Hence, modelling the keeping of balance is a demanding task because it is a dynamic equilibrium that also depends on the rider's sense of balance, his physiology, posture, counter–balanced pedaling and many more decisive details. For example, the cyclist may be sitting on the saddle or standing on the pedals for riding. If he rides over the edge of a pavement, he may jump up and lift the handlebars to relieve the weight of the front wheel to overgo the edge without falling. A car driver, on the other side, can barely spring up in his seat to balance out an irregularity of the road (e.g. pothole). The seat, the belt, the suspension of the chassis, the four tires all are materialized complexity–reducing features to cope with an edge or pothole to the expense of limiting the personal freedom to move.

quantities of influence	car	bicycle
balance	trivial, 4 wheels	in interaction with the human body
air resistance	constant value car type specific	profile depends also on the posture, position and clothes of the rider
anatomy and physiology of the driver	trivial, automobilist may be an invalid	important
effect of the accident on the passengers	constantly given by the passenger's cell	depends on the road conditions
rotational inertia of the wheels	neglectable	important for keeping balance

Table 2: Comparison of a car and a bicycle in the judgement of physical quantities

An other example for the freedom a cyclist has and an automobilist has not is that the cyclist can adapt his profile to the actual wind conditions. He of course takes advantage to change position according to the direction of the wind. He bends down upon head wind and raises himself upon tail wind. The automobilist has no other choice than to compensate his lack of adaptability by burning more gasoline by a slightly different foot position that really is not that exciting to be modelled or computer simulated.

In summary, numerous technical safety devices protect alien drivenees not only from external impacts – they also cause a high consumption of energy – whereby air conditioning has not even been mentioned – and simplify the operating and thus the modelling for ordinary usage, since many risks simply can be ignored. There is a counter–monotonic dependence of energy wastage and mental achievement, i.e. the more alien energy is wasted the less complex is the mental achievement. For the assessment of driving skills, therefore, one has to differentiate clearly between intelligent usage of own driving power and ordinary consumption of alien energy. Our opinion is that the appreciation for intellectually mastering a self–driven technique should be based on the complexity of modelling the underlying physics. By means of computer simulation such knowledge can be deepened and made accessible to a broader population. In lack of proper appreciation of the mental and physical capabilities of young persons, the adulation of the setting free of energy must be observed too often. It is to be hoped for that self–driveness will serve once as a basis to measure mental and physical work.

That riding a bicycle objectively is difficult to learn and hence to model, one can experience when teaching an adult person how to ride a bicycle who has never sat on one.

1.5 Sportily disguised fake optimizations

Self–drivers have high demands on the optimal usage of their effort. Thus, at the same time, the material should be light and solid under all kind of stress e.g. like temperature. Every part should have optimal stiffness and elasticity. Depending on the ground and road surface it is meaningful to use off–road tires and specially suspended vehicles. At daytime, upon good weather conditions, one is tempted to do without rain gear, chain guard, mudguard, baggage carrier and light system for weight reasons. The shops are full of all sorts of diversifying sports items which urge to own a whole fleet of bicycles, i.e. racing, mountain, touring and city bikes, to cover all possible ways of usage. About all this exciting sports outfits, one should not forget that riding per se is a difficult operation. A bicycle customer is easily deluged and – a ratio of alien energy always finds its way through the back door due to the production and deposit costs of the numerous variants of parts and vehicles or by passing over steep parts of a course by alien helping means.

Fakes in optimization pop up on the modelling side because it is much easier to optimize for a special sportive case than for the general case in every day traffic. The manifold features of the new sports devices thereby not only are an enrichment of the selection range, they also bear a risk to every day cyclists who are exposed to a very much different task than a sportsman. For example the suspension, in particular shock absorbers at the front wheel fork, which today are found almost at all new everyday bikes, change the drive and brake dynamics essentially. For justification, the analogy with other 2–wheelers, i.e. the sprung motor bike, is stressed – but this justification is defective. In difference to the motor bike, the center of mass of the rider and the bicycle is unequally higher. The contraction of the sprung fork in the front of a bicycle may provoke severe consequences unlike the motor bike whose heavy motor block is close to the road so that the total center of mass is much lower. Our strong opinion is that it does not make sense to include spring forks for bicycles constructed for road traffic use. The additional comfort does not cope with the loss in stability and we will try to reinforce this thesis by a computer simulation as sketched in figure 2.

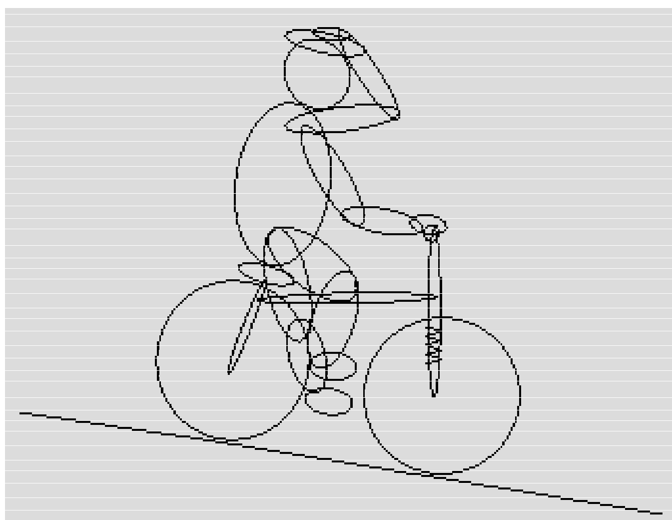

Figure 2: Simulation of the dynamics of riding down a ramp

Such a simulation venture asks for an interdisciplinary comprehensive investigation and shakes at the scientific foundations. Nowadays, interdisciplinary must not be justified especially and we think that besides of mathematics and computer science the following sciences need to be studied thoroughly to reach a solution to the simulation problem: computer simulation, physics (mechanics, dynamics), technical dynamics, system control engineering, biomechanics, sports motorics (coordination, anticipation). Biomechanics pays attention to the biological preconditions besides to physical laws to explain human movements [Strähl 1985].

Sportsmotorical coordination means to steadily tune the inside and outside forces onto each other in order to keep balance. Because outside forces (centripetal, reaction and friction forces) change continually when riding, a desired track in a chosen lane can be followed only by repeatingly repositioning the body and distributing the weight onto the saddle, the pedals and the handlebars. The cyclist senses by sight, hearing, touch, smell and balance data about his own movement and the environment. This data enables him to compare his current state of movement (status quo) with his intension (status int). Do the current and the desirable state not correspond, the cyclist corrects his movement. Hereby, small movements of correction are sufficient for the experienced cyclist.

Sportsmotorical anticipation means that with gained experience of movement the ability of the cyclist grows to foresee conditions of the ground relief, the lane, the appreciation of the traffic situation and so on. He learns to relate his movements accordingly. This thinking ahead in expectation of coming up conditions is called anticipation. The development of anticipation is an important goal of bicycle riding instruction.

Sportsmotorics of cycling is related to other sports, i.e. skiing, skating, roller–skating and –blading, skate– and snow–boarding, water–skiing, wave–, windsufing. Common attribute is the aiming to keep balance. The main behavioral difference between cycling and the mentioned sports is the control of speed. The bicycle has a dedicated and efficient brake system whereas other sports devices have not. They rely on a skillful and sometimes tricky choice of the course.

event / effect	acceleration
accident free braking	(0.1–0.5) g
free fall	g
shock on a roller coaster	3 g
neck injury by a rear–end collision	(5–9) g
– body	5 g
– head	9 g
survivable/fatality limit	30 g
head–on collision of a bicycle and a car	
– cyclist	67 g
– automobilist	3 g

Table 3: Typical events and effects of accelerations

1.6 Roughly measuring risks of injuries by acceleration

The acceleration of (parts of)a body gives a hint about the potential risk of injury. The acceleration can be calculated from quantities that are more accessible to measurement. We give an example and quantify the correlation between the acceleration and a typical event or effect in table 3.

In the derivation 1, we consider a head–on collision between a cyclist and an automobilist and calculate the accelerations for estimated typical values.

variable	description	initial value / result
g:	constant acceleration of a free fall	=: 9.81 m/s2
mv:	mass of the bicycle and the cyclist	=: 80 kg
vv:	velocity of the bicycle	=: 30 km/h
ma:	mass of the car and the driver	=: 800 kg
–va:	velocity car	=: –60 km/h

(conservation of the linear momentum)
=> {given variables and common velocity V after an inelastic collision}
mv∗vv + ma∗(–va) = (mv + ma)∗V

=> {division by (mv + ma)}
V = mv*vv + ma*(–va) / (mv + ma)

V:	resulting velocity after an inelastic collision evaluated with the assigned values	= –51.82 km/h
l:	crumple zone	=: 50 cm
tv:	duration of the collision for the cyclist: tv = l / V	= –0.5 * 10E–3 km / 51.82 km/h = 9.65E–6 h = 0.03 s
s:	length of the seat belt relaxation	=: 50 cm
ta:	duration of the collision for the automobilist: ta = (l+s) / V	= – 10E–3 km / 51.82 km/h = 19.8E–6 h = 0.07 s
bv:	acceleration of the bicycle and cyclist: bv = (vv–V) / tv	= (–51.82 km/h – 30 km/h)/0.03 s = –22.73 m/s / 0.03 s = –654.27 m/s2 = –66.67 g
ba:	acceleration of the automobilist: ba = (va–V) / ta	= (–51.82 km/h – –60 km/h)/0.07 s = 2.27 m/s / 0.07 s = 32.71 m/s2 = 3.33 g

Derivation 1: Head–on collision between a cyclist and an automobilist

This means that the cyclist has to bear a 20 times higher acceleration than the automobilist upon a head–on collision with an ideally crumpling zoned car with airbag and seat belt. If he is not lucky to be thrown over the bonnet to be deflected by the wind screen, the collision, of course, is absolute fatal for the cyclist, whereas the car driver suffers at most from an emotional surprise similar to a roller coaster experience (see table 3). Actual injuries of the cyclist are very difficult to forecast and the sequence of the events are not that simple to imagine or reconstruct in order to explain the injuries of the cyclist in detail.

Traditionally, high value has been attached to the car market. Many eventualities and risks have been related to injuries of concrete parts of the body, explained to a broad public by all sorts of documentation and materialized to road construction, traffic signals and severity–reducing, built–in safety devices comfortably neglecting the alien energy ratio (see table 4).

The intricacy of cause and effect of a bicycle accident mostly involves more than one party and a causality between eventuality and concrete injury is difficult to identify. By the high accelerations or probability of overrolling occurring in bicycle accidents, many of them are fatal and with burials you can't really do good business. That is why we think that the bicycle market value divided per passenger and riding time (not distance!) has developed to be financially rated much lower than the corresponding car market value. Nevertheless, our opinion is, that by the aimed at concrete simulation documentation the market assessments will approach each other.

What can be learned from the car and transfered to the bicycle market is that eventualities and risks have to be related to injured parts of the body for a specific documentation of the related pairs. The intricacy of cause and effect can be documented be a simulation. The materialisation poses a problem. The cyclist drives the vehicle and is, for optimality, very sensible to additional equipment. We think that the bicycle market's safety featuring is limited to gloves and blinking lights in addition to the normal equipment. Helmets are a cumbersome burden without net advantage except for at a collision that often is fatal, anyway. Hence, the risks have to be materialized on the hard traffic's side by the help of a third party, e.g. the state or an insurance (see table 5).

risk of injury/eventuality	safety feature	responsible party
neck injury by a rear–end collision	head restraint	self
child thrown to the front part of the car	children seat	self
legs injury by a head–on collision	crumple zone	self
being thrown out of the car	seat belts	self
cuts in the face from the wind shield	safety glass	
internal bleedings	airbag	self
fatality by missing a curve	crash barrier, guardrail	state, road constructors

Table 4: Injuries and related safety features for automobilists

risk of injury/eventuality	safety feature	responsible party
hand scraping	gloves	self
run over from behind	blinking light	self
head crack	helmet	self
abdominal pain	joint style of handlebars	self
slip–stream	tire case, separate lanes	state, lorry owner
fatality	bumper style at trucks	state, truck owner
graze, abrasion	tar	state, road constructors
blind spot	mirror, whistle signal	state, lorry owner
right turns	barrier, radio bike whistler	self&state, lorry owner
running down	extra lanes	state, road constructors

Table 5: Injuries and related safety features for cyclists

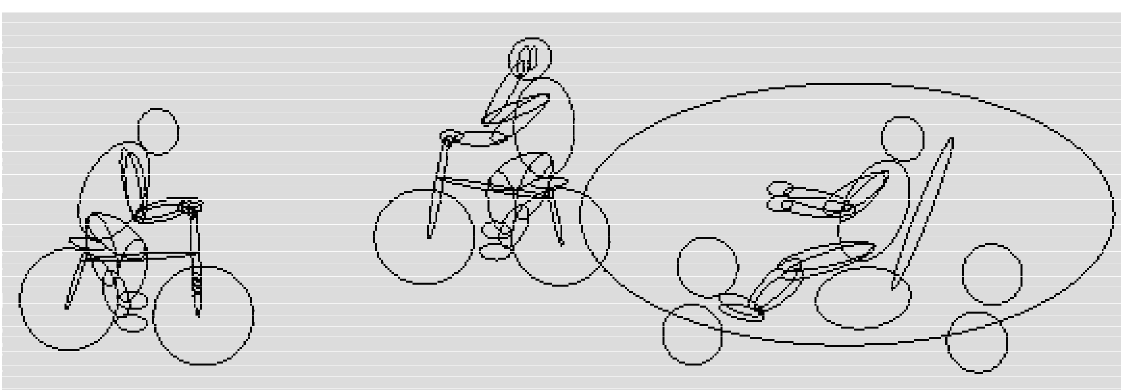

Figure 3: The difference in linear momentum of a cyclist and an automobilist gives a high factor of the acceleration magnitude

A correlation has been fitted to the collected data about head–on collisions of two cars to be able to estimate the fatality–risk of the drivers. Driver 1's fatality risk is $r1 = c\ (m2/m1)\uparrow 1.79$, where m1 and m2 are the weight of the drivers respectively and c is a constant [Halliday, 2005]. We mention this statistical result in order to show the value of collecting data about the physics of accidents and we would like to prompt doing this seriously for accidents where cyclists are involved. Acceleration or the given formula from fitted data may work for cars – for bicycles, however, such measurements are too simple. We believe that it can not be done without simulation techniques that allow to consider a multitude of parameters.

1.7 Financing pipsoft's simulation project

No doubt, there is a considerable difference in force and momentum between a self–driver's and alien–drivenee's vehicle (see figure 3 and derivation 1). Hence it is difficult to get due attention from an automobilist by physical means on the road. A self–driver can not insist on his priority without considerable personal danger. An alien–drivenee 'beweighted' and enclosed by a bodywork oppresses the energy–efficient self–driver according to the 'right of the stronger' to get his right better in a cautious way – according to the motto: 'intellectuals gives in' and collect data for later reference. Little has changed in this respect and therefore the question rightfully is asked, whether and if then how the proposed simulation project may be financed.

The sad message first: "The bicycle market, this is constructor, dealer and rider, have to come up for the costs for the save utilisation of their bicycles themselves." The good news is: "There are new electro–magnetic means that are light and affordable. The disadvantage in competition with alien–driven traffic based on the reason that radio devices could not be taken along on a bicycle is history." Before, electronic devices were heavy and unsuitable to be used on bicycles. Today, almost everybody is able to record sounds, take pictures, record movies without much body effort anywhere at anytime and everybody may be capable to transmit the data in real time without problem to any other place. Light–weighted registration and communication facilities combined with an agile vehicle such as the bicycle shift the strike force significantly in favour of the self–drivers in particular in cities and agglomerations. Hence, why not collecting data with such devices for precise reconstruction of incidents in order to reach a fair judgement?

The loss in freedom and prestige for car drivers is noticeable and yields already negative side effects in the Zurich greater area. On one hand the shift leads to higher risk–taking among frustrated automobilists that peaks in amok drives of road hogs and on the other hand it leads to poor risk–estimation by perspective slate and laptop carriers. In bicycle outlets, the scale of effect spans from overwhelming mean–clever offers of unsuitable bicycle components to the deliberate sale of defective material and parts. In our opinion, there is a necessity, to help soft traffic consolidate by the help of convincing computer–aided simulation (CAS) expertises of realistically reconstructed accident scenarios. The simulation documents may help to approach the value assessments of self– and alien drivers in favour to the overdue appreciation of self–riders' daily accomplishments. A new distribution of city and state police forces is to be established, although only few politicians have consciously noticed the shift in power that suggests a separation into soft and hard traffic forces. Preventive constructural measures should aim at establishing soft traffic transit routes that consider gravity– and air–guided preferences of self–riders.

As long as the chances of the new technological registration and communication means are poorly exploited, understood and accepted by society, it is to be feared that the number of accidents among self–drivers will rise. Computer simulations offer a handle to legitimate necessary measures to be taken by the police. In particular, we want to stimulate a serious technical discussion around constructural incapacitation and material defects. Based on this exchange of expertise, animations of accident scenarios can be produced, depersonalized and presented to a broad audience for fair judgement. Much depends on the simulation quality situated in the range between scientificly based, realistically simulated animations and imaginary cartoons or computer games, by which teenagers are flooded with extensively – there are sufficient many 'cheerleaders' already.

The climatic changes of the last years has been noticed by normal human beings, which start to sympathize with soft traffic. This goodwill justifies the adaptation of our habits not only in wording but also in using electronic equipment. The high starting investment costs of the pipsoft simulation project is well–placed money. It aims at the settlement of the responsibility and liability of a concrete traffic accident that happened on the 26th of June 2005. The attacked endeavor is to reduce a legal argument to simulated physics. – In the far future, one can even imagine that bicycles get built–in black–boxes that register data for validating simulations as in planes – and that even before such devices serve in everyday cars – so that the bicycle could surpass the car's status as the carrier of technical or technological innovation!

As a starting point, the pipsoft informathematics enterprise has received a finance confirmation of a notable amount of money by the South African Reserve Bank sponsored by sunset games lottery funds. Such funding could be a good chance for balancing out the north–south inequities. Even though the amount currently still is blocked by the South African Revenue Services due to an open cross–border fee, it is hoped that this article gives a reference for that the pipsoft simulation project becomes a world state sensitive and sustainable effort worth an intercontinental investment.

1.8 Standardization in global marchandizing

Manufacturers assemble bikes out of many purchased parts which interchange in a complex way on a ride. The arbitrary composition of new types of components, as practiced in the last years, may strongly effect the riding and braking behavior of the assembled vehicles. In need of repair, the replacement by original parts has become an expensive endeavor due to the multiplicity of components. Even in specialist outlets, components are replaced opportunistically without estimating the risks of the modified ride and stop conditions for the client. A save usage of the two–wheelers hence is not granted without further measurements. Due to the individual compositionality of bikes, typetests turn out to be complicate and tedious. Official individual checks are constrained to motor–powered vehicles. Bike tests are left to specialist shops which are overtaxed. The high mobility of cyclists and the globalized business with bike components require globally harmonized bicycle safety regulations as well. The respectful contact with the environment friendly riders is a key issue for the urgent socialization process in the mondial economy.

Cyclists have a high potential of self–endangerment which brings them up to high responsibility such that they rarely cause accidents. If, however, they are involved in a collision, they often are seriously injured so that the subjective run of the accident can not be reconstructed. Mishaps in handling or material defects are therefore seldom sufficiently examined and in lack of comprehensive knowledge about all reasons, the accident often is trivialized and the victim is blamed for it by alleged riding mistakes or other misbehavior. In difference to popular skiing where bindings are checked as a matter of routine, there exist no testing apparatus for bikes – e.g. for measuring the contraction of shock absorbers or the efficiency of brakes. In consequence, the salesmen and clients are not aware of that poorly tuned components may partly cause a (self–)accident. With the observable trend to sports&funbikes more often then ever there are rides at the limits of physical feasibility. This increased risks alone justify pipsoft's intent to carefully model the riding and braking dynamics. Moreover, there is the danger that costs of the trendy sports are burdened to the ordinary traffic riders because the trendy devices are not suitable for everyday road traffic and because muscle powered road users hardly pay sufficient attention to the exposed problem.

We think that there should be a general interest in a scientific investigation of bicycles' ordinary road traffic safety. The research goal should be the development of a globally applicable test standard that, for example, describes the simulation of the riding and braking dynamics based on simple measurements at the exchangeable pieces of equipment. In addition to the bicycle's properties, also the cyclist's profile (e.g. reaction time for balancing out) and mean environmental and climatic conditions (e.g. road surface and wind) should be modelled. By that a foundation for testing apparatus could be established, which allow for serious consultation at specialized bike agencies so that a bicycle's frame and components could be selected, equipped, assembled and repaired according to the cyclist's profile.

1.9 Further perspectives

Gravitational force plays an important role for self–driven vehicles and consequently more value is paid to the choice of ideal routes in dependence of the aim and goal of the ride. The usage of navigation instruments therefore mean much higher value to self than to alien traffic participants where a difference in altitude barely is paid proper attention to for the choice of a route. This becomes clear when comparing a car with a bicycle map. The car map has no contour lines and the bicycle map not only shows the topography but additionally emphasizes the road's slope.

We think that there are a lot of chances in soft tourism, i.e. tourism that involves soft traffic! In Switzerland, there already is a world–wide travel operator specialized on bicycle touring vacation who is serious about sustainable development and environmental friendliness. The organisation chooses his local partners carefully and gives priority to hotels operated by natives and to the local kitchen where ever possible. It makes his local partners more sensitive to environmental issues and chooses the train and in general local public transport preferably.

Conclusions

The modelling of soft traffic at an appropriate level of detail is rarely done even though handy technical equipment is available to collect data in order to be used in computer simulations that could document accidents involving cyclists. We have shown by the differentiation of self– and alien–driven vehicles that the 'good old Ottomotor being the driving force of economy' has become a myth – rather the cheer number of them hinders the opening of social–motional economic viability. Contrary to current perception, we have indicated a counter–monotonic correlation between the wastage of alien energy and mental achievement of operating a vehicle. For fair judgement, an up–to–date scientific view assesses transport work by the individual's complexity of its modelling and includes the body–related effort, i.e. soft traffic is hard work! Such an assessment frees the way to qualitative economical growth by optimal energy usage rather than a quantitative one by extravagant energy wastage that has been indulged for many decades in Western civilizations.

Finally, we hope to have pointed out convincingly that simulating bicycle ride dynamics is a perspective investment project. We think that this article contains sufficient arguments why financing pipsoft informathematics becomes unavoidable and why that a bicycle ride dynamics simulation project will prevail to be established continuously on a mondial scale. Finally, we hint at a simple accident scenario whose simulation is expected to point out the necessity of global standardization in the sector of self–driven vehicles. Last but not least, perspective intellectual software projects are promised to be financed generously.

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