

# THE ULTIMATE SOLUTION FOR INSURANCE COMPANIES THAT NEED ONBOARD RISK ASSESSMENT : SafetyNex

- . WHY TESTED SOLUTIONS ALL FAILED (ACTUARIES SAY) ?
- . WHY SOLUTIONS BASED ON "SEVERE BRAKING", "VELOCITY IN CURVE", "ACCELERATIONS" ... HAVE STRICTLY NO CHANCE TO WORK ?
- . WHAT TO DO TO GET A RISK ASSESSMENT MODULE THAT WORKS? (Presentation of a disruptive solution)

By NEXYAD

## 1-INTRODUCTION

Insurance companies now find themselves in front of a potential change in business model, and the so-called "pay how you drive" pricing is an idea whose time has come. Indeed, since actuaries analyze their customer profile, projecting accidents on groups of customers, they generate pricing taking into account number of accidents and cost of accidents (risk and loss). Then why not consider a unitary manner to "measure" the behavior of a driver and his/her risk of accident, in real time ? This would adjust the rate, not only by the group to which the driver belongs to (eg youth, seniors, professionals ...) but also by its actual driving behavior NOW (at every second).

The challenge is to enable the sorting of policyholders, so as not disadvantaging a careful driver that would be unfortunately projected in a group of risky drivers (because he is young and owns a red car, for example) and do not miss a dangerous driver who would luckily be projected in a safe drivers class (because it was the right age and doesn't drive much, for example) :



Moreover, we think that some companies using "bonus-malus" should make the difference between a dangerous driver who has been lucky (and we all know, it will not last forever) and a careful driver who has had two unlucky accidents last month. It is then important to understand that an accident is defined as a statistically rare event, and we dare say it is a shame to wait for the repeat of dangerous behavior of a bad driver until it leads to accident (knowing that hitherto, he has avoided the accident, thanks to the reflexes of other road users). The risk taken by such a driver is much higher than the insurer thinks. And actuaries compute their pricing taking a wrong risk into account.

The overall objective of a better unitary risk assessment is multiple :

- . gain profitability by keeping good seniors, taking the good youth and deterring dangerous drivers
- . teach drivers so they collectively reduced the number of accidents and loss (if the risk measurement system allows this explanatory function)
- . increase customer satisfaction by decreasing injustice

For those reasons, and since it is practically feasible, insurers have started to put telematics devices into cars, and they already measure drivers behavior (electronic device may be the smartphone, either telematics boxes, or both together). Ordinary telematics Companies have extensive experience of App (smartphones) and telematics devices deployment. They all started with geolocation devices, which is a very simple application of GPS. Then, they developed software to measure acceleration and braking, and some of them propose estimation of eco-driving (based on estimation of the conservation of the inertia of the vehicle). Eco-driving is important for fleet managers that wish to reduce fuel budget. While these applications may include niceties (gearbox ratio engaged and engine speed, transported mass, etc.), it's still a mathematically simple application, which deals with some thresholds on accelerometer data.

Recently, insurers said they are interested in embedded onboard risk estimation (heart of their business), and have turned to their historical partners of telematics to find solutions. These operators believe (or they "want to believe") that their accelerometer thresholding software can also be used to estimate the risk of driving, and so they have proposed various and varied scores, often based on a measure of the severity of the braking and also on lateral acceleration (speed on curve).

NB: these companies have never worked on driver assistance systems for automotive manufacturers or for road safety teams responsible for the development of roads in order to reduce accidents, and however good they are on telematics, they are not experts in complex applied maths solutions for onboard safety measurement.

And recently, we could read the first feedback from some Insurance companies (see 7 - REFERENCES), which demonstrate that the measures and estimations made by the historical providers of ordinary telematics devices have absolutely no predictive power regarding the accident !

No actuary in the world, until now, could find any correlation between their accident database and all scores measured in vehicles on the basis described above (severe braking detection, ...). We explain in this article why this lack of conclusive results is absolutely normal, and we show that simplistic assumptions made by telematics companies and insurers themselves have no foundation.

Finally, we present as an alternative a totally disruptive solution, which has been developed and tested, validated during the last 15 years, and that is now available.

## **2- STATEMENT OF TOTAL FAILURE OF ALL INSURERS THAT TESTED ONBOARD TELEMATICS DEVICES TO MEASURE THE RISK**

AG Insurance and KBC Bank Insurer have recently publically said that their telematics tests results were very difficult or impossible to compare to their accident database. The conclusion for those two Insurance Companies was a total stop of their onboard telematics devices experiment...

Moreover, NEXYAD visited many insurers in France that are currently testing solutions for "driving behavior measurement" and they all confessed that actuaries could not find any correlation between the data reported by these embedded telematics tools and accident.

**No correlation AT ALL.**

This is a unanimous and concrete verdict : the solutions proposed by the actors of the ordinary telematics devices provide no effective gain to insurers for onboard risk assessment.

Besides, if those telematics solutions were satisfactory and would bring light to insurers, it is obvious that they would be deployed on a large scale... But insurers still test solutions these days, on panels or a few thousand customers at most.

All this demonstrates that the historical actors of telematics, which have a real expertise in the deployment of aftermarket electronic devices, have however no proven expertise in applied mathematics for embedded estimation of complex values, and especially for onboard risk assessment. This is indeed the field of ADAS (Advanced Driver Assistance Systems), and companies working in this sector have long worked as suppliers for automotive manufacturers and Tier One Companies, not for Insurers. You don't know their names, but they exist.

This is the case of NEXYAD that brings now an entirely fresh and disruptive solution (SafetyNex software module), a revolution in telematics for insurers, since SafetyNex calculates the IMMEDIATE RISK taken by the driver, and at every moment, and at every location (as the driver's vehicle is geolocated in navigation map).

## **3- EXPLANATION OF THIS TOTAL FAILURE IN RISK ASSESSMENT**

### **3-1-DATABASES, STATISTICS AND ACCIDENTS : HOW ACTUARIES VALIDATE OR DISQUALIFY AN ONBOARD RISK ASSESSMENT SOLUTION ?**

Actuaries have been recording databases of accidents and claim that they have values recorded in recent years.

When a driver drives with onboard telematics solution, a risk (of accident) is computed at every moment, and it would be then possible to check whether the average risks are lit in areas where many accidents have happened those last years (screening the database). Indeed, these areas are dangerous, by definition, potentially due to shape of infrastructure, and risk scores should increase for most drivers (or at least for "some" drivers).

All actuaries recently met by NEXYAD, and who have worked on this type of analysis, found no correlation of onboard telematics data with their database of accident.

Failure is actual, and starting a new try with the same onboard measurement is a completely waste of time. NEXYAD think that insurance companies should cooperate and exchange such information.

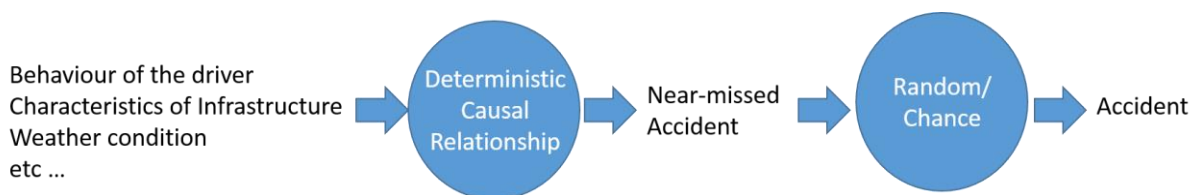
### 3-2-OBSERVATORY OF "NEAR-MISSED ACCIDENTS"

NEXYAD would first like to explain why we have a unique knowledge of the accident, as this deep knowledge is THE key for developing a smartphone App or an effective telematics device for insurance companies, focused on risk assessment. NEXYAD acquired this knowledge working with French Administration in charge of road safety.

Indeed, French Department responsible for explaining road accidents (in order to reshape infrastructure) have decided in 2004 to build what is called an "observatory of trajectories" and that, in order to observe, record, and count the near misses, or near-missed accidents (or "quasi-accidents", see chapter 7 - REFERENCES). This was decided because by definition, an accident (definition: "what happens fortuitously") is something that cannot be predicted (or it is not an accident then, it is a deliberate act).

Researchers then sought a similar concept but that is predictable. And this notion is the "near miss" (near missed accident, or quasi accident). Indeed accident is rare : the reflexes of the driver, the reflexes of other road users, luck, circumstances, etc... usually allow for 'narrowly avoid the accident'. By definition, a near accident is called a near miss. It is the expression of a high risk, in the statistical sense, of course, and repetition of near misses finally lead to an accident. Research has shown that one can construct causal relationships that fully explain the near misses.

However, the transformation of a near-miss into an accident has no explanation of cause and effect, it is only statistical (it takes on average more than 100 or 1000 near misses to generate an accident).



This notion of near misses (or near missed accidents, or quasi-accidents) is very interesting for actuaries : if we compute a risk score between 0 and 1 (1 for actual near miss situation), then we can measure the risk taken by the driver. Let's fancy a driver who often have high risk score, it means that he/she is often in near accident situation, and then sooner or later this driver will end up having an accident. It is this definition of risk that is of interest to the insurance business. You definitely don't have to wait for the accident, you can predict that a driver will end up having an accident very quickly.

To make sure it is fully understood, let's take an example in usual domestic life : if you go in your shower, feet in water, and then if you decide to fix the electricity (without turning it off), you are 100% in a case of near-missed accident. But it is possible to do it without being electrocuted... Of course, if you do this every day, sooner or later, you will end up having an accident. The accident is not predictable. But the situation of near missed accident is. This prediction doesn't use any "data mining" or other data analysis-based or machine learning methods, but only "knowledge" coded with logical rules : "if you touch the electricity with your feet in water, you might be severely electrocuted". It is a cause effect relationship.

NEXYAD has been working for 15 years with experts on cause-effect relationships that generate a near missed accident, especially on the relationships of cause and effect related to the shape of the infrastructure, which affects more than 75% of accidents.

NEXYAD is the ONLY company that has been working on near missed accident for 15 years, and we extracted more than 5 000 rules (knowledge of road safety experts) to score the risk depending on the shape and characteristics of infrastructure, plus speed of the car : this work has been made possible

through our participation since 2001 to French collaborative research programs (public-private) on road safety, during which we have collaborated with INRETS and LCPC (now merged into IFSTTAR since 2011). In particular we were involved in two PREDIT programs : ARCOS, and SARI (see 7 - REFERENCES)

This unique experience in accident analysis definitely distinguishes NEXYAD from historical companies of telematics.

### **3-3-DIFFERENCE BETWEEN CORRELATION AND RELATIONSHIP OF CAUSE AND EFFECT**

NEXYAD has a Business Unit called ANALYTICS, that works for Banks, Insurance, Marketing. So we know the DATA SCIENTIST work : seeking statistical relationships between variables and build models to estimate magnitudes deduced from those observed.

The work we've done in our Business Unit AUTOMOTIVE & TRANSPORTATION to build our onboard software module of risk assessment is totally different. Indeed, we do not use the correlations between variables on a database (not at all).

We followed the experts in charge of the road infrastructure : they decode the reading difficulty of infrastructure by human drivers, based on the shape and other characteristics. These ratings make use of the expertise in accident (of Accident Research laboratories in charge of the recording and description of near-missed accident), of the expertise in cognitive ergonomics, etc...

Experts use to rate sections of road with an "INTRINSIC DANGER LEVEL". Example : a low bend radius turn (tight) will receive a different level of danger based on the fact that it connects with other bends, or it arrives behind a straight line, or depending on the equation (clothoid, circle, ...) of the curve. Similarly, a junction will be scored differently depending on whether it leads off on a straight road, or on a fork that is much more complex to "read".

This knowledge is formalized and designated by the generic term BREAKING ON A ROUTE. The breaks are points that require a very high mental workload for the driver to understand how is the road ahead.

From this break scoring, experts have charts that transform a level of danger into risk of accident. These graph charts were plotted by observing near missed accidents, not accidents.

The SafetyNex system is therefore NOT a model whose parameters have been adjusted on a basis of accident database, but a knowledge based system (which contains more than 5000 rules) and graph charts functions that modulate the risk depending on the speed of the car. Those rules has been validated by the experts in France and in Europe).

Note : because the decoding of road shape is made in real time by the onboard software, SafetyNex can use any navigation map. Because criteria are based on psychology and biology works (ability for a human being to understand the difficulties of the road ahead), SafetyNex works in every country.

### **3-4- FALSE BELIEFS : "THE SEVERE BRAKING ASSUMPTION" (CONCRETE EXAMPLES)**

Insurance Companies and incumbents of onboard telematics have never worked in the context described above (explanation of the formation of a near-accident). In the absence of any formal jurisdiction over the subject, these companies have sought ideas of "common sense" that designated them as their intuition may be used to estimate the risk of driving.

Among those "hunches" you may find in pole position the idea of linking the anticipation abilities of the driver to its severe braking : if he/she brakes severely, the idea is to consider that he/she is surprised, proof that he/she did not anticipate.

#### Two notes :

. **First:** a bit of mathematical logic

The proposal "A implies B" (eg "lack of anticipation implies severe braking") can also be written (that is of mathematical logic) "not B implies not A" (that is to say, for our example : "no severe braking means good anticipation."

But each of us has ever seen (fairly common) on roads quiet drivers, even very calm ones, that accelerate gently, never brake hard, but roll through a stop sign, do not respect priorities, and that do not slow down when traffic lights are orange, do not slow down at the entrance of a village, etc... This is the case especially of cautious beginners who have no automatic reflexes and do not know "where to look" (then they are always late to understand), and also of some seniors with sensorimotor system that may be a bit slow (being aware of it, they never make sudden movement).

The existence (not exceptional) of these types of drivers totally discredits the hypothesis called the "severe braking assumption."

Moreover, actuaries are aware of these populations at high risk of accident, and the challenge would be to "sort" good drivers in these categories and even educate them, help them to drive in a safer way.

. **Second:** a street lined with vans and buses can let out a child running with the ball. Careful observation of the street won't let you see the child coming, and only a sudden and severe braking can avoid the accident. A driver who just avoided an accident by sudden and severe braking has just shown that he/she KEPT THE CONTROL OF THE VEHICLE, what is required by TRAFFIC RULES. It would be a shame to classify this driver in the "risky drivers".

In conclusion, we AFFIRM that the apparently common sense ideas developed in recent years by insurance companies and by historical companies of onboard telematics are simply FALSE GOOD IDEAS. This also explains why there are still so far from mass deployment. Nothing works and nothing will work on this basis. Definitely.

Our presentation makes it easy to understand that driver's behavior, alone, has absolutely no meaning (driving quietly without speeding or braking does not have the same meaning depending on whether one is at a stop sign or not, for example), it is the adequacy of driver's behavior to the difficulty of the road that is important to measure the risk he/she takes. That's what SafetyNex does with its 5000 rules of cause and effect.

Moreover, the TRAFFIC RULES allow the police to punish an "inappropriate speed" even though there is no speeding over the speed limit. If the police estimates that your speed is not appropriate to the context they may arrest you. Let us return to the rules of traffic. Especially for insurance companies, it is important to refer to a solid basis (not to "intuitions").

## **4- DISRUPTIVE SOLUTION: A TRUE MEASURE BASED ON KNOWLEDGE ABOUT THE GENESIS OF A ROAD ACCIDENT (RELATIONSHIPS CAUSE AND EFFECT)**

### **4-1-PRESENTATION OF THE COMPANY NEXYAD**

NEXYAD is an Applied Mathematics company working both on road safety applications (via its Business Unit AUTOMOTIVE & TRANSPORTATION) and for insurance companies and banks (via its Business Unit ANALYTICS).

SafetyNex was not initially developed for insurers, but for the French Department of roads and highways, in order to estimate the risk taken by a panel of drivers along 1,000,000 km of French roads. Although they have different behaviors, SafetyNex was able to discriminate segments of road infrastructure that have "pushed" drivers to take more risks than usual. On this basis, the idea is to focus in priority on the areas that generate the most accidents and reshape those areas (and then reduce the national accident statistics).

Second, we found a new market for SafetyNex with car manufacturers that wish to incorporate our risk assessment solution into their Advanced Driver assistance System.

Finally, new expectations of insurance companies that wish to estimate individual risk during driving let us target a third market : for insurers, our SafetyNex solution is a complete innovation (it has not been deployed yet, even if some French Insurance Companies are about to do it).

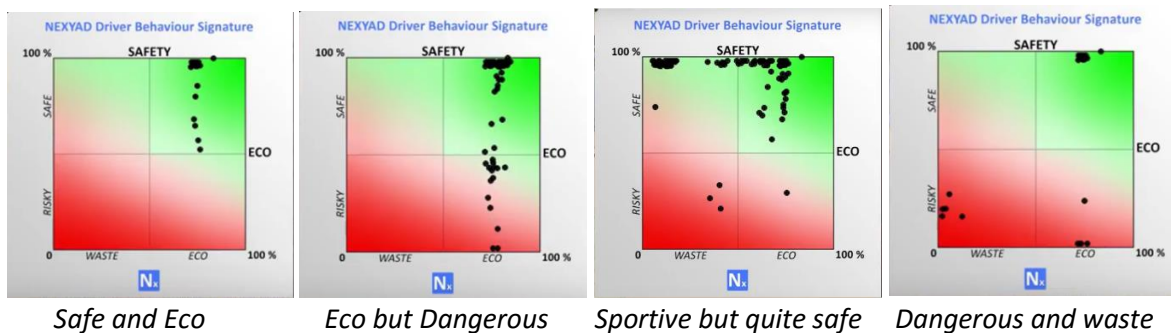
#### 4-2-EXAMPLES OF RESULTS AND VALIDATION OF RELEVANCE

NEXYAD has hired a professional pilot that drove on known paths, and we asked this pilot to simulate calibrated driving manner types. To check the calibration of the pilot, the same behavior was done N times on the same routes, so as to measure and validate the repeatability of driving manners.

The four types of driving are:

- . careful driver who wants to consume as little as possible (therefore both Safe and Eco)
- . stunned drivers who wish to consume as little as possible (Eco, but not Sure)
- . sporty driver who takes very few risks even if they drive fast (Safe mostly, but not Eco)
- . brutal debutant driver who thinks he/she is a pilot but that is not the case (not Safe not Eco)

We could VALIDATE SafetyNex relevance of these four driving profiles: on the following charts, we draw one point per second (for the demo in the App, NEXYAD control the flow of data reassembled at will). A path is represented by a "point cloud" that draws a shape. The more this shape is up on the chart, the more the driving is "Safe" (low risk). The more this shape is located on the right, and the more the driving is "Eco".



Note : severe braking influence the Eco rating, and not the Safety rating (or risk).

Links to online demos: [http://nexyad.net/Automotive-Transportation/?page\\_id=441](http://nexyad.net/Automotive-Transportation/?page_id=441)

#### 4-3-NEXYAD ENTERING INTO THE WORLD OF ONBOARD TELEMATICS

NEXYAD started last year the implementation of SafetyNex on smartphones.

The SafetyNex for smartphone application is available (end of March 2016 - NEXYAD roadmap). This will be deployed massively. The interest of smartphone App for insurers is the opportunity to deploy

several million units and own their data. This solution is interesting because it is "cheap" (or even free, cf. opportunity of smart business model in "Conclusion"): no need for telematics device.

However, the telematics unit, which has the disadvantage of cost, also has advantages (installed and "forgotten" by the driver, still in operation, etc...).

NEXYAD moved closer to its regular customers, and now has an automotive supplier partner (a tier One Company), claiming TENS OF MILLIONS telematics devices worldwide, and this partner integrates SafetyNex into a professional aftermarket telematics device.

The intervention of a rank 1 supplier (who built the car with the car manufacturers, and therefore has access to all information) has an obvious interest, and this solution avoids :

- . regulatory problems with OBD2 plug (which also brings major practical problems of physical accessibility, and which is not a worldwide standardization anyway)
- . installation costs (the cost of installation is zero).

It is with this partnership on telematics devices and with the solution on smartphones, that NEXYAD calmly discusses the Insurance market in Europe, and very quickly in the US and Canada.

## 5 – CUSTOMER NEEDS ABOUT SAFETY (French Spoken Survey of French Insurance Amaguiz)

A study was made in France by the Insurer Amaguiz :

- . **65% of French drivers** want to be warned before they enter into a dangerous area

Interesting to notice that even on the French market that has traditionally a conservative attitude about insurance, 65% of drivers would like to be aware of the danger of the road (before they are in danger of course). SafetyNex completely answer this need of customers : SafetyNex sends real time alarm and NOT because you accelerate or brake... but because you are about to enter into a dangerous area and because your speed might be inappropriate to the difficulties you will have to front. SafetyNex doesn't send too much alarms (only high level of danger are buzzing, other possible dangerous situation may be warned more smoothly).

Source : <http://pro.largus.fr/actualites/les-francais-imaginent-la-voiture-de-demain-plus-sure-et-ecologique-6809387.html>

## 6 – CONCLUSION

The shift from geolocation and study of acceleration/eco-driving to risk assessment is an extremely strong BREACH OF COMPLEXITY. We cannot estimate the risk of accident by applying thresholds on driving signals, according simplistic ideas, even when they seem to be "good intuitions" (like the assumption of severe braking). It has been demonstrated and published.

This disqualifies leader companies of onboard telematics whose expertise covers the electronics and reliability of the installation, maintenance... but relatively little about mathematics and nothing about accident genesis knowledge !

This also disqualifies startups that propose accelerometer analysis and that remain confident that you can move from braking analysis to risk assessment (by detecting severe braking). However, the risk (and actuaries of insurance well know) is a HUGE JUMP IN COMPLEXITY.



Note : NEXYAD did not seek to develop an eco-driving score, and took an already existing product, in order to focus on their knowledge on risk assessment.

The development of a system such as SafetyNet led to extract over 5000 rules.

NEXYAD has no competitor in this area, and we believe it will take several years to potential competitors to develop an equivalent system, knowing that NEXYAD already has additional modules (still "expensive" to deploy because using computer vision) that will allow SafetyNex to keep leadership.

Moreover, NEXYAD worked on a business model that may enable insurers to deploy SafetyNex FOR FREE to several million copies (for more information contact us).

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