Deep changes in the business of car insurance. Contribution of smartphone App SafetyNex in this global context.

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1 - Role of the insurer

The insurance idea would have appeared on the occasion of the first great journey by boat, and the appearance of "modern" insurance is generally dated from the 19th century.
The principle of insurance is easy to understand: if accidents are rare (compared to the number of occurrences - travel, car trips, etc.), a simple and prudent idea then is to "put aside" a certain amount of money for each occurrence (which on average does not lead to an accident) and to use the money to repay the cost of the claim in case (rare) of accident.
One could imagine that individuals manage themselves each a "pot" of this type. Of course, even if an accident is rare, you never know when it happens and it may happen at any beginning of the process so that the pot is almost empty.
We could then easily make a common pot between several people, to smooth it: if three people make a common pot, it is unlikely that the three have an accident while starting hoarding. But... it is anyway possible. Although if the pot is conceived with hundreds of thousands of people there, you secure the problem of "instant" of the accident. This is the « law of large numbers », which allows a deterministic modeling of chance: the odds. It remains to define the amount of money to set aside each month for example (or each travel).
To handle this (a pot shared by hundreds of thousands of contributors, the estimated sum to put aside, etc...), it is obvious that it is necessary to have qualified personnel, sufficient... and finally, it happens naturally to the idea of the Insurance Company.
The insurer has hundreds of thousands or even millions of policyholders, and smooth the sinister occurrences thanks to the law of large numbers. He is responsible for ensuring that claims even exceptionally expensive will be refunded.
NB: in the case of home insurance, a natural disaster on a large area can resynchronize the claims despite the large number of insured people... the insurance company then would better spread in different territories and / or to associate with other insurance companies operating on other territories to make quite impossible synchronization of claims.

The forecast of the number of potential accidents on territory and over a given period is referred to as the "Risk". In French as a first approximation we see the term "risk" roughly coincides with the idea of « probability ». If a loss is probable, the insurer takes more risk than if the disaster is unlikely. But that's not all : if one has a probability X had an accident but that the loss really cost cheap, it will be considered, always in natural language, that the risk taken by the insurer is less important than if the probability is still X (the same) but with sinister potentially costing much more !
For example, assume that the probability of burglary of an apartment is always the same (neglecting the Protections effect), then it is more risky to insure an apartment featuring original works by Picasso than apartment emblazoned with photo reproductions of works by Picasso. The probability is the same, but when the burglary applicable, the amount refunded is very different. What emerges very intuitively is an entity that is the multiplcation of likelihood by cost of the disaster.

2 - Risk management and calculation method of pricing

2.1 - Customer segmentation and risk statistics by segment

Generally, a numerous population does not lead to a homogeneous risk : someone who lives on top of a rock python have less chance to get 1m of water in his/her house than someone who lives at sea level or in the bed of a river.
The insurer's interest is to achieve groups (segments) of people who have homogeneous risk. Please note, as the risk is linked to the idea of probability, it is a value which is estimated by statistics... However, claims (housing, car accidents, plane crashes, etc...) are rare (and thankfully), so the statistics are long to make and complex to interpret as for long periods, many parameters may vary (other parameters than one that interests us). This means that the well-known hypothesis statisticians "all things being equal" is rarely verified.
Similarly, groups cannot be based on discriminatory or racist sort variables. We saw in France the example of insurance cheaper for women than for men who have been banned. Indeed, in this case, men doing more km that women, on average, it is normal that they have more accidents. All discriminatory interpretations are only belief and fake psychology. Such segmentation may instead be reformulated by charging differently depending on the number of travelled km (which is called "pay as you drive", see following chapters).
This remark felt the need to better understand the behaviour and usage of policyholders, factually.

2.2 – Pricing : expected value

Once we have achieved a uniform customer segmentation in terms of risk, one must determine the amounts to be paid.
The mathematical object used involves multiplying the probability by the loss of cost, and is called "the expected value". The expected value for the insurance is the amount of insurance premiums minus total costs claims multiplied by their probability of occurrence. Obviously, this expected value must be positive (the sum of premiums must be greater than the sum of costs weighted by their probability of occurrence). When the number of insured is very large, the sign of the expectation value is a predictor of the gain his, if the probability and the costs are "well estimated."
If the insurer has a bad estimation of accident occurrence probabilities, and / or if the insurer poorly estimated cost of claims when they arrive, then he may realize that the sum of insurance premiums does not cover what to pay.
Conversely, if the insurer is too cautious about risk by increasing insurance premiums, then the insured may be tempted to move to competitors. The scope of insurers is fairly narrow practice.

Then you can list four very strong concerns of the insurer:
. better estimate the probabilities of accidents
. estimate at best the cost of claims likely to happen

. lowering claim probabilities : examples impose the installation of an alarm system, advocating responsible conduct even offer driving courses, warn in real time a driver ahead of a hazardous area (if he/she slows down, it may avoid an accident), etc...
. lowering claims costs : examples : impose a degree of reparability of goods (car, ...), help a driver to detect hazardous areas (if he/she slows down, even if the accident occurs, it occurs more slowly, and the cost of claims is statistically less heavy)

3 - Contribution of embedded telematics for car insurance: measuring factual uses and instant individual risk

Technology now allows to integrate in a vehicle telematics device (communicating electronics) that may inform insurer of every events happening to the vehicle. The first telematics applications were built around geolocation, especially to retrieve stolen vehicles and then, by extension, to optimize fleet operations professional. Afterwards, applications have integrated accelerometers (processing of signals from accelerometers) to estimate exhaust of vehicles due to driving style, and next, to estimate fuel consumption (and therefore CO2 and pollutants emissions).
The major pure players in the automotive telematics are mostly electronics companies, installation garages, and experts of fleets monitoring (Real-time editing performance parameters of a fleet, in the form of dashboards for the fleet manager).
For insurers, vehicle telematics allows to know the usages: number of travelled kilometres, type of use (short trips, long trips, in urban, rural, highways, etc...). This knowledge is used then to develop a new offer of insurance called "pay as you drive".
The interest of telematics is that factual and individual aspect can be calculated, if desired, and lead to an ad hoc fee for a driver, instead of assign him the price of the segment which he or she belongs. In practice, insurers still mostly work on segments, as individual fees are complex to communicate (depends on the country) but the segments are more accurate.
The accelerometer lets you know if the driver drives in a smooth or brutal manner, and the coupling of the accelerometer with GPS allows to know the actual speeds. This gave the idea to the experts of onboard telematics to tackle the risk estimation / risk assessment (linked to customer driving behaviour).
But the risk of accident and its assessment is a breakthrough in terms of data processing complexity: it is strictly not possible (unfortunately) to estimate a risk of accident by using, for a given individual, statistics and / or deep learning methods, and unlike anything recount hundreds of contacts that come to appoint experts on the subject. This impossibility is due to theoretical issues, it is then futile to try to circumvent them.

Some reasons:
. accident is a very rare event (on average, a driver has an accident every 70 000 km): and rare events are not well observed by the use of statistics and deep learning. Of course, one can aggregate data from a large population, over a large duration, and a large territory, and do statistics, but when one try to focus on one individual in a specific location at a specific time, there is not enough data to edit robust and significant statistics.
. accident is unexplainable BY DEFINITION (in the dictionary accident "happens by chance"). It takes many factors aligned for the accident to occur (hence its rarity), and even when these factors are present, the accident may not happen, it happens randomly in that rare case where it is possible. When a factor is not present, the accident does not occur. This means that at the individual level, there is no gradualness or regularity in the data, which makes them absolutely unsuitable for any analysis (including automated methods of deep learning).
It is a phenomenon that mathematicians call "parsimonious and random process". The scoring methods are inapplicable. When they seem to work (sometimes one can read that a company have built scores that show "some correlations" with risk) it is simply that one have tested these scores on

a small data base. Just test it longer on more data and you will find that the correlations collapse. For these reasons, estimation of individual risk of driving is a real rupture of complexity, which is why telematics experts are currently facing a wall: a lot of tests, no massive deployment (after 2 to 5 years of test).
The company NEXYAD has been studying accident for 15 years through French collaborative research programs and is now able to estimate the risk taken by the driver. Those research included working in contact with experts (those who make the roads, those who study one by one serious accidents, psychologists, etc.): mainly PREDIT national research programs.
This work led to the development of the software **SafetyNex**, available as an App for smartphones that gives in real time the risk taken by the driver seen as a measure of the possibility level of "near accident" (a key concept for research in road safety).
This software **SafetyNex**, is not based on observation of a database, for the reasons explained above, but on expert knowledge. It has been validated on 50 million km. This means that the insurer have now a tool that provides the histograms (profile) of risk and every contingency tables with usages (km, kind of infrastructure, day/night, etc.).
SafetyNex is a major development that can help the insurer to change its business and strategy.

3.1 - Presentation of the application **SafetyNex**

SafetyNex runs on a smartphone onboard the vehicle and provides the following features:
. Estimated risk taken by the driver, at every moment
. Vocal warning messages to the driver before a dangerous area, which allows the driver to slow down (decreasing the risk of accident, and decreasing cost loss if accident cannot be avoided)
. Statistics to the driver to show him/her risk profile (and how risk could be decreased)
. Comprehensive statistics (risk, eco, uses, etc.) for the insurance company
. Crash detection and display on the smartphone an emergency phone number with an "OK" button to call easily in case of accident

3.2 - Possible uses

. pay as you drive
The insurer has all the statistics of usage, and in particular the number of kilometres travelled, the type of infrastructure borrowed, and time slots.

. Pay how you drive
The insurer has the risk taken by driver and crossing of risk with all other variables (usages).

. Prevention and coaching
The insurer may follow over time the risk profiles of each customer, and propose training courses, medical visits, etc… adapted to the actual kind of taken risk, in order to keep drivers as long as possible in good safety conditions.

. communication
The « regular » contact between insurer and customer is not very « fun »: account debit, insurance claim / accident.
SafetyNex can be seen by insurers as a communication tool as they provide a real co-pilot that may save the life of drivers (positive image).

. improving the profitability of insurance
When driver is warned prior to a dangerous situation, he /she has the time to slow down. This induces structurally:
- A decrease in the number of accidents
- A decrease in the cost of claims, for accidents that could not have been avoided, because they happen more slowly

3.3 - Respect for private data

Of course, recording behaviour data in real-time raises the issue of respect for the privacy of the driver: except when it is a professional driver (in which case path is part of his/her job and he/she has to answer for what he/she did to the employer), it appears inappropriate that an organization (such as an insurance company, for example) would know at every moment where the driver is, how fast he/she drives, how long he/she stopped at what address, etc…

And it is important to notice that the insurer does not need to have access to private data (location, etc…), as needed information for an insurance company is :
. number of kilometers traveled (without the need to locate)
. detail by type of infrastructure : h ighways, countryside roads, cities, …
. risk taken by the driver : profile of risk (histogram)
. etc…
Crossing of risk and usage allows to know is the driver takes more risk in cities, on roads, etc, then it is even possible to propose accurate training / prevention programs.

These aggregated data, absolutely do not allow to trace the actions of the driver. This shows that the need of insurance companies for onboard data are not in conflict with driver's privacy issues. But these useful data for insurers are computed using raw indiscrete data (that you wouldn't like to be recorded: where you go at what speed, where you stop, how long…).
It means that it is NOT ACCEPTABLE to compute a risk on computers of the cloud. A lot of companies propose this solution: record raw data on the cloud and then compute « risk scores »… THIS IS NOT ACCEPTABLE because raw data shouldn't be recorded on the cloud, it is not compliant with the respect of driver's privacy. With such solutions, the insurance company would be able to spy the driver, and it is not the job of an insurance company.
Moreover, if raw data include GPS and speed, then it is easy (using points of interest on electronic maps that give geo-located speed limits) to know speed limit infringements. Recording infringement on computers (without being official police forces) is NOT allowed in most countries (including France). And it is not necessary to change the law because there is a technical solution fully available: **SafetyNex**.
Indeed, the **SafetyNex** app solves this problem very simply: all computing applying on indiscreet raw data are made BY THE MICROPROCESSOR OF THE SMARTPHONE, in real time, and raw data are not saved. Only risk and usage statistics are recorded on the cloud.

The mere fact that **SafetyNex** can do it totally disqualifies claims from telematics companies that say there is no choice and that try hard to influence regulation and laws in order to have the right to record raw data. Recording of raw data is DEFINITELY NOT needed for insurance companies, and there is a solution that computes every needed information without infringing laws: **SafetyNex**.
Note: the driver is « morally owner of his behaviour », and if someone saves behaviour data on a computer, it is expected that the driver can draw a profit of it (this should not be only a profit for the insurer).
SafetyNex estimates the risk in real time and warns the driver before arriving on a danger zone when the vehicle speed and attitude clearly show that the driver did not realize the danger. This means that **SafetyNex** can potentially save the life of the driver. This is a very important feature of direct driver's interest. **SafetyNex** therefore also satisfies the basic constraints of ethics: the driver has a personal interest in using **SafetyNex**.

4 - Changes in the business of the insurer beyond insurance

Telematics via SafetyNex allows the insurer to offer its customers comprehensive functionality of prevention: risk is monitored in real time and also in duration. If the risk begins to increase at a certain time (after several years of low risk), one can inform the driver and discuss to find where it may come:
. Sudden drop in view and delayed decision to wear glasses
. declining reflexes or health problem due to age
. decrease the driving frequency and therefore expertise
. modification of uses (moving to a more accident-prone area)
. etc…
Some insurers then think, rather than being passive observers (that give awards to good drivers and that give the sack to bad drivers) they should be proactive and act on risk.
And some insurers already started it:
. proposal to free medical visits
. proposed course of driving adapted to a type of risk
. etc...

It is obvious that the App SafetyNex fits in this perspective:
By warning the driver before a danger, SafetyNex makes it possible to slow down and be more vigilant, it changes sustainably the risk of accident. The driver is not "spied, and punished or rewarded" but rather "advised, coached" by the App and therefore by the insurer. A more proactive insurance, which is directed towards the prevention and coaching, beyond pure actuarial applications.
The insurer may track the level of risk in time, and be warned when it increases: something is happening to the driver, and the insurer may help. This will also end the discrimination of young drivers. In France, for instance, the young drivers premium is about 3 times the average premium. This amount may seem high, but these young drivers should pay much more to cover their loss! (They are not "profitable" for the insurer, even with an expensive premium). This true on average. But it is possible that a young driver is a better driver than an average driver: this one is victim of discrimination. Because it is not possible to see that he/she is a good driver, the expensive premium is applied.
SafetyNex makes it possible to know individually the risk taken by the driver: young or old, who cares? If you have the risk, you can use it for pricing. Of course, for the risky population SafetyNex gives the « kind of risks » taken by the driver. Then you may cluster drivers in homogenous risk class and propose focused training courses to decrease this risks (so SafetyNex allows to measure, but also to modify risk).

This proactive posture, which already began with some insurers, is greatly facilitated by telematics, either via smartphone or via a telematics housing installed in the vehicle. Note here that the smartphone is now the nomad object that never leaves its owner. The investment of insurers on smartphone App type tools will then emerge as being one of the key developments in insurance towards more prevention and coaching for driving, health, etc...

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