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EVALUATION MODELS IN ROAD SAFETY: A SYSTEMIC ROADMAP

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ABSTRACT
The evaluation of road safety actions' effectiveness is one of the main activities carried out in road safety research. Safety actions refer to safety measures such as regulations or technology-based safety system. Each safety action follows a detailed set of functional specifications according to specific goals. Evaluation refers to the process of assessing the designed safety action against these specifications and these goals in a context.

We address evaluation activity for the decision, optimization or design processes. To support these objectives, we use the ability of the evaluation activity to create new knowledge. However, we have the habit to deal this activity through existing indicators that are not enough reconsidering or/and that their design process is not enough formalized.

This paper deals with the construction of a theoretical framework to be used as a guide for the evaluation process in terms of building of new evaluation models for specific stakeholders and viewpoints based on the expertise of evaluators, on the documentation of previous evaluations and on a theoretical model.

Keywords: Road safety, evaluation activity, generation of evaluation methods

1 INTRODUCTION
Evaluation activity is present in several occupations; it allows judgment making on the result(s) of an action. For Micaëlli, by its ability to provide information for validation, optimization and specification, evaluation activity can be considered as a regulation activity that allows people to better control their actions [1].
Developing evaluation methods is a complex activity that cannot be performed using a single global model that handles all the evaluation cases. Usually, each case needs a specific evaluation model. Therefore, a creative approach is needed to deal with the design of evaluation activity. This approach needs to use the evaluator expertise and the partial evaluation models that exist.

Aiming at the improvement of road safety, it is necessary to evaluate road safety actions during their development process and during their use period. Even if they have different objectives, car manufacturers and public authorities need to make a judgment on safety actions in a way to validate, to improve, to design and to specify future road safety actions. By its ability to construct knowledge, evaluation activity allows fulfilling these actions.

We state that the fulfillment of evaluations is extremely connected to the understanding of the evaluated action and its surroundings. For example in road safety, comprehension of road crashes is needed to address evaluation activity. There are many models and approaches to analyze road crashes by understanding the failure mechanisms. Brenac [2] proposed an approach that focus on the sequential aspect of the crashes (figure 1), others focus on the human mechanisms in error production and information processing [3, 4]. All these different models focus on a specific aspect of the crashes. Consequently, handling the crashes' complexity we have to consider several models.

Driving is a complex task that involves a lot of actors and dynamic environment due to the other cars, buses, bicycles, etc. Therefore, the evaluation of any safety action requires a multidisciplinary vision in a way to understand this complex system. This leads to a major challenge for the evaluators since major decisions rely on their assessments or judgments. It is clear that models or tools are necessary to face this challenge that is not specific to road safety.

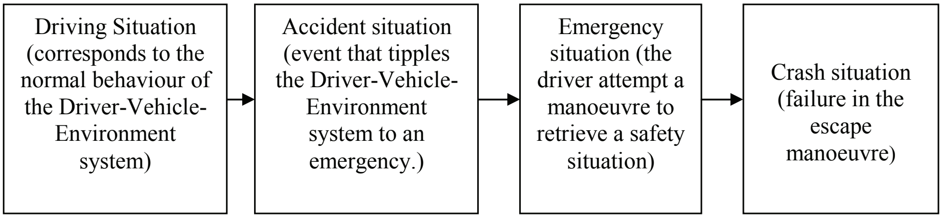

Figure 1. Sequential accident model developed by Brenac [2]

A way to fulfill the various needs that we enumerate just overhead (validation, selection, optimization, etc.) is to use indicators that allow making performance judgments and/or value judgments. The performance judgment is on relation with the specifications of the evaluated actions. The value judgment adds the expertise notion; a judgment gets value when it is relevant for a domain according to its knowledge and its references.

Usually, in road safety, the evaluation approaches mainly focus on the number of killed or injured people. It aims at measuring the evolution of this number due to the insertion of the evaluated safety action. We can find examples of this approach in Page et al. [5] and in Tingvall et al. [6]. These indicators are the most employed but they are not the only one. We can also regard the occurrences of these indicators (adaptation to various contexts), the other indicators in road safety (offense number, behavior survey, etc.) and the indicators that come from other domains (not only road safety).

According to these statements and in order to fulfill the evaluation stakeholders' needs, we identify two major issues. The first one regards the needs to use the existing indicators. We have to structure the existing evaluation methods and indicators in order to provide relevant knowledge to stakeholders. The second issue regards the expansion of the indicators; we think that it is required to design new indicators in order to address changes in road safety and to process the domain that are not yet handled.

A way to address these issues is to design a theoretical framework of the evaluation activity. This would be helpful to understand what evaluation activity is and how we should perform it.

This paper addresses the design of a general framework to cope with the construction of the evaluation activity in the road safety domain. We deal with that by reporting (a) research on evaluation activity in general and more specifically in the road safety domain, (b) knowledge that is used to understand phenomena, (c) representation of the evaluation cases through the formalization of the objectives and the knowledge of the stakeholders of the evaluation. Value concepts of stakeholders and (d) a prospective vision in road safety.

This research is performed in the LAB (Laboratory of Accidentology, Biomechanics and human behavior), which is a joined institute to the two main French car manufacturers, PSA (Peugeot-Citroën) and Renault. In this paper, we focus on the need for the LAB to set a general framework for the evaluation activity to allow experts to develop evaluation methods in relation to specific evaluation cases. In the following sections, we introduce the theoretical notions needed to cover the evaluation activity. Finally, we develop the framework that will guide the design of evaluation models.

2 EVALUATION MODELS AND CONCEPTS

Evaluation activity addresses various issues as regulation and knowledge acquisition in various domains. In order to characterize this activity, it is necessary to handle its design and its practice according to its surroundings.

Evaluation is mainly seen as an activity that allows selecting the good decision. In the engineering design process, it is useful to make the right decision in order to fulfill the requirements that have been stated in the preliminary stages. It is also useful to handle the changes in the environment in order to adapt decisions and actions. Therefore, evaluation activity is a regulation activity where performed actions are adapted to the requirements and to the environment [1]. This regulation objective can be depicted through two different ways. The first one addresses the deterministic behavior of the bounded system. Data and information are captured and provided by sensors. Then, the system compares them to expectations or reference points in order to activate or deactivate specific function. This adaptation is done in a deterministic way because all the actions are predictable. The second way adds the creative behavior, the system does not only use the deterministic answer, it designs some new behavior.
Although the regulation issue is the major one, it is important to handle the other objectives of the evaluation activity as knowledge acquisition, diagnosis, optimization, risk assessment, etc. For example, Ben Ahmed introduced an evaluation framework that aims to validate the design of engineering model [7].

Engineering design needs information to support design, implementation and revision of its actions. Evaluation activity performs these objectives by providing performance or value judgments. However, there are some issues. Firstly, in the present context where industrial companies have to face with a competitive market, judgments have to take into account many variables. Due to the limited rationality of humans, the number of these data has to be small whereas we handle complex phenomena. Secondly, evaluation of innovations is sometime difficult because of the utilization of old criteria that do not handle the novelty. Thirdly, the evaluation criteria are not necessarily representative of the needs of the decision maker or the customer. Lastly, means of measurement are sometimes limited because of the complexity of the studied phenomena.
Multi criteria evaluation methods are used to cover the issue of the design requirements diversity. For example, Stagl [8] designed criteria to handle the economic, social and environmental aspects of the designed actions' impacts in order to make decision on energy supply options. Almeida [9] made an evaluation of both cost and quality of service in order to select alternative of an outsourcing contract. However, Clivillé [10] stated that design of the indicators' system is well controlled, but not its interactions with environment. He proposed a systemic approach where the life cycle (design, exploitation, revision, and deletion) of indicators is treated.

We can state that evaluation activity is performed according to its changing objectives and environment. Therefore, in order to handle these variations, each evaluation have to be adapted to each evaluation study. One needs to design evaluation models that are adapted to evaluation matters. Thus, evaluation is not a process in the meaning of a deterministic method; it is rather an activity where designing behavior is needed. Consequently, we have to face the challenge that rise from this assertion: how to design an evaluation activity that handles all the studied cases with the ability to address new cases?

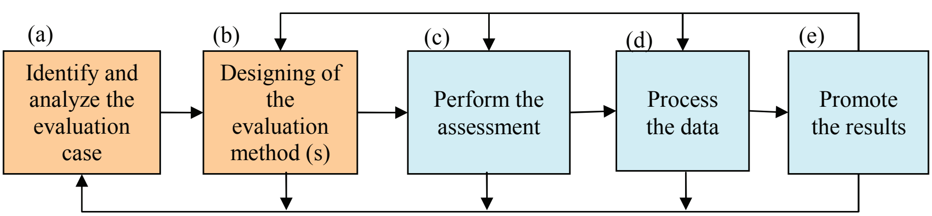

Figure 2: generic model of the evaluation activity.

In our research work, we seek general evaluation methods or theories that allows performing evaluation in the context of road safety and in addressing the various issues that we declared. Currently, we do not find some general theory, we only find some partial models and recommendations that are defined and used in various domain liked engineering design, education, economy, etc. These models and recommendations can be ordered. For example, Alkin [11] presents a

classification that aims to deal with the utilization of the evaluation results, with the different methods used to perform evaluation, and with the construction of value judgments.
Even if we do not find theories that match with our requirements, it is possible to design a generic description of the evaluation activity (figure 2) that can be used to support evaluators. In the figure 2, The loop below expresses the need to reconsider the step of formalizing the case study. The overhead loop expresses the need to reconsider some actions where the results are not valid. It is significant to consider these loops in order to handle the iterative and evolutionary aspects of the evaluation activity.

In conclusion, we address the evaluation activity in a way to make performance and value judgments in order to support the decision process and to enhance modification in road safety. Thus, according to the various viewpoints in road safety, to the various concepts on evaluation activity and to the complexity of phenomena, we think that the achievement of evaluation activity needs a new general approach.

3 EVALUATION ACTIVITY IN ROAD SAFETY

Evaluation activity in road safety aims at studying impacts of the insertion of a safety action. These impacts are measured through indicators that give information on road safety. Currently, the main existing evaluation methods give information on:

- The number of dead and injured people [5, 6],
- The economic impact of road insecurity. Elvik [12], Trawén et al [13] and Rienstra et al. [14] present some approaches and compare some results according to different countries,
- Safety variables (speed, drinking, use of restraints systems, etc.) that are considered as relevant for evaluating the traffic behavior trends. We can find some examples in a rapport from the ETSC [15].

The accidentological department of the LAB, which works for car manufacturers, public authorities, and other road safety organisms, mainly uses approaches that allow measuring the number of fatalities and injured users.
Studies on the economic cost of crashes are used to take decisions that are economically effective. One approach consists in taking into account the direct cost of the crash (rescuers, financing of the damage repair work), the indirect cost due to the unavailability for work or the reduction of purchases and finally the cost of the grief due to the loss of family member. For example, in Europe the cost of one life is estimated at 1.2 million Euros.

These indicators are the most employed because they are available and the most expressive. Obviously, they are not the only one and by adapting them to various environments, we can create many occurrences of these indicators.

To perform evaluations, data are needed in order to calculate indicators. For example, calculation of the fatalities number needs data on crashes. Concerning these data, we need to treat the data acquisition issue and the validity issue. The acquisition can be executed by an expert team that goes on crash areas to study the sequence of the crash. However, as one does not have directly access to the crashes in live, one needs to make assumptions to handle the lack of data. That is why evaluation methods and results are restrained. One example of the validity issue is the outdated data or outdated accident prediction models. With the time and changes in the understanding level, data or models could be outdated. Hirst et al. [16] develop methods to partly correct this type of errors.

As we noticed in the introduction, evaluation activity needs to design evaluation methods that are adapted to the various evaluation matters. For this, we stated that evaluators have to deal with their own experience and with the few models that exist to cope with this design issue. To support it, we aim at identifying the relevant knowledge that will be helpful for evaluators. We seek to design the evaluation processes according to specific objectives and level of understanding. In this way, we will make more efficient and more relevant the results. In other words, we aim at considering the needs of car manufacturers, public authorities and other organisms to adapt and design our practice of evaluation.

Therefore, we decided to design a general framework that would be used as a support for evaluators' work. We do not more seek to build a general model; we seek to frame the generation activity of evaluation methods. We aim at designing the "Identify and analyze the evaluation case" stage in order to aid the "Designing of the evaluation method (s)" stage (see figure 2). Our approach is to handle the evaluation activity by providing a framework that supports the generation of the evaluation methods. In the next part, we present the theoretical concepts that are used to develop this approach.

4 PRESENTATION OF GENERAL FRAMEWORK FOR EVALUATION ACTIVITY IN ROAD SAFETY

In order to specify our approach, it is needed to introduce concepts on modeling activity that will be used to depict our representation of the evaluation activity and the knowledge that support it. For us, it is a major concern to specify the modeling activity because "*we only communicate with model*" (G. Bateson) and "*we only think on model*" (P. Valery).

We identify two main modeling paradigms that differ in their treatment of design knowledge and understanding of complex phenomena. The classic paradigm, which is defined by an absolute and deterministic vision, does not address the complexity. It can be applied to complicated phenomena for which we are able to provide deterministic models. The systemic paradigm was created to handle this issue of the complex system modeling activity. In our approach, we use it to create operational representation of the evaluation activity considering the evaluators, the stakeholders and the environment. We also build models to represent and to structure relevant knowledge.

From the systemic approach, we consider that the complex phenomena under study can be depicted as a system that exits, operates, evolves following its own purposes. The concept of self-organization describes the ability of complex systems to make new behavior emerged in response to modifications in their environment and their own internal structure. In road safety, the system formed by Driver, Vehicle and Environment (DVE) is a complex system. Its behavior is not entirely predictable; we have not the ability to design predicable and absolute models of its behaviors. We assume that a part of the complexity is due to our lack of understanding but the intelligent capacity of the system explains the major part of the complexity. A complex system can adapt its behavior to its environment, but we do not know how.

The concepts that form the systemic paradigm are used to design the framework characteristics. J-L. Le Moigne [17, 18] has formalized this paradigm in the concept of "general system", which follows the research of Bertalanffy [19]. It is the conjunction of a structuralism and a cybernetic paradigm. His work is inspired by the paradigm of complexity from E. Morin [20] and by the paradigm of intelligent action from H. Simon [21]. This paradigm was developed to deal with the increasing complexity in the phenomena that we have to analyze.

According to these concepts, we aim at developing a general framework of evaluation activity to integrate the evaluators' capabilities to design new evaluation methods in relation to requirements. The systemic paradigm states that an activity is described by its finalities. Its behavior results from a complex adaptation process of the changes in the environment and the evolution of its intrinsic mechanism. This is mainly linked to the emergence or self-organization concepts introduced by Ashby [22] and Varela [23]. Therefore, our vision of the evaluation activity as a creative activity can only be addressed in the systemic paradigm.

This adaptation process needs knowledge to perform. We stated that evaluation aims to make performance judgments or value judgments, therefore knowledge have to be linked to these objectives. We develop a knowledge system that is based on value systems and on heuristics that come from the former evaluations.

A major issue is that the evaluation objectives are too general and are not enough wide-ranging. It is needed to extend this objective package by identifying new objectives and by according them to a particular context in order to construct value systems. Indeed, according to each stakeholder, objectives have specific definition. If we want to be able to build value judgments and thus provide relevant knowledge to the stakeholders, it is necessary to identify their models and their references. We introduce the concept of value system that represents the different descriptions of an objective in relation to stakeholders and/or disciplines

In evaluation like in most activities, it is important to be able to use approaches already formalized to perform new studies. Experience and use of heuristics are part of this knowledge to fulfill those needs. We focus n the heuristics. For us, it is a good generic answer to a problem in a given context. We mainly focus on the heuristics from road safety evaluation, but we spread our research on heuristics that come from others domains where evaluation is present such as in economy, education, public policy and engineering design. We aim at developing a project memory where we can store information on previous evaluation studies in order to help for the design of evaluation models.

In this part, we have just described the main concepts that are used to specify our framework. Our approach is to mix systemic concepts, operational tools and the capacity of evaluators to have a complex behavior. In the next section, we present the concept of evaluation model generator (EMG). This concept is designed to handle the operational issues of the framework.

5 DEVELOPMENT OF THE EVALUATION MODEL GENERATOR (EMG)

Using the systemic approach to describe the evaluation activity, we address the designing of the evaluation methods by focusing on the first two steps of the general model of evaluation (figure 2).
We seek to formalize the relevant knowledge to guide the realization of the evaluation. This requires a study of the evaluation matter by always trying to use the knowledge already formalized in other evaluations and to integrate the evolving expectations of stakeholders and changing behavior of the evaluated phenomena. The figure 3 represents the actions to perform in order to deal with the design of evaluation methods that refer to the sequence of the last tree steps of the general model of evaluation (figure 2).
We formalize the evaluation matter by using some heuristics that were design thanks to a literature review and workshops. These workshops were done with various stakeholders of the road safety domain. We constituted small groups of around ten participants from car manufacturers, public authorities or research laboratory. Instructions were to identify knowledge on evaluation studies in relation to their activity. In this way, we identify the goals in relation to road safety and to evaluation activity. These sessions were also a way to identify the heuristics that are used to deal with evaluation practice.

We propose a description of this EMG (figure 3):

- *Declaration of the evaluation matter*: evaluation always begins with a need expressed by a backer/stakeholder. He formulates a problem in relation to his profession and to its representation of the phenomena that he handles.

- *Express the stated evaluation matter*: the aim is to create, reuse and structure knowledge that describe the evaluation matter. The following formulation of the evaluation matter and the construction of representative models require exchanges between stakeholders and evaluators in order to formalize the more comprehensive representation of the matter.
    - We started by the rendering of the stated evaluation matter. We express the evaluation matter and the objectives of the stakeholder who ordered this evaluation. This description could be performed by using descriptive heuristics that were designed through a literature review and workshops. We also describe the evaluated action by designing a representation of this action in relation with its environment/context. To deal with modeling activity, we can adapt the work of W. Ben Ahmed [24, 25] who developed an accident multi-view model. It was used to describe accidents with a systemic approach. The aim of his work was to automatically project a "given accident or a given scenario (a description of a group of accident) on a given viewpoints". The adaptation of this model can be generalized to all knowledge that is used in road safety. We seek to design a representation that is multi-view, i.e. one entity can be described by various models that are linked to various visions of the stakeholders. See section 6.2 for more details.
    - Then, we seek to identify some stakeholders that could be in relation with the evaluation matter. The aim is to spread the evaluation matter by seeking the view points that could be impacted by the evaluated action.

- Finally, the expression of the evaluation matter and the case of evaluation through the baker and the various stakeholders is used to describe what we call the value systems. In these systems, we aim at expressing the references, the representations and the expectations of various stakeholders. They will be used to identify the overall evaluation matter and to assist evaluators to construct value judgments on the evaluated action. It also allows us to go beyond what has been expressed by the baker in order to include all possible impacts.

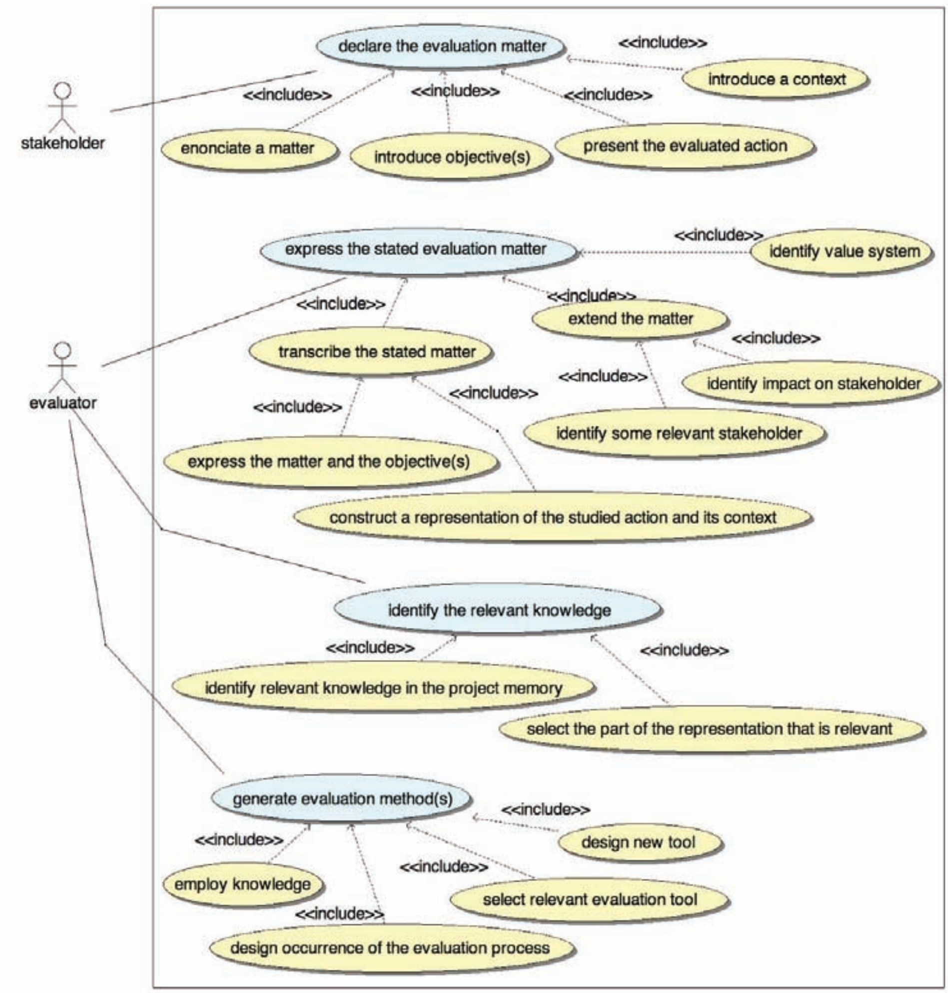

Figure 3: Representation of the Evaluation Model Generator (EMG)

- *Identify relevant knowledge:* this step supports the formulation of the evaluation matter and the design of the evaluation method(s) by using a project memory that stores information on the previous evaluation studies. This allows identifying taxonomies that help to formulate the evaluation matter and identifying tools, methods and limits to make easier the generation of evaluation method(s). This selection is performed thanks to the structure of the project memory and a research by keywords according to knowledge formulated by evaluator on the current evaluation study. It is important to note that knowledge about the formulation of the matter evolves in time through interactions with stakeholders and the project memory up to reach a final state. In order to go beyond the knowledge accumulated in the memory of the project, it is necessary to work on the matter to identify gaps in stored knowledge.

- *Generate evaluation method(s)*: once the studied system and the value systems are described, we use them to design the operational evaluation methods. This way of thinking allows separating the theoretical and the operational issues. Even we identify needs that cannot be treated due to lack of data or operational tools; we identify research tracks for future evaluations. At this design stage, it is also necessary to consider the iterative approach. There may be a need to review or complete some knowledge formalized during the analysis stage, this will create some new issues of understanding. In other words, it will have a common construction of the evaluation methods area and the knowledge (models and concepts). This dynamic process is a major point of the genetic aspect of our research.

6 CASE STUDY

In order to illustrate our framework, we address the evaluation of the ESC (Electronic Stability Control). We start by presenting the existing evaluation methods and their limits. Then, we focus on the formulation of the objectives and the construction of the evaluated action representation.

6.1 Example of the Electronic Stability Control

We address the evaluation of the ESC (Electronic Stability Control) as an application case of our framework. The aim is to identify the existing methods that deal the evaluation of this safety system and the evaluation issues that are not addressed yet.
ESC is an on-board safety system, which prevents the lateral instability of a vehicle by correcting understeering or oversteering. Today, it is considered as one of the most effective and promising safety system. The major issue related to this system is its development strategy (regulation issue for public policy and generalization issue for carmakers).

We focus on the aim of the system to reduce the number of killed or injured people. Currently, the most common approach is to measure the reduction from a constant diagnosis of the situation in road safety (in-depth accidents analysis). We present an approach used in the LAB by Page et al. [26].
Due to a lack of data (risk exposure) it is impossible to assess the accident risk according to a safety system. The alternative consists in assessing the effectiveness E from the relative risk that can be approximate by the odds ratio (OR). Practically, the effectiveness E is estimated by (1):

$$E = 1 - OR = 1 - \left[\frac{A \times D}{B \times C} \right] \qquad (1)$$

The required numbers A, B, C, D to calculate OR are explained in the table 1. This distribution is made from an expert assessment on the involvement of the ESC on the various types of accident situation.

Table 1. Distribution of accidents adapted from [26]

	ESC-equipped cars	Non ESC-equipped cars
ESC- pertinent accidents	A = 22	B = 177
Non ESC-pertinent accidents	C = 71	D = 318

In this example, we calculate the odds ratio, **OR= (22x318)/(71x177)=0.56**, the effectiveness E is **1-0.56=44%.** Therefore, “the risk of being involved in an ESP-pertinent accident for ESP-equipped cars is 44% lower than the same risk for non-equipped cars”. However, the confidence interval of the OR is [0.46, 1.29], because of the small sample size, the result is not statistically significant. In order to adjust the OR and its confidence limits, it is possible to take into consideration the values of the explanatory variables (gender of the driver, vehicle age, state of the pavement, etc.) in a logistic regression.

6.2 Application of the framework

We presented an method that evaluates the effectiveness of safety systems from an accidentological viewpoint. This method is focused on the number of fatalities and injured users that can be avoided or mitigated due to the safety functions. We seek to expand this vision to meet some of the stakeholders' objectives.

ESC is an active safety system that is embedded into the cars. It is regarded as one of the most effective and most promising system. For example, according to car manufacturers, public authorities and road users that handle the ESC, there are some issues that lead to perform evaluations. There is the customer value of this system, regulation, low cost market, interaction with drivers, robust and representative evaluation test.

In the approach presented in the section 6.1, the evaluation of the ESC effectiveness to save lives and to prevent injuries could be interesting for car manufacturers, public authorities and road users. However, it is a little difficult to exactly state the objectives that are fulfilled with this figure. Therefore, in order to structure and to extend objectives we use a list of existing objectives and stakeholders (table 2).

Table 2: example of lists of stakeholders and objectives

Stakeholders		**Objectives**
Car manufacturers	Designer	Selection
	Provider	Validation
	Ergonomist	Optimization
	Decision maker	Simulation
	…	Risk assessment
Public authorities		Behavior assessment
Road users	Car driver	
	Pedestrian	
	Bicycle	
	…	

Following this identification work (table 2), we use it to build a representation of evaluation objectives in relation to the ESC and the different stakeholders. In the figure 4, we propose a selection of these objectives.

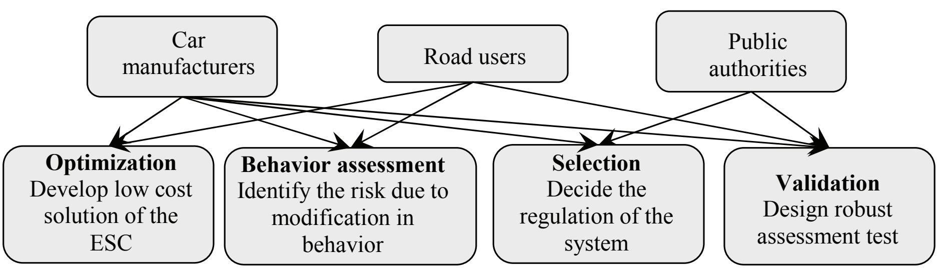

Figure 4: Correlation stakeholders-objectives for the ESC

Formalization of the objectives is the first step in the analysis of the studied case. The second is to build representations to express useful knowledge to design evaluation methods. We seek to design a multi-perspective representation of the evaluated safety action in interaction with its environment (the studied system). For this, we use a meta-model (figure 5). The structure of this meta-model allows us to address the representation of the studied system through the various viewpoints of the stakeholder. Using a systemic approach allows us to grasp the complexity of phenomena. For example, figure 6 is a simplified representation of some concept to be taken into account to manage the issues presented in Figure 4.

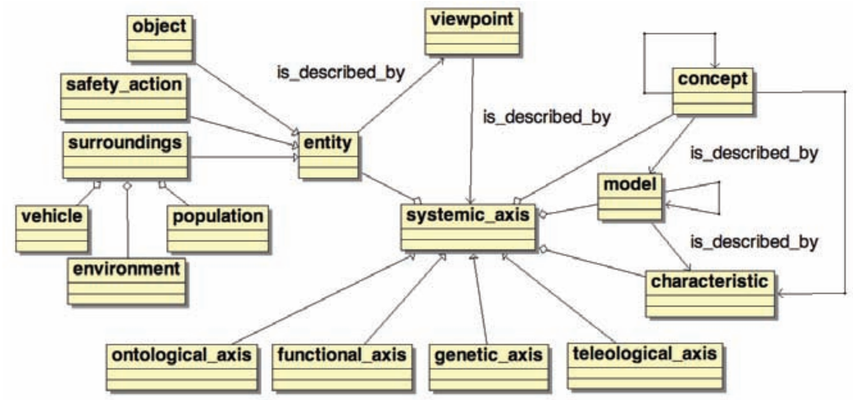

Figure 5: Meta model for the representation of evaluated safety action and its surroundings

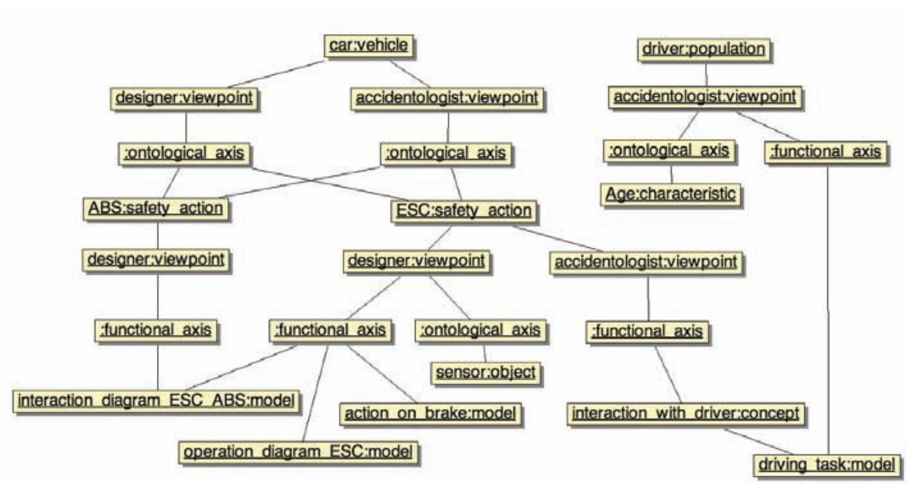

Figure 6: bounded representation of studied system formed by the ESC and its surroundings

We do not represent the entire process of knowledge construction. It is an iterative process between the identification of stakeholders and the studied system, the project memory and the identification of the objectives. The project memory evolves according to the needs to create new knowledge to deal with new evaluation issues.

In conclusion, we provide information to build evaluation method(s). It is important to emphasize that this upstream work is crucial to encompass the main features of the evaluation. We know what we want and we have provided useful knowledge to achieve these objectives. The section on the construction of the evaluation method(s) is not addressed here.

7 DISCUSSION

We propose a general framework that we use to support the evaluation methods design activity. We assume that evaluation activity needs a creative process to deal with the diversity of the evaluation cases that we handle. For this purpose, our approach is based on the fact that evaluators have the capacity to adapt their activity; it is the self organization concept. However, the difficulty for this cognitive process is to start it and to support it. We consider that it involves a step of gap identification and a step of knowledge growing.

The presented framework implies that the designing of the evaluation methods are based on goals reflection and not only on the evaluators' expertness. This allows having a more significant and global reflection on the expectations in relation to the evaluation. However, even if it is still too difficult to deal with the operational issues, evaluators can now conduct evaluation according to the purposes of the various stakeholders and they can identify the research focus.

Our work is part of a general approach of road safety enhancement, which is associated to the design of safety actions. The evaluation activity allows building knowledge for design. This knowledge is useful to make decisions because they provide information about the impact of an action. We also consider the knowledge constructed by the interaction of the evaluator with the phenomenon; they are used to have a better representation of phenomena. Therefore, the design activity can use knowledge that is more accurate and can therefore more targeted the safety actions to design or to optimize.

The prospects for the continuation of our research work are to propose a meta model (figure 5) that is better adapted to the needs in terms of representation of the interactions between the safety actions and users. We regard the concept of user as a variable concept; it can be at the same time pedestrian, driver, passenger, etc. It is also necessary to work to propose approaches to construct and to use the project memory. As we have already presented, one of the objectives is to use heuristics as template to analyze the evaluation matter and as methods to perform parts of evaluations. These heuristics can be created through an expert analyze or an automated analyze of the data that are stored in the project memory. For example, we can use Gallois trellis to bring groups of concepts based on data.

8 CONCLUSION

Our research work addresses the needs to structure the existing indicators and to design new ones in order to provide relevant knowledge for stakeholders in road safety. Results of the evaluations have effects on the decision process, the design requirements, or the knowledge growing process. However, this is a complex activity because of the diversity and the multiplicity of the stakeholders and the complexity of the road transport concept. Main issue is to perform evaluation by trying to adapt methods to the diversity of the studied cases.

In this paper, we propose a global framework for the evaluation in road safety. We use the systemic paradigm to represent activity or phenomena as systems that exist, operate, and evolve, in an active environment according to purposes. This framework provides evaluators a support to design evaluation methods. It provides a representation and an analysis of an evaluation case, a model of knowledge in road safety and in the evaluation activity, and finally specifications of value concepts that are used as the purposes for evaluators. All these concepts are combining to create what we name the EMG (Evaluation Models Generator). We do not consider it as a tool or a process but rather as a guide for the construction of evaluation models.

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