B. Pund
Medical Psychological Institute, Hannover, Germany
D. Otte
Hannover Medical School, Germany

Assessment of Accident Causation from the Viewpoint of In-Depth Investigation on Scene – Traffic Psychological Methodology on Examples of In-Depth Cases by GIDAS

Abstract

This contribution introduces a number of psychological methods of analysis that are based on the practice-oriented collection of information directly at the site of an accident and that allow for an analysis and coding of the accident causes. Investigation examples and examples of the data combinations with basic medical and technical data are outlined.

Objective of the collection is the inter-disciplinary investigation of human factors in the causes of accidents ("human-factor-analysis"). The psychological data are incorporated according to an integrative model for accident causes based on empiric algorithms in the data base of the accident research, where the clustered evaluation potential of comprehensive factors of the accident development can be illustrated.

The central theoretical concept for the basic model of the progress of the accident from a psychological point of view comprises psychological indicators for the evaluation of the site of the accident for the analysis of the perception conditions as well as a classification of the gleaned data into the accident progress model according to chronological and local criteria. Perception conditions, action intentions and executions as well as conditions limiting perception and actions are acquired, using a questionnaire for persons involved in an accident, and are also integrated into the data structure concerning weighted feature characteristics as well as combined with other relevant features.

Suitable systematization tools for the collection and coding of psychological accident development parameters have to be provided, which require primarily a model image of the corresponding processes from the persons involved in the accident (perceptions, expectations, decisions, actions). The interactive accident model contains components of the models by KÜTING 1990, MC DONALD 1972, SURREY 1969 and RASMUSSEN 1980. Based on the inter-action of the three partial systems "person", "vehicle" and "environment", the first step is the assessment of the situation by the persons involved in the accident. This is dependent on the personal attitudes and motives, on experiences and expectations concerning the progress of the situation. Subsequently, data concerning the manner of the coping with the ambiguous state as well as with the instable state (emergency reaction immediately before the accident occurs) are collected. The factors relating to the persons involved in the accident are gathered on several levels using corresponding questionnaires. The coding of the found and collected characteristics is conducted in a multi-dimensional evaluation relating to the technical results of the accident reconstruction and of the psychological classification, which are subsequently integrated in coded form into the data base of the accident research. The result of this analysis is a description of the development of the accident depicted on a chronological vector from a perception and decision theoretical perspective. This is explained in detail using exemplary cases.

Introduction

Starting in 1973, a team of physicians and engineers at the Medical Universtiy of Hannover, Germany, has conducted accident investigations in the Hannover area according to a set sampling and investigation plan. The methodology has been internationally described (OTTE, 1994). The data collected this way refer amongst others to the determination of the driving and collision speeds and the time-distance-behavior of the road users involved. The accident causes are derived from police protocols according to the official list of causes. In order to emphasize the interdependence and the interaction of vehicle makes, environmental impact and personal features of the involved persons, in the early 90s a subgroup of investigations of accidents with personal damage was conducted using the help of a psychological interrogator of the Medical-Psychological Institute

(TÜV NORD GRUPPE Hannover). The results of the comparison of different methods of data collection based on psychological questioning of persons involved in an accident were summarized in a methodology study (PUND and NICKEL, 1994) and applied to a number of real life sample cases. This required the development of tools for the data acquisition on site, which deal with the inherent difficulties, and by the same token, interrogators, who have been well trained in traffic psychological background knowledge and traffic psychological methodology. The questioning tool that had been used up to that point in time had been a semi-standardized questionnaire that was sub-divided into nine sub-categories and which permitted the interrogator to collect in a pre-structured form the most important features and their specifications from the reports by persons involved in the accident (figure 1: questionnaire for persons involved in an accident).

Development of a Methodology Study

In the course of the application of the psychological investigation tools it turned out that the data gleaning during the psychological questioning has to be streamlined, because the questioning of persons involved in the accident and witnesses at the site of the accident has to be conducted under a lot of pressure and in parallel to the collection of medical and engineering data shortly after the accident event. This may cause the loss of relevant information. Also, the psychological assessment of the site of an accident concerning its complexity and the perception conditions of the road users turned out to be problematical taking into account the time-critical conditions. Even if the interrogation of the persons involved in an accident is conducted at a later stage or if the analysis of the site of an accident is conducted subsequently, it has to be stated that a considerable effort has to be made, in order to acquire the data, especially considering that for a subsequent data acquisition the claim of an investigation closely related to the occurrence of the accident event would have to be given up.

- direction of movements/driving manoeuvres
- environmental features
- perception
- expectations
- danger assessment
- prevention strategy/reaction
- purpose of the drive/progress of the drive
- driving habits/driving experience
- psychological and health status

Fig. 1: Questionnaire for persons involved in an accident

Further steps of the integration of a psychologically oriented data acquisition into the tasks of the investigation teams thus refer to a reduction of the variables that have to be assembled, which should on the other hand not overshoot, in which case the informational value might be lost/disturbed. Next to the objective of increasing the efficiency of the data acquisition, the psychological questionnaire was edited concerning its relevancy towards the clarification of that part of the origins of the accident, which has to be attributed to the “human factor“. This in turn required that the features catalogue had to be based on a model that follows the demands of an interactive and systemic point of view, as has been recognized for analyses of “human – machine – systems“ in other areas of accident analysis.

In order to reach this goal, a model for the origins of the accident was used that takes into account the human and his interaction with the system components “vehicle“ and “environment/traffic directing/traffic situation“.

Development of an Accident-Sequence Model

If accident research is not conducted reductionist, i.e. restricted to the most conceivable and obvious data, it must be based on a model that is derived from a system concept. System concepts are characterized by a great degree of credibility, on the other hand they are not very vivid. This is largely due to the fact that an explicit consideration of complex correlations can only be realized using massive simplification, if the lucidity e.g. of conjunction rules of the variables is too be ensured. The objective of the project, namely to provide a systematization suitable to the investigation and coding of psychological accident origin parameters, requires primarily the model-type image of the corresponding processes of the

persons involved in the accident (perceptions, expectations, decisions, actions), the classification of the whole perception situation at the site of the accident as well as the classification of the driving tasks and tangible driving manoeuvers in the model image. Secondarily, the model has to be able to depict the analysis of the conflicts immediately before the accident, also external and internal influences have to be taken into account, as they supply information concerning possible action errors. The systemic approach thus comprises features of the requirements before the accident situation as well as features of the acquisition of information, the data processing and the tangible decisions of the active persons. Basic models for the origins of accidents contain, if they are based on a systemic approach, the interacting process components "person – environment – machine". For purposes of accident research at the site of an accident ("on the spot") and immediately after the accident has occurred ("in time"), those models are suitable that depict the effect system with its components as a closed loop. Models such as the one by APEL (1996) for instance ask how the driver operates his vehicle and how he assimilates and processes the driving state variables, starting with the vehicle (see figure 2)

Other models on the other hand, that follow the same systemic approach, further differentiate the effect component "environment" by emphasizing the interaction of the traffic situation and directing (MAREK and STEN, 1977) (figure 3).

The exemplarily depicted models of interactive effect mechanisms just like many comparable models lack a closer description of those processes, however, that are contained in the "control variable" human and that start with him. Based on analysis methods from the area of the ergonomics, a model used for data processing is to be applied that corresponds to the so-called analysis process of the second generation. Other publications have frequently complained of the lack of a standardized process for traffic psychological questions as well as for the analysis of the task of driving that would allow for a requirement analysis, but corresponding to the action analysis in the traditional industrial psychology the individual driving tasks concerning perception, decision and actions of the human can be differentiated. In addition, the analogy of the psychological data acquisition to a model gleaned from the data processing has the advantage that especially human objectives and requirements move into the center of the consideration. The systemic data processing point of view takes into account that human behavior contains far more than the perception signals and warnings and the subsequent optimum execution of prescribed actions. A systematic set-up on this basis takes the following into account:

- the human generally has to process more than one signal simultaneously in the course of the data processing; additional interference such as weather and environmental conditions during driving constitute increased demands of the cognitive processing process;
- the human has expectations, objectives, preferences and needs; he has e.g.

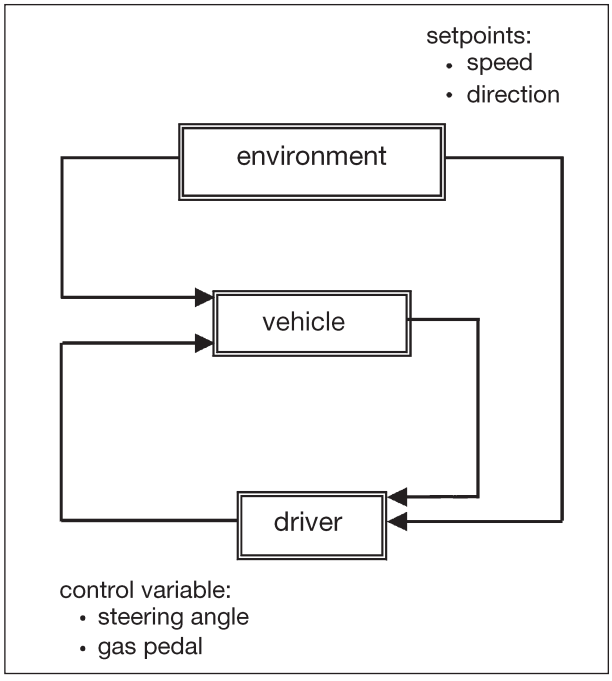

Fig. 2: Effect system driver-vehicle-environment

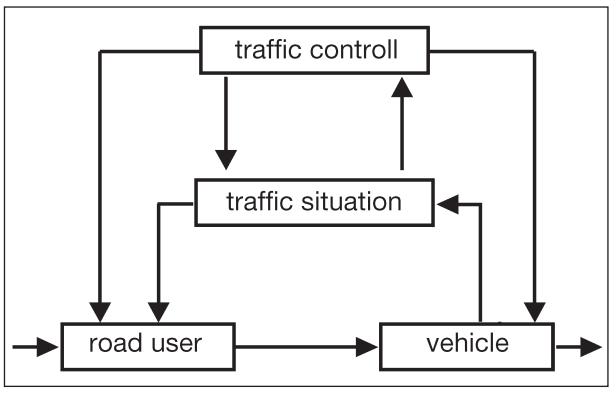

Fig. 3: Traffic system according to MAREK and STEN (1977)

expectations in the functioning of the technical system; furthermore the reaching of the destination is the primary goal of the drive.

The cognitive processing process is greatly influenced, as shown in figure 4, by the aim orientation of the human and the environment as well as the situation factors. These parameters should be part of the model on which the psychological accident research is based.

At this point it has to be emphasized that there can not be an extensive driver-model, that is also used for the description and explanation of accidents, but only driver models, that are adapted to the special requirements of an application area (HEINRICH and PORSCHEN, 1989; WILLUMEIT and JÜRGENSOHN, 1997). One of the main problems for the modeling of human behavior is its immense variation, flexibility and the great inter-individual differences. Also internal conditions such as objectives, requirements and motives are (within certain limits) subject to change. As there can be a number of ways to satisfy an objective or a requirement, the human behavior, even for identical external conditions, varies widely. Thus, for the purpose of psychological traffic accident research, models are preferred that can deal with the internal variations of the human behavior and simultaneously supply sorting principles for the acquisition and description of these variations. For the adaptation of the mentioned model gleaned from data processing, the model according to CROSS and FISCHER (quoted after CIER et al., 1983) is deemed suitable. Similar to the models of the functional levels by RASMUSSEN (RASSMUSSEN 1980, 1981, 1995; RASMUSSEN and LIND, 1982), cognitive functions of the identification and recognition, decision and action execution are taken into account (model of the rules levels). In order to categorize perceptions, evaluation processes, decisions and actions before the accident event in a sensible manner and attribute them to the accident cause explanation, a chronological acquisition, i.e. the analysis of the individual subsequent processes, becomes necessary. The model by McDONALD (1972) takes this sequential idea into account, which (roughly summarized) describes the states “normal course“, “meta-stable state“ and “instable state“ before the occurrence of the damaging event (accident). Within these individual phases the required driving tasks for the coping with the traffic situation can be found:

- perception and identification,
- interpretation and evaluation,
- decision,
- action and execution control.

Derived from these model images the model shown in figure 5 depicts the driver relevant accident sequence phases, where the chronological sequences have been integrated into the individual requirements to perceptive, decisive and executive processes.

When closely considering this model, it becomes obvious that the structural elements of the hierarchic model have been incorporated in the

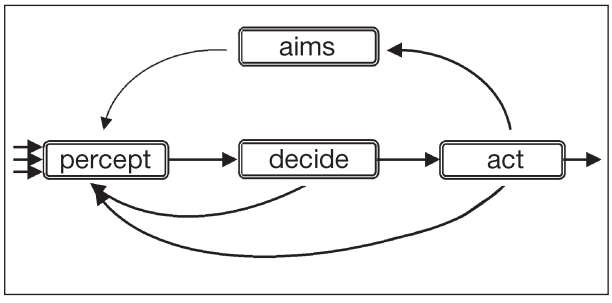

Fig. 4: Data processing model

phase	explanation
1. routine course	strategy and navigation; routine actions; initial states of the person (human predisposition)
2. occasion to orientate	transition from routine to orientation action in cases of ambiguous situation (search)
3. attention direction	transition from the distributed to the focused perception, activation, recognition/identification of warning signals (detection)
4. processing and evaluation*	transition from identification to interpretation, balance of the mental model with the chain of events, expectation formation, situation and risk evaluation (evaluation)
5. action plan*	assessment of alternative actions and selection of suitable actions according to cost-benefit-aspects, ability, experience and degrees of freedom (decision)
6. reactions	prevention reactions; “emergency action“, operation action, reactions and accompanying effects (operator action)
7. driving manoeuvres	resulting 3D and time-dependant driving dynamics (vehicle action)

* alternatively reflectorial/automated processes (modified according to CROSS & FISCHER quoted from CIER et al., 1983 and RASMUSSEN, 1986; model names in brackets)

Fig. 5: Driver-related accident-sequence phases

driving task: from the task of navigating to the leading level up to the stabilization level. This hierarchic model comprises the following steps (e.g. according to JANSSEN, 1979):

- navigation level (strategic level) e.g. planning the route, determination of the chronological sequences;
- leading level (level of the driving manoeuvres), where dependent on the conditions of the driving and traffic situations the determination of setpoint direction, setpoint speed and driving manoeuvres (e.g. changing lanes, overtaking) is executed;
- stabilization and control level (level of the automated or reflectorial control mechanisms), where the driver deals with deviations of the current from the setpoint values (e.g. keeping within the track) according to the ascertained feedback via vehicle and environment.

According to the accident-sequence-model the meta-stable state starts with the perception and identification of danger signals, thus in figure 5 with the transition from a routine to an orientating action in ambiguous situations (item 2). At the latest starting from the level of the driving manoeuvres (item 6) the instable state occurs with prevention reactions or an ”emergency action“, where according to the model of the hierarchic structure of the driving actions largely unconscious and automated action patterns are employed.

According to the hierarchic driver behavior-models of KESKINEN (1996), also features concerning motive, attitude and valuing enter into the level of strategy and navigation that influence the driver behavior. High level targets and the context of the driving become important for the investigation of psychological parameters, such as the importance of the cars and of driving for personal development, the destination of the drive, the social context of driving. Even though in publications the importance of higher level features of life style and motives are evaluated differently concerning the type of participation in traffic or the tangible driving style, ”in-depth studies“ for the explanation of psychological accident causes can not be completely ruled out, due to the reasons delivered above based on the systemic point of view.

After the development and the structure of the model that has been chosen as a basis, now the influence of the individual model components on the tangible investigation contents are to be highlighted.

Derivation of a Psychological Questionnaire

The model for the psychological analysis concerning the ””human“ accident conditions has the following features:

1. its base is systemic-interactive,
2. it follows information and decision theoretical concepts,
3. it is set up based on the theory of actions (reliability of actions and accuracy of observations),
4. it shows the chronological sequence of the pre-crash phase.

Concerning the importance of the interactive or systemic perspective, it has to be noted that only the data combination of psychological together with medical and technical data is appropriate to this approach. Thus it is assumed that a behavior adapted to the requirements (accident prevention) derives from the interrelation between the driving task and the performance abilities of the drivers (situation x person). A psychological data acquisition thus has to ask the following questions:

- Which were the requirements in the situation? (e.g. data processing, operational actions)
- Which were the features of the traffic situation concerning the complexity of the driving task and the perception conditions?
- Which information on the danger was available?
- How were the abilities for the recognition and processing of objectively existing risks?
- Which decisions were made when?
- Was there room for actions to prevent the danger?
- Which were the external targets, specified by the driving task, and which were the internal ones?

The model described in figure 5 of the driver-related accident-sequence phases can be integrated into a comprehensive model, which also contains model images by KÜTING (1990),

SURREY (1969) and RASMUSSEN (1980, 1981, 1986) (cf. attachment 1: interactive accident model). In a simplified form, psychological questionnaires result from three states in their chronological sequence: routine situation (stable state), ambiguous situation (meta-stable state) and danger situation (instable state). An example of this (cf. attachment 2) is given in the following.

On the level of the routine situation the degree of attention e.g. of the driver of a vehicle for danger signals or a change of the situation is to be closely identified. In analogy to REASON (1990) and RASMUSSEN (1986) action errors in this context are analyzed on certain rules levels that result in a reduction of the attention. Demands on the driver besides his main task of driving can then result in distractions by external and internal stimuli, other dominant intentions and secondary tasks, which in turn can result in faulty actions (fault by omission, fault by confusion, fault by orientation). Concerning the questioning of the persons involved in an accident this means that the concrete conduct in the sense of a faulty action has to be gleaned from his information. On the next level in time, the ambiguous or the orientation situations (meta-stable state), the conduct of the participants is more closely narrowed down, for instance by asking for interpretational errors and execution plans. Here, as shown in the following example case, a ”confirmation or confidence error“ can be present.

Example Case

Traffic situation and driving task:

A car driver has to turn left into right-of-way street at a T-intersection (figure 6), lets pass a van turning into her street from the right, also lets pass another van approaching from the left and starts: collision in mid-intersection with a motorcycle approaching from the right side, who turns against her driving direction.

Results of the technical reconstruction:

It was determined on the basis of deformations and movement pre- and post-crash that the car hit the cycle with its front laterally at a speed of 14km/h, a time of 2.2 seconds after starting acceleration. The cyclist was driven with approximately 6km/h at moment of collision.

Results of the accident recording:

Good visibility, no restrictions by weather conditions (time of the accident app. 9 a.m. in summer on a clear day), driver wants to drive her children to school.

Results of the later interrogation (car driver):

Question concerning the perception conditions at the site of the accident:
She has driven vehicles for more than 20 years, she knew the route, ”like the back of my hand“. She

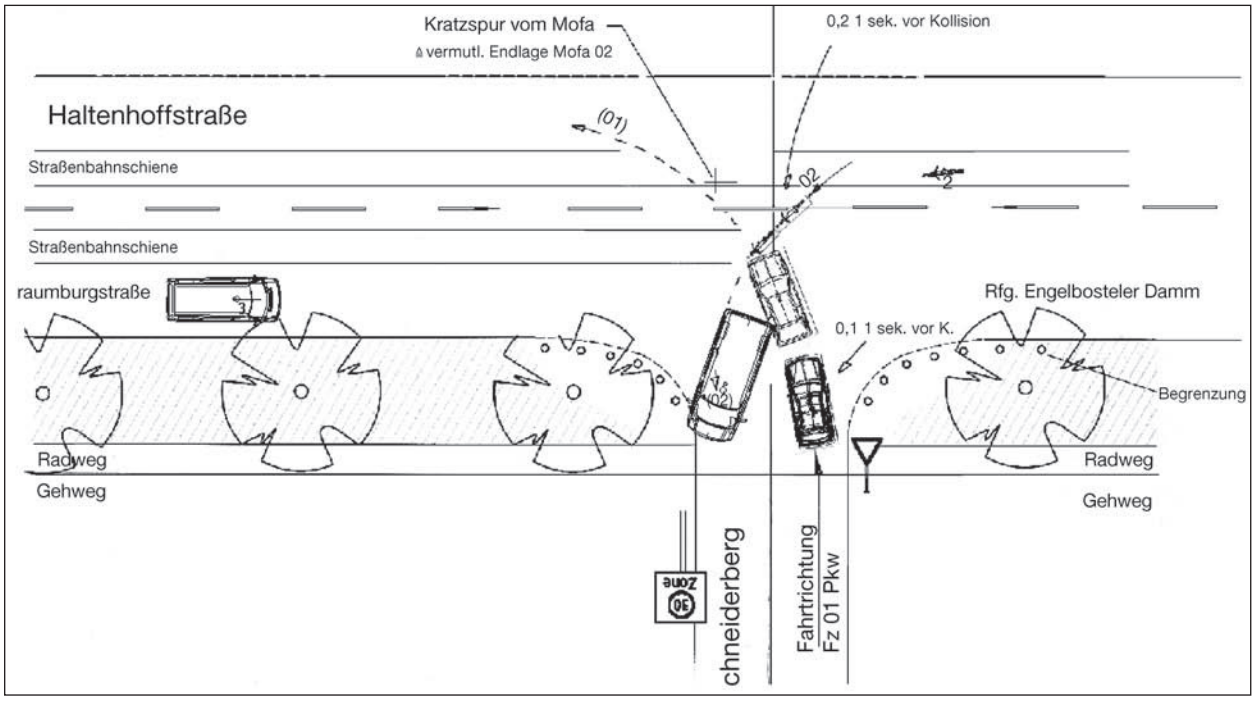

Fig. 6: Accident situation of example case (positions of car and two-wheeler at collision and pre-crash phase)

had waited in front of the intersection, she proceeded slowly across the plateau, the right-of-way street was difficult to overlook, as cars were parked at the sides of the street. Directly to the left of her a VW van was standing in a no-parking zone. The motorcyclist had approached from the right, but the car parking on the left had distracted her orientation.

Question concerning weather conditions:
It had been a sunny morning, she had been on her way to school with her daughter and her daughter's friend who had spent the night with them. It had been a very nice morning, but the sun had blinded her when orientating towards the right.

Question concerning development of the accident:
She had not seen the motorcycle at all, ”until he was under the car“. She had entered the intersection quite slowly, she was glad that she had driven so slowly, otherwise the damage might have been worse.

Question concerning the duration of the waiting period at the intersection:
„Just like always.“ She had been able to enter the intersection quickly, she was able to remember traffic from the left, but not from the right, ”up on the hump, left, right, left, just as always, then I drive on“. This had been the case for years, she had always looked left, right, left and then had started. The traffic had not developed any different on this day from other days.

Question concerning the start and destination of the drive:
Just like every morning she had started at 08:45 a.m. at home in order to drive her child to school. The drive took always about 10 minutes, her daughter needed another 5 minutes to get into school. The school starts at 9 a.m. After the accident the children had continued on foot towards the school, that took about 7–8 minutes. She had to note that her child had had another accident in school: she had later fallen down the stairs.

Again a question concerning the development of the accident:
From the left a car had come, then she had not paid so much attention to the right side, the danger being always on the left. The motorcyclist had appeared just like ”he had fallen from the skies".

Question concerning her personal well-being on the morning of the accident:
„Good mood, well rested…“ She had felt well, had not had any special worries or stresses and strains, everything had been ”normal“.

Question concerning the preventability of the accident:
She should have looked again to the right. She believed that she had trusted the sequence of the situation too much, that she had relied too much on the situation: “One knows the route, everyday, just like always.“ She had the feeling that she had started pretty well across the intersection as nothing special had happened.

Probing about her current behavior at the site of the accident:
She looked more today or waited longer or took a different route. There was another way that she chose for taking her daughter to school, but this was ”more curved“, did not take longer, though.

What could be improved at the site of the accident:
The cars parking at the corners of the intersection always constitute a problem. This leads to an impaired visibility.

Results of the questioning at the site of the accident (motorcycle driver):

Question concering the development of the accident:
He had wanted to turn left, in front of him there had been a truck and which had also turned left. He had had the impression that the driver of the car had been looking at him, which was why he had continued. The driver of the car had looked to the left, because from the left from her point of view a VW van had approached, ”at that moment she takes off and hits me squarely“.

Question concerning the destination:
He had wanted to see the doctor, the practice was directly opposite and he still had had time, as the practice only opens at 09:00 a.m.. He had driven very slowly.

Question concerning the avoidability of the accident:
He assumed that the driver, as she was looking to her right in his direction, had been blinded by the sun. He believed that the driver had concentrated to the left on the passing VW van. Also, her car had entered the intersection a little too far, while she was still waiting.

Question concerning the perception conditions at the site of the accident:

In order to turn into the main arterial, the car drivers had to approach very closely. In his opinion the intersection should be changed in order to allow the drivers of approaching vehicles a better visibility of the thoroughfare.

From the Collected Features to Coding

Based on the above deliberations the original questionnaire for persons involved in an accident a directive was derived, that is suitable for the execution of the collection at the site of the accident immediately after the accident (attachment 3: ”interview on-site“). The directive has the purpose to extract the most important information from the persons involved in the accident in a short period of time, the use of a recording device is recommended. The directive is subdivided into the following groups of questions:

1. introduction
2. direction of movement/perception of danger/ type of reaction/time
3. evaluation of the accident and its causes/ action error
4. well-being and health on the day of the accident/progress and purpose of the drive
5. experience and habits of the driver/attitude towards driving
6. termination of the interview

Under ideal conditions the directive can be edited at least in its obligatory parts by a direct questioning after the accident. In the most cases it will become necessary to ask the persons involved in the accident a few days after the event again (supplementary).

It is a further task of the investigation team, to analyze the site of the accident towards its perception conditions. For this purpose, another directive has been set up for the investigation team: psychological indicators for the judging of the site of an accident (cf. in attachment 5 the main categories).

The coding of the individual features for a subsequent integration in a data matrix of the accident research is executed using coding sheets, where the corresponding code number is attributed to every collected feature specification.

In the above example, the erroneous behavior of the car driver was attributed to a perception error through distraction, i.e. ”internal distraction caused by time/deadline pressure ” (cf. attachment 2, coding Nr. 6). From the information supplied by the investigated person it can be gathered that she had only a limited time frame available for getting the children to school: 10 minutes drive and 5 minutes walk for the children. As the accident happened at 8:55 a.m. and school started at 9:00 a.m., the influence of an internal distraction because of time pressure can be assumed. Based on the results of the questioning, the driver of the car had mistakenly assumed to have completed the problem of the turning and orienting. Consequently, she had assessed the situation wrongly and omitted a major error concerning the coping with the traffic situation and the prevention of the accident vital action (renewed orientation). These results were supported by the interrogation of the motorcycle driver, as well as the influence of being blinded by the sun. This is an error of performance or judgment by an interpretational error, which we code as ”confirmation or confidence error“ (cf. attachment 3, code number 1). As the observation behavior of the driver of the car according to her statement at the site of the accident is extremely routined, the current case is additionally characterized by an ”error of expectation/routine error“, code number 3. These codings characterize the events shortly before the critical approach behavior of the two vehicles; the interpretation and the actions in the face of immediate danger are coded similarly. As the driver of the car did not observe or recognize an immediate danger during turning, the phase of the ”instable state“ is coded accordingly (cf. attachment 6, code number 0: not interpreted as dangerous).

In a similar manner, perceptions and action errors of the other persons involved in an accident can be coded; additionally codings are executed for the assessments of the site of the accident (cf. attachment 7: codings no. 7 and 9 for an increase in complexity due to cross-traffic and parking vehicles).

The gathering of the causes resulting from human erroneous assessments and action errors results together with the formal accident cause (disregarding the right of way) as provided in our example in a better transparency towards the origins of the accident.

Summary and Outlook

The objective of the above study within the investigations at the site of the accident is the interdisciplinary acquisition of ”human factors“ at the origin of accidents and the setting up of a method to integrate these into a database. The main objective is to determine causative factors in their interaction and their co-dependence. The basic psychological model of the accident sequence comprises psychological indicators for the judging of the site of an accident (analysis of the perception conditions) as well as a classification of the data gleaned from the interrogations on-site in the accident-sequence-model. Perceptions, evaluations, decisions, action intentions and executions as well as perception and action limiting conditions are determined using a questionnaire on persons involved in an accident and can be integrated in the data structure of the accident research concerning their feature specifications and combined with other features.

The methodology of the traffic psychological accident analysis in the course of in-depth Investigations at the Medizical University of Hannover introduced herein has set up the following minimum requirements for the description and explanation of an accident:

At first the site of an accident has to be categorized according to its condition and the predominant perception conditions, where next to the already mentioned psychological indicators (attachment 5) also a classification concerning the given traffic situation is executed (FASTENMEIER, 1995). Furthermore the driving task should be described that the persons involved in the accident had to deal with in spatial and chronological approximation to the site of the accident. A number of differentiated suggestions have been offered in different papers, but for the purpose of the accident analysis at the site of an accident simple yet precise classifications are preferable, such as the ”prototypical driving tasks“ according to JENSCH, SPOERER and UTZELMANN (1977). Concerning the traffic situation and the driving task that has to be managed, the concrete actions of the driving manoeevres as well as the emergence reaction, also in codable form, should be described. On this level the perception and action errors are to be identified, that have to be set in relation to the objective conditions of the site of the accident (e.g. to the conditions that limit perception). A further emphasis of the analysis of the pre-crash phase is put on the classification of interpretations, expectations and intentions of the persons involved in the accident.

The next steps for the further development of this methodology consist in the creation of a sensible control system, on which the psychological data combinations for the analysis of the causes is based, furthermore the continued testing and optimization of the instruments in the course of further investigations and analyses. This procedure of a retrospective analysis of accident causes should, provided a sufficient number of individual cases, permit the possibility of an optimized accident research in the foreseeable future.

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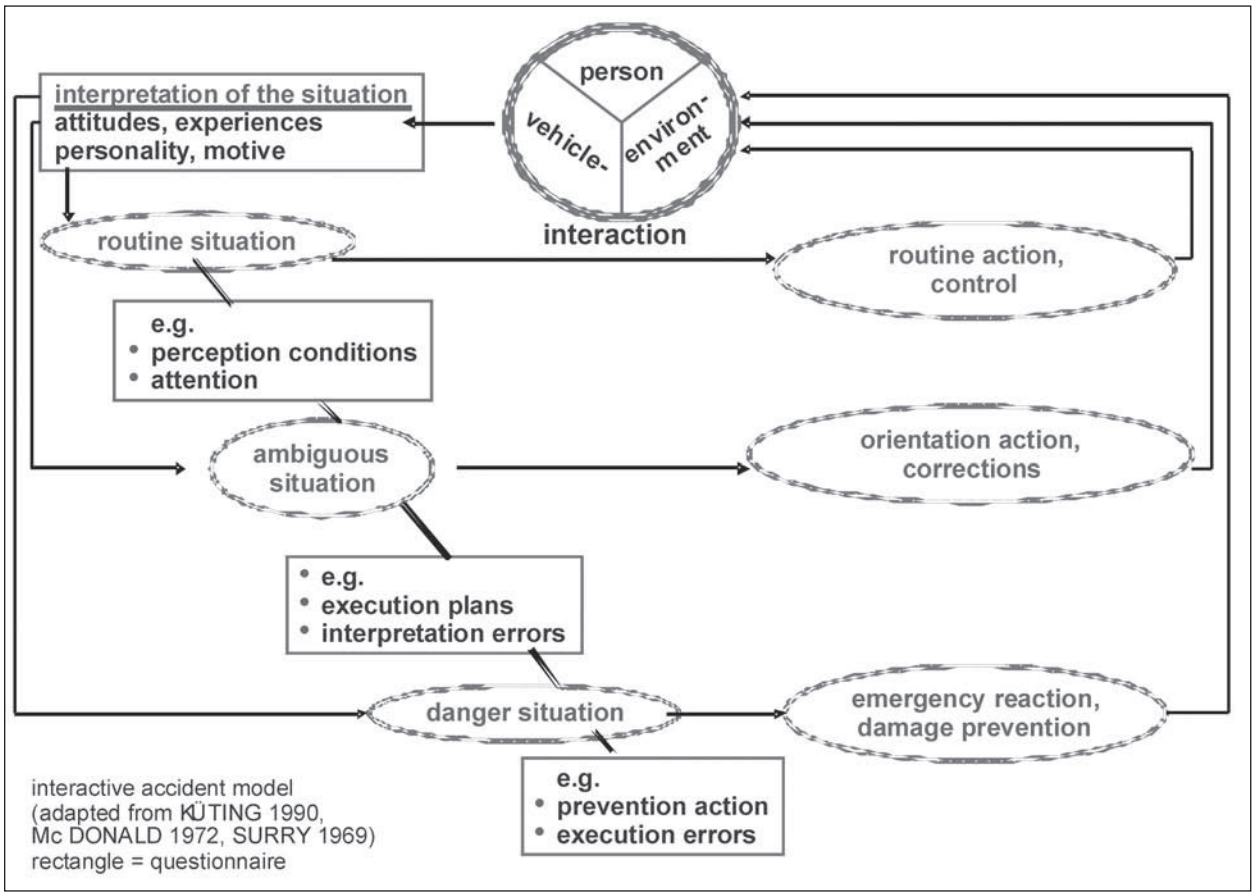
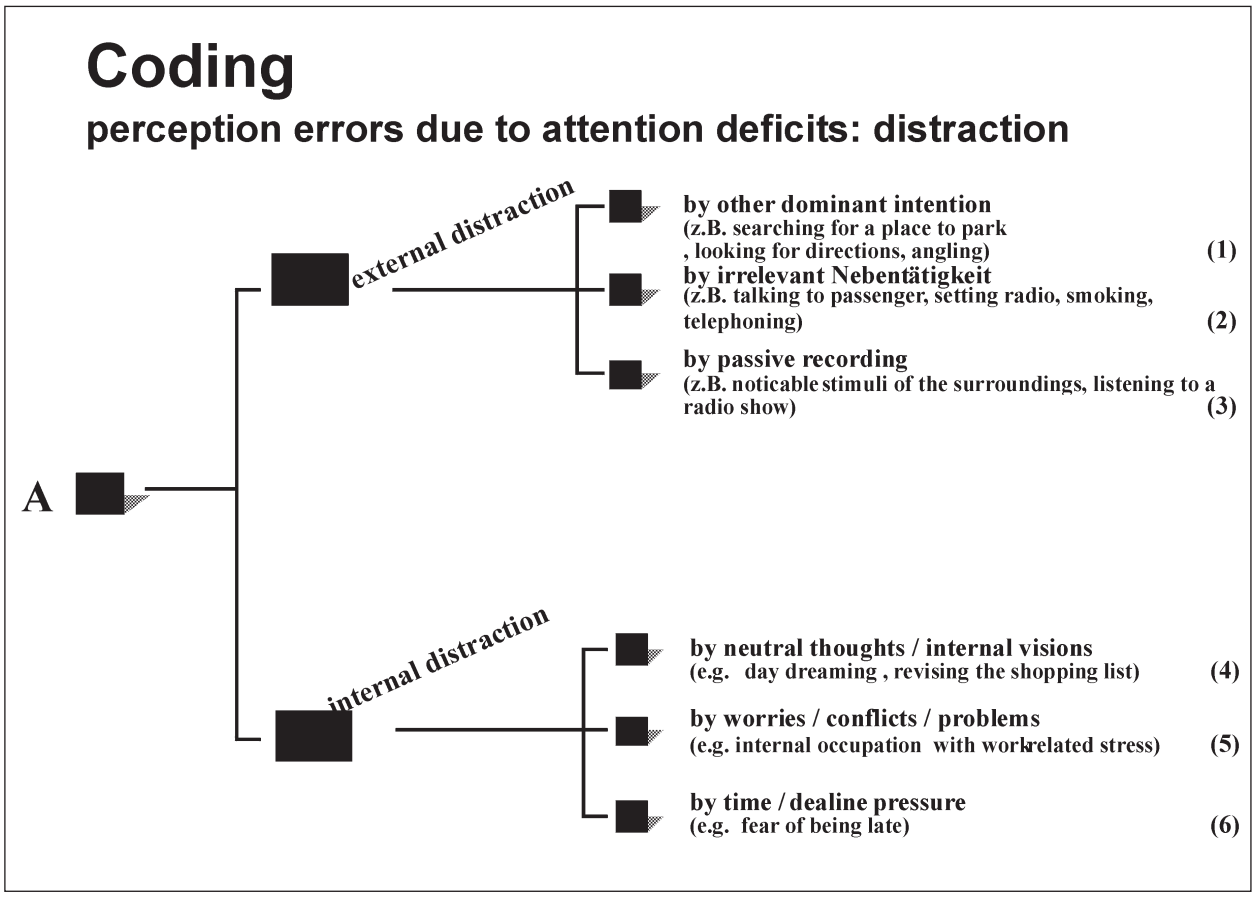


Attachment 1



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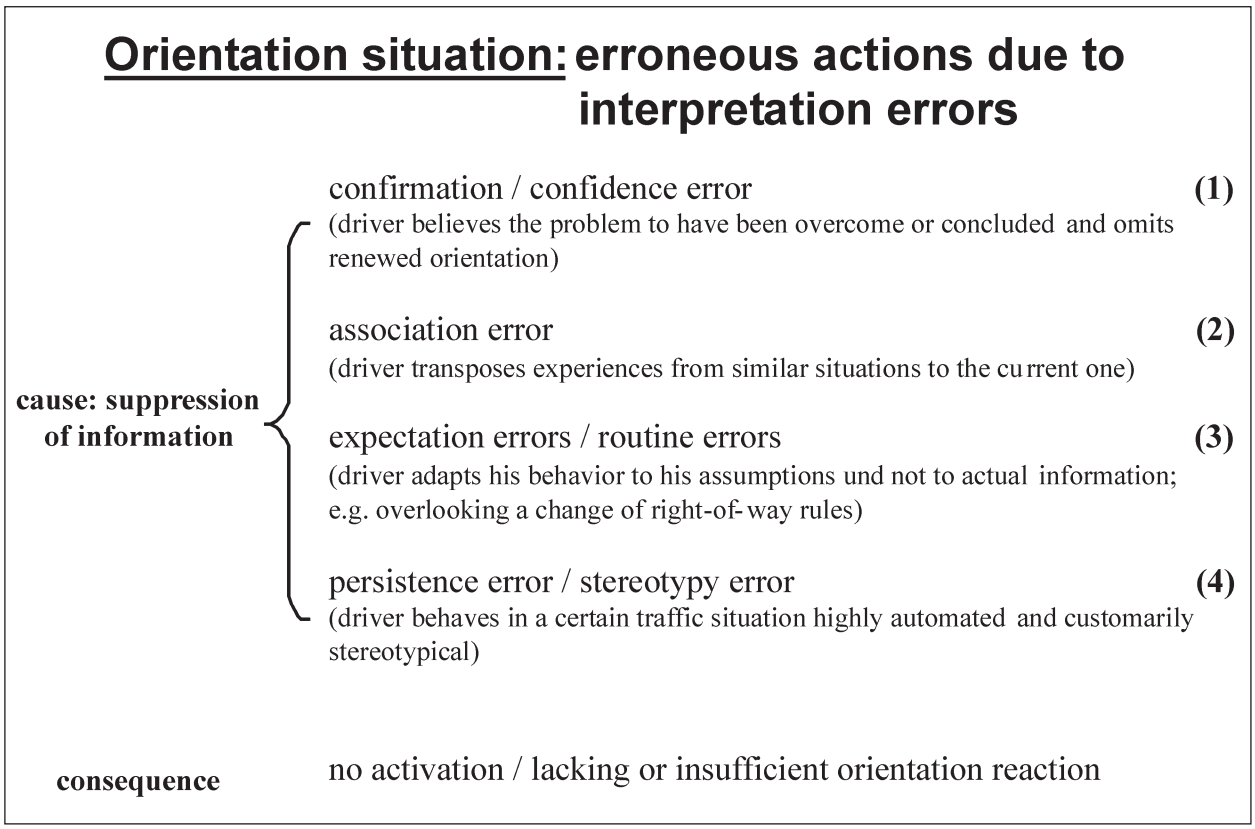


Attachment 3

Questionnaire for the "interview on-site"

(arrow → mandatory question)
(circle O question is expendable, as it is also covered by the report of the team)

1. Opening the interview
→ Introduction/showing understanding / transition to the purpose/reference to protection of privacy and recording device)
- What is your first thought when thinking about the accident?
→ Now tell us from your point of view ho the accident happened.

2. Direction of movement/Danger perception/Reaction/Time
O Which was your initial direction? Where were you going?
→ Where was the other person coming from? When and where did you notice him first?
- When did you first notice danger?
- What caught your attention?
→ What were you thinking of when you noticed the danger?
- What did you decide to do? Why? Did it work?
- What was your first action when you noticed the danger? (did you brake, accelerate, swerve? Controlled or suddenly? Signal, wave?
- How did the other react? How did your vehicle?
→ Were you distracted shortly before the accident?
→ Were there problems concerning visibility? (Which?)
→ How long did it take from the moment you noticed the danger until the point of impact?
- Was there something you noticed too late? (or the last moment?)
→ How fast were you going, when you noticed the danger? And your opponent?
→ How fast were you at the point of impact? The opponent?

3. Evaluation of the accident and its causes/action errors
→ Did you expect a danger?
→ What would you call warning signals when looking back?
→ Did you have the feeling that you still had the situation under control shortly before the accident?
- What could you have done, in order to prevent the accident?
- Who or what caused the accident according to your opinion?
O How often do you drive this route?
→ What is the standard traffic situation when you normally drive along here?
→ Did you expect that it would be different this time? Was it any different?
→ What would you improve at this site / along this route?
- How did you feel 1 second before the impact? (heart rate/trembling/sweat/shortness of breath/constricted throat?)
- How do you assess your reaction speed at during the accident? And in general?
- What was your first thought right after the accident?
- What was the first thing you did right after the collision?

4. Personal condition on the day of the accident/ course of the drive and its purpose
→ How well did you sleep the night before the accident? How did you feel in themorning?
→ What did you do during the last 24 hours before the accident? And right before starting for the drive?
→ Were there any events before the accident? Did you have any special sorrows, worries, stress, strains?
→ What were you thinking of during the drive?
- Did any extraordinary things happen right before the accidents? (were you distracted?)
- How much traffic was there? How many in front of you/behind you?
→ Where were you coming from? Where were you going?
→ How did the drive progress right up to the accident? Just like always?
→ At what time did you start? How many kilometers had you driven when the accident occurred? How many kilometers are there still to go until your destination?
→ At what time had you planned to arrive?
→ Were you in a hurry? Were you held up in traffic, by traffic back-ups etc.?
- How many cigarettes do you smoke daily? Did you smoke during this drive? When the accident occurred?
- Did you listen to the radio or tapes? Which station? Did you shortly before the accident change stations or tapes?
→ Were you ill lately? Treated medically?
O Which medications do you take? Regularly? Did you take any medication within 24 hours of the accident?
→ When did you last drink alcohol? How much? Drugs?

5. Driving experience and habits/ Attitude towards driving
O Driving license (Date of issue? Category?) Any limitations/ restraints entered?
O Wearing glasses or contact lenses during the drive that led to the accident?
→ Annual number of kilometers driven? Number of kilometers driven in professional capacity?
→ In how many accidents were you involved as a driver up to now? How many points have you got?
- How do you prepare for drives in general? How much spare time do you assess in general? And today?
- How often do you drive per week? How many kilometers per day? How often do you take the same roads and do you also travel new routes?
- Do you drive mainly in the city or cross-country? Where do you like driving best?
→ Why did you buy exactly this car? What do you like best?
O Which type of car? How much power?
O Which optional components or extra equipment does your car have? (ABS, automatic transmission/air conditioning turned on?
Do you also drive other types of vehicles? Which?
→ What percentage of drivers are worse drivers than you are?
- Which consequences will this accident have on your future driving behavior?
- Will it have any personal or professional consequences for you?

6. Termination of the interview
- Is there something else you noticed during the accident?
→ How do you feel now?
→ Thank you very much for your cooperation, you jave helped us a lot.
→ In a few weeks you will receive a questionnaire, please complete is and return ist us.
You contribute to the prevention of future accidents.

Psychological indicators for the evaluation of the site of the accident

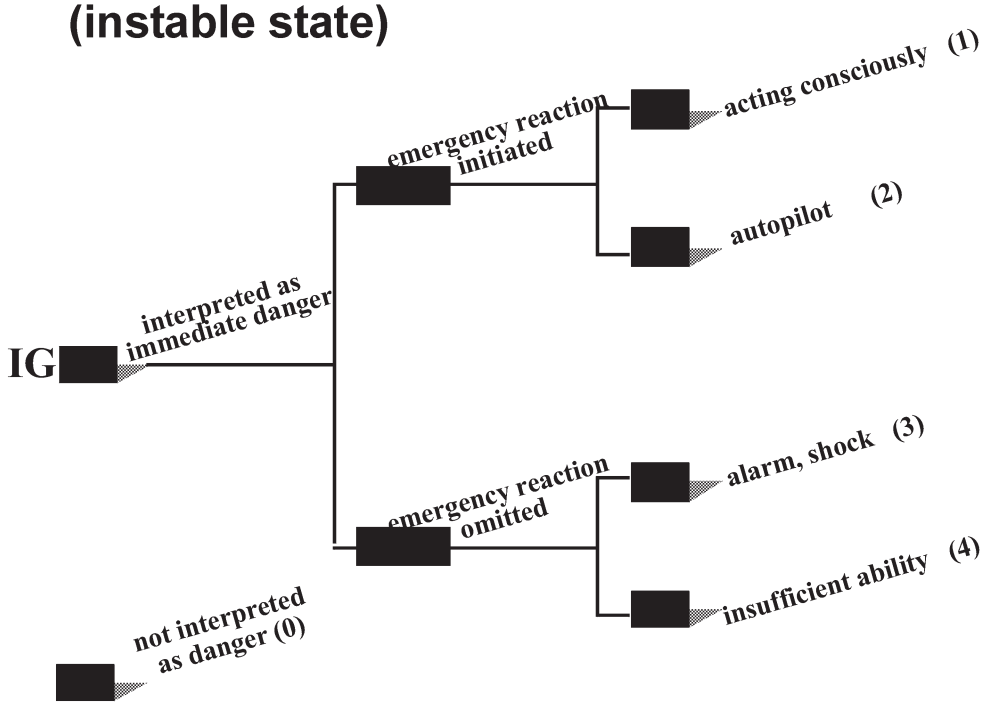
(analysis of the perception conditions)

- reference system
- predictability
- difficulty of the driving action
- information relaying
- visibility, clarity
- complexity

Attachment 5

Coding

interpretation of the immediate danger (instable state)



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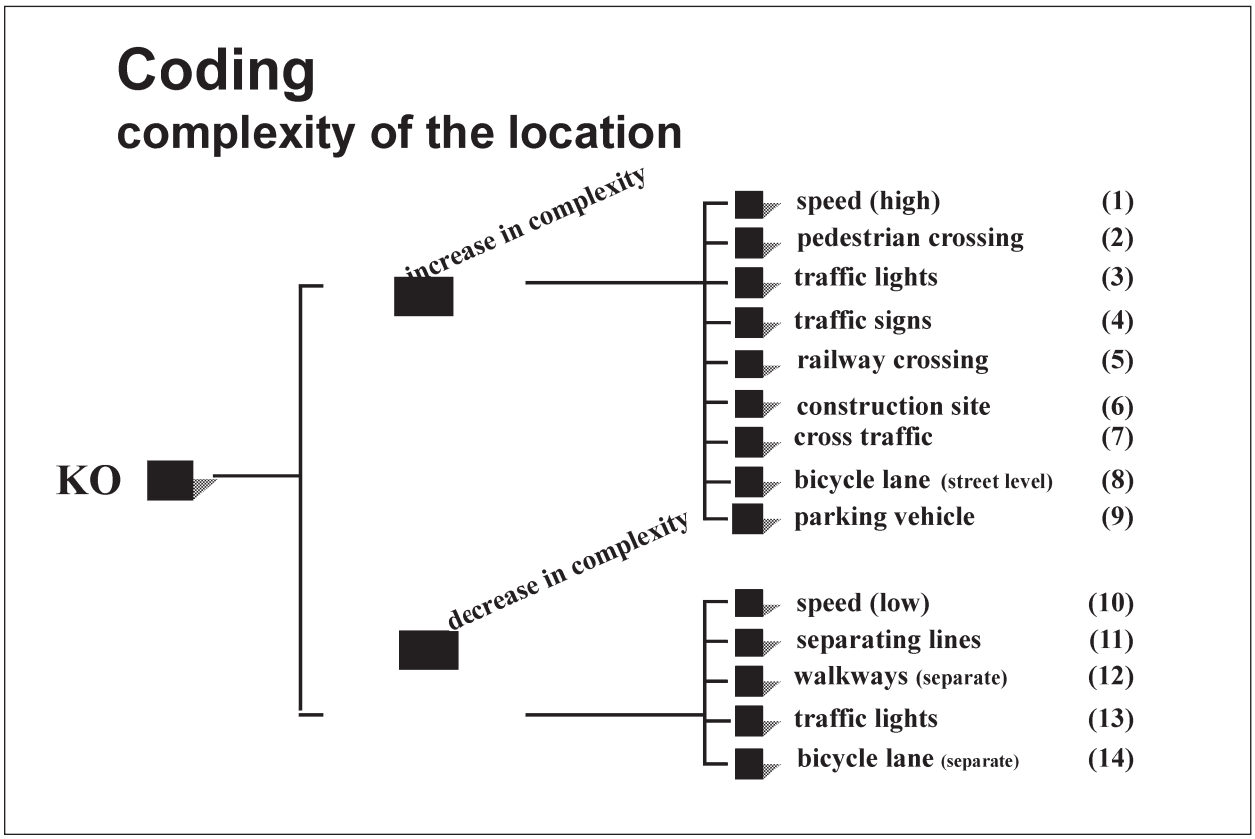

Attachment 7