Magda DRASKOCZY
Lund Institute of Technology

TOWARD THE INTEGRATION OF TRAFFIC CONFLICT AND BEHAVIOURAL STUDIES INTO GENERAL SAFETY ASSESSMENT IN 'DRIVE' PROJECTS

1. Introduction

"DRIVE envisages a common European road transport environment in which drivers are better informed and intelligent vehicles communicate and cooperate with the road infrastructure itself . . . DRIVE therefore seeks to create favourable conditions for the development of this Integrated Road Transport Environment (IRTE), through the pre-competitive and collaborative R & D in the field of information technology and telecommunications applied to road transport (known as Road Transport Informatics, or RTI).
DRIVE has 3 primary objectives:
- improving road safety
- maximizing road transport efficiency,
- contributing to environmental improvements."

The sentences mentioned above (1) are taken from one of the DRIVE documents and might give some impression about the place of a psychologist in the project.
- Firstly, it is a project driven by technological developments and having a scenario in which "intelligent vehicles communicate and cooperate with the road infrastructure itself".
- Secondly, improving road safety is mentioned as first among its primary objectives, and road safety, according to our present conceptualization of the problem, is dependent first of all on the behaviour of the human traffic participant. As Oppe expressed it ironically: "Because the authorities responsible for the safety of the traffic system are not able to guarantee a completely fail-safe system, the burden of final control is largely placed on road users themselves. They are expected to keep the system safe." (2)

DRIVE projects have been arranged into four groups on the basis of their areas of research and on the degree of cooperation required between them. These are:
- General approach and modelling (15 projects),
- Behavioural aspects and traffic safety (14 projects),
- Traffic control (22 projects),
- Services, telecommunications, databases (20 projects).

The second group of projects is where technical and behavioural experts work together.

Three main approaches can be identified in their work:

- identifying safety-related problems/safety objectives which probably can be influenced by the technical tools to be developed,
- evaluating the possible behavioural effects of RTI and IRTE,
- working on problems of man-machine interface.

I am involved in two projects that belong to the behavioural and traffic safety group, one mentioned by Christer Hydén in the previous presentation, and one with the title "An intelligent traffic system for vulnerable road users". Although the level of generality and partly the approach is different in the two projects, the most difficult and still not solved problem for the participants in both projects is, how to integrate behaviour oriented data which are specific and detailed with general aggregated data (national accident statistics data, traffic flow data, etc.).

2. The psychologist's dilemma working in the project "Multilayered safety objectives"

The basic model going to be applied in the project to define safety objectives was, as was already shown in the previous presentation:

Expected safety benefit= Na . Ca . Av . Rc, where

Na = the number of accidents in a given category
Ca = the average cost of accidents in that category
Av = the avoidability of the accident in purely technical terms
Rc = risk compensation in human reactions to the RTI system.

The first two members of the equation are quite simple to compute, although the categorization related to specific RTI solutions is not simple, and the weaknesses of the national accident data bases need not be proven here.

The third and fourth members of the equation came from Evans' paper on Human Behaviour Feedback and Traffic Safety (3). I consider his expression 'human behaviour feedback' more exact than 'risk compensation' which is bound too much to theory stating that the human behavioural feedback not only modifies but compensates all safety effects of the safety measures. The "avoidability of the accident in purely technical terms" seems to be a value which comes from technical experts, but it is true only if one supposes that by analyzing accident statistics one can define 'the cause' of groups of accidents and if then one has a technical tool that eliminates the specific cause, the category of accidents that was caused by it, is eliminated. That presupposition is far from being true. Different sorts of soft/behavioural data are needed, therefore, in order to give a rough estimation of the avoidability of the accident by using different technical solutions. But in a team where modelers, technicians and human factors experts are working together, the behavioural expert's usual conditional answer "It depends on..." is very often swept aside by offering the newest modelling technique which is able to handle qualitative data and answer all these questions by using accident files as base.

The core of the dilemma is (for all partners, not only for the psychologist) that although the need for integration is felt, none of us is able judge the quality of the solution proposed by the other, therefore we either can stick to our traditional solutions and approach and give up the possibility of a higher integration, or we need to venture out into the only partly understood and partly controlled territory by trusting each others professional competence. It might be a very vague, far from technical description of the integration of our knowledge into a general safety assessment, but firstly, we do not have yet any technology of integration, and secondly, this sort of decision and attitude change seems to be an unavoidable antecedent of the specific process.

3. Integrating data of different levels of generalization in the project "Intelligent traffic system for vulnerable road users".

The basic philosophy of the project can be described as follows: "Present developments in Road Traffic Informatics (RTI) will have a large impact on the traffic system as a whole. However, most developments are exclusively directed at the improvement of the safety and efficiency of motorized traffic and tend to neglect the position of vulnerable road users. As a result RTI systems may have negative safety and mobility effects for vulnerable road users which can seriously impair the positive effects on the traffic system as a whole."

The originally planned way of working was twofold:

- on a system level the project is working on a model of the traffic system that incorporates vulnerable road users as an integral part. "This model will have the capability of meeting the needs of vulnerable road users in terms of journey desires by offering them preferred routes and then protecting them on those routes, rather than by sacrificing their preferred routes to assist motorized travel and reduce conflicts between vulnerable road users and motor vehicles."
- on a more local level, the project evaluates a number of RTI applications in signalling and junction control, in order to ascertain what benefits can be obtained for vulnerable road users by such measures.
- in the later stages of the project the two levels (macro and micro) are linked by feeding back into the model the results of the localized experiments.

Several experiments, traffic conflict and behavioural studies have been carried out during the last 22 months. The partners have had several discussions on the possible and desirable level of the model and the integration of observational data into it.

The overview of long term modelling structure and the separate modal (movement) models of VULCAN (the model being developed under the project) can be seen in Figure 1. and 2. VULCAN defines three levels of modeling, the macro, the meso and the micro level. The idea of IRTE pushes us towards the macro level, but at least to the meso level. Our observations are valid on the micro level, perhaps they can be generalized at the meso level, but those who are working with behaviour observations feel that too much uncertainty is present at the generalized level.

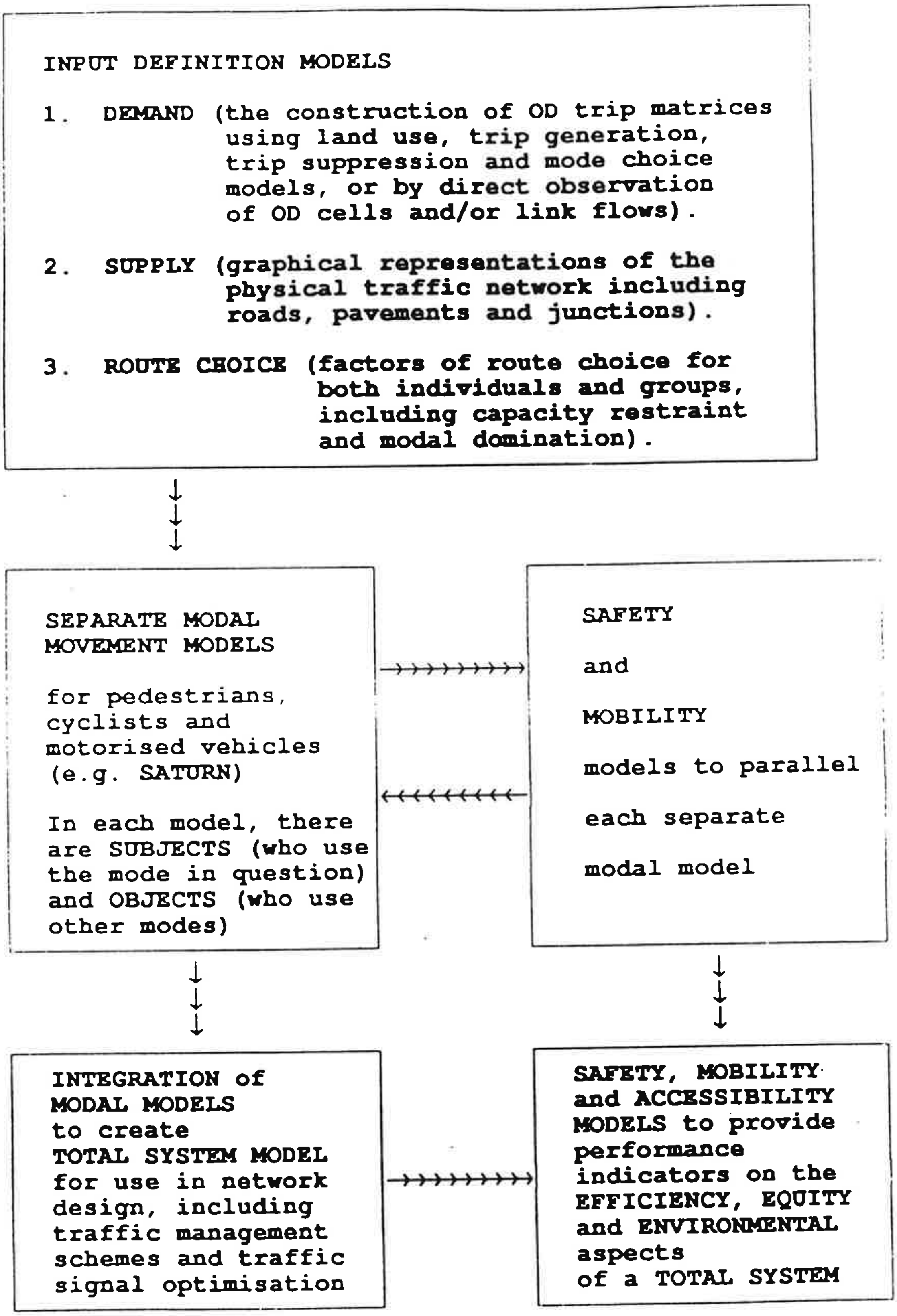

Figure 1: Overview of Long-Term Modelling Structure

As can be seen from Figure 2., there is a plan to produce a safety model within VULCAN that can estimate the underlying rate of accidents for a particular network configuration, given flows of pedestrians/bicyclists and road traffic. At the present project, an attempt has been made to create a simple model which can form the basis of future work. This model attempts to provide an objective measure of unsafety for a particular individual crossing at a certain place at a certain time (in terms of the signal cycle, if relevant). The total unsafety for a network configuration is than computed by factoring up the levels of individual unsafety.

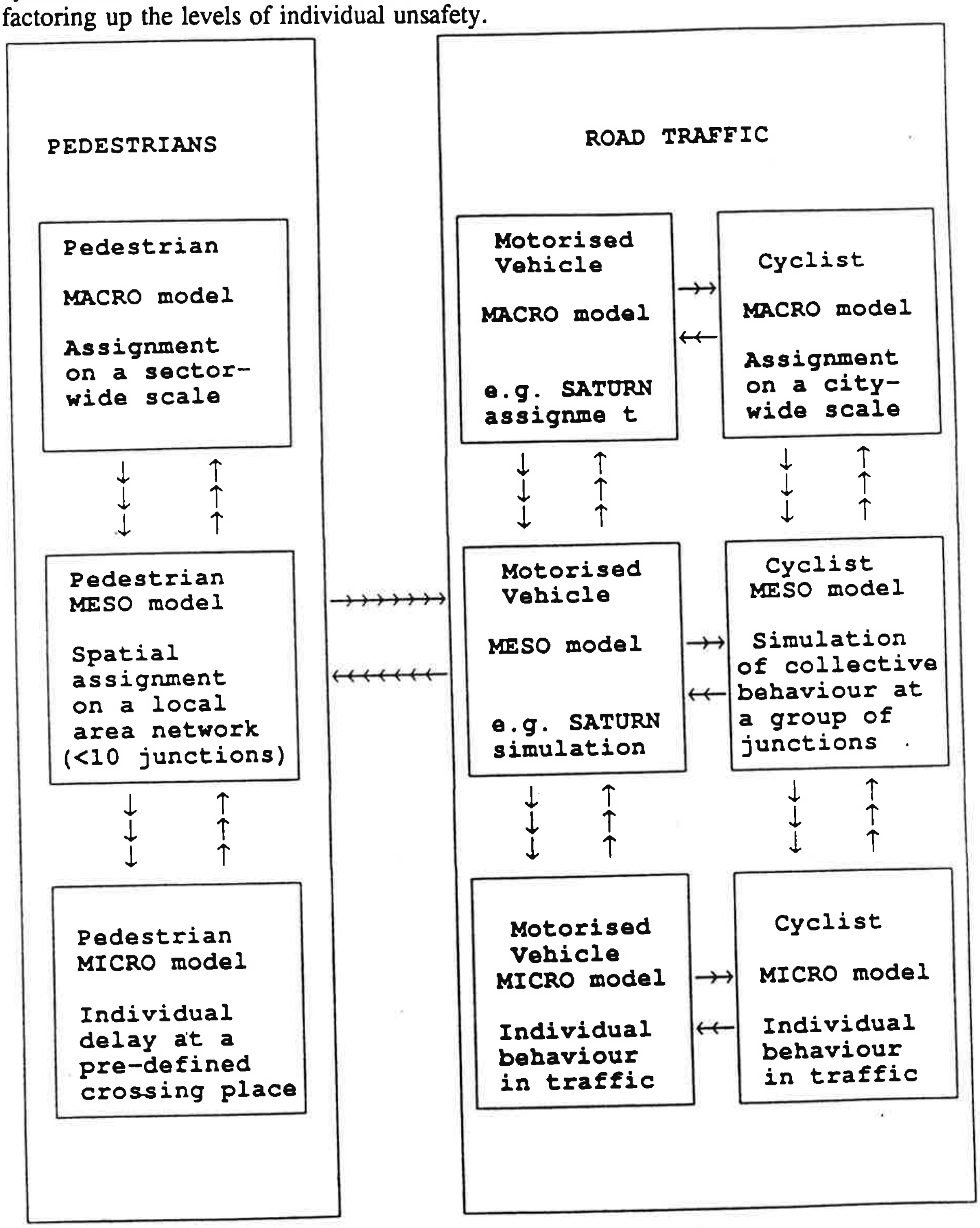

Figure 2: Separate Modal (movement) Models

The modeler described the unsafety model planned as follows (4):

"In the long-term, unsafety will be defined as:

unsafety per person = p(car) * p(not avoid/car)

where p(car) is the probability of a car arriving within a specified "unsafety period" when the pedestrian has stepped into the road (cyclist has started making a manoeuvre), thus creating an "unsafety situation"
and p(not avoid/car) is the probability of an accident not being avoided once an unsafety situation has arisen."

P(not avoid/car) is a component of the model containing almost all our knowledge on traffic environment and road user, the two systems determining traffic behaviour and traffic safety. But the ways to convert that knowledge into mathematical formulas are still quite unclear, at least for me. One possible solution might be first building first separate behavioural models of specific traffic situations, using traffic conflict and behavioural observations, and integrate them in a later phase into a more general model. A good example of the first step modeling is presented by Himanen and Kulmala on pedestrian crossings (5).

REFERENCES

1. R & D in Advanced Road Transport Telematics in Europe. DRIVE '90.

2. Oppe,S. (1988) The concept of risk: a decision theoretic approach. Ergonomics, 31, 435-440.

3. Evans,L. (1985) Human behavior feedback and traffic safety. Human Factors, 27, 555-576.

4. Timms,P.- Carvalho,S. (1990) Inclusion of Pedestrians and Cyclists in Network Planning Models. (manuscript)

5. Himanen,V.- Kulmala,R. (1988) An Application of Logit Models in Analyzing the Behaviour of Pedestrians and Car Drivers on Pedestrian Crossings. Acc. Anal. & Prevention 20, 187-197.