

INTELLIGENT TUTOR: CONCEPTS AND FEASIBILITY

S. ESPIÉ / INRETS - MSIS

CAR DRIVING: COMPLEX TASK

- Road situations (infrastructure + traffic) are dynamic
- The driver must permanently adapt himself to the new situations
- Dealing with complex situations is difficult for both young and old drivers
- Better knowledge on driving task will improve safety
 - Better design of road infrastructure, car, driving aids, ...
 - Better teaching of adequate behaviours

DRIVER'S BEHAVIOUR STUDIES AND MODELLING

- A prerequisite ...

ARCHISIM: AIM OF THE PROJECT

KNOWLEDGE IMPROVEMENT RELATING TO DRIVER TASK AND DRIVER ACTIVITY (COOPERATION WITH INRETS LABORATORY ON DRIVER PSYCHOLOGY : LPC)

- design, test, refine drivers' behaviour models

PROTOTYPE, TEST, REFINE AND VALIDATE ANY CHANGE IN THE TRAFFIC SYSTEM ... AND NOTICELY IN THE DRIVING TASK

- infrastructure characteristics (geometry, equipments, ...)
- traffic control systems
- driving-aid devices systems (in terms of equipment level rates as well as nature and quality of exchanged informations)

EVALUATE DRIVER'S BEHAVIOUR IN VARIOUS SITUATIONS

- Acceptance and usage assessment

ARCHISIM: POSTULATES AND METHODOLOGY

POSTULATES

- Road situation = infrastructure + traffic
- Road situations are dynamics and come from interactions between the various actors of the situation
- Each actor is autonomous, with its own knowledge, goals and strategies

METHODOLOGY: ITERATIVE PROCESS

- Analysis of road situations and drivers' activity with the aim of modelling
- Designing of a conceptual model of drivers' behaviour
- Designing of a traffic model based upon the psychological studies and able to host a driving simulator
- Validation and use

ARCHISIM: DRIVER'S ACTIVITY ANALYSIS

ANALYSIS OF DRIVERS' ACTIVITY : “SITUATIONAL TASKS”

Aim: to identify drivers' knowledge and strategies, motives underlying their decision-making

- Analysis of road situations and drivers' behaviour based upon observation data in actual driving conditions
- Analysis of verbal reports based on subsequent interviews
- Confrontation of data obtained from these two types of analysis

DESIGNING OF A CONCEPTUAL MODEL

- The model was developed on the basis of the experimental results it was intended to explain
- It seeks to account for behavioural variations in relation to situational variations
- It does not deal in detail with the perceptual and motor aspects, but more specifically with the cognitive aspects: situation categorisation and decision-making

DRIVING TASK ANALYSIS: SOME GENERIC RESULT

THE RULES GENERATING INTENTIONS OBEY THE FOLLOWING PATTERNS

- interaction + long duration + possible suppression => suppression of interaction
- interaction + short duration + possible suppression => short-term adaptation
- interaction + short duration + temporary impossibility of suppression => short-term adaptation
- interaction + long duration + long term impossibility of suppression => long-term adaptation

WHERE INTERACTION IS EITHER IMMEDIATE OR ANTICIPATED.

ARCHISIM: BEHAVIOURAL TRAFFIC SIMULATION

- Road situations are dynamics and come from interactions between the various actors of the situation
 - multi-actors approach, eco-resolution
- Each actor is autonomous, with its own knowledge, goals and strategies
 - individual characteristics, distributed and parallel computation
 - each actor is provided with data related to his environment
- Able to host a driving simulator
 - the driver of the driving simulator is fully “immersed” in the traffic
 - the traffic model deal with a 3D road network



ARCHISIM: VALIDATION

INDIVIDUAL LEVEL VALIDATION

- For various typical scenarii: qualitative assessment of anticipation mechanisms

COLLECTIVE LEVEL VALIDATION

- In the framework of the european project DIATS: Deployment of Interurban ATT Test Scenarios (4th Framework - DG 7)
 - validation with real data, cross-validation on typicals scenarii with calibrated simulations: SIMONE (macroscopic, TUHH) , SYSTEM (microscopic, TRL)
- In collaboration with University of Reggio Calabria
 - validation with data in actual driving condition: car distribution in lanes according to traffic density

ARCHISIM: PERSPECTIVES RELATED TO DRIVER'S TRAINING AND EVALUATION

DRIVER'S BEHAVIOUR MODEL + "REALISTIC" TRAFFIC SIMULATION + DRIVING SIMULATOR

- Bases for a tool
 - Able to immerse drivers (trainee) in complex road situations
 - Able to assess drivers (trainee) behaviours
- Limitations
 - Limits in the driver's model (and in the traffic simulation)
 - Transfer of learning

FAISABILITÉ DE DRIVER'S EVALUATION IN COMPLEX ROAD SITUATIONS

A COLLABORATION BETWEEN INRETS MSIS AND LIRMM & ERES (UNIV. MONTPELLIER II)

- INRETS in charge of the simulation part
 - ARCHISIM and SIM² background
- LIRMM in charge of the evaluation part
 - Background in intelligent tutoring system techniques

FOCUSING ON THE COGNITIVE ASPECT OF THE DRIVING TASK

- Decision making process

DRIVER'S EVALUATION IN COMPLEX ROAD SITUATIONS

PRINCIPLE

- Comparaison between driver and model decisions
 - Problem of induction of driver decisions from driver actions
- Detection of “abnormal” decisions
 - Problem of the validity of the model
- Production and on-line recording of alarms
 - True / False
- Off-line management of the (false) alarms
 - By a specialist (trainer)
 - Using assisted playback techniques

DRIVER'S EVALUATION IN COMPLEX ROAD SITUATIONS: COMPLETION

PROBATORY MOCKUP

- Extra “actor” in the simulation: the evaluator
 - In the shadow of the driver
 - Elaborating its own decision from the current road situation
 - Instantaneous and anticipated situation
 - Interpretating the actions of the driver
 - Inference process from driver's actions and context
 - Comparing choices, generating and recording alarms
- “Assisted” playback
 - “Fast forward” to the alarms

CONCLUSION AND PROSPECTS

THE PROBATORY MOCKUP WORKS

- Demonstrate the interest of the approach...
- But is currently limited to motorway situations

FUTURE WORK

- Improvement of the driver's model
 - Validation for new road situations (urban)
- Improvement of the evaluation system
 - Better inference from driver's action and driver's surrounding
- Enhancement of the off-line playback tool
 - Explanation of the model decision
 - Different standpoints (from the actors involved in the situation)