Learning to Drive; a technique for monitoring progress

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Abstract

The process of learning to drive was investigated, and techniques were developed to assess the learner drivers level of progress during the course of their training.

Two indices, one of the learner driver's "competence" (λ), and another of the learner driver's "nervousness" (α) were derived.

9 pupils were given a total of 121 driving lessons, and their progress was assessed "by the instructor — using the techniques developed in this project. The learners own assessment of the value of the lessons were also included.

The results of the experiment showed that it was feasible to obtain the values of the λ and the α indices for the learners from their driving lessons.

3 of the pupils were kept in quiet areas until they reached a level at which no significant amount of intervention was necessary on the part of the instructor. The results showed that the initial rapid progress made by these pupils received a setback when transfer was made to the busier traffic conditions.

The results also suggest direction in which future research should proceed.

CHAPTER TWO

THEORETICAL BACKGROUND TO THE EXPERIMENTS

Driving a car involves a whole series of complex tasks of various degrees of difficulty. The tasks themselves are difficult to analyse and define, and there is as yet no satisfactory direct measure of level of difficulty. It is, therefore, hard to evaluate particular methods of teaching people to drive or to assess the value of the technical side already available (or potentially feasible) in terms of their general effectiveness, in terms of safety, and in terms of cost.

The intention of this chapter is to try to develop a method by which the learner driver's level of progress can be assessed, and as a result of this the effectiveness of the various methods of training people to drive can be evaluated.

There are three main parts to this chapter. Part one (sections 2.1 to 2.4) is intended to explain and discuss recent knowledge about the complex task of driving a car. Part two (section 2.5) outlines some theories about the process of learning, particularly those theories relevant to the process of learning to drive a car. Part three (sections 2.6 to 2.9) is an attempt to combine parts one and two and develop a method of assessment of the learner driver's level of progress during the course of his training.

2.1 Levels of driver behaviour

As in any other evaluation there are certain basic criteria necessary in the assessment of driver behaviour which can be stated as:

1. Safety.
2. Capacity restraints ("traffic pressure").
3. Economy.

These criteria are present at both the macro and micro levels of driver behaviour. At the macro level, behaviour is represented, for example, by decision on the desired speed, and critical evaluation of daily traffic forecasts including avoidance of congested routes. The micro level of behaviour is that which takes place in the streets and roads, i.e. in the immediate traffic environment. At this level the prevailing concerns are for safety and the immediate traffic "pressure", i.e. the volume of traffic in relation to the capacity of the road, referred to as the "capacity restraint".

The process of learning to drive a car also involves the criteria of safety and capacity restraint, and to a lesser extent economy, but generally only at the micro level of behaviour – i.e. in the immediate traffic environment. In order to evaluate the level of competence that a driver has reached, not only does his dexterity in operating the controls of the car have to be assessed, but also his skill in manoeuvring the car in traffic situations, and his ability to read the relevant cues from the surrounding environment. Whilst the assessment of the dexterity does not present a major problem, systematic assessment of manoeuvring skills, and ability to read cues, are more of a problem.

2.2 Ability to manoeuvre

Klebesberg's concept of safety and capacity limits (3) represents a good basis for consideration of comparative driver behaviour in the context of their ability to manoeuvre a car in traffic. Klebesberg's representation (Fig 2.21) illustrates several important points:

1. Seldom can the actual course of action be identical with the desired course of action, due to traffic safety and capacity constraints and due to the roadway environment.
2. The most desirable actual course of action would be balanced between the limits of safety and capacity.
3. The adjustment ability of an individual driver in a particular traffic situation can stretch in one direction only, e.g. increasing the safety margin, while the capacity margin would be shortened, or vice versa.
4. Extreme shortening of one of the margins would result in violation of the limits, i.e. a traffic accident or driver behaviour unacceptable from a capacity point of view.
5. The most desirable conditions are those which match both the desired and the actual course of action.

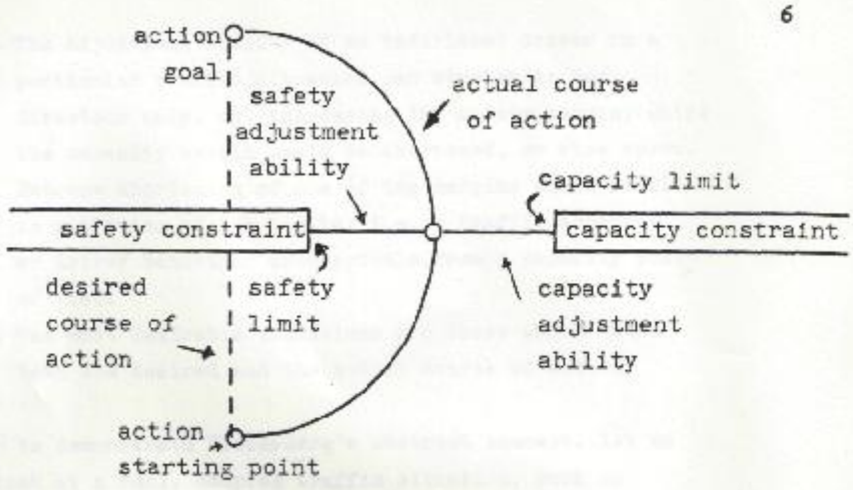

FIG. 2·21· DRIVER BEHAVIOUR ADJUSTMENT MODEL

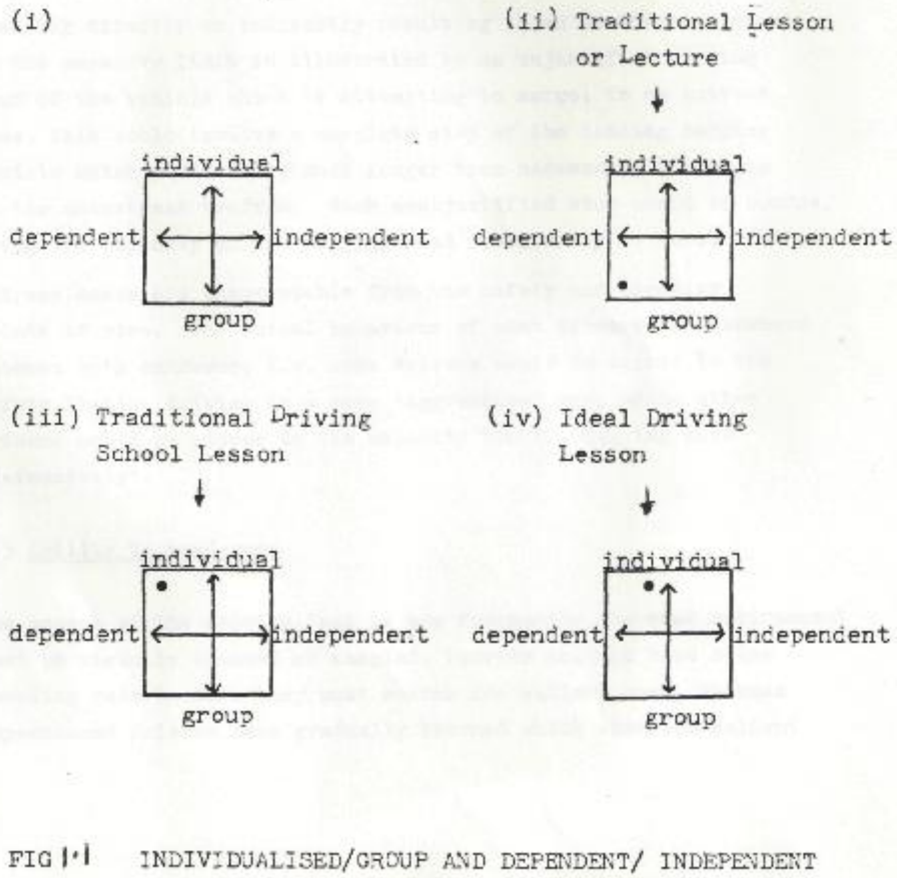

FIG 1·1 INDIVIDUALISED/GROUP AND DEPENDENT/ INDEPENDENT LEARNING CONTINUA

In order to demonstrate Klebesberg's abstract concept, let us have a look at a real, complete traffic situation, such as manoeuvring in a merging area. Infringement of the safety limit is represented by hazardous "cutting off", i.e. in merging into a gap which is too short for the prevailing speed, a manoeuvre which forces the following main-road traffic to brake dangerously possibly directly or indirectly resulting in an accident. Impact on the capacity limit is illustrated by an unjustified slowing down of the vehicle which is attempting to merge; in an extreme case, this could involve a complete stop of the leading merging vehicle which would wait, much longer than necessary, for a gap in the mainstream traffic. Such an unjustified stop would, of course, bring the capacity of the merging road momentarily to zero. Both extreme cases are unacceptable from the safety and capacity points of view. The actual behaviour of most drivers is somewhere between both extremes, i.e. some drivers would be closer to the safety limits, driving in a more "aggressive" way, while other drivers would be closer to the capacity limit, driving more "defensively".

2.3 Ability to read cues

One aspect of the driving task is how frequently the road environment must be visually scanned or sampled. Learner drivers have a low sampling rate because they must search for salient cues, whereas experienced drivers have gradually learned which cues are salient and can respond quickly to minimal cues in a more efficient search pattern. This is dramatically evident when comparing eye movement patterns of novices with those of experienced drivers (15). Similar results have been obtained from aircraft pilots and it is a familiar experience for anyone who has ever attempted to teach another person to drive.

For the novice, the visual search pattern is more active and erratic and dwell-times tend to be longer. For the experienced driver, visual search patterns are generally less active and dwell-times much shorter because the central nervous system (CNS) processing takes place more rapidly and because the driver has learned what to expect.

With increasing age of the driver, the dwell-time increases because of a slowdown in the CNS process time, but this slowdown occurs gradually over many years and is adjusted by changes in pace and offset by additional learning. Unfortunately, reduction of the driving pace only reduces a portion of the driving task load because the remainder of the task load is determined by other drivers, pedestrians, other road users, and sudden or unexpected changes in the road environment such as illuminations, alignment, road surface conditions, and visibility.

Tracking and object avoidance must be performed concurrently, but man has essentially a one-track (single-channel) mind and, therefore, he must divide his attention whilst driving. Most driving information comes to the driver visually in a stream of changing scenes that he must sample (because he cannot take it all in) and select from and use to make decisions on where he is going to be in the next instant and the next few seconds. This is a spatial commitment that Hulbert and Burg describe as a fan-shaped zone extending in front of the moving vehicle (16). Fig. 2.31 describes this zone which, of course, varies in its exact shape but, nevertheless, is there and has been committed to by the driver.

Hyman Forbes has extended the concept of the committed zone (17) and has shown it in three-dimensional form In this way, it is possible to portray the committed zone as it appears through the windscreen to the driver.

As the time-frame of this commitment increases, the commitment becomes more and more provisional because the driver has more time to receive new (updated) information and change his path or speed. Each driver knows that this is the case (although perhaps not consciously) and behaves accordingly, which explains why so many motorway drivers travel with only 1 second headway at speeds over 60 mph. Each driver knows that the driver ahead of him has already committed his vehicle to be somewhere far ahead in the next few seconds and therefore he is comfortable in making a similar spatial commitment allowing only 1 second for reaction time and assuming that he can stop as quickly as the driver ahead of him. If drivers did not behave in this way, motorway volumes of as much as 1,900 veh/lane/hr could not be achieved. However, motorway accidents do occur and could be reduced by educating the driver so that he can make better use of available information.

Vanstrum and Caples have extended the concept of a "spatial commitment" projected fan-shaped zone ahead to describe their model of driver perception and how it relates to hazards on the road (18). Fig. 2.32 shows this zone of committed motion ahead divided into four segments or bands. Band 1 represents the distance travelled during minimum perception time; band 2 the distance travelled during minimum decision time; band 3 the distance travelled during minimum reaction time; and band 4 the minimum committed motion area of the vehicle after activation has been made to turn or stop. Zone 4 out to arc S represents the minimum stopping distance for the vehicle based on vehicle speed and weight, brake efficiency, and coefficient of friction between tyre and road, should the driver choose to brake. On the right is a hazard of some sort as designated by the box marked X. This could be many things: a stalled vehicle, a pedestrian, debris on the road, an oncoming car. As a special case, it can also be considered a potential hazard, for example, an intersection, a curve, a car ahead just starting slow down, a level crossing, or even the edge of the road.

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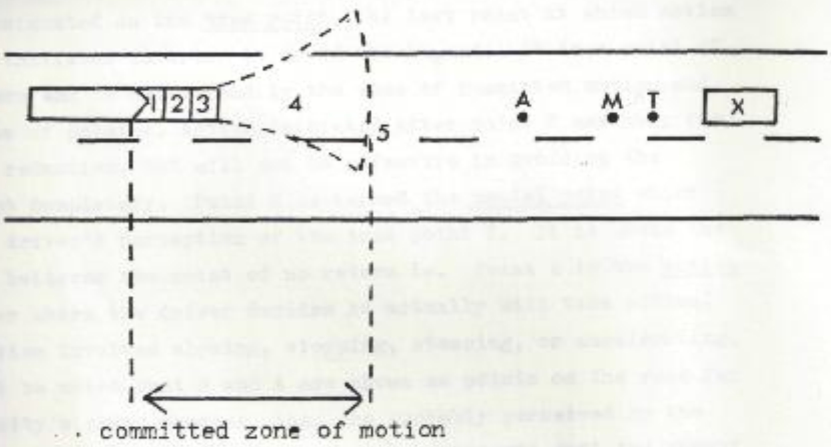

FIG. 2·32 CONCEPTUAL MODEL OF DRIVER PERCEPTION

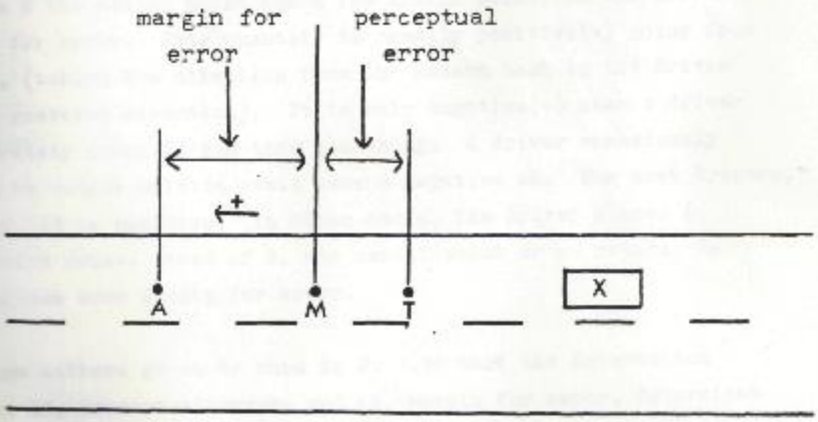

FIG. 2·33 PERCEPTUAL ERROR IN DRIVING TASK

T is designated as the <u>true point</u>, the last point at which action can be initiated in order to avoid the hazard. It is a point of no return and is determined by the zone of committed motion and the laws of physics. Action initiated after point T may help for injury reduction, but will not be effective in avoiding the accident completely. Point N is termed the mental point which is the driver's perception of the true point T. It is where the driver believes the point of no return is. Point A is the action point or where the driver decides he actually will take action. The action involves slowing, stopping, steering, or accelerating. It must be noted that M and A are shown as points on the road for simplicity's sake, whereas they are probably perceived by the driver more as areas. Also, the model represents just one moment in time and in the dynamic situation the various points, the committed zone of motion, and the driver's perception of the relationships are changing from second to second.

Fig. 2.33 is used by Vanstrum and Caples to discuss the concept of margin for error as follows: the distance AM, or the difference between M the mental point and A the action point, is the driver's margin for error. This quantity is usually positive (+) going from M to A (taking the direction from the hazard back to the driver as the positive direction). It is only negative (-) when a driver deliberately tries to ram into something. A driver consciously trying to commit suicide would have a negative AM. For most drivers, however, AM is positive. In other words, the driver places A, his action point, ahead of M, his mental point of no return. He thus allows some margin for error.

The same authors go on to show in Fig. 2.34 that the interaction between TM, perceptual error, and AM, margin for error, determines whether or not an accident results. It determines whether point A is toward the driver from point T where no accident results or whether point A is on the other side of point T away from the driver, in which case an accident does occur.

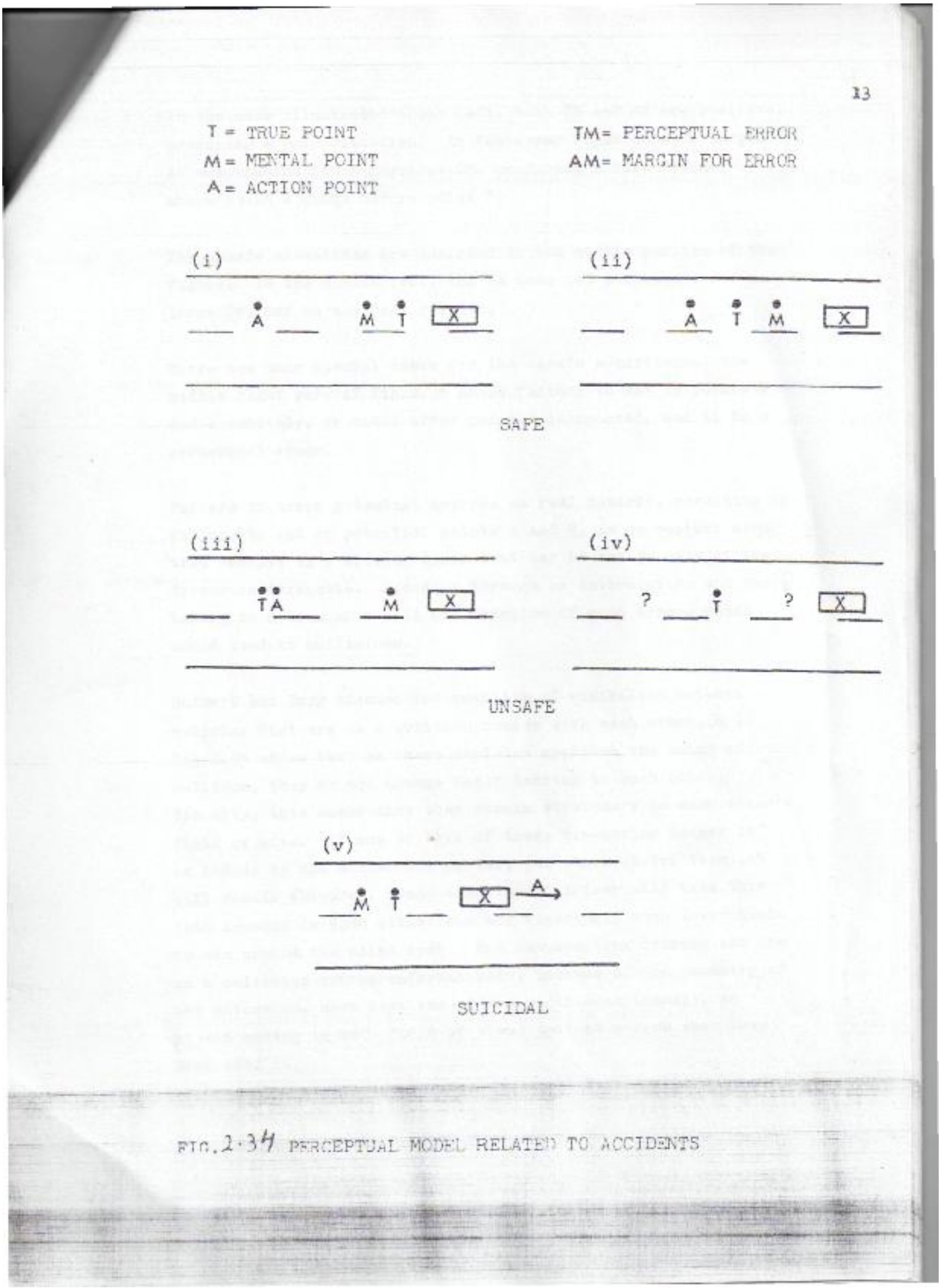

FIG. 2.34 PERCEPTUAL MODEL RELATED TO ACCIDENTS

In the case illustrated upper left, both TM and AM are positive, producing a safe situation. In the upper right case, a larger AM compensates for a negative TM, producing a safe situation where point A comes before point T.

The unsafe situations are depicted in the middle portion of the figure. In the middle left, the AM does not compensate for a large TM, and an accident results.

There are many special cases for the unsafe conditions. The middle right part of Fig. 2.34 shows failure to set up points M and A entirely, or until after point T is reached, and it is a perceptual error.

Failure to treat potential hazards as real hazards, resulting in failure to set up potential points A and M, is perceptual error that results in a driving error that may be benign only if the driver is fortunate. Speeding through an intersection and overtaking on a brow of a hill are examples of such errors which could lead to collisions.

Hulbert and Burg discuss the question of visibility between vehicles that are on a collision course with each other (16). Fig. 2.35 shows that as these vehicles approach the point of collision, they do not change their bearing to each other. Visually, this means that they remain stationary in each other's field of view. If one or both of these non-moving images is hidden by the windscreen pillar (or other obstruction), it will remain obscured. Some experienced drivers will take this into account in some situations and vigorously move their heads to see around the blind spot. But unsuspecting drivers who are on a collision course unfortunately, because of the geometry of the situation, have lost one of the major cues (namely, an object moving in their field of view) just at a time when they most need it.

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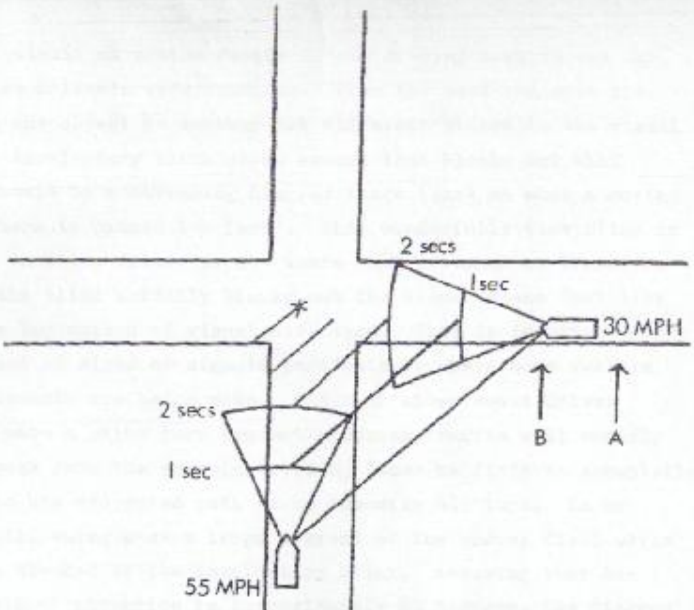

FIG. 2.35 COMMITTED ZONES FOR TWO VEHICLES APPROACHING AN INTERSECTION.

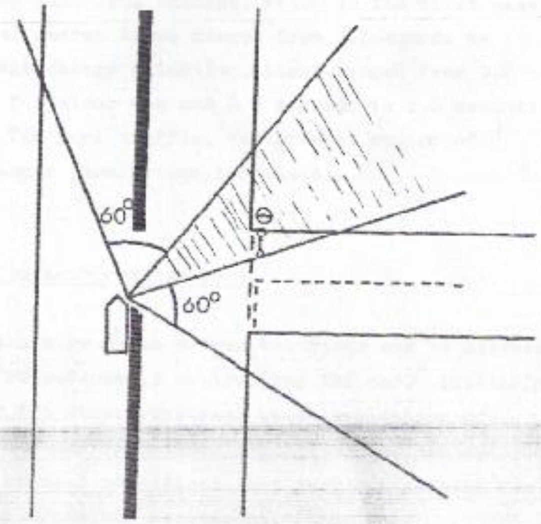

FIG. 2.36 CHANGES IN VISUAL FIELD FOR RIGHT TURN SITUATION.

FIG. 2.35 COMMITTED ZONES FOR TWO VEHICLES APPROACHING AN INTERSECTION

FIG. 2.36 CHANGES IN VISUAL FIELD FOR RIGHT TURN SITUATION

The second visual attention factor in the driving task is the way in which the driver's eyes function. When the head and eyes are moved from one object to another (at different places in the visual field), an involuntary blink often occurs that blocks out what otherwise would be a streaming blurred image (just as when a moving picture camera is panned too fast). This wonderfully timed blink is so natural that the driver is not aware that often as he transfers his gaze, the blink actually blanks out the visual scene that lies between the two points of visual attention. This is important for the placement of signs or signals, particularly where some vehicle turning movements are being made. Fig. 2.36 shows how a driver waiting to make a right turn against oncoming traffic will rapidly shift his gaze from the oncoming stream (when he finds an acceptable gap) over to his projected path as he executes his turn. In so doing, he will swing past a large segment of the visual field while his view is blocked by the involuntary blink. Assuming that the central field of attention is approximately 60 degrees, the diagram shows how the driver can completely fail to see signs that are placed in the crosshatched area which is where many signs are placed or where a pedestrian may be crossing.

Robinson et al. studied drivers as they waited to cross a major highway and also as they made lane changes (19). In the first case (stop and enter), visual search times ranged from 1.1 seconds to 2.6 seconds. In the lane change situation, times ranged from 0.8 seconds to 1.6 seconds for minor use and 0.8 seconds to 1.0 seconds for "look back" time. The more traffic, the greater number of "looks" tended to be longer (dwell-time increased).

2.4 Methods of driver behaviour assessment

There are two basic methods by which driver behaviour can be assessed, and hence the driver's competence in controlling the car. Initially they were developed for two other purposes: quick evaluation of potential traffic problems and operational improvement; and evaluation of the "dangerousness" of road conditions, but they can adapted for use as methods of driver behaviour assessment. They are:

1. "Critical incidents" method.
2. "Traffic conflicts" method

"Critical Incident" method has over the past 15 or 20 years been widely used in Central Europe by practising traffic engineers in the signal industry who had to base their professional judgement on limited amount of data which had to be supplemented by a short period of field observation. Traffic engineers in municipal service also use this method of observation when attempting to identify causal relationships at accident locations.

A "Critical Incident" can be described by perceived unusual driver behaviour, i.e. behaviour unusual from the point of view of the standards accepted by the observer. For that reason, this technique can be used not only to identify deviations from the accepted local desired or ideal driver behaviour, but also to determine deviations from comparative standards adopted from another traffic environment, such as another country. Unusual driver behaviour may be defined as unnecessary slowing down, excessive acceleration, braking too late, braking too early, too close or too far from the vehicles around, not exercising proper care in use of speed, incorrect procedure at crossroads and junctions and while overtaking, etc. Critical incidents, however, do not have to be really critical in the immediate traffic environment. They are only potentially critical, i.e. they may become critical from the point of view of safety or capacity under more difficult traffic conditions. Obviously, a very experienced instructor is required in order to identify "ideal" driver behaviour and to recognise signs of deviations from the accepted norm.

"Traffic Conflicts" technique (1) was originally developed by the General Motors Research Laboratories in 1967 and has gained popularity, although not without some criticism, in North America.

"Traffic Conflicts" are defined as evasive actions of learners or instructors. Such actions are noted by weaving manoeuvres (lane changes) forced on a driver by an impending accident situation or a traffic violation, or by the necessity to use the dual controls in order to avoid a potential accident. Evidently such conflicts involve only the immediate traffic conditions and in most cases two or more vehicle traffic situations, or presence of pedestrians. They can be observed more objectively, since the signs of the behaviour are more obvious and therefore less interpretation of the implications of a given traffic situation is involved. On the other hand, keeping in mind Klebesberg's diagram (Fig. 2.21), they represent only a portion of the spectrum of potentially hazardous behaviour (see section 2.3). Also, the traffic conflict technique does not account for the implication of driver behaviour on capacity limits. Basically, it is most suitable for identification and ranking of specific safety deficiencies in order to determine specific countermeasures.

2.5 Assessment for learning

1.In teaching people to drive, as in any other training programme, some method of assessment of the progress made by the learner has to be worked out. Before we embark on the description of one such method let us list in more general terms to what purposes assessment can be put. Rowntree (1977) suggests the following:

1. Selection
2. Maintaining standards
3. Motivation of students
4. Feedback to students
5. Feedback to the teacher

6. Preparation for life

To those one might add “licence to practise a profession or skill”, although this may be considered covered by “selection”.

Of the purposes listed, 3 and 4 - motivation and feedback to student - help to promote learning directly, and 5 - feedback to teacher - one may hope does so indirectly. To the extent that all training should aim to prepare learners for the rest of their lives, purposes 1 and 2 are very different. Selection, and maintenance of standards, do not in themselves encourage learning at all, although they define markers which learners can only reach through appropriate learning. They are the purposes which in practice are institutionally the most important.

In the case of the assessment of the progress made by a learner driver during the course of his lessons, criteria of selection and maintenance of standards (Department of Transport driving test level) cannot be applied, as the learner has not reached that standard. Although certain guidelines exist for such purposes these guidelines are not explicit enough to enable meaningful assessment of the level of progress to be made. For this purpose it is important to assess the process which is characterised by the learning activities of a learner driver.

Learning to drive a car is essentially learning by apprenticeship. In this learning paradigm, subjects are confronted with examples of data orderings which are in the set of possible states of the world. The apprentice is taught how to operate on these specific examples, and by means of stimulus and response generalisation he learns to cope with similar or analogous conditions, not previously encountered. If we assume that::

1. The learners develop their internal representations without being given explicit references as to the ordering principle governing the real world, e.g. the driver cannot predict the events that happen during the course of his driving, nor can he predict the order in which they happen; nevertheless he has learned to cope with them as a result of his previous training and experience.

2. The internal representation that is characteristic is somehow transferred to the trainee as a consequence of training.

3. It is feasible to use the expert’s representation - which after all enables him to operate in the real world quite reliably - as a basis for the design of training courses.

Then some means of assessment of the level of competence reached by the learner based on the correlation of his level of judgement in a given situation with that of the instructor can be worked out.

2.6 Venn diagram

In any experiment a distinction can be made between quantitative and qualitative factors. QUANTITATIVE FACTORS are those which can be measured on a numerical scale. The intensity of a sound (loudness) is a quantitative factor, as is the age of a learner driver, or the amount of fuel used on a driving lesson. QUALITATIVE FACTORS cannot be measured on a numerical scale. In this category are such factors as the shape of a geometric figure. Often the distinction becomes FUZZY as in the case of colour or attitudes; indeed most of the driving situation factors fall within the fuzzy area (for example, the learner driver's judgement of a critical situation). In order to somehow measure his level of judgement in such a situation the three following cases can be considered.

1. The number of situations identified as critical by the learner which were truly critical, e.g. when a learner brakes sharply and failure to have done so would have resulted in an accident. These are labelled "correct positives".

2. The number of situations which were identified as critical by the learner, but were not critical, e.g. when a learner takes evasive action which was not necessary. These are labelled "false positives".

3. The number of critical situations which were not identified by the learner as requiring positive action, e.g. when the instructor has to use the dual controls in order to avoid an accident. These are labelled "false negatives".

A measure of the actual difficulty that a learner has to face in a particular experiment is required for control purposes. This may be taken as the total number of critical situations during the period of the experiment.

The central issues raised above are easy to visualise, with the aid of a VENN DIAGRM.

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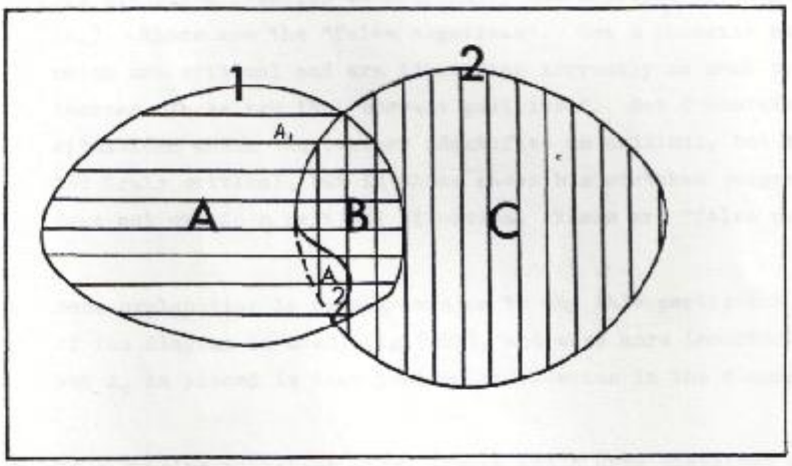


FIG. 2.61 VENN DIAGRAM

Let the box in Fig. 2.61 symbolise the collection of all situations occurring within a given driving lesson (the sum total of all individual moments of a driving lesson). The set of all critical situations is enclosed by curve 1. Thus all non-critical situations are outside curve 1. The set of all situations identified as critical by the learner is enclosed by curve 2. An ideal learner driver judgement situation is one which falls in the area where curves 1 and 2 coincide. Therefore, curves 1 and 2 portray three distinct sets. Set A = ($A_1 + A_2$) contains situations which are either critical and are not recognised as such by the learner (A_1) or are the situations which the learner has turned into critical ones by his misjudged reaction to originally non-critical situations (A_2). These are the “false negatives”. Set B contains situations which are critical and are identified correctly as such by the learner. These are the “correct positives”. Set C contains situations which the learner identifies as critical but which are not truly critical, but in these cases his mistaken judgement does not create a critical situation. These are “false positives”.

Some explanation is needed here as to why this particular form of the diagram is used (Fig. 2.61), and even more important why set A_2 is placed in that particular location in the diagram.

In a simpler situation, the diagram would have contained a set of the number of critical situations (curve 1) and a set of the number of times that the learner reacted to what he thought were critical moments (curve 2). Ideal judgement situations would have been ones where the two curves coincide. But in this case one has to consider the problem of the nature of the critical situation. Situations A_1 and B are the original critical situations, and therefore they must be contained within curve 1, but situations A_2 were originally benign and as a result of the learner’s mistaken identification they were turned into critical situations. Now my reasons for the justification of the location of A_2 are as follows: as they are the learner’s reaction to what he thought were critical situations they must be included in curve 2, but they also become critical situations that he does not correct - therefore they must be included in Group A.

In order to assess the level of difficulty of a particular session of driving lesson, one can consider the total number of the critical moments in that lesson. Inclusion of A_2 moments in this total does not present any problem: one can argue that as these particular moments were turned into A_2s (as opposed to remaining Cs) they are simply a measure of the difficulty of the environment in which the lesson was given.

Given the above explanation, the only area where the learner’s judgement coincides with that of the “expert” is area B.

The union of sets A and B is the collection of all the critical situations during the period of the lesson. Curve 1 (A + B) corresponds to some true measure of level of difficulty of the particular lesson. A more difficult period of lesson would be associated with a larger ellipse.

Curve 2 ($C + A_2 + B$) corresponds to a specific criterion by which the learner views a situation as critical.

2.7 Assessment of the learner driver's level of "competence"

In general, as the learner becomes more competent, his recognition of the critical situations becomes closer to that of the expert. Therefore:

(1)

$$\lambda_1 = \frac{B}{A + B}$$

where λ_1 = a measure of learner driver's competence.

B = number of all critical situations correctly identified by the learner.

A = number of all critical situations not identified by the learner.

The limits of λ_1 are:

0 = when the learner has not identified any of the critical situations, i.e. when B = 0.

1 = when the learner has identified all the critical situations, i.e. when A = 0

2.7.1 Definition of critical situations

A critical situation may be defined as one which requires corrective action to be taken to avoid it being turned into a dangerous situation.

Whilst this definition is related very well to the SAFETY ASPECT of the process of driving, it nevertheless introduced a major problem in the assessment of the competence of the driver - the problem is that as some of these critical situations can be caused by lack of competence or dexterity on the part of the driver (e.g. his inability to read cues or his misuse of controls in the first place), therefore the simple measure of competence based on the ratio of the number of times the driver recognises critical situations and acts on them over the total number of critical situations does not seem to be satisfactory. As a result one has to include in the calculations the number of times his lack of dexterity or inability to read cues causes critical situations in the first place, and formula (1) can be modified as follows:

$$\frac{B}{A+B} - \frac{F}{A+B} = \frac{B-F}{A+B}$$

∴

$$\lambda = \frac{B - F}{A + B} \qquad (2)$$

where:

F is the number of times his lack of dexterity or inability to read cues created a critical situation.

λ = learner driver's index of "competence".

The limits of λ are:

-1 when B = 0 and F = A, i.e. when all critical situations are created, and

none are detected (by the learner).

+1 when F = 0 and A = 0, i.e. when none of the critical situations are

created, and all are detected (by the learner).

2.8 Assessment of the learner driver's level of "nervousness"

In order to judge the performance of a learner driver during the course of a lesson, the number of times that he mistakenly identifies a non-critical situation as critical should also be taken into account. For this purpose if one defines:

(3)

$$\alpha = \frac{C + A_2}{A + B + 1}$$

where α is defined as a measure of "nervousness" of the learner driver. This measure may or may not correlate with the psychological measure of nervousness.

C = the number of occasions that the learner mistakenly reacted to a non-critical situation as if it were critical, but a new critical situation did not arise as a result of his reaction.

A_2 = As C, but this time his reaction created a new critical situation.

A = number of all critical situations not identified by the learner.

B = number of all critical situations correctly identified by the learner.

1 is added in order to make it possible to compare reactions to non-critical situations where there were no critical situations present (otherwise no matter how many false reactions on the part of the learner the answer would always have been α). Addition of 1 in the denominator will not significantly alter the ratios.

2.9 A conceptual model of the driver training situation

In order to present a systems view of the driving instruction situation incorporating all the ideas presented in the previous sections, Fig. 2.61 can be modified and represented as Fig. 2.91, where:

-x = total critical situations arising.

D = instructor's use of dual controls.

W = instructor's warning to the learner.

A = total of critical situations not identified by the learner:

$$A = D + W$$

B = critical situations identified by the learner.

A_2 = critical situations created by the learner's misjudgement of previously non-critical situations.

C = non-critical situations misjudged as critical by the learner, but not resulting in a critical situation.

I = total of non-critical situations misjudged as critical by the learner:

$$I = A_2 + C$$

f = the number of times that the learner created critical situations, not as a result of his mistaken reaction (as in A_2) but as a result of lack of control over the car that he is driving, and his inability to recognise the potential danger of the situation.

F = Total number of the critical situations created by the learner:

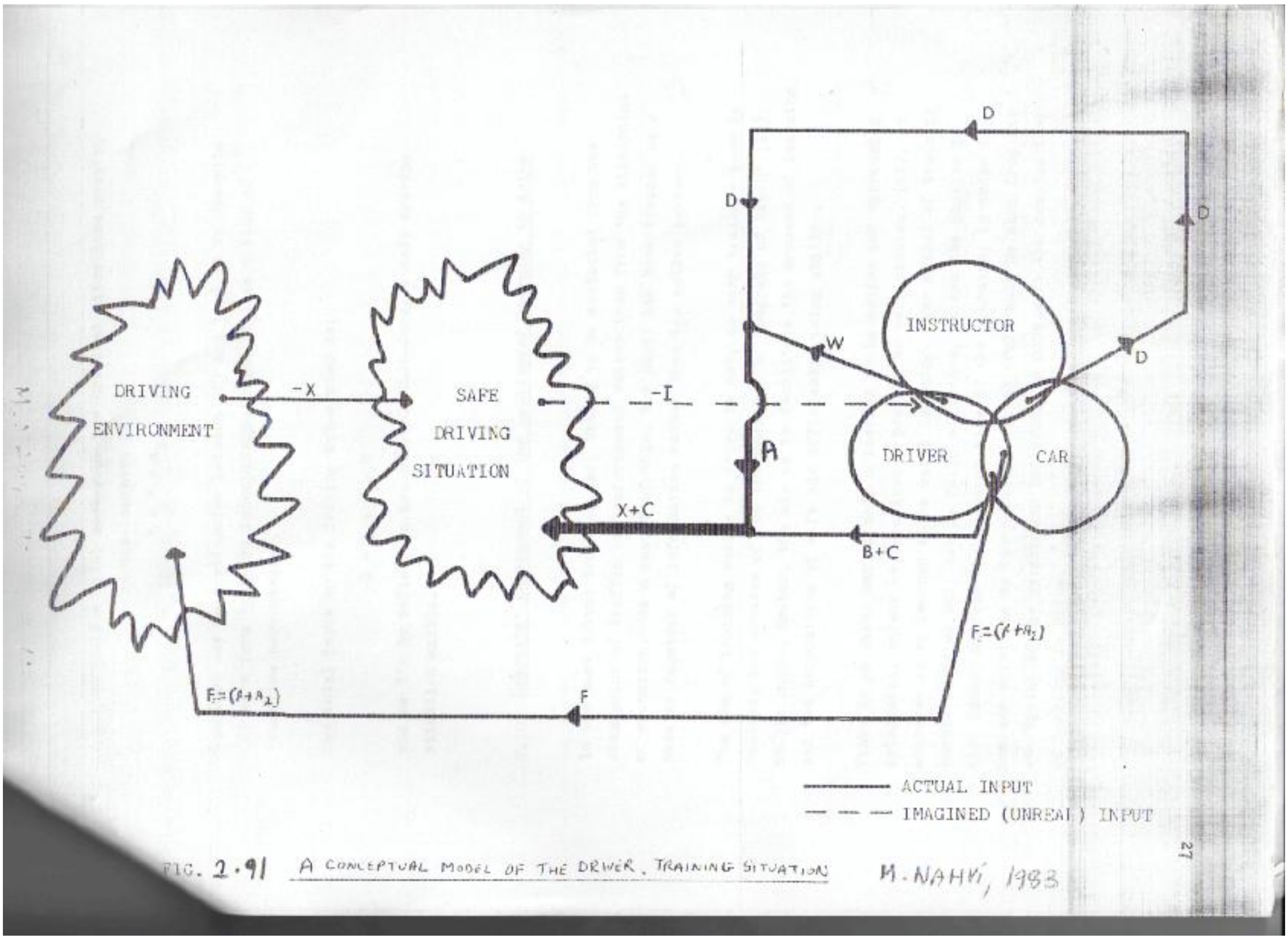
$$F = f + A_2$$

The best way to distinguish between (f) and (A_2) is to describe (f) as a form of "passive incompetence", and (A_2) as a kind of "reactive nervousness".

The total input to the driving sub-system is:

$$-X + X + C = C$$

and as Cs by definition are benign, therefore a safe driving situation exists.



2.91: A CONCEPTUAL MODEL OF THE DRIVER TRAINING SITUATION

2.10 Learners' assessment of the problems of learning to drive

In the past, driver training has tended to be conducted from the standpoint of traffic law enforcement rather than from the standpoint of education. As a result of this, the pupil has been treated as a passive receiver of information rather than the active partner.

The aim of training people to drive is not, as many trainers seem to believe, the process of the transmission of "nuggets of truth" (11) to the pupil. Rather, the aim is to facilitate the process of learning and the acquisition of safe and efficient driving ability.

There is no other way to help a learner to be active and thoroughly interested, unless he perceives a problem to be a problem (12), or whatever is to be learned to be worth learning. Any method of training people to drive will not be fully effective, unless the problem is also looked at from the point of view of the learners, in order to include solutions to the problem which could only be seen from the standpoint of the person who is trying to cope with the complex task of learning to drive.

It seems worthwhile, therefore, to try and obtain information about the way pupils view the process of learning to drive, and also to try and find out whether in their view any of the aspects of this process merit particular attention.

For this reason, the learners' own assessment of the value of their lessons were considered in this research and are included in Chapter 3 of this report.