Impact

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Pedestrians' Choice of Actions When Crossing the Road

UK launches Road Crash Investigation Authority

The Situational Awareness of Distracted Drivers

The Self-Administered Interview for Road Traffic Collisions

Opinion: The USA is collecting data on crashes involving ADAS systems. Why isn't the EU?

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From the Editor

June saw the post COVID-19 return of a very well attended and successful Crash Day at Darley Moor, with the new facility allowing for the introduction of some pole impact testing and tests where both test vehicles were moving at impact.

RiVR & Leica Geosystems joined us for the day and recorded a number of the live crashes and subsequent collision scenes using a multitude of recording techniques. They have used these to produce VR models. Alex Harvey of RiVR has written an article, with number of video links, that discussed what they did on the day. This can be found on their LinkedIn page or via https://www.linkedin.com/pulse/itai-crash-research-day-darleymoor-rivr-leica-alex-harvey

Dr Gemma Briggs of The Open University will be presenting another webinar on 14th September 2022, a recording of which will be available on the website, and this edition of Impact includes a sort article from her as a preamble to the webinar.

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The Institute of Traffic Accident Investigators

General information concerning Membership Grades,

The Institute of Traffic Accident Investigators provides a means of communication, education, representation and regulation in the field of traffic accident investigation. Its main aim is to provide a forum for spreading knowledge and enhancing experience amongst those engaged in the discipline.

Further, the Institute seeks to promote a professional approach to traffic accident investigation and, through its rules and discipline procedures, to encourage honesty and integrity.

The current membership represents a wide spectrum of professions, including police officers, researchers, lecturers in higher education, and private practitioners.

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Impact (The Institute's journal)

'Impact' (in hard copy or electronic form) is distributed free of charge to all members three times each year. Non-members are able to subscribe by application to the Institute's Administration Department, or by making the appropriate payment at the Institute's on-line shop - (see details set out below). Back issues of *'Impact'* can also be purchased via the Institute's Administration Department or on-line shop.

Letters to the Editor are welcomed. Opinions expressed in letters and articles within *'Impact'* do not necessarily reflect those of the Editorial Board or the Institute.

PEDESTRIANS' CHOICE OF ACTIONS WHEN CROSSING THE ROAD

Dr John Searle

Abstract

Pedestrians can greatly influence their own safety when crossing the road by using a formal crossing facility or, in the absence of such facility, checking for approaching vehicles and ensuring that the gap is sufficient to allow them to cross. When a collision does occur, the Courts will often need to determine the extent to which the actions of the pedestrian have contributed to the causation, or indeed been the sole cause.

The paper suggests measurements and observations which can be made at site in order to assist the Court in this process, incorporating published data on the decisions the pedestrian makes when crossing.

Introduction

When a vehicle/pedestrian collision comes before a Court, the physical events are to be determined from witness evidence which is often supplemented by the techniques of reconstruction: CCTV analysis, on-board logging of speed and other data, throw distance and lateral throw distance, progression of contacts on the vehicle, and so on. Each of these topics has of course been the subject of numerous papers in the literature, and any attempt to summarise would be a mammoth task.

The present paper is not concerned with such topics, but expands the reconstruction by quantifying the feasibility of other courses of action by the pedestrian, and what effect there would have been upon the outcome. This may be done no matter whether the reconstruction being considered is uncertain and contentious, or whether it is based on a high quality CCTV recording and is agreed by all parties. A particular version of the physical events is taken as a basis, and the paper explores what more may be said of a mathematical or scientific nature.

The legal responsibilities of drivers and pedestrians are specified in statutory instruments and the like, as interpreted by a vast volume of legal judgements. A summary is given in the Highway Code. This paper does not seek to modify or to supplement the requirements on how drivers and pedestrians should behave.

Hunt and Griffiths [1] open their paper with a concise description of how the interaction between drivers and pedestrians operates in practice:-

> *"Except where special crossing facilities are provided, vehicles implicitly have priority on the carriageway. Pedestrians, who are more adaptable but also more vulnerable than motor vehicles in an accident situation, must cross in gaps in the traffic or walk to the nearest formal crossing facility. In many situations gap crossing by pedestrians is difficult or dangerous, particularly for the disadvantaged groups such as the elderly and young children."*

Hunt and Griffiths [1] do not mention the exception that at a junction pedestrians who are crossing (recently extended to include pedestrians who are waiting) have priority over a turning vehicle.

For pedestrians, the principal expectations therefore appear to be that they will:

i) Use a formal facility, if there is one which would not extend unduly their journey.
ii) If crossing at road level, then to make

appropriate observation of vehicles which may be approaching.

iii) Wait for a gap which allows them to cross without collision.

Away from junctions and formal facilities, the corresponding expectations upon drivers appear to be that they will:

i) Drive at a speed appropriate for the circumstances.

ii) Maintain a lookout for any obstruction in their intended path, or any developing event which will shortly result in such an obstruction.

iii) Respond appropriately to such a situation.

For both parties, these expectations are of course governed by what is physically possible, by what is humanly possible, and by what is foreseeable by them.

USE OF A FORMAL CROSSING

The Highway Code (Rule 7) advises pedestrians to *"find a safe place to cross"* and mentions a subway, a footbridge, an island, a zebra or pelican crossing, or a crossing point controlled by a school crossing patrol or the like. Not mentioned is to cross at a junction although, particularly if there are traffic lights, that too might be considered to be a "safe place". Where the pedestrian has crossed without the benefit of any of those facilities, the surroundings of the collision scene may be examined to establish whether one or more was reasonably available.

Regarding what is reasonable in that context, the graph by *Moore* [2] (Fig. 7) shows that in practice more than 90% of pedestrian will not use a footbridge if the time to do so is any greater than the ground level route. Subways are a little better, but more than 90% of pedestrians will not use a subway if the time to do so is any greater than a third longer than the ground level route. Improvements in footbridge and subway design, along with increased traffic flows, may perhaps have reduced somewhat those percentages. At pelican crossings, *Rennie et al* [3] found that the delay experienced by pedestrians in waiting for 'green man' causes over 80% of them to cross either on red man or flashing green man. Most pedestrians will arrive on red man or flashing green and, rather than wait, will use a gap if one occurs.

If near the site there is a formal crossing facility, a first question is whether the pedestrian knew of, or should have looked for, the facility. If so, an estimate can be made of the delay (if any) which using it would have introduced into the pedestrian's journey. In that way an assessment can be made of the reasonableness of any suggestion that the pedestrian should have made use of the facility.

PEDESTRIANS' OBSERVATION OF VEHICLES

In the UK the Green Cross Code outlines the actions pedestrians should take in the absence of any formal facility, but studies show a generally lower level of care. *Schoon* [4] quoted *Grayson's* studies [5][6] which found that, depending upon the traffic, between 19% and 73% of pedestrians stopped at the kerb. Only 5% to 56% of pedestrians then looked both ways, although many had made head movements as they approached the kerb. The young and the elderly were generally better than mid-range adults in adherence to the individual items of the Green Cross Code.

Wilson and Grayson [6] also found that two thirds of pedestrians crossed the road diagonally, and one third were crossing near parked vehicles.

A pedestrian of course requires time to observe and respond to the traffic situation, especially on a two-way road when there is no traffic island. *Schoon* [4] notes that, for an adult with no disabilities, *Hunt and Abduljaber* assumed a response time of 2.0 seconds but his own pilot study, although very limited, suggested double as much.

However it is perhaps likely that many pedestrians, particularly adults, are aware of the traffic situation as they walk on the pavement towards their destination, and approach the kerb when they believe that there will be a suitable gap in traffic. In those circumstances confirmatory checks may not require a strict adherence to the Green Cross Code or any long reaction time, particularly since a check on the further traffic lane can continue as the nearer lane is crossed.

This is not the Highway Code, but a tentative description of the observed behaviour of pedestrians crossing roads in the UK. The study by *Bungum et al* [7] suggests that behaviour may be much the same in the USA. A majority of pedestrians do not stop at the kerb, look both ways, and then go straight across, but mostly they must be aware that they are not on a collision course. The accident rate would otherwise be far higher than it is.

PEDESTRIAN FAILS TO LOOK, OR TO LOOK PROPERLY

When a pedestrian does cross the road without being aware of the traffic situation, then whether or not a vehicle happens to be near is a matter of chance. It has been known for many years [6] that the majority of pedestrians who are struck had not seen (or at least not registered) the vehicle which collided with them.

Many road crossings occur where a pedestrian, often a child, sets out without having looked and in the great majority of those the pedestrian completes the crossing without mishap. There simply did not happen to be a vehicle for which the speed, position, and driver's response served to create a collision course.

However the Courts are not concerned with these no-contact incidents, but only with those cases where chance has sent the heedless pedestrian off at an unfortunate moment which does create a collision course. Events where such a pedestrian happened to make their crossing 10 seconds ahead of an oncoming vehicle, or where an oncoming vehicle was so very close that it passed before the pedestrian could get into its path, are simply not investigated.

A pedestrian who has not seen the approaching vehicle, due to not looking or not looking properly, has made no judgement of the feasibility of crossing the road ahead of it. Factors such as the speed and position of the vehicle cannot have affected the pedestrian's judgement, since no judgement was made at all. This can happen not only when the pedestrian was unaware of the approaching vehicle, but also when their entry onto the carriageway was unintentional.

Example

> A jogger was training on a narrow country lane, on the nearside because he was coming to a sharp right hand bend of limited visibility. Hearing a car approaching behind him, the jogger climbed onto the steep and uneven verge alongside. Unfortunately the jogger lost his balance and stumbled out into the side of the car as it went past. The pedestrian's initial movement off the road had been based on hearing, but the subsequent re-entry was unintentional and not related to any decision based upon the car's speed or position. The collision course has been a purely chance event.

Whether the pedestrian has looked is therefore important and the speed adopted across the road is often a guide, since a pedestrian who is aware of a close vehicle will walk more quickly, or even run. However pedestrian speed is not an infallible guide, particularly where the location is on a formal crossing where there is no need for a pedestrian to go quickly through some brief gap. Furthermore a pedestrian who, although not having seen any vehicle approaching, chooses to run for their own reasons, is much more likely to be struck because the approaching driver has less opportunity to avoid. The outcome may appear to suggest that the pedestrian was running because there was a vehicle approaching.

Example

> Two exchange students came from a country where vehicles drive on the right. Each morning they took their bus to college, and the bus stop was located to the right on the other side of a zebra crossing. The leading student, some 30 metres in front, had stopped a couple of metres before the crossing to wait for the other. At that point the bus they wanted appeared in the distance to the left and the leading student, apparently hoping to hold the bus at the bus stop until the other student could catch it too, suddenly ran forward. Almost immediately the student was struck by a vehicle coming from the right, the opposite way to the bus. It does not seem at all likely that the student was deliberately trying to race in front of the approaching vehicle and more likely that it had not been seen at all. The speed of the approaching vehicle has not influenced either the decision to cross or the speed of crossing, and if the pedestrian happened to set off on a collision course the vehicle was much too close to stop from any reasonable speed.

INJURY CAUSATION

In a collision between a vehicle and a pedestrian, the speed of the vehicle at impact is an important factor in the severity of injury to the pedestrian. The risk of serious or fatal injury increases with speed, because impact forces are higher. The link however is a statistical one, and of course cases occur of a fatality in a low speed impact and a miraculous absence of injury in a high speed one.

Numerous researchers have investigated this relationship, and this paper is not the place to attempt to summarise the results. It is sufficient to note that if several injury levels are defined, say four including 'No injury', then the risks of 'At least Minor', 'At least Serious' and 'Fatal' all increase monotonically with vehicle speed.

The severity of injury, as well as being related to speed, also depends upon which location on the vehicle was contacted by the pedestrian. A particular example is that a pedestrian whose head strikes the windscreen pillar is likely to have a worse outcome than had their head gone either side of the pillar. Occasionally one sees the argument put forward that, had the vehicle (or indeed the pedestrian) been travelling slightly more slowly, then although the pedestrian would still strike the vehicle it would be on a less injury producing part of it. It is argued that even a slightly slower speed would have produced a major reduction in injury likelihood.

Such an argument overlooks the requirement of foreseeability. The driver, who did not intend to be involved in a collision at all, certainly could not foresee that the pedestrian (whether or not having seen the approaching vehicle) would set off at a time and at a pace which, in combination with the speed of the vehicle and any braking by the driver, would put their head on a collision course with one of the windscreen pillars. The contact on the windscreen pillar has the signature characteristic of a chance event: it would not occur had the speed been slower, but also not occur had the speed been higher. In a similar way the pedestrian could certainly not foresee, if the crossing were to go wrong resulting in a collision with a vehicle, what part of the vehicle might be contacted.

As well as the location of the contact on the vehicle being a matter of chance, the cases with which the Courts are concerned are usually those where the outcome has been life-changing. That life-changing outcome may have been because the impact location on the vehicle was unfortunate, and/or because the pedestrian has proved vulnerable, since in the general population there is a large variation in susceptibility to injury [8]. The outcome of a case which has come before the Court is likely to be more serious than what some research study has shown to be the 'expected' or 'average' outcome for all collision events at that impact speed. In the case before the Court, the pedestrian is more likely to have been low-tolerance or the vehicle contact point injurious, making it difficult to estimate speed from injury level.

EFFECT OF VEHICLE SPEED ON PEDESTRIAN GAP JUDGEMENT

When the pedestrian has seen the approaching vehicle and assessed that there was time to cross in front of it, collisions occur where the assessment proves mistaken. If the speed of the vehicle has been higher than appropriate, that may have been causative by contributing to the pedestrian's misjudgement.

The Court will have evidence on what the vehicle's speed has been, and it may assist the Court if that speed is set in context. To that end a first step is to note the speed limit, for that class of vehicle on that road at that time. If the accident vehicle is of a class which is restricted to a speed below general traffic, then the limit for general traffic can usefully also be mentioned.

The Court will note the legal speed limit but will need to determine what was an appropriate speed for the driver in the circumstances of the event. The speeds which drivers of similar vehicles adopt in similar circumstances may have evidential weight, and those can be determined at the site by a survey with a speed measurement device. Particularly on narrow rural roads, the median speed of similar vehicles may be no more than half the speed limit applicable. The survey needs to be conducted covertly, to avoid the possibility of the measurements being affected. If the accident vehicle has been travelling singly, vehicles travelling in platoons should be ignored.

Moore [2] found that higher speeds by the approaching vehicle will tend to prompt pedestrians to make errors in judging a safe gap. Moore asked pedestrian subjects to signal the last moment at which they would consider it safe to walk across (at 1.56 metres/ sec) in front of vehicles approaching at various speeds, and he recorded unsafe judgements:-

	Speed of Approaching Vehicle							
	15mph	20mph	25mph	30mph	35mph	40mph	50mph	60mph
Collisions [C]	5	2	11	7	9	9	11	22
Rolling Average	-	6.0	6.7	9.0	8.3	9.4	14.0	-
Near Misses [NM]	5	8	6	7	10	7	12	13
Total of C + NM	10	10	17	14	19	16	23	35
Rolling Average	-	12.3	13.7	16.7	16.3	17.3	24.7	-

Moore [2] conducted 100 runs at each test speed, so that the recorded numbers at each speed may be regarded as percentages. Rolling averages have been added to *Moore's* data by averaging the numbers recorded for the speeds just below, at, and just above the chosen speed. The rolling averages for 40mph are weighted to allow for the speed interval changing from 5mph to 10mph.

It will be seen that the pedestrian's risk of misjudgement is fairly constant for vehicle approach speeds in the range say 27½ to 37½ mph or so, a speed range commonly encountered on urban roads where the majority of road crossings are made. A slower approach speed is not fully recognised by the pedestrian, who allows a margin of safety which is greater than usual. A faster approach speed is again not fully recognised, and the pedestrian allows a margin of safety which is less than usual. *Moore's* subjects were adults. For adolescents and children, who cannot judge speed as well as adults [9], these effects are likely to be greater.

Moore's tests of pedestrians' judgements were made as long ago as 1956. Since then cars and roads have changed significantly, but pedestrians presumably remain much the same. Indeed the basic features *Moore* [2] observed in pedestrians judgements have been discovered with other road users (e.g. *Staplin* [10]).

Real pedestrians cross the road at a speed according to the length of gap, and real drivers respond to a potentially dangerous situation by braking to increase the time available. Nevertheless in general terms *Moore's* result seems likely to apply. A pedestrian who is self-setting a crossing task will make more errors when the approaching vehicle is travelling at a fast speed.

ACCEPTANCE OF GAP BY PEDESTRIAN

Pedestrians who do not have the benefit of any special provision are advised by the Highway Code (Rule 7) not to cross "until there is a safe gap in the traffic and you are certain there is plenty of time". In addition, the Highway Code advises "when safe to do so, go straight across and do not run".

How that advice should be interpreted is a matter of law, but *Moore* [2] reports observations on an actual road to establish how pedestrians do in fact cross. One side of a road, some 5.5 metres from kerb to traffic island, was studied and *Moore* [2], referring to his graph, reports:-

> *"It will be seen that, for vehicle intervals of 7 seconds or greater, the mean crossing speed of pedestrians is constant; we suppose they are moving in an unhurried manner. For shorter vehicle intervals the time taken by the pedestrian to cross the road becomes less; the pedestrian now hurries, until, for a 2-second interval he breaks into a run."*

More recently *Jakym et al* [11] reported observations of pedestrians who were crossing a very different road: a seven lane highway in Ontario with three lanes in each direction and no central reservation, only a lane in the middle for turning traffic. There was no opportunity for a pedestrian to pause part way across the seven lanes. The posted speed limit was not 30mph but 60km/h (37mph), and furthermore there was no physical limitation on drivers' speeds nor anything to prevent drivers from changing lanes. As might be expected, pedestrians making this crossing did so at speeds noticeably faster than the pedestrians on *Moore's* urban street.

Whilst the results obtained by *Jakym et al* [11], or indeed numerous other authors, might be used in some circumstances, the majority of pedestrian collisions occur on urban streets. The work by *Moore* [2] will be used in the present paper. His graph, of the time of arrival of the approaching vehicle, and the corresponding time the pedestrian took to cross, is reproduced below as *Figure 1*.

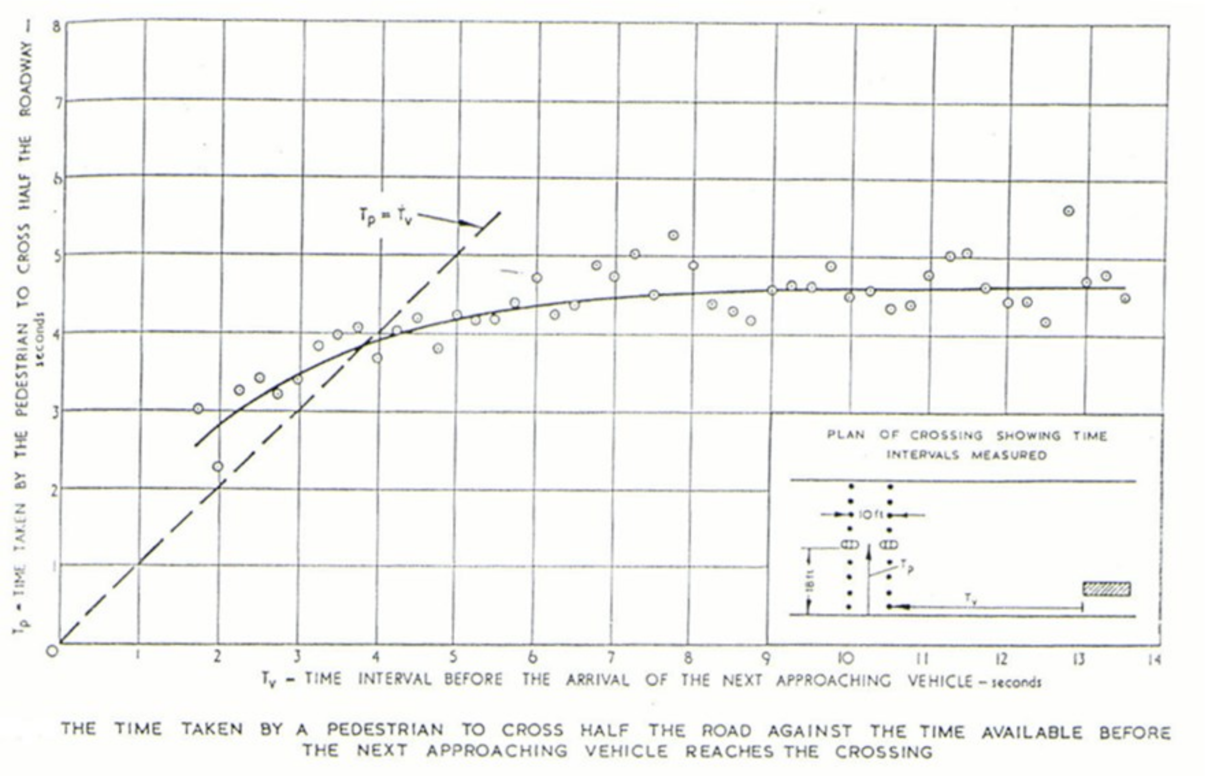

***Figure 1**. Times of road crossings observed by Moore [2]*

The Highway Code advice, to "wait until there is a safe gap in the traffic and you are certain there is plenty of time", might be interpreted from *Moore's* results as suggesting that an able bodied person crossing a 5.5 metre width should wait for a 7 second gap, so as not to need to hurry. When the relevant vehicle is in the further lane of a two lane carriageway, the gap would need to be longer to be equivalent, and as an approximation one might scale pro rata on the width to be crossed. When the person is not able bodied, again the time would need to be extended.

By quantifying the Highway Code "safe gap in the traffic", say by using *Moore's* observations, the patience a pedestrian requires to cross the road at the collision location can in turn be quantified. On some roads there is little traffic, and a pedestrian accepting a short gap (and misjudging it or there would not have been a collision) has taken a wholly unnecessary risk. Conversely, on busy roads a 'safe gap' is a rare event and the pedestrian may have little choice but to accept a gap which they know is barely enough. By visiting the scene at a time when traffic will be similar to the time of the accident, a short video (say 5 or 10 minutes) can be made to record the flow of vehicles on the road.

Such a recording can not only be shown to the Court, but also replayed to determine when 'safe gaps' (for example above 7 seconds) occur during the length of the video. A table can be prepared of periods during which, if a crossing were begun, there would not have been a 'safe gap' to the nearest approaching vehicle. Such periods may be called 'blocks'. An average waiting time can be determined from which one can say for how long the pedestrian, had they not accepted the unsafe gap which led to the accident, would expect to wait for a safe one. The Court can be assisted with information more specific than a subjective impression that 'this is a very busy road' or the like.

To calculate the average waiting time, the number of pedestrians expected to arrive during a block of length t_i will be proportional to the length of that block. The average time those pedestrians would have to wait is ½ t_i or in other words also proportional to the length of the block. If the total time of the video is T, during which there are n blocks of durations t_1, t_2, t_3 ….. t_n, then the expected waiting time of a randomly arriving pedestrian is $\frac{1}{2} \Sigma t_i^2/T$. The summation is from 1 to n.

To reduce the effect of the arbitrary start and finish times, the video may be clipped at both ends to remove the initial period before a transition occurs, either from 'block' to 'non-block' or else vice versa, and the end period after the last transition in the same direction. What remains contains an equal integral number of blocks and non-blocks, in a measured time.

The Highway Code 'safe gap', quantified from *Moore's* observations, represents something of an ideal crossing opportunity. *Moore* [2] recognised this and summarised:-

> *"Pedestrians can cross a 20-foot carriageway easily with a 7-second or greater vehicle interval. If intervals are shorter than 4 seconds, only the agile can cross safely."*

The video recording of traffic at the site, as well as determining how long a pedestrian needs to wait for the occurrence of 'safe gaps', also allows the occurrence of 4 second 'barely safe gaps' to be quantified, if necessary scaling the 4 seconds for the width to be crossed. Similarly if the length of the gap the pedestrian has actually accepted is known from the reconstruction of the incident, then the video can be used to determine how long a pedestrian could expect to wait for a gap better than the one accepted.

These expected waiting times will quantify whether the pedestrian has needed to cross a busy road with a very limited opportunity to do so, a situation with which a Court might well feel sympathy, or has simply taken an unnecessary risk.

EFFECT OF VEHICLE SPEED ON THE OUTCOME OF THE PEDESTRIAN'S JUDGEMENT

It has been mentioned earlier that pedestrians, in front of faster vehicles, tend to misjudge their opportunity to cross. Where such an incident has resulted in a collision, consideration may be given to what the outcome the pedestrian would have achieved had the vehicle been travelling at some alternative speed. Three requirements need to be met:-

a) The pedestrian has seen the approaching vehicle and judged that they could cross in front of it. Otherwise the outcome has been a matter of chance.

b) The alternative speed considered needs to be slower than the actual speed, so that there can be little doubt that the pedestrian would have attempted the crossing. If the alternative speed is faster than the actual speed, the pedestrian might not have attempted to go in front.

c) The vehicle has been travelling faster than the Court subsequently decides to have been an appropriate speed in the circumstances. If not, although it might still be said that the collision would not have occurred had the vehicle been travelling more slowly, that cannot be regarded as causative.

The vehicle driver has usually no foreknowledge of whether the pedestrian will attempt to cross, nor the instant the crossing will start, nor the speed the pedestrian will adopt. Sometimes a pedestrian will appear from behind a parked vehicle, already in the process of crossing. Unless the driver were to give precedence to any waiting pedestrian, the only influence the driver might bring to bear on those factors is by way of sounding the horn as a warning. The pedestrian and the vehicle being on a collision course has been an error of the pedestrian's judgement. A calculation can be made to assess whether the error was so large that, even had the vehicle been travelling at some slower alternative speed, nevertheless the pedestrian still would not have made it across.

It is important that the outcome, had the vehicle been travelling at some alternative speed, be presented on the correct basis. Such a calculation is not simply noting the physical fact that vehicle and pedestrian, at their actual speeds, have collided and at other speeds they would not. It would be pointless to observe that the vehicle at 40mph was on a collision course, but at 30mph the pedestrian would have passed in front of the vehicle, and at 50mph the vehicle would have passed in front of the pedestrian. Even where a driver might appreciate that a pedestrian is waiting to cross the carriageway, the occurrence of a collision course is not foreseeable by the driver, who does not know when and at what speed the pedestrian will set off, or even that the pedestrian will set off at all. It is the pedestrian who has foresight and control of those parameters. The driver could not possibly know that the actual vehicle speed, whatever it was, should be avoided at all costs but anything significantly faster or slower would be fine.

The correct basis is that one of the reasons why drivers are required to adopt an appropriate speed is because it has been known for many years that inappropriately high speeds will prompt dangerous errors by pedestrians attempting to cross, creating 'near misses' and 'collisions'. Inappropriately low speeds similarly produce misjudgements, but those are in the direction of safety. The calculation is directed towards the extent to which the pedestrian's error has been prompted by the inappropriate vehicle speed. Where the calculation shows that, had the vehicle been travelling at an appropriate speed, the pedestrian would have cleared its path, the Court may of course still find the pedestrian to have contributed to causation by setting off on what would have been a 'near miss' even had the approaching vehicle been travelling at an appropriate speed.

On the above basis, the magnitude of the pedestrian's error may be assessed by examining what percentage the pedestrian achieved, before being struck, of the distance needed to clear the vehicle's path. A calculation is then made of what the percentage would have been had the vehicle, from where it was when seen, been approaching at some alternative speed. If the percentage is over 100%, the pedestrian would have cleared the vehicle's path with a near miss.

The simplest way to make the calculation is on a pro-rata basis. If the actual vehicle speed was U and the pedestrian achieved $P\%$ of the way to clearing the vehicle's path, then for an alternative vehicle speed of V they would have achieved:

$$Q = \frac{U}{V} . P\%$$

There is however a complicating factor to this simple calculation. *Moore* [2] found that pedestrians adjust how long they take to make the crossing, allowing themselves more time to cross when more time is available. At the slower vehicle speed, the pedestrian too would be expected to go more slowly.

From *Moore's* graph, shown as *Figure 1* above, an allowance can be made for the extra time a pedestrian will take when extra time is available. Say that in the accident the pedestrian needed to cover a distance X to clear the path of the approaching vehicle. For Moore's pedestrians this was 3.66 metres. If the accident situation gave the pedestrian a time t_v before the vehicle arrived, for comparison with *Moore's* pedestrians that will need to be scaled to become:

$$T_v = \frac{3.66}{X} . t_v$$

Moore's graph is now entered with T_v as the time interval before vehicle arrival, and the corresponding time the average pedestrian would take to cross 5.5 metres, that is T_p, is read off. The process is repeated with the interval before vehicle arrival increased in the ratio *U/V*, where *U* is the speed at which the accident vehicle approached, and *V* is the alternative speed being considered. The ratio of the two values of T_p represents the extra time the average pedestrian would be expected to take when given the longer opportunity to cross.

The pedestrians observed by *Moore* [2] were shortening their crossing times when vehicles, due to some combination of speed and position on the road, had shorter arrival times. The allowance has been calculated on the basis that the shorter arrival time will have the same effect on the pedestrian, whatever the combination which caused it. However *Moore's* subjects on the test track showed that when the time of arrival of an approaching vehicle was shortened by increasing its speed, that had less than half the effect of a similar shortening due to reducing the distance away of the vehicle. The allowance calculated will therefore overestimate the effect of speed alone, and it may be reasonable to quote the pro-rata result with and without the allowance, as bracketing the correct result.

The comparison between the 'actual' scenario and the 'appropriate' scenario has been based upon the vehicle not braking on its approach. If there has been braking, then similar braking but starting from the slower speed would result in the pedestrian getting a little further than suggested by the above calculation, but the effect is small.

Such a calculation cannot be made where the pedestrian has made no judgement of the opportunity to cross, such as occurs when the pedestrian has not looked, not looked properly, or entered the carriageway inadvertently. Whether they are on a collision course is purely a matter of chance.

CONCLUSION

When a pedestrian has been struck by a vehicle whilst crossing the road, it is often the case that the Court is asked to consider the actions of the pedestrian with not much more than witnesses' verbal descriptions of it being a 'busy road' or the like, and some photographs of the scene.

The reconstruction practitioner will normally have visited the site and so be in a position to assist the Court with quantified information relevant to evaluating the actions of the pedestrian:-

i) Was there a formal crossing facility which a significant proportion of pedestrians would be expected to have used?

ii) What visibility was available and were the pedestrian's actions those of someone who has seen the approaching vehicle?

iii) How long would a pedestrian expect to wait for a gap in the traffic which would give "plenty of time" to cross, and how long for a gap of barely adequate length?

iv) How did the speed of the accident vehicle compare with the normal speed range of traffic at the site?

v) If the Court decides that the speed of the collision vehicle has been inappropriately high, may that have contributed to the pedestrian's misjudgement?

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Impact

Submissions invited

Next Edition Nov/Dec 2022

As ever, the Editor would be very pleased to hear from members, non-members or subscribers, who have produced material that they feel would be of interest to readers of *'Impact'*. Details of research projects or relevant collision investigation testing would be particularly welcome. Attracting sufficient numbers of articles for publication in the Institute's journal remains a difficulty! Whilst the Editor is delighted to receive papers from overseas contributors, a greater supply of 'home grown' material would also be very welcome.
If you have any questions regarding the publication of an article / paper, or simply wish to discuss the possibility of preparing a piece for the journal, please contact the Editor at **editor@itai.org**

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Registration is available at wrex.org. Attendees who pre-registered need to visit the website again to fully register.

WREX 2023 has already attracted over 750 attendees who have registered and pre-registered. We have also signed on numerous vendors so that attendees can see the latest reconstruction gear. WREX 2023 is also gaining support from numerous sponsors in order to provide the best experience possible for our attendees. **Remember** the attendee room block at the host hotel sold out in 2016. The WREX 2023 planning staff encourages you to reserve your hotel room ASAP to ensure your ability to stay on site while attending this sure-to-be spectacular event. Room reservations may now be made on our website at wrex.org.

If you were unable attend WREX 2016, ask someone who did. We will see you at WREX 2023.

UK launches road crash investigation authority

July 2022

The UK government has announced the forthcoming creation of an independent organisation that will investigate road crashes and make recommendations to government on road safety policy.

The "Road Safety Investigation Branch (RSIB)" will recruit a specialist team of crash investigators that will look at why incidents happen and "provide insight into how new technologies…can be rolled out." New legislation is required for the new agency to go ahead, and this could be delayed as a consequence of the recent resignation of Prime Minister Boris Johnson.

ETSC has recommended independent crash investigation as a key element in road safety policy for many years. The Dutch Safety Board, a founding member of ETSC, carries out independent investigations of safety issues, including in the transport and road sectors. In 2019 the organisation published a report encompassing a number of investigations into crashes involving advanced driver assistance systems. Finland carries out an in-depth crash investigation of every fatal road collision, but this policy is not widespread in Europe.

In the United States, the National Transport Safety Board has carried out a number of investigations into crashes involving driver assistance systems and automated vehicles. The National Highway Traffic Safety Administration (NHTSA) now requires carmakers to provide data on crashes involving such systems.

ETSC says a European Union agency to investigate road crashes is essential to the safe roll-out of assisted driving systems and automated vehicles across the EU. The EU has agencies responsible for Air, Maritime and Rail safety but no agency for road safety despite the much larger numbers of deaths and injuries caused by road collisions.

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'Impact' is published 3 times each year (April, September, December) and is circulated to all members of the Institute in the UK and overseas. In addition, there are many non-member subscribers (also in the UK and overseas), who receive the publication.

The journal reaches specialist police officers, researchers, private consultants, engineers and other professionals involved in collision investigation.

'Impact' is now in its 29th year ! Over that period, advertisements placed in the journal have proved highly effective in alerting its readers to -

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The Situational Awareness of distracted drivers

Dr. Gemma Briggs
Head of Discipline and Senior Lecturer in Psychology

It is well established, and very well documented, that any type of phone use by drivers can contribute to increased crash risk [1] and reduced hazard detection ability [2]. While 'phone use' is a broad term which can incorporate lots of different activities (e.g. texting, using social media, making a call), car manufacturers and many consumers assume that if the activity is hands free/voice activated then safety concerns are removed. However, this ignores the role of cognitive distraction, imposed by phone use, which has been shown to degrade driving performance considerably. It also implicitly suggests that it is acceptable to complete secondary tasks while driving, and that drivers are perfectly capable of doing so. This assumption is particularly interesting to researchers given what we know about how drivers process information even when they are not distracted. Take, for example, the case of an "I'm sorry I didn't see you, mate" incident involving a car and a motorcycle. In this common event, drivers *look* before pulling out into the path of a motorcycle but fail to *see* the motorcycle. Research on this type of incident has shown that drivers failing to notice motorcyclists don't do so because they can't see them, rather they don't *expect* to see motorcycles and therefore don't perceive them [3]. This offers some insight into how drivers process scenes by demonstrating that it isn't just a case of taking in what is physically present, rather the driver brings their own expectations and experience to the situation which can affect what they 'see' [4].

This ties into research on Situational Awareness [5], which has further explained how driving scenes are processed. Situational awareness is essentially the driver's mental model of the driving situation which is made up of three levels: perception, comprehension and projection. The driver takes in relevant information from the environment and combines it with previous knowledge and experience, in order to understand the scene ahead of them, as well as anticipating potential changes in the driving situation. As such, a driver's situational awareness, or mental model, is made up of their own movements/plans, but also those of other road users [6]. This mental model is constantly updated with incoming information, but is also informed by the individual driver's experiences, expectations and specific goals for a given journey. This helps to explain that drivers are not simply passive processors of information, rather they bring experience and expectations to the driving situation, which in turn can affect both which information is processed and how it is processed.

Good situational awareness is crucial for safe driving, but even in the absence of distractions, driver awareness can fail. Drivers are largely unaware of their mental model of the driving situation they are in – it's not something they consciously think about – meaning they are likewise unaware when their situational awareness is depleted. As such, a driver who legally uses a hands-free phone is likely unaware of the impact of their behaviour on their awareness of the driving situation. In the absence of any incident or event, such a driver will have the illusion of awareness – they will be unaware of the hazards/events they have missed that other road users may have compensated for. So, situational awareness can be poor without distractions due to biases in processing of information, but when distractions are added, awareness decreases further.

Research on phone-use has demonstrated how it can selectively impair the different levels of situational awareness [7][8]. Some of my own collaborative research [9] has looked at this, demonstrating that phone using drivers over rely on their expectations for 'normal' driving situations. We asked participants to watch a series of driving videos, within a simulator, and to press the brake pedal if they noticed something unexpected. In a first experiment, the unexpected items were either images of road signs, or smiley face emojis which could appear either in the centre of the screen or in the peripheral areas. We found that participants who also completed a handsfree phone conversation task were generally poorer overall at noticing these unexpected items than undistracted participants, even when they were shown in the centre of the screen. However, those items that they did notice were far more likely to be the road signs, rather than the smiley faces, despite them being matched for size and position. This led us to conclude that our phone-using participants were relying on an 'attentional set' for driving: you expect to see road signs in normal driving situations, you don't expect to see randomly appearing smiley faces! In our second experiment, the unexpected events were simply driving scenarios which ran contrary to expectations, such as stopping at a green traffic light or giving way to the incorrect side on a roundabout. Again, we

found that our distracted participants were very poor at noticing these events, compared with controls, supporting the attentional set theory.

My talk on 14th September will discuss this and other research relating to the situational awareness of phone-using drivers. Building on my previous talk, which discussed the measurable effects of distraction on driving performance, this session will discuss changes in reaction time and hazard detection when driver situational awareness is depleted. It will provide some case-based examples of incidents which could be attributed to reduced situational awareness and will discuss how new technology, including semi-autonomous vehicles and driver assistance modes, may differentially affect driver awareness.

I look forward to seeing you on 14th September.

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The Self-Administered Interview for Road Traffic Collisions

Ruth Horry - Swansea University

Chelsea Hughes - Swansea University

Fiona Gabbert - Goldsmiths, University of London

Lorraine Hope - University of Portsmouth

Every year, thousands of people are injured or killed on UK roads. Information provided by eyewitnesses is often crucial for the successful prosecution of dangerous drivers. However, witness reports are often incomplete and lack the key details needed to underpin a strong case. Decades of psychological research have shown that memory decays quite rapidly following a witnessed event, such that specific details are progressively lost while the gist remains. However, research shows that an early comprehensive recall of relevant information can protect memory for details over a longer period.

The Self-Administered Interview© is an investigative tool based on the same principles of memory retrieval and reporting as the Cognitive Interview, which is often considered to be the gold standard of investigative interview techniques. Witnesses can independently work through a booklet to produce an account without the need for a trained interviewer to be present. The Self-Administered Interview guides them through the process of recalling and reporting the witnessed event in a high level of detail. Extensive laboratory testing over the past 13 years has shown that witnesses who complete the Self-Administered Interview© provide more comprehensive accounts than witnesses who provide written accounts using less structured reporting forms. Since its development, the Self-Administered Interview© has been implemented by several police forces in the UK and abroad. It has been endorsed by the College of Policing for the reporting of initial accounts in cases involving multiple witnesses and limited resources.

Several variations on the Self-Administered Interview© have been developed for specific investigative contexts, including missing persons cases and investigations of industrial accidents. Our research team developed a new version of the Self-Administered Interview©, designed specifically for the roads policing context – the Self-Administered Interview for Road Traffic Collisions© (SAI-RTC©). The SAI-RTC© was co-created with frontline roads policing officers, who provided expert knowledge insights regarding the types of details that would support a successful and efficient investigation.

To test the effectiveness of the SAI-RTC©, we conducted a field trial, funded by the Road Safety Trust, in which real witness reports obtained via the SAI-RTC© were compared with witness reports obtained via the force's standard reporting form (the F280). Roads policing officers in the SAI-RTC© group were trained in the administration of the SAI-RTC©, and were encouraged to use the booklet for any cases where it was deemed suitable. Wherever practical, the officers were encouraged to hand the SAI-RTC© to witnesses while they were still at the scene of the collision; however, where that was not possible, they could arrange for a copy of the booklet to be posted to the witness. Officers in the comparison group continued to use standard practice, which typically involved arranging for a copy of the standard reporting form to be posted to the witnesses after the collision.

During the 20-month trial, 58 eligible SAI-RTC©s and 218 eligible standard reporting forms were received by the police, redacted, and shared with the research team for evaluation. Overall, there was a 57% average increase in the number of details reported by witnesses who used the SAI-RTC© compared to witnesses who used the standard reporting form. We also observed increases in every type of detail that we examined; average increases ranged from 46% for information concerning the spatial relationships between people, vehicles, and objects, to 84% for information relating to the road layout and surroundings.

Of all of the cases in the field trial, a similar percentage of SAI-RTC© cases were referred to the Crown Prosecution service (61%) as cases that used the standard reporting form (51%). We also found that a similar percentage of SAI-RTC© booklets were returned (62%) as standard reporting forms (56%). Thus, the imbalance in the number of SAI-RTC© and standard reporting forms in our sample was because fewer SAI-RTCs© were administered, rather than because witnesses were any less likely to return them.

Our field trial showed that the memory retrieval support provided by the SAI-RTC© allows witnesses to produce more complete, detailed reports of a witnessed road traffic collision than more standard reporting forms that are in current usage. Witnesses were also positive about the SAI-RTC, as they overwhelmingly reported that they found the SAI-RTC© easy to use and that it helped them remember the incident in more detail.

Following the trial, our research team has used witness and officer feedback to refine and streamline the SAI-RTC©. Through detailed analysis of how witnesses used the reporting space provided to them, we have cut approximately one third of the length from the booklet, increasing its usability. Our current work is focused on the development of a digital version of the SAI-RTC©, which will be evaluated in the field in the second half of 2022.

For more information about the SAI-RTC©, please see:

https://www.selfadministeredinterview.com/sai-rtc-road-traffic-incident/

or for the final report of the SAI-RTC© trial please see

https://static1.squarespace.com/static/61d570b3a2957b5f755587d2/t/626957d30d13d3686e5b61f6/1651070934512/SAI-RTC%2BFinal%2BReport%2BMarch%2B2022.pdf

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Opinion: The USA is collecting data on crashes involving ADAS systems. Why isn't the EU?

Antonio Avenoso, Executive Director

July 2022

Last month NHTSA, a US government agency, released its first set of data on crashes involving vehicles with advanced driver assistance systems (ADAS). In the ten months since mandatory reporting began, there have been around 400 reported incidents. How about in Europe, a market comparable in size? Nobody knows.

There is no equivalent to NHTSA that covers the whole of the EU. A car approved in one Member State can be sold across the EU. For example, a car approved in the Netherlands by RDW, such as a Tesla, can be sold in any EU country. The new Mercedes Level 3 automated low-speed driving system was approved by the KBA in Germany for the German market, and they will most likely be responsible for EU-wide approval of the Mercedes system too.

What if a driver spots a problem? In the US, anyone can report a defect to NHTSA. Likewise, in theory, in the EU, anyone can report a vehicle defect to a national

authority. But see if you can find the web page for your country to do that easily.

Did you hear about Tesla vehicles and 'phantom braking' recently? If so, that was based on reports made in America to NHTSA. Is that problem occurring in Europe? Good luck finding out.

When there is a recall, it is reported in a central EU database, but the reports published there give no information on the number of incidents reported or how many people might have been injured as a result of a defect.

While it's true that, in general, the EU is ahead of the USA on vehicle safety standards, on transparency on defects or potential problems with ADAS systems, not so much.

And these crashes are happening in the EU. A report by the Dutch Safety Board, published in 2019, investigated several collisions involving assisted driving systems. At the EU level? Nothing.

Reporting and investigating crashes is getting even more important now that computers are taking over some driving tasks. If computer code or sensors cause a problem that contributed to a crash, we need to know, so we can prevent future problems.

That's why ETSC is calling for mandatory reporting of crashes involving assisted and automated driving systems in the EU, and a central agency to collect those data, supervise in-depth crash investigations and oversee the rollout of new assisted and automated driving technologies safely.

Impact

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Next Edition Nov/Dec 2022

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