Identifying the higher-order factors of a motorcycle collision: An Accimap analysis

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ABSTRACT

The UK's STATS19 road traffic collision database contains large volumes of information regarding the road users, vehicles, and physical factors involved in a given collision. There is little, however, in the way of the higher system factors that led to the collision's occurrence. We present the analysis of a fatal motorcycle accident in the UK using the Accimap approach, a sociotechnical systems method that aims to help the analyst identify the broader, systemic factors contributing to safety outcomes. In doing so, we contribute to the growing literature calling for the sociotechnical approach to be applied to road safety, and we provide road safety recommendations that, if implemented, would provide wide reaching benefits beyond simply reducing the likelihood of collisions of the same type and location as that analysed here.

KEYWORDS

Accimap, road traffic collision, sociotechnical systems

Introduction and analysis

Road traffic casualty rates have not decreased in the UK since around 2010 – since then, between three and four people (on average) have died on our roads every day (DfT, 2019). This stagnation has led to an ever-increasing call for the application of sociotechnical systems approaches to the issue (see, for example, Salmon et al., 2012; McIlroy et al., 2019). The argument is that we must consider more than just the immediate physical and road-user focussed factors contributing to collisions: we need also to look at the road system as a whole, and consider the higher, abstract factors that shape system behaviour and outcomes. One method that supports this is the Accimap approach to accident (or collision) analysis. Dividing a given system into a number of hierarchical levels, it aims to graphically display the actions, events, and decision points that lead to a system failure (in our case, a collision) such that causal pathways can be traced back, from the event itself, to the various contributory factors, at all levels of a system.

In Figure 1, we present the Accimap analysis of a fatal motorcycle collision. The collision was chosen due to its location (a known collision-prone area), and its type – vehicle-motorcycle collisions cause the majority of motorcyclist fatalities, with motorcyclists being the most highly represented group in UK road fatality statistics (DfT, 2019). The analysis (and description, below) was based on information contained in a publicly available collision database, media reports, on local knowledge, and on the coroner's reports (after permission was obtained from the coroner, and ethical approval granted by the University of Southampton's ethics board, ID 49186). To guide completion of the upper levels of the diagram, online sources, such as gov.uk (the UK government's online portal), and the websites of insurance companies, motoring organisations, road safety charities, and international standards organisations, were consulted. A focus group was held to validate the model. This involved nine participants of varying backgrounds, from public health to

transport engineering, and was facilitated by the three current authors. The resulting Accimap is presented in Figure 1.



Figure 1: Accimap of a fatal motorcycle collision

The collision represented in Figure 1 occurred in a busy commercial street in Southampton, UK, at around 17:30 on a sunny Thursday in May. An experienced motorcyclist was travelling down a busy, commercial 30mph street prone to heavy, mixed traffic (for example, pedestrian, car, bus, bicycle), on a large-engine motorcycle, travelling at 46mph. He had low levels of alcohol and amphetamines in his system. Meanwhile, a driver in his late twenties was in the opposing lane waiting to turn into a side street. Upon commencing his turning manoeuvre, he saw the motorcyclist approaching. Although the driver had stopped his vehicle before a collision occurred, the motorcyclist had already reacted by pulling hard on the brake. The motorcyclist lost control of, and came off his bike. Both rider and bike skidded and collided with the stopped car. The resulting injuries were fatal to the motorcyclist. The bike had not had its headlights on, nor did it have ABS brakes. The rider was wearing protective leathers and a helmet, but was not wearing high-visibility clothing.

Discussion

The information contained in the lower two levels of Figure 1 comes directly from the coroner's reports and details the physical and environmental processes resulting in the collision. These factors, arguably the most straightforward to identify (from witness reports, forensic analyses, etc.), are of less interest here. This is not because they are not important or useful, but rather that they are already commonly considered. Instead, we focus on the higher system factors, those appearing in the upper six levels of Figure 1. These factors are, arguably, more subjective (hence the requirement for analyst skill and a validating focus group with subject matter experts), yet are those from which wider-reaching recommendations can be made. Given the complexity of the diagram, not all pathways can be discussed here; however, all *could* be explored, and recommendations generated. For the purposes of this article, we focus only on some of the nodes related to the timing of the car driver's decision to turn into the side road (represented at the 'physical processes and actor activities' level, right hand side of Figure 1).

Something not discussed in the coroner's reports was the presence of a motorcycle shop close to the junction where the collision took place. The location of the shop is such that it lies directly in the driver's line of sight as they look to check for on-coming traffic before turning right. Given shared features, it is possible that the visual scene of the motorcycles on display on the forecourt masked the on-coming, moving motorcycle, thus causing a delay in reaction from the driver. Academic research in the field of visual perception suggests this could be the case (for example, Evans and Treisman, 2005); however, the urban planner is neither encouraged nor supported in searching for or applying this type of information when considering planning applications (noted at the 'technical and operational management' level). Going further up the Accimap, a lack of sufficient dissemination of academic research findings was identified, preceded (at the 'regulators and associations' level) by the point that academic findings are not sufficiently accessible to those outside of academia. We would therefore recommend a much closer connection between local council planning departments and university transportation or psychology research groups. One manifestation of this could be that a university provides a consulting service to new projects where traffic safety may be a concern. We would also advocate for open-access research as standard, with consideration to this included by default in all funding proposals. This would provide far wider reaching benefits than altering the design of (or removing) the motorcycle shop in question. Such an intervention (based on low-level factors) may be beneficial to that particular junction, however it would offer no benefit to road users in other locations.

Exploring another branch, at the 'local area government' level it was noted that driving schools do not sufficiently train drivers to search for motorcyclists. Despite motorcyclists being the most highly represented group in fatalities per kilometre travelled (DfT, 2019), and motorcycle-car collisions being the leading cause of those fatalities, this is not a priority in driver training. At the

'regulators and associations' level, it was noted that the driver training curriculum is not written with all road users in mind. Above that, at the 'national committees' level, a general lack of push for motorcycle safety was noted, as well as the influence of economic considerations outweighing safety concerns in this regard. Although the World Health Organisation provides guidance and recommendations, they have no formal powers to enforce, hence there is no strong motivation at the national level to prioritise safety over economics. Translating into recommendations, the first would be to include a stronger emphasis on awareness and detection of the vulnerable road user in the driver training curriculum. One potential manifestation of this could be cross-modal training, whereby drivers experience the road environment as a cyclist or motorcyclist as part of their practical, car-driver training. This could help raise empathy between road users and improve shared situation awareness (though this should be tested empirically). At the higher levels of the system, more enforcement power could be assigned to international organisations, however given the need for inter-governmental agreement, this would by no means be simple.

Limitations

A criticism that could be levelled at this type of analysis is that the higher-order factors identified do not come directly from the tangible facts of the case, rather they come from the mind of the analyst(s). While true that a level of intuition or imagination is indeed required when identifying these factors, we would argue that this creativity is necessary if we are to push road safety forward beyond the impasse we currently face. The benefit provided by the Accimap comes from the structure it provides to this creativity, framing the intuiting process and linking high-level recommendations back to the physical factors of a given case. This requires some skill on the part of the analyst, hence one could argue that the analysis results would be different given different analysts. This being the case would not, however, render the outputs of one analysis any more or less valid. The utility of one analysis does not preclude the equal utility of another, distinct analysis.

Conclusions

The epidemiological approach has undoubtedly brought us a long way in terms of learning about the factors involved in collisions, and applying that learning to road safety intervention design. It still represents an essential component of the road safety intervention designer's toolbox, however additional tools are now required. Rather than providing improvements specific to a particular road user or location, addressing the high system factors is more likely to provide global improvements that will affect a wide variety of road users, in a wide variety of contexts.

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