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Dash Cam videos on YouTube™ offer insights into factors related to moose-vehicle collisions

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ABSTRACT

To gain a better understanding of the dynamics of moose-vehicle collisions, we analyzed 96 videos of moose-vehicle interactions recorded by vehicle dash-mounted cameras (Dash Cams) that had been posted to the video-sharing website YouTube™. Our objective was to determine the effects of road conditions, season and weather, moose behavior, and driver response to actual collisions compared to near misses when the collision was avoided. We identified 11 variables that were consistently observable in each video and that we hypothesized would help to explain a collision or near miss. The most parsimonious logistic regression model contained variables for number of moose, sight time, vehicle slows, and vehicle swerves ($AIC_c w = 0.529$). This model had good predictive accuracy (AUC = 0.860, SE = 0.041). The only statistically significant variable from this model that explained the difference between moose-vehicle collisions and near misses was 'Vehicle slows'. Our results provide no evidence that road surface conditions (dry, wet, ice or snow), roadside habitat type (forested or cleared), the extent to which roadside vegetation was cleared, natural light conditions (overcast, clear, twilight, dark), season (winter, spring and summer, fall), the presence of oncoming traffic, or the direction from which the moose entered the roadway had any influence on whether a motorist collided with a moose. Dash Cam videos posted to YouTube™ provide a unique source of data for road safety planners trying to understand what happens in the moments just before a moose-vehicle collision and how those factors may differ from moose-vehicle encounters that do not result in a collision.

1. Introduction

Collisions between motor vehicles and moose are a serious problem. Behavioral characteristics of both moose and driver, as well as various environmental characteristics, have been linked to moose-vehicle collisions (MVC; Joyce and Mahoney, 2001; Gunson and Clevenger, 2003; Biggs et al., 2004; Seiler, 2005). For example, detection time of the moose by the driver is known to be an important factor in determining whether a vehicle strikes a moose (Rodgers and Robins, 2006) or a deer (Mastro et al., 2010). Also, equally important are the number of animals on the road and whether drivers swerve to avoid them (Joyce and Mahoney, 2001).

The amount, structure, and quality of roadside vegetation in and adjacent to transportation corridors have also been associated with moose-vehicle collisions (Rea, 2003; Rea et al., 2010; Seiler, 2005; Laurian et al., 2012). Roadside vegetation is attractive as forage for moose and may conceal animals, obscuring the motorists' view and altering driver reaction times (Gundersen et al., 1998; Dussault et al., 2006; Gunson et al., 2011). The position of the animal on and/or its angle of entry onto the road either from the left or right side of the road may also influence the risk of collision (Rodgers and Robins, 2006; Mastro et al., 2010). Because sensory distractions may delay a motorist's ability to see an animal on or near the road (Mastro et al., 2010), objects such as approaching vehicles (especially when it is dark outside) may also presumably alter the ability of a motorist to detect and respond quickly to the presence of an animal in the transportation corridor. Very little research, however, has focused on what specifically happens in those moments just before a moose-vehicle collision occurs, what conditions may precipitate such an event, and what action drivers may take to avoid it.

Historically, determining what transpires in the moments preceding a collision was usually only obtainable by interviewing those involved in the collision. However, some people do not survive to tell their stories, while others have difficulty recalling the details of the events as

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a result of the injuries sustained in the collision (Ehlers et al., 1998; Cassidy et al., 2014). In addition, recollection of the events related to wildlife-vehicle collisions becomes increasingly difficult with the passage of time (Seiler et al., 2004).

Modern advances in camera technology offer drivers an opportunity to install and operate dashboard-mounted cameras (Dash Cams) that record highway conditions and driving experiences of the motorist. Many motorists now use these cameras to document collision events in order to support their insurance claims (Štitilis and Laurinaitis, 2016). These cameras occasionally document interactions between motorists and animals that enter or are present within the transportation corridor, some of which result in collisions. The use of Dash Cams is increasing globally as is the posting of videos (including those of animal-vehicle interactions; Rea et al., 2010) to video sharing sites such as YouTube™ (Park et al., 2016; Mehrish et al., 2017).

To determine the circumstances immediately preceding MVC, we studied Dash Cam videos of moose-vehicle interactions posted to YouTube™. Our objective was to determine the effects of road conditions, season and weather, moose behavior, and driver view and response to actual collisions compared to near misses when a collision was avoided. We predicted that motorists involved in a collision with moose had less time (e.g., moose was moving quickly or driver's view of the animal was obscured) or a reduced ability (e.g., because of road conditions such as ice) to avoid a collision. Our null hypothesis was that videos would reveal no differences in the circumstances that led to MVC when compared to those circumstances that resulted in a near miss or no collision.

2. Methods

Between January 2016 and October 2017, we searched YouTube™ for videos of moose-vehicle interactions. We used the search terms: accident, *Alces*, automobile, car, collision, highway, moose, road, and vehicle, as well as similar terms in other languages (e.g., Swedish = älg; Finnish = Hirvikolari). We identified 96 videos that recorded moose-vehicle interactions, most of which appeared to have been taken by Dash Cams (Fig. 1).

Once we selected a video, we recorded the Universal Resource Locator (URL) and assigned each video a reference number. For the purpose of our analysis, we assumed that what the Dash Cam recorded was the same thing observed by the driver. We viewed each video and classified the moose-vehicle interaction as either a collision or near miss. In 12 of the 96 videos, the collision or near miss involved a vehicle other than the vehicle equipped with the Dash Cam (e.g., oncoming car or car in front of the car with the Dash Cam). In such cases, we recorded the event as it would occur from the perspective of the vehicle that encountered the moose.

Each video was viewed 15 to 20 times in order to identify and record a number of variables that we hypothesized may influence the likelihood of a moose-vehicle collision. We identified 11 variables that were consistently observable in each video (Table 1). Nine of the 11 variables were categorical and were represented with deviation coding. 'Vehicle slows' was determined by detection of a decrease in vehicle speed relative to environmental surroundings (e.g., highway lines, roadside reflectors, trees, etc.). We did not attempt to calculate or estimate a deceleration rate, we simply recorded whether or not the vehicle slowed. Two of the variables were continuous. First, we defined 'Sight time' as the number of seconds that the moose was visible from its first appearance on screen until it was either struck by the vehicle or crossed the road in front of the vehicle and was no longer a collision threat. Some of the videos showed information strips with a clock that we read to calculate 'Sight time'. If no clock was observed embedded in the video we used a stop watch to determine the 'Sight time'. Second, we roughly estimated the average number of average lane widths worth of vegetation clearing that had occurred on each side of the road. While in some cases it was too dark to determine whether or not the habitat type adjacent to the highway corridor could largely be classified as forested or clearings such as fields, meadows or clear cuts, vehicle headlights always provided enough light to estimate the amount of roadside shoulder and verge that had been cleared by mowing/brush-cutting. We tabulated the nine categorical variables and reported $\bar{x} \pm$ SD for the two continuous variables (Table 2).

Additional information that was available from some videos included country of origin, number of lanes on the road, and sounds from within the passenger compartment of the vehicle. We identified the country in which a video had been recorded for 38 of the 96 videos. Eighty-eight of the 96 videos were recorded on two lane roads. Some videos contained sounds, while others did not. Consequently, we did not use either the number of lanes in our analysis, nor did we attempt to interpret sounds of the driver, passengers or other noises for the purpose of our analysis.

3. Statistical analysis

We used logistic regression to test a series of model hypotheses that differentiated observed collisions (1) from non-collisions (near misses; 0) where moose were present on or adjacent to roads. Statistical models were adapted from the highway safety programming of Milton et al.

Fig. 1. A screen shot of a moment in one of the 96 videos recorded by Dash Cam and posted to YouTube™ that were analyzed for the purpose of this study.

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