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To signal or not to signal: That should not be the question

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ABSTRACT

The purpose of the present research was to examine rates of turn signal use, a positive and potentially valuable means by which drivers can communicate. A second purpose was to explore factors that might impact these rates, including the modeling influence of other drivers. A series of observations involving more than 5600 vehicles making turns were recorded at a variety of intersections in British Columbia, Canada. Though the occurrence of signal use varied widely, ranging from a low of 54% to a high of 95%, the overall rate was 76%. Drivers used turn signals significantly less often when making right as compared with left turns, when traffic volume was higher, and when a designated turning lane was provided. In addition, compared with drivers following another vehicle not using signals, those following a vehicle with turn signals on were significantly more likely to activate their turn signals, suggesting a possible modeling effect. Both internal and external influences on turn signal use by drivers were considered. External factors explored in this research included direction of turn, traffic volume, intersection configuration, and the example of other drivers. It was concluded that the practice of signaling turns merits more research attention, since consistent use of signals is a potential contributor to enhanced safety for all road users.

1. Introduction

By its very nature, driving a vehicle is a cooperative venture (Dewar and Olson, 2007, p. 260), since every road user occupies the same physical space (sections of streets and roads) as other drivers. The cooperation needed to share the available space depends on good communication. There are several rude or angry ways for drivers to communicate with one another, horn-honking being one of the most common (Ellison-Potter et al., 2001). Whatever specific form they take, these negative messages are often ambiguous. By contrast, ways of sending positive messages are limited. In selected situations, a friendly wave is appropriate. Arm signals can be used to communicate intentions by both car drivers and cyclists (Walker, 2005). But the most effective means of communicating positively with another driver involves the use of turn signals. As many observers will attest, however, drivers make use of this communication device in a disturbingly inconsistent manner (Ponziani, 2012; Response Insurance, 2006).

Turn signals serve the important purpose of alerting other road users to a driver's intention to change course, thus providing time to make any necessary adjustments. But activating a signal before initiating a maneuver may also be valuable for two additional reasons. First, we know that expectancy (as opposed to surprise) can reduce braking reaction time (Green, 2000). When combined with the fact that a changing stimulus is noticed sooner than a steady one, it follows that a blinking turn signal will grab another driver's attention sooner than a headlight or taillight, particularly if it appears in peripheral regions of the visual field (Cohen, 1987). Second, because it represents a voluntary means of communication, signal use provides the potential for a human connection—a non-verbal message that says "I'm here and I want you to be aware of me". In this way, signaling can help to reduce the anonymity drivers experience when encased in cages of steel and glass (Ellison-Potter et al., 2001; Rosenbloom et al., 2009).

Like use of seatbelts or compliance with stop signs, activation of turn signals is widely understood to be both required by law and beneficial for our collective safety. However, little hard data are available as to the rates of turn signal use in North America. Based on a national poll conducted in 2006 on 1000 American drivers, Response Insurance reported that 57% admit to NOT using signals when changing lanes (Response Insurance, 2006). Excuses cited by participants ranged from lack of time, to being lazy, to thinking it is not important or that it adds excitement to driving. The poll also showed that a smaller percentage of male drivers and younger drivers report giving advance notice of their intention to change lanes when compared with females and older drivers.

A handful of studies have employed direct observation to determine turn signal usage rates or to investigate ways to improve those rates. Ludwig et al. (2001) used observational methods as part of a campaign to enhance the safe driving practices of Pizza delivery

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personnel. Their objective was to determine whether a competitive safety campaign that posted individual performance records and offered rewards for improvement could raise the rates of seatbelt wearing, turn signal use, and stop sign compliance among their employees. Based on 6500 observations spread over a ten week period, they reported that for employees of a store targeting this behavior, the rate of signaling when making a turn at a busy intersection increased from 36% to 58%. Although no significance test results were reported, the observed improvement was almost certainly real, since increases in signaling rates during a comparable time period at stores not providing this intervention were 7% or less.

Another study explored the impact of a visual prompt (a large white sign that read 'Please Signal and Drive Safely') on rates of turn signal use by drivers on a university campus (Clayton and Myers, 2007). In an investigation lasting a total of ten weeks and employing an ABABA reversal design, these researchers compared signaling rates during three baseline and two prompting sessions. All observations were made at the same four-way intersection near a three-level parking garage on campus. Signal use rates averaged across the three baseline phases and the two prompting phases were 63% and 87% respectively, indicating a sizeable positive impact for the prompt. During six 1-h observation sessions for each phase, usage rates ranged from a low of 59% to a high of 89%. No meaningful differences were found between left and right turns.

Lebbon et al. (2007) also conducted observations on a university campus, this time at a T-intersection where vehicles had to turn either right or left. Behaviors were always recorded at the same intersection, but were gathered over an eight-month period. The main focus of this study was examination of the impact of traffic patterns on both compliance with the Stop Sign and use of turn signals. They compared traffic and no traffic conditions, defining the traffic condition in terms of another vehicle being within 30 ft of the Stop Sign when the target vehicle arrived at the intersection to make a turn. Full stops were made in 5% of the no traffic conditions and 100% of the traffic conditions; turn signals were used in 63% of the traffic conditions and 44% of the no traffic conditions. The direction of drivers' turns (left or right) was not recorded.

A study conducted in China investigated signals used to indicate planned lane changes (Zhang et al., 2006). Three sites within a large city were monitored by video-recorders and subsequently analyzed. All observations were recorded in good weather conditions. Averaged across locations, signals were used only 40% of the time.

One recent observational study conducted in Dayton, Ohio involved records of signal use by drivers either turning or changing lanes (Ponziani, 2012). All observations were made from a moving vehicle while the author was driving his own car in his home region. Based on 10,000 vehicles seen making turns and 2000 vehicles observed as they changed lanes, the author reported that drivers signaled their turns 75% of the time and signaled their lane changes 52% of the time. No distinction was made between left and right turns and no attempt was made to record road or weather conditions or types of vehicles. Instead, data were gathered in a broad cross section of times of day, weather and traffic conditions, and driving locations.

Based on these studies, it is clear that regularity of turn signal use varies considerably, ranging from reported values as low as 36% to as high of 89%, depending on driver populations, locations, and traffic conditions. To date, there is no solid evidence that signal use varies with direction of turn.

In addition to providing a rough idea of the rate of signal use by drivers, these studies also help to point toward possible influencing factors, particularly traffic patterns and prompts or reminders. The study by Lebbon et al. (2007) suggests the signals are used more consistently when other vehicles are nearby. Clayton and Myers' (2007) study provides evidence that a reminding prompt can be effective in increasing turn signal use, and opens the possibility that the actions of other drivers may exert some influence. The fact that internally generated reminders of the need to use signals may also be influential is suggested by the findings of Ludwig et al. (2001) who discovered that drivers involved in a safety awareness campaign substantially increased their use of turn signals. Further, recent work by Sullivan and Flannagan (2012) suggests that physical characteristics of rear turn signals such as their color may impact crash risk, with amber turning lights linked to fewer strikes during turns compared with red lights. Thus we have suggestive evidence that internal and external factors may both be important.

A number of other studies have examined factors influencing rates of other safe driving practices such as using seat belts or complying with stop signs. Chaudhary and Presseur (2006) found a significantly higher rate of seatbelt use during daylight hours compared with night, suggesting that visibility conditions may impact this behavior. They also found that the rate of seat belt use differed depending on the type of vehicle being driven, with pickup truck drivers being less likely to buckle up. An investigation by Farrell et al. (2007) used prompts to increase seatbelt wearing on a university campus showed that gender of young drivers was related to seatbelt use, and that drivers of both genders were affected by the prompt. In a study of older drivers' compliance with stop signs (Keay et al., 2009), a link between this behavior and the location (rural or urban) was discovered. As well, Rakauskas et al. (2009) found an urban–rural difference in seat belt use, and confirmed a lower use by drivers of pick-up trucks. Based on this evidence, it is plausible that factors such as location, gender of drivers, type of vehicle, and weather or lighting conditions could impact drivers' rates of turn signal use as well.

One additional factor to be considered is the potential influence of observing other drivers using or not using their signals. It can be argued that the demonstrated impact of prompting overlaps with a modeling effect, since both involve a driver's awareness of what others are doing. Applying reasoning based on the theory of planned behavior, Simsekoglu and Lajunen (2008) attempted to better understand the low rates of seat belt use in Turkey. One of the three components of this theory is a person's perception of social norms, and models are one way in which information about normative behaviors is communicated. Similar findings reported by Walsh et al. (2008) provided confirmation that attitudes and social norms also influence drivers' use of cell phones. In addition, Bianchi and Summala (2004) used scores obtained by young drivers and their parents on various subscales of the Driver Behavior Questionnaire to argue that parental modeling is one significant factor in the style of driving which young drivers adopt. Thus, to expect that models might have an impact on a range of driving behaviors including mobile phone use, seat belt use, and turn signal activation seems reasonable.

Nevertheless, one recent study raises a question in this regard (Sato and Akamatsu, 2007). Private cars were fitted with specialized equipment in order to examine factors affecting preparation for intersection turns. The authors found variations in the timing of a driver's slowing and signaling behaviors in advance of a turn as a function of nearby traffic. Though the presence of these vehicles was noted, evidence that they actually affected turn signal activation was weak. Thus, a clear demonstration of a modeling effect on turn signal use has not yet been achieved.

1.1. Purpose

The purpose of the present series of observational studies was to address three related questions: