Effect of Text Format on Determining Tires' Date of Manufacture

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Previous research indicates that most consumers are unaware that older tires can deteriorate and lead to tread separation which could result in crashes. Even if they were to know about this hazard, the task of determining the date of manufacture (DOM) on tires is difficult. In the U.S., consumers must decode a 4 digit number at the end of a longer U.S. Department of Transportation (DOT) identification number in small, black print embossed onto black sidewalls. Eighty-three participants (45 students and 38 adult non-students) were asked to decode 6 different date of manufacture (DOM) markings. Analyses showed that people have difficulty with determining dates in the current U.S. DOT format and that date formats resembling common U.S. date representations were more understandable to participants. Additionally, only half of the participants reported having knowledge of tire aging issues and few have looked at the DOT identification number before participating in this research. Discussed are implications for date formatting, followed by guidance on designing a more consumer-friendly DOM.

INTRODUCTION

Tires are an important safety feature on motor vehicles. In fact, tires are the only part of a motor vehicle that is in contact with the road. Tires are involved in many important operations, such as steering, braking, and accelerating. Tire failures resulting from blowouts and tread separations can lead to catastrophic accidents. From 1994 to 2004, the U.S. National Highway Traffic Safety Administration (NHTSA) estimates that 400 fatalities that occurred each year may have been related to tire failures (NHTSA, 2007).

Several studies indicate that people lack adequate knowledge concerning basic motor vehicle maintenance including their tires (Kalsher, Wogalter, Lim, & Laughery, 2005; Mayer & Laux, 1990; Starch, 1999). These and other studies show that many people report not knowing how to change a flat tire. Few reported having changed a flat tire by themselves. Many drivers also do not know and do not do the practices recommended to maintain proper tire inflation pressure. Driving on tires with incorrect tire pressure can lead to tire failure and loss of vehicle control, as well as other effects such as poor gas mileage and handling (NHTSA, 2001). NHTSA and many manufacturers advise that tire inflation pressure should be checked at least once a month. Most tire maintenance guidelines recommend that motorists refer to the vehicle sticker placard, which is usually located on the driver's side door jam or on the glove box door, or in the vehicle owner's manual for the correct tire inflation pressure. However, many consumers appear unaware of basic tire inflation guidelines and where they can be found (e.g., Starch, 1999). People also report not checking the pressure of tires at all or doing it very infrequently (Kalsher et al., 2005).

In addition to problems with tire pressure, there are other factors that can contribute to tire failure. One is *tire aging*. According to Baldwin, Bauer, and Hurley (2005), as a tire ages, its internal components dry out and the adhesion holding the components together deteriorates. Oxidation and heat accelerate this deterioration, even with lesser-used tires (e.g., spare and recreational vehicle tires) (Baldwin et al., 2005; Kane, 2003). This deterioration can cause tread separation (i.e., tread detaches from rest of the tire) and/or a tire blowout. Some vehicle manufacturers and auto safety advocates recommend replacing tires that are over 6 years from the *date of manufacture (DOM)* because older tires may fail even if the tread looks adequate (Kane, 2003). Spare tires and recreational vehicle tires are particularly vulnerable because they are often stored in extreme temperature conditions for extended durations.

Unfortunately, consumers cannot rely solely on visual inspection to determine if tires have exceeded a safe lifespan. According to Kane (2003), a tire may not show any visual indications of aging because the degradation occurs within its internal structure. Thus, an aged tire can appear to be safe to use even though it is not. Recent research indicates that many consumers are unaware of tire aging and its dangers. Cowley, Kim, and Wogalter (2006) studied people's understanding of tire aging and other tire-related problems, and they found

that only 4% of 225 participants reported tire aging as a potential tire problem. In another study, approximately 25% of respondents over-estimated the tire life span by four years or more (Kalsher et al., 2005). Kalsher et al. also reported that participants over-estimated how long spare tires should be stored in a vehicle trunk. There has been some media exposure about tire-aging hazards associated with aged tires (e.g., ABC News, 2008), and some vehicle manufacturers are including some information on tire aging in owner's manuals (Kane, 2008), such as discarding vehicle tires after 6 years even if the tread appears good. However, this recommendation and the tire aging issue itself do not appear to be widely dispersed to the public. Very few consumer guidelines about tire maintenance and safety mention it at all. Most tire manufacturers do not warn directly about it. Together this suggests that the public is not well informed about tire aging issues, and that efforts are needed to better inform them.

Implementing an effective system to inform and warn about tire aging could be a challenging task. Research shows that many people do not read their vehicle owner's manuals (Cowley et al., 2006; Leonard, 2001; Mehlenbacher, Wogalter, & Laughery, 2002). For example, Cowley et al. (2006) reported that 63.7% of those who reported reading their vehicle owner's manuals (55.1%) also stated that they read less than 50% of the manual. These studies suggest that an effective system needs to use other channels along with owner's manuals to reach consumers.

In the U.S., every tire has a U.S. DOT identification number (DOT number) on its sidewall. The DOT number consists of different codes of information (NHTSA Part 574 – Tire Identification Requirements, 2009), including the *Date of Manufacture* (DOM). The current DOM requirements consist of the week (2-digits) and the year (2-digits) in which the tire was made, but it does not have any notable characteristics indicating that it is the date. It is part of a series of letters and digits, and there is nothing that indicates any significance for consumers. Thus, consumers likely would not know DOM is part of the DOT number (without something additional being given). Moreover, one must know how to locate and decode the 4-digit number at the end of a long sequence of numbers to determine when the tire was made. For example, "1204" at the end the DOT number indicates the 12th week in the year 2004, or in March 2004—it is not December 2004 as some people may guess.

The DOM is the only information consumers and technicians can use to determine if a tire has exceeded its safe lifespan. However, anecdotal evidence suggests that the DOM format is confusing to consumers. According to Kane (2006), the NHTSA obtained feedback from participants in focus groups about the current DOT number format: Most participants could not identify or describe codes in the DOT number including the DOM. Some participants even suggested that the codes needed reformatting to be more understandable to consumers. Despite some evidence indicating that most consumers probably cannot decipher the DOM codes, no research on which formats are better has been published thus far.

To be effective, a warning system for tire aging must increase consumers' hazard awareness of using old tires and provide easily accessible information about the DOM. The tire itself is only one component of an overall tire warning system and probably cannot provide adequate information on the topic of tire aging by itself. Other components of the warning system are needed to communicate that information. However, on-product information on tires can give *some* information such as the tire's DOM and should do it in a way that consumers can find and interpret it.

The primary focus of the present study was to determine if the currently used format in the U.S. of giving the DOM as part of the DOT identification number is interpretable by consumers. The study also explores the effectiveness of several alternative formats for the DOM on consumers' ability to determine the DOM accurately. In the U.S., slashes ("/") are frequently used to designate different parts of a date. One of the alternative formats examined in this research used a single slash to separate the weeks (first 2 digits) from the year in DOM. Another alternative format used two slashes to separate the month, day, and year in the DOM. Ease of use of the date formats were also evaluated.

In this study, participants' task was to decode tire markings in the current DOM format as well as DOMs in the alternative date formats described earlier. Additionally, participants rated how easy they could identify the dates. Lastly, participants were asked if they had been aware of tire aging as a problem before participating in the study and whether they have ever previously looked at the U.S. DOT number on a tire in the past.

METHOD

Participants

One-hundred ten individuals participated, but only 83 were included in the analyses. The reasons for excluding 27 were due to the following: (a) not having a valid driver's license, (b) not having regular access to a vehicle, or (c) substantially incomplete or erroneous answers. In the resulting sample, there were 40 males

and 43 females, with an overall mean age of 29.8 years, *SD* = 13.4, ranging from 16 to 64 years. Forty-five were students (age *M* = 20.1 yr, *SD* = 1.6) and 38 were non-student adults (age *M* = 41.3 yr, *SD* = 11.9) from the surrounding community of central North Carolina.

Materials and Procedure

Each participant completed a multi-topic questionnaire that included a consent form and demographics form (gender, ethnicity, age, education). Participants were asked several questions related to tire markings.

Tire markings. Participants wrote the dates that they believed corresponded with the following 6 tire markings: (a) 2205, (b) 12/05/07, (c) 03/01, (d) 41/07, (e) 03/06/09, and (f) 1102. These markings were printed in reverse order for half of the participants.

Participants were instructed to imagine these markings as being printed on actual tires. To give some context detailed tire pictures were shown on the questionnaire page with the date markings.

Participants wrote their answers in the blanks next to the dates. One set of blanks was for answers in the month/year format and the other for answers in week/year format. The set of blanks designated for month/year had two blanks for the month and four blanks for the year (i.e., _ _/_ _ _ _); these blanks were labeled below with "MM/YYYY." The blanks for week/year were labeled with "WW/YYYY." Participants were told they could use either month or week format in giving their answers.

Additionally, there was another set of blanks associated with the date markings for responses to the question on how easy it was to determine the date from the marking. Participants used a 9-point Likert-type scale to rate each marking. The scale contained text descriptions at the even number anchors: 0 = *Not at all easy*, 2 = *Somewhat easy*, 4 = *Easy*, 6 = *Very easy*, and 8 = *Extremely easy*.

Other items. Participants reported whether they had previous knowledge that auto manufacturers recommended replacing used and unused tires after a certain amount of time. They were also asked if they ever looked for the DOT number printed on tires. They responded to both questions with a yes or no.

RESULTS

Accuracy for the date markings were scored by giving participants one point for answering with the correct date and no points for responding with an incorrect date. The date markings *2205* and *1102* were based on the current DOT's DOM rule. With the DOT rule, the first two digits refer to the number of weeks and last two refer to the year. Markings *03/01* and *41/07* were also based on the current rule but were slightly different in format because they included the slash separating the weeks from the year.

Participants responded by writing the dates in either of two formats: week/year or by converting them into month/year. Several of the date markings could represent either weeks or months. The four date markings with four digits were scored using the DOT's DOM rule in which the first two digits are the week of manufacture (ranging from 01 to 52) and the last two digits represent the year. For these four dates, all the participants needed to do to be correct were to put these exact digits into the week/year blanks directly. They did not need to use the month/year blanks at all. It is possible to get the DOM correct in months/year by conversion from week/year but it would be more difficult.

The date designations are described below. Using DOT's DOM rule, *2205* indicates the 22nd week which translates to the 5th month (May) of 2005. The date marking *03/01* corresponds to the 3rd week which translates to the 1st month (January) of 2001. This marking was designated to represent week and year (because of the DOT's DOM rule) but it could have been designated as month and year because 03 could also indicate the third month (March). The latter interpretation was counted as incorrect in the present study. The date marking *41/*07 indicates the 41st week, which translates to the 10th month (October) in 2007. Marking *1102* was designated to indicate the 11th week, which translates to the 3rd month (March) in 2002. This marking was designated to represent week and year (because of the DOT's DOM rule), but it could have been designated as month and year because 11 could also indicate the 11th month (November). The latter interpretation was counted as incorrect in the present study. Participants could translate these week/year dates to month/year dates from the week/year designation and if done properly would be scored as correct.

The date markings *12/05/07* and *03/06/09* used common U.S. date abbreviations: month/day/year. Date marking *12/05/07* indicates the 12th month (December) of 2007 or could be correctly translated to the 48th week in 2007. Marking 03/06/09 corresponds to the 3rd month (March) of 2009 or translates to the 9th week of 2009. Table 1 shows the frequencies of correct responses to all of the markings.

Table 1. *Frequencies of correct answers as a function of date format and date marking.*

	Format					
	MM/YYYY			WW/YYYY		
Date Marking	*n*	Freq.	Prop.	*n*	Freq.	Prop.
2205	23	4	.17	60	60	1.00
12/05/07	81	81	1.00	1	0	.00
03/01	75	0	.00	7	7	1.00
41/07	21	4	.19	59	59	1.00
03/06/09	80	79	.99	2	0	.00
1102	64	0	.00	18	17	.94

Responses in Month/Year Format

As can be seen in Table 1, the two markings, with the highest accuracy were *12/05/07* (100%) and *03/06/09* (99%). Only a small proportion of participants, less than 20%, was accurate when converting *2205*, *03/01*, *41/07*, and *1102* from week/year format to month/year. Markings *03/01* and *1102* had the lowest accuracy (0%) but if the correct date answer had been designated as month an year than accuracy would have 100%. On average, 57 participants chose to interpret the date markings in month/year format while an average of 25 participants interpreted the markings in the week/year format.

Responses in Week/Year Format

Table 1 shows that participants provided the correct dates for *2205* (100%), *03/01* (100%), *41/07* (100%), and *1102* (94%) when they wrote the dates in the same format as the format in which the markings were designated. Only 22% of participants provided a date in week/year format for marking *1102* and 9% did the same for marking *03/01*. On the other hand, a much larger proportion of the study sample interpreted *2205* and *41/07* in the week/year format.

Ease of Identifying Dates

Table 2 shows the means and standard deviations of perceived ease of determining dates for the six markings, arranged in order from highest rated to lowest rated. The range of the most extreme ratings was nearly four rating-scale points. Participants rated markings *12/05/07* ($M = 6.65$) and *03/06/09* ($M = 6.59$) as the easiest to identify as dates. The lowest rated were *41/07* ($M = 3.53$) and 2205 ($M = 2.73$). The highest standard deviations occurred for *1102* ($SD = 2.62$), *41/07* ($SD = 2.61$), and *2205* ($SD = 2.34$).

Table 2. *Mean ratings for perceived ease of identifying dates.*

Date Marking	*n*	*M*	*SD*
12/05/07	82	6.65	1.91
03/06/09	81	6.59	2.17
03/01	81	5.48	2.10
1102	80	3.63	2.62
41/07	79	3.53	2.61
2205	82	2.73	2.34

Replacing Tires and Checking DOT Number

Forty-three (51.8%) participants reported they were not aware that tires—new or used—need to be replaced after a certain time. Only 6 (7.2%) participants reported to have ever checked the DOT number on tires.

Non-student vs. Student Analyses

Responses to tire marking questions were analyzed as a function of student status (student vs. non-student). No difference was found between the students' and the non-students' responses ($p > .05$).

DISCUSSION

This research examined whether people can accurately interpret the date of manufacture (DOM) of tires in the current U.S. DOT format and in a set of alternative date formats. The results indicate that the DOM code as it is currently mandated is not consumer friendly. Tire DOMs should be provided in ways that consumers can use it to make quality decisions about their tires.

Most participants were able to identify the appropriate dates in month/year format for DOMs designated in month/day/year. The month/day/year date representation is commonly-used in the U.S. and the use of week/year is not. Based on previous experience, participants likely had the expectation that the dates were in months not weeks.

Although accuracy was high for month/day/year markings, it might be important to mention that some consumers could confuse this commonly-used U.S. date abbreviation with the international date abbreviation, day/month/year. Letters such as Jan or Feb might help clarify the 3-part dates.

The results show that people do not use the week/year format except when the numbers do not fit the month/year format. Participants generally assumed the dates were in the month/year format unless the date forced to them to use the week/year format as in *41/07*. Accuracy was low when participants chose to write the month and year of markings that were designated to be

week/year. Some participants used an arithmetic shortcut (week number divided by 4, the average number of weeks in each month) to answer in months, reducing accuracy somewhat. These results suggest that tires should convey the DOM in ways consistent with U.S. consumers' expectations of how dates are represented.

It is noteworthy to mention why no participants correctly identified the date for *1102* in month/year format. Participants assumed this marking was designated in month and year, but it was actually designated to be in week/year format to be consistent with current U.S. DOT formatting requirements.

In addition to decoding DOMs, participants rated how *easily* they could identify the date associated with each DOM. When they did this, they had not been given feedback on the correctness of their DOM answers. They reported that it was easiest to identify DOMs in a month/day/year representation than the other formats. Moreover, they reported that it was more difficult to identify dates for the markings in the currently-used format. Participants rated *41/07* and *2205* as being the most difficult to determine as dates. These date markings forced participants to consider formats to which they were not familiar.

There was one other notable finding in the ratings. Participants rated marking *03/01* as easy to recognize as a date even though most participants did not give the correct date in month/year format. This might suggest that designating DOM in month/year with the slash would help people identify the DOM more easily. Together, these ratings along with the accuracy results strongly suggest that U.S. DOT's current DOM format is not very easy to use.

The method by which consumers are currently informed of the DOM of tires needs to be changed. A change is necessary because safety is involved, particularly the tire aging issue. One limiting factor to making the date more apparent and easier to use is that tire manufacturers are currently required to give the DOT number as specified by law. At the same time, manufacturers have a responsibility to ensure that consumers are provided adequate information for safe use of the product. If the U.S. DOT retains the current DOM code, then this does not mean that tire manufacturers are prevented from using other methods to communicate the DOM to consumers. Tire manufacturers could put the DOM in a clear format elsewhere on the tire, separate from the DOT number. Some difficulty might be involved in giving exact DOMs (as in month/day/year) because tire manufacturers would need to make daily changes to tire molds and/or the embossing process to display exact dates. However, manufacturers should not have substantial difficulty giving the DOM in the month/year directly on the tire in a way that is clear and understandable to consumers. Future studies should be conducted to examine whether including the DOM consisting of an abbreviated month in text rather than numerically (e.g., JAN vs. 01) facilitates communication of DOM.

When tires are sold new, they come with removable paper labels on the tread. Some consumers never see these labels because they are removed when the tires are installed or they are left on the tire and are worn off after some initial use. With some modest changes to the paper tire-tread label, communication of the DOM could be further improved. Once a tire is purchased, sellers or technicians could be instructed to remove a portion of a sticker from that tire's tread label with the DOM and place the sticker on the door jam and/or on the bill of sale. These and other potential methods could be used to more effectively convey DOM to vehicle owners.

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