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Learning from what might have been:

Lessons learned (or not learned) from accidents and near-accidents

Jens Andreas Terum Frode Svartdal

UiT The Arctic University of Norway, Tromsø, Norway

Corresponding author:
Jens Andreas Terum

Department of Psychology

UiT The Arctic University of Norway

9037 Tromsø, Norway

Tel (+47 77600785)

jens.a.terum@uit.no

Abstract

What do people learn from accidents and near-accidents? Experience with accidents tends to make us more cautious, whereas near-accidents are inherently ambiguous: On the one hand they signal that margins were good enough, on the other hand, they contain information that could induce increased caution. To explore these issues, participants (N = 614) reported on their experiences with traffic accidents and near-accidents, assessing changes in cautiousness as well as cognitive (i.e., counterfactual thinking) and emotional mechanisms possibly involved in learning from such experience. The results indicate that people become more cautious after accidents and even more so from repeated exposures to accidents, but near-accidents had little effect on cautiousness. Downward counterfactuals, thinking about worse possible consequences, do not appear to directly motivate corrective action following near-accidents, but near-accidents leads to cautiousness when people feel personally responsible for causing the incident.

Keywords: Counterfactual thinking, emotion, near misses, learning from experience.

The aim of this article is to investigate how and what people learn from accidents and near-accidents. Individuals and organizations learn from obvious failures (e.g. Ellis, Carette, Anseel, Lievens, 2014; Reason, 1997), but less is known about the lessons learned from mere incidents and near-accidents. There are more incidents than accidents, and therefore incidents could potentially be a potent source of learning. However, incidents and near-accidents are inherently ambiguous and can be interpreted both as a wakeup call highlighting a potential source of danger (McMullen & Markman, 2000) or as a success indicating that margins were good enough (Dillon & Tinsley, 2008, Plous, 1991; Tinsley, Dillon & Cronin, 2012). We investigate this dilemma by asking people about thoughts and emotions following accidents and near-accidents in traffic and the degree to which prior incidents inspire caution or confidence. Overall, increased caution should result from having experienced one or more accidents. As for near-accidents, the outcome is more uncertain. Hence we explore the role of counterfactual thoughts and feelings in the learning process related to such events. Before presenting our study, we first review the rather comprehensive literature related to these questions.

Learning from accidents versus near-accidents

We assume that people learn from accidents. Negative events tend to grab our attention, lead to more thorough and detailed-oriented processing of information, and motivate cognitive activity aimed at understanding what went wrong (Liberman, Gaunt, Gilbert & Trope, 2002; Markman, Lindberg, Kray & Galinsky, 2007). Whereas the hindsight bias (Fischoff & Beyth, 1975; Roese & Vohs, 2012) – the tendency to overestimate how predictable an event was before the outcome was known – sometimes leads to overconfidence and complacency (Wilson & Gilbert, 2009), negative events typically trigger counterfactual thinking and corrective action (Epstude & Roese, 2008; Roese, 1997). According to

contemporary theories, such learning can come about by two different routes. One route is via a content-specific pathway, where the negative affect associated with a blocked goal activates upward counterfactual thoughts specifying how a better possible outcome could have been achieved (Roese, 1994). Alternatively, learning might occur via a content-neutral pathway, improving performance via a more general activation of enhanced attentional, cognitive or motivational processes (Epstude & Roese, 2008; Smallman & Roese, 2009). In either case, failures tend to activate thoughts or mindsets that help improve future performance.

Learning from near-accidents is less straightforward. In order to determine whether a given outcome is a success of failure, we must rely on some reference information, typically social (Festinger, 1954), temporal (Albert, 1977; Wilson & Ross, 2000) or counterfactual (Kahneman & Miller, 1986; Markman & McMullen, 2003), to serve as a comparison standard for the evaluation. Comparing reality to a better alternative (upward comparison) typically results in negative affect and signals that corrective action is required. Thinking that things could be worse (downward comparison) results in positive affect and indicates that margins were good enough. Consequently, whether an outcome is considered a success or failure is influenced by the counterfactual alternative to which it is compared. This phenomenon has been termed an affective contrast effect (McMullen 1997; Roese, 1994), as affective evaluations depend on the contrast, or difference in valence, between actual events and imagined alternatives. Highly salient counterfactuals tend to highlight the contrast between the actual outcome and a counterfactual alternative, which in turn intensifies emotional reactions to the actual outcome (Kahneman &Tversky, 1982). One interesting aspect of this effect is that negative outcomes (spraining your arm) might be evaluated positively if it is easy to imagine a counterfactual that is even more negative (breaking your arm) (e.g., Teigen, 1995). This can even lead to a *satisfaction reversal* such that people who are objectively worse off feel better about the outcome (Medvec, Madey & Gilovich, 1995; McMullen &

Markman, 2002), and are more optimistic about future success (Clark et al., 2013; Wohl & Enzle, 2003; Zhang & Covey, 2014).

Affective contrast and the near-miss bias

As research on the affective contrast effect suggests, a problem with learning from near-accidents is that they might not even trigger the attentional, cognitive and attributional resources required to search for and detect the warning signals embedded in a near-miss. This is what Dillon and Tinsley (2008) found when studying near-misses in organizational decision making. Consistent with an outcome bias (Baron & Hershey, 1988), Dillon and Tinsley reported that the evaluations of decision outcomes were heavily dependent on final outcomes. Near-misses, situations where a negative outcome is feared but avoided, were evaluated similarly to successes and significantly more favorable than failures. This was true both for final outcomes and of the decisions leading up to it (see Svartdal, 2011, for similar results). In explaining their results, the authors draw on Kahneman and Varey's (1990) distinction between events that could have happened vs. events that almost happened. While both are hypothetical or counterfactual alternatives to the actual outcome, they differ in that the first depends on preexisting beliefs and expectations (i.e., the event's disposition) whereas the latter depends on situational event cues (i.e., propensity). Events perceived as having a high propensity for occurring, but did not, tended to inspire counterfactual thinking and a sense of urgency. Near-misses with merely a high propensity for occurring, but were situation-specific details did not indicate that an alternative outcome was "close" to occurring, resulted in "disposition neglect" and tended to inspire complacency.

Dillon and Tinsley (2008) termed this a near-miss bias, and reported that exposure to certain types of near miss experiences do not only fail to act as a warning signal, but may even promote risky decision-making. This increased willingness to take risk seem to be connected to the process by which people update risk estimates, but appears to be affective

rather than cognitive. Thus, faced with a near-miss event, people do not seem to be adjusting the subjective probability of an unfortunate outcome downward, in accord with Bayesian updating. Rather, in line with a dual process account of information processing (Kahneman & Fredriks, 2005), a near-miss event contains case-specific information that triggers associative (system 1) reasoning and an update of the relevant hazard category in memory. Consequently, we subsequently perceive the category to which the risk belongs as less affectively threatening and become more risk accepting in future decision making. A potential consequence of this process is that repeated experience with near-accidents will serve to increase one's sense of safety, as each additional experience confirms the safety of the situation or hazard. Furthermore, this change in perceived risk is likely to be domain specific rather than general, but still applies to classes or categories of hazards rather than specific instances.

Near-accidents and avoidance motivation

The research discussed indicates that near-accidents might sometimes inspire more confidence than caution. However, an alternative line of research suggests an opposite expectation. Whereas studies on the affective contrast effect and its consequences for future optimism have largely focused on the benefit of upward counterfactuals for approach motivation (e.g. Wohl & Enzle, 2003; Zhang & Covey, 2014), some studies have investigated the effect of downward counterfactuals for avoidance motivation (e.g. Markman et al., 2006; McMullen & Markman, 2000, 2003, Pennington & Roese, 2003). McMullen and Markman (2003) studied the motivational implications of thinking about how things could have been worse. In their Reflection and Evaluation Model (REM) they distinguish between two processing modes: reflection and evaluation. The evaluation process involves using a counterfactual outcome as a standard of comparison to evaluate the factual outcome, and typically leads to the affective contrast effect described previously. Reflection, on the other

hand, involves mentally simulating and experientially reflecting on the counterfactual as if it were true. The REM-model therefore generally suggests that negative affect, and the motivation that accompanies it, can come about by two different routes. One is by contrasting reality to a more favorable alternative (upward contrast), the other by vividly imagining a worse possible scenario thereby assimilating the negative affect associated with that outcome (downward assimilation). This assimilation effect could be an important component in avoidance motivation, as is at least implicitly suggested by studies of people having experienced accidents and near-accidents (Teigen, 1995).

Although upward counterfactuals appear to be the automatic default and are generally more beneficial for learning (e.g. Morris & More, 2000), people who have been in dangerous situations appear to be quite insistent on rather dramatic downward counterfactuals and tend to imagine that the outcome could have been much worse (Teigen, 1995, 1996). Consequently, reports of good luck, relief, and even gratefulness are particularly frequent in situations characterized by risk and hazards (Teigen 1997, 1998a; Teigen & Jensen, 2011). The positive emotions in such situations are possibly the result of the affective contrast effect, but we argue that these findings could still represent a functional mechanism to the extent that such incidents may represent "close calls" that one should try to avoid in the future. Here we differentiate between the affect activated by situational cues that triggers immediate counterfactual thinking (Roese, 1994, Russell, 2003), and the full-blown conscious emotions (relief, gratitude) that stimulate further counterfactual analysis and elaboration over behaviour and possible outcomes in the aftermath of the situation (Baumeister, Vohs, DeWall, & Zhang, 2007; Epstude and Roese, 2008; Roese, 1994). For avoidance motivation, downward counterfactuals and the emotions that accompany them may be particularly useful for driving home lessons for the future after near-accidents. To praise oneself as a lucky survivor, one must first reflect on how one easily could have been an unlucky victim. This last point is

additionally supported by findings showing that people appear to exaggerate both the potential consequences (Teigen, Kanten & Terum, 2011) and the post-hoc probabilities for counterfactual outcomes (Teigen, 2005), suggesting that such exaggerated evaluations may be important in learning from near-misses.

The present study

The ambiguity inherent in near-accident experiences makes such experiences particularly interesting in real-life settings. Do we at all utilize potentially important information following near-accidents to regulate future action, and if we do, what are the possible mechanisms that induce increased caution vs. boosted confidence? In the present study, we asked people about their thoughts and feelings following accidents and near-accidents in traffic. Our primary outcome variable was the degree to which the experiences have made them become a more careful driver. Based on the literature reviewed, accidents should make people become more cautions drivers, but near-accidents should not. Furthermore, as an accident signals that an important barrier was breached, repeated experiences with accidents should increase caution. On the other hand, repeated experience with near-accidents, as they signal both resilience and vulnerability, should not necessarily induce more caution; on the contrary, repeated experience with near-accidents might have an opposite effect, as each additional experience confirm that margins were good enough.

As previous research also indicates that thoughts about what *could have happened*, and the emotions that accompany them, might be an important determinant for the lesson people learn, we explore the role of thoughts and emotions for learning after accidents and near accidents. Specifically, we explored whether participants (1) report more intense emotions after accidents compared to near-accidents. This could be expected, as accidents are events that actually happened whereas the main emotion-evoking stimuli after near-accident is something that could have happened, a hypothetical event. We also explored (2) whether

people experience different emotions after accidents compared to near-accidents. One could expect learning from accidents to be mainly associated with negative emotions, as they clearly signal that corrective action is required. Learning after near-accidents, on the other hand, are perhaps more strongly associated with emotions signaling that something was feared, but avoided. If so, emotions indicating affective contrast, such as gratitude and relief, would be a stronger predictor for learned carefulness. Finally, we (3) explored the role of counterfactual thoughts for learning after accidents and near-accidents.

Method

Participants. 614 participants (367 women) were recruited via various social media platforms (Reddit, Facebook) and from a university mailing list. Participants were primarily of Norwegian nationality. The majority were aged 18-23 (34%) and 24-29 (44%), while 21% were aged 30-38 and only 1% were 39 or older. Participants that did not have a driver's license (9%) were removed from the analysis. The vast majority of participants (98%) were living in one of the three northernmost counties of Norway. Data from 17 respondents were removed prior to analysis due to incomplete data.

Material and procedure. We developed and distributed a questionnaire using survey software from Qualtrics (Qualtrics, Provo, UT). All participants received the same questionnaire, introduced as a study "…aimed at understanding risk behavior and accident experiences among drivers." Participants read that the survey would take approximately 15-20 minutes to complete, that participation was voluntary, and that one could exit the survey at any time. Participants were asked to provide relevant demographic information (sex, age, place of residence, and the year they acquired a driver's license). To ensure participant's anonymity, we collected information about age in five-year intervals, and residency was only specific to county and country. We did not collect IP-addresses. Participants first answered 60

questions concerning typical driving behaviors. These questions were relevant to a different project that is not reported here.

The questions relevant to the present article started by asking participants whether they had previously been in a traffic accident. Predefined alternatives were: “never, once, twice, 3 - 4 times or five-or-more”. Participants who had experienced at least one accident were then asked to think of a specific accident and evaluate (a) what *actually* happened and (b) what *could* have happened on separate six-point scales (1 = very negative, 6 = very positive). Six-point scales with no midpoint were used to facilitate outcome coding as either positive or negative. The scales were reverse-coded into negativity scales prior to analysis. Participants also rated their feelings of unpleasantness, anger, regret, relief, joy and gratitude during the incident on five-point scales (1 = not at all, 5 = very much). Unpleasantness and relief were intended as measures of general affect, regret, and anger as measures of specific self-focused and other-focused negative emotions, and joy and gratitude as self-focused versus other-focused positive emotions. Participants were then asked to which degree the accident had contributed to making them a more careful driver on a five-point scale (1 = not very much, 5 = very much).

Next, participants were asked to indicate previous experience with near-accidents, to evaluate both the factual and counterfactual outcome on separate six-point scales, and to rate their feelings of unpleasantness, anger, regret, relief, joy and gratitude during the incident, in the same manner as for the previous question about accidents. As we were particularly interested in *near-accidents* in this study, we also asked participants to evaluate the degree to which they felt (a) personally responsible for causing the incident, (b) that someone else was responsible for causing the incident, (c) they felt causally responsible for resolving the situation, and (d) whether someone else was responsible for resolving the situation. Answers were to be provided on four separate five-point scales (1 = not at all, 5 = very much).

Furthermore, participants were asked to consider how the incident could have turned out differently, and formulate the considered sentiment with and if-then statement in an open-ended sentence completion task. To illustrate, participants were provided with two example statements (one additive and downward; the other subtractive and downward). Finally, participants were asked to indicate the degree to which the near-accident had contributed to making them a more careful driver on a five-point scale (1 = not very much, 5 = very much). Finally, participants were thanked for their participation and debriefed.

Results and discussion

Both accidents and near-accidents were quite common in our sample, with near-accidents (reported by 438 of 597 participants) more common than accidents (reported by 256 of 597 participants) overall. A Spearman rank-order correlation indicated that there was a low but significant correlation between number of accidents and near-accidents experienced by participants, $r_s(597) = .247$, $p < .05$. Experience with one (n = 141; 25.5%), two (n = 112; 18.7%), three or four (n = 105; 17.61%), or five or more (n = 80; 13.4%) near-accidents were more common compared to experience with one (n = 152; 25.5%), two (n = 77; 12.9%), three or four (n = 26 4.4%) or more than five (n = 1; 0.2%) accidents. The one respondent who reported experience with five or more accidents were included in the group reporting experience with three or four accidents in further analysis.

Caution following accidents and near-accidents

Overall, as is seen in Table 1, participants reported that they had become more careful as a consequence of the accident ($M = 3.27$; $SD = 1.38$). Furthermore, repeated experience with accidents tended to lead to increased caution, $F(2, 253) = 7.50$, $p = .001$. Post hock analysis with a Bonferroni correction showed that change occurred primarily after two accidents ($M = 3.69$; $SD = 1.31$) vs. one ($M = 3.00$; $SD = 1.35$), $F(1, 253) = 13.29$, $p < 0.001$. There was no difference between people reporting experience with two as opposed to three or

four accidents (*M* = 3.59; *SD* = 1.45), *F*(1, 253) = 0.1, *ns*. Note however that only 27 participants reported experience with three or more accidents. For near-accidents, the results were different. Overall, participants reported that they had become more careful after near-accidents (*M* = 3.07; *SD* = 1.36), but no change in caution appeared following repeated exposure to such incidents, *F*(3, 428) = 1.13, p = .335

Table 1

Mean and Standard deviation of reported carefulness for accidents and near-accidents depending on number of experiences

	Caution following accidents and near-accidents				
	One	Two	Three or four	Five or more	Total
Accidents	3.00 (1.35)	3.69 (1.31)	3.59 (1.45)	*Na.*	3.27 (1.38)
Near-accidents	3.08 (1.42)	3.19 (1.27)	3.14 (1.38)	2.84 (1.35)	3.07 (1.36)

As 196 participants in our sample reported having experienced both accidents and near-accidents, the effect on accidents on caution can be directly compared in two ways, first, by comparing the degree to which accidents and near accidents inspire caution, and secondly, by comparing the degree to which people report more caution with repeated experience with accidents and near-accidents, respectively. A mixed ANOVA with accident type (near-accident vs. accident) as a within-group factor and number of experiences with accidents and near accidents as separate between group factors indicated a marginally significant tendency for people to report becoming more cautious after accidents (*M* = 3.40; *SD* =1.38) compared

to near-accidents (M = 3.24; SD =1.37), $F(1, 190) = 3.77$, $p = .054$. Furthermore, there was a marginally significant main effect of number of accidents, $F(2, 190) = 3{,}13$, $p = .046$, indicating that people do become more cautious with repeated accident experiences. Post hoc analysis qualified this by showing that two accident experiences (M = 3.86; SD = 1.28) inspired more caution than one (M = 3.11; SD = 1.34), $F(190) = 14.04$, $p < .0001$, but no difference appeared between people who reported two versus three or more accidents (M = 3.52; SD = 1.48) accidents, $F(190) = 1.05$, *ns*. However, there was no main effect of number of near-accidents, indicating that repeated experience with near-accidents did not inspire more caution, $F(3, 190) = 1.38$, $p =$ ns. In summary, accidents tended to inspire more caution than near-accidents, and repeated experience with accidents lead to increased caution whereas repeated experience with near-accident did not.

Possible mechanisms in learning from accidents and near accidents

Intensity of emotional reactions. Contrary to our expectation, emotional reactions appeared to be less intense after accidents than after near-accidents, both for positive (accidents: M = 2.67; SD = 1.22 vs. near-accidents: M = 3.06; SD = 1.15) and negative (accidents: M = 2.48; SD = 1.03 vs. near-accidents: M = 2.85; SD = 1.04) emotions. Furthermore, positive and negative emotions were positively correlated both for accidents ($r(256) = .14$, $p < .05$) and near accidents ($r(256) = .40$, $p < .05$). However, there was no association between the number of accidents participants had experienced and the intensity of their emotional reactions for either positive ($r_s(256) = -.002$, $p > .05$) or negative emotions ($r_s(256) = .09$, $p > .05$). The same was found for positive ($r_s(437) = -.07$, $p > .05$) and negative ($r_s(437) = -.09$, $p > .05$) emotional reactions after repeated experience with near-accidents.

By looking at participants who had experienced both accidents and near accidents, we could compare their respective effect on the intensity of emotional reactions directly. A repeated measures ANOVA with type of incidents (accident vs. near-accident) as one within-

group factor and type of emotion (positive vs. negative) as a second within-group factor showed that emotional reactions after accidents (M = 2.65; SD = 1.10) were less intense than after near-accidents (M = 2.93; SD = 1.11), $F(1, 197 = 29.19, p < .0001)$. However, there was no main effect of positive versus negative emotions ($F(1, 197) = ,71, p = ,40$) and no interaction effect ($F(1, 197) = ,42, p = ,52$). Thus, participants reported stronger emotional reactions on both positive and negative emotions after near-accidents than after accidents, and positive and negative emotions were in both cases positively correlated. Furthermore, there was no change in the intensity of emotional reactions depending on the number of incidents participants had experienced.

Differences in kinds of emotions. We ran separate multiple regression analyses to investigate how well the six rated emotions (i.e., unpleasantness, anger, regret, relief, joy, and gratitude) experienced during accidents and near-accidents predicted changed carefulness.

Regressing carefulness on emotions experienced during accidents explained 17.8% of the variance, $R^{2 =}$ .18, $F(6, 249) = 10.23, p < .0001$. The negative emotions of regret (β = .28, $p < .001$) and unpleasantness (β = .22, p = .001) were associated with increased carefulness, whereas anger (β = - .13, p = .041) was negatively associated with carefulness. However, no significant association was observes between positive emotions and increased carefulness, neither for joy (β = - .107, p = .14), gratitude (β = .106, p = .17), nor relief (β = .07, p = .373).

Regressing carefulness on emotions experienced during near-accidents explained 24.5% of the variance, $R^{2 =}$ .26, $F(6, 415) = 23.79, p < .0001$. Again, the negative emotions of unpleasantness (β = .36, $p < .0001$) and regret (β = .20, $p < .0001$) were positively associated with increased carefulness, whereas there was a weak negative association with anger (β = - .09, p = .05). There was no significant association between carefulness and the positive emotions of joy (β = - .04, p = .42), gratitude (β = .11, p = .06), or relief (β = .03, p = .58). Thus, the mix of positive and negative emotions were similar after accidents and near-

accidents in our sample. For both types of outcomes, negative emotions were significantly associated with carefulness, whereas positive emotions were not. Specifically, unpleasantness and regret were most strongly associated with carefulness for both types of incidents.

Direction of counterfactual comparison. Participants also rated the factual and counterfactual outcomes of both accidents and near-accidents on a general positive - negative dimension. In both cases, the counterfactual outcome – what could have happened? – tended to be more negative than what actually happened. The outcome of accidents were rated as slightly positive (M = 2.72; SD = 1.49), but the counterfactual outcome was clearly negative (M = 4.37; SD = 1.56), $F(1, 248) = 165{,}17$, $p < .0001$. The same pattern was observed for the factual (M = 2.24; SD = 1.46) and counterfactual outcome (M = 4.88; SD = 1.31) of near-accidents, $F(1, 428) = 768.39$, $p < .0001$. Furthermore, data from participants who had experience with both accidents and near-accidents indicate that accidents were rated as more negative (M = 2.67; SD = 1.45) than near-accidents (M = 2.43; SD = 1.54), $F(1, 192) = 6.43$, $p = .01$. Counterfactual outcomes, on the other hand, were rated as more severe for near-accidents (M = 4.91; SD = 1.39) than accidents (M = 4.38; SD = 1.57), F (1, 193) = 17.63, $p < .0001$. However, the correlations between factual and counterfactual outcome evaluations and learned carefulness were low. For accidents, learned carefulness did not correlated significantly with the actual outcome ($r(256) = -.09$, $p > .05$) and only weakly with the counterfactual outcome ($r(256) = -.09$, $p < .14$). For near-accidents neither the factual ($r(423) = -.05$, $p > .05$) nor counterfactual ($r(423) = -.06$, $p > .05$) outcome correlated with learned carefulness. Furthermore, learned carefulness was only weakly correlated with the absolute value of the contrast between the factual and counterfactual for both accidents ($r(249) = .05$, $p > .05$) and near-accidents ($r(423) = -.01$, $p > .05$). These results indicate that although downward counterfactuals were most common after both accidents (69%) and near-accidents (81%), and tended to be more extreme after near-accidents compared to accidents, learned

carefulness did not appear to be contingent on either evaluations of what did happened, considerations about what could have happened, nor the contrast between the two.

Self-focused versus other-focused counterfactuals. As we were particularly interested in near-accidents in the present study, participants were asked to indicate who were responsible for causing the near-accident, either themselves or someone else, and who were responsible for avoiding an even more serious incident. Regressing learned carefulness on the four variables measuring causal responsibility explained 10.4% of the variance, $R^2 = .11$, $F(4, 424) = 13.47$, $p < .0001$. Personal responsibility in causing the accident was positively associated with carefulness ($\beta = .31$, $p < .0001$), whereas others responsibility in causing the incident ($\beta = -.01$, $p = .85$), or oneself ($\beta = -.05$. $p = .40$) versus others ($\beta = .06$, $p = .23$) responsibility in avoiding an even more serious accident, were less important and not significant.

If –then statements decoded. Participants also completed an if-then statement indicating how the situation could have turned out differently. These counterfactual statements were coded by two independent raters as upward vs. downward, self-focused vs. other-focused, and additive vs. subtractive. Disagreements between raters were resolved by discussion. A factorial between-groups ANOVA showed a significant main effect of direction of comparison, indicating that people learned more caution from upward ($M = 3.33$; $SD = 1.38$) compared to downward comparisons ($M = 2.75$; $SD = 1.37$), $F(1, 198) = 6.46$, $p < .05$. Furthermore, participants who generated self-focused ($M = 3.91$; $SD = 1.09$) counterfactuals learned more than participants who generated other-focused counterfactuals ($M = 2.77$; $SD = 1.38$), $F(1, 198) = 8.15$, $p < .05$. There was no significant main effect of additive vs. subtractive counterfactuals ($F(1, 198) = 2.96$, $p = .09$) and no significant interactions. Thus, these results indicate that learned carefulness after near-accidents appears to be contingent on self-focused, upward counterfactuals.

General discussion

The present research investigated thoughts and feelings following accidents and near-accidents in traffic, and explored whether such experiences had made respondents more careful drivers. We expected that accidents would lead to increased caution, but presented two lines of argument with opposing expectations about the effect of near-accidents. According to the near-miss bias literature, no change in carefulness should result. According to the counterfactual thinking literature, near-accidents could be expected to "scare people straight." The results can be summarized as follows: (a) People reported increased carefulness after both accidents and near-accidents, but significantly more so after accidents than near-accidents. Particularly notable was the result that people do not report becoming more careful after repeated experience with near-accidents, but they did after repeated experience with accidents. Examining possible mechanisms, these results could not be explained by (b) differences in the intensity of emotional reactions, as near-accidents gave rise to more intense emotional reactions of both positive and negative valence compared to accidents, or (c) differences in the kinds of emotions elicited by the different outcomes. Instead, (d) changes in carefulness was primarily determined by how unpleasant the situation had been and how much regret participants felt about the situation. Furthermore, (e) although the counterfactual outcomes were rated as more negative compared to factual outcomes, and the contrast between factual – counterfactual outcomes were more pronounced for accidents than near-accidents, these outcome evaluations correlated only weakly with learned carefulness. However, (f) participants own reflections about near-accident experiences, as expressed through the completions of if-then statements, clearly showed that self-focused upward counterfactual were associated with learned carefulness.

The finding that near-accidents inspire less caution than accidents is consistent with previous studies demonstrating a near-miss bias following near-accidents (Dillon & Tinsley,

2008; Tinsley, Dillon, & Cronin, 2012). Dillon and Tinsley (2008) reported that accidents inspire caution, but demonstrated that near-miss events tend to attenuate evaluations of risk and consequently motivate people to take more risk in subsequent decision-making. Furthermore, our research extends the previously reviewed research in two ways. First, whereas studies on the impact bias have focused on organizational decision making, where both the evaluation of risk and the decisions made relate to other people, we focused on situations where people actually have experienced near-accidents and found that near-accidents seem to lead to complacency rather than urgency even when future decision-making is personally relevant. This extends the scope of the near-miss bias to a new domain with potentially high importance. Secondly, as we asked people about their thoughts and feelings following accidents and near-accidents, we could more directly examine the potential role of affect and feelings in the learning process.

Research on the near-miss bias was framed in a dual process account of information processing (e. g. Chaiken & Trope, 1999; Kahneman & Fredrick, 2005; Sloman, 1996; Stanovich, 1999) where perceptions of risk are believed to be informed partly by deliberative rule-based reasoning, and partly by intuitions generated from associations between event-cues and previous experience. Such intuitions are quick and affective, and guide decision-makers efficiently in complex and uncertain environments (Slovic, Finucane, Peters, & MacGregor, 2002). However, as such intuitions originate from experience rather than deliberate analysis, statistical understanding of risk sometimes deviates from how people feel about the risk (e.g. Windschitl & Wells, 1998). The near-miss bias occurs when event-cues fail to signal that an alternative and worse outcome almost-happened (Kahneman & Varey, 1990), and people update their general category knowledge about the hazard and the affect associated with it. Near-misses, that are not recognized as such, makes hazards feel less threatening (Dillon &

Tinsley, 2008; Tinsley, Dillon & Cronin, 2012). Our results that accidents inspire more caution than near-accidents, can be interpreted as consistent with these previous findings.

Interestingly, our data also show a slight tendency for near-accidents to increase caution, which is at odds with the typical finding in the near-miss bias literature and could be interpreted as weak demonstration of the bias. However, the reason for this difference might be that that we explicitly asked people about their *near-accident* experiences, whereas previous research has used an experimental paradigm where participants are free to label an incident as a near-accident or not (e.g. Dylan & Tinsley, 2008). Thus, the traditional account of the near-miss bias is that it occurs precisely when near-misses are interpreted as a success rather than a near-failure, and consequently leads to perceived resilience rather than vulnerability. Importantly, our results show that near-accidents are only moderately effective at inspiring caution, and significantly less so than actual accidents, even when participants themselves actually recognize and label them as near-accidents. This indicates that the near-miss bias is robust, and cannot be countered simply by shifting attention from actual outcomes to alternative or possible outcomes, a debiasing strategy that has been found effective against both the outcome-bias and the hindsight-bias (Arkes, 1991).

A striking result in the present project was that repeated exposures to accidents was associated with increased carefulness, whereas respondents did not report becoming more careful after repeated experiences with near-accidents. One interpretation would be that repeated exposure to accidents increases the negative affect associated with this category and functions as a warning sign that leads to increased caution in future decision making. Near-accidents, on the other hand, if treated as an indication that margins were good enough, lead to no change in emotional reactions and require no need to increase caution. Consistent with this interpretation, our data show that repeated experience with near-accidents have no impact on the strength or valence of reported emotional reactions, indicating that near-accidents do

not “scare people straight”. However, two results in our data potentially challenge the above interpretation. First, there was no increase in reported emotional reactions with repeated experience with accidents. Second, emotional reactions of both positive and negative valence were in our data more intense after near-accidents compared to accidents.

Perhaps both these results were related to the fact that we asked people about autobiographical events, and that participants were free to both chose and label the experience they reported on. While having people sample experiences from memory adds ecological validity, it leads to higher variability in evaluations, which again makes it harder to detect potential between-group effects of repeated experience. Furthermore, as near-accidents were more common than accidents, participants could simply have recollected more dramatic experiences when reporting on near-accidents compared to accidents. This interpretation is further supported by the observation that counterfactual outcome evaluations were more severe following near-accidents than accidents, and would explain the stronger emotional reactions following near-accidents. If this interpretation is correct, it is particularly striking that we observe no increase in carefulness with repeated experience with near-accidents, as this implies that dramatic downward counterfactuals do not directly increase caution. We note however, that our results are correlational and must be interpreted with caution. A more direct test of the effect of dramatic downward counterfactuals could be to randomly assign participants to a condition where they are asked to vividly imagine and elaborate on possible consequences of an experienced near-miss, and compare this to a control group asked to focus on affective contrast.

Although our results are broadly consistent with findings from the impact bias literature, the present results qualify this picture, as they demonstrate that people became more careful when they felt personally responsible for causing the incident. This finding was supported by an analysis of the counterfactual statements generated in response to the near-

accident: people were more inclined to learn when they responded to the accident with self-focused counterfactuals, and there was a tendency for people to learn more when they responded with upward as opposed to downward counterfactuals. This is consistent with previous findings indicating that self-focused upward counterfactuals are beneficial for learning, as such thoughts both increase motivation to improve and specify how change should be implemented (Roese, 1994; Morris and Moore, 2000). In light of this, it is paradoxical that both previous research (Teigen 1995, 1996, 1998a; Teigen & Jensen, 2011) and the present results indicate that people typically engage in downward counterfactual thinking after accidents and near-accidents. Why spend time thinking about worse case scenarios, if one learns more from thinking about how the incident could have been avoided (an upward counterfactual)? Perhaps time is a critical factor in that the immediate reaction is a dramatic downward counterfactual, which again motivates deliberate reflection of what one could have done to avoid the incident. In that case, we would expect the proportion of (the more functional) upward counterfactuals to increase over time.

Furthermore, although some learning of increased caution related to near-accidents was observed, we found no direct explanation for this difference in terms of emotional valence or strength. This observation is inconsistent with our initial argument that dramatic downward counterfactual comparisons could play a direct role in avoidance motivation. We proposed, in line with the REM- model of counterfactual thinking (McMullen & Markman, 2003), that downward reflection – vividly simulating a worse possible outcome – might directly fuel motivation to avoid similar situations in the future. However, our data was not consistent with this line of reasoning. Although we did replicate the finding that downward counterfactuals appear to be the default following accidents and near-accidents (e.g. Teigen, 1998a), and that the contrast between actual outcomes and counterfactual alternatives tend to be large rather than small (Teigen, Kanten, & Terum, 2011), we found no association between

the strength of downward counterfactuals and learned carefulness. Furthermore, although people reported a higher degree of learned carefulness after accident compared to near-accidents, the intensity of emotional reactions were stronger following near-accidents, again indicating no direct link between downward counterfactuals and learned carefulness. Although a weakness of the present design is that we have relied on self-report as a measure of learned carefulness, and hence do not know whether this measure correlates with actual behavior, it is still puzzling that we observe no link between downward counterfactuals and reported caution.

One possibility is, as mentioned previously, that the primary function of downward counterfactuals is not to motivate behavior directly, but rather motivate deliberate analysis and reflection that then in turn promotes insight and learning. Several researchers have proposed such a link between conscious emotion and behavior (Baumeister, Vohs, DeWall, & Zhang, 2007; Epstude and Roese, 2008). There is some support for this interpretation in our data. For instance, when participants focused on evaluations of outcomes, and rated the severity of the factual and counterfactual outcomes, there was an overwhelming tendency to rate the counterfactual as more negative (a downward comparison). However, this distribution changed when we looked at the if-then statements where participants reflected on the link between antecedent events and outcomes. There we observed an even distribution of upward and downward counterfactuals. As outcome evaluations are arguably quick and affective, whereas causal reasoning is more deliberate, perhaps the purpose of the first primarily is to motivate the latter. Our finding that regret, an emotion that requires a degree of conscious appraisal (Zeelenberg & Pieters, 2007), was associated with learned carefulness after both accidents and near-accidents, is consistent with such an interpretation.

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