"We aren't idlers": Using subjective group dynamics to promote prosocial driver behaviour at long-wait stops

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Abstract

Idling engines are a substantial air pollutant which contribute to many health and environmental problems. In this field experiment (N = 419) we use the subjective group dynamics framework to test ways of motivating car drivers to turn off idle engines at a long wait stop where the majority leave their engines idling. One of three normative messages (descriptive norm, in-group prescriptive deviance, outgroup prescriptive deviance) was displayed when barriers were down at a busy railway level-crossing. Compared to the baseline, normative messages increased the proportion of drivers that turned off their engines. Consistent with subjective group dynamics theory, the most effective approach was to highlight instances of in-group prescriptive deviance (47% stopped idling, compared with 28% in the baseline). Implications for health and environmental outcomes and future research are discussed.

Keywords:

social norms; deviance; engine emissions; air quality; pro-environmental behavior; subjective group dynamics.

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Outdoor air pollution has been classified as equally carcinogenic to humans as smoking (WHO, 2013). In 2015 outdoor air pollution was estimated to be responsible for 4.2 million deaths worldwide (Cohen et al., 2017). Traffic and vehicle pollution is considered as a primary contributor to poor air quality (WHO, 2016), and idling traffic is of particular concern. Pollution levels inside vehicles are 40% higher while in stationary rather than moving traffic and passengers are exposed to 29 times more harmful pollution particles (Kumar & Goel, 2015; Kumar & Goel, 2016). In this report, we draw from research on social norms and subjective group dynamics to present an experimental field study which tests the effectiveness of norm-based signs for encouraging drivers to turn off their idle engines at a Railway level-crossing.

Social Norms

Research in behavioral science has established that social norms are key drivers of human behavior and when social norms are activated they can be used to improve pro-social conduct. Normative information has been used fairly extensively in the environmental domain to encourage residential energy conservation (e.g. Emeakaroha, Ang, Yan, & Hopthrow, 2014; Nolan, Schultz, Cialdini, Goldstein, & Griskevicius, 2008), water conservation (e.g. Schultz et al., 2016), and resource conservation in the hospitality industry (e.g. Goldstein, Cialdini, & Griskevicius, 2008).

These types of normative interventions typically test whether descriptive norm messages (highlighting objectively modal behavior) or prescriptive (sometimes called 'injunctive') norm messages (highlighting desired/ideal behavior) promote behavioral compliance. However, it is important to investigate what happens when descriptive

norms and prescriptive norms are not aligned. In a study to reduce environmental theft, Cialdini and colleagues (2006) found that highlighting an undesirable descriptive norm increased undesirable behavior. However, when highlighting a desirable prescriptive norm, undesirable behavior reduced. In a study on household energy conservation, Schultz et al. (2007) showed that highlighting a descriptive norm produced either desirable energy savings or the undesirable boomerang effect, depending on whether households were already consuming at a low or high rate. Adding a prescriptive norm (conveying social approval or disapproval) eliminated the boomerang effect (Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007). Other research has found that highlighting an undesirable descriptive norm has no effect on behavioral compliance compared to a baseline condition (Van de Vyver & John, 2017). Therefore, rather than drawing attention to an undesirable descriptive norm, research suggests it may be more effective to emphasize social disapproval. There are situations in which descriptive norms are directly observable through on-going behavior, and in which an attempt to refute those norms may be impractical and unethical because it would be deceptive. In such a case, the question arises of whether or how it may be possible to invoke prescriptive norms that can induce non-conformity to modal behavior.

This problem applies to the situation of drivers with idling engines, where negative consequences are widely acknowledged (i.e. “turn it off” campaign, Idling Action London) and, in some countries is a motoring offence. However, if a large majority of motorists leave their engines idle, as is the case in the location of the present research (Meleady et al., 2017), a descriptive norm message may not be optimal for promoting behavioral compliance (see Van de Vyver & John, 2017). Although social referencing (highlighting others’ behavior) to norms should generally

stimulate some reflection on behavior, the strength of effects should depend on how self-relevant the norms are. Descriptive norms do not inherently imply divergence from current modal actions of others. But they may at least stimulate people to reflect on the contrast with any explicit injunction (in this case the request to turn engines off).

In situations characterized by high levels of socially disapproved conduct, a message that focuses recipients on the prescriptive norm, should be the most effective method of inducing behavior change. In this research we introduce a new approach, which involves activating prescriptive norms by highlighting others' deviance – their non-compliance with desirable behavior. By highlighting that this non-compliance is exhibited by certain individuals, we hope to stimulate others to engage in desirable behavior. This idea is based on principles of subjective group dynamics theory, whereby deviance serves as a psychological reference point from which people infer prescriptive norms.

Subjective Group Dynamics

Societally, one of the functions of deviance is to remind people of the boundaries for acceptable behavior. It thereby defines and motivates people to reinforce prescriptive norms (i.e. social and moral obligations; see Durkheim, 1960). Experimental evidence on subjective group dynamics (SGD; Marques, Páez & Abrams, 1998; Marques, Abrams, Páez & Hogg, 2001) shows generally that these norms are psychologically much more compelling if they relate to one's in-group, and hence one's own identity (Tajfel, 1979). SGD theory proposes that when people regard themselves as members of a social group they become motivated to maximise and maintain the group's standards by ensuring that it adheres to prescriptive in-group norms. This is achieved through the parallel processes of intergroup and intragroup

differentiation (Marques, Abrams, Páez, & Taboada, 1998). In order to establish that one's in-group has high social standing it is psychologically particularly important to respond when in-group members deviate from key norms. For this reason, in-group deviants are generally judged more severely than comparably deviant members of out-groups, a phenomenon known as the 'black sheep effect' (see Marques, Páez, & Abrams, 2001). More critically, when an in-group member deviates from the group's standards, other members are motivated to take corrective action to reinforce the in-group's claim to occupy a socially desirable normative position (Marques et al., 1998), or more simply, to show that that the in-group is good.

Relative to the baseline situation, highlighting prescriptive norms by identifying deviant behavior should have greater potential to remind drivers of their environmental responsibilities and encourage them to turn off idling ignitions. But this effect should primarily arise when these norms refer to drivers' in-group because of its clear self-relevance. Indeed, if self-relevance is the key mechanism we would expect the impact of the three normative conditions to be least in the outgroup prescriptive deviance condition (because it is explicitly non-self-relevant), moderate in the descriptive condition (because self-relevance is ambiguous) and greatest in the in-group prescriptive deviance condition (because self-relevance is greatest). However, it is possible that given that only a minority of motorists turn off their engines (25%), both prescriptive norm conditions may be more effective than the descriptive norm condition for promoting behavioral compliance.

In summary, we test two hypotheses. One is that the presence of normative cues in general should reduce engine idling relative to a baseline with no normative cues. The second is that if the mechanism through which normative cues affect behavior is that the norms are prescriptive and self-relevant, the cues should be most

effective when they are linked to the in-group. Finally, we also check the plausibility of the self-relevance assumption by testing whether there is a positive linear effect from baseline to out-group to descriptive to in-group conditions.

Current Research

We report a field study conducted to assess whether behavioral cues (descriptive norm, in-group prescriptive deviance, outgroup prescriptive deviance) can encourage drivers to turn off their engines whilst waiting at a level-crossing. The crossing, situated in Canterbury, UK, is part of a main route to the city railway station and busy route for pedestrians. At the time of the study the annual mean concentration of nitrogen oxide at this site was 39 $\mu g/m^3$ (Medway Council, 2013), marginally below levels set by the European Commission (40 $\mu g/m^3$, European Commission, 2013). Canterbury City Council had, prior to and throughout the duration of the research, erected a permanent sign at the site to encourage drivers to turn off their engines. But despite its presence, 77 percent of drivers left their engines idling in this location (see Meleady et al., 2017). To encourage more drivers to comply with the request to turn off their engines, our field study tested the influence of additional norm-based messages.

Method

Sample and Procedure

Data were collected over a period of 6 months (October, 2012 to March, 2013) between 08.00 h and 18.00 h in single hour time slots, Mondays to Saturdays. The time-slots for data collection for each condition was randomized to ensure intervention conditions would not be confounded and sampling was from a wider range of drivers (i.e. to avoid sampling the same car more than once). Additionally, weather was taken into account (i.e. rain, sunshine). The level-crossing barrier

dropped an average of 4 times per hour for a mean period of 2.31 min (SD = 0.81 min). Throughout the study an average sample included 23.7 cars per hour timeslot.

Canterbury is one of the UK's most popular tourist destinations and also is a major shopping hub for surrounding towns in East Kent. Therefore, as well as its large population of residents (over 59,000 people) the city attracts more than 7 million visitors and 40,000 students a year. At any given time, the average proportion of visitors is 36% (Destination Research, 2016). The distinction between visitors and residents is therefore a relevant and meaningful one. However, given that visitors generally arrive more by rail or coach, most of the vehicular traffic in the area of the study involved local commuters and residents (Canterbury City Council, 2011).

Based on previous research and an intention to achieve power of .99 to detect a medium effect size, and power of .8 to detect a small to medium effect size at $p < .01$, data were collected from 419 cars across 4 conditions ($N_{baseline} = 106$, $N_{descriptive\ norm} = 109$, $N_{in\text{-}group\ prescriptive\ deviance} = 99$, $N_{outgroup\ prescriptive\ deviance} = 106$). The baseline measure involved no information about norms, drivers were only exposed to the Council sign. The descriptive norm condition invoked the norm by focusing on what drivers do (indicating the proportion who engage in a desirable course of action), with a placard containing the message, "When barriers are down 25% of motorists turn off their engines!". In the prescriptive norm conditions, we increased the prescriptive focus using the combined reference to what 'some' people do not do and an exclamation mark. In the in-group prescriptive deviance condition the message was, "*When barriers are down some Canterbury residents don't turn off their* engine!". In the outgroup prescriptive deviance condition the message stated, "When *barriers are down some Canterbury visitors don't turn off their engine!*".

Each normative message was printed on a placard (W: 420 x 594 mm, H: 2000 mm; font type = Franklin Gothic Medium, font size = 100 pt.) and was affixed to a stationary pole 2m above ground level held by a research assistant who remained stationary on the sidewalk. The first placard was placed 5 m from the current council sign and approximately 50 m from the level-crossing with traffic travelling out of the city center. The second placard was placed approximately 50 m from the level-crossing facing traffic travelling into the city center. After the level-crossing barriers had dropped down, another research assistant walked along the sidewalk until the end of the line of stationary vehicles (all of whom had just passed or could view the sign) and inconspicuously recorded whether each vehicle's engine was on or off by noting exhaust activity and engine noise.

Research assistants were aware of the conditions of the study, however, blind to the specific hypotheses. The consistency of the recording was established during a pilot period prior to formal data collection in which two of the research assistants starting at opposite ends of the traffic line, independently sampled 160 motorists at the level-crossing. There was good consistency in the proportion of engines reported as off from the same sets of vehicles, χ^2 (1, N = 160) = 1.48, p = .224, range = 25-33% of engines were off. Prior research in this location had also established that the mere presence of a person holding a sign or sign that merely reinforced the message on the council sign, was not sufficient to alter driver behavior compared with the baseline levels (see Meleady et al., 2017).

Results

Logistic regression was used to analyze the data. To account for random factors we also measured the type of weather, number of passengers, duration of the barrier drop and the time of day. These were initially treated as statistical covariates.

However, as none were significantly related to behavior they were removed from subsequent analyses, χ^2 (4, N = 419) = 3.47, p = .48, Nagelkerke R^2 = .01.

Logistic regression with the four conditions (baseline, out-group prescriptive deviance, descriptive norms, in-group prescriptive deviance) revealed a significant omnibus test of model coefficients, χ^2 (3, N = 419) = 8.49, p = .04, Nagelkerke R^2 = .03.

There was a significant effect of condition (Wald = 8.26, p = .04). We formally tested two hypotheses. The first contrasted all norm conditions against the baseline. The second specified that the baseline and in-group norm condition should differ. Contrast analysis between baseline versus norms (descriptive norm, in-group prescriptive deviance, outgroup prescriptive deviance), showed that, compared to the baseline, signs with any reference to social norms significantly increased the probability that drivers would turn off their engines, t(415) = - 2.46, p = .04. Specifically, 28% of drivers turned off their engines in the baseline condition (no sign). As predicted, a higher proportion (47%) turned off their engines in the in-group prescriptive deviance condition (When barriers are down some Canterbury residents *don't turn off their engine*!'), B = .83, SE = 0.30 (Wald = 7.89, p < .01). Differences against baseline were also in the expected direction but were non-significant in the outgroup prescriptive deviance condition ('When barriers are down some Canterbury *visitors don't turn off their engine!')*, in which 37% in total turned off their engines, B = .39, SE = 0.30 (Wald = 1.73, p = .19), and in the descriptive norm condition (When barriers are down 25% of motorists turn off their engines!), in which 41% turned off their engines, B = .56, SE = 0.29 (Wald = 3.63, p = .06) (see Table 1 and Figure 1). The proportions in the three norm conditions did not differ significantly from one another (ps > .12). Finally, we checked whether the effect of the normative conditions

followed the expected linear progression (baseline < out-group < descriptive < in-group). The linear effect was significant, B = .53, SE = 0.23 (Wald = 7.91, p < .01). The quadratic and cubic effects were not (ps > .59). Examination of the odds ratios revealed that, compared to the baseline, drivers were 2.29 times more likely to switch off their engines in the in-group prescriptive deviance condition, 1.74 times more likely in the descriptive norms condition and 1.48 times more likely in the outgroup prescriptive deviance condition.

Discussion

In this experiment, we wanted to examine whether specific types of norm-based interventions can encourage pro-environmental action in a context where existing levels of that behavior are low. We tested the effectiveness of three different types of normative messages (descriptive norms, in-group prescriptive deviance, or outgroup prescriptive deviance) to urge drivers to turn off their engines at a long-wait stop. Results revealed that only the message that focused on in-group prescriptive deviance was sufficient to achieve a significant improvement relative to the baseline, resulting in a 68% increase in the proportion of drivers who switched off their engines while waiting at the level-crossing.

People are aware that negative in-group information can damage the group's status and image (see van Leeuwen, van den Bosch, Castano, & Hopman, 2010) because deviant behavior prompts them to acknowledge the parameters of socially acceptable behavior and encourages them to behave responsibly. According to subjective group dynamics theory, in-group prescriptive deviance can create a powerful instigator of people's motivation to uphold positively valued group norms, thereby preserving the group's status, and therefore one's own identity (Marques et al., 1998; Marques et al., 2001). For instance, to maintain group distinctiveness group

members may distance themselves from deviant behavior to protect the in-group (Abrams et al., 2000) and improve its validity (see Hogg & Abrams, 1993). The present research provides a new application of subjective group dynamics theory and suggests scope for further theory development on the question of how deviant behavior can create a basis for reactive social influence. Consistent with prior laboratory based research, the message that drew attention to in-group prescriptive deviance was sufficient to raise compliance above baseline levels.

While the descriptive norm and outgroup prescriptive deviance norm messages did not significantly increase pro-environmental behavioral compliance compared to the baseline condition, the linear pattern of effects suggests that, if the research were repeated over a longer time period or much larger samples, the out-group deviance or descriptive messages may also be sufficient to have some effect, but to a lesser degree than the in-group deviance message. This pattern is consistent with our hypothesis that the presence of normative cues in general should reduce engine idling relative to a baseline with no normative cues. Both prescriptive deviance conditions highlighted social disapproval, which is an effective mechanism for promoting behavioral compliance (Durkheim, 1960). However, as expected, the self-relevant prescriptive condition (ingroup) was most effective. This is consistent with the finding that messages that engage self-related interests are more likely to induce compliance (Van de Vyver, Abrams, Hopthrow, Purewal, Randsley de Moura & Meleady, 2018). Interestingly, the descriptive norm condition led to marginal increases in behavioral compliance relative to the baseline. Given that the descriptive norm message stated that only a minority of motorists turn off their engines (25%), this finding suggests that undesirable descriptive norms may increase behavioral compliance under certain conditions. We propose that highlighting an undesirable

descriptive norm may promote positive behavioral compliance when (1) it is coupled with a clear behavioral request (i.e., the sign from the local council in this study), and (2) the desirable prescriptive norm is widely acknowledged.

Limitations, Future Research and Conclusions

Although not all drivers may have been aware of the signs, the difference between the baseline and in-group prescriptive deviance condition indicates that a sufficient proportion of drivers did attend. Some research suggests that the presence of observers can encourage pro-social behavior (see Dawes, McTavish & Shaklee, 1977). In previous research, we have shown that the mere presence of a research assistant holding a sign that contained no message did not increase levels of driver compliance above baselines (Meleady et al., 2017). However, we do not know how the presence of the research assistants in combination with the normative messages may potentially augment their effects. The same could be said, however, for the presence of pedestrians in the environment who could potentially also observe drivers' behavior (for review see Bradley, Lawrence, & Ferguson, 2018).

Some improvements could also be made to recording and sampling. For example, it would be beneficial to record the specific type of car (e.g. electric, hybrid) and the number of pedestrians. Furthermore, whilst the sampling in this study embraces some variability across periods of the day or week, it would be desirable to sample across a larger number of barrier drops within each condition, and perhaps comparable locations. It would also be useful to test different variants of messages based on each type of norm to establish the generalizability of the effects more clearly (see Wells & Windschitle, 1999). That said, the current paper has direct implications for how local authorities can tackle local air pollution. Rather than simply tell people

what to do – reference should be made to social norms surrounding that behaviour, particularly self-relevant prescriptive norms.

Future research should address whether norm-based interventions can effectively target other types of traffic and context, targeting different locations and types of idling traffic. For example, pedestrians would benefit greatly not only from interventions that influence local car drivers but also ones that may discourage idling by commercial traffic that is frequently and voluntarily idle at the curbside (e.g. taxis, delivery drivers, trucks). Because drivers of these vehicles are not usually part of a collective situation (e.g. sharing the same community as most others) it may be that other points of intervention or types of norm focus would be effective.

Overall, the present research indicates that, in areas where idling traffic is problematic, such as cities during rush hour, car ferry queues, busy intersections, contraflows due to roadworks, at taxi ranks, and school drops, the use of a norm-focused behavioral approach could make an important contribution to reducing toxic air pollutants generally and for pedestrians in the immediate vicinity. Crucially, gradual and pervasive impact on norms could have a sustainable long-term influence on environmental outcomes affecting human health, air quality, and climate change.

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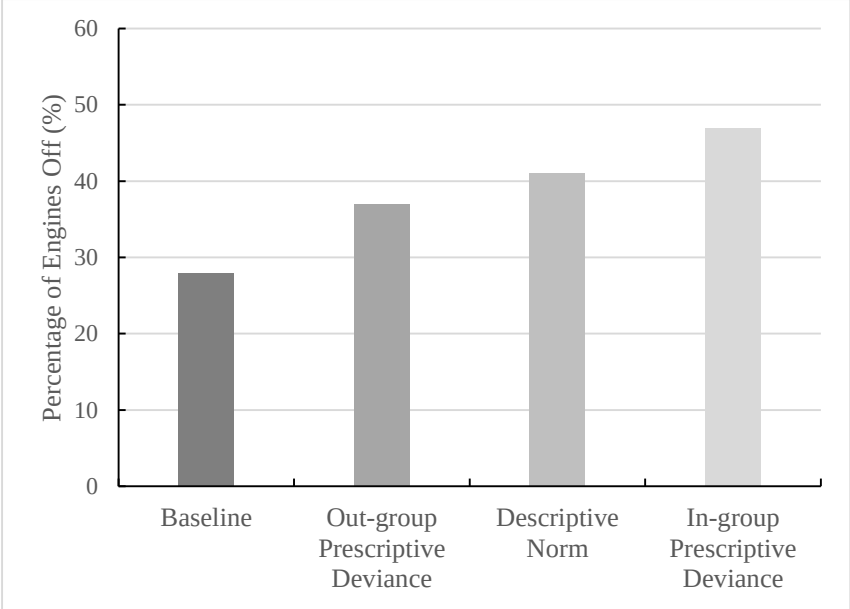

Figure 1. Results demonstrating the effect of social-behavioral normative cues on driver behavior.

Table 1. Logistic regression model for all conditions

	B	SE	Wald	p
Baseline vs. in-group prescriptive deviance	.83	.30	7.89	< .01
Baseline vs. outgroup prescriptive deviance	.39	.30	1.73	.19
Baseline vs. descriptive norm	.56	.29	3.63	.06

χ^2 (3, N = 419) = 8.49, p = .04, Nagelkerke R^2 = .03.