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Does morality predict aggressive driving? A conceptual analysis and exploratory empirical investigation

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ABSTRACT

Risky and aggressive driving is an important cause of traffic casualties and as such a major health and cost problem to society. Given the consequences for others, risky and aggressive driving has a clear moral component. Surprisingly, however, there has been little research on the relation between morality and risky and aggressive driving behavior. In this study we aim at addressing this gap. First, we present a conceptual analysis of the relationship between moral values and aggressive driving behavior. For this purpose, we extend Schwartz's integrated model of ethical decision making and apply it to the context of aggressive driving. This conceptual analysis shows that moral decision-making processes consist of several stages, like moral awareness, moral judgment and moral intent, each of which are influenced by individual and situational factors and all of which need to materialize before someone's generally endorsed moral value affects concrete behavior. This suggests that the moral value-aggressive driving relationship is rather indeterminate. This conceptual picture is confirmed by our empirical investigation, which tests to what extent respondents' moral values, measured through the Moral Foundation Questionnaire, are predictive of respondents' aggressive driving behavior, as measured through an aggressive driving behavior scale. Our results show few and rather weak empirical relationships between moral values and committed aggressive driving behaviors, as was expected in light of our conceptual analysis. We derive several policy implications from these results.

1. Introduction

Risky and aggressive driving behavior[1] causes major health and cost problems to society. Worldwide 1.35 million people die from road accidents annually. Moreover, it is the number one cause of death for children and young adults (WHO, 2018). Also, in Europe traffic accidents are still a major problem and reach much higher numbers than targeted by EU-policy. After a sharp decline in traffic fatalities since the beginning of the century the decrease has effectively stagnated during the past five years, rendering the EU target for reducing traffic deaths by 50% between 2010 and 2020 far out of reach (Adminaité-Fodor, Heilpern, & Jost, 2019). In the Netherlands, after a few decades of decline, the number of traffic victims has even gone up again in the last

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[1] Following Houston, Harris and Norman (2003, *p270)* their definition, we define risky and aggressive driving behavior in this study as *'a pattern of unsafe driving behavior that puts the driver and/or others at risk. . . and that others perceive as potentially aggressive and harmful*'. Note that this definition does not include an intentional or cognitive element, i.e. it is not required that the driver him or herself also had the intention to drive aggressively or harmful for the behavior to fall within this definition and the scope of this study.

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couple of years, counting well above 600 deaths per year (CBS, 2019a). Research shows that the behavior of the driver plays a significant role in the vast majority of car accidents (Evans, 1993). In particular risky driving behavior, like ignoring basic travel rules and speeding, is linked to involvement in car accidents (Fergusson, Swain-Campbell, & Horwood, 2003; Iversen & Rundmo, 2002). As such, a better understanding of this harmful behavior is of vital importance for the design of policies and measures to prevent accidents and their harmful consequences.

In the last two decades a vast body of literature within psychology and travel behavior research has taken up the task of better understanding risky and aggressive driving behavior by studying individual factors that affect this type of behavior. Two streams of literature have been dominant within this research (Ulleberg & Rundmo, 2003). The first focuses on personality traits as predictors of risky and aggressive driving behavior. This research has revealed weak but stable relations between some personality traits, like sensation seeking, anger and normlessness, and potentially harmful driving behavior (Yang, Du, Qu, Gong, & Sun, 2013; Nordfjaern, Jørgensen, & Rundmo, 2010; Iversen & Rundmo, 2002). Personality traits are therefore generally considered as distal influencers of this kind of behavior (Mallia, Lazuras, Violani, & Lucidi, 2015; Ulleberg & Rundmo, 2003).

A second stream of literature has directed its attention towards so-called social cognitive factors, like perceptions, beliefs, and attitudes, which presumably influence risky and aggressive driving behavior more directly (Ulleberg & Rundmo, 2003). To capture the influences of these factors a frequently used theoretical framework is the theory of planned behavior (Ajzen, 1988), which posits that a person's behavior is determined by one's intention to perform the behavior. In turn, someone's intention is determined by one's attitude towards the behavior, one's perception of control over the behavior, and one's perception of the social norms involved with the behavior (Ajzen, 1988). Several empirical studies have established significant relationships between these three components of the theory of planned behavior and the intention to perform risky driving behavior (Parker, Stradling, & Manstead, 1996).

Inspired by both approaches Ulleberg and Rundmo (2003) integrated personality factors and social cognitive factors into a single model, in which personality influences risky driving behavior directly as well as indirectly through its effect on attitudes. This integrated model has consequently been adopted to explain the risky driving behavior of different particular groups of drivers, like young drivers (Machin & Sankey, 2008) and professional bus drivers (Mallia et al., 2015).

Though much work has been done in psychology and travel behavior research to explain individual differences in risky and aggressive driving behavior, an important area that seems particularly relevant to get a better understanding of this kind of behavior has been largely overlooked: *moral* psychology. The field of moral psychology looks into the moral dimension of the human being, like the moral values and beliefs that people have, and their influence on people's attitudes and behavior in moral contexts. The fact that moral considerations can play an important role in the constitution of many kinds of behavior has a long pedigree and is in recent years increasingly being recognized by a growing number of disciplines that aim at a better understanding of social behavior, ranging from economics (Harsanyi, 1982; Andreoni & Miller, 2002) to consumer behavior (Andorfer & Liebe, 2012; Arvola et al., 2008) to transport (Matthies, Klöckner, & Preissner, 2006; Chorus, Pudāne, Mouter, & Campbell, 2018).

(Unsafe) driving behavior seems to be an obvious form of social behavior in which moral considerations may play a role. Traffic violations and risky or aggressive driving behavior have a clear moral component as it can produce great harm to oneself, others and society as a whole (Parker, Manstead & Stradling, 1995). Considerations of wrong and right thus potentially play a role in drivers' decision to (not) perform such kinds of risky behavior. In this light it is surprising to see the earlier mentioned lack of attention from a moral psychological perspective.[2] Next to personality and social cognitive factors, people's moral values and attitudes seem to be a relevant factor to investigate in order to get a further understanding and explanation of aggressive driving behavior. In this study we aim to contribute to addressing this gap by conducting a conceptual analysis of the relationship between moral values and aggressive driving behavior and subsequently investigate this relationship empirically.

2. Earlier work and specification of the knowledge gap

So far, to the best of our knowledge, only two studies have explicitly focused on the relation between morality and risky and aggressive driving. One study directly measured the relationship between people's general morality and driving behavior (Bianchi & Summala, 2002). This study, conducted among Brazilian students, used a measure of moral judgment that reflected Kohlberg's (1969) stages of moral development. The results revealed no significant relationship between the development stage of moral judgment and aggressive driving violations. According to the authors, this result was probably due to the small variance of the moral judgment score in the sample.

Another study, conducted by Parker, Manstead and Stradling (1995), did find a relationship between a moral concept and the intention to commit a driving violation. The study tested if an extended model of the theory of planned behavior, including a fourth predictor variable of 'personal norm', would yield better predictions than the original model. Here, a relationship

[2] Morality within a driving context has been studied increasingly in the last decade in relation to the moral questions and, more specifically, hypothetical moral dilemmas, that the development of autonomous vehicles raise (i.e. trolley problems) (e.g. Li et al., 2019; Awad et al., 2018). These investigations often have a more normative character (what is the right decision when an automated vehicle has to choose between hitting a granny or a child?) or are focused on people's decisions in such hypothetical situations rather than the role of moral values in actual moral decision-making by drivers which is the focus of this study.

was found between a person's moral attitude towards a certain driving violation and the intention to commit such a violation. This is an interesting finding that at least suggests the relevance of moral convictions for explaining driving violations.

Since this earlier work on this subject, however, major developments have taken place within the field of moral psychology. Importantly, a new and highly influential theory of morality has been introduced, the so-called Moral Foundation Theory (MFT) (Graham et al., 2013; Haidt & Joseph, 2004), which is considered as a reaction to and alternative for Kohlberg's theory of moral development (Graham et al., 2013; Haidt, 2007). MFT maintains that human morality consists of at least five different universal and irreducible moral values that developed during human evolution and which thus all people possess to some extent, the extent to which depending on social and cultural influences. These values are considered our moral foundations, producing the moral intuitions by which we judge wrong from right. The five moral foundations that have so far been identified are: care/harm, fairness/cheating, loyalty/betrayal, authority/subversion and sanctity/degradation (Graham et al., 2013). For empirical analyses, MFT is operationalized in the Moral Foundation Questionnaire (MFQ) (see www.moral-foundations.org, 2013), which is an extensively validated scale to measure each of the five foundations (Graham et al., 2011).

MFT and MFQ have become widely used in the last decade, also outside its field of origin, like in economics or the political sciences, to measure what people find morally important and to explain different phenomena in terms of people's moral values and beliefs. It has, for instance, been used to explain political and ideological orientation (Graham, Haidt, & Nosek, 2009), climate friendliness (Vainio & Makiniemi, 2016), and charity donations (Nilsson, Erlandsson, & Västfjäll, 2016). When investigating the influence of moral values and considerations on risky and aggressive driving behavior MFT/MFQ therefore seems to be the obvious choice of measure.

The present study aims at getting a better understanding of the role that moral factors play in the constitution of risky and aggressive driving behavior. Building upon the moral framework of MFT we test to what extent individual differences in morality can predict *committed* risky and aggressive driving behavior. In order to do so, we proceed to answer the following research question: 'To what extent is there a relationship between an individual's endorsement of the different moral foundations of MFT and her or his committed risky and aggressive driving behavior?'

However, before embarking on this empirical research question, it is important to conceptually clarify the assumed psychological processes through which moral values may influence aggressive driving behavior; this will also enhance our understanding of the empirical findings to be discussed further on. For this conceptual analysis, we use and extend Schwartz's (2016) model of ethical decision-making.

3. The theoretical conceptualization of the moral value-aggressive driving behavior relationship

3.1. Models of ethical decision-making

During the last three decades moral psychology has explicated the moral decision process and developed models of ethical decision-making[3]. Ethical decision-making models aim to clarify which behavioral and situational factors and processes play a role when an individual is confronted with a moral decision situation, which may be defined broadly as a situation in which moral considerations can potentially play a role in the decision-making. As such, these models seem well equipped to explicate the relationship between moral values and concrete behavior with a potential moral dimension, such as aggressive driving. Although much of the work done in this field is related to moral decision-making within an organizational environment, its findings are not confined to this context. In fact, one of the founders and main contributors to the field of ethical decision-making intended to develop a general model applying to a broad range of contexts (Rest, 1986).

The ethical decision-making literature can be divided into two main conflicting streams: one focused on developing rational models and the other on non-rational models (Schwartz, 2016). Rational models proceed from the idea that people's moral decision-making is essentially based on moral reasoning resulting in a moral judgment (e.g. Rest, 1986; Trevino, 1986; Jones, 1991). Non-rational models, in contrast, assume that people's moral judgments are not the result of moral reasoning but are rather the results of intuitions and emotions that directly produce a moral judgment. Moral reasoning is then assumed to take place after the fact as an ex *post facto* process that has no direct influence on the moral judgment itself; it only functions as a rationalization of the moral judgment that was already produced through intuitive and emotional processes (Haidt, 2001).

For our study it may seem logical to follow the non-rational model to further explicate the moral value-aggressive driving relationship in more detail. This is because the instrument that we use to measure moral values, the MFQ, is theoretically grounded in Haidt's non-rational social-intuitionist model (Graham et al., 2013). However, the use of MFQ itself and the questions that are asked do not seem to strictly exclude a rational model. It seems perfectly justifiable for researchers within both the rational and the non-rational stream to use MFQ as a measure of people's moral values and relate it to behavior. Luckily, we do not have to choose. Schwartz (2016) developed an integrated model of ethical decision making, based on models like those of Rest (1986), Jones (1991), Haidt (2001), and others, which incorporates the rational and the non-rational perspectives. In the following, this integrated model is discussed and further elaborated on to get a better conceptual understanding of the processes that play a role in moral decision-making and thereby explicate the moral value-aggressive driving relationship.

[3] Note that these are *descriptive* models of ethical decision-making rather than *normative* models determining how one *should* behave.

3.2. A conceptualization of the moral value-moral behavior relationship in the context of aggressive driving

Fig. 1 presents a modified version of In Schwartz's (2016) model, one which is simplified and focused on aggressive driving behavior. The process of moral decision-making[4] potentially starts off in a context in which an ethical issue can arise. As we are interested in explicating the individual moral value-moral behavior relationship in the context of aggressive driving, we can define this starting point more explicitly. Our starting point then is an individual with a certain moral foundation make-up who, while driving a car, makes a decision (rationally or intuitively) about whether to perform an aggressive driving behavior act or not. As moral considerations potentially play a role in this decision situation, the person could get involved in a moral decision-making process.

Based on Schwartz's (2016) model it can be derived that, in order for a person's endorsed moral values to affect the decision whether to perform an aggressive driving behavior act, the process of moral decision-making has to fully materialize, meaning that the person needs to go through the following four process stages[5]: for a person to actually get involved in a process of moral decision-making he or she first needs to become *aware (1)* of the fact that a moral value could be at stake and that a moral consideration plays a role in the decision situation. Once aware, the person makes a *moral judgment (2)* about the right course of action that should be taken, either through a rational or non-rational process. This is followed (or not) by establishing the *intent (3)* to follow up on this moral judgment, and finally this leads to according *behavior (4)*. Schwartz (2016) states that the first three process stages are regarded as mental states, the fourth as an active conduct.

In Schwartz's (2016) model, each of these four stages within the process of moral decision-making are affected by two sorts of factors: individual and situational factors. Individual factors are captured by the broad construct of 'moral capacity'. It is one's level of ethical maturity, or moral development, as well as to what extent one follows through on one's moral judgment when faced with pressures to deviate from it. Other individual factors, like demographics or personality etc., are regarded as affecting someone's personal moral capacity and thus only indirectly affect the process of moral decision-making. Situational factors are characteristics of the situational context that influence the different stages of the decision-making process. These characteristics have to do with the specific issue that is dealt with, like its complexity or its moral intensity; with the (organizational) environment, like the ethical infrastructure and culture; and with someone's personal situation, like someone's changing ethical vulnerability (think of someone's changing financial situation) (Schwartz, 2016). In the following we will go deeper into the four different process stages and the influence of individual and situational factors. Since becoming aware of the relevant moral meaning of a decision situation is the crucial first step for the link between moral values and moral behavior to be activated at all, we will first elaborate on this stage and then discuss the other stages more briefly.

3.2.1. Awareness

The first process stage of 'awareness' represents the fact that before a moral value can influence the decision process it is first necessary that the person becomes aware of the fact that a moral value is possibly at stake within a decision situation. Moral awareness comes with the interpretation of the decision situation, which involves imagining the possible courses of actions *and* its consequences for the wellbeing of (oneself and) others and to determine possible violations of moral principles and duties (Rest, 1986). This leads to awareness of the *moral meaning* of a situation. As Jones (1991) states, when someone is not aware that the situation he or she is dealing with is a moral situation, the moral decision framework is not activated. Rather, this person may deal with the decision situation using a different framework, like one based on economic transactions. It should be understood though, that in reality people might not think about whether they are facing a 'moral situation' in such an abstract sense. Instead, people may or may not realize that one or more of their endorsed moral values, or more concrete moral standards based on these values, are in jeopardy within a situation they are confronted with and which they have interpreted in a certain way. In both the rational as well as the non-rational model this awareness stage is relevant and can be distinguished from the other stages for analytical purposes. But note that, for the non-rational models, it seems that this stage and the moral judgment stage practically arise simultaneously as it is assumed that the judgment is produced by a direct intuition.[6]

It may well be that a person does *not* become aware of the fact that a moral value that he or she finds important in general is potentially at stake within a certain decision situation. Though not mentioned by Schwartz (2016), it seems that at least three different general reasons can be given for not realizing a relevant moral meaning of the situation. First, a person may not know or does not believe the correct facts or lacks crucial information. For example, someone might not know or believe that speeding significantly increases the risk of making a collision (instead, the person might think that he or she has everything under control).

Secondly, one may know the material facts, yet somehow miss or not realize a possibly relevant moral meaning of the situation. It may be that a person interprets the social situation differently or that he or she simply does not think, or not

[4] Several authors within the ethical decision-making literature indicate to use the words 'ethical' and 'moral' interchangeably (Jones, 1991; Schwartz, 2016). The process of *ethical* decision-making that they describe can thus also be understood as the process of *moral* decision-making. We will mainly use the latter when referring to the decision process in which moral considerations potentially play a role.

[5] Here Schwartz follows Rest's (1986) four component model of ethical decision-making.

[6] It should be noted though that also for the rational model this can be the case. At least in a very preliminary way as becoming aware of the moral meaning of a decision situation implies a cognition at some level that a moral value is at stake implying an initial form of moral judgment.

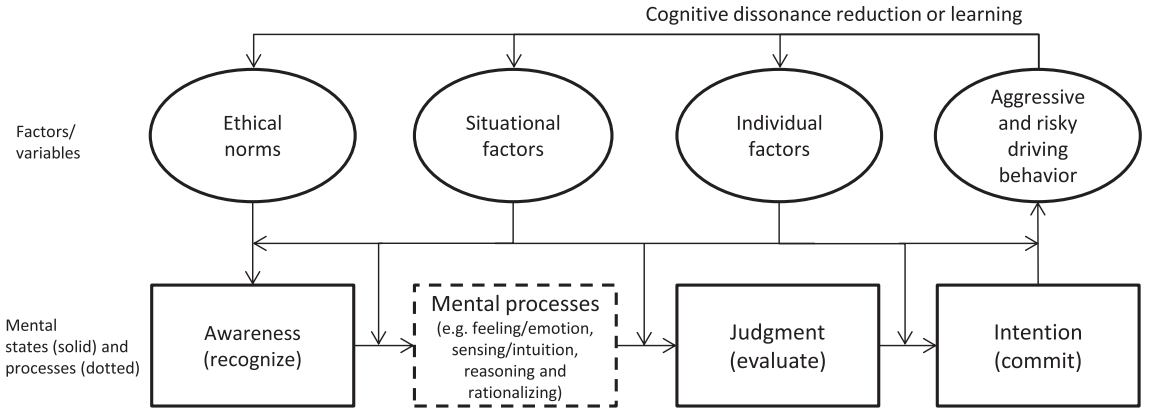

Fig. 1. Modified version of Schwartz's (2016) Integrated Ethical Decision Making model.

very thoroughly, about the moral implications of a decision or action. The person then does not realize what the consequences are for him- or herself and others nor whether it violates a moral principle. For instance, experiments on 'moral framing effects' conducted by Wolsko, Ariceaga and Seiden (2016) show that conservatives tend to shift their opinion on climate change when presented with a pro-environmental message framed in terms of conservative values like authority and sanctity instead of the usual care/ harm frame. This suggests that it was at first not realized that within the same situation or issue particular moral values were in jeopardy. In the context of aggressive driving it may be that one realizes that speeding increases the risk on a collision but that he or she does not take the second step of really thinking about how this could dramatically impact the lives of the people hurt in a potential accident.

Thirdly, it is possible that a person knows the material facts of the situation and realizes what the possible consequences are for one's and other's wellbeing, but that he or she places relevant others outside of one's moral concern. This often takes some form of dehumanization. The person may think of the other road users as annoying objects and 'forget' that there are actual human beings in those other cars and on those bikes. Delbosc, Naznin, Haslam, & Haworth (2019) recently provided evidence for this train of thought.

Schwartz (2016) mentions several psychological mechanisms that can be linked to one or more of these possible reasons for not becoming aware of a relevant moral meaning of a situation. One is the notion of ethical blindness, which refers to the temporal and non-conscious deviation from one's own norms as you do not see the moral dimension of a decision. Palazzo, Krings, and Hoffrage (2012) explain that this often has its source in a framing of the specific situation by the individual that blocks a moral interpretation. So, in our context, someone is driving to work but is only focused on getting there on time for an important meeting. They may only think of how to be quicker without realizing that the reckless moves they perform in the rush put themselves and others at considerable risk. Another, related mechanism, is Bandura's (1999) notion of moral disengagement, which entails the ability to convince oneself that ethical standards do not apply to a particular situation, by using rationalizations such as disregarding the injurious effects for others or by dehumanizing others. This process of evading the moral meaning of the situation may be supported by using sanitizing or euphemistic language. When you refer to bikers as 'annoying objects' they are no longer humans and you cutting them off may seem rather like a 'fun' game than jeopardizing people's life. The moral dimension of the decision then fades away. Such mechanisms of rationalizations and using sanitizing language may also constitute or results in a lack of awareness retroactively: though you may have become aware of moral considerations at first, these are retroactively negated through these mechanisms ('if he drives on the pavement, I am allowed to do it'). Also, rationalizations or sanitizing language may in the long term become so ingrained that they prevent you from realizing a relevant moral meaning of a situation in the first place ('tourists do not know how to bike so they should just get out of my way').

Schwartz (2016) states that these psychological mechanisms are often related to someone's environment, and are thus predominantly influenced by situational factors. In our context: another person in the car may considerably instigate, support or shatter one's dehumanizing views and rationalizations. However, also individual factors play a role. One that influences moral awareness is, for instance, a lack of moral imagination that prevents one to think of what possible consequences an action can have for others. You are then less inclined to imagine the impact your reckless action may potentially have on other road users. Such situational and individual factors then determine whether the awareness stage commences and thus whether an endorsed moral value can potentially influence driving behavior.

3.2.2. Moral judgment

In the case that a person does become aware that one or more moral values are at stake, then the next phase commences in which a moral judgment is constituted. A moral judgment is defined as the "determination of the most ethically appropriate course of action among the alternatives" (Schwartz, 2016, p. 767). It is here that endorsed moral values materialize

into a concrete judgment about what is the right thing to do. Schwartz (2016) emphasizes that the constitution of a moral judgment involves an interplay of reason, intuition, emotion and rationalization. However, how this mechanism exactly works and what influence each has is still debated.

For our purpose of explicating the moral value-moral behavior relationship, it should be noted that the endorsement of a particular moral value does not determine one particular moral judgment. First of all, a moral value can be outweighed by another moral value that is considered more important within a concrete situation. Think of driving a friend to an important meeting that he cannot miss. Your loyalty towards him may require you to speed, overriding your possible concern for other road users. The importance and influence of a generally endorsed moral value can thus be said to be context depended and can therefore differ per situation. Also, general moral values are not specified towards a particular situation; the same general moral value can therefore result in different and sometimes even contrasting moral judgments within a specific context. Speeding your friend to a meeting is in line with your loyalty towards him, but may conflict with your possible loyalty towards society and its laws. In other words, though people may agree in embracing loyalty in an abstract sense, they may still differ on what loyalty demands in a particular situation.

3.2.3. Moral intention and behavior

Once a moral judgment is formed on what would be the right course of action, this does not automatically lead to the according behavior. In the third stage this moral judgment is weighed against other non-moral considerations, like egoistic preferences, before a final intention[7] or decision is formed regarding what to do. Say that you are aware that speeding will put others at considerable risk and you know that the right thing to do is to stick to the speed limit. However, you still decide to step on the gas because you really want to be home as soon as possible because your favorite tv-show is starting. In this case the moral value of caring for others that you endorse in general is overruled by an egoistic preference and as such does not affect the eventual behavior.

In Schwartz's (2016) model, whether a moral judgment is overruled, again, depends on individual and situational factors. Individual factors that play a role at this stage are those that influence the moral integrity side of someone's moral capacity, like the level of one's moral identity (Aquino & Reed, 2002) and, as Schwartz mentions, moral courage (Hannah, Avolio, & May, 2011). Situational factors that can co-determine whether the moral judgment also becomes the behavioral intention are, for instance, phenomena like the influence of an authority (Milgram, 1963) or the above mentioned ethical vulnerability of a person. A situational factor that has been shown to be of considerable effect on risky and aggressive driving is peer pressure (Shepherd, Lane, Tapscott, & Gentile, 2011).

Note that Festinger's theory of cognitive dissonance (1957) suggests that such a discrepancy between a moral judgment and your final decision cannot be maintained without considerable stress. In the case that a person sticks to a decision that deviates from his or her moral judgment it is likely that the person will adjust the initial judgment through rationalizations. One may for instance downplay the risk and possible consequences of speeding, dehumanize potential victims, or come up with an alternative moral reason that supports the final decision. This then produces a back loop from decision to moral judgment or, as mentioned above, to moral awareness. Schwartz (2016), though emphasizing the role of rationalizations in the moral decision process, does not make this back loop explicit in his model. This may be due to the fact that he discusses the moral judgment and intention stages simultaneously. Indeed, though analytically distinct, it is important to stress that the different process stages can commence virtually at the same time and that together with the mutual influence of process stages this makes the moral decision process not a strictly sequential one.

When the (moral) intention or decision is made this consequently leads to according behavior. However, this does not have to be an automatism; it is still possible that the behavior stage does not commence even though the intention has been formed. The intended action may be out of your reach or a physical barrier may be in the way of performing the intended action. For instance, if you intend to speed you may be stopped from performing this behavior by road bumps or another car blocking your way.[8]

Together, the above elaboration gives a conception of the moral value-aggressive driving behavior relationship and the 'route' along which moral values need to travel before having an effect on aggressive driving. When someone with a certain moral foundation becomes aware that an endorsed moral value is at stake in a certain situation, judges a certain course of action as the right one in light of this value and other values, and sticks to his or her judgment by forming the intention to act upon it, while not hindered by any other barriers, the endorsed moral value will affect the driving behavior. Whether this relationship materializes for a particular person in a particular situation at a particular moment in time depends on a variety of individual and situational factors. It should thus be recognized that this conceptual chain reflects a rather uncertain and indeterminate route; the question appears legitimate to what extent this influences, i.e., weakens or even precludes, the empirical relationship between moral values and aggressive driving behavior. In the following we will empirically explore this question by testing the effects of drivers' moral foundations on their aggressive driving behaviors.

[7] When the intention is in line with the moral judgment it is regarded as 'moral intention' (Schwartz, 2016; Rest, 1986).

[8] Note that physically blocking a *moral intention* in the context of aggressive driving is much harder to imagine.

4. Method

4.1. Measurements

To measure people's moral values and risky and aggressive driving behavior we employed an online survey consisting of the Moral Foundation Questionnaire (www.moralfoundations.org, 2013) and the Aggressive Driving Behavior Scale (ADBS) (Houston, Harris & Norman, 2003). The ADBS consists of 11 self-reported items related to aggressive and potentially harmful driving behavior (see Table 1). Respondents were asked to indicate the frequency with which they have engaged with each of the 11 aggressive driving behaviors in the past six months, on a scale from one to six (1 = never, 6 = always). The scale has previously been validated in a study among American undergraduate students (Houston et al., 2003), revealing two components, namely "speeding" and "conflict behavior". As the members of the target population of the research are Dutch drivers, the items were translated from English into Dutch.

A Principal Component Analysis (PCA) was conducted to assess the dimensionality of the ADBS items in our sample and summarize the data. Instead of the two-component solution found by Houston et al. (2003), our data produced a three-component solution that (after varimax rotation) led to a simple structure (all loadings > 0.5 and all cross-loadings < 0.5) which was easily interpretable (see Table 1). The components reflect three different aspects of aggressive driving, namely 'speeding/rushing', 'thwarting', and 'aggressive communication'. Based on the items with loadings above 0.5 sum scores were computed, which were used as dependent variables in the subsequent analyses.

Moral values were measured through the 20-item MFQ scale (MFQ20) (Graham et al., 2011; www.moralfoundations.org, 2013). MFQ20 consists of twenty items plus two control items and is divided into two parts. The first part contains ten considerations (two for each moral foundation) each of which may to a certain extent be relevant to one's thinking when deciding whether something is right or wrong and is judged on a scale from 1 (not at all relevant) to 6 (extremely relevant). For example, whether or not someone suffered emotionally (an item of the care/harm dimension) or whether or not some people were treated differently than others (an item of the fairness/cheating dimension). The second part consists of ten statements (again two for each foundation) to which respondents indicate their agreement on a scale from 1 (strongly disagree) to 6 (strongly agree). This part includes statements such as 'respect for authority is something all children need to learn' (an item of the authority/subversion foundation) and 'people should not do things that are disgusting, even if no one is harmed' (an item of the sanctity/degradation foundation). For the Dutch translation of MFQ20 we used the official one that is made available by its developers through the moral foundation website (www.moralfoundations.org).

For the MFQ we used the existing five component structure that is given by the theoretical framework of MFT (see Table 2). While this structure has been validated in several studies (Graham et al., 2011), other studies report that MFQ only gives rise to a two-factor model where care and fairness are grouped together as the 'individual' foundations and loyalty, authority and purity as the 'binding' foundations (Curry, Chesters, & Van Lissa, 2019; Iurino & Saucier, 2019). This two-factor structure has also been recognized by the developers of MFT/MFQ and has, as such, also been used and referred to in several empirical studies (Smith, Aquino, Koleva, & Graham, 2014; Graham, Haidt, & Nosek, 2009). A PCA performed on our own dataset in fact generates a six-factor solution. In line with the fact that different datasets find a different number of factors, we found that on our data the scales of the five-factor structure stay below the reliability threshold of 0.7. In the discussion we will further elaborate and substantiate the choice for using the original structure of the MFQ as our measurement tool despite a lower scale reliability than usually desired, and also elaborate on the extra analyses that were performed to ensure that this choice did not influence our results and conclusions.

Our survey additionally included several socio-demographic characteristics and driver's license ownership.

4.2. Data collection and sample composition

For data collection we made use of a convenience sample (N = 281). The first author and a master student promoted the survey among their respective social networks. To ensure that respondents could potentially engage in the behavior under

Table 1
Rotated component matrix.

Component	Item	Loadings
Speeding	1. Drive 20 miles per hour faster than the posted speed limit	0.738
	2. Follow a slower car at less than a car length	0.703
	3. Pass in front of a car at less than a car length	0.638
	4. Accelerate into an intersection when the traffic light is changing from yellow to red	0.537
	5. Merge into traffic even when another driver tries to close the gap between cars	0.517
Thwarting	6. Intentionally tap my brakes when another car follows too closely	0.660
	7. Follow another car in front of me closely to prevent another car from merging in front of me	0.611
	8. Speed up when another car tries to overtake me	0.607
Aggressive Communication	9. Flash my high beams at slower traffic so that it will get out of my way	0.802
	10. Honk when another driver does something inappropriate	0.695
	11. Make rude gestures at other drivers when they do something I don't like	0.548

Table 2
Descriptive statistics of the five moral foundations (based on MFQ20).

Moral foundation	Mean	SD	Reliability (Cronbach's α)
Care/ Harm	4.04	0.87	0.57
Fairness	4.60	0.71	0.49
Loyalty	3.05	0.90	0.63
Authority	3.33	0.83	0.52
Purity	3.86	0.89	0.55

Table 3
Sample distributions of socio-demographic characteristics.

		Sample (%)	Population (%)[a]
Gender	Male	54.8	49.6
	Female	44.5	50.4
	other	0.7	–
Age	18–27	11.7	12.7
	28–37	34.6	12.4
	38–47	12.0	12.4
	48–57	15.2	14.8
	58–67	22.3	12.6
	>67	4.2	15.8
Education level	Lower	19.4	65.3
	Higher	80.6	34.7

[a] Retrieved from Statistics Netherlands (CBS, 2019b).

investigation (i.e. aggressive driving), only respondents that were in possession of a driver's license were considered eligible and included in the sample. The demographic make-up of the sample is shown in Table 3. With respect to gender the sample is more or less representative, but the distributions of age and education level were biased compared to the respective Dutch population distributions. In particular, higher educated and younger people were overrepresented. Although age and education level influence average levels of aggressive driving downwards and upwards respectively (see also our results further below), it should be noted here that, importantly, our study does not aim to make any claims about these average levels of aggressive driving per se. Rather, we focus on the relation between moral values and aggressive driving behavior; clearly, there is no conceptual intuition or theoretical reason to expect that sample-bias in terms of age and education would have a (large) effect on these estimated relationships. Finally, note that in our empirical analyses, we use age and education (as well as gender) as control variables, which was enabled by a sufficient range in these variables.

To prevent bias due to ordering effects, we randomly alternated the order of either asking the MFQ-items or the ADBS-items first. Half of the respondents were thus first asked about their aggressive driving behavior and half first about their moral foundations.

4.3. Method of analysis

To test whether the endorsement of the different moral foundations predicts aggressive driving behavior, multiple linear regression analyses were conducted. Six models were estimated; two for each type of aggressive driving where the latter was entered as the dependent variable. The first of each pair includes only the three control variables age, gender, and education,

Table 4
Standardized parameter estimates of the regression models predicting speeding/ rushing.

	Model 1		Model 2	
	Beta	***p*-value**	**Beta**	***p*-value**
Age	−0.234	0.000	−0.241	0.000
Female (ref.: male)	−0.228	0.000	−0.200	0.001
High level of education (ref.: low)	−0.020	0.727	0.000	0.999
Care/ Harm			−0.014	0.843
Fairness			−0.148	0.036
Loyalty			0.059	0.429
Authority			0.081	0.245
Purity			0.058	0.407
R square	0.102		0.133	
Delta R square			0.031	0.089

Table 5
Standardized parameter estimates of the regression models predicting aggressive communication.

	Model 3		Model 4	
	Beta	***p*-value**	**Beta**	***p*-value**
Age	−0.297	0.000	−0.335	0.000
Female (ref.: male)	−0.267	0.000	−0.258	0.000
High level of education (ref.: low)	0.013	0.824	0.014	0.817
Care/ Harm			−0.142	0.041
Fairness			0.074	0.275
Loyalty			0.085	0.239
Authority			−0.061	0.370
Purity			0.128	0.061
R square	0.156		0.183	
Delta R square			0.027	0.114

Table 6
Standardized parameter estimates of the regression models predicting thwarting.

	Model 5		Model 6	
	Beta	***p*-value**	**Beta**	***p*-value**
Age	−0.151	0.012	−0.164	0.008
Female (ref.: male)	−0.123	0.036	−0.068	0.274
High level of education (ref.: low)	0.101	0.092	0.144	0.022
Care/ Harm			0.014	0.850
Fairness			−0.128	0.077
Loyalty			0.174	0.023
Authority			0.051	0.476
Purity			−0.037	0.609
R square	0.052		0.084	
Delta R square			0.032	0.099

the second also the five moral foundations as predictors (see Tables 4–6). Using multiple regression analysis enabled us to estimate the individual effects of each moral foundation on the different types of driving behavior. By estimating two models per aspect of aggressive driving in which the first model consisted of only the control variables and adding the moral foundation as predictor in the second of the pair, it was possible to discern the unique predictive value of the moral foundation framework as a whole on aggressive driving behavior. Each model satisfied the assumptions for linear regression analysis. An inspection of the residuals showed that the errors approximate the normal distribution, also there was no multicollinearity among the independent variables (VIF all between 1 and 2).

5. Results

The results show that for each aspect of aggressive driving only one foundation has a significant, although weak effect. For 'speeding/rushing' only the fairness foundation has a significant negative effect (Table 4, model 2). This means that those who consider fairness to be an important value when making a moral judgment are less inclined to show speeding or rushing behavior while driving. A high or low endorsement of the four other foundations does not have any effect on speeding and rushing based on this model. Regarding aggressive communication, we only find an effect for the care/harm foundation, which is again negative (Table 5, model 4). This indicates that people who consider caring for and not harming others to be important when making a moral judgment score lower on the aggressive communication scale. For the four other foundations we found no statistical association with the communication aspect of aggressive driving. Also, for thwarting we find only one moral foundation, loyalty, to have a significant effect (Table 6, model 6). Interestingly, the found relationship between loyalty and thwarting is *positive*. This suggests that people who consider the value of loyalty important when making a moral judgment also tend to thwart other drivers on the road more. We will further go into and interpret this, at first sight, counter intuitive finding in the conclusion.

When considering the added explanatory power of the models (delta R squared) when the five moral foundation are included as predictors, it is seen that these do not explain significantly more variation in aggressive driving than the models consisting of only the control variables.

6. Conclusion and discussion

The conducted conceptual and empirical investigation into the relationship between moral values and aggressive driving behavior gives us new insights into and a better understanding of the role that moral values play in the constitution of this

kind of behavior. The empirical results suggest that the relationship is very weak at best. Per aspect of aggressive driving we find only one moral foundation to have a predictive effect. When controlled for age, gender and education, the standardized effects are all well under 0.2 and must therefore be regarded as rather small. Though few and weak, the found effects are interpretable. The negative effects of fairness and care/ harm on speeding and aggressive communication respectively are as expected. Also, the found positive effect of the moral foundation of loyalty on thwarting is logically interpretable. Though it may seem counterintuitive at first to suggest that a higher endorsement of a moral value can lead to behavior that is actually undesirable from a moral and societal point of view, this relation is intelligible from an in-group/out-group perspective. The loyalty foundation includes the idea of taking care of the in-group and protect them from outgroup threats (Smith et al., 2014; Graham et al., 2013). When on the road, other drivers may well be identified as an out-group potentially threatening you and your in-group (e.g. family) in your car. Getting other drivers off your tail by tapping the breaks, for instance, or not giving them leeway in order to improve your own position and that of the one's in your car seems logical for someone who endorses the value of loyalty.

Furthermore, the amount of extra variation explained by the models that, besides the three control variables, also include the five moral foundations does not reach statistical significance. This means that adding the five moral foundations to the model does not lead to a better prediction of aggressive driving behavior. The endorsement level of the different moral foundations does then not have an effect on aggressive driving behavior that cannot already be explained by age, gender and education. This also suggests that the individual moral foundations for which a significant effect was found mediate, for a very small part, the effects of the social demographics on aggressive driving. Model 2 (Table 4) for instance shows a slight reduction of the effect of gender on speeding/ rushing in comparison with model 1 and a small significant effect for fairness. This indicates that the relation between gender and the tendency to speed may for a small part be explained by the value of fairness. Overall, however, our results imply a very limited association between the moral foundation framework and aggressive driving, and a very weak prediction of the latter by the former.

Considering the fact that aggressive driving has a clear moral component and that it therefore seems to be intuitive that people's moral values influence their (absence of) aggressive driving behavior, our results raise important questions for further explanation. By building upon our conceptual analysis of the process of moral decision-making it is possible to interpret and further clarify the results and argue whether, based on this analysis, it is in fact in line with what should be expected. Before elaborating on the interpretation of our empirical results in terms of the process of moral decision-making we will first go into the limitations of our empirical study that may have influenced our results.

First of all, it should be noted that the analysis is based on a convenience sample whose composition does not fully reflect the Dutch population. As discussed in section 4.2, we believe that the influence of this on our results and conclusions is limited. Of course, to test the robustness of our empirical findings beyond the confines of our sample, further empirical research is needed. It can then also be tested if our findings can be replicated in different cultures and different countries.

Secondly, we are aware of some limitations regarding the used measurement tools concerning its reliability and validity. With respect to *reliability* it is important to be conscious of the fact that asking people about their moral beliefs and about behavior that is generally found to be morally or socially objectionable is of course sensitive to socially desirable answering. Even the assurance of anonymity may not fully take away that effect. Although this is necessarily a limitation of our study, as it is a limitation of many studies dealing with socially deviant behavior (and as such a common issue within fields like criminology), we believe that the effect on our results is limited. The main reason for this belief is that our study aims to discern the relationship between the two main variables instead of estimating variable levels within the population. As long as we can assume that respondents under report their level of aggressive driving (and, in the same vein, over report their level of moral value endorsement) to the same degree, so for instance all one point lower (or higher) than in reality –note there does not seem to be a pressing reason not to assume this– the variations used for predicting the dependent variable based on the independent variables can be assumed to be similar (though varying around a higher or lower mean than found in reality) and thus useful for analyzing their relationship.

A second concern regarding the reliability of the used measurement tools is whether people are able to make a good estimation of their actual aggressive driving behavior of the last six months. The fallibility of memory and interpretation seems to play a role here. However, any errors resulting from this may be assumed to be random and as such will only affect the reliability of the parameter estimates (the standard errors) and not the estimates themselves.

A third issue concerning reliability is the selection of a particular constellation and number of factors and their internal consistency. Note that for both the ADBS and the MFQ20 there is the choice to go for the original factor structure *or* the solution that is generated by our own data. Regarding the ADBS we chose for our own solution instead of the original one given by the developers of the questionnaire, as the PCA here functions as a data-reduction technique and we wanted to use the best summarization possible that is logically interpretable. This was the case for the found three factor structure of the ADBS that we used in the analysis. Note that two out of the three scales do not reach the 0.7 Cronbach's Alpha reliability threshold. However, because we use the dimensions here merely as a way to summarize the data and do not assume them to be existing latent variables this does not seem problematic.

In the case of MFQ20 we did decide to stick to the original structure, instead of the six-factor solution that appeared from our data. The reason for choosing the original structure here is that in this case the factors do represent genuine psychological latent variables. As it is our primary goal to use MFQ20 as a theoretically backed up empirical tool to measure people's endorsement of different moral values, using the original structure seems to be the right route. As reported in the method section though, the reliability of the original MFQ20 scales did not reach the usually required threshold.

To be sure that the latter as well as the other abovementioned choices concerning scale structure did not affect our results and consequent conclusions, we conducted (but will not report here for reasons of space limitations) some additional tests. First of all, it was tested whether using the above-mentioned alternative scales –the original ADBS structure, the two-factor MFQ structure (*see* method section) and the six-factor MFQ structure– render different results. Secondly, a series of eleven *ordinal* regression models were estimated, one for each single ADBS-item, which was entered as the dependent variable. With these latter analyses we checked whether the used summarization of the ADBS-data through the three-factor structure influenced our results. Also, conducting ordinal regression analyses enabled us to make sure that the possible limitation of entering originally ordinal variables, the three ADBS-factors, as dependent variables in the linear regression analyses - thereby assuming them to function as continuous variables- did not affect the results. None of the above additional analyses produced results that are substantively different from those presented in the results section.

With respect to the *validity* of the used measurement tools the question can be posed whether they measure what they intend to measure. A limitation of our research in this regard is that at least one important form of what generally may be regarded as risky and aggressive driving is not included in the ADBS-questionnaire: drunk driving. In future research, it would be interesting to take this form of aggressive driving into account. One approach would be to investigate the relation between one's moral values and the decision to drink and drive. Another interesting aspect is to look into how the moral decision process underlying aggressive driving behavior is influenced by the intake of alcohol.

However, also when the mentioned limitations are taken into account, we have good reason to believe that we would still find the same few and weak relationships between people's moral values and aggressive driving behavior. An explanation for this result can namely be found within the process of moral decision-making itself. In light of the discussed conceptual model of moral decision-making it becomes clear that for a moral value to have an effect on behavior it needs to go through several process stages that are each influenced by individual and situational factors. This makes the relationship between moral values and aggressive driving behavior indeterminate. First of all, as we have seen, a person driving in a car may not become aware that the choice for aggressive driving may violate (or is supported by, as seems to be the case for some persons endorsing the value of loyalty) an endorsed moral value. In the case awareness does arise, a judgment follows whose outcome is not just dependent on the level of endorsement of the moral value in a general non-specified context, as is the setting of MFQ, but also on the specific context the person is confronted with. For instance, when different endorsed moral values are in conflict it also depends on the context which one prevails. Furthermore, it can be unclear what choice a general moral value actually determines in a specific context. The found positive effect for loyalty on aggressive driving (thwarting) indicates this possible indeterminacy as it may conflict with an interpretation of loyalty that instigates conformity towards the rules of the community. Then, once a judgment is made, it may subsequently be pushed aside by a preference for certain egoistic considerations. In the case that the moral judgment does prevail and a moral intent is formed then there may be certain obstacles that prevent the intended behavior to commence (though for the decision *not* to commit aggressive driving this seems hard to imagine).

Because a generally endorsed moral value is for its effect dependent on these process stages that are each influenced by individual and situational factors, the potential effect of a moral value on one's behavior is easily annulled. This then can account for the found absence of and weak relationships between people's moral values and reported aggressive driving behavior. Though people endorse a certain value in general, it does not take effect when driving in a car.

The above analysis has at least the following implications. First of all, it suggests that in order to get a better understanding of the phenomenon of aggressive driving and the role of morality in the constitution of this behavior we need to zoom further in into the different process stages of the moral decision-making process within the specific context of aggressive driving and see what factors influence them. So, for instance, what context specific situational and individual factors play a role in (not) becoming aware of the moral implications that a choice for aggressive driving has? And, furthermore, what context specific egoistic considerations play a role that can overrule someone's moral judgment to not drive aggressively? What factors influence people their moral motivation and moral perseverance when they are driving in a car? This first point also suggests that the found empirical result does not imply that moral values necessarily have barely any effect on aggressive driving behavior. It only means that at this moment it is quite weak, but also that it might be improved by, for example, raising awareness about the moral impact of people's choices while driving, or by improving people's moral motivation and moral perseverance to keep them from discarding their moral judgment in favor of self-interest while driving a car.

A second implication of our work regards the validity and scope of the MFQ. With MFQ we assume to measure aspects of morality that play an actual role in the decision-making process, but the question can be asked to what extent this is indeed the case. The questions asked in the questionnaire are quite general, not tailored to the context of aggressive driving, and could also just reflect what people find morally relevant in a very general sense. It may well be then, that these general moral statements made by people in a questionnaire do not reflect, or barely reflect, the moral dimensions that play a role when real life decisions are made in the context of aggressive driving nor in other particular contexts. Our conceptual discussion as well as our empirical results clearly suggest that this may be a fundamental problem associated with the MFQ. Although the MFQ is a well-established tool to measure people's beliefs and attitudes, the above-mentioned criticism should be taken seriously and asks for further investigation into its validation and its usefulness as a predictor of concrete and particular moral behaviors. A potential fruitful line of research could be to investigate the presence and measurement of more contextual moral values, for instance, to what extent persons care about vulnerable others, and their relationship to aggressive driving behavior. In such an investigation one should be aware though of the possible inverse of the causal relationship between the

context specific moral values and aggressive driving as a consequence of predicting behavior from more specific attitudes (Kroesen & Chorus, 2018).

This brings us to the following policy implications. The first is that in order to increase traffic safety, developing safety policies only targeted at changing people's moral values does not seem the most effective way forward. Policies should have significant attention for the different process stages that play a role in the moral decision-making process and that form the route from moral value to behavior. This means that attention needs be directed toward e.g. raising people's moral awareness when driving a car and inducing them to hold on to their own moral judgment in the face of internal and external pressures to choose otherwise. For awareness, our analysis at least suggests that people should become aware of the *facts* about aggressive driving, realize the *moral meaning* it has, by linking it to a moral principle or realizing the actual consequences it has for others, and thirdly, by acknowledging that this moral meaning is *applicable to other traffic users*, as on every bike and behind every car windscreen there is an actual human being. Which individual and situational factors exactly influence these aspects of awareness and people's moral intent within the context of aggressive driving is subject to further research. If our analysis is on the right track, this suggests that it may be possible to influence aggressive driving behavior without necessarily raising the level of the endorsement of certain moral values, but rather by influencing the role of the process stages that block or give way to the influence of moral values that are already endorsed. However, further empirical research is needed on the effects of the intermediate process stages on aggressive driving behavior before anything more conclusive can be said about this idea.

Secondly our empirical and conceptual analysis suggest that targeting 'soft' factors, like people's moral beliefs and attitudes towards aggressive driving, is quite a vulnerable route for preventing this kind of behavior. This supports the idea that physical interventions, located in between the intention and behavior stage, could be the most effective ones. On roads one can of course think of speedbumps and other physical measures that prevent speeding. But it may also be possible to put restrictions on the car itself that make it impossible to show aggressive driving behavior. Research on the effect of alcohol ignition interlock supports the above train of thought as it is shown that the device is only effective in reducing traffic violations as long as it is installed and physically prevents drunk driving. Once it is removed and the behavior of drunk driving is only dependent on (moral) decision-making, there is no difference anymore between the ones who formerly were and were not subjected to this measure (Beck, Rauch, Baker, & Williams, 1999).

CRediT authorship contribution statement

Tom G.C. van den Berg: Conceptualization, Writing - original draft, Methodology. **Maarten Kroesen:** Conceptualization, Methodology, Writing - review & editing. **Caspar G. Chorus:** Writing - review & editing, Supervision, Funding acquisition.

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