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Acceptability of single and combined transport policy measures: The importance of environmental and policy specific beliefs

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ABSTRACT

In this study, the acceptability of different transport policy measures was examined. Three measures were assessed individually and as packages combining one push measure (a raised tax on fossil fuel) and one pull measure (in Package 1 improved public transport and in Package 2 a subsidy of renewable fuel). To analyze factors important for the acceptability, we proposed a model where the value-belief-norm theory combined with policy specific beliefs (perceived fairness and perceived effectiveness) predicted acceptability. Furthermore, we examined whether problem awareness or personal norm was more important for acceptability. In a questionnaire study conducted in Sweden, a sample of car users ($N = 616$) assessed the transport policy measures. Results showed that while the pull measures were perceived to be effective, fair, and acceptable, the push measure and the packages were perceived to be rather ineffective, unfair, and unacceptable. The proposed model was supported for the measures and problem awareness was found to have a direct effect on acceptability for the pull measures while personal norm was found to have a direct effect on acceptability for the push measure and the two policy packages. In addition, perceived fairness and effectiveness were found to be particularly important for acceptability.

1. Introduction

Motorized traffic causes severe environmental problems such as local and large scale air pollution, noise, climate change, and acidification (see e.g., Van Wee, 2007). Since households' transportation is dominated by the motor car, households contribute to these environmental problems (see e.g., Eurostat, 2007). To facilitate a reduction of the negative environmental effects of households' transportation, different transport policy measures may be implemented, for example improve the public transport, raise the tax on fossil fuel, subsidize renewable fuel, improve the facilities for cyclists and pedestrians, road charging, increase the price for parking, and land use management. In addition to selecting effective policy measures, there is a need to consider the publics' acceptability of the measures since a low level of public acceptability is a barrier for implementation (see e.g., Gärling and Loukopoulos, 2007; Schade, 2003; Vieira et al., 2007). For example, economic instruments causing an increased cost for using the car tend to be difficult to implement because of the low level of public and political acceptability. Despite this, several researchers claim that at least some degree of coercion is needed in order to influence car users (e.g., Meyer, 1999; see Gärling and Loukopoulos, 2007 for a discussion). To overcome these difficulties several researchers have suggested a combination of different measures to increase the acceptability of unpopular measures, for example using supportive measures such as improved public transport simultaneously with pricing measures (e.g., Gärling and Schuitema, 2007; May et al., 2006; May and Roberts, 1995; Steg, 2003). In order to select appropriate policy measures, there is a

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need to have a thorough understanding of the publics' acceptability of different policy measures individually and combined into packages. Furthermore, a successful implementation process requires knowledge of factors important for the acceptability of the measures. The aim of the present study is to compare car users' beliefs about different transport policy measures and packages of measures aiming to reduce the negative environmental effects of car use. In addition, beliefs important for acceptability of the measures will be analyzed.

1.1. Transport policy measures

There are different types of transport policy measures[1], for example legal policies, economic policies, measures changing the physical context, and informational/educational measures (see e.g., Gärling and Schuitema, 2007; Steg, 2003). While Vlek (1996) makes a distinction between structural or hard measures (i.e., measures intending to alter the individual's context) and psychological or soft measures (i.e. measures aiming to increase awareness/knowledge), Steg and Vlek (1997) distinguish between push measures intending to make car use less beneficial (e.g., prohibiting car use in city centres, raising the tax on fossil fuel, road user charging schemes), and pull measures aiming to improve alternative travel options (e.g., improving the public transport, improving the facilities for cycling or walking, information). In addition, the policy measures may have different objectives, for example to increase the use of less environmentally harmful technology or to reduce the demand for car use (Gärling et al., 2002). In order for technical solutions to be effective, households need to attain the new technology (e.g., a car fuelled by renewable fuel) but there is no need for changes in travel behavior. On the other hand, reducing the demand for car use (e.g., by using alternative travel modes), requires modifications in individuals' everyday travel behavior. Comparably, Gardner and Stern (2002) have proposed a distinction between efficiency behaviors, i.e. the individual use more energy-efficient technology, and curtailment behaviors, i.e. the individual make behavioral changes in order to restrain their use of energy. While the adoption of less environmentally harmful technology may be seen as an efficiency behavior, reducing car use could be perceived as a curtailment behavior.

1.2. Car users' beliefs about transport policy measures

According to Steg and Schuitema (2007), the attributes of the transport policy measure are important for acceptability. For example, studies have demonstrated that pull measures are perceived to be more acceptable as compared to push measures, using the revenues from push measures within the same domain is more acceptable compared to if the revenues are given to the general public funds, and measures targeting efficiency is more acceptable than measures targeting curtailment behavior (Steg et al., 2005, 2006). The distinction between push and pull measures seem to be particularly important for acceptability. Even though there are a few exceptions, the public generally assume push measures to be ineffective, unfair, and unacceptable (see e.g., Rienstra et al., 1999; Steg and Vlek, 1997), while pull measures are perceived to be effective, fair, and acceptable (Eriksson et al., 2006; Joireman et al., 2001; Rienstra et al., 1999).[2] Overall, only a few studies have examined the acceptability of packages of push and pull transport policy measures. In a study by Bamberg and Rölle (2003), the respondents evaluated a combination of decreased price on public transport (pull) and increased fuel price (push) as not very effective and to some extent unfair and unacceptable. Similarly, Schade and Schlag (2003) found a low level of support for packages of different push and pull measures. Furthermore, the support for different combinations of push and pull measures vary, for example packages with different pricing strategies and improved public transport was perceived to be more acceptable as compared to a package containing improved public transport and zone access control (Thorpe et al., 2000).

1.3. The present study

The aim of this study is twofold; first, to examine car users' beliefs about single transport policy measures and the measures combined into packages and second, to investigate the importance of general environmental beliefs and policy specific beliefs for the acceptability of the examined measures. Three transport policy measures and two packages combining these measures will be compared. The examined measures; a raised tax on fossil fuel, improved public transport, and a subsidy of renewable fuel are all structural rather than psychological measures (see Vlek, 1996) and contain economic incentives or disincentives. Two different packages, described as scenarios, were created using these measures. In Package 1, a raised tax on fossil fuel was used to finance an improved public transport in a package intending to reduce the use of fossil fuel cars and to increase the use of public transport. In contrast, Package 2 contains a raised tax on fossil fuel that was used to finance a subsidy of renewable fuel with the aim to reduce the use of fossil fuel cars and to get car users to replace their car with a car fuelled by renewable fuel. Consequently, both packages include one push and one pull measure (see Steg and

[1] According to Rienstra et al. (1999), the term transport policy measures include both Travel Demand Management (TDM) measures aiming to change travel behavior (see e.g., Loukopoulos, 2005) and technical solutions attempting to deal with various problems associated with transportation (e.g., safety, congestion, and/or environmental issues). In this study, transport policy measures refer to all measures aiming to reduce the negative environmental effects of car use.

[2] In contrast, some push measures have been perceived to be moderately effective and acceptable (e.g., a car free centre has been evaluated as effective and supported to some extent (Loukopoulos et al., 2005; Nordlund and Garvill, 2006) and a package of transport pricing measures has been perceived as neither acceptable nor unacceptable (De Groot and Steg, 2006)). In addition, there are studies where pull measures were not perceived to be effective (Steg and Vlek, 1997).

Vlek, 1997) although the packages have different aims. Package 1 aims to change travel behavior (i.e. curtailment) while the purpose of Package 2 is to encourage the use of new technology (i.e. efficiency) (see Gardner and Stern, 2002).

In several studies, predictors of acceptability have been examined. Although background characteristics such as age, income, education level, and car use have been found to be important for the acceptability of transport policy measures (see e.g., Odeck and Bråthen, 1997, 2008), psychological factors such as problem awareness, perceived effectiveness, and perceived fairness have often been found to influence acceptability to a greater extent (Rienstra et al., 1999; Jakobsson et al., 2000; Jaensirisak et al., 2005; Schade, 2003). Different psychological models have been employed to describe the relation between beliefs and attitudes on the one hand and travel behavior on the other (see e.g., Thøgersen, 2006; Gatersleben and Appleton, 2007). However, in relation to the acceptability of transport policy measures the importance of psychological factors has often not been governed by a theoretical model (for an exception see Eriksson et al., 2006). In this study, we use a social psychological model combining general environmental beliefs (i.e. a pro-environmental orientation, problem awareness, personal norm, and willingness to act) and policy specific beliefs (i.e. perceived effectiveness and perceived fairness) in order to explain the acceptability of the transport policy measures.

1.4. Factors influencing the acceptability of transport policy measures

In addition to the attributes of the policy measure (e.g., whether it is a pull or a push measure), the individuals' characteristics, for example general environmental beliefs and policy specific beliefs, are central for an understanding of acceptability (Steg and Schuitema, 2007; see also Eriksson et al., 2006). The importance of general environmental beliefs for a pro-environmental readiness (e.g., the acceptability of a transport policy measure) is stipulated within the value-belief-norm (VBN) theory of environmentalism (Stern et al., 1999; see also Stern, 2000). The VBN theory highlights the normative base for acting pro-environmentally. According to the theory, the willingness to reduce the negative environmental effects of car use is explained by a norm activation process i.e. a personal norm to reduce the negative environmental effects of car use is activated by personal values and problem awareness. The VBN theory stipulates that values (e.g., altruistic values), a general pro-environmental orientation (e.g., measured by the New Ecological Paradigm (NEP) scale, Dunlap et al., 2000), awareness of the adverse consequences of human actions for the environment, and ascription of responsibility to act to oneself activate a personal norm to act pro-environmentally. In turn, a stronger personal norm creates a stronger willingness to act in support of the environment. In several studies, the importance of problem awareness for the acceptability of transport policy measures has been demonstrated (e.g., Loukopoulos et al., 2005; Poortinga et al., 2004; Steg and Vlek, 1997). Furthermore, the full VBN theory has been applied to the acceptability of energy policy measures (Steg et al., 2005). In a study by Eriksson et al. (2006), main parts of the VBN theory, in combination with policy specific beliefs (i.e. freedom to choose travel mode, own reduction of car use, effectiveness, and fairness), predicted acceptability of different TDM measures. For the most part, the policy specific beliefs mediated between general environmental beliefs and acceptability. However, personal norm was found to be significantly related to the acceptability of a raised tax on fossil fuel and an information campaign, while problem awareness was found to be significantly linked to the acceptability of improved public transport. The results demonstrate the importance of considering the individuals' general environmental beliefs when examining acceptability of transport policy measures.

Furthermore, there is strong support for a need to consider policy specific beliefs in order to explain acceptability (see e.g., Bamberg and Rölle, 2003; Eriksson et al., 2006; Jakobsson et al., 2000). Since policy measures are implemented in order to achieve a certain aim (e.g., reduce the negative environmental effects of car use), it is not surprising that one factor important for the acceptability of transport policy measures is perceived effectiveness. Several studies have demonstrated the importance of perceived effectiveness for the acceptability of policy measures showing that the acceptability is higher when the measure is perceive to actually contribute to the solution of the environmental problems (e.g., Bamberg and Rölle, 2003; Nordlund and Garvill, 2006; Rienstra et al., 1999; Schade and Schlag, 2003). Furthermore, perceiving the problems associated with car use as more serious and having a general intention not to use the car has been found to be positively related to evaluating a policy measure as more effective (Bamberg and Rölle, 2003; Nordlund and Garvill, 2006). A second factor crucial for acceptability is to what extent the measure is perceived to be fair (see Samuelson, 1993; Samuelson and Messick, 1995). Studies have showed that both push and pull measures are perceived to be more acceptable if they are perceived to be fair measures (Eriksson et al., 2006; Ittner et al., 2003; Jakobsson et al., 2000; Joireman et al., 2001). Examinations of factors important for fairness demonstrate that transport policy measures are perceived to be more fair if they are evaluated as effective (e.g., Bamberg and Rölle, 2003; Eriksson et al., 2006; Ittner et al., 2003) and if the individual has a readiness to act for the sake of the environment (Eriksson et al., 2006). Even though perceived fairness is essential for the understanding of acceptability, the concept of fairness in relation to transport policy measures is unexplored to a large extent. For example, different principles may guide the individual's fairness evaluation of transport policy measures (e.g., equity, equality or need) (see e.g., Steg and Schuitema, 2007) and there is uncertainty whether car users evaluate perceived fairness of the measure mainly for themselves or if others are taken into consideration (e.g., to what extent a measure is perceived to be fair for low income groups or citizens in sparsely populated areas).

1.5. Proposed model

Based on previous research, we propose a model explaining the acceptability of transport policy measures. The model combines general environmental beliefs as part of the VBN theory (Stern et al., 1999) with policy specific beliefs (perceived

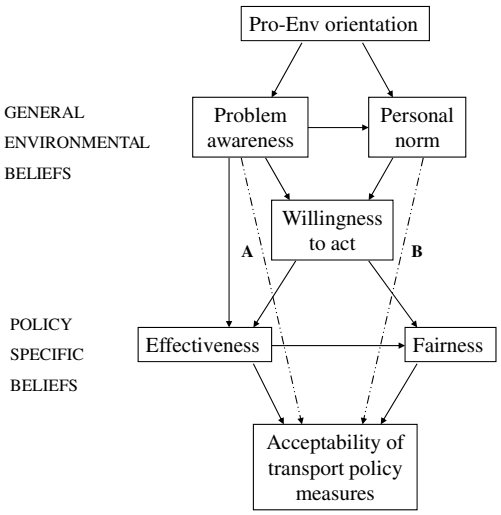

Fig. 1. Proposed model of factors predicting acceptability of transport policy measures (the original model, model A, and model B).

effectiveness and perceived fairness) in a hierarchical chain of predictors (see Fig. 1). Direct as well as indirect determinants of acceptability are incorporated in the model in order to demonstrate the psychological base for policy beliefs while at the same time maintaining a parsimonious model.

In line with the VBN theory, pro-environmental orientation is related to problem awareness and a personal norm to reduce the negative environmental effects of own car use. Subsequently, problem awareness is associated with a personal norm and a willingness to take action with the purpose of reducing the negative environmental effects of own car use. In turn, personal norm is linked to a willingness to act. According to the model, the general environmental beliefs are related to the policy specific beliefs in two ways. First, a general willingness to act is positively related to the policy specific beliefs; perceived effectiveness and perceived fairness. Second, a direct positive relation between problem awareness and perceived effectiveness is proposed given that it is possible that transport policy measures may be perceived as effective when car use is perceived to be a problem without the mediation of a personal willingness to act. Furthermore, the model stipulates a positive relation between perceived effectiveness and perceived fairness as well as positive relations between perceived effectiveness and acceptability and between perceived fairness and acceptability.

A previous study (see Eriksson et al., 2006) have shown that personal norm was more influential for acceptability when the policy measure was perceived to involve a personal sacrifice (e.g., a push measure) and problem awareness was more important for acceptability when the measure provides the car user with additional options (e.g., a pull measure). To follow up on this result, we want to analyze whether problem awareness or personal norm has a direct effect on acceptability of the examined measures. For the single transport policy measures, we anticipate a direct effect of problem awareness on acceptability for improved public transport and for subsidies of renewable fuel and a direct effect of personal norm on acceptability for raised tax on fossil fuel. For the packages including a push and a pull measure, we expect a direct effect between personal norm and acceptability if the packages are perceived to be ineffective, unfair, and unacceptable (i.e. like a push measure) and a direct relation between problem awareness and acceptability if the packages are perceived to be effective, fair and acceptable (i.e. like a pull measure). Whether personal norm or problem awareness are more important for the acceptability of the packages will be examined by testing three models; the original model without direct paths from problem awareness or personal norm on acceptability, model A including a direct relation between problem awareness and acceptability, and model B including a direct relation between personal norm and acceptability.

2. Method

2.1. Procedure and participants

The study was carried out in four municipalities in Sweden (Piteå, Huddinge, Växjö, and Göteborg). A questionnaire was sent by mail to a randomly selected sample of 2800 respondents, 20–75 years of age and following a reminder sent after one week, the response rate was 30% (N = 827). Since the response rate was rather low an analysis of the attrition was carried out. A group of 200 of the non-respondents were called by telephone and asked questions about background characteristics, the perceived seriousness of car use, the willingness to reduce the negative environmental effects of own car use, and the

acceptability of two transport policy measures; raised tax on fossil fuel and improved public transport.[3] In both the attrition group and the sample, 80% of the individuals had a driving license and access to car in the household leaving 159 car users in the attrition group and 658 in the sample. In relation to gender and civil status there were no differences between the groups. However, the sample was older compared to the attrition group (M = 50.4, SD = 14/M = 44.8, SD = 12, $t(809) = 4.64$, $p = .01$) and there was a significant difference in education level (in the sample 39% had finished high school and 35% had a university degree and in the attrition group 63% had a high school certificate while 30% had a university degree, $\chi^2(3, N = 801) = 39.12$, $p = .01$). The analyses of the environmental beliefs showed that the sample perceived air pollution from private car use to be a more serious problem as compared to the attrition group (M = 4.19, SD = 1.74/M = 3.73, SD = 1.96, $t(796) = 2.90$, $p = .01$), however, no significant difference was found in willingness to reduce the negative environmental effects of own car use (M = 4.54, SD = 1.62/M = 4.44, SD = 1.71, $t(778) = 0.73$, $p = .47$). The sample was to some extent less extreme in the evaluations of transport policy measures; less negative towards a raised tax on fossil fuel ($M = -1.57$, SD = 1.63/$M = -2.22$, SD = 1.20, $t(779) = 4.69$, $p = .01$) and less positive towards improved public transport (M = 1.70, SD = 1.46/M = 2.48, SD = 0.96, $t(778) = -6.35$, $p = .01$). Overall, the sample did not differ to a large extent from the attrition group even though the sample was older and displayed a tendency to be more pro-environmental.

Among the respondents with a driving license and access to car, 23 (3.6%) had access to a car fuelled by renewable fuel and for another 19 of the respondents the information of what kind of car they had access to was missing. This group of respondents was excluded since we wanted the policy measures to be evaluated by car users driving a car fuelled by fossil fuel, leaving 616 respondents in the analyses. In the examined sample, the gender distribution was even (46% women) and mean age was 50.4 years (SD = 14). Among the respondents, 40% had completed high school and 34% had a university degree. The majority was married/cohabiting (84%) and a large share had children living at home (55%). Median monthly household income was 35 000 SEK (approximately 4800 USD). Over half of the car users, 55%, had one car in the household while the rest had two or more cars. Median annual driving distance in the household was 15 000 km and the respondents own annual driving distance was 10 000 km.

2.2. Measures

As part of a questionnaire, the respondents answered questions concerning background characteristics, general environmental beliefs, and policy specific beliefs. In the section containing questions about background characteristics, the respondents also rated how likely it would be that they would buy a car fuelled by renewable fuel within one year on a seven point scale (1 = not at all likely, 7 = very likely).

General environmental beliefs: The car users' pro-environmental orientation was assessed by the 15 items included in the NEP scale (Dunlap et al., 2000) (see Appendix A). The respondents evaluated the items on a five point scale to what extent they agreed with the statements (1 = strongly disagree, 2 = mildly disagree, 3 = unsure, 4 = mildly agree, 5 = strongly agree). To create an index variable, seven of the 15 NEP items were reversed so that a higher value signified a stronger pro-environmental orientation. Subsequently, the means of the 15 items were combined into a measure of pro-environmental orientation with a reasonable high alpha value ($\alpha = .76$). Moreover, problem awareness of car use was assessed by four statements; to what extent air pollution from private car use was perceived to be a threat to humans and the environment in the whole world, in Sweden, in the municipality, and to the health and well-being of the respondent and the respondent's family. The respondents evaluated to what extent they agreed with the statements on a seven point scale (1 = strongly disagree, 4 = unsure, 7 = strongly agree). The mean of the four items were merged resulting in a measure of problem awareness with a high internal reliability ($\alpha = .94$). Personal norm was measured by two items; "I feel morally responsible to reduce the negative environmental effects of my car use" and "I get a guilty conscience if I don't try to reduce the negative environmental effects of my car use". The items were evaluated on a seven point scale (1 = strongly disagree, 4 = unsure, 7 = strongly agree). Subsequently, a measure of personal norm was created using the means of the two items. The internal reliability was high ($\alpha = .83$). Willingness to act was assessed with one item; "I am willing to reduce the negative environmental effects of my car use" and rated on a seven point scale to what extent the respondent agreed with the statement (1 = strongly disagree, 4 = unsure, 7 = strongly agree).

Transport policy measures: Following the general environmental beliefs, the respondents evaluated the transport policy measures. First, among other measures the three policy measures examined in this study were assessed; raised tax on fossil fuel (e.g., gasoline, diesel), increased financial support of the public transport in your municipality (e.g., cheaper tickets, increased trip frequency), and subsidies of renewable fuel (e.g., cheaper biogas, ethanol, Rapeseed Methyl Ester (RME). The specific levels of tax increase or decreases in prices as a result of the subsidies were not explicitly mentioned. Second, the two packages of policy measures, described as scenarios, were assessed. In Package 1 (P1), revenues from a raised tax on fossil fuel resulting in an increase of five SEK/l fuel (approximately 0.68 USD) were used to subsidize the public transport in the respondent's municipality resulting in a decrease of the ticket price with 50% (the price for a single ticket was approximately

[3] Perceived seriousness of car use and willingness to reduce the negative environmental effects of own car use was evaluated on a seven point scale (1 = strongly disagree, 4 = unsure, 7 = strongly agree) and the acceptability of transport policy measures were evaluated on a seven point scale (1 = completely against, 4 = neither in favor nor against, 7 = completely in favor). In order to compare the sample and the attrition group, the acceptability evaluations were recoded into a seven point bipolar scale (−3 completely against, 0 = neither in favor nor against, 3 completely in favor).

20 SEK, 2.74 USD) and increased trip frequency. In contrast, revenues from a raised tax on fossil fuel resulting in an increase of five SEK/l fuel were used to subsidize renewable fuel resulting in a decrease of five SEK/l renewable fuels in Package 2 (P2).

Policy specific beliefs: The single transport policy measures and the policy packages were evaluated to what extent they were perceived to be effective, fair, and acceptable. Perceived effectiveness was evaluated by one question; "To what extent do you perceive this policy measure/policy package to be effective and leading to an improved environment in your municipality?" and were rated on a seven point scale (1 = not at all effective, 7 = very effective). In relation to the transport policy measures evaluated individually, approximately half of the respondents evaluated fairness for themselves and the other half fairness for others. In relation to the packages, all respondents evaluated fairness for themselves. The following question assessed fairness for themselves; "To what extent do you perceive this policy measure/policy package to be fair for you?" and the following question measured fairness for others; "To what extent do you perceive this policy measure to be fair for the citizens in your municipality?". Answers were given on a seven point bipolar scale (−3 = very unfair, 0 = neither fair nor unfair, 3 = very fair). The acceptability of the policies was assessed by the question "To what extent are you in favor of or against the implementation of this policy measure/policy package?" and were rated on a seven point bipolar scale (−3 = completely against, 0 = neither in favor nor against, 3 = completely in favor). In addition, the respondents evaluated how likely it would be that they would buy a car fuelled by renewable fuel within one year, if Package 2 was to be implemented. The answer was given on a seven point scale (1 = not at all likely, 7 = very likely).

3. Results

3.1. Descriptive analyses

An analysis of the means and standard deviations of the general environmental beliefs indicated that the sample of car users displayed a pro-environmental orientation ($M = 3.68$, $SD = 0.48$) and were aware of the problems associated with car use ($M = 4.93$, $SD = 1.48$). However, fewer had a strong personal norm to reduce the negative environmental effect of car use ($M = 4.05$, $SD = 1.58$) and a willingness to act ($M = 4.55$, $SD = 1.60$).[4]

Table 1 shows the means and standard deviations of perceived effectiveness, fairness, and acceptability of the three single transport policy measures and the two packages. In order to compare the measures, repeated measures ANOVAs with Bonferroni correction were performed. In addition, one-sample *t*-tests were carried out to examine whether the measures were perceived to be fair or unfair and acceptable or unacceptable. Overall, the results showed that the subsidies were perceived to be the most effective measures as well as the most fair, and acceptable measures. Among the subsidies, improved public transport was perceived to be more effective, fair and acceptable than subsidies of renewable fuel. In contrast, the raised tax on fossil fuel was perceived to be the least effective, an unfair and unacceptable measure. The two examined packages combining one push and one pull measure were perceived to be unfair and unacceptable, however to a lesser extent compared to the push measure evaluated individually. Furthermore, the package including a raised tax and a subsidy of renewable fuel was perceived to be slightly less unfair and less unacceptable than the package combining the raised tax with improved public transport. In order to analyze whether perceived fairness of the measures differed if the respondents evaluated fairness for themselves or fairness for the citizens in the municipality, independent sample *t*-tests were performed for the single transport policy measures. Results showed that improved public transport was perceived to be fairer for the citizens in the municipality compared to the respondents themselves ($t(573) = -2.01$, $p = .05$); however in relation to the other single measures there were no significant differences. In general, the comparisons between the different transport policy measures showed that the pull measures were perceived to be more acceptable than the push measure and the packages including both pull and push measures seem to have been perceived as a mix of the included measures although more similar to the push measure (i.e. rather ineffective, unfair, and unacceptable). Notably, improved public transport was perceived to be more acceptable than subsidies of renewable fuel. However, when a raised tax financed an improved public transport it was perceived to be less acceptable compared to when a raised tax financed a subsidy of renewable fuel.

Since the objective of Package 2 was to encourage the use of less environmentally harmful technology, the likelihood of buying a car fuelled by renewable fuel within one year in the present situation was compared to the likelihood if Package 2 was to be implemented. The results demonstrated an increased likelihood to buy a car fuelled by renewable fuel if Package 2 was to be implemented ($M = 1.75$, $SD = 1.37$/$M = 2.63$, $SD = 1.97$, $F(1,583) = 151.65$, $p = .01$, partial $\eta^2 = .206$).

3.2. Model evaluation

The proposed model of acceptability was tested for the three transport policy measures individually and for the two policy packages. The general environmental beliefs included in the model were pro-environmental orientation, problem awareness, personal norm, and willingness to act. In addition, two policy specific beliefs, perceived effectiveness and perceived fairness, were included in the model of acceptability. The whole sample ($N = 616$) was used in these analyses, hence the sample evaluating perceived fairness for me and the sample evaluating perceived fairness for the citizens in the municipality

[4] The pro-environmental orientation was measured on a five point scale while problem awareness of car use, personal norm, and willingness to act were measured on a seven point scale.

Table 1
Means and standard deviations of perceived effectiveness, fairness for me, fairness for citizens in the municipality, and acceptability of transport policy measures

	Raised tax on fossil fuel (TAX)	Improved public transport (PUB)	Subsidies of renewable fuel (RENEW)	Package 1 (TAX and PUB)	Package 2 (TAX and RENEW)	*F*-Value [e]	Partial η^2
Effectiveness[a]	3.11 (1.91)	5.56 (1.51)**	5.36 (1.50)**	3.77 (1.73)	3.88 (1.63)	320.04	.364
Fairness for me[b]	−1.29 (1.60)**	1.29 (1.51)**	1.00 (1.51)**	−0.86 (1.67)**	−0.48 (1.62)**	219.95	.432
Fairness for citizens in the municipality[c]	−1.48 (1.57)**	1.54 (1.42)**	1.14 (1.56)**	–	–	386.58	.594
Acceptability[d]	−1.57 (1.61)**	1.72 (1.44)**	1.41 (1.51)**	−0.94 (1.90)**	−0.25 (1.87)**	605.37	.523

Note: In order to examine whether the mean differs from 0, one-sample *t*-tests were performed for fairness and acceptability (** $p < .01$).

[a] $N = 616$. Scale 1 to 7 (1 = not at all effective, 7 = very effective).

[b] $N = 319$ for the single measures and $N = 616$ for the packages. Scale −3 to 3 (−3 = very unfair, 0 = neither fair nor unfair, 3 = very fair).

[c] $N = 297$. Scale −3 to 3 (−3 = very unfair, 0 = neither fair nor unfair, 3 = very fair).

[d] $N = 616$. Scale −3 to 3 (−3 = completely against, 0 = neither in favor nor against, 3 = completely in favor).

[e] Repeated measures ANOVAs showed a significant main effect ($p < .01$) for effectiveness, fairness for me, fairness for citizens in the municipality, and acceptability. Post hoc test with Bonferroni correction showed differences between all measures on all evaluated dimensions except between Package 1 and 2 regarding effectiveness. Note. Only 319 respondents were used for the repeated measure ANOVA for fairness for me since only half the sample had stated their beliefs in relation to the single transport policy measures, however no large differences were detected between those included in the analyses and those excluded in relation to the packages (Package 1 M: −0.84 vs. −0.89, Package 2 M: −0.44 vs. −0.52).

were merged for the three single transport policy measures. AMOS 7.0 (Arbuckle, 2003) was used to test the proposed model and the full information maximum likelihood method was used to estimate the model since there were missing values.[5] Except for a few non-significant correlations between beliefs about the single measures, all included variables were significantly correlated (see Table 2).

For each transport policy measure, three models were tested and compared; the simplest model (original model), a model with a direct relation between problem awareness and acceptability (model A), and a model with a direct relation between personal norm and acceptability (model B). The independence model and the saturated model were tested for comparison (see Maruyama, 1998). The nested models were compared by means of the chi-square difference statistics (χ^2_{diff}) (i.e. the original model compared to model A and model B, respectively). In addition, several goodness-of-fit measures were used to assess the overall fit of the model (the chi-square, the relative chi-square, the root mean square index of approximation (RMSEA), Bentler's Comparative Fit Index (CFI), the Akaike information criteria (AIC) and the expected cross-validation index (ECVI)).

3.3. Factors influencing the acceptability of transport policy measures

For the acceptability of raised tax on fossil fuel, we expected a direct relation between personal norm and acceptability while for improved public transport and subsidies of renewable fuel a direct relation between problem awareness and acceptability was anticipated. In relation to the packages, we expected direct relations between personal norm and acceptability since the evaluations of the two packages were dominated by the included push measure, that is, the packages were perceived to be rather ineffective, unfair, and unacceptable. First, the original model was tested for the five measures and the path coefficients were examined. In relation to the general environmental beliefs, the test confirmed that all relations were significant ($p < .05$), except for the path between pro-environmental orientation and personal norm. Concerning the policy specific beliefs, only the relation between willingness to act and fairness in the model of improved public transport failed to reach a significant level. In a next step, the goodness-of-fit statistics for the test of the original model were examined (see Table 3). Particularly for raised tax on fossil fuel and the two packages, the goodness-of-fit was not satisfactory since the RMSEA was above .07 and significantly different from $p = .05$, indicating that the fit may be improved. Although the goodness-of-fit level was reasonable for the pull measures, model A and model B were tested for comparison. Results from testing model A, including a relation between problem awareness and acceptability, showed that the added relation was significant for all measures. Furthermore, based on the chi-square difference statistic the overall fit was significantly improved for all measures except Package 2. The test of model B, demonstrated a significant relation between personal norm and acceptability for all examined measures, and according to the chi-square difference statistic, the fit of the model was improved as compared to the original model. Hence, for all measures except for Package 2 both model A and model B were better compared to the original model. However, the different goodness-of-fit measures indicate that for the pull measures model A was a slightly better model while for the push measure and for the packages, model B displayed a better model fit.

Table 4 shows the results from the final models for the transport policy measures with path coefficients and the standard errors of the path coefficients in brackets. In the models of acceptability of the pull measures a direct relation between problem awareness and acceptability is included and in the models of acceptability of the push measure, Package 1 and Package 2; a direct relation between personal norm and acceptability is incorporated. The explained variance in acceptability of the

[5] The number of missing values ranged from 0.5 to 7.0 percent on the included variables.

Table 2
Correlation matrix of variables included in the models of acceptability of the transport policy measures

	PRO-ENV	Problem	PN	Willingness	TAX effective	TAX fair	TAX acc	PUB effective	PUB fair	PUB acc	RENEW effective	RENEW fair	RENEW acc	P1 effective	P1 fair	P1 acc	P2 effective	P2 fair
Problem	.39																	
PN	.25	.52																
Willingness	.13	.36	.52															
TAX effective	.13	.18	.29	.24														
TAX fair	.11	.28	.34	.26	.44													
TAX acc	.15	.29	.41	.28	.54	.72												
PUB effective	.20	.29	.18	.23	**.06**	**.08**	.10											
PUB fair	.17	.31	.20	.18	**.03**	.09	.13	.66										
PUB acc	.19	.32	.23	.20	**.06**	.12	.12	.70	.76									
RENEW effective	.14	.22	.19	.21	.10	.11	.10	.42	.35	.31								
RENEW fair	.14	.24	.22	.22	**.04**	.11	.10	.29	.42	.33	.70							
RENEW acc	.16	.28	.25	.27	.11	.14	.10	.31	.32	.39	.73	.80						
P1 effective	.24	.39	.34	.27	.35	.34	.37	.30	.29	.34	.23	.22	.29					
P1 fair	.14	.32	.30	.22	.25	.46	.45	.16	.22	.24	.09	.14	.17	.55				
P1 acc	.19	.39	.38	.26	.31	.43	.51	.22	.27	.31	.12	.17	.20	.60	.73			
P2 effective	.16	.30	.29	.28	.28	.19	.22	.22	.23	.26	.46	.40	.48	.48	.26	.29		
P2 fair	.15	.31	.29	.29	.22	.29	.26	.15	.21	.22	.30	.38	.42	.36	.48	.39	.59	
P2 acc	.18	.32	.35	.36	.26	.27	.33	.18	.24	.27	.39	.41	.50	.39	.40	.47	.64	.76

Note: All correlations are significant on $p < .05$, except for the correlations in bold. PRO-ENV = pro-environmental orientation, problem = problem awareness, PN = personal norm, willingness = willingness to act, effective = effectiveness, fair = fairness, acc = acceptability, TAX = raised tax on fossil fuel, PUB = improved public transport, RENEW = subsidies of renewable fuel, P1 = Package 1 (TAX and PUB), P2 = Package 2 (TAX and RENEW).

Table 3
Goodness-of-fit statistics for the original model, model A (including a relation between problem awareness and acceptability) and model B (including a relation between personal norm and acceptability) for the transport policy measures

	χ^2	df	χ^2/df[a]	CFI[b]	RMSEA[c]	AIC[d]	ECVI[d]	χ^2_{diff}[e]
Raised tax on fossil fuel (TAX)								
Independence model	1227.84**	28	43.85	.000	.264**	1241.84	2.019	
Saturated model	0.00	0	–	1.000	–	70.00	0.114	
Original model	76.16**	10	7.62	0.945	.104**	126.16	0.205	
Model A	66.05**	9	7.34	0.952	.102**	118.05	0.192	10.11**
Model B	49.59**	9	5.51	0.966	.086**	101.59	0.165	26.57**
Improved public transport(PUB)								
Independence model	1497.19**	28	53.47	.000	.292**	1511.19	2.457	
Saturated model	0.00	0	–	1.000	–	70.00	0.114	
Original model	28.48**	10	2.85	.987	.055	78.48	0.128	
Model A	22.83**	9	2.54	.991	.050	74.83	0.122	5.65**
Model B	24.22**	9	2.69	.990	.052	76.23	0.124	4.26**
Subsidies of renewable fuel(RENEW)								
Independence model	1619.80**	28	57.85	.000	.304**	1633.80	2.657	
Saturated model	0.00	0	–	1.000	–	70.00	0.114	
Original model	24.89**	10	2.49	.991	.049	74.89	0.122	
Model A	14.48*	9	1.61	.997	.031	66.48	0.108	10.41**
Model B	17.73*	9	1.97	.995	.040	69.73	0.113	7.16**
Package 1 (TAX and PUB)								
Independence model	1403.13**	28	50.11	.000	.283**	1417.13	2.304	
Saturated model	0.00	0	–	1.000	–	70.00	0.114	
Original model	53.28**	10	5.33	.969	.084**	103.28	0.168	
Model A	37.66**	9	4.18	.979	.072*	89.66	0.146	15.62**
Model B	32.09**	9	3.57	.983	.065	84.09	0.137	21.19**
Package 2 (TAX and RENEW)								
Independence model	1459.87**	28	52.14	.000	.288**	1473.87	2.397	
Saturated model	0.00	0	–	1.000	–	70.00	0.114	
Original model	44.18**	10	4.42	.976	.075*	94.18	0.153	
Model A	40.36**	9	4.49	.978	.075*	92.36	0.150	3.82
Model B	28.83**	9	3.20	.986	.060	80.83	0.131	15.35**

[a] Cut off values vary from two or three to five (Bollen and Long, 1993).
[b] .95 represents a reasonable fit (Hu and Bentler, 1999).
[c] .08 represents a reasonable fit while .05 is considered a good fit (Browne and Cudeck, 1993). $^{**}p < .01$ and $^{*}p < .05$ represent PCLOSE (whether the value is significantly different from .05).
[d] The model with the lowest value is considered to be the best model (Jöreskog and Sörbom, 1993).
[e] The model compared to the original model. A non-significant value suggests that the compared models fit the data equally well (df = 1) (Maruyama, 1998). $^{**}p < .01$, $^{*}p < .05$.

different measures ranged from 58% to 70%. Hence, the acceptability of the different transport policy measures could be explained by the same factors with comparable path coefficients and explained variances.

In Table 5, the standardized total effects (i.e. the sum of direct and indirect effects) on acceptability are displayed. By comparing the coefficients, the total effects of various factors on acceptability may be identified. Once again the differences between pull and push measures were highlighted. The total effects of problem awareness and personal norm on acceptability were comparable for the push measure and the packages while for the pull measures problem awareness was more important than personal norm. In all models, fairness and effectiveness were important for acceptability, although fairness was slightly more important than effectiveness for the push measure, effectiveness was more important than fairness for the pull measures, and fairness and effectiveness were equally important for the packages.

4. Discussion

The present study demonstrates the importance of considering the features of the transport policy measure as well as the individuals' beliefs when acceptability is examined. In line with previous studies (e.g., Rienstra et al., 1999; Steg and Vlek, 1997), the distinction between push and pull measures was found to be relevant for the beliefs about transport policy measures. The pull measures were perceived to be more effective, fairer, and more acceptable as compared to the push measure. Furthermore, the packages combining push and pull measures were perceived to be unfair and unacceptable (cf. Bamberg and Rölle, 2003; Schade and Schlag, 2003). According to Steg et al. (2006), how the revenues are used and whether efficiency or curtailment behavior is targeted may be important for acceptability. Notably, the acceptability of the packages was higher compared to the push measure evaluated individually. Hence, in line with results presented by Steg et al. using the revenues to finance pull measures seem to make the evaluation less negative. In contrast to Steg et al. however, this study showed that the improved public transport, targeting curtailment behavior, was perceived to be more acceptable as compared to the

Table 4
Results from the evaluation of the path model in relation to the transport policy measures with the path coefficients and standard errors for the path coefficients in brackets

	All models[a]	Raised tax on fossil fuel (TAX)[b]	Improved public transport (PUB)[c]	Subsidies of renewable fuel (RENEW)[d]	Package 1 (TAX and PUB)[e]	Package 2 (TAX and RENEW)[f]
PRO-ENV → Problem	.39 (.11)					
PRO-ENV → PN	**.06 (.13)**					
Problem → PN	.50 (.04)					
Problem → willingness	.11 (.05)					
PN → Willingness	.47 (.04)					
Problem → acc		–	.06 (.03)	.08 (.02)	–	–
PN → acc		.16 (.03)	–	–	.13 (.03)	.10 (.03)
Problem → effective		.12 (.06)	.23 (.04)	.16 (.04)	.33 (.05)	.23 (.05)
Willingness → effective		.20 (.05)	.15 (.04)	.16 (.04)	.15 (.04)	.20 (.04)
Willingness → fair		.16 (.04)	**.02 (.03)**	.07 (.03)	.08 (.04)	.13 (.04)
Effective → fair		.41 (.03)	.66 (.03)	.68 (.03)	.53 (.03)	.55 (.03)
Effective → acc		.25 (.03)	.34 (.03)	.33 (.03)	.25 (.03)	.27 (.04)
Fair → acc		.57 (.03)	.52 (.03)	.55 (.03)	.57 (.04)	.58 (.04)

Note: All path coefficients are significant on $p < .05$, except for the path coefficients in bold. PRO-ENV = pro-environmental orientation, problem = problem awareness, PN = personal norm, willingness = willingness to act, effective = effectiveness, fair = fairness, acc = acceptability.

[a] Explained variance: problem 15%, PN 28%, willingness 28%.
[b] Explained variance: effective 7%, fair 22%, acc 58%.
[c] Explained variance: effective 10%, fair 45%, acc 66%.
[d] Explained variance: effective 7%, fair 49%, acc 70%.
[e] Explained variance: effective 17%, fair 31%, acc 60%.
[f] Explained variance: effective 13%, fair 36%, acc 64%.

Table 5
The total standardized effects (i.e., the sum of direct and indirect effects) on acceptability for the transport policy measures

	PRO-ENV	Problem	PN	Willingness	Effective	Fair
Raised tax on fossil fuel (TAX)	.09	.20	.24	.19	.48	.57
Improved public transport (PUB)	.10	.26	.05	.11	.69	.52
Subsidies of renewable fuel (RENEW)	.10	.24	.07	.15	.71	.55
Package 1 (TAX and PUB)	.13	.29	.19	.13	.55	.57
Package 2 (TAX and RENEW)	.11	.26	.20	.20	.59	.58

Note: PRO-ENV = pro-environmental orientation, problem = problem awareness, PN = personal norm, willingness = willingness to act, effective = effectiveness, fair = fairness.

subsidies of renewable fuel, targeting efficiency. Nevertheless, when a raised tax on fossil fuel was used to finance a subsidy of renewable fuel it was perceived to be more acceptable as compared to financing improvements of the public transport. In future studies, the relation between different features of transport policy measures (e.g., coerciveness, costs, funding, whether the measure is market-based or regulatory) and acceptability needs to be examined further.

The individuals' beliefs, in this study represented by a model combining the VBN theory and policy specific beliefs were found to be important for the acceptability of the transport policy measures. The general environmental beliefs were linked to the extent the measure was perceived to be effective and fair, and subsequently to acceptability. Furthermore, a direct relation between problem awareness and acceptability was found for the pull measures while a direct relation between personal norm and acceptability was demonstrated for the push measure and for the two policy packages. According to Eriksson et al. (2006), a personal norm may be more strongly associated with the acceptability of measures involving a personal sacrifice (e.g., a push measure) and even though the packages in this study actually provide something for the car user (i.e. an improved public transport or a cheaper renewable fuel) there seems to be a tendency to mainly focus on the push measure, hence a sacrifice is needed in order to accept the packages. Shifting from car use to public transport in response to Package 1 or replacing the old car with a car fuelled by renewable fuel in response to Package 2 are likely to be associated with several barriers. For example, the additional time and effort involved in using public transport has been found to hinder a behavioral change (Nordlund, 2002; Shannon et al., 2006) and even though Package 1 may improve public transport important barriers would not be removed. In this study, the likelihood of buying a car fuelled by renewable fuel increased if Package 2 would be implemented, however since buying a new car is associated with a substantial economic cost the possibility to make this change may be difficult in a short-term perspective.

Even though the examined models were supported and the results were generally in line with earlier studies, there are limitations associated with the present study. Since the response rate was rather low, caution is advised before generalizing to car users in the examined municipalities even though there were no large discrepancies between the sample and the attrition group. Furthermore, on the basis of the present study it is not possible to draw causal conclusions of the order between variables in the examined models. Experimental or longitudinal studies are needed to rule out different order of relations.

Even though the explained variance in acceptability was reasonably high (approximately 60–70%), there may be additional determinants of acceptability, for example the effects of the measure on the individual car user assessed through perceived infringement on freedom to choose (Bamberg and Rölle, 2003; Jakobsson et al., 2000) personal outcome expectation (Schade and Schlag, 2003) or personal benefit (Joireman et al., 2001).

5. Conclusions

The question of public acceptability is a key issue for sustainable mobility (Banister, 2008). Since car use is expected to increase (OECD, 2002), policy makers may perceive it necessary to implement more restrictive measures even though the acceptability is low. The present study demonstrates the importance of combining push measures with measures facilitating alternative travel options in order to increase acceptability. It is important that there are enough alternatives so that a behavioral change is feasible when more restrictive measures are implemented. However, since the acceptability may still be rather low there is also a need to influence individual factors. The results indicate that the acceptability of different transport policy measures may increase as a result of increased problem awareness and strengthening of a personal norm among car users. Furthermore, the process for how the measure is implemented may be facilitated by an understanding of the car users' beliefs about the measures, for example emphasizing the measures' fairness and effectiveness may increase the level of acceptability. To ensure acceptability, as well as effectiveness, the policy packages need to be designed carefully and adjusted to the context as well as to the group of car users targeted.

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Appendix A

The balance of nature is strong enough to cope with the impacts of modern industrial nations. (*R*)
Humans have the right to modify the natural environment to suit their needs. (*R*)
Plants and animals have as much right as humans to exist.
Despite our special abilities humans are still subject to the laws of nature.
Humans were meant to rule over the rest of nature. (*R*)
The earth is like a spaceship with very limited room and resources.
When humans interfere with nature it often produces disastrous consequences.
We are approaching the limit of the number of people the earth can support.
The earth has plenty of natural resources if we just learn how to develop them. (*R*)
Humans are severely abusing the environment.
Human ingenuity will insure that we do *not* make the earth unlivable. (*R*)
If things continue on their present course, we will soon experience a major ecological catastrophe.
Humans will eventually learn enough about how nature works to be able to control it. (*R*)
The so-called "ecological crisis" facing humankind has been greatly exaggerated. (*R*)
The balance of nature is very delicate and easily upset.
R = The item should be reversed so that a higher value signify a more pro-environmental orientation.

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