Altruistic preferences in the Willingness to Allocate Public Budget approach

A trade-off between travel time savings and safety

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List of Abbreviations

BIC	Bayesian Information Criterion
BVR	Bivariate Residuals
CBA	Cost Benefit Analysis
CBS	Centraal Bureau Statistiek
DCM	Discrete Choice Model
LCA	Latent Class Analysis
LCCA	Latent Class Cluster Analysis
MAIS	Maximum Abbreviated Injury Scale
MNL	Multinomial Logit Model
MRS	Marginal Rate of Substitution
PVE	Participatory Value Evaluation
RWS	Rijkswaterstaat
SVO	Social Value Orientation
SWOV	Stichting Wetenschappelijk Onderzoek Verkeersveiligheid
WTAPB	Willingness to Allocate Public Budget

Abbreviations attributes

TT_N	Average travel time savings on an average day for 10,000 citizens including yourself [min]
TT_M	Average travel time savings on an average day for 10,000 other citizens [min]
S_N	Risk reduction for 10,000 citizens including yourself in the period of one year to become a victim of a serious traffic accident [%]
S_M	Risk reduction for 10,000 other citizens in the period of one year to become a victim of a serious traffic accident [%]

1 Introduction

Recently the Participatory Value Evaluation (PVE) has been introduced in the field of the evaluation of government projects. The PVE is a method operationalised in an online web-tool where citizens: 1) advice a government with regard to a specific decision-making problem; 2) can express their preferences with regard to different policy options; 3) gain insight in the advantages and disadvantages (or effects) of the policy options and; 4) gain insight in the constraints that the government is facing (e.g. limited budget) (Mouter et al., 2020). Citizens are basically put in the shoes of a policymaker. Based on the social preferences of citizens, it is possible to see to what extent they would opt for a public sector project (Dekker et al., 2019). This way policymakers gain insight in the attractiveness of different project portfolio's.

The PVE uses the Willingness to Allocate Public Budget (WTAPB) approach to measure preferences of citizens for government projects. This preference elicitation approach assumes that preferences of citizens for the effects of government policy should be derived from the extent to which individuals think that the government should allocate public budget to these effects (Mouter et al., 2020).

The WTAPB approach has been used in various contexts, but to the best of gained knowledge the extent to which citizens are willing to sacrifice effects for themselves to realize effects for other people, has not been studied in a WTAPB setting. This is the most important research gap that this study aims to alleviate. It is important to investigate this, because there is a growing literature showing that individuals care not only about their own preferences, but about the preferences of other individuals as well (Jacobsson et al., 2007; Veisten et al., 2015; Flores, 2002). Since this is key in the WTAPB approach, it is necessary to investigate if citizens are willing to sacrifice policy effects. In addition, the government often has to decide between different projects. Based on the preferences of citizens it is possible for the government to steer policy.

In contrast to conventional evaluation approaches, the WTAPB approach has the advantage to include considerations with regard to the way in which respondents think a government should weigh costs and benefits of different projects (Mouter et al., 2019). Finally, citizens' preferences can complement the result of other evaluations of transport (e.g. Cost Benefit Analysis) which is strategically important in prioritizing government projects (Mouter et al., 2019).

Altruistic preferences can be described as the value that individuals allocate to the effects of a government policy on other individuals (Mouter et al., 2020). There are two kinds of altruistic preferences (Flores, 2002; Mouter et al., 2018a):

- paternalistic altruistic preference: refers to the value individuals allocate to the effects of government policy on other individuals, irrespective if these other individuals attach value to that government policy
- non-paternalistic altruistic preference: refers to the value individuals allocate based on the utility that other individuals derive from the effects of a government policy (i.e. respecting the preferences of these other individuals)

Literature states that it is important to determine to which extent altruistic preferences are paternalistic or non-paternalistic (Veisten et al., 2015; Robinson and Hammitt, 2011; Jacobsson et al., 2007; Flores, 2002). Therefore, this thesis will also investigate this. If individuals *"include the utility of other's in one's own utility, there is a potential problem of double counting and overestimation of economic values"* (Veisten et al., 2015). However, the aim of this thesis is not to further settle this discussion. What kind of altruistic preferences individuals have will be empirically considered first.

The primary goal of this thesis is to investigate to what extent citizens express (paternalistic and non-paternalistic) altruistic preferences in a WTAPB setting. To investigate this higher goal, two stated choice experiments are performed in a WTAPB approach in a transport context. The first experiment will focus on altruistic preferences where respondents will be asked to advice the government on several infrastructural bicycle projects which differ in travel time savings and safety respectively for 10.000 citizens including themselves and 10.000 other citizens. The second experiment will distinguish paternalistic and non-paternalistic altruistic preferences. Respondents will be asked to advice the government in the same context as experiment one, however the effects will only experienced by other citizens. Each time, one out of three projects will be the preferred variant according to and experienced by 10.000 other citizens. If respondents decide in line with the preferred variant, they are more likely to choose non-paternalistic (i.e. respecting the preferences of these other individuals).

An investment in bicycle infrastructure is chosen as case study, since the bicycle is an increasingly popular means of transport. It is sustainable, cheap and fast. At the same time, the number of bicycle casualties is growing fast. The Dutch government has the goal to reduce the number of road injuries from 21.700 to 10.600 in 2020 (Weijermars, 2019). Therefore the government could invest in fast bicycle paths, separate bicycle paths and the improvement of current links. This might save travel time and risk reduction for citizens. This allows to make concrete trade-offs to investigate altruistic preferences.

This thesis is structured as follows. In chapter 2, the main and sub research questions are defined. In chapter 3 a literature review is performed with regard to altruism, (non)-paternalistic altruism and empirical evidence about altruism. Chapter 4 provides the methodological approach. In chapter 5, the conceptualization of the experiments will be elaborated on. Chapter 6 and chapter 7 present the operationalization and pilot experiments. Chapter 8 presents the obtained MNL results of the experiments. Chapter 9 elaborates on the additional results by means of analysis of the qualitative substantiations and a Latent Class Cluster Analysis. Chapter 10 provides the conclusion, discussion and recommendations for further research.

2 Research Set-Up

Within this chapter, the research goal will be described in section 2.1, the scope of this research in section 2.2, the main research question this thesis addresses in section 2.3 and the sub research questions to answer the main research question in section 2.4. Section 2.5 provides the scientific and societal contribution.

2.1 Research goal

The WTAPB is an approach to measure preferences of citizens on how they think that the government should conduct policy. The aim of this research is to investigate to what extent citizens express (paternalistic and non-paternalistic) altruistic preferences in a WTAPB approach in a transport context.

2.2 Scope

Several assumptions need to be made to narrow down the scope of this research:

- It is not necessary to perform a PVE to answer the main- and sub research questions. Therefore, no PVE will be carried out in this study. Only two WTAPB stated choice experiments.
- Literature about altruism is vast. As this research focuses on (non)- paternalistic altruism, other types of altruism are not taken into account.

2.3 Main research question

The main research question this thesis addresses is:

To what extent are individuals willing to sacrifice the utility of transport policy effects they experience themselves, for the utility that other individuals derive from these transport policy effects or for the effects that other individuals experience, in the context of a Willingness to Allocate Public Budget approach and which segments of the population can be identified?

2.4 Sub research questions

To answer the main research question, different sub research questions need to be answered. It is important to know what altruism and the difference between paternalistic and non-paternalistic altruism is. Literature about altruism will help to define the definitions used in this thesis and will define the knowledge gap. Therefore, sub research question one, two and three are formulated as follows:

1. What is altruism in the context of this thesis?
2. What is the difference between paternalistic altruistic- and non-paternalistic altruistic preferences?

3. What empirical evidence has been collected on altruism?

   Sub research question four will be used to investigate altruistic preferences in the WTAPB approach. A distinction is made between local effects (transport effects for 10.000 citizens including yourself) and the global effects (transport effects for 10.000 other citizens). Sub question five will be used to investigate to what extent altruistic preferences are paternalistic or non-paternalistic.

4. To what extent are individuals willing to sacrifice local transport policy effects they experience themselves, for global transport policy effects that other individuals experience in a Willingness to Allocate Public Budget experiment?

5. To what extent do individuals express paternalistic and non-paternalistic altruistic preferences in the context of a Willingness to Allocate Public Budget experiment?

   Sub research question four and five do not give information which types of individuals do have the same preferences on observed characteristics. To answer sub question six, a Latent Class Cluster Analysis (LCCA) will be performed to identify different clusters and investigate which socio-demographic characteristics affect the probability to belong to a certain cluster.

6. Which clusters can be identified based on project selection and which socio-demographic characteristics affect the probability to belong to a certain cluster?

2.5 Scientific and societal contribution

There are different scientific and societal contributions to be identified. First of all, to the best of gained knowledge, this study will be the first to investigate altruistic preferences in a WTAPB approach in a transport context. Prior research of Mouter et al. (2019) concluded that *"it is difficult to defend that individuals participating in a WTAPB experiment aim to maximize social welfare, as some individuals clearly adopted a self-interested perspective"*. But as described in chapter 1, the WTAPB approach assumes that individuals consider preferences of other individuals as well. By investigating specifically altruistic preferences throughout thesis, the conclusion of Mouter et al. (2019) can be refuted.

Secondly, formal assessments like a Cost Benefit Analysis (CBA) do not fully capture for (moral) values and concerns (Van Wee, 2012). As described in chapter 1, in a WTAPB experiment it is possible to elicit social considerations with regard to the way respondents think a government should weigh costs and benefits. Besides the mainly self-interested perspective as included in the CBA, the WTAPB approach considers the view on social impacts for others. This research reveals, contrary to previous WTAPB experiments, explicitly these preferences of other citizens. This could help policymakers in the distribution of the allocation of government budget towards transportation projects.

Thirdly, a distinction is made between paternalistic and non-paternalistic altruistic preferences. Government policy is usually paternalistic. If non-paternalistic preferences compose a large part of the total valuation of government policy, it could induce changes in the way government steers on

preferences. Finally, participatory decision-making is becoming more and more important. With the empirical insights of this research, preferences can be better identified and used when dealing with complex public policy problems. This allows the government to take the required measures with regard to policy.

3 Literature review

This chapter covers literature about altruism and the distinction between paternalistic and non-paternalistic altruism. This literature is used to define the definitions used in this thesis and will define the knowledge gap this thesis addresses. Since literature about altruism is vast, this chapter will only provide empirical insights and definitions of terms how they are used in this thesis. Section 3.1 contains the concept of altruism. Section 3.2 and 3.3 the distinction between paternalistic and non-paternalistic altruism, which is summarized in section 3.4. Section 3.5 provides empirical evidence about altruism.

3.1 Altruism

The concept of altruism is embedded in a variety of different theories in sociology, psychology, biology, economics and politics. Altruism in social psychology involves increasing the welfare of another person. In contrast, egoism increases your own welfare (Batson and Powell, 2003). The definition of altruism in biology is behavior that increases the fitness of the recipient at a cost of the performer (De Waal, 2008). The underlying mechanism of direct altruism is empathy: actions and behavior caused by the emotional state of another (De Waal, 2008). In economics the focus is on wealth consumption and the altruist is willing to increase the consumption of others, by decreasing his own consumption (Fehr and Schmidt, 2006). All these theories have in common that the happiness of another person increases in someway, at a cost or decrease for one's own.

In the traditional theory of altruism an individual cares about the utility of the beneficiary (Bruce and Waldman, 1991). In public policy individuals could care about other individuals as well. Individuals can allocate a value to the effects of public policies on other individuals. Those preferences are named altruistic preferences (Mouter et al., 2020). An example of an altruistic preference is that individuals value the fact that others can make use of (e.g. enjoy) nature (Klooster et al., 2018).

However, it is questionable who that other individual is. Veisten et al. (2015); Aabø and Strand (2004) distinguishes different dimension of altruism. The first distinction is between local and global altruism.

- local altruism: altruism towards friends, within-family and kinship
- global altruism: altruism to unknown and out-of-family individuals

Long and Krause (2017) investigated, in the context of wealth and health, that respondents generally exhibited the highest level of altruism with respect to friends, within-family and kinship (local altruism) and the least with respect to unknown individuals, (global altruism). However, to the best of gained knowledge, in the context of transport effects, this ratio remains unknown.

The second dimension is between paternalistic and non-paternalistic altruism (Aabø and Strand, 2004). But literature distinguishes even more motives of altruism. For instance, Takeuchi et al. (2008) classifies altruism in genuine, pure (non), individualistic, paternalistic, intrinsic and impure.

As described in chapter 1, this thesis will only focus on paternalistic and non-paternalistic altruistic preferences.

3.2 Paternalistic altruism

Paternalistic altruism refers to the value an individual allocates to a public good, whether or not another individual valuates the utility of this public good (Flores, 2002). According to Suh and Harrison (2006) *"an individual cares explicitly about the consumption of services from a resource by others, but not about other's utilities"*. An example to illustrate paternalistic preferences is the following: the society in general, allocates value to the public good of health and school. But giving poor people money instead of health and school, could be more beneficial. Yet the government decides to ignore the preferences of the poor people, which is in line with the theory of paternalistic altruism (Jacobsson et al., 2007). Another example is alcohol. It can be stated that (most) people derive utility from alcohol. Yet the government has a policy of levying excise duty on alcohol. Following peoples preferences, it would be better not to levy this excise duty. Despite the fact that people derive utility from alcohol, the government decides not to respect people's preferences (McConnell, 1997).

3.3 Non-paternalistic altruism

According to Archibald and Donaldson (1976), non-paternalistic preferences do have the property to be independent of other attributes and *"the non-paternalist condition is that each individual respect the tastes of others, no matter what he thinks of them, however he forms his judgment of their welfare, and whatever his opinion of the justice of the distribution"*. Following the definition of Flores (2002), non paternalistic preferences refers to the value an individual allocates to the value of the welfare of another individual. This value is the sum of the preference of an individual and the preferences of others. Suh and Harrison (2006) describe non-paternalistic altruism as the utility an individual derives from other's utility.

3.4 Paternalistic vs. non-paternalistic altruism

Based on previous literature, it can be concluded that in the traditional context of altruism, an individual cares about the utility of another individual, at a cost of one's own. An important difference between paternalistic and non-paternalistic altruism is that paternalistic altruism cares about a public good or consumption of services from a resource, whether or not another individual derives utility of this public good. Non-paternalistic altruism is defined as the utility an individual derives from others utility (and in particular, respect their preferences).

In the context of public (transport) policy, the following definitions are used in this thesis:

- **Altruistic preference:** the value an individual allocates to the effect of a government policy on other individuals
- **paternalistic altruistic preference:** refers to the value individuals allocate to the effects of government policy on other individuals, irrespective if these other individuals attache value to that government policy
- **non-paternalistic altruistic preference:** refers to the value individuals allocate based on the utility that other individuals derive from the effects of a government policy (i.e. respecting the preferences of these other individuals)

For the remainder of this thesis, the value an individual allocates to an effect and the utility an individual derives from an effect of government policy will be used interchangeably.

Preferences of individuals about the allocation of resources between one's own or another individual, can be investigated by the Social Value orientation (SVO). For the remainder of this thesis SVO will be used. SVO is a measure to explain human decision behavior and assumes that *"decision makers (DMs) are concerned about maximizing their own material gain, indifferent to the payoffs of other DMs around them"* (Murphy et al., 2011). SVO could help to understand the motivations when respondents evaluate different source allocations between one's own and other persons. There are four categories within SVO: altruistic, pro-social, individualistic and competitive. On average, individuals the category pro-social occurs 59% and the category individualistic 35% (Murphy et al., 2011; Au and Kwong, 2004). See Appendix C for a full description of the SVO. The SVO will be used in experiment 2, which will be described in chapter 7.

3.5 Empirical evidence about altruism

Several studies have investigated if and how altruism can influence outcomes in experiments. For example, Jacobsson et al. (2007) have performed an experiment whether individuals have paternalistic or non-paternalistic preferences in a health context. Participants could donate money or nicotine patches to (unknown) diabetes patients. Those diabetes patients were selected based on the fact that they had a desire to quit smoking. The participants of the experiment were told that the diabetes patients had a strong preference to receive money instead of the nicotine patches. For the participants of the experiment there were two donation options:

1. Money treatment (donation in the form of money, amount comparable to the cost of the nicotine patches)

2. Nicotine patches (donation in the form of nicotine patches)

Now there are two options. The participants can either choose option 1: then they choose in line with the preferences of the diabetes patient. They respect this preference and do not care about the impact of the policy. Those participants have non-paternalistic preferences: they purely choose for the utility of another individual. The participant can also choose option 2: then they decide not to respect the preference of the diabetes patient and choose for the impact of the policy. Those participants have paternalistic preferences.

This experiment concluded that the participants predominantly have paternalistic altruistic preferences. Despite the fact that the participants knew that the diabetes patients preferred a donation instead of the nicotine patches, 90% choose for the nicotine treatment (Jacobsson et al., 2007).

Takeuchi et al. (2008) examined how paternalistic and non-paternalistic altruism plays a role in reducing child mortality. Qualitative statements showed that 73% had paternalistic preferences and 53% non-paternalistic preferences. However, the non-paternalistic preferences were not significant. In an experiment, Veisten et al. (2015) identified paternalistic and non-paternalistic altruistic preferences regarding the reduction of road traffic fatalities in Norway. The share of non-paternalistic preferences was very low, around 10% (Veisten et al., 2015). Aabø and Strand (2004) performed an

experiment towards the value of public libraries including altruistic motivations. 60% of all motivations were self-interested (including any within-family, or local, altruism) while 40% were motivated by social interests (including out-of-family, or global, altruism). However, further research needs to validate if those motivations are paternalistic or non-paternalistic (Aabø and Strand, 2004).

Despite a variety of experiments with regard to altruism, to the best of gained knowledge, no attention has been paid to altruism in the context of the WTAPB approach. Above-mentioned literature illustrates that altruism in the context of policy is usually paternalistic. This thesis will contribute to the extent if altruism is paternalistic or non-paternalistic as well. The WTAPB approach will be elaborated on in chapter 4.

4 Research method

This chapter presents the theory behind the methodology that is utilized in this research. The context of WTAPB will be described first in section 4.1. Next, the theory behind Discrete Choice Modelling will be described in section 4.2. To analyse the additional results, Latent Class Cluster Analysis will be used and will be described in section 4.3.

4.1 Willingness to Allocate Public Budget

Participatory decision-making is becoming more and more important when dealing with complex public policy problems. The WTAPB is an appropriate approach for involving citizens in the allocation of public budget and this approach measures their preferences regarding government policy. This preference elicitation approach assumes that preferences of citizens with regard to effects of government policy should be derived from the extent to which individuals think that the government should allocate public budget to these effects (Mouter et al., 2020).

People can trade-off effects of government policy (e.g. infrastructural projects) differently, namely as consumer and citizen. Consumer preferences relate to individual budget constraints (after tax incomes), while citizen preferences relate to the allocation of government's budget (Mouter et al., 2017a; Mouter and Chorus, 2016). This concept is known as the "consumer-citizen duality" (Mouter et al., 2017a, 2018b; Mouter and Chorus, 2016). An example of the "consumer-citizen" duality is examined in the trade-off between travel time savings and safety. In a (citizen) stated choice experiment of Mouter et al. (2017a), individuals had to choose between routes that differ in travel time savings and safety. The individuals were told that the government wanted their advice in the allocation of public budget. Mouter et al. (2017a) showed empirical evidence that individuals valuate safety higher than travel time as citizen rather than consumer. This results in different behaviour and can bring bias in their attitude towards public policies (Mouter et al., 2020).

Evaluation of infrastructural projects by using consumer preferences might not comply with the preferences as citizen with reference to public policy (Mouter et al., 2020). For this purpose, it is better to value governmental projects based on preferences of citizens, and the WTAPB is an appropriate method to do so (Mouter et al., 2017a). A key benefit of the WTAPB approach is the fact that respondents are informed during the experiment that the government wants to spend a budget and asks citizens' preference to give advice on the different infrastructural projects. Their advice will be used in the decision-making process.

Hereby, it is possible to investigate in a WTAPB experiment to which extent citizens are willing to support the allocation of taxes towards infrastructural projects and their associated effects that are subject of the analysis (Mouter et al., 2019). By designing a citizen stated choice experiment with different choice tasks, citizens are asked to choose between different bicycle infrastructural projects with effects they experience themselves and effects other citizens experience. Theory about stated choice experiments and the additional Latent Class Cluster Analysis can be found in section 4.2 and section 4.3. Stated choice experiments will be used for straightforward interpretation of parameter estimates. LCCA will be used to identify different segments of the population. The conceptualization will be described in chapter 5 and the operationalization of the experiments will be described in chapter 6 and chapter 7 respectively.

4.2 Discrete choice modelling

To investigate the relative importance of the trade-off citizens make with regard to travel time savings and safety, a stated preference Discrete Choice Experiment (DCE) will be performed (Johnson et al., 2013) in a WTAPB approach. DCE are widely used in the context of health (Johnston et al., 2017) and transport (Mouter et al., 2017a; Mouter and Chorus, 2016). With a number of hypothetical choice situations respondents are asked to choose the variant from which they derive the highest utility. The conceptualization and operationalisation of the choice experiment can be found in chapter 5 and chapter 6.

Working-horse of DCE is the Random Utility Maximization-Multinomial Logit (RUM-MNL) model (McFadden et al., 1973). This model assumes:

$U_i = V_i + \varepsilon_i = B_j X_{ij} + \varepsilon_i$

- U_i = Utility of alternative i
- V_i = Observed utility of alternative i
- ε_i = Unobserved utility of alternative i
- X_{ij} = attribute level of attribute j for alternative i
- B_j = weight of attribute j

The MNL model will be used for straightforward interpretation of the parameter estimates.

4.3 Latent Class Cluster Analysis

A shortcoming of the MNL model is the fact that it cannot capture unobserved preference heterogeneity. Therefore it is chosen to use Latent Class Cluster Analysis (LCCA) as well. LCCA is a probabilistic clustering method that aims to find groups that are similar on observed characteristics (Vermunt and Magidson, 2002). Goal is to maximize homogeneity within clusters and heterogeneity between clusters (Kroesen, M., 2019). The software to be used is LatentGold (Vermunt and Magidson, 2002).

This research will perform two Latent Class Cluster Analysis. Goal of these two analysis is to identify clusters based on project selection and investigate which (socio-demographic) characteristics affect the probabilities to belong to a certain cluster. The advantage of LCCA is that it is a technique based on similarity in response patterns, instead of distance between respondents. Next it can be applied on variables of different scale types (e.g. nominal and numeric). And there are statistical test available to determine the optimal number of clusters (Kroesen, M., 2019).

Figure 1 presents the Latent Class Model with indicators, the latent variable which indicates the common factor between indicators and the covariates. The indicators consist of the choice sets defined in chapter 6 and 7. The output of the estimated model with indicators provides different clusters. This could for instance be one cluster focuses always on safety and one always on travel time savings.

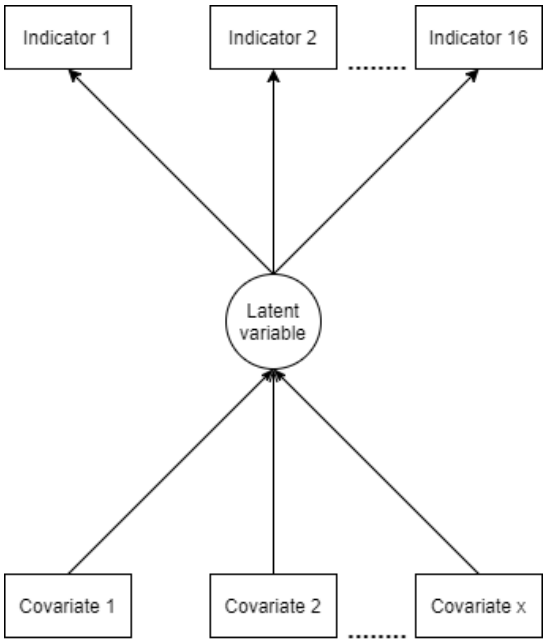

Figure 1: LCCA model indicators and covariates

The number of clusters are based on two measures (Molin et al., 2016): the bivariate residuals (BVR's) and the Bayesian Information Criterion (BIC). BVR is a local model fit and the BIC a global model fit (Molin et al., 2016). The values of the BVR should be below 3.84. BVR's above the 3.84 indicate an association between indicators (Vermunt and Magidson, 2002). However, the number of clusters should not be too large since interpretation could be more complex. Therefore the BIC can be used as well. The BIC should be as low as possible for the most parsimonious model.

Based on both measures the number of clusters and the optimal model without insignificant indicators is determined. An insignificant indicator means that there is likely no relation between the latent class variable and this indicator in the population. This indicator can be removed from the model. Next, the covariates are added. The covariates will consist of socio-demographic characteristics and other potential explanatory variables. The Wald statistic is used to check whether an indicator or covariate is statistical significant. Significant Wald means p=0.000 and a Wald >3.84. Insignificant covariates are kept in, however these covariates do not predict class membership. But variables in the cluster profile distributions might give insights in the cluster probabilities.

5 Conceptualization WTAPB experiments

In this chapter the conceptualization of the experiments will be described first, since this is the same for both experiments. Different steps need to be considered in the composition phase of the choice experiments. First of all, the goals of the experiments are defined in section 5.1. Next, important factors to be used in the experiment context are described in 5.2. Than, the attributes will be mentioned and specified in sections 5.3, 5.4 and 5.5. These subsections cover both experiments.

The operationalisation of experiment 1 can be found in chapter 6 and the operationalisation of experiment 2 in section 7 respectively.

5.1 Goals of the experiments

First of all, the goals of the experiments are determined. As described in chapter 1, two knowledge gaps will be investigated. These two knowledge gaps are translated into goals. Both the experiments will take place in a Willingness to Allocate Public Budget setting as described in section 4.1.

Experiment 1: WTAPB on altruistic preferences
Goal: Exploring to what extent individuals are willing to sacrifice transport effects they experience themselves for the transport effects other individuals experience in a Willingness to Allocate approach.

Experiment 2: WTAPB on paternalistic and non-paternalistic altruistic preferences
Goal: Exploring to what extent individuals express paternalistic and non-paternalistic altruistic preferences in the context of a Willingness to Allocate Public Budget approach.

5.2 Context of the experiments

When the goals of the experiments are clear, the context of the experiments need to be defined. An important criteria when designing an experiment is realism (Johnston et al., 2017). The experiment should reflect real world choice situations to the best of it's abilities. Too simple choice situations would probably increase reliability but may decrease validity. Realistic choice situations can increase validity (Molin, 2019).

However, stated choice experiments assume hypothetical situations and can lead to hypothetical bias. Choices of individuals in hypothetical situations, might not always reflect their actual behaviour (Lindberg, 2005). Another problem within hypothetical situations is scale bias. Individuals are limited in understanding extreme or small probabilities (Lindberg, 2005; Tversky and Kahneman, 1979). Comparing a situation with two low probabilities could make individuals insensitive to risk. In those situations where choices are possible but not probable, individuals choose the options that offers the largest gain (Tversky and Kahneman, 1979). Therefore, it is chosen to use imaginable probabilities, which will be further elaborated on in section 5.4.

To overcome hypothetical bias, "consequentiality" is used in the experiments. Consequentiality means that respondents have the feeling that their choices have consequences in real life (Mouter et al., 2017b,a). This is an important factor to include in the context of preference elicitation, since hypothetical bias could disappear. Consequentiality can be enlarged when citizens are asked to give their advice to the government in the decisions of investment in transport projects.

5.3 Experiment attribute specification

It is decided to investigate citizen's preferences for travel time savings and safety because these effects are central elements in the evaluation of transport policy (Mouter et al., 2017b; Andersson and Lundborg, 2007). Policymakers often have to make the choice between travel time savings and safety in infrastructural projects (Mouter et al., 2018b). Travel time savings are often the main goal of an infrastructural project. But according to the Leidraad OEI, safety must be included as an effect to be investigated and is therefore indispensable. Only if both the effects are incorporated in the analysis, a well insight could be presented for policymakers (RWS, 2012). Section 5.4 will further elaborate on the case study of bicycle infrastructure.

5.4 Road safety

The first attribute included in this experiment will consist of road safety. Two important indicators to express road safety are the **number of road fatalities** and the **number of road injuries**. Usually the number of road fatalities is used in experiments. This section explains the definitions of both the indicators and the reasons why the number of road injuries will be used as attribute in this experiment.

5.4.1 Definition of road fatalities and road injuries

Road fatalities: the definition of a road fatality is an "individual who has died directly as a result of a road accident, as well as those that have died elsewhere up to and including 30 days after the accident as a result of the injuries sustained" (RWS, 2012)

Road injuries: the definition of a road injury is "a serious traffic injury is a victim who, as a result of a traffic accident, has been admitted to a hospital with an injury severity expressed in MAIS (Maximum Abbreviated Injury Scale) of at least 2, and who, moreover, has not died within 30 days from the consequences of the accident" (SWOV, 2019).

5.4.2 Reasons to include number of road injuries

There are several reasons to use the number of road injuries instead of the number of road fatalities as indicator in the experiment. The three most important arguments will be explained below.

Number of road fatalities vs. number of road injuries

The first reason to use the number of road injuries instead of the number of road fatalities is the big difference in how often these accidents occur. In 2018, 678 road fatalities occurred. This stands in contrast with the number of road injuries, which reached a record of 21.700 (Weijermars, 2019).

Looking at Figure 2 and Figure 3, a rising trend in the number of road fatalities and number of road injuries seems to emerge. This thesis will not examine what direct and indirect effects contribute to this upward trend.

Figure 2: Developments number of road fatalities (Weijermars, 2019)

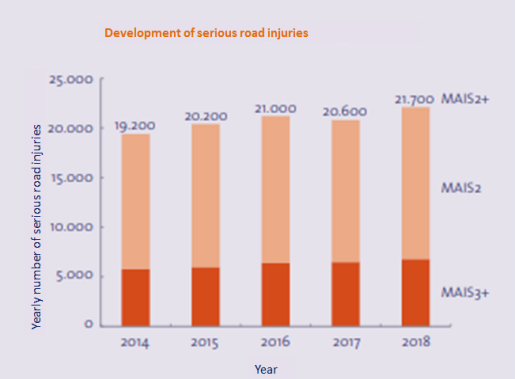

Figure 3: Developments number of road injuries (Weijermars, 2019)

Costs of road fatalities vs. costs of road injuries

The second reason is the difference in total social costs. SWOV and RWS use key numbers to express road safety in terms of social costs (RWS, 2012). The costs for a road fatality are determined at 2.612 million euro's. The costs for a road injury are determined at 0.281 million euro's. However, when comparing the number of road fatalities and injuries, as can be seen in Table 1, the total costs for road injuries are many times higher.

	Costs per fatality (million €)	**Number of accidents (2018)**	**Total costs (million €)**
Road fatality	2.612	678	1771
Road injury	0.281	21.700	**6098**

Table 1: Total social costs per road fatalities and injuries

Goal to reduce number of road injuries

The third reason is the goal to reduce the number of road injuries from 21.700 to 10.600 (Weijermars, 2019). In view of the current developments and increase of the number of road injuries in recent years, this goal seems unattainable. This shows the urgency to reduce the number of serious road injuries.

Next to that, understanding the risk of one's own fatality could be difficult (Andersson and Lundborg, 2007). For these reasons, it was decided to use the **number of road injuries** as an indicator in the experiment.

Transport modality specification

Considering the number of road injuries per transport modality, it can be seen that more than half of the road injuries happened within the modality bicycles (64%) in 2018.

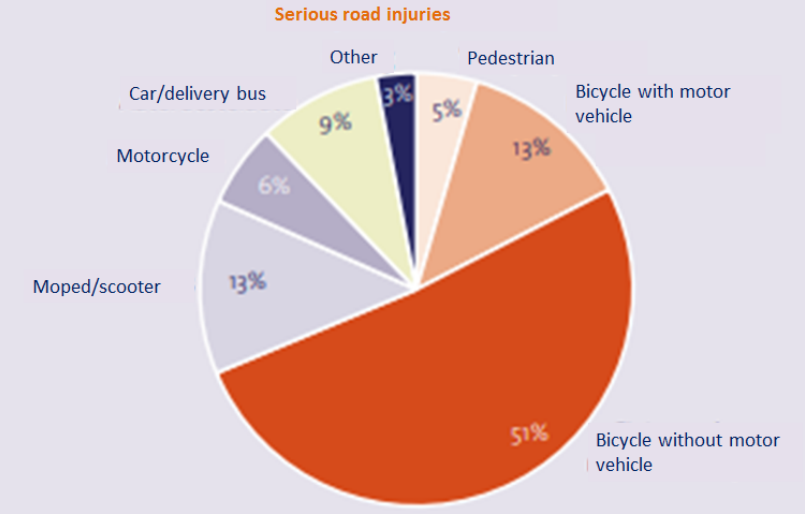

Figure 4: Number of road injuries per modality (Weijermars, 2019)

At the same time, the bicycle is becoming an increasingly popular means of transport. It is sustainable, cheap and fast. Looking at current developments and the growing popularity of the bicycle indicates that investments should be made in bicycle infrastructure. Examples could be fast bicycle paths, separate bicycle paths and the improvement of current links (Wijnen and Vis, 2010).

A lot of profit in terms of safety can be achieved by investing in bicycle infrastructure. For instance, investment in separate bicycle paths can result in a risk reduction of 15% till 30% (Wijnen and Vis, 2010; Wijnen, 2012). Comparing all these findings, it is decided to use **risk reduction in the context of bicycle infrastructure** as attribute in the experiment.

5.5 Travel time savings

The second attribute will consist of travel time savings. Travel time savings are often involved in evaluation of transport decisions (Mouter et al., 2017a). In the experiments citizens are asked to make a choice between policy options which differ in travel time savings (in minutes) (Mouter et al., 2017a).

Small travel time savings

Daly et al. (2014) stated that travel time savings count for 80% of the benefits in the evaluation of transport. Most of the time, a large group of citizens experiences small travel time savings. Research has shown that small travel time savings up to 5 minutes could be negligible in the evaluation of transport, but still small travel time savings weigh heavily in the evaluation of transport. However, realism is weighed more heavily in this research. More than 6 minutes travel time savings in the context of bicycle infrastructure is not credible for a respondent. Therefore, it is decided to use travel time savings up to 6 minutes.

6 Operationalization experiment 1

The operationalisation of experiment 1 and 2 is slightly different. First, experiment 1 will be operationalized. This is done by defining the final attributes in section 6.1, establishing the experimental design in section 6.2, a pilot survey in section 6.3 and the final survey in 6.4. In chapter 7 experiment 2 will be operationalized.

6.1 Defining final attributes

Based on literature, previous subsections, conversations with experts of SWOV, Economics2 and tests on the experiment context and attribute descriptions, the final attributes for experiment 1 are defined as follow:

1. Average travel time savings on an average day for **10,000 citizens including yourself** [min]
2. Average travel time savings on an average day for **10,000 other citizens** [min]
3. Risk reduction for **10,000 citizens including yourself** in the period of one year to become a victim of a serious traffic accident [%]
4. Risk reduction for **10,000 other citizens** in the period of one year to become a victim of a serious traffic accident [%]

In the remainder of this thesis, the following shortened description and abbreviations will be used:

Table 2: Descriptions of attributes and abbreviations used in software and tables

Shortened description	**Abbreviation**
Travel time savings for 10.000 citizens **including yourself**	TT_N
Travel time savings for 10.000 **other** citizens	TT_M
Risk reduction for 10,000 citizens **including yourself**	S_N
Risk reduction for 10.000 **other** citizens	S_M

6.2 Establishing experimental design

To ensure credibility of an experiment, establishing the experimental designs is very important (Johnston et al., 2017). The foundation of experimental designs are based on attributes and attribute levels. In order to reach plausibility to the respondent, statistical efficiency and reliable parameter estimates, different steps need to be considered (Johnston et al., 2017; Rose and Bliemer, 2009):

1. **Design labelled or unlabelled:** model specifications could be labelled or unlabelled. If alternatives are labeled (e.g. train, bus, car), then alternative-specific parameters are included. In this experiment generic parameters are used. The alternatives are chosen as follow: **variant 1, variant 2 and variant 3**. Therefore the alternatives are unlabeled.

2. **Attribute level balance:** attribute level balance is a desirable property when designing an experimental design. Attribute level balance means that each attribute appears an equal number of times for each attribute. This allows for well estimations on the whole range of levels for all the parameters. This property is used in the experimental design.

3. **Number of attribute levels:** in order to preserve a higher number of choice situations, for both the attributes the same number of attribute levels are fixed at four levels.

4. **Attribute level range:** the range of attribute levels should be selected to support decision making. The range of attribute levels is a trade-off between practical and statistical properties. A wide range of attribute levels is more desirable than a small range as a wide range will better estimate the parameters. However, a too wide range can lead to dominant alternatives. A pilot study is able to correct for this phenomenon. The final attributes and the corresponding attribute levels can be found in Table 3.

5. **Design type:** Different design types of experimental designs are described in ChoiceMetrics (2018). To avoid too many choice situations, a fractional factorial design is used instead of a full factorial design (Rose and Bliemer, 2009). To maximize the information trade-offs and minimize the standard errors, a D-efficient design is applied. To improve the efficient design, priors need to be estimated. Priors are the best guesses on the parameter values (Rose and Bliemer, 2009). Because there is no literature available on the parameters used in this context, a pilot study will be conducted to estimated the priors and optimize the D-efficient design.

6. **Number of choice situations to be used:** By using four attributes, each four levels, the number of choice situations to be used is determined at 16. Since 16 choice situations could be large to process for a respondent, the choice situations are divided into 2 blocks. Each respondent fills in 8 choice sets.

In order to create the design as described above, the software Ngene is used (ChoiceMetrics, 2018).

Table 3: Attributes and attribute levels experiment 1

Attribute	**Attribute levels**			
Travel time savings for 10.000 citizens including yourself [min]	0	2	4	6
Travel time savings for 10.000 other citizens [min]	0	2	4	6
Risk reduction for 10.000 citizens including yourself [%]	0	10	20	30
Risk reduction for 10.000 other citizens [%]	0	10	20	30

6.3 Pilot survey experiment 1: N = 34

The pilot survey of the choice experiment was processed in the online survey software Qualtrics. A pilot survey is important to be able to solve and detect small issues. Next to that, the pilot survey is used to estimate the priors (best guesses on parameter values) in order to create an efficient design. The established experimental design described in section 6.2 is used in the pilot survey. In total, 48 respondents started the questionnaire and 34 respondents finished all the questions. All of the respondents are acquaintances of the researcher. This has resulted in a sample including students and mostly young working people.

Feedback pilot

Overall, the feedback of the experiment was quite positive. The survey was not too long. The introduction stated 10 minutes, but most of the respondents finished in less than 10 minutes. On average, each respondent spend **8 minutes and 36 seconds** on the survey.

However, it was stated that the goal of the experiment on page one was described too obvious. This can cause *priming*, causing respondents to be subconsciously steered in their answers. This is solved by making the goal less explicit. In addition, it was too clearly stated in the context that the government is going to carry out one of the programs. Therefore in the introducing text it is stated that respondents need to imagine that the government has decided to carry out one of the programs. Since the respondents are still asked to advice to the government, consequentiality is more likely. Finally, the questions regarding trips and mode of transport could be read too quickly by respondents since it was not clear if the questions considered commuting trips, within or outside urban areas. This has been solved by means of bold text in the survey question.

Dominance

Two respondents stated dominance in some of the choice sets. Dominant alternatives are a common problem when designing unlabelled experimental designs. If an alternative is better than (or equal to) all other alternatives within a choice set, an alternative is called dominant (Bliemer et al., 2017). Dominant alternatives are problematic because it does not give any information about the trade-off respondents make. One might use a dominant alternative as check if respondents understand the choice task. If a respondent does not choose the dominant alternative, the data of the respondent could be removed. Remove the choice task itself could be risky, because of the loss of efficiency and attribute level balance (Bliemer et al., 2017).

Because of the complexity of the experimental design as described in section 6.2 it is chosen to use a D*-efficient design. The asterisk (*), indicates that the design prevents dominance (Bliemer et al., 2017). The expected choice probabilities and final D*efficient design can be found in Appendix B.

Prior estimation

After conducting the pilot survey it is possible to estimate the priors: the best guesses on the parameter values. The priors have been estimated in the software PandasBiogeme (Bierlare, 2018). The estimated priors can be seen in Table 4.

Table 4: Prior estimation values experiment 1

	Value	**Std. err**	**t-test**	**p-value**
β_{TT_N}	0.35	0.039	8.79	0.00
β_{TT_M}	0.14	0.042	7.74	7.74e-4
β_{S_N}	0.067	0.0077	8.72	0.00
β_{S_M}	0.048	0.0075	6.33	2.44e-10

It can be seen that all the values do have the expected sign and seem plausible. All parameters are statistically significant. The estimated priors will be used in the final D*-efficient design. The final Ngene syntax including the priors can be found in Appendix B.

6.4 Final design experiment 1

For the final design of the survey different steps need to be considered. First of all, the survey needs to be introduced. Afterwards, the context needs to be written. Than the choice sets are presented. The last part consist of the socio-demographic characteristics and number of trips and choice of modality, which will be used as covariates in the LCCA.

1. **Introduction:** It is desirable for a respondent to know the goal of the survey in the introduction. However, priming must be avoided. Therefore it is decided to describe the goal as follows: "This study will examine how the Dutch citizens trade-off different effects when it comes to traffic safety and travel time savings.

2. **Context description:** as described in section 5.2, realism is incorporated in the context description. But based on the feedback of the pilot, is it chosen to use a hypothetical context. In order to reduce hypothetical bias, consequentiality (Mouter et al., 2017a) is included in the context. Citizens are asked to give advice to the government in the context of travel time savings and safety. The full description of experiment 1 can be found in Appendix B.

3. **Choice sets:** 16 choice sets are incorporated based on the experimental design, as described in section 6.2. Since 16 choice sets are a lot to process for a respondent, the choice set is divided in two blocks. Each respondent is randomly assigned to 8 out of 16 choice sets. In Figure 5, an example of a choice set can be seen.

	Variant 1	Variant 2	Variant 3
Average **travel time savings** on an average day for 10,000 citizens **including yourself**	6 min	0 min	4 min
Average **travel time savings** on an average day for 10,000 other citizens	0 min	2 min	6 min
Risk reduction for 10,000 citizens, **including yourself**, to become a victim of a serious traffic accident in the period of one year	30 %	20 %	0 %
Risk reduction for 10,000 **other** citizens to become a victim of a serious traffic accident in the period of one year	0 %	20 %	30 %

Figure 5: Example choice set experiment 1

4. **level of importance social effects:** The respondents are asked to what extent they think the travel time savings and safety reduction are important for them and other citizens. See Appendix B, Figure 19. Afterwards they will be asked to substantiate their answers.

5. **Socio-demographics**: the following socio-demographic characteristics will be included to investigate whether or not there are differences in preferences for certain variants. These socio-demographic are expected to affect the probabilities to belong to a certain claster in the LCCA.

    - Gender: male, female, other
    - Age: year of birth
    - Education: vmbo, havo, vwo, mbo, hbo, wo
    - Income: net yearly income. Less than €10.000; €10.000 - €19.999 ; €20.000 - €29.999 etc.

6. **Bike as modality and number of trips and transport modality:** Different questions are asked to gain information about the main transport modality during the week, usage frequency and commuting trips. The following questions are included:

    - Do you have a bike or do you have a bike available to use?
    - How often on a weekly basis before the COVID-19 crisis did you use the following transport mode as your main mode of transport to and from work?
    - How often on a weekly basis before the COVID-19 crisis did you use the following modes of transport for short distances (distances within urban areas)?
    - How often on a weekly basis before the COVID-19 crisis did you use the following modes of transport for long distances (distances outside urban areas/travels between cities)?

It is decided to use transport frequencies of respondents in the period before COVID-19. During COVID-19, almost everyone works from home, so that does not provide any information regarding frequencies and transport modalities. Questioning the period after COVID-19 can be difficult because respondents do not yet have any experience with this. That is why it was decided to use the period before COVID-19. See Appendix B, Figure 20, 21 and 22.

7 Operationalization experiment 2

In this section the operationalization of experiment 2 will be described and the differences will be mentioned in comparison with experiment 1. First of all, the final attributes will be defined in section 7.1. Than the experimental design will be established in 7.2. Afterwards the pilot survey will be conducted in section 7.3.

The goal of this experiment is exploring to what extent individuals express paternalistic and non-paternalistic altruistic preferences in the context of a Willingness to Allocate Public Budget approach.

7.1 Defining final attributes

As described in chapter 5, the context and attribute specifications are the same in experiment 2. However, this experiment does not make a difference in effects that individuals experience themselves, but only considers the effects that other individuals experience. Therefore, the attribute specification is as follow:

1. Average travel time savings on an average day for **10,000 other citizens** [min]
2. Risk reduction for **10,000 other citizens** in the period of one year to become a victim of a serious traffic accident [%]

7.2 Establishing experimental design

The design of experiment 2 will also be unlabelled (e.g. variant 1, variant 2 and variant 3). The property of attribute level balance is followed. The number of attribute levels will be four as well. The range of attribute levels can be found in Table 5. In experiment 2, a D-efficient design is applied. The number of choice situations to be used is 16, divided in 2 blocks of 8.

Table 5: Attributes and attribute levels experiment 2

Attribute	**Attribute levels**			
Travel time savings for 10.000 other citizens [min]	0	2	4	6
Risk reduction for 10.000 other citizens [%]	0	10	20	30

7.3 Pilot survey experiment 2: N = 33

In this section the pilot of experiment 2 is explained. Based on the established experimental design described in section 7.2, the choice situations are defined. An example of a choice set can be seen in Figure 6. The effects on travel time savings and safety are only experienced by other individuals. Respondents are told these other individuals have indicated a preference for the variant *"marked yellow"*. These preferred variants are defined manually, e.g. variants with the highest risk reduction, highest travel time savings or a combination of both effects are equally distributed. The correlations between the preferred alternatives and the experimental design have been taken into account. See Appendix C for a the final design and full description of the context of experiment 2.

	Variant 1	Variant 2	Variant 3
Average **travel time savings** on an average day for 10,000 **other** citizens	2 min	4 min	6 min
Risk reduction for **other** 10,000 citizens to become a victim of a serious traffic accident in the period of one year	30 %	20%	0 %

Figure 6: Example choice set experiment 2

If respondents choose in line with the preference of these other citizens, they are more likely to decide non-paternalistic. If respondents choose for one of the two other variants, they are more likely to decide for a paternalistic variant.

Feedback pilot

Overall, respondents spend **13 minutes and 23 seconds** on the survey. The difference between part 1 of the survey (the part where respondents fill in the 8 choice sets) and part 2 of the survey (the part where respondents fill in the SVO) was stated as unclear. Therefore the following has been added after part 1: *This is the end of part 1. Now part 2 starts. This part is separate from the previous questions.*

Prior estimation

After conducting the pilot survey it is possible to estimate the priors: the best guesses on the parameter values. The priors have been estimated in the software PandasBiogeme (Bierlare, 2018). The estimated priors can be seen in Table 6.

Table 6: Prior estimation values experiment 2

	Value	**Std. err**	**t-test**	**p-value**
β_{TT_N}	0.054	0.056	9.76	0.00
β_{S_M}	0.15	0.014	10.29	0.00

It can be seen that all the values have the expected sign and seem plausible. All parameters are statistically significant. The estimated priors were used to estimate a new design. However, a better model did not converge. Therefore it is chosen to use the pilot version as final version, since the current trade-offs comply for this experiment. The final syntax can be found in Appendix C. Final design of the whole experiment can be found in Appendix C as well.

8 Results

This chapter presents the results of experiment 1 and 2. First of all, the data collection will be described in section 8.1. After that, the descriptive statics will be presented in section 8.2, this section also analyzes the representativity of both samples of the experiments. Section 8.3 provides the results of the MNL models of experiment 1 and 2. After that, the additional results will be discussed in chapter 9.

8.1 Data collection

Survey company Kantar Public was asked to draw two random samples (for each experiment one sample) from the population of Dutch citizens, which are all 18 years and older (TNS NIPO, 2020). Citizens below 18 years old were automatically filtered out. Kantar carefully selected two samples in which all socio-demographic criteria were present (e.g. gender, age, education and income). The Ethics Board of the Delft University of Technology approved the data collection. The average response time of experiment 1 is 6 minutes and 49 seconds and the average response time of experiment 2 is 9 minutes and 16 seconds. Respondents who filled in the questionnaire unreliably quick were deleted. In total there were 188 valid responses for experiment 1 and 196 valid responses for experiment 2. Table 7 presents the socio-demographic characteristics of the respondents.

8.2 Descriptive statics

All socio-demographic characteristics as described in section 8.1 are presented in both samples. Representativeness has been analyzed according to data of CBS (2019) and the chi-square statistic within SPSS was utilized to explore if these samples are representative for the Dutch population. Only gender is present to the same extent in the sample and in the population and does not significantly differ from each other. In experiment 1, age does not significantly differ in the sample and population. In experiment 2, age category 18-34 is a bit underrepresented. Education and income do significantly differ in the sample and population, which means that education and income are not representative for the Dutch population. See Appendix D for the statistical tests on representativity.

Table 7: Descriptive statics of total valid samples of experiment 1 and 2

Variable		Exp 1	Exp 2
Total		188	196
Gender (percentage)			
	Female	50	49
	Male	50	51
Age (percentage)			
	18-34	27	25
	35-54	35	37
	55-99	38	38
Completed education (percentage)			
	Lower education	39	41
	Higher education	37	36
	University	24	23
Household net income (percentage)			
	Less than 10.000	7	9
	10.000 - 30.000	29	27
	30.000 - 60.000	36	40
	More than 60.000	10	11

It is not remarkable that some variables deviate from representativity, since Kantar was asked to draw a sample where all socio-demopgrahic characteristics are present, not particularly a representative sample. See Appendix D for the statistical tests on representativity.

8.3 Multinomial Logit models

As described in section 4.2, data analysis of experiment 1 and 2 were conducted by using discrete choice models. A multinomial logit (MNL) is applied for straightforward interpretation of the results. First the results of experiment 1 will be presented.

Table 8: Results MNL experiment 1

Context	Experiment 1		
# Observations			
Null LL:	-1652.3		
Final LL:	-1504.2		
Estimated parameters	4		
ρ^2	0.087		
Estimates	Est	SE	T
β_{TT_N}	0.0444	0.015	2.97
β_{TT_M}	0.0257	0.0123	2.09
β_{S_N}	0.0402	0.00272	14.7
β_{S_M}	0.0286	0.00259	11
Marginal rates of substitution			
β_{TT_N}/β_{S_M}	**1.55**		
$\beta_{TT_N}/\beta_{TT_M}$	**1.72**		
β_{S_N}/β_{TT_M}	**1.56**		
β_{S_N}/β_{S_M}	**1.41**		

Table 8 presents the MNL results of experiment 1. Where:

- β_{TT_N} = marginal utility of one additional minute travel time savings for 10,000 citizens including yourself on an average day
- β_{TT_M} = marginal utility of one additional minute travel time savings for 10,000 other citizens on an average day
- β_{S_N} = marginal utility of one percent risk reduction for 10,000 citizens including yourself in the period of one year to become a victim of a serious traffic accident
- β_{S_M} = marginal utility of one percent risk reduction for 10,000 other citizens in the period of one year to become a victim of a serious traffic accident

Experiment 1: general interpretation

First of all, the parameters from Table 8 are analysed by identifying some key characteristics. All parameters from Table 8 have the expected sign. The parameters are significant at a 5% level. This

means all parameters are relevant regarding to the trade-offs. The parameters alone from Table 8 cannot be used to check their level of importance since they have different scales (e.g. minutes and %). However, multiplying the parameters with the attribute range will present the relative importance. Table 9 presents the relative importance of the attributes. β_{TT_M} has the least impact on utility (0.154) given the estimated parameters and range of the attribute values in experiment 1. β_{S_N} has the highest impact on utility (1.206) given the estimated parameters and range of the attribute values in experiment 1. Concluding, the results from Table 9 show that respondents derive higher utility from 30% risk reduction than from 6 minutes travel time savings.

Table 9: Relative importance of parameters experiment 1

	Utility range	**Est exp 1**	**Utility range exp 1 equals**
β_{TT_N}	0 - 6	0.0444	0.266 utils
β_{TT_M}	0 - 6	0.0257	0.154 utils
β_{S_N}	0 - 30	0.0402	1.206 utils
β_{S_M}	0 - 30	0.0286	0.858 utils

Experiment 1: Marginal Rate of Substitution

Considering the data from Table 8, it is possible to elicit the Marginal Rate of Substitution (MRS). The MRS is the marginal willingness of individual N to give away a reduced increase of his own utility to an increase of the utility of individual M (Long and Krause, 2017). In this case; the utility derived from the effects of risk reduction and travel time savings for 10.000 citizens including yourself or 10.000 other citizens.

The marginal rates of substitution are reported in bold in Table 8. For example, respondents derive equal level of utility of 1 minute travel time savings for 10.000 citizens including themselves on an average day and 1.55% risk reduction for 10.000 other citizens in the period of one year to become a victim of a serious traffic accident. Furthermore, respondents derive a comparable level of utility of one percent risk reduction for 10.000 citizens including themselves in the period of one year to become a victim of a serious traffic accident and 1.41% risk reduction for 10.000 other citizens. Next, citizens derive equal utility of 1 minute travel time savings for 10.000 citizens including themselves for 1.72 minutes of travel time savings for 10.000 other citizens. This means, that citizens are willing to sacrifice transport policy effects they experience themselves for the transport policy effects other citizens experience.

When the MRS is taken into account, it can be inferred that the MRS of β_{S_N}/β_{S_M} (1.41) is substantially lower than the MRS of $\beta_{TT_N}/\beta_T T_M$ (1.72). Respondents seem more selfish when it comes to saving travel time than safety.

However, imagine that you live municipality A and consider a government that has to decide between two bicycle infrastructure projects being:

- Project 1: 6 min travel time savings and no risk reduction in municipality A, the municipality where you live

- Project 2: 0 min travel time savings and 30% risk reduction in municipality B

On basis of the results of the analysis, the 'aggregate utility' of project 2 exceeds the 'aggregate utility' of project 1, since respondents derive more utility from 30% risk reduction for 10.000 other citizens than 6 minutes travel time savings for 10.000 citizens including themselves. Another example could be, project 3 being 6 minutes travel time savings and 10% risk reduction in municipality A, the municipality where you live. Project 4 being 0 minutes of travel time savings and 30% risk reduction in municipality B. Again, on basis of the results of the analysis, the 'aggregate utility' of project 2 exceeds the 'aggregate utility' of project 1.

Given these analysis and MRS, sub question *"To what extent are individuals willing to sacrifice local transport policy effects they experience themselves, for global transport policy effects that other individuals experience in a Willingness to Allocate Public Budget experiment?"* can be answered. Individuals are willing to sacrifice transport policy effects they experience themselves for the transport policy effects that other individuals experience with regard to travel time savings and safety. Individuals are willing to sacrifice more than 6 minutes travel time savings for 10.000 citizens including themselves, for a 10% risk reduction for 10.000 other citizens. Furthermore, individuals are willing to sacrifice 7% risk reduction for 10.000 citizens including themselves for 10% risk reduction for 10.000 other citizens.

Experiment 2: interpretation paternalistic and non-paternalistic preferences

In this section, the MNL results of experiment 2 with the preferred variant will be presented and interpreted. The parameter for the preferred variant has been introduced to investigate to what extent citizens express non-paternalistic preferences.

Table 10: Results MNL experiment 2

Context	Experiment 2		
# Observations			
Null LL:	-1719.3		
Final LL:	-1449.2		
Estimated parameters	3		
ρ^2	0.155		
Estimates	Est	SE	T
β_{TT_M}	0.0968	0.0144	6.7
β_{S_M}	0.0549	0.0032	17.4
β_{PV}	0.641	0.0539	11.9

Table 10 presents the MNL results of experiment 2. Where:

- β_{TT_M} = marginal utility of one additional minute travel time savings for 10,000 other citizens on an average day
- β_{S_M} = marginal utility of one percent risk reduction for 10,000 other citizens in the period of one year to become a victim of a serious traffic accident
- β_{PV} = marginal utility of the preferred variant. This variant is preferred by 10.000 other citizens

Table 10 presents the estimated results of experiment 2 with a parameter estimated for the Preferred Variant (PV). All parameters are significant at a 5% level. The estimated parameter of PV measures the isolated effect of β_{PV}. The value of β_{PV} (0.641) indicates that respondents derive a significant level of utility from the preferred variant, irrespective of the effects. Given the relative importance of the parameters (Table 11), respondents derive higher utility from 30% risk reduction for 10.000 other citizens than from 6 minutes travel time savings for 10.000 other citizens. Respondents are more likely to decide non-paternalistic (i.e. in line with the preferred variant) up to 12% risk reduction or 6 minutes of travel time savings. However, when a paternalistic variant scores better than the non-paternalistic variant in terms of risk reduction more than 12%, it is more likely that respondents decide in line with the paternalistic variant.

Table 11: Relative importance of parameters experiment 2

	Utility range	**Est exp 2**	**Utility range exp 2 equals**
β_{TT_M}	0 - 6	0.0986	0.592 utils
β_{S_M}	0 - 30	0.0549	1.647 utils
β_{PV}	0 or 1	0.641	0.641 utils

Comparing these results with experiment 1 and considering the relative importance of the parameters in Table 11, again 30% risk reduction is valuated higher than 6 minutes travel time savings. This is in line with empirical results from previous research (Mouter et al., 2017a, 2018b), which established that individuals assign more value to safety than travel time in their role as citizen. The results of experiment 2 show that respondents are more likely to decide for a paternalistic variant if this variant scores better than the non-paternalistic variant in terms of risk reduction higher than 12%. A cautious conclusion could be drawn that respondents in this experiment, want to contribute to risk reduction for 10.000 other citizens, irrespective of the preference of 10.000 other citizens. This result is comparable to the result of Veisten et al. (2015).

Now consider a government of municipality A which needs to decide between two bicycle infrastructure projects. Citizens in municipality A have indicated a preference for project 1, although project 2 has 3 more minutes of travel time savings and 5% risk reduction. Based on the analysis, the aggregated utility of project 1 exceeds the utility of project 2 since respondents derive more utility of the preferred variant than the effects from project 2.

Whether or not respondents **always** decide in line with someone else's preference (pure non-paternalistic), irrespective of the effects of this variant, has also been investigated. This share is quite low: 6%. Only 6% have always decided with someone else's preference (i.e. respecting their preferences). These respondents can be stated as "non-traders". Non-traders in this research are respondents who always chose the preference variant. Non-trading can be caused by boredom or fatigue during the stated choice experiment. Another reason could be a form of policy behaviour: always opting for the preference variant can positively influence decision-making. See Hess et al. (2010) for extensive research about non-traders. However, always deciding in line with someone else's preference could also be a personal belief. If an individual is a convinced liberal, this individual always respects the preference of another individual, irrespective of what he or she thinks.

Given the analysis and data, sub-research question 5 *"To what extent do individuals express paternalistic and non-paternalistic altruistic preferences in the context of a Willingness to Allocate Public Budget experiment?"* can be answered. Respondents express non-paternalistic preferences in a WTAPB setting in a transport context with regard to travel time savings and safety. The value of β_{PV} (0.641) indicates that respondents derive a significant level of utility from the preferred variant for 10.000 other citizens, irrespective of the effects. Respondent are more likely to decide non-paternalistic (i.e. in line with the preferred variant) if the variant has up 6 minutes travel time savings or 12% risk reduction. However, when a paternalistic variant scores better than the non-paternalistic variant in terms of risk reduction more than 12%, it is more likely that respondents decide in line with the paternalistic variant. The share of pure non-paternalism is quite low, only 6%.

Experiment 2: Social Value Orientation

As described in section 3, the SVO analysis is performed and analysed in SPSS. The SVO is used as measure to explain human decision behavior and could help to understand motivations when respondents evaluate different source allocations. Respondents were asked to divide six times an amount of money for themselves and someone else. Based on the distributions, respondents can be assigned to four SVO categories: altruistic, pro-social, individualistic or competitive. In Figure 7, the categories are placed in the perspective of "pay-off to self" and "pay-off to other". Given the data from experiment 2, the majority, namely 66.3%, tend to be pro-social. The other 33.7% tends to be individualistic. The categories altruistic and competitive do not occur in this sample. This is in line with earlier research, which shows that on average the category pro-social occurs 59% and the category individualistic 35% (Murphy et al., 2011; Au and Kwong, 2004). It can be concluded from these results that respondents, in contrast with transport effects, are not particularly altruistic when it comes to the distribution of money this way. However, the SVO will be used as indicator in the LCCA.

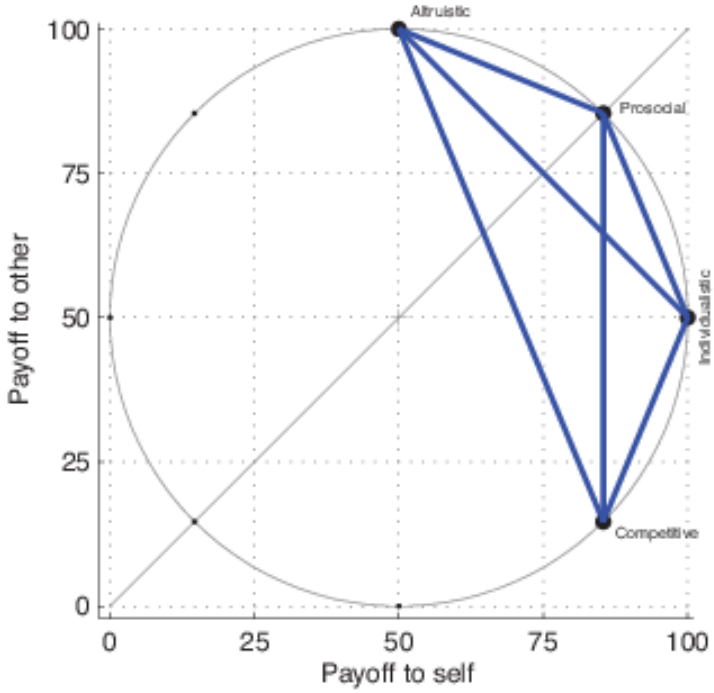

Figure 7: SVO types (Murphy et al., 2011)

9 Additional results experiment 1 and 2

This section will further elaborate on the results stated in chapter 8. A MNL model cannot capture for unobserved preference heterogeneity. Therefore additional analysis will be performed. The goal of this chapter is substantiation and explanation of the results presented previous. Section 9.1 (experiment 1) and section 9.2 (experiment 2) are build up in the following manner: first of all, the level of importance of the social impacts will be provided, then the qualitative data of the substantiations of the respondents will be analysed and finally these results will be used as a basis for the LCCA. Goal of the LCCA is to identify clusters based on project selection and investigate which (socio-demographic) characteristics affect the probabilities to belong to a certain cluster. This way different segments of the population can be identified with regard to (paternalistic and non-paternalistic) altruistic preferences.

9.1 Experiment 1: Altruistic preferences

First the level of importance of the attributes will be presented. Since these levels do not provide information about why respondents choose these levels, the qualitative data will be analysed. Next the LCCA will be performed for experiment 1.

9.1.1 Level of importance of the social impacts

For each of the social impacts (attributes), citizens were asked to indicate how important they were in giving their advice. Figure 11 presents the level of importance for each social impact.

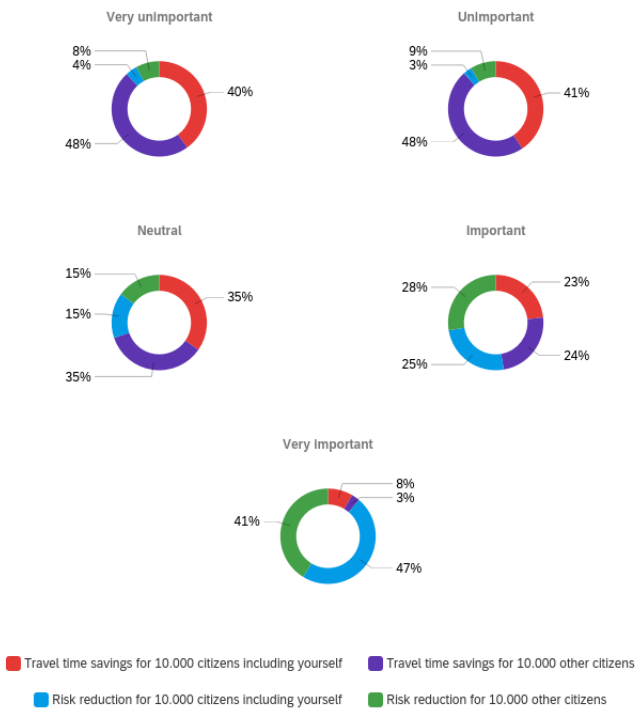

Figure 8: Level of importance social impacts experiment 1

As Figure 11 shows, there is a wide variety in the level of importance of the attributes respondents indicate, both for travel time savings and risk reduction. However, these Figures do not present anything about the underlying reasons why citizens choose these levels. Therefore qualitative data is gathered.

9.1.2 Data analysis of qualitative substantiations social impacts

Citizens have been told that the government is very interested in why they consider certain social effects to be important or unimportant. They were asked to substantiate qualitatively why certain social effects were important or unimportant in the advice they gave. The most important categories are discussed below.

Safety

- *Risk reduction prevails: accidents cause a huge social impact and cost a lot of money*
- *We have many cycle paths in the Netherlands, so safety is the focus for me now*
- *Safety first!*

Travel Time Savings

- *Travel time savings are important to make it attractive to make use of the investment*
- *In some cases I chose the option that travel time gain for others is higher than mine. That also depended on the risk reduction but also because I have no problem with it if my travel time remains the same*
- *Travel time is not really important to me, but it is more important to others*

Spatial and social equality

- *I opt for neutral allocations. This is because you can't make everyone happy*
- *I think they are all equally important so I chose the golden mean as much as possible*
- *We have to try to find a balance between travel time savings and risk reduction*

Altruism or selfishness?

- *Saving time is a great incentive, but if it is at the expense of safety in any form it is less important. A bit of selfishness is also present so look at what it means to myself*
- *As few serious traffic casualties as possible! It could also be your parents or your children*
- *Cycling is a dangerous business today with all those fast bikes. I wish everyone the highest level of safety*
- *Self-interest vs society. In case of doubt, I decide to choose for myself*

Government decision or not?

- *Government should look to what is most important for all Dutch citizens*
- *Safety is everything. Certainly in urban areas, you will not gain much in terms of travel time, but a lot in terms of traffic safety. in urban areas, the government must invest as much as possible in cycling and the associated safety reductions*
- *It's important what kind of effect it has on society*
- *The probability of a serious accident is a collective achievement*

Conclusions qualitative data analysis experiment 1

Safety is mentioned in the qualitative substantiations most often. Although the travel time savings are quite small, respondents also care about travel time savings. This can be confirmed based on the relative utilities in Table 9. Respondents state travel time savings as an important criteria for a governmental investment to make the investment attractive to use. Especially interesting is the fact that respondents care about the travel time savings for themselves. This is also revealed by the MRS between $\beta_{TT_N}/\beta_{TT_M}$ of 1.72. Considering the qualitative substantiations there is a variety in altruism and selfishness. When it comes to safety, some respondents especially consider the safety of 10.000 citizens including themselves. An interesting argument is the fact that it could be your parents or children. Finally, it is important that the government monitors the effects of policy for all Dutch citizens.

The analysis of qualitative substantiations of the social impact present different point of views, but nothing about the common preferences among different segments of the population. Therefore a LCCA is performed to underpin different groups (clusters). The qualitative substantiations are used as basis to define the clusters in the LCCA.

9.1.3 Latent Class Cluster Analysis

The level of importance of the attributes and the substantiations of the qualitative data does not present information about respondents which has the same preferences. Therefore a LCCA will be performed to investigate those different clusters. As indicator the 16 choice situations are added. The added covariates will consist of the socio-demographic characteristics and number of bicycle trips from and to work, in- and outside urban areas. LCCA captures inter-correlations between socio-demographic characteristics.

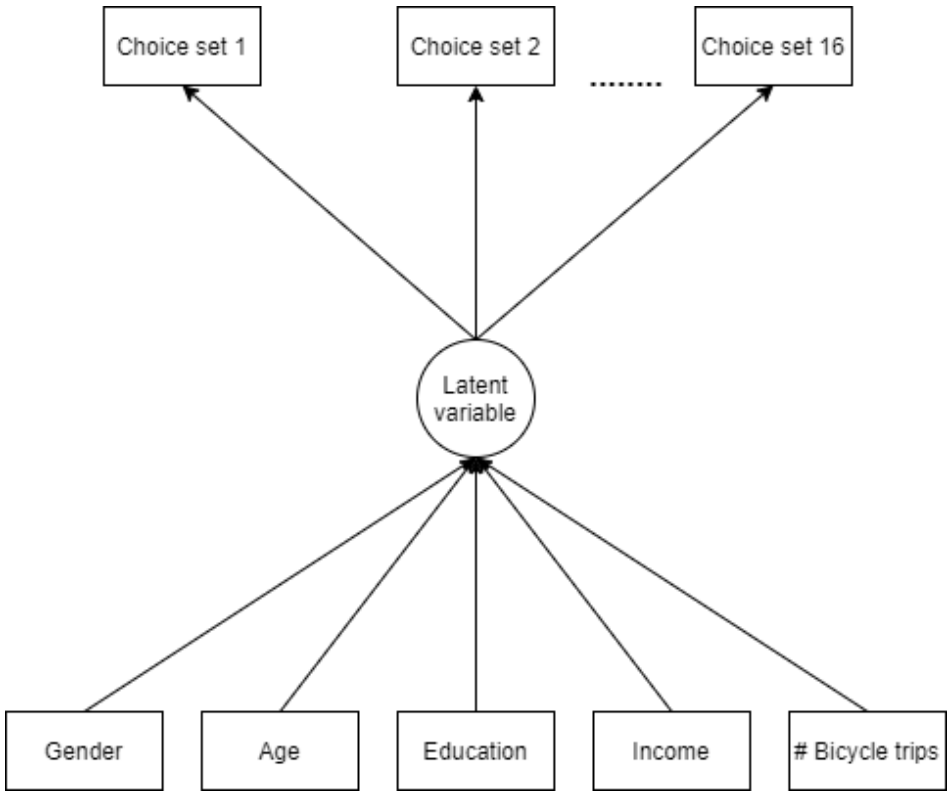

Figure 9: LCCA indicators and covariates experiment 1

Project selection

The first model is based on project selection. All 16 choice sets are used as indicators. The goal is to investigate and maximize homogeneity within the group e.g. respondents with a common response pattern and maximize heterogeneity without the groups. For example, one cluster always opts for safety and another cluster always opts for travel time savings.

Expectations

It is expected that gender, age, education and number of bicycle trips will influence the cluster profiles. Females probably care more about safety, as well as older people. The number of trips by bicycle is also expected to influence the clusters, since the context of the experiments is bicycle infrastructure.

Table 12: Model overview 1-5 clusters: BIC and BVR

	LL	**BIC(LL)**	**Npar**	**L2**	**df**	**p-value**	**#BVR > 3.87**
1-Cluster	-1464.2	3096.1	32	2917.4	156	9.6e-504	21
2-Cluster	-1327.6	**2995.6**	65	2644.2	123	7.4e-469	1
3-Cluster	-1288.4	3090.0	98	2565.7	90	1.6e-475	1
4-Cluster	-1251.5	3189.1	131	2492.0	57	1.8e-485	1
5-Cluster	-1221.7	3302.2	164	2432.3	24	1.5e-502	**0**

BIC (LL)	Bayesian Information Criterion
BVR	Bivariate Residuals
Npar	Number of Parameters
LL	final Log-Likelihood of the model
L^2	Likelihood-ratio chi squared statistic
df	degrees of freedom

Based on the BVR, the most optimal model would be a 5-cluster model. However the interpretation of 5 clusters would be too complex. Considering the lowest BIC value, the optimal number of clusters would be 2. Therefore the optimal number of clusters is determined at 2.

The Wald Statistic is used to check whether a indicator is statistically significant or not. Based on the Wald statistic, three choice sets (investment program 2, 7 and 13) are deleted. An insignificant indicator means that there is likely no relation between the latent class variable and this indicator in the population. The model is estimated for the 13 choice situations left. Again the optimal number of clusters is determined at 2. All p-values are significant which means that the clusters differ among each other. The probabilities of being part of a certain cluster are presented in Appendix D, Table 21. If all respondents opt for a specific variant, the value is 1.00 and 0.00 when none of the respondents select a specific variant. The highest probabilities (>0.8 for cluster 1 and >0.5 for cluster 2) are presented in bold. Based on the highest probabilities the cluster descriptions are established:

- **Cluster 1 (63%):** respondents within cluster 1 predominantly select the variant with the highest safety (i.e. highest risk reduction). If possible the highest risk reduction for 10.000 citizens including themselves, but respondents in this cluster do care about other's safety as well. Besides, respondents within cluster 1 prefer safety over equally distributed transport effects.
- **Cluster 2 (37%):** respondents within cluster 2 preferably select the variant with highest travel time savings for 10.000 citizens including themselves. In situations when this is not a possibility, they choose a variant with equally distributed effects, both for travel time savings and safety.

Cluster 1 and 2 summarize the qualitative substantiations from section 9.1.2 properly into safety and travel time savings/equality. Subsequently, the socio-demographic characteristics are added as covariates to predict class membership (Table 13). The model for clusters indicates the in- or decrease of the probability that a category is selected given class membership (Table 14).

Table 13: Covariates Wald test

Covariates	**Wald**	**p-value**
Gender		
Man	*0.01*	*0.93*
Female		
Age		
18 - 34	6.15	0.05
35 - 54		
55 - 99		
Education		
Lower education	14.87	0.00
Higher education		
University		
Income		
Less than €10.000	*2.94*	*0.57*
10.000 - 29.999		
€30.000 - €59.999		
More than €60.000		
N/A		

From age, gender, education and income, only education and age are statistically significant considering the Wald statistic (see Table 13). This means that only education and age, controlled for income and education, likely has an effect on class membership in the population.

Table 14 presents the cluster profile distributions of the covariates. Age and education are presented in bold. These results can be interpreted as follows: with increasing level of (higher) education, the probability of being a member of the first class will increase, and the class membership probability of the second class will decrease. A respondent with lower level of education is more likely to make choices in accordance with the model of class two (see Table 14). Given the probabilities that predict class membership, higher educated people are likely to be less altruistic than low educated people. Furthermore, with increasing age, the probability of being a member of the first class will increase. This is in line with the expectation that elderly are more focused on safety.

Table 14: Cluster profile distributions of covariates within a certain class

Covariates	**Cluster 1**	**Cluster 2**
Gender		
Man	*0.49*	*0.50*
Female	*0.51*	*0.50*
Age		
18 - 34	0.25	0.29
35 - 54	0.35	0.37
55 - 99	0.41	0.34
Education		
Lower education	0.30	0.51
Higher education	0.39	0.36
University	0.31	0.13
Income		
Less than €10.000	*0.09*	*0.04*
€10.000 - €29.999	*0.29*	*0.30*
€30.000 - €59.999	*0.35*	*0.38*
More than €60.000	*0.09*	*0.10*
N/A	*0.19*	*0.18*

Since the context of this research is about an investment in cycling infrastructure, the choice has been made to investigate if the number of trips with bicycle in- and outside urban areas and trips to and from work can predict class membership. However, none of the Wald statistics on bicycling are significant. This means that controlled for the effects of the number of bicycle trips there is no unique effect on class membership.

Conclusion LCCA experiment 1

With these results, sub research question 6 *"Which clusters can be identified based on project selection and which socio-demographic characteristics affect the probability to belong to a certain cluster?"* can be answered. After conducting the LCCA two clusters can be identified. Respondents in cluster 1 (63%) always select the variant with the highest risk reduction for 10.000 citizens including themselves and prefers safety over equality. Class membership can be predicted by education and age. With higher age and education, the probability of being member of cluster 1 will increase. Given these classes and class membership probabilities, high educated people are likely to be less altruistic with regard to safety than low educated people. However, this conclusion must be interpret with caution. Respondents in cluster 2 (37%) preferably select the variant with the highest travel time savings for 10.000 citizens including themselves, but do care about equality. Cluster 2 can be predicted by education level. With lower education the probability of being member of cluster 2 will increase. The number of trips in- and outside urban areas were not significant which means that the number of trips can not predict class membership.

9.2 Experiment 2: paternalistic and non-paternalistic altruistic preferences

First the level of importance will be presented. Then the qualitative data will be analysed. Next the LCCA will be performed for experiment 2.

9.2.1 Level of importance social impacts

For each of the social impacts, citizens were asked to indicate how important they were in giving their advice for other citizens. Figure 10 presents the level of importance for each social impact.

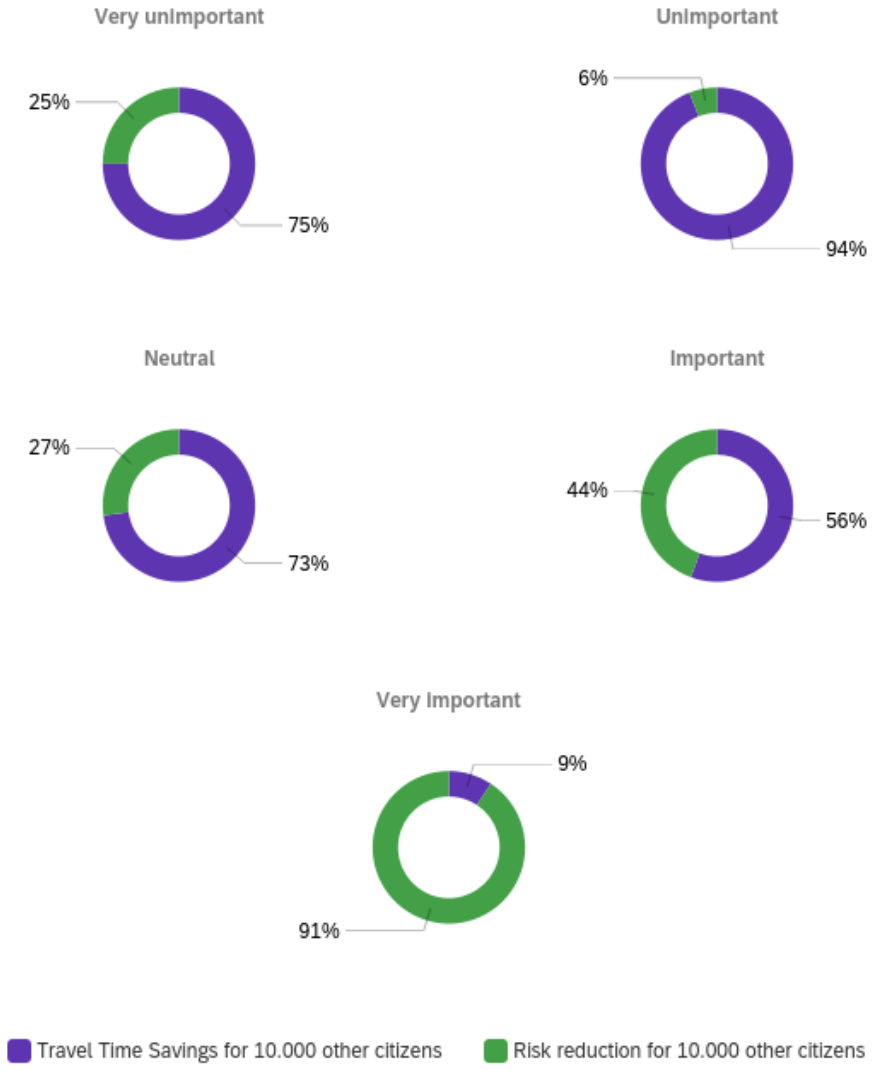

Figure 10: Level of importance social impacts experiment 2

Experiment 2 presents a wide variety in level of importance as well. Citizens consider travel time savings and risk reduction as important social effects. Their qualitative line of reasoning will be elaborated in the next section.

9.2.2 Data analysis of qualitative substantiations social impacts

Citizens have been told that the government is very interested in why they consider certain social effects to be important or unimportant. They were asked to substantiate qualitatively why certain social effects were important or unimportant in the advice they gave. The most important categories are discussed below.

Safety

- *The number of traffic accidents should be further reduced*
- *Risk reduction is always the most important social impact*
- *Health is more important than a few more minutes cycling*
- *A few minutes of time saved doesn't outweigh increased safety*

Travel Time Savings

- *Travel time is a profit, risk reduction is partly your own responsibility and counts less strictly*
- *The net travel time savings are important and welcome, but I think risk reduction important as well*
- *Travel time savings are important as well*
- *I think the travel time savings are very important, but it has to outweigh the number of casualties otherwise it weighs more heavily in my opinion*

Spatial and social equality

- *I believe that every person in traffic counts, including the other traffic participants*
- *For me, such a large investment must have an advantage on both criteria (gain of time + decrease of risk). Preferably on both criteria the maximum positive result*
- *Both social impacts are important to me*
- *Both social impacts should weigh equally*

Future generation, altruism and selfishness

- *The environment is very important for people/children who are coming*
- *I care about each other because I'm Christian*
- *If it's at the expense of my current situation, I'm against it*
- *I think it's very important for everyone, not just me, that they're safer*
- *People's safety is important. It could only be your child that crashed!*

Government decision or not?

- *It is very important that the government listens to society, in this way they can take measures*
- *I don't think there should be too many opinions but that the government should decide more*
- *I think it is important that the government ensures the safety and protection of citizens across all fields*
- *If road safety improves, the costs of hospitals and rehabilitation and other matters will also decrease*
- *Place bicycle paths on both sides of a provincial road*

Conclusions qualitative data analysis experiment 2

As described above, different motives can be identified with regard to the choices made. Most of the respondents state that risk reduction is always the most important social impact and that the number of traffic accidents should be further reduced. However, they are aware of the fact that saving travel time is a profit and substantiate travel time savings as an important criteria. Interestingly some respondents state that risk reduction is partly your own responsibility.

Although costs were not specified, respondents state that such a large investment should maximize both effects. Considering equality from a policy point of view, every person in traffic counts. Interesting are the substantiations if you ask respondents to choose for someone else. Respondents do care about other people and especially about people/children who still have to be born. Future generations will benefit from the investments that are being made now. Religion was also mentioned when giving the advice. It would be interesting to investigate how important the role of religion is when it comes to altruism in the context of transport and WTAPB. Again, safety with regard to other people is stated as important and than especially focused on children. It would be interesting to investigate if respondents have higher (non-)paternalistic preferences with regard to children in this context.

Most respondents indicated that it is important for the government to listen to the society. In this way they can take measures, especially with regard to safety. As a consequence, if road safety improves, social costs will decrease. A measure that the government could take is placing bicycle paths on both sides of a provincial road. Another respondent stated that ease of travel seems much more valuable.

9.2.3 Latent Class Cluster Analysis

Since the level of importance of the attributes and the qualitative data does not present information about respondents which have the same preferences, a LCCA will be performed to investigate different clusters. As indicator the 16 choice situations are added. The added covariates will consist of the socio-demographic characteristics and the social value orientation. The LCCA captures for inter-correlations between socio-demographic characteristics.

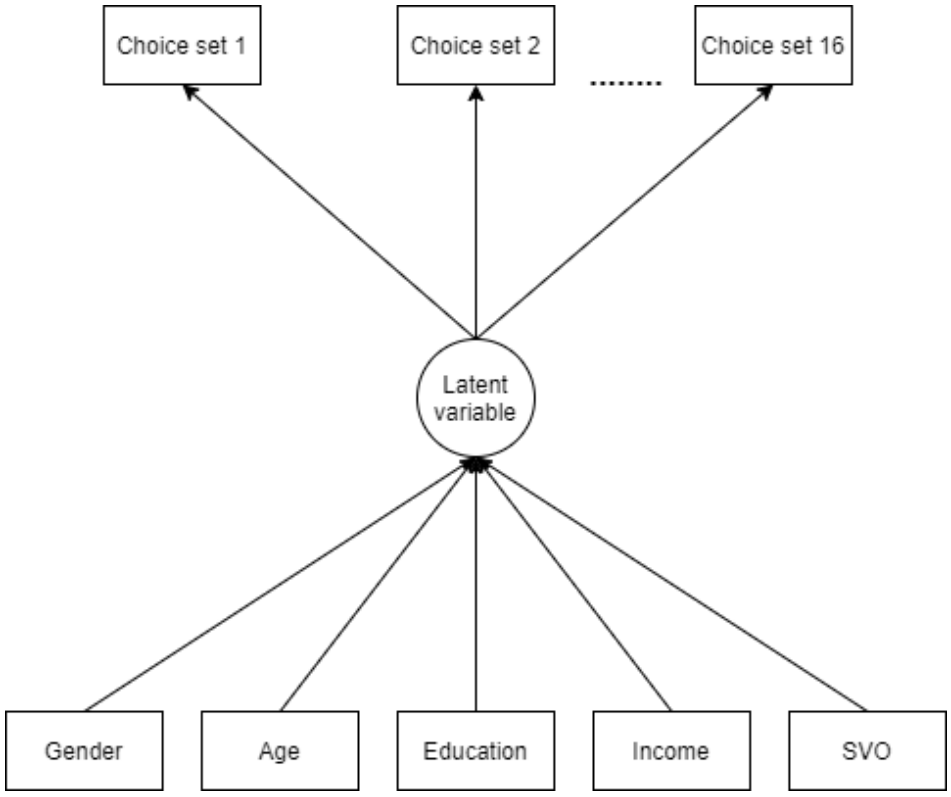

Figure 11: LCCA indicators and covariates experiment 2

Project selection

The first model is based on project selection. All 16 choice situations are added as indicator. The goal is to investigate and maximize homogeneity within the group e.g. respondents with a common response pattern and maximize heterogeneity without the groups. For example, one cluster always opts in line with the preference variant and another group always opts for the highest travel time savings.

Expectations

Based on the results of experiment 1, it is expected that at least education will predict class membership. Age might influence cluster profiles as well, however it is questionable if this variable is significant. Besides, pro-social respondents probably do care more about safety than travel time savings.

Table 15: Model overview 1-5 clusters: BIC and BVR

	LL	**BIC(LL)**	**Npar**	**L^2**	**df**	**p-value**	**Class.Err.**	**# BVR >3.84**
1-Cluster	-1371.9	2912.8	32	2715.1	164	2.8e-457	0.0000	49
2-Cluster	-1145.1	**2633.4**	65	2261.5	131	7.5e-385	0.0213	**4**
3-Cluster	-1085.0	2687.3	98	2141.3	98	2.4e-381	0.0200	3
4-Cluster	-1042.8	2777.1	131	2056.9	65	3.9e-387	0.0211	2
5-Cluster	-1004.2	2874.0	164	1979.6	32	9.1e-398	0.0465	1

The 4 BVR's above the 3.84 in Figure 15, do suggest that this 2-cluster model might fall a little bit short in reproducing an association between 4 choice sets. However, this is not problematic since there is still a clear difference in probabilities of the response patterns that distinguish the clusters. Based on the lowest BIC value, the optimal number of clusters to be interpreted is determined at 2.

The Wald Statistic is used to check whether a variant is statistically significant or not. Based on the Wald statistic, two choice sets (investment program 3 and 10) are deleted. The model is estimated for the remaining 14 choice situations. Again, the optimal number of clusters is determined at 2. All p-values are significant which means that the clusters differ among each other. The probabilities of being part of a certain cluster are presented in Appendix D, table 22. If all respondents opt for a specific variant the value is 1.00, and 0.00 when none of the respondents select a specific variant. The highest probabilities (>0.9 for cluster 1 and >0.5 for cluster 2) are presented in bold. Based on the highest probabilities the cluster descriptions are established:

- **Cluster 1 (58%):** The first group represents 58% of the respondents. This group selected the preferred variant if this variant had the highest risk reduction. They selected another variant if this variant had the most risk reduction. Cluster 1 probably cares less about travel time savings.
- **Cluster 2 (42%):** The second group represents 42% of the respondents. This group selected predominantly the preferred variant. They selected another variant if this variant had the highest travel time savings.

After defining the clusters, the socio-demographic characteristics are added as covariates to predict class membership. From the covariates gender, age, education, income, only education is highly significant (Table 16). This means that education directly predict class membership.

Table 16: Covariates Wald test experiment 2

Covariates	**Wald**	**p-value**
Gender	*0.11*	*0.74*
Age	*5.29*	*0.07*
Education	14.80	0.00
Income	*5.89*	*0.21*

The model for clusters indicates the in- or decrease of the probability that a category is selected given class membership. Only education is significant. This means with higher education, the probability of being member of class 1 is higher. With lower education, the probability of being member of class 2 is higher.

Table 17: Cluster profile distributions of covariates within a certain class

Covariates	**Cluster 1**	**Cluster 2**
Gender		
Man	*0.48*	*0.49*
Female	*0.52*	*0.51*
Age		
18 - 34	*0.19*	*0.34*
35 - 54	*0.43*	*0.29*
55 - 99	*0.37*	*0.37*
Education		
lower education	0.28	0.58
higher education	0.43	0.27
university	0.29	0.15
Income		
less than €10.000	*0.05*	*0.14*
€10.000 - €29.999	*0.19*	*0.36*
€30.000 - €59.999	*0.47*	*0.30*
more than €60.000	*0.13*	*0.06*
N/A	*0.15*	*0.13*

Lastly, the Social Value Orientation is used to check whether the outcomes can predict class membership. Considering the profile output (Table 18), pro-social respondents do have a higher probability to be a member of class 1. The probability of being member of class 2 as individualists is higher in class 2 than class 1. However, the SVO analysis is not statistically significant. This means that the pro-socials and individualists have no effect on class membership in the population.

Table 18: Cluster profile distributions of covariates within a certain class

Covariates		
SVO type		
Prosocial	0.72	0.58
Individualistic	0.28	0.42

Conclusion LCCA experiment 2

With these results, sub research question 6 *"Which clusters can be identified based on project selection and which socio-demographic characteristics affect the probability to belong to a certain cluster?"* can be answered. After conducting the LCCA two clusters can be identified. Respondents in cluster 1 (58%) selected predominantly the preferred variant (non-paternalistic) if this variant had the highest risk reduction. They selected another variant (paternalistic) if this variant had the highest risk reduction. Cluster 1 is likely to care less about travel time savings. With higher education, the probability of being member of class 1 will increase. Based on class 1 and the class membership probabilities, higher educated respondents are more likely to decide paternalistic with regard to safety. However, this result should be interpret with caution because a LCCA is not "model based". This makes it difficult to statistically underpin such conclusions. This problem could be solved by using Latent Class Analysis (LCA). With a LCA, a statistical model is available that allows for comparisons to be statistically tested. This makes conclusions less arbitrary and subjective (Magidson and Vermunt, 2002).

Respondents in cluster 2 (42%) selected predominantly the preferred variant, irrespective of the variants. They selected another variant if this variant had the highest travel time savings. With lower education, the probability of being member of cluster 2 will increase. It can be cautiously suggested that lower educated people are more inclined to decide non-paternalistic. Lastly, pro-social respondents do have a higher probability of being member of class 1. However, this does not predict class membership since the covariates of the SVO analysis are not statistically significant.

10 Conclusion, Discussion and Recommendations

This research investigated paternalistic and non-paternalistic altruistic preferences in the Willingness to Allocate Public Budget approach with regard to travel time savings and safety. Chapter 10.1 describes the answer of the main research question and sub questions. Section 10.2 contains a discussion and it addresses the limitations of this research. Recommendations and paths for further research is elaborated on in section 10.3.

10.1 Conclusion

The main goal of this study was answering the research question: *To what extent are individuals willing to sacrifice the utility of transport policy effects they experience themselves, for the utility that other individuals derive from these transport policy effects or for the effects that other individuals experience, in the context of a Willingness to Allocate Public Budget approach and which segments of the population can be identified?*

To answer this question, two WTAPB stated choice experiments were conducted and analysed with discrete choice models. In both experiments respondents were asked to advice the government with regard to an investment in bicycle infrastructure. In experiment 1 respondents were asked to choose between several infrastructural bicycle projects which differ in travel time savings and safety respectively for 10.000 citizens including themselves and 10.000 other citizens. Therefore, experiment 1 focused on altruistic preferences. If respondents are altruistic it is more likely that they would sacrifice the utility of transport policy effects they experience themselves for the effects other individuals experience.

The second experiment focused on paternalistic and non-paternalistic altruistic preferences for 10.000 other citizens. Respondents were asked to advice the government on several infrastructural bicycle projects which differ in travel time savings and safety for 10.000 other citizens. The respondents do not experience the effects themselves and have been told that those 10.000 other citizens have indicated a preferred variant. Each time, one out of three projects was the preferred variant according to 10.000 other citizens. If respondents decide in line with the preferred variant, they are more likely to choose non-paternalistic (i.e. respecting the preferences of these other individuals).

Afterwards, respondents were asked to substantiate why these social impacts are important, to gain empirical insights on how citizens think that the government should conduct policy. Next, a LCCA is used to investigate preference heterogeneity of the respondents with regard to travel time savings and risk reduction to define different segments in the population.

This research has shown that respondents are willing to sacrifice more than 6 minutes travel time savings for 10.000 citizens including themselves, for a 10% risk reduction for 10.000 other citizens. Furthermore, individuals are willing to sacrifice 7% risk reduction for 10.000 citizens including themselves for 10% risk reduction for 10.000 other citizens. These results reveal that individuals are willing to sacrifice transport policy effect and thus express altruistic preferences in a WTAPB approach.

In addition, the results of this study reveal that respondents express non-paternalistic altruistic preferences to a certain extent. Respondent are more likely to decide non-paternalistic (i.e. in line with the preferred variant) if this variant has up 6 minutes travel time savings or 12% risk reduction. However, when a paternalistic variant scores better than the non-paternalistic variant in terms of a risk reduction more than 12%, it is more likely that respondents decide in line with the paternalistic variant.

The empirical substantiations allows to distinguish six categories on why social impacts are important. 1) respondents assign substantially more value to safety than travel time savings. 2) travel time savings are an important criteria to make the investment in bicycle infrastructure attractive, however it has to outweigh the number of casualties. 3) respondents think that preferably both effects should have the maximum positive result for everyone. 4) altruism/selfishness: people's safety is very important. Self-interest vs. society; in case of doubt, some respondents chose the variant with the highest benefits for 10.000 citizens including themselves. 5) the environment is very important for society and future generations. 6) government decision or not: it is important that the government listens to society. By listening carefully to society, the government can take the appropriate measures. In addition, safety is the core responsibility of the government. If road safety improves, social costs will decrease.

Finally, by means of a LCCA, different segments of the population can be identified. Considering the LCCA analysis of experiment 1, two clusters can be determined. Respondents in cluster 1 predominantly selected the variant with the highest risk reduction for 10.000 citizens including themselves. Respondents in cluster 2 preferably select the variant with the highest travel time savings for 10.000 citizens including themselves, but do care about equally distributed transport effects. Class membership for both clusters can be especially well predicted by education level. With higher education, the probability of being member of cluster 1 will increase and the probability of being member of cluster 2 will decrease. Given these classes and class membership probabilities, higher educated respondents in this experiment are likely to be less altruistic with regard to safety than lower educated respondents.

Considering the LCCA analysis of experiment 2, two clusters can be determined. Respondents in cluster 1 predominantly selected the preferred variant if this variant had the highest risk reduction (non-paternalistic preference). They selected another variant if this variant had a higher risk reduction (paternalistic preference). Respondents in cluster 2 predominantly selected the preferred variant, irrespective of the effects. Class membership can especially well be predicted by education level. Based on class 1 and the class membership probabilities, higher educated respondents in this experiment are more likely to decide paternalistic with regard to safety. Besides that, it can be cautiously suggested that lower educated people are more likely to decide non-paternalistic. Income, gender, the SVO and the number of bicycle trips do not appear as explanatory variables to predict class membership.

10.2 Discussion

The conclusions from section 10.1 should be interpreted with caution because this study has a number of limitations. The estimated parameters of safety and travel time savings in both experiment are all significant. Based on these results, it can be concluded that respondents attach substantially more value to a 30% risk reduction than to 6 minutes travel time savings in the context of the WTAPB approach. This is in line with earlier research (Mouter et al., 2017b, 2018b). However, the results of this study cannot be generalized to the Dutch population because only gender is representative for the Dutch population.

Generalizing these results to other contexts would not be fully appropriate because of consequentiality, measuring pure altruism and the variation of effects in other transport contexts. First, an attempt was made to add consequentiality (Mouter et al., 2017b,a) to the experiment: "Is there a chance that the choices made by respondents will have consequences in reality?" However, this condition was not fully met because the case study of bicycle infrastructure was not an actual policy program of the government. As a consequence, choices of respondents might be different when it comes to an bicycle infrastructure investment in their own municipality. Secondly, in order to measure pure altruism the effects should actually have been travel time savings and risk reduction for individual x and individual y. Finally, the attached values to the effects of bicycle infrastructure are likely to vary across other transport contexts (e.g. investment in car- or public transport infrastructure).

Next, in experiment 2 the conclusion is cautiously drawn that respondents are more likely to choose another variant (other than the non-paternalistic variant) if this variant has more than 12% risk reduction. This finding suggests that when travel safety is evaluated, respondents are more likely to decide in line with the paternalistic variant. This is consistent with the results of Veisten et al. (2015) and Jacobsson et al. (2007). However, based on the results from this study, the levels of non-paternalism are compared to the level of safety and travel time savings.

The proportion of pure non-paternalism (i.e. respondents who always decide in line with the preferred variant) was quite low (6%), which is in line with the results of Veisten et al. (2015). Predominantly low educated respondents came forward as non-traders in the analysis with regard to pure non-paternalism. The non-traders could have affected the parameters of travel time savings and risk reduction. This might have influenced the outcome of the extent of non-paternalism.

The small travel time savings in both experiment are questionable (Daly et al., 2014). However, realism in an experiment is important as well (Johnston et al., 2017). More than 6 minutes travel time savings in bicycle infrastructure in a relative small country like the Netherlands is not realistic. But a shortcoming in the travel time savings is that the travel time savings are all relative. 6 minutes travel time savings on 12 minutes of cycling is not realistic. But 6 minutes travel time savings on 45 minutes of cycling could be realistic. This could have been relevant in establishing the experiment.

Both analysis of the qualitative substantiations reveal that the largest share of respondents considered safety as the most important social impact in bicycle infrastructure. According to Daly et al. (2014), 80% of the benefits of conventional transport evaluations (e.g. CBA) consist of travel time savings. The large benefits of small travel time savings in a CBA stands in contrast with the fact that safety is mentioned most often in a social choice setting. Using the WTAPB approach can therefore substantially impact the outcome of the evaluation of a transport project, since safety is viewed as important effect in a social choice setting.

Next, we consider the VoT according to the Dutch Guidelines (RWS, 2020). The Value of Travel Time Savings is determined at 9 euro per hour. 6 minutes of travel time savings for 10,000 travelers results in a yearly benefit of 2.2 million euros (10,000 * 240 working days * 9.00 euro Value of Time * 6 min/60). Next we can calculate the total social benefits for risk reduction per 10.000 citizens. Social cost per saved road injury is 0.281 million euros. The total number of road injuries was 21.700 in 2018 (RWS, 2012; Weijermars, 2019). The Netherlands has currently 17.28 million inhabitants. Number of road injuries per 10.000 citizens is then determined at 12. Saving 12 road injuries per 10.000 citizens results in a yearly benefit of 3.4 million euros (12 * 0.281 million euro). From a social point of view, it could be beneficial to invest in road safety. Of course, costs have to outweigh the benefits, but this is beyond the scope of this research.

The context of this experiment left freedom for respondent's own interpretation. Costs of the project were not specified, "the others" were unknown and the location of a project somewhere else was not specifically mentioned. It is striking and good to see how aware respondents are of these criteria. Respondents gave information they could not have known themselves (probably based on personal experience). Given the empirical substantiations, respondents considered safety with regard to children and future generations as important. Hereby, it could be that respondents assigned more value to risk reduction. But since these criteria were not specified, it is not possible to determine exactly which and how many respondents took this into consideration.

Furthermore, respondents did not have the option not to choose. They were forced to choose a variant. This is a design limitation of the experiment. It is imaginable that respondents do not have a preference for a certain variant. A PVE allows for choice of freedom (Mouter et al., 2020).

Finally, a great benefit of the WTAPB approach is the possibility to elicit social considerations with regard policy effects, (moral) values and concerns. The qualitative substantiations and considerations from this research could be an useful addition to conventional transport evaluations. The fact that respondents assign a substantial value to the safety of other citizens is valuable for policymakers. In this way they can take appropriate measures.

10.3 Recommendations and further research

Long and Krause (2017); Aabø and Strand (2004) have empirically shown that respondents generally exhibit higher levels of altruism with respect to friends and family and a lower level of altruism towards unknown individuals. Safety of children and future generations has been mentioned several times. It would be interesting to specifically investigate those altruistic preferences in the context of transport, because this might affect the evaluation of transport policy.

Furthermore, the results of experiment 2 reveal that the utility derived from 6 minutes travel time savings is nearly the same as the utility derived from the preferred variant (i.e. non-paternalistic altruism). Hereby, the social value of non-paternalism for 10.000 other citizens could be cautiously put at 2.2 million euro. As far as known, the social value of non-paternalistic altruism has not been concluded in this way before. Further research is needed to investigate how this value should be used in the valuation of transport policy.

With the LCCA, different segments of the population have been identified. The conclusions of the LCCA should be interpret with caution because LCCA is not "model based". This makes it difficult to statistically underpin conclusions. With a Latent Class Analysis (LCA), a statistical model is available that allows for comparisons to be statistically tested. This makes conclusions less arbitrary and subjective (Magidson and Vermunt, 2002). It is recommended to use the LCA as the utilized method in further WTAPB experiments.

Prior research of Mouter et al. (2019) concluded that *"it is difficult to defend that individuals participating in a WTAPB experiment aim to maximize social welfare, as some individuals clearly adopted a self-interested perspective"*. The results of this study reveal the presence of altruism in the context of a WTAPB approach with regard to transport effects. However, further research is needed to gain insights into how these results could directly be used in other transport evaluations (e.g. Cost Benefit Analysis).

It is also recommended to repeat this study in other transport contexts (e.g. investment in car-public transport infrastructure) as well. This could be used to research whether the results of this study can be generalized to other contexts.

Furthermore, the WTAPB provides policymakers with 1) concrete trade-offs of citizens with regard to different policy effects; 2) citizen's preferences on policy effects 3) important empirical insights with regard to these policy effects. It is recommended to use the WTAPB approach in addition to conventional evaluation approaches.

This study has revealed that citizens are willing to sacrifice transport policy effects they experience themselves for the transport policy effects other individuals experience. The fact that respondents are willing to sacrifice travel time for someone else's safety could be important if two concrete infrastructural projects are included on the political agenda. It is recommended for policymakers to consider explicitly the preferences of other citizens (i.e. other than own municipality). Especially when it comes to the distribution of the allocation of government budget towards transportation projects.

Finally, participatory decision-making is becoming more and more important. Empirical insights of this research reveal that 1) respondents think it is very important that the government listens to society; 2) the government considers transport policy effects for all citizens, especially focused on safety. It is recommended for a government to use these insights in policy-making. This allows the government to take the required measures with regard to policy.

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APPENDIX

Scientific Paper

Altruistic preferences in the Willingness to Allocate Public Budget approach: a trade off between travel time savings and safety

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***Abstract*—This study investigates paternalistic and non-paternalistic altruistic preferences in the Willingness to Allocate Public Budget approach (WTAPB) in a transport context. To the best of my knowledge the extent to which citizens are willing to sacrifice effects for themselves to realize effects for other people, has not been studied in a WTAPB setting. This is the most important research gap that this study aims to alleviate. Furthermore, it is investigated to what extent citizens express paternalistic and non-paternalistic altruistic preferences. Two stated choice experiments were conducted by asking citizens to advice the government with regard to an investment in a bicycle infrastructure project which differ in travel time savings and safety. The first experiment focused on altruistic preferences for 10.000 citizens including themselves and 10.000 other citizens respectively. The second experiment focused on paternalistic and non-paternalistic preferences for 10.000 other citizens. This research has shown that respondents are willing to sacrifice more than 6 minutes travel time savings for 10.000 citizens including themselves, for a 10% risk reduction for 10.000 other citizens. Furthermore, individuals are willing to sacrifice 7% risk reduction for 10.000 citizens including themselves for 10% risk reduction for 10.000 other citizens. In addition, the results of this study reveal that respondent are more likely to decide non-paternalistic (i.e. in line with the preferred variant) if this variant has up 6 minutes travel time savings or 12% risk reduction. However, when a paternalistic variant scores better than the non-paternalistic variant in terms of a risk reduction more than 12%, it is more likely that respondents decide in line with the paternalistic variant.**

Keywords: Participatory Value Evaluation, Discrete choice experiment, Altruism, (non)-paternalism, Transport policy

I. Introduction

THE Participatory Value Evaluation (PVE) has been introduced in the field of the evaluation of government projects. The PVE is a method operationalised in an online web-tool where citizens: 1) advice a government with regard to a specific decision-making problem; 2) can express their preferences with regard to different policy options; 3) gain insight in the advantages and disadvantages (or effects) of the policy options and; 4) gain insight in the constraints that the government is facing (e.g. limited budget) [1]. Citizens are basically put in the shoes of a policymaker.

The PVE uses the Willingness to Allocate Public Budget (WTAPB) approach to measure preferences of citizens for government projects. This preference elicitation approach assumes that preferences of citizens for the effects of government policy should be derived from the extent to which individuals think that the government should allocate public budget to these effects [1].

The value individuals allocate to the effects of a government policy on other individuals can be described as altruistic preferences [1]. Literature distinguish two types of altruistic preferences [2], [3]:

- paternalistic altruistic preference: refers to the value individuals allocate to the effects of government policy on other individuals, irrespective if these other individuals attach value to that government policy
- non-paternalistic altruistic preference: refers to the value individuals allocate based on the utility that other individuals derive from the effects of a government policy (i.e. respecting the preferences of these other individuals)

The WTAPB approach has been used in various contexts, but to the best of gained knowledge the extent to which citizens are willing to sacrifice effects for themselves to realize effects for other people, has not been studied in a WTAPB setting. This is the most important research gap that this study aims to alleviate. Furthermore, it is investigated to what extent citizens express paternalistic and non-paternalistic altruistic preferences.

The main research question of this paper is:
To what extent are individuals willing to sacrifice the utility of transport policy effects they experience themselves, for the utility that other individuals derive from these transport policy effects or for the effects that other individuals experience, in the context of a Willingness to Allocate Public Budget approach?

There are three main reasons to conduct this research: 1) There is a growing literature showing that individuals care not only about their own preferences, but about the preferences of other individuals as well [2], [4], [5]. Prior research concluded that *"it is difficult to defend that individuals participating in a WTAPB experiment aim to maximize social welfare, as some individuals clearly adopted a self-interested perspective"* [6]. As previously described, the WTAPB approach assumes that individuals consider preferences of other individuals. By investigating specifically

altruistic preferences throughout this paper, the conclusion of [6] can be refuted. 2) Steering on the preferences of citizens can complement the result of other evaluations of transport (e.g. Cost Benefit Analysis) which is strategically important in prioritizing government projects [6]. In contrast to conventional evaluation approaches, the WTAPB approach has the advantage to include considerations with regard to the way in which respondents think a government should weigh costs and benefits of different projects [6]. 3) Literature states that it is important to determine to which extent altruistic preferences are paternalistic or non-paternalistic [2], [4], [5], [7]. Therefore, this thesis will also investigate this. If individuals *"include the utility of other's in one's own utility, there is a potential problem of double counting and overestimation of economic values"* [5]. However, the aim of this thesis is not to further settle this discussion. What kind of altruistic preferences individuals have will be empirically considered first. If non-paternalistic preferences compose a large part of the total valuation of government policy, it could induce changes in the way government steers on preferences.

This paper is organized as follows: section II contains a literature study that is relevant for this study. Section III provides the research design and methodological choices. Section IV presents the data collection. Section V describes the obtained results. Section VI provides the conclusions, discussion and possible further research.

II. Literature review

This section covers literature on altruism and the distinction between paternalistic and non-paternalistic altruism.

The concept of altruism is embedded in a variety of different theories in sociology, psychology, biology, economics and politics [8]–[10]. Contrary to egoism, altruism involves increasing the welfare of another person at a small decrease of one's own [8]. In the traditional theory of altruism an individual cares about the utility of the beneficiary [11]. In public policy individuals could care about other individuals as well. Altruism in the context of public policy is the value individuals allocate to the effects of public policies on other individuals [1].

A distinction is made between paternalistic and non-paternalistic altruism. Paternalistic altruism refers to the value an individual allocates to a public good, whether or not another individual valuates the utility of this public good [2]. In addition, an individual cares explicitly about the consumption of services from a resource by others, but not about other's utilities [12]. An example to illustrate paternalistic preferences is the following: the society in general, allocates value to the public good of health and school. But giving poor people money instead of health and school, could be more beneficial. Yet the government decides to ignore the preferences of the poor people, which is in line with the theory of paternalistic altruism [4].

Non-paternalistic preferences refers to the value an individual allocates to the value of the welfare of another individual [2]. Furthermore, non-paternalistic altruism can be described as the utility an individual derives from other's utility [12].

Concluding, paternalistic altruistic preferences refers to the value individuals allocate to the effects of government policy on other individuals, irrespective if these other individuals attache value to that government policy. Non-paternalistic altruistic preferences refers to the value individuals allocate based on the utility that other individuals derive from the effects of a government policy (i.e. respecting the preferences of these other individuals).

Research examined how paternalistic and non-paternalistic altruism plays a role in reducing child mortality. Qualitative statements showed that 73% had paternalistic preferences and 53% non-paternalistic preferences [13]. However, the non-paternalistic preferences were not significant. In another experiment, paternalistic and non-paternalistic altruistic preferences were identified regarding the reduction of road traffic fatalities in Norway [5]. The share of non-paternalistic preferences was very low, around 10% [5]. Furthermore, an experiment is performed towards the value of public libraries including altruistic motivations. 60% of all motivations were self-interested (including any within-family, or local, altruism) while 40% were motivated by social interests (including out-of-family, or global, altruism) [14]. However, further research needs to validate if those motivations are paternalistic or non-paternalistic [14].

Despite a variety of experiments with regard to altruism, to the best of gained knowledge, no attention has been paid to altruism in the context of the WTAPB approach. Above-mentioned literature illustrates that altruism in the context of policy is usually paternalistic. This paper will contribute to the extent if altruism is paternalistic or non-paternalistic in the context of the WTAPB approach.

III. Research design and methods

To investigate to what extent citizens express paternalistic and non-paternalistic altruistic preferences in a WTAPB setting, two stated choice experiments with regard to transport effects will be performed. It is decided to investigate citizen's preferences for travel time savings and safety because these effects are central elements in the evaluation of transport policy [15], [16]. Travel time savings count for 80% of the benefits in the evaluation of transport, however according to the Leidraad OEI, safety must be included as an effect to be investigated and is therefore indispensable [17], [18].

An investment in bicycle infrastructure is chosen as case study, since the bicycle is an increasingly popular means of transport. It is sustainable, cheap and fast. At the same time, the number of bicycle casualties is growing fast. The Dutch government has the goal to reduce the number of road injuries from 21.700 to 10.600 in 2020 [19]. Therefore, the government could invest in fast bicycle paths, separate bicycle paths and the improvement of current links. This might save travel time and risk reduction for citizens. These transport effects allow to make concrete trade-offs with regard to altruistic preferences.

A. Research design experiment 1: altruistic preferences

In experiment 1 respondents are asked to advice the government on several infrastructural bicycle projects which differ in travel time savings and safety respectively for 10.000 citizens including themselves and 10.000 other citizens. Therefore, experiment 1 is focusing on altruistic preferences. If respondents are altruistic, it is more likely that they would sacrifice the utility of transport policy effects they experience themselves for the effects other individuals experience. Figure 1 presents an example of a choice set of experiment 1.

	Variant 1	Variant 2	Variant 3
Average **travel time savings** on an average day for 10,000 citizens **including yourself**	6 min	0 min	4 min
Average **travel time savings** on an average day for 10,000 other citizens	0 min	2 min	6 min
Risk reduction for 10,000 citizens, **including yourself**, to become a victim of a serious traffic accident in the period of one year	30 %	20 %	0 %
Risk reduction for 10,000 **other** citizens to become a victim of a serious traffic accident in the period of one year	0 %	20 %	30 %

Fig. 1. Example choice set experiment 1

B. Research design experiment 2: paternalistic and non-paternalistic altruistic preferences

The second experiment focused on paternalistic and non-paternalistic altruistic preferences for 10.000 other citizens. Respondents were asked to advice the government on several infrastructural bicycle projects which differ in travel time savings and safety for 10.000 other citizens. The respondents do not experience the effects themselves and have been told that those 10.000 other citizens have indicated a preferred variant. Each time, one out of three projects will be the preferred variant according to 10.000 other citizens. If respondents decide in line with the preferred variant, they are more likely to choose non-paternalistic (i.e. respecting the preferences of these other individuals). Figure 2 presents an example choice set of experiment 2. In this example, 10.000 other citizens indicated a preference for variant 3. If respondents decide in line with this preferred variant, they are more likely to decide non-paternalistic.

	Variant 1	Variant 2	Variant 3
Average **travel time savings** on an average day for 10,000 **other** citizens	2 min	4 min	6 min
Risk reduction for **other** 10,000 citizens to become a victim of a serious traffic accident in the period of one year	30 %	20%	0 %

Fig. 2. Example choice set experiment 2

C. Attribute levels and other methodological choices

The attribute levels for risk reduction are based on Dutch studies of Stichting Wetenschappelijk Onderzoek Verkeersveiligheid (SWOV). These studies reveal that an investment in bicycle infrastructure (e.g. separate bicycle paths) can result in a risk reduction of 15% till 30% [20], [21]. Therefore, the attribute levels are determined at [0%, 10%, 20% and 30%]. Travel time savings levels are determined at [0 min, 2 min, 4 min and 6 min]. An important criteria when designing an experiment is realism [22]. The experiment should reflect real world choice situations to the best of it's abilities. Travel time savings more than 6 minutes in a relative small country like the Netherlands are not realistic. Next, consequentiality is included. Consequentiality means that respondents *"have the feeling that there is a chance that their choices made will have consequences in reality"* [15], [23]. Furthermore, the design of the stated choice experiments is based on a D-efficient design [24]. The property of attribute balance level has been used in both experiments [24]. Finally in each experiment, respondents fill in 8 out of 16 choice sets. Note that the attributes do not differ (in terms of travel time savings and safety), only the attribute levels.

IV. Data Collection

Survey company Kantar Public was asked to draw two random samples (for each experiment one sample) from the population of Dutch citizens, which are all 18 years and older [25]. Citizens below 18 years old were automatically filtered out. Kantar carefully selected two samples in which all socio-demographic criteria were present (e.g. gender, age, education and income), not particularly a representative sample. The Ethics Board of the Delft University of Technology approved the data collection. In total there were 188 valid responses for experiment 1 and 196 valid responses for experiment 2. Table I presents the socio-demographic characteristics of the respondents.

TABLE I
Descriptive statics of total valid samples of experiment 1 and 2

Variable		Exp 1	Exp 2
Total		188	196
Gender (percentage)			
	Female	50	49
	Male	50	51
Age (percentage)			
	18-34	27	25
	35-54	35	37
	55-99	38	38
Completed education (percentage)			
	Lower education	39	41
	Higher education	37	36
	University	24	23
Household net income (percentage)			
	Less than 10.000	7	9
	10.000 - 30.000	29	27
	30.000 - 60.000	36	40
	More than 60.000	10	11

V. Results

To analyze the results of the stated choice experiments, Discrete Choice Models (DCM) are used. This model assumes that respondents choose the variant from which they derive the highest utility. Working-horse of DCM is the Random Utility Maximization-Multinomial Logit (RUM-MNL) model [26] where:
$U_i = V_i + \varepsilon_i = B_j X_{ij} + \varepsilon_i$. U_i = Utility of alternative; V_i = Observed utility of alternative i; ε_i = Unobserved utility of alternative i; X_{ij} = attribute level of attribute j for alternative i and B_j = weight of attribute j. The MNL model will be used for straightforward interpretation of the parameter estimates and Marginal Rates of Substitution (MRS).

A. Results experiment 1: altruistic preferences

First the results of experiment 1 will be presented.

TABLE II
Results MNL experiment 1

Context	Experiment 1		
# Observations			
Null LL:	-1652.3		
Final LL:	-1504.2		
Estimated parameters	4		
ρ^2	0.087		
Estimates	Est	SE	T
β_{TT_N}	0.0444	0.015	2.97
β_{TT_M}	0.0257	0.0123	2.09
β_{S_N}	0.0402	0.00272	14.7
β_{S_M}	0.0286	0.00259	11
Marginal rates of substitution			
β_{TT_N}/β_{S_M}	**1.55**		
$\beta_{TT_N}/\beta_{TT_M}$	**1.72**		
β_{S_N}/β_{TT_M}	**1.56**		
β_{S_N}/β_{S_M}	**1.41**		

Table II presents the MNL results of experiment 1. Where:

- β_{TT_N} = marginal utility of one additional minute travel time savings for 10,000 citizens including yourself on an average day
- β_{TT_M} = marginal utility of one additional minute travel time savings for 10,000 other citizens on an average day
- β_{S_N} = marginal utility of one percent risk reduction for 10,000 citizens including yourself in the period of one year to become a victim of a serious traffic accident
- β_{S_M} = marginal utility of one percent risk reduction for 10,000 other citizens in the period of one year to become a victim of a serious traffic accident

All parameters from Table II have the expected sign. All parameters are significant at a 5% level. This means all parameters are relevant regarding to the trade-offs. Considering the data from Table II, it is possible to elicit the MRS. The MRS is the marginal willingness of individual N to give away a reduced increase of his own utility to an increase of the utility of individual M [27]. In this case; the utility derived from the effects of risk reduction and travel time savings for 10.000 citizens including yourself or 10.000 other citizens.

The MRS are reported in bold in Table II. For example, respondents derive equal level of utility of 1 minute travel time savings for 10.000 citizens including themselves on an average day and 1.55% risk reduction for 10.000 other citizens in the period of one year to become a victim of a serious traffic accident. Furthermore, respondents derive equal level of utility of one percent risk reduction for 10.000 citizens including themselves in the period of one year to become a victim of a serious traffic accident and 1.41% risk reduction for 10.000 other citizens. Next, citizens derive equal utility of 1 minute travel time savings for 10.000 citizens including themselves for 1.72 minute of travel time savings for 10.000 other citizens.

When the MRS is taken into account, it can be inferred that the MRS of β_{S_N}/β_{S_M} (1.41) is substantially lower than the MRS of $\beta_{TT_N}/\beta_{T}T_{_M}$ (1.72). Respondents seem more selfish when it comes to saving travel time than safety.

However, imagine you live in municipality A and consider a government that has to decide between two bicycle infrastructure projects being project 1: 6 min travel time savings and no risk reduction in municipality A, the municipality where you live. Project 2 being 0 min travel time savings and 30% risk reduction in municipality B. On basis of the results of the analysis, the 'aggregate utility' of project 2 exceeds the 'aggregate utility' of project 1, since respondents derive more utility from 30% risk reduction for 10.000 other citizens than 6 minutes travel time savings for 10.000 citizens including themselves.

B. Results experiment 2: paternalistic and non-paternalistic preferences

In this section the MNL results of experiment 2 with the preferred variant will be presented and interpreted. The parameter for the preferred variant has been introduced to investigate to what extent citizens express (non-)paternalistic preferences.

TABLE III
Results MNL experiment 2

Context	Experiment 2		
# Observations			
Null LL:	-1719.3		
Final LL:	-1449.2		
Estimated parameters	3		
ρ^2	0.155		
Estimates	Est	SE	T
β_{TT_M}	0.0968	0.0144	6.7
β_{S_M}	0.0549	0.0032	17.4
β_{PV}	0.641	0.0539	11.9

Table III presents the MNL results of experiment 2. Where:

- β_{TT_M} = marginal utility of one additional minute travel time savings for 10,000 other citizens on an average day
- β_{S_M} = marginal utility of one percent risk reduction for 10,000 other citizens in the period of one year to become a victim of a serious traffic accident

- β_{PV} = marginal utility of the preferred variant. This variant is preferred by 10.000 other citizens

Table III presents the estimated results of experiment 2 with a parameter estimated for the Preferred Variant (PV). All parameters are significant at a 5% level. The estimated parameter of PV measures the isolated effect of β_{PV}. The value of β_{PV} (0.641) indicates that respondents derive a significant level of utility from the preferred variant, irrespective of the effects.

Respondents are more likely to decide non-paternalistic (i.e. in line with the preferred variant) up to 12% risk reduction or 6 minutes of travel time savings. However, when a paternalistic variant scores better than the non-paternalistic variant in terms of risk reduction more than 12%, it is more likely that respondents decide in line with the paternalistic variant. A cautious conclusion could be drawn that respondents, in this experiment, want to contribute to risk reduction for 10.000 other citizens, irrespective of the preference of 10.000 other citizens. This result is comparable to prior research [5].

VI. Conclusion, discussion, further research

Section VI-1 provides the conclusions of this research. Section VI-2 provides a discussion and paths for further research.

1) Conclusion: The aim of this research was to investigate to what extent citizens express paternalistic and non-paternalistic altruistic preferences in a WTAPB approach in a transport context. To answer this question two stated choice experiments were conducted and analysed with discrete choice models. In both experiments respondents were asked to advice the government with regard to an investment in bicycle infrastructure. In experiment 1 respondents were asked to choose between several infrastructural bicycle projects which differ in travel time savings and safety respectively for 10.000 citizens including themselves and 10.000 other citizens. Therefore experiment 1 focused on altruistic preferences. If respondents are altruistic, it is more likely that they would sacrifice the utility of transport policy effects they experience themselves for the effects other individuals experience.

The second experiment focused on paternalistic and non-paternalistic altruistic preferences for 10.000 other citizens. Respondents were asked to advice the government on several infrastructural bicycle projects which differ in travel time savings and safety for 10.000 other citizens. The respondents do not experience the effects themselves and have been told that those 10.000 other citizens have indicated a preferred variant. Each time, one out of three projects was the preferred variant according to 10.000 other citizens. If respondents decide in line with the preferred variant, they are more likely to choose non-paternalistic (i.e. respecting the preferences of these other individuals).

This research has shown that respondents are willing to sacrifice more than 6 minutes travel time savings for 10.000 citizens including themselves, for a 10% risk reduction for 10.000 other citizens. Furthermore, individuals are willing to sacrifice 7% risk reduction for 10.000 citizens including themselves for 10% risk reduction for 10.000 other citizens. These results reveal that individuals express altruistic preferences in a WTAPB approach.

In addition, the results of this study reveal that respondents express non-paternalistic altruistic preferences to a certain extent. Respondent are more likely to decide non-paternalistic (i.e. in line with the preferred variant) if this variant has up 6 minutes travel time savings or 12% risk reduction. However, when a paternalistic variant scores better than the non-paternalistic variant in terms of a risk reduction more than 12%, it is more likely that respondents decide in line with the paternalistic variant.

2) Discussion and further research: The conclusions from section VI-1 should be interpreted with caution because this study has a number of limitations. First of all, the results of this study cannot be generalized to the Dutch population because only gender is representative for the Dutch population.

Furthermore, generalizing these results to other contexts would not be fully appropriate because of consequentiality, measuring pure altruism and the variation of effects in other transport contexts. First, an attempt was made to add consequentiality [15], [23] to the experiment: "Is there a chance that the choices made by respondents will have consequences in reality?" However, this condition was not fully met because the case study of bicycle infrastructure was not an actual policy program of the government. As a consequence, choices of respondents might be different when it comes to an bicycle infrastructure investment in their own municipality. Secondly, in order to measure pure altruism the effects should actually have been travel time savings and risk reduction for individual x and individual y. Finally, the attached values to the effects of bicycle infrastructure are likely to vary across other transport contexts (e.g. investment in car- or public transport infrastructure).

Next, in experiment 2 the conclusion is cautiously drawn that respondents are more likely to choose another variant (other than the non-paternalistic variant) if this variant has more than 12% risk reduction. This finding suggests that when travel safety is evaluated, respondents are more likely to decide in line with the paternalistic variant. This is consistent with the results of [4], [5]. However, based on the results from this study, the levels of non-paternalism are compared to the level of safety and travel time savings.

The small travel time savings in both experiment are questionable [17]. However, realism in an experiment is important as well [22]. More than 6 minutes travel time savings in bicycle infrastructure in a relative small country like the Netherlands is not realistic. But a shortcoming in the travel time savings is that the travel time savings are all relative. 6 minutes travel time savings on 12 minutes of cycling is not realistic. But 6 minutes travel time savings on 45 minutes of cycling could be realistic. This could have been relevant in establishing the experiment.

Analysis of the results reveal that respondents derive higher utility from 30% risk reduction than from 6 minutes travel time savings in bicycle infrastructure. 80% of the benefits of conventional transport evaluations (e.g. Cost Benefit Analysis; CBA) consist of travel time savings [17]. The large benefits of small travel time savings in a CBA stands in contrast with

the utility level derived from safety in a social choice setting. Using the WTAPB approach can therefore substantially impact the outcome of the evaluation of a transport project, since safety is viewed as important effect in a social choice setting.

In addition, a great benefit of the WTAPB approach is the possibility to elicit social considerations with regard policy effects, (moral) values and concerns. The qualitative substantiations and considerations from this research could be an useful addition to conventional transport evaluations. The fact that respondents assign a substantial value to the safety of other citizens is valuable for policymakers. In this way they can take appropriate measures.

Prior research of concluded that *"it is difficult to defend that individuals participating in a WTAPB experiment aim to maximize social welfare, as some individuals clearly adopted a self-interested perspective"* [6]. The results of this study reveal the presence of altruism in the context of a WTAPB approach with regard to transport effects. However, further research is needed to gain insights into how these results could directly be used in other transport evaluations (e.g. Cost Benefit Analysis).

It is also recommended to repeat this study in other transport contexts (e.g. investment in car- public transport infrastructure) as well. This could be used to research whether the results of this study can be generalized to other contexts.

The fact that respondents are willing to sacrifice travel time for someone else's safety could be important if two concrete infrastructural projects are included on the political agenda. It is recommended for policymakers to consider explicitly the preferences of other citizens (i.e. other than own municipality). Especially when it comes to the distribution of the allocation of government budget towards transportation projects.

Finally, participatory decision-making is becoming more and more important. This research reveal that 1) respondents think it is very important that the government listens to society; 2) the government considers transport policy effects for all citizens, especially focused on safety. It is recommended for a government to use these insights in policy-making. This allows the government to take the required measures with regard to policy.

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A Participatory Value Evaluation

This section covers brief some additional information about the PVE. However, there is no need to perform a PVE to answer the main- and sub research questions. Therefore, no PVE will be carried out in this study. Only two WTAPB experiments.

The PVE uses the Willingness to Allocate Public Budget (WTAPB) approach to measure preferences of citizens for government projects. Within a PVE, participants are asked to choose in an online web-tool between different transport projects (e.g. policy options) including the effects of the policy options, given a limited governmental budget (Mouter et al., 2020). Important difference between a WTAPB experiment and the PVE is the choice of freedom in the PVE. Participants are free to include or exclude certain policy options in a PVE. This in contrast to a WTAPB experiment where respondents are forced to make a choice.

Next, respondents are forced to spend the full budget in a WTAPB. This in contrast with the PVE, where respondents do have the possibility not to spend budget to government projects or shift budget to next year (Mouter et al., 2020). A similarity between the WTAPB and PVE is the advice respondents give tot the government about governmental projects. Respondents have the opportunity to substantiate their choices qualitatively afterwards. Via the qualitative substantiations of citizens, it is possible to investigate their motivations and underlying reasons behind their choices. At the same time, citizens are becoming aware of the complex dilemmas the government is facing.

B Experiment 1: Altruistic preferences

Goal: Exploring to what extent individuals are willing to sacrifice transport effects they experience themselves for the transport effects other individuals experience in a Willingness to Allocate approach.

B.1 Ngene syntax and Final D*-efficient design

```
Design
; alts = alt1*, alt2*, alt3*
; rows = 16
; eff = (mnl,d)
; block = 2
; model:
U(alt1) = B_TT_N[0.345] * TT_N [0,2,4,6] + B_TT_M[0.140] * TT_M [0,2,4,6] + B_S_N[0.067] * S_N [0,10,20,30] + B_S_M[0.048]
U(alt2) = B_TT_N * TT_N + B_TT_M * TT_M + B_S_N * S_N + B_S_M * S_M /
U(alt3) = B_TT_N * TT_N + B_TT_M * TT_M + B_S_N * S_N + B_S_M * S_M
$
```

Figure 12: Final Ngene syntax including estimated priors experiment 1

Design													
Choice situation	alt1.tt_n	alt1.tt_m	alt1.s_n	alt1.s_m	alt2.tt_n	alt2.tt_m	alt2.s_n	alt2.s_m	alt3.tt_n	alt3.tt_m	alt3.s_n	alt3.s_m	Block
1	0	4	20	30	6	2	20	0	2	4	10	0	1
2	4	6	0	30	4	0	30	0	0	2	20	10	2
3	0	2	10	20	0	6	30	10	6	0	0	30	1
4	2	4	10	10	4	4	0	20	4	2	30	20	2
5	0	0	30	30	6	6	0	0	0	4	10	10	2
6	2	6	30	0	2	2	0	10	6	0	0	30	1
7	4	0	30	0	0	2	10	20	4	6	0	30	2
8	4	2	10	10	6	0	20	0	2	6	20	30	2
9	4	2	0	20	2	6	30	20	4	0	10	10	1
10	6	0	0	30	2	2	10	20	4	6	30	0	1
11	6	6	0	0	0	0	30	30	2	4	0	10	2
12	6	0	30	20	4	4	10	10	0	6	20	20	1
13	0	4	20	10	6	4	0	30	2	2	30	0	1
14	2	2	10	10	0	6	20	30	6	0	20	0	2
15	6	6	20	0	2	0	20	30	0	4	10	20	1
16	2	4	20	20	4	4	10	10	6	2	30	20	2

Figure 13: Final D*-efficient design experiment 1

MNL efficiency measures				
D error	0.00297			
A error	0.010687			
B estimate	43.961507			
S estimate	2.66699			
Prior	b_tt_n	b_tt_m	b_s_n	b_s_m
Fixed prior value	0.345	0.14	0.067	0.048
Sp estimates	0.887708	2.66699	0.811087	1.146431
Sp t-ratios	2.080276	1.200177	2.176318	1.830552

Figure 14: MNL efficiency measures

In Figure 15, the expected MNL probabilities of experiment 1 are shown. The rule of thumb for expected choice probabilities is that the choice probabilities must be below 0.90 to reach utility balance. The highest value is 0.78 so utility balance is complied with.

MNL probabilities			
Choice situation	alt1	alt2	alt3
1	0.375829	0.533327	0.090843
2	0.50671	0.386812	0.106478
3	0.099107	0.410016	0.490878
4	0.083692	0.137985	0.778323
5	0.568741	0.331433	0.099826
6	0.477525	0.059064	0.463412
7	0.394073	0.089706	0.516221
8	0.136915	0.249475	0.61361
9	0.1181	0.773966	0.107935
10	0.289272	0.116439	0.594289
11	0.330766	0.567597	0.101637
12	0.774088	0.110133	0.115779
13	0.121336	0.657576	0.221088
14	0.109716	0.491711	0.398573
15	0.630573	0.289058	0.080369
16	0.133295	0.084147	0.782557

Figure 15: MNL probabilities experiment 1

	Value	Std err	t-test	p-value	Rob. Std err	Rob. t-test	Rob. p-value
Beta_S_M	0.047570	0.007514	6.330741	2.439871e-10	0.007708	6.171191	6.777763e-10
Beta_S_N	0.067343	0.007726	8.716430	0.000000e+00	0.007765	8.672780	0.000000e+00
Beta_TT_M	0.139813	0.041587	3.361929	7.739996e-04	0.037117	3.766835	1.653301e-04
Beta_TT_N	0.345299	0.039264	8.794188	0.000000e+00	0.038940	8.867356	0.000000e+00

Figure 16: Estimated priors from PandasBiogeme

B.2 Final design

The final design consists of a introduction page (Figure 17), the context of the experiment (Figure 18) and the questions afterwards (Figure 19 and so on).

Beste deelnemer,

In dit onderzoek staat centraal hoe Nederlanders verschillende effecten afwegen als het gaat om verkeersveiligheid en reistijdwinst.

Het beantwoorden van de vragen duurt ongeveer 5 a 10 minuten. Uw antwoorden worden alleen gebruikt voor wetenschappelijke doeleinden en blijven anoniem.

Hartelijk dank voor uw deelname.

Figure 17: Introduction page experiment 1

In Figure 18, the context of experiment 1 is shown. Citizens are asked to advice the government about an investment in bicycle infrastructure.

In 2018 raakten naar schatting 21.700 personen ernstig gewond in het verkeer in Nederland. 64% van de in het ziekenhuis geregistreerde ernstig verkeersgewonden betrof een fietser. Tegelijkertijd wordt fietsen gezien als duurzaam, gezond en snel vervoersmiddel.

Daarom kan de overheid op verschillende plaatsen in Nederland investeren in fietsinfrastructuur om verkeersveiligheid te verbeteren en reistijden te verkorten. Hierbij kunt u denken aan de aanleg van vrij liggende fietspaden, het aanleggen van fietstunnels bij gevaarlijke oversteekplaatsen, introductie van snelfietspaden en het aanleggen van nieuwe fietspaden op plaatsen waar fietsers nu lang moeten omrijden.

Stelt u zich voor dat de overheid heeft besloten om één groot investeringsprogramma uit te voeren, maar nog moet beslissen hoe dit er precies uit gaat zien.

Recent heeft zij drie varianten uitgewerkt. Deze varianten dragen elk in meer of mindere mate bij aan het verkorten van de reistijd (*reistijdwinst in minuten*) en het verbeteren van de verkeersveiligheid (*risico daling in %*) voor **uzelf** en voor **anderen**. U mag ervan uitgaan dat de varianten hetzelfde zijn op alle andere kenmerken (waaronder kosten).

De overheid wil graag advies van een groep burgers bij het maken van een keuze tussen deze varianten. Per variant krijgt u de effecten op reistijd en verkeersveiligheid voor **uzelf** en de effecten voor **anderen** te zien. Deze anderen zijn mensen zoals u, in een andere provincie.

U krijgt acht keer drie varianten van het programma voorgelegd en we vragen u om telkens tussen één van de drie varianten te kiezen.

Figure 18: Context experiment 1

Kunt u voor elk van de maatschappelijke effecten aangeven hoe belangrijk ze waren bij het geven van uw advies?

	Heel erg onbelangrijk	Onbelangrijk	Neutraal	Belangrijk	Heel erg belangrijk
Reistijdwinst voor 10.000 burgers **waaronder uzelf**	○	○	○	○	○
Reistijdwinst voor 10.000 **andere** burgers	○	○	○	○	○
Risico daling voor 10.000 burgers **waaronder uzelf**	○	○	○	○	○
Risicodaling voor 10.000 **andere** burgers	○	○	○	○	○

De overheid is erg benieuwd waarom Nederlanders bepaalde maatschappelijke effecten belangrijk of juist onbelangrijk vinden. Kunt u aangeven waarom bepaalde maatschappelijke effecten belangrijk of juist onbelangrijk waren bij de adviezen die u zojuist hebt gegeven?

Figure 19: Question about level of importance attributes

Hoe vaak gebruikte u op weekbasis **vóór de corona crisis** de volgende transport modaliteit als **hoofdvervoerswijze** om **van en naar uw werk** te gaan?

Figure 20: Question main travel mode commuting

Hoe vaak gebruikte u op weekbasis **vóór de corona crisis** de volgende transport modaliteiten voor korte afstanden (**afstanden binnen de bebouwde kom**)?

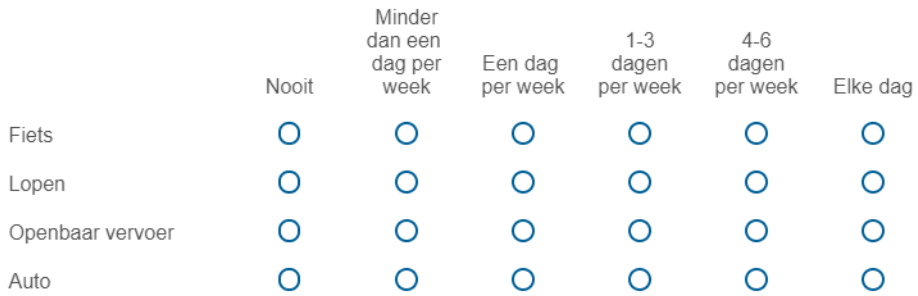

Figure 21: Question within urban areas

Hoe vaak gebruikte u op weekbasis **vóór de corona crisis** de volgende transport modaliteiten voor lange afstanden (**afstanden buiten de bebouwde kom/reizen tussen steden**)?

Figure 22: Question outside urban areas

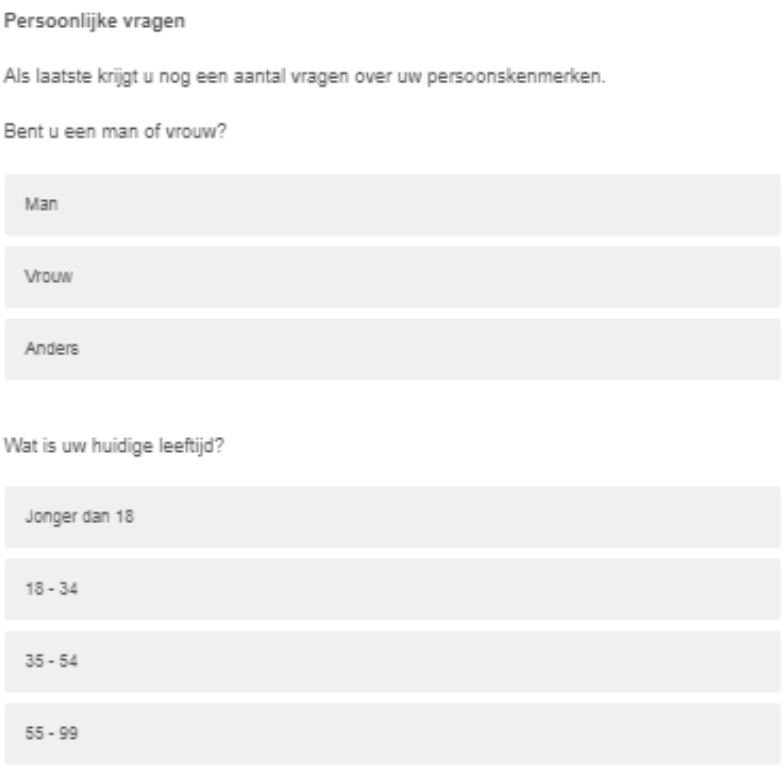

Figure 23: Socio-demographics part 1 experiment 1 and 2

Figure 24: Socio-demographics part 2 experiment 1 and 2

Figure 25: Socio-demographics part 3 experiment 1 and 2

C Experiment 2: paternalistic and non-paternalistic preferences

Goal: Exploring to what extent individuals express paternalistic and non-paternalistic altruistic preferences in the context of a Willingness to Allocate Public Budget approach.

C.1 Ngene syntax and Final D-efficient design

```
Design
; alts = alt1*, alt2*, alt3*
; rows = 16
; eff = (mnl,d)
; block = 2
;cond:

if(alt1.tt_m=0, alt1.s_m=[10,20,30]),
if(alt2.tt_m=0, alt2.s_m=[10,20,30]),
if(alt3.tt_m=0, alt3.s_m=[10,20,30]),

if(alt1.tt_m=6, alt1.s_m=[0,10,20]),
if(alt2.tt_m=6, alt2.s_m=[0,10,20]),
if(alt3.tt_m=6, alt3.s_m=[0,10,20])

; model:
U(alt1) = B_TT_M * TT_M [0,2,4,6] + B_S_M * S_M [0,10,20,30] /
U(alt2) = B_TT_M * TT_M + B_S_M * S_M /
U(alt3) = B_TT_M * TT_M + B_S_M * S_M
$
```

Figure 26: Final syntax experiment 2

Choice situation	alt1.tt_m	alt1.s_m	alt2.tt_m	alt2.s_m	alt3.tt_m	alt3.s_m	Block
1	6	20	0	30	4	0	2
2	2	0	2	30	4	20	2
3	0	30	6	20	2	0	1
4	4	20	2	10	2	20	2
5	2	10	6	10	0	30	2
6	4	30	0	10	4	10	1
7	0	10	6	0	4	30	1
8	4	10	0	30	6	10	1
9	2	20	4	0	2	30	2
10	2	30	2	0	6	20	2
11	0	20	4	20	6	0	2
12	6	0	4	10	0	30	1
13	4	0	0	20	6	20	1
14	6	10	2	20	0	20	1
15	6	10	4	30	0	10	2
16	0	30	6	0	2	10	1
MNL efficiency measures							
D error	0.002874						
A error	0.007851						
B estimate	100						
S estimate	0						

Figure 27: Final choice situations experiment 2

C.2 Final design experiment 2

Table 19: Preferred variants experiment 2

CS	alt1.tt_m	alt1.s_m	alt2.tt_m	alt2.s_m	alt3.tt_m	alt3.s_m	Var 1	Var 2	Var 3
1	6	20	0	30	4	0	0	**1**	0
2	2	0	2	30	4	20	0	0	**1**
3	0	30	6	20	2	0	0	**1**	0
4	4	20	2	10	2	20	**1**	0	0
5	2	10	6	10	0	30	0	0	**1**
6	4	30	0	10	4	10	0	0	**1**
7	0	10	6	0	4	30	0	**1**	0
8	4	10	0	30	6	10	0	**1**	0
9	2	20	4	0	2	30	0	**1**	0
10	2	30	2	0	6	20	**1**	0	0
11	0	20	4	20	6	0	0	0	**1**
12	6	0	4	10	0	30	1	0	0
13	4	0	0	20	6	20	0	0	**1**
14	6	10	2	20	0	20	0	**1**	0
15	6	10	4	30	0	10	**1**	0	0
16	0	30	6	0	0	10	**1**	0	0


Beste deelnemer,

In dit onderzoek staat centraal hoe Nederlanders de verkeersveiligheids- en reistijdwinsteffecten van beleid afwegen.

Wij vragen uw advies over een project dat elders in het land wordt uitgevoerd waar u zelf géén effecten van ondervindt.

Het beantwoorden van de vragen duurt ongeveer 5 a 10 minuten en bestaat uit twee korte onderdelen. Uw antwoorden worden alleen gebruikt voor wetenschappelijke doeleinden en blijven anoniem.

Hartelijk dank voor uw deelname.

Figure 28: Introduction page experiment 2

In figure 29 the final context of experiment 2 can be seen.


In 2018 raakten naar schatting 21.700 personen ernstig gewond in het verkeer in Nederland. 64% van de in het ziekenhuis geregistreerde ernstig verkeersgewonden betrof een fietser. Tegelijkertijd wordt fietsen gezien als een duurzaam, gezond en snel vervoersmiddel.

Daarom kan de overheid op verschillende plaatsen in Nederland investeren in fietsinfrastructuur om verkeersveiligheid te verbeteren en reistijden te verkorten. Hierbij kunt u denken aan de aanleg van vrijliggende fietspaden, het aanleggen van fietstunnels bij gevaarlijke oversteekplaatsen, introductie van snelfietspaden en het aanleggen van nieuwe fietspaden op plaatsen waar fietsers nu lang moeten omrijden.

Stelt u zich voor dat de overheid heeft besloten om één groot investeringsprogramma uit te voeren, maar nog moet beslissen hoe dit er precies uit gaat zien.

Recent heeft zij drie varianten uitgewerkt. Deze varianten dragen elk in meer of mindere mate bij aan het verkorten van de reistijd (*reistijdwinst in minuten*) en het verbeteren van de verkeersveiligheid (*risico daling in %*). U mag ervan uitgaan dat de varianten hetzelfde zijn op alle andere kenmerken (waaronder kosten).

De overheid wil graag advies van een groep burgers bij het maken van een keuze tussen deze varianten. De overheid wil zowel advies krijgen van burgers die wel effecten ervaren van het programma, en burgers die geen effecten ervaren. U behoort tot die laatste groep. Het investeringsprogramma heeft geen effecten voor uzelf.

Per investeringsoptie krijgt u de effecten te zien voor andere inwoners van Nederland. De inwoners in dit gebied zijn zelf ook geraadpleegd en u krijgt ook te zien aan welk investeringsprogramma zij de voorkeur geven. Deze optie is geel gearceerd.

U krijgt acht keer drie varianten van het programma voorgelegd en we vragen u om telkens tussen één van de drie varianten te kiezen.

Figure 29: Final context experiment 2

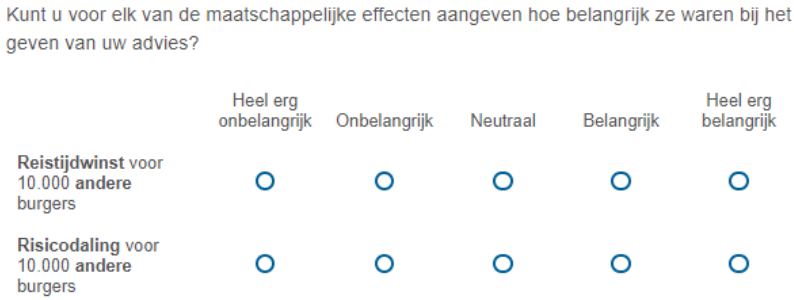

Figure 30: Level of importance experiment 2

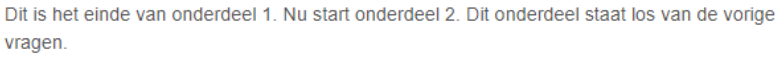

Figure 31: Intermediate page experiment 2

Figure 32: Social Value Orientation experiment 2

Boven staat het bedrag dat **u** ontvangt. **Onder** staat het bedrag dat de **ander** ontvangt.

85	87	89	91	93	94	96	98	100
15	19	24	28	33	37	41	46	50
Uw keuze	○	○	○	○	○	○	○	○	○

Boven staat het bedrag dat **u** ontvangt. **Onder** staat het bedrag dat de **ander** ontvangt.

50	54	59	63	68	72	76	81	85
100	98	96	94	93	91	89	87	85
Uw keuze	○	○	○	○	○	○	○	○	○

Boven staat het bedrag dat **u** ontvangt. **Onder** staat het bedrag dat de **ander** ontvangt.

50	54	59	63	68	72	76	81	85
100	89	79	68	58	47	36	26	15
Uw keuze	○	○	○	○	○	○	○	○	○

Boven staat het bedrag dat **u** ontvangt. **Onder** staat het bedrag dat de **ander** ontvangt.

100	94	88	81	75	69	63	56	50
50	56	63	69	75	81	88	94	100
Uw keuze	○	○	○	○	○	○	○	○	○

Boven staat het bedrag dat **u** ontvangt. **Onder** staat het bedrag dat de **ander** ontvangt.

100	98	96	94	93	91	89	87	85
50	54	59	63	68	72	76	81	85
Uw keuze	○	○	○	○	○	○	○	○	○

Figure 33: Social Value Orientation experiment 2

D Results

Table 20 contains the representativity of the sample. Kantar was asked to draw a sample where all socio-demograhic results are presented (e.g. gender, age, education, income). Not particularly a representative sample. This may cause some variables to deviate from representativity.

Table 20: Statistical tests representativity

	Variable	**Chi-square**	**P-value**
Exp 1	Gender	0.165	0.684
	Age	3.25	0.197
	Education	55.99	0.000
	Income	153.8	0.000
Exp 2	Gender	0.679	0.410
	Age	29.1	0.000
	Education	175.8	0.000
	Income	260.7	0.000

Table 21: Cluster profiles variant choice (percentages divided by 100) and statistical Wald test

	Cluster1	**Cluster2**	**Wald**	**p-value**
Cluster Size	0.63	0.37		
Indicators				
I1			11.071	0.00
Variant 1	0.74	0.36		
Variant 2	0.18	0.35		
Variant 3	0.08	0.29		
I3			12.05	0.00
Variant 1	0.12	0.35		
Variant 2	0.70	0.27		
Variant 3	0.17	0.38		
I4			20.97	0.00
Variant 1	0.01	0.36		
Variant 2	0.09	0.43		
Variant 3	**0.90**	0.21		
I5			16.17	0.00
Variant 1	**0.83**	0.36		
Variant 2	0.07	**0.50**		
Variant 3	0.11	0.14		
I6			10.82	0.00

Table 21 continued from previous page

	Cluster1	Cluster2	Wald	p-value
Variant 1	0.72	0.10		
Variant 2	0.00	**0.65**		
Variant 3	0.27	0.26		
I8			23.64	0.00
Variant 1	0.01	0.38		
Variant 2	0.10	**0.50**		
Variant 3	**0.89**	0.12		
I9			8.42	0.02
Variant 1	0.03	**0.53**		
Variant 2	**0.89**	0.03		
Variant 3	0.07	0.45		
I10			11.77	0.00
Variant 1	0.05	0.35		
Variant 2	0.44	0.42		
Variant 3	0.51	0.22		
I11			13.88	0.00
Variant 1	0.05	0.44		
Variant 2	**0.85**	0.39		
Variant 3	0.10	0.17		
I12			11.74	0.00
Variant 1	0.69	0.30		
Variant 2	0.20	**0.55**		
Variant 3	0.11	0.15		
I14			20.66	0.00
Variant 1	0.12	0.41		
Variant 2	**0.83**	0.22		
Variant 3	0.04	0.37		
I15			16.18	0.00
Variant 1	0.16	0.49		
Variant 2	**0.81**	0.26		
Variant 3	0.03	0.26		
I16			18.53	0.00
Variant 1	0.20	0.36		
Variant 2	0.08	0.47		
Variant 3	0.72	0.17		

Table 22: Cluster profiles variant choice (percentages divided by 100) and statistical Wald test

	Cluster1	**Cluster2**	**Wald**	**p-value**
Cluster Size	0.58	0.42		
Indicators				
I1				
Variant 1	0.30	0.23	7.30	0.026
Variant 2	0.67	0.43		
Variant 3	0.03	0.34		
I2				
Variant 1	0.00	0.30	13.69	0.001
Variant 2	0.74	0.21		
Variant 3	0.26	0.49		
I4				
Variant 1	0.89	**0.50**	9.76	0.008
Variant 2	0.02	0.40		
Variant 3	0.09	0.09		
I5				
Variant 1	0.08	0.22	15.37	0.000
Variant 2	0.08	0.37		
Variant 3	0.83	0.41		
I6				
Variant 1	**0.96**	0.24	22.13	0.000
Variant 2	0.00	0.32		
Variant 3	0.04	0.44		
I7				
Variant 1	0.00	0.15	25.35	0.000
Variant 2	0.06	**0.73**		
Variant 3	**0.94**	0.11		
I8				
Variant 1	0.02	0.22	9.83	0.007
Variant 2	0.86	**0.54**		
Variant 3	0.12	0.23		
I9				
Variant 1	0.04	0.09	12.76	0.002
Variant 2	0.01	**0.73**		
Variant 3	**0.95**	0.18		
I11				
Variant 1	0.14	0.21	11.26	0.004
Variant 2	0.85	0.22		
Variant 3	0.00	**0.57**		
I12				
Variant 1	0.08	**0.69**	31.89	0.000
Variant 2	0.10	0.22		
Variant 3	0.82	0.09		

Table 22 continued from previous page

	Cluster1	**Cluster2**	**Wald**	**p-value**
I13				
Variant 1	0.00	0.29	6.81	0.033
Variant 2	0.09	0.21		
Variant 3	**0.91**	**0.50**		
I14				
Variant 1	0.06	0.41	16.51	0.000
Variant 2	0.87	0.38		
Variant 3	0.07	0.21		
I15				
Variant 1	0.04	**0.65**	36.11	0.000
Variant 2	**0.94**	0.14		
Variant 3	0.02	0.21		
I16				
Variant 1	**0.95**	0.48	11.89	0.003
Variant 2	0.03	0.41		
Variant 3	0.02	0.11		