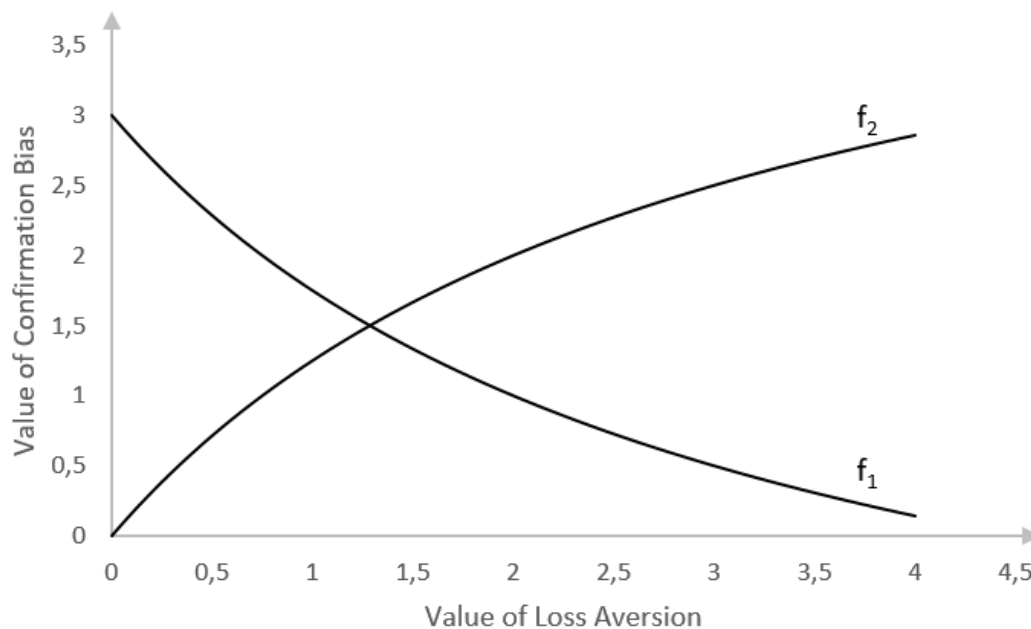Hochschule
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# Loss Aversion and its impact on motivated Confirmation Bias in a human-specific perspective

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*Abstract*

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Cognitive biases are influencing humans and decision-making processes significantly. Therefore, this paper tries to point out the importance as well as the need for consideration. It provides a theoretical framework, how to measure quantitatively the cognitive biases loss aversion and confirmation bias of an individual human. Moreover, an experimental design, how to measure the relation between the two biases is presented.

First, theoretical background about the theory of choice and prospect theory is explained. Further, the biases loss aversion and confirmation bias are described, and possible explanations are presented. Within the practical implementation, possible ways, how to measure the individual loss aversion as well as the confirmation bias, and other methods coming along with it are presented. In addition, the author provides his own theory about how to measure the individual loss aversion. Closing the practical part, the author's hypotheses about the relationship between loss aversion and confirmation bias are discussed and possible results are presented. As this paper only provides the theoretical framework, further research and adjustments might be necessary, when implementing the study.

The practical implementation can also be used for further research in the areas of loss aversion and confirmation bias. Furthermore, it provides suggestions and ideas about biases, which are not defined yet but in high interest for the economic world.

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| | |
|---|---|
| e.g. | exempli gratia (= Latin for "for example") |
| WTA | Willingness to accept |
| WTP | Willingness to pay |
| LA | Loss aversion |
| CB | Confirmation bias |
| Gv | Group value |

## 5    Introduction

This paper covers the research question whether loss aversion has an impact on the motivated confirmation bias. The loss aversion is explained as well as a general experiment by Kahneman, Knetsch, and Thaler, which shows loss aversion. Furthermore, possible explanations coming from further researches are presented. In addition, possible explanations and reasons for the loss aversion made by the author are described. Concerning the confirmation bias, prior researches are described, and the various occurrences and explanations are shown.

As the research focusses on the individual aspect, this paper provides methods on how to measure the individual loss aversion of humans. Therefore, the participants will be customers, who are willing to participate in a customer survey. Within this survey, the different determinations will be done. The participant will be aware that those questions are about how humans make decisions.

First, a prior way how to measure the individual loss aversion is presented. However, the author presents his own theory, how the individual loss aversion can be measured more precisely and explains it as well. The individual loss aversion level will be measured by a ratio concerning the willingness to accept an offer. This will be determined by a questionnaire and the outcome will be measurable with a number. The participant will receive depending on his belonging group two different questions, asking for their willingness to pay or accept an offer. This experiment is based on a former research explained in the loss aversion section. There is going to be a control-group to ensure the quality of the research. The control-group will deal with the same scenario like the former research, which measured as well the individual loss aversion. The second group will deal with the scenario, which measured the individual loss aversion the way the author suggested.

Measuring the individual motivated confirmation bias will be done by a questionnaire as well. The participants will receive information and facts about the actually bought object, which the rest of the customer survey is about. Before presenting this information, the participant states a hypothesis. The information is going to support and contradict the prior stated hypothesis. After receiving the information, the participant is being asked again to state the hypothesis. Both hypotheses will be measured in a number and the discrepancy between the stated hypotheses will, together with other components, determine the individual motivated confirmation bias.

To verify the stated hypothesis of the author about the relation between loss aversion and confirmation bias, the participants will be spread into two groups representing different characteristics of the participants. The total outcome of the research will be a graph showing the theoretical relation between the individual loss aversion and the individual motivated confirmation bias.

The scientific importance of this research paper is broadly based. As the confirmation bias might be the most occurrence bias in organisations, knowing how to measure the individual confirmation bias might help organisations to succeed. The same applies to the loss aversion. The management should not be influenced by cognitive biases such as the confirmation bias and the loss aversion. Not knowing about the influences might cause huge damage to companies, organisations, and society. In both cases, knowing how to measure them individually and their relationship to each other helps to reduce this damage. Moreover, organisations and people benefit from this knowledge not only internal. This knowledge can be used as well when dealing with customers and setting up a marketing campaign. Being aware of the individual loss aversion of the targeted market give more opportunity to position the service and product the best way.

# 6    Theoretical background

## 6.1    Theory of choice

### 6.1.1    Decision-making

One of the most important theories in the scientific area is the reasonable person. It is commonly accepted that humans are mostly looking out for their own benefits and they do not change their preferences.[1] However, the human brain, its functions and the process of decision-making are not as simple as that. The concepts of explaining the human-being used by economists and psychologists vary significantly. The concept of the "homo-economicus", a rational human being, with a narrow self-interest, maximizing mindset is used by economists.[2] On the other hand, psychologists, such as Daniel Kahneman[3], or the German author Bas Kast[4], strive for the concept of the "homo sapiens", a motive driven human being. In either case, the decision theory can be subdivided into three different categories, which will be covered in the following.

Normative decision theory

The normative decision theory is based on normative models and the rational-choice-theory.[5] A pioneering figure in establishing the rational choice theory was George Casper Homans, who published his theory about the human brain, collecting as much rational information as possible to weigh up the positive and negative aspects of every alternative.[6] By now, rational choice theories have a more mathematical focus, such as Colemans model, which is a more mathematical and formal model of Homan's thoughts.[7] Moreover, an important aspect of the normative decision theory is the use of axioms. Those lead the so-called "rational agent" to a logical, consistent solution.

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[1] Chlupsa (2017).
[2] Zak and Jensen (2010).
[3] D. Kahneman (2012).
[4] Kast (2011).
[5] Blume and Durlauf (2017).
[6] George Caspar (1968).
[7] Coleman (1990).

Prescriptive decision theory

Using normative models, the prescriptive decision theory explores methods and strategies to consult humans to make better decisions. Moreover, it includes problems such as the bounded cognitive abilities of humans and other narratives of the human brain relating to work with rational decision-making models.

Descriptive decision theory

The descriptive decision theory differs from the normative and prescriptive decision theory as it looks at the situation from another perspective. This theory covers the empirical question about how humans actually make decisions. When dealing with experiments there are two ways of implementation, depending on the research. The between-subject study design is used when the participant test only a single user interface. The other way around, the within-subject study design is used when the same participant tests all the conditions.[8] This publication addresses the descriptive decision theory, as the outcome is the practical implementation of an experiment of the decision-making process in a situation of uncertainty.

Choice under uncertainty

Choices under uncertainty are choices where future scenarios cannot be predicted.[9] Even after defining possible future scenarios, there is no possibility to cover all circumstances and environmental factors in those scenarios. Therefore, in existing and used models or theories the term "risk-based decision-making" is used to underline the facts mentioned above.

However, humanitarian decision-making is often far away from the ideals that are postulated in the rational decision theory. This is caused by the circumstance that decisions often must be made quickly. Furthermore, accurate information and the access to it might lack as well. Therefore, the awareness of the decision-making process, troubles and biases coming along with it should be well known by the management. This paper tries to address the management to widen their view about the extensive topic of decision making and cognitive biases influencing them.

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[8] Charness, Gneezy, and Kuhn (2012).
[9] Christoph Schneeweiß (1991).

## 6.2 Prospect Theory

### 6.2.1 Expected utility theory

Expected utility theory has widely being used for analysing decision making when risk is involved. Therefore, it has been applied as a descriptive model[10] as well as it is generally accepted as a normative model of rational choice.[11] Furthermore, it was assumed that most people actually do obey the axioms discussed in the expected utility theory, or at least that all reasonable people would wish to do so.[12] Daniel Kahneman and Amos Tversky externalize classes of choice problems in their article in 1979, which pointed out the systematical violation of axioms of the expected utility theory. For example, that in the expected utility theory the utility is weighted by its probability, but experiments show a completely different result.[13] Since the expected utility theory does not offer an adequate model to explain choices when risk is involved the authors offer an alternative model of choice: The Prospect Theory.[14] This publication will cover different aspects of the prospect theory, such as loss aversion.

### 6.2.2 Loss Aversion

Loss aversion applies to the observation that the aggravation of losing an amount of money is greater than the pleasure of gaining the same amount.[15] Kahneman and Tversky conducted many empirical studies relating to this phenomenon between the years of 1979 and 1991.[16] In contrast to the expected utility theory, Kahneman and Tversky discuss in their prospect theory the assumption that the value function is defined by losses and gains relative to a reference point instead of defining it as levels of wealth or welfare.[17] Moreover, they suggest a value function of utility:[18]

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[10] Friedman and Savage (1948, pp. 279–304).
[11] Keeney and Raiffa (1976).
[12] Neumann and Morgenstern (1944).
[13] D. Kahneman and Tversky (1979, p. 264).
[14] Kahneman and Tversky (1979, p. 263).
[15] Kahneman and Tversky (1979, p. 279).

[16] Tversky and Kahneman (1991).
[17] Kahneman and Tversky (1979).; Tversky and Kahneman (1991).; D. Kahneman, Knetsch, and Thaler (1991, p. 199).
[18] D. Kahneman and Tversky (2000, p. 306).

$$v(x) = \begin{cases} x^\alpha & if \ x \geq 0 \\ -\lambda(-x)^\beta & if \ x < 0 \end{cases}$$

Formula 1: The value function of utility by Kahneman and Tversky

In this value function, λ is the coefficient of the loss aversion. Kahneman and Tversky suggest λ to be 2.25 and α as well as β to be 0.88. Those parameters were determined by the authors in different empirical experiments. In general, the parameter λ>1 shows the loss aversion a person has. The higher it gets, the higher gets the discrepancy between the negative feelings, someone experiences when losing something compared to its positive ones when gaining something. The coefficients α and β represent the decreasing sensitivity as it is well known that every additional loss or gain impacts less than the one before.[19] Furthermore, the function has a reference point, which is defined by all human being themselves. This value function, therefore, features three main characteristics.

Loss aversion: the curve progression is steeper in the negative domain than it is in the positive.

Reference dependence: losses and gains are relative expressions based on the individual reference point.

Diminishing sensitivity: the marginal value of losses as well as gains reduce with their size.

As the value function is convex below the reference point and concave above it, the function is an asymmetric S-shaped one, as shown in figure 1.[20]

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[19] Gierl, Helm, and Stumpp (2001, p. 560).
[20] Tversky and Kahneman (1991, 1039; 1048ff).; Tversky and Kahneman (1991, 1048ff).; Christensen (1989, pp. 69–80).
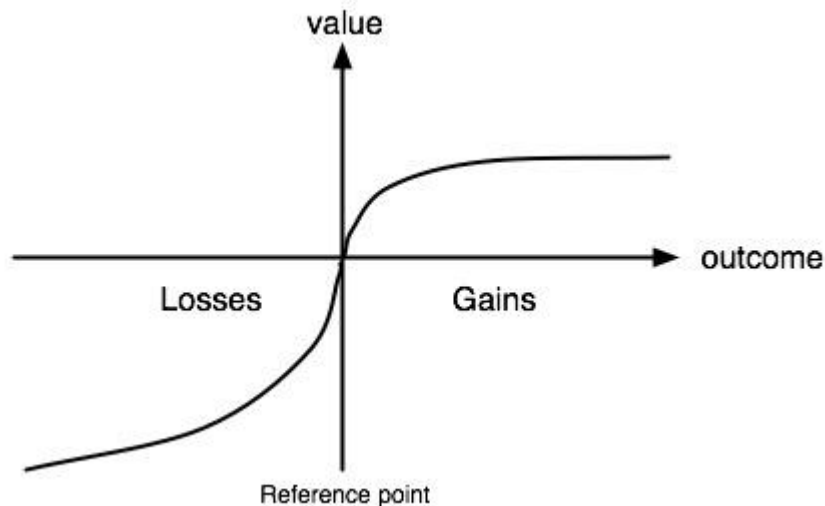
Figure 1: The value function of utility by Kahneman and Tversky


Experiments


Kahneman, Knetsch, and Thaler demonstrated the loss aversion by the following classroom demonstration.[21] There are three groups in a test room. To one-third of the students, they distributed an attractive object, in this case, a decorated mug. Those students are described as the owners or sellers. They know that at some point of the experiment they have the opportunity to sell the mug for a given amount of money. After this, they are asked for the minimal amount of money they would be willing to accept, also known as the willingness to accept (WTA). The second group of the students are supposed to be the choosers. They had the opportunity between getting the exact same mug as their neighbours or an amount of cash. They were asked to state the minimal amount of money they would accept for not having a mug. The last group of students were the buyers. They were asked to state the amount of money they were willing to pay, also known as the willingness to pay (WTP), to get a mug. In all three situations, the amount of money has to be between $0.25 and $9.25[22]. In this representative experiment, the median prices were as follows: owners/sellers $7.12, choosers $3.12, and the buyers were willing to pay $2.88 per mug.

The difference between the median valuation of choosers and owners seems to be odd, as they face the same situation and choice: going home with a sum of money or with a mug. One part of

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[21] D. Kahneman, Knetsch, and Thaler (1990).
[22] Grutters et al. (2008, p. 1110).; Knetsch and Sinden (1984).; Coursey, Hovis, and Schulze (1987).; Kahneman et al. (1991, p. 194)

this difference can be explained by looking from a subjective point of view: the choosers values the mug as a gain, as the owners on the other side evaluate it as something they lose.[23] This is where the loss aversion steps in: less money is needed to persuade the choosers to choose the mug than it is needed to persuade the owners to give up their mug.

There are many other empirical studies showing an equal outcome, such as a study by Viscusi, Magat, and Huber in 1987[24] as well as one from Richard Thaler in the year 1980[25]. In either case, this classroom demonstration eliminated the problem others had before. As further researchers acted on the assumption that the low volume of trade is caused by the unwillingness of buyers to part with their money. The experiment by Kahneman, Knetsch and Thaler suggests that the low volume of trade is caused mainly by the owner's unwillingness to part from their gift. This suggestion is explained by the fact that the choosers and sellers are in an equal economic situation, which was not the case in earlier studies. Ultimately however, all studies come to the same conclusion: perceived losses are more painful than foregone gains.[26]

Explanation

A possible explanation for loss aversion can be found in the mental accounting as well as in the cognitive dissonance theory. Mental accounting was first described by Richard H. Thaler.[27]

Mental accounts summon the gains and losses of a person and influence later decisions. However, the value function itself is not based on one single account where all gains and losses are summarized. Every human being has several mental accounts. Therefore, there are several value functions with several different reference points. Fundamentally, the value functions are alike, but the scale of loss aversion can differ a lot from account to account.

Within the cognitive dissonance theory, which is already well explored, it is explained that every decision brings a certain commitment with it.[28] The value of those commitments is based on the voluntariness of the decision, the sunk costs, the accountability, and the standard deviation. The voluntariness of the decision covers the aspect, whether the decision is made voluntary or not. Voluntariness is not given if e.g. the person is forced to take a specific decision. This cooperates

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[23] Kahneman and Tversky (2000, pp. 481–482).
[24] Viscusi, Magat, and Huber (1987).
[25] R. Thaler (1980).
[26] Kahneman et al. (1991, p. 196).
[27] R. H. Thaler (1985).; R. H. Thaler (1999).
[28] Festinger (1957).

as well with the accountability, as the latter term is referring to the level, a person is feeling to be accountable for the decision.

The commitment which comes along with every decision affects the mental account and therefore the loss aversion. The asymmetry in the value function can be explained by these theories. Commitments and mental accounts produce psychological costs which affect mainly the value function below the reference point. On the one hand, there are some pride effects affecting the value function above the reference point, which harmonize with the empirical studies of Loewenstein & Issacharoff in 1994.[29] However, the effect of the commitments has a much deeper impact on the value function below the reference point, better known as the loss aversion.

The phenomenon of loss aversion is influenced by many other anomalies as well as it influences them. The anomalies with the highest impact, which are already explored, are anchoring, the endowment effect, framing, and the status-quo-bias. Their nature and how they rely on the loss aversion will be discussed in the following sections.

Anchoring

The anchoring effect is known as a bias that comes along with decisions. The effect occurs when people estimate quantities. While they estimate a discretionary starting point, they do not adopt additional facts in a reasonable amount. Therefore, every decision is highly affected by the starting point.[30] This is in line with the loss aversion as the value of loss aversion refers to an individual reference point as well.[31] The influence of the anchoring effect on the loss aversion becomes clearer when thinking about the willingness to pay and the willingness to accept, such as the earlier described classroom demonstration from Kahneman, Knetsch, and Thaler. The students point out their willingness to pay or accept. At this point, the anchoring effect influences the loss aversion by its discretionary starting point and resulting smaller adaption of additional facts, which is in this specific experiment the given amount between $0.25 and $9.25. In addition, the anchoring effect refers to the influence of parameters, such as in this classroom demonstration: people tend to be influenced by the given numbers and therefore, the same experiment without the given

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[29] Loewenstein and Issacharoff (1994).
[30] A. Tversky and Kahneman (1974).
[31] Kahneman and Tversky (2000, p. 665).

framework would lead to a different outcome and the loss aversion would change because of anchoring effects.[32]

Endowment effect

A quite similar effect as loss aversion is known as the endowment effect, which describes the systematical overestimation of owned goods compared to comparable ones, which the subject does not own.[33] The first experimental demonstration of this was published by Knetsch and Sinden in 1984.[34] All participants were endowed with either $2.00 or a lottery ticket. After that, they had the opportunity to buy the lottery ticket with the money or the other way around. However, only a very few took the opportunity to switch. Furthermore, those participants who were given lottery tickets were more likely to keep them than those with the money. The phenomenon of the endowment effect can be explained by the discrepancy between the willingness to pay and the willingness to accept. Therefore, the endowment effect cooccurs with the loss aversion, as it explains the higher impact of losses against gains on the human brain when it comes to decision making.[35] Based on the study of Loewenstein and Kahneman published in a working paper in 1991 it could be even suggested that the main effect of the endowment is the pain of giving the good up, not to own the good.[36] To conclude the thoughts about the endowment effect, it is important to point out the difference of this effect and loss aversion. Even though loss aversion is described in the 'experiments' section as a phenomenon coming along with e.g. a decorated mug, loss aversion is the general discrepancy between the felt loss and gain. The endowment effect on the other side might be seen as always connected with the loss of something, the person owned before. The two effects refer to a quite similar phenomenon and existing differences should be explored further.

Framing

The term framing is used by Kahneman to refer to unjustified influences in the preferences a person has while making a decision.[37] It also refers to the observation that people tend to be

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[32] Bokhari and Geltner (2011).; Tversky and Kahneman (1974)
[33] Coursey et al. (1987).
[34] Knetsch and Sinden (1984).
[35] Kahneman et al. (1991, p. 194).; Kahneman and Tversky (2000, pp. 273–276).
[36] Kahneman et al. (1991, p. 197).
[37] Chlupsa (2017, p. 43).

affected by the way a problem or decision is presented. Therefore, framing conflicts with the rational choice theory.[38] Framing influences the loss aversion in such a way, so that the loss aversion changes with different frames. The loss aversion is supposable higher when the decision is specifically presented as a loss for the person. Ironically, if a decision is presented in a way that it occurs to be a gain for the person, it will not strengthen the emotions the same way it does to the loss aversion in the scenario before, what underlines the effect of loss aversion.

Status Quo Bias

Samuelson and Zeckhauser were the first to use the term status quo bias to describe the strong tendency to keep with the status quo. It covers the circumstance that the main question is about if there is going to be a change in the status quo rather than if the consequences are positive or negative. Furthermore, the more alternatives there are available the higher the preference to the status quo will be.[39] This can be explained by loss aversion as the disadvantages of leaving something to loom larger than the advantages coming with it. Especially thinking of the discrepancy between the willingness to accept and the willingness to pay. In one experiment by Samuelson and Zeckhauser, all subjects were confronted with the same problem. What differentiated the one group from the other was that the 'neutral' one had to select between different options, but the second group had already one option of those designated as the status quo.[40] This experiment and many other scenarios came to the same conclusion: an alternative is significantly more often chosen and therefore more attractive when it was their status quo.[41]

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[38] A. Tversky and Kahneman (1981).
[39] Bognanno and Thaler (1993).
[40] Samuelson and Zeckhauser (1988).
[41] Kahneman et al. (1991, p. 198).

6.2.3    Individual loss aversion

By applying the prospect theory of Tversky and Kahneman (1992)[42] loss aversion can even be measured in risky choices easily by applying certain assumptions for small amounts. While deciding, a decision maker has a neutral view of rejecting and accepting the lottery with a 50% chance to gain or lose if

$$\omega^+(0.5) * \nu(G) = \omega^-(0.5) * \lambda * \nu(L).$$

Formula 2: Loss aversion in a 50/50 lottery

In this equation, G denotes the gain in a given lottery and L the loss; $\nu(x)$ denotes the utility of the outcome $x \in \{G, L\}$; $\lambda$ denotes the coefficient of the loss aversion; and $\omega^+(0.5)$ and $\omega^-(0.5)$ denote the probablitlity weights both times with the 0.5-chance of gaining or losing.

> *Assumption 1*: The weighting function used for gains and losses are equal as proposed by Prelec in 1998.[43]

$$\omega^+(0.5) = \omega^-(0.5)$$

Formula 3: The weighting function proposed by Prelec

> *Assumption 2*: Assuming linearity of $\nu(x)$ for small amounts is a frequent assumption.

$$\nu(x) = x$$

Formula 4: The value function for small amounts

Therefore, the equation changes as follows for small amounts:

$$\lambda = \frac{G}{L}.$$

Formula 5: Loss aversion for small amounts

According to the equation in combination with the given assumptions, the value of loss aversion can be measured by the ratio of gains to losses.

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[42] A. Tversky and Kahneman (1992).
[43] Prelec (1998, p. 503).

In the specific terms of willingness to accept and willingness to pay, Gächter, Johnson, and Herrmann suggest in their scientific research in 2007[44] to measure the individual loss aversion of a person with the following equation:

$$\lambda = \frac{WTA_{seller}}{WTP}$$

Formula 6: Value of loss aversion by Gächter, Johnson, and Herrmann

They suggest the loss aversion to be the ratio between the seller's willingness to accept and the buyer's willingness to pay. Thinking about the experiment by Kahneman, Knetsch, and Thaler[45] and the situations of the seller and buyer coming along with the mug, the seller is feeling a loss by giving up the mug. Furthermore, the buyer is not feeling a loss concerning the mug. However, the buyer is feeling a loss concerning the money. Therefore, the equation by Gächter, Johnson, and Hermann seem not to estimate the loss aversion in an appropriate way. This is why, in this research, loss aversion is going to be measured by the ratio of the seller's willingness to accept and the chooser's willingness to accept:

$$\lambda = \frac{WTA_{seller}}{WTA_{chooser}}$$

Formula 7: Value of loss aversion by Borutzki

By using the chooser's willingness to accept instead of the buyer's willingness to pay, there are several characteristics that should lead to a more exact human-specific loss aversion. First, the discrepancy between the situation the seller's faces and the one the chooser faces is much lower compared to the buyer's situation. Both, the chooser and the seller, are feeling gain, receiving the money. The difference is that the seller is feeling a loss concerning the mug, but the chooser is feeling gain. This discrepancy between the feeling of loss and gain is exactly what the human-specific loss aversion represents. Furthermore, by using a ratio including twice the willingness to accept, psychological influences and biases such as the framing effect, which contradicts with the invariance axiom, can be reduced. The seller and the chooser face the same question about their willingness to accept. Therefore, they are making their decision in the same framework.[46] A further explanation can be seen in the section 'loss and gain in the scenario' within the section 7.2.

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[44] Gächter, Johnson, and Herrmann (2007).
[45] Kahneman et al. (1990).
[46] Tversky and Kahneman (1981).

## 6.3    Confirmation Bias

In the psychological literature, seeking or interpreting evidence in ways that confirm existing expectations, beliefs or hypothesis on hand is known as the confirmation bias.[47] It is one of the best known and widely accepted biases of human reasoning.[48] The phenomenon can be seen in experiments similar to the following scenario by Mynatt, Doherty, and Tweney published in 1977. The participants of the study were shown two screens. On the first screen, there were shapes, such as triangles and squares, in different colours. The participant was allowed to shoot as many particles on the screen as they wanted by clicking with the computer mouse. Those particles moved on the screen afterwards. Then they were asked to state a hypothesis, which would explain the motion of the particles. The second screen showed a similar scenario. However, the shape, which the particles moved to on the first screen was now behind another shape and the participant was not able to see it. This time, the particles moved to the other shape, which lies above. The participant was asked to state again a hypothesis that explains the motion of the particles. They could state the same hypothesis again. In this experiment, most participants kept their prior states hypothesis even though, the circumstances changed. [49] This shows the confirmation bias, which will be explained further in the following paragraphs.

Thinking of the obvious difference between evaluating evidence to get an unbiased conclusion rather than evaluating evidence in order to confirm a conclusion drawn before, the confirmation bias is generally interpreted by psychologists the latter way as well as the unwitting selectivity in the use and acquisition of evidence. Confirmation bias can be distinct in an unmotivated and motivated form. In the motivated form, people treat evidence biased because of their desire to reason their beliefs. In the unmotivated form, people treat evidence biased without any personal interest or material stake. In either case, adequate research has to embrace both cases, as they are both well documented.[50]

Moreover, human beings tend to have a restriction of attention to one specific hypothesis they favour. When realizing only one possible explanation for something, it is most likely that seeking and interpreting data that is supporting any different explanation will be precluded. Studies show

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[47] Raymond S. Nickerson (1998, p. 175).
[48] Evans (1989, p. 41).
[49] Mynatt, Doherty, and Tweney (1977).
[50] Raymond S. Nickerson (1998).

that people often only consider the probability of their alternative without taking the probabilities of the other alternatives into account.[51]

Analogical to the restriction of attention, there is a tendency to weight information supporting beliefs, hypothesis and expectations higher than ones refute them.[52] In addition, when trying to disconfirm a hypothesis, belief or expectation, a person tends to undue weight evidence. In this case, the confirmation bias would be the drive to confirm the hypothesis as false, which is nothing else than a negative form of interpretation of the confirmation bias mentioned before.[53]

Furthermore, people tend not to search or even avoid information that is oppositional with their beliefs, hypotheses or expectations as well as information that supports alternative possibilities.[54] Matling and Stang explained such a phenomenon with the Pollyanna principle, according to which people are tending to prefer pleasant memories and thoughts over unpleasant ones.[55]

Research by Bruner, Goodnow, and Austin in 1956 shows the fact that people tend to search confirmatory information even if they have no interest in the true value of it.[56] Looking for primarily positive cases, participants of the experiment preclude cases which show that an incorrect hypothesis is incorrect. Those experiments have equal settings to the following: the triplet 3-6-9 is given. They are asked to produce another triplet, following the rule of the given triplet. As a participant is testing his hypothesis, for example, that the rule is numbered increasing by 3, a correct answer is 12-15-18. However, by searching only on positive cases, the participant will never know for sure, that his hypothesis is correct. Towards the triplet to confirm the hypothesis, the actual rule could be any three positive numbers or numbers increasing in size. Anyway, the majority of participants failed to attempt the hypothesis as wrong. And they are still certain about their rule being the one used in the given triplet.[57]

This should not be confused with the positive test strategy, which is a strategy to test a hypothesis by examining instances which are expected to occur. Therefore, the positive test strategy is a conscious heuristic to decrease the workload.[58] Baron, Beattie, and Hershey referred to this strategy as the congruence heuristic as they showed that people prefer questions where the

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[51] Beyth-Marom and Fischhoff (1983).
[52] Raymond S. Nickerson (1998, p. 178).
[53] Raymond S. Nickerson (1998, p. 176).
[54] Koriat, Lichtenstein, and Fischhoff (1980).
[55] Matlin and Stang (1978).
[56] Bruner, Goodnow, and Austin (1956).
[57] Raymond S. Nickerson (1998, p. 179).
[58] Klayman and Ha (1987, p. 212).

hypothesis is correct by having a positive answer rather than questions where the hypothesis is correct by having a negative answer.[59]

In addition to the fact of underweighting negative evidence, studies show the tendency of over-weighting positive evidence as well. In their article, Pyszczynski and Greenberg interpreted this behaviour with a general observation of human beings. When evaluating evidence, people tend to need more evidence to reject a hypothesis rather than they need supporting evidence to accept a hypothesis.[60]

Moreover, the confirmation bias is influenced by the tendency that people find what they are looking for. Different studies, such as the one by Kelley in 1950, show the effect of expectations in social situations. Therefore, Kelley pointed out the influence of a prior description on student's opinions about a guest lecturer. When giving a positive description, the students were more likely to rate the guest lecturer as a friendly and good lecturer as they did when having a negative prior description.[61]

In addition to the discussed influences of the confirmation bias, several studies show that when asking people to explain why a hypothesis might be true, they tend to become even more convinced about the hypothesis being true. This effect occurs even higher when the person has not given much thought to the hypothesis before being asked.[62] Even if the experiment was carried out in a way that the testing person is going to know that the hypothesis is wrong at a certain moment, they often still believe in the hypothesis if they were asked to explain it beforehand. The participants that had not been tasked to explain it beforehand were more likely to accept the hypothesis to be wrong.[63]

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[59] Baron, Beattie, and Hershey (1988).
[60] Pyszczynski and Greenberg (1987).
[61] Kelley (1950).
[62] Campbell and Fairey (1985).; Sherman, Zehner, Johnson, and Hirt (1983).
[63] Ross (1977).

## 7    Practical implementation

### 7.1    Scenario and setup

Measuring the individual loss aversion and its impact on the motivated form of confirmation bias in a human-specific perspective will be explored by a scientific study, which will be explained in the following.

This study is embedded in a customer survey coming after the buying process. It takes place either at the customers home or the local car dealer, as the participant feels more comfortable, especially because of the well-known framework. To induce them to participate at all as well as to cover their opportunity costs, everyone participating in the experiment receives a flat payment of €50. In addition to this, they are rewarded according to their decision in the experiment. The experiment is managed by ten professional interviewers. On the one side, this reduces the variables of disturbance as they are professionals. Furthermore, the small number increases the quality of the research, as the experiment leaders are reduced to a small number and therefore, the instructions, situational environment, and experimental settings, in general, are more likely to be the same for every participant. In the surveys, the participant is alone with two of the interviewers. There are several reasons for choosing two interviewers: Firstly, the group is not disturbed by other customers or car dealers and secondly, it enables the study to minimise disturbances that typically come along with human-beings, here in form of the interviewer. By choosing two interviewers these factors could be reduced and at the same time, it does not put too much pressure on the participant. To reduce the external impacts on the participant, even more, the interviewers are familiar with the experimental design and the questions asked in it, but not with the experimental hypothesis. This avoids any impact of the interviewers on the participants as the interviewers would try to illustrate the hypothesis to be true or false ($\rightarrow$ confirmation bias). The whole experiment is in written form and the interviewer's job is to answer questions at any point and to evaluate the participant about his honesty and correctness of answering the questions.

When customers buy the same product, they tend to share interests. The more cost-intensive the product is, the more likely it gets that they share the same interests. Therefore, the participants in this study are going to be car owners, who recently bought the same electric car. The participants will be German speakers and currently living in south Germany as the actual wage level is

above the average of Germany (Baden-Württemberg: 110%; Bayern: 106,4%)[64] and the number of electric cars owned by a private citizen of south Germany made about 43,6% of electric cars in 2018 in Germany (Bayern: 24,0%; Baden-Württemberg: 19,6%)[65].

Looking at the reasons for Germans to buy electric cars the most common reasons are as follows. First, electric cars are more comfortable and quieter, as the driver does not have to shift gears and there are no high torques. At least in Germany, buyers of electric cars getting rewarded in the shape of a reduction of the price up to 4.000€ in 2018.[66] Furthermore, electric cars are free of taxes in the first 10 years. You are able to charge your car even at home and the range is enough for short to medium distances and around the city. In addition, electric cars do not exhaust gases while driving and the technical components are reduced to the needed ones and therefore, they are almost maintenance-free.[67] All in all, buyers of electric cars often argue with the environment-friendliness of the electric cars. However, the environment-friendliness of electric cars is a controversially discussed topic and therefore, a good fundament for the experiment of individual loss aversion and confirmation bias.

This experiment is designed with the following components of loss aversion and confirmation bias. To measure the individual value function of the participant it is necessary to use a within-subject design. Therefore, the participant is answering both willingness to pay and willingness to accept. The group is divided randomly into two different situations. Each group should contain out of minimum 30 participants to assure a significant output. The first group is dealing with the within-subject design, consisting out of the seller's and chooser's scenario. However, to both dignify and review the experiments of Gächter, Johnson, and Herrmann[68] there is a control group dealing with a within-subject design, consisting out of the seller's and buyer's scenario. Moreover, this experiment will cover the motivated form of confirmation bias, as the motivated form occurs to be more relevant in the day to day business life. In addition, several pilot sessions should be used to test and fine-tune the experimental design.

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[64] Gehalt.de (2018).
[65] Kraftfahrt-Bundesamt (2018).
[66] ("Elektromobilität," 2018).
[67] Sedlak.
[68] Gächter et al. (2007).

## 7.2    Determining the loss aversion

The introduction concerning the human-specific loss aversion part of all group equals each other as follows. It gives the participant the first overview, why he or she is doing the questionnaire as well as how they should respond to the questions.

> In the following questionnaire, there is no right or wrong answer. Your response to each question should reflect your own preferences without any external influence. Like other parts of this questionnaire, the following questions are part of a scientific research on how consumer make economic choices.

After the introduction, the instructions for the different groups vary. The individual instructions will be explained further. Furthermore, the exact questionnaire handed to the participant is shown in the appendix.

Seller

The sellers are the ones getting an attractive gift. As they are recent buyers of an electric car, they get a model version of the same car, which cost approximately 5€ when buying it in the store. This information is not provided at the time when they receive the gift. After receiving the gift they get the choice of whether they want to keep it or they want to sell it. For this, they have a table in the following form:

| If the price is **0,0€** | ☐I am **ready** to accept | ☐I am **not ready** to accept |
| If the price is **0,5€** | ☐I am **ready** to accept | ☐I am **not ready** to accept |

Table 1: Extraction of the sellers' questionnaire

The participant chooses between rejecting the offer or accepting it in steps of 0,5€. The reason for choosing these increments is that the participant has the opportunity to compare the decision they face at the moment with the one before. This makes the decision-making process easier. Choosing a given amount of money at all can be reasoned by the fact that human beings can decide easier and faster when comparing two options rather than choosing an amount of money on a huge scale. The scale of increasing by 0,5€ can be explained by the attempt to avoid getting the participant's annoyed by asking them too often for their willingness to accept. Moreover,

many little steps would make the decision process more difficult as the comparing component is much harder if the opportunities differ not a lot from each other.

Furthermore, the participants know that after they answer every question the price by which the interviewer will buy the toy is determined randomly between 0,0€ and 10,0€ and every price is equally likely to be determined. This is ensured by using a computer program, which ensures the equal opportunity to depict every number. In case the determined price is higher than the seller was willing to accept the offer, the participant gets the determined money in exchange for the model car. The participant keeps the model car in case that the determined price is lower than the stated willingness to accept. Negotiations are not allowed in any of the steps. Applying this mechanism first described by Becker et al. in 1964 guarantees that the participants respond to the questions with their true preference.[69]

Buyer

The buyers are the ones having the choice to buy an attractive gift. As recent buyers of electric cars, they get the offer of buying a model version of the same car. They do not know the real value of the model car. However, they state, how much they are willing to pay, to own the presented model car. For this, they have a table in the following form:

| If the price is **0,0€** | ☐I am **ready** to pay | ☐I am **not ready** to pay |
|:---:|:---:|:---:|
| If the price is **0,5€** | ☐I am **ready** to pay | ☐I am **not ready** to pay |

Table 2: Extraction of the buyers' questionnaire

The participant chooses between rejecting and accepting the offer in steps of 0,5€. Furthermore, the participant is aware that the price, at which the model car is sold, is determined randomly and that every amount between 0,0€ and 10,0€ has the same probability to be determined. In case the determined price is higher than the stated willingness to pay, the participant does not get the model car and the survey goes on. If the determined price is lower than the stated willingness to pay, the participant becomes the model car in exchange for the determined money. Negotiations are not allowed in any steps and the same mechanism and explanations apply as in the seller's scenario.

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[69] Becker, Degroot, and Marschak (1964).

Chooser

The choosers are the ones having the choice of either receiving money or an attractive gift. As recent buyers of electric cars, they get the offer of receiving a model version of the same car. They do not know the real value of the model car. To determine, whether they receive money or the model car, they have to state out, at what price they are willing to receive money instead of the model car. This is equal to the situation, the sellers face: receiving the model car or money. For this, the participants have a table in the following form:

| If the price is **0,0€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
|---|---|---|
| If the price is **0,5€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |

Table 3: Extraction of the choosers' questionnaire

The participants choose between rejecting and accepting to receive money instead of the model car in steps of 0,5€. Furthermore, the participant is aware that the price, at which the car model is exchanged with money, is determined randomly and that every price within the range of 0,0€ and 10,0€ is equally likely to be determined. In the case that the determined price is higher than the stated willingness to accept, the participant will receive money in the amount of the determined price. Whereas if the determined price is lower than the stated willingness to accept, the participant will receive a model car suiting with the recently bought electric car. Negotiations are not allowed in any steps and the same mechanism and explanations apply as in the seller's scenario.

Loss and gain in the scenario

In this scenario, the decisions of the three groups differ from each other. The decisions, the seller have to face, are shown in figure 2.
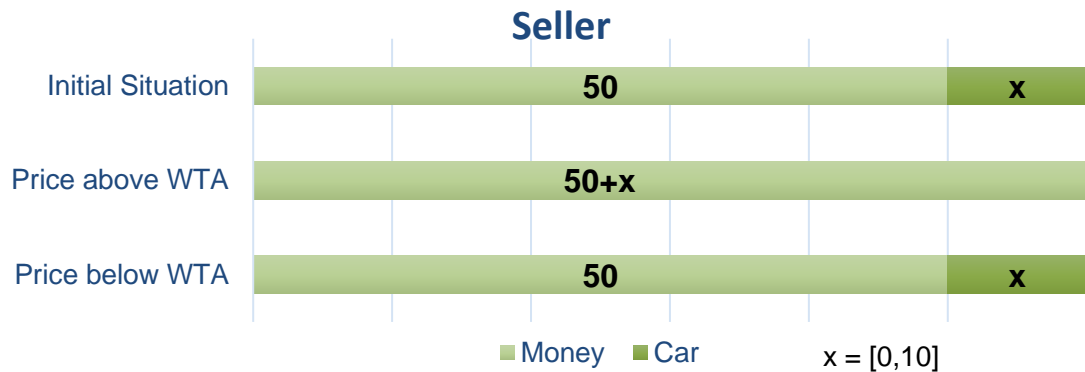


Figure 2: The seller's choice

The initial situation is a combination of the 50€ they receive for participating in the survey and the additional unknown value of the model car. However, they know that the value of the model car is within the range of 0€ and 10€. In case the price is above the stated willingness to accept the offer of selling the model car, the amount of money replaces the model car. In this situation, the loosing of the model car equates to the loss the participant senses when making the decision beforehand. At the same time, receiving money equates to the gain the participant senses when making the decision.

Figure 3 contains the decisions the buyer has to face during the experiment.

Figure 3: The buyer's choice

As the buyer does not receive a model car in advance, the 50€ that they receive for participating in the survey defines the initial situation. After stating their willingness to pay for receiving a model car, there are two possible outcomes. On the one hand, the buyer's financial situation does not change, in case the determined price is above their stated willingness to pay. The other way around, in case the determined price is below their stated willingness to pay, their amount of money will decrease in the value of the determined price and is replaced with the model c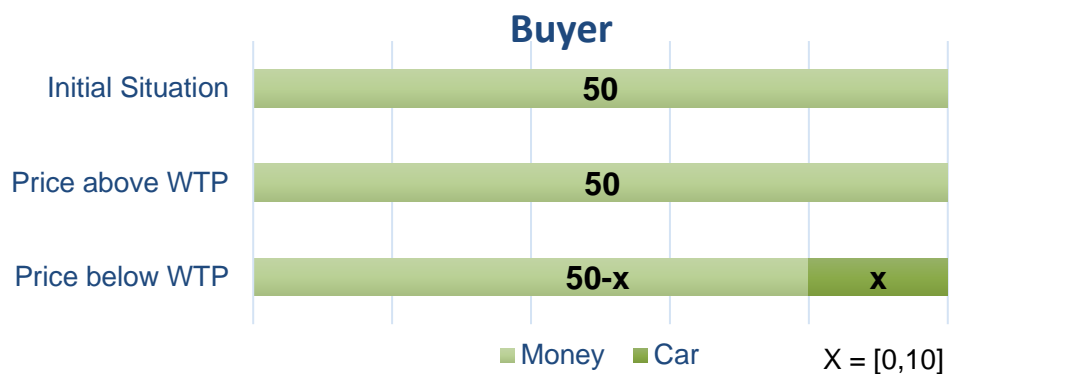ar. In either way, the total amount equals the initial situation. Therefore, in case the price is below their willingness to pay, the participant experience, when thinking rational, the same value when gaining the model car and losing the money.

The choices the chooser has to consider can be seen in figure 4.
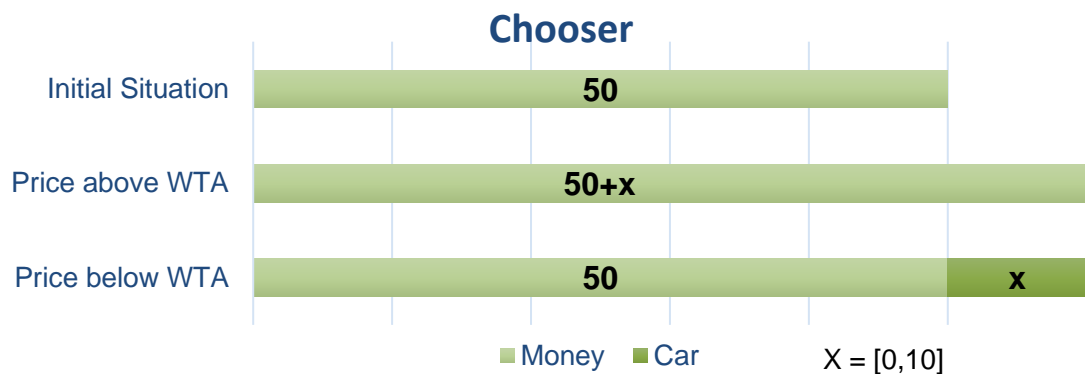


Figure 4: The chooser's choice

The chooser's initial situation equals the one of the buyers. However, in case the estimated price is above the willingness to accept, the chooser receives money identical to the estimated price. Corresponding, the choosers receive a model car in case that the price is below their willingness to accept the offer. In both cases, the choosers gain something.

In all three cases, the actual felt happiness/sadness of the participants is dependent on the difference between the stated willingness to pay or accept and the determined price, which is illustrated in figure 5. The buyers e.g. may lose money when the price is below their stated willingness to pay. However, in case that the determined price is not identical with the stated willingness to pay, the gain is higher as the loss. As the buyer does not only receive the model car but also keep the difference between their stated willingness to pay and the actually paid money, in general, they gain something.

Figure 5: The difference between the stated willingness to pay or accept and the determined price

## 7.3    Measuring the individual loss aversion

Concerning the measurement of the individual loss aversion, several aspects should be considered. First, the within-subject analysis might involve statistical problems, such as the reasonable lack of independence between the choices the participant make in the first and second request about their willingness to pay/accept.[70] Even though this variable cannot be eliminated completel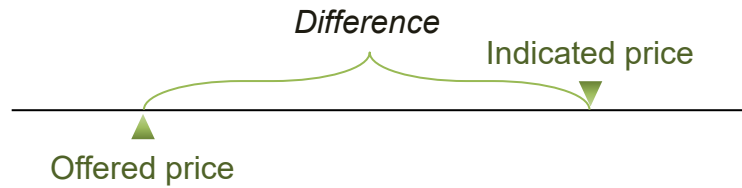y, changing the order of asking about the willingness to pay and accept in 50% of the cases might reduce the bias coming along with that problem. Moreover, as the participant is answering a customer survey, there is the possibility of trying to distract the participant by asking questions of other subjects in between the requests as well. This might reduce the influence on the latter decisions by the decisions the participant did in the first place. Furthermore, it is suggested to pull apart the two requests as much as reasonably possible to reduce the influence of the variable as much as possible.

As mentioned, the participants will face randomly different scenarios. There are four scenarios possible.

Seller – Buyer; Buyer – Seller; Seller – Chooser; Chooser – Seller.

However, the total amount of people participating in each scenario should be the same. This is reasoned by additional confounding variables coming along with the erratic splitting of the participants, which would influence the outcome.

In addition, the scenarios show a problem coming along with within-subject designed researches similar to this one. To assure that the second request, whether it is their willingness to accept or to pay, can still be implemented, the participant has to be fooled. In the sections before as well

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[70] Schmidt and Traub (2002).

as in the official instructions handed out to the participants, an important part of the experimental design is to make sure that the participant is stating the willingness to pay/accept as close to the truth as possible. To ensure this, the experimental instructions clearly states that every price is equally likely to be determined. However, why this cannot be implemented will be shown in the following.

In the Seller-Buyer scenario, the participants first receive the model car. In case the participants' willingness to accept the offer is higher than the determined price, the model car will not be exchanged with the money. In this case, in the second request, the participant would already own the model car. Therefore, asking for their willingness to pay for receiving an additional model car would not represent the original consideration. This points out that the determined price in the Seller-Buyer scenario has to be higher than the participant's willingness to accept. Anyway, within the possible scale, the determined price can still be determined randomly. This randomisation might reduce variables influencing the second choice, such as psychological variables that appears when the determined price is close to the stated price or the other way around, far away from the stated price.

The Buyer-Seller scenario has two possible intermediate results after requesting the first decision. In case the participants receive the model car, the sense of gifting a similar model car when starting the second request does not represent the original consideration, as the participant has two model cars and will only lose one in case the willingness to accept is lower than the determined price in the seller scenario. However, in case that the participant does not receive the model car in the buyer scenario, the choice the participant has to face in the second scenario, the seller's scenario, is similar to the original consideration. Therefore, it might be needed to manipulate the determination process of the offered price again to ensure that the participant does not receive the model car already in the first scenario. Furthermore, within the possible scale, it might be again reasonable to determine the offered price randomly.

In the Seller-Chooser scenario, the assumptions are similar to the Seller-Buyer scenario. As the participant should not own the model car already when facing the chooser's scenario, the research should be manipulated in the way that the participant sells the model car in the first request. Like in the other scenarios, the offered price can be determined randomly within the possible scale.

The Chooser-Seller scenario is the only scenario where the manipulation of the research might not be needed. This would be the case if the chooser is receiving the model car in the first request

and has the opportunity to sell the car in the second request again. On the other side, the participant will receive first the money and then, in the seller's scenario, receive the car anyway. However, as this scenario is not similar to the original consideration, as the participant might receive money and the car, all scenarios have to be manipulated. In this case, the chooser's scenario must end with the receiving of the model car to ensure a significant output of the research.

In all cases, the extreme cases are not able to be manipulated. Therefore, in case the participant is not willing to accept the offer at all or to pay anything, the results cannot be included in the outcome of the research.

All in all, there is a need for manipulation in every possible scenario constellation, even though this might not be necessary at first sight. However, to manipulate the experiment as well as fooling the participant comes along with ethical problems. One of the ethical principles coming along with psychological research is the principle of avoidance of deception. To temper this loss of trust, which is generated by the manipulations, there should be an elucidation of the procedure after the experiment. By pointing out the same explanation mentioned above to the participant, there is a chance that the loss of trust is tempered or eliminated. Furthermore, the participant should have the opportunity to veto their agreement they give beforehand in the experiment, as the framework has changed.[71]

In general, the individual loss aversion is going to be measured as further explained in the 'Individual loss aversion' chapter in this publication. In the two seller/buyer constellations, the individual loss aversion is going to be measured with the ratio between the participant's willingness to accept the offered price as the seller and their willingness to pay for the model car.

$$\lambda = \frac{WTA_{seller}}{WTP_{buyer}}$$

In contrast, in the two seller/chooser constellations, the individual loss aversion is going to be measured with the ratio between the participant's willingness to accept the offered price as the seller and their willingness to accept money instead of the model car as the chooser.

$$\lambda = \frac{WTA_{seller}}{WTA_{chooser}}$$

In all scenarios, the willingness to accept/pay equates the stated price, at which the participant is willing to change the former status.

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[71] Hussy, Schreier, and Echterhoff (2013).

## 7.4    Measuring the individual motivated confirmation bias

To determine the individual motivated confirmation bias, there is a questionnaire, which can be seen in the appendix.[72] The questions will be spread among the customer's survey in 8 different positions.

The questions (1) to (3) stick in the same order. They should be positioned at the beginning of the customer survey. They determine whether the ecological performance of electric cars did influence the participant's decision in the recent buying process of the electric car. Furthermore, the questions evaluate the current opinion of the participant concerning the environmental-friendliness of electric cars as well as how the participant rank the ecological performance compared with the types of engine gasoline, diesel, gasoline-hybrid, and fuel cell. Question (1) is a critical question concerning the motivated form of the confirmation bias. The participant has the options to affirm that the ecological performance of the recently bought car influenced the decision in favour of it or not. By affirming, the participant points out that any confirmation bias measured in the research is based on the motivated confirmation bias. This is reasoned by the participant's involvement of the ecological performance into the decision-making process. Question (3) is a critical question concerning the determination of the individual confirmation bias. It requests the participant's opinion on the environmental-friendliness of electric cars on a scale of 1 to 7. The score 1 equates to the perception that the car is very environmentally-unfriendly, 4 represents a neutral opinion, and the number 7 represents a high level of environmental-friendliness. This stated number, combined with the outcome of the question (10), will be used to measure the individual confirmation bias. We will cover more detail when addressing the question (10).

Questions (4) to (9) will be asked separately within the customer survey. They should be positioned between the beginning and the ending part. The gaps between the questions should be as even as possible to decrease possible additional variables and influences coming along with the answering process of the different questions to each other. Those questions contain rational pointed out facts about electric cars, concerning their environmental-friendliness. There are three questions pointing out negative aspects of electric cars and three questions pointing out the positive aspects. All questions should not cause any emotional statement. The reason for this non-emotionally charged questions are the side effects influencing human being when getting

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[72] To get a deeper inside about how to design and implement questionnaires and how it is done in this paper, see: Oppenheim (2004).

triggered with negative or positive emotions. Therefore, the questions should be as non-emotional and objective as possible. This can be seen especially looking at the questions asked after the facts have been pointed out. They ask about the awareness and knowledge of the facts skipping any trigger pointing to the possible outcome the experiment is looking for. This eliminates at the same time the confirmation bias, which the head of the experiment and the instructor might have. Furthermore, asking about the awareness of the facts gives more inside of the participant's confirmation bias. In the analytical part, there is the chance to use this data to analyse at what specific points the confirmation bias occurred. Moreover, all questions (4) to (9) have counterparts with the similar framing. Those pairs and their input are:

Question (4), negative, and question (5), positive.

Question (6), negative, and question (7), positive.

Question (8), negative, and question (9), positive.

Looking at the presented pairs, it becomes clear that a pair is always a match of positive aspects about entirely electric cars and a negative one, with the same general framework and question. All questions will be randomly positioned within the earlier stated optimal positions. This reduces the variables coming along with e.g. position the pairing questions after each other or positioning first all negative aspects. All these variables will be reduced when (re-)position the questions (4) to (9) randomly for every participant.

Question (10) requests the same as the question (3) already did. However, it has slightly different wording. This might reduce the feeling the participant gets when answering the same question twice. Using almost the same question might be necessary looking at the fact that the decision the participant is requested about should include the same trigger and question as the original one. Again, the number 1 equals the car to be very environmental-unfriendly, the number 4 equals a neutral opinion, and number 7 equals the car to be very environmental-friendly.

## 7.5    The value of confirmation bias

The value of confirmation bias will be determined indirectly by the difference between the values stated in question (3) and (10). The following value function will be used.

$$v(a, b) = \quad |a - b|$$

Formula 8: The value function of the occurrence of the confirmation bias

In this value function, 'a' is the value, the participant states out in question (3) and 'b' is the value, the participant states out in question (10). Therefore, in this research, the maximal possible discrepancy is 6 and the lowest 0. Furthermore, the confirmation bias only occurs when the discrepancy is 0. This results out of the logic that the participant should adjust their evaluation when receiving new information in favour of or against their prior hypothesis. The confirmation bias tells in general that information is collected and interpreted the way that they confirm the prior hypothesis of the participant. Therefore, if the discrepancy between the question (3) and the question (10) is 0, even though the participant received new information leading to a change in question (10) compared to question (3), the participant is influenced by the confirmation bias.

Moreover, in the experiment, there are negative and positive aspects of entirely electric cars. As the different aspects have also different effects depending on the participant it is generally assumed that in case the participant receives new information, all factors influence the participant to the same extent. Therefore, if the participant receives one negative and one positive new information, it is assumed that both have a balancing effect on each other. An overview of which participants this research focusses on can be seen in figure 6.
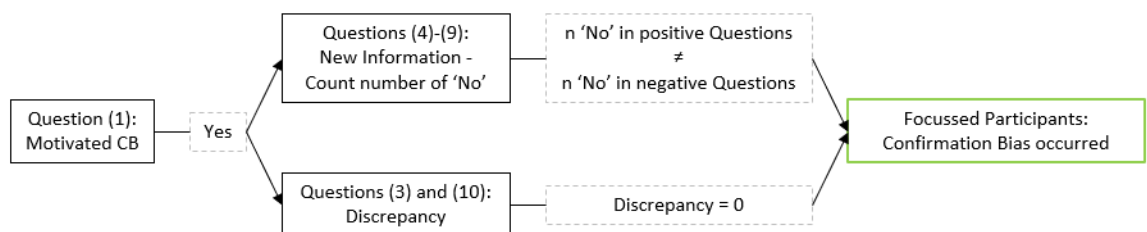


Figure 6: The participants this research focusses on

The value of confirmation bias will be determined within the participants, who appear to be influenced by the confirmation bias. Within those participants, there are three possible scenarios, which can occur.

The participant receives more new information from the opposite site (negative/positive) than the stated first value (negative/positive sector). The new information appears to have no influence on the participant and the discrepancy between the values of the question (3) and (10) is 0.

The participant receives more new information from the same site (negative/positive) than the stated first value (negative/positive sector). The new information appears to have no influence on the participant and the discrepancy between the values of the question (3) and (10) is 0.

The participant receives more new information from any site (negative/positive) than from the other and first stated a neutral (Value in question (3) = 4) value. The new information appears to have no influence on the participant and the discrepancy between the values of the question (3) and (10) is 0.

Even though it might be reasonable to separate the scenarios in terms of the value of confirmation bias, there are also arguments against the separation, as the variable of the individualistic participant has a too high impact. It might be reasonable to say that new information from the opposite site cause a higher confirmation bias than from the same site, as they might disconfirm the original hypothesis more than new information from the same site. However, the different input on the decision-making process between these scenarios is influenced by individualistic variables, which might differ a lot among different participants. This causes this simplification.

Therefore, the value of confirmation bias will be determined as shown in formula 9.

$$CB(a,b) = \quad |a - b|$$

Formula 9: The value function of confirmation bias

In the value function, the variable 'a' signifies the number of the answer 'no' the participant chooses when answering the questions with positive aspects. The variable 'b' signifies the number of the answer 'no' the participant chooses when answering the questions with negative aspects.

The discrepancy between those two variables measures the value of the confirmation bias (CB). The higher the value gets, the higher is the measured confirmation bias.

In the presented measuring process of the confirmation bias in this study, the highest confirmation bias would be the value '3' and the lowest '1'. However, the more information the experiment provides to the participant, the higher the value of confirmation bias might be. Therefore, the interpretation of the strength the confirmation bias occurs has to be appropriately adjusted depending on the experimental design when being implemented. Within this research, there are three possible values of confirmation bias. Therefore, the value '1' signifies a low level of confirmation bias, the value '2' signifies a medium level of confirmation bias, and the value '3' signifies a high level of confirmation bias.

## 7.6   Hypothesis

Within the analysation process, the two measurements of the individual loss aversion and the individual motivated confirmation bias will be combined. As this paper researches the impact of the loss aversion on the motivated confirmation bias, the outcome will be a graph pointing out the results of the research. The hypotheses of this paper are as follows.

Hypothesis 1: The higher the loss aversion, the lower the confirmation bias.

Hypothesis 1 can be explained as follows. The higher the loss aversion, the more fearful the same participant might be. This causes more open-minded and realistic thinking of the participant. Therefore, the participant is more open to adjusting further statements when receiving new facts and information, which equals a lower confirmation bias. The participant has received information clearer and adapts the prior statement more when having a higher loss aversion. Overall, the higher the loss aversion gets, the lower might be the confirmation bias.

Hypothesis 2: The higher the loss aversion, the higher the confirmation bias.

Even though hypothesis 2 contradicts hypothesis 1, both hypotheses might be correct. Hypothesis 2 can be explained as follows. The higher the loss aversion, the more fearful the same participant might be. Therefore, the participant might be more fearful of being wrong with the stated hypothesis/statement. This might cause a higher confirmation bias. The participant might interpret information the wrong way or even avoid aspects pointing out that the former statement is

incorrect. This rejection of the information is caused by the higher fear the participant has by the higher loss aversion. Overall, the higher the loss aversion gets, the higher might be the confirmation bias.

As Hypothesis 1 and 2 contradict each other, further data collection should be done before the research question can be analysed. Therefore, the participants will be subdivided into two groups representing the characteristics in the two hypotheses. In the first group, group (A), there are the participants, who can be represented by the characteristics shown in the explanation of hypothesis 1. In the second group, group (B), there are participants, who can be represented by the characteristics shown in the explanation of hypothesis 2. How the participants will be divided can be seen in section 7.7: Determining the group membership.

## 7.7    Determining the group membership

Concerning the evaluation, in which group the individual participant belongs, there is going to be additional questions within the customers' survey. To determine the individual curve affiliation, the participant is doing a self-assessment. Within that self-assessment, the participant evaluates three questions. The determined group value is composed out of those three values to reduce confounding variables caused by the participant, the situation, and the questions asked. By spreading the value determination on three individual questions, problems such as misunderstandings within one question might affect the outcome less. Within the three questions, the same process of positioning will be done like in the questionnaire, where the value of confirmation bias is determined. The three questions should be asked separately to reduce influences on each other and the distance should be maximised between them. Furthermore, the order will be determined randomly. The questions are as follows and the questionnaire, which will be shown to the participant, can be seen in the appendix.

(11) How open do you see yourself, concerning confessing? (1 = I am always admitting mistakes immediately; 7 = I am never admitting mistakes)

(12) How much does new information influence you, concerning existing beliefs? (1 = New information influence my existing believes strongly; 7 = New information influence my existing believes not at all)

(13) How rational and realistic do you gather information and facts? (1 = I always
gather information and facts the exact same way, they are presented; 7 = I always
gather information and facts the way I feel about them)

All three shown questions will determine the group, the individual participant belongs to. The
group will be determined by the average of the three values stated in the questions. The mathe-
matical equation to the determination of the group membership can be seen in formula 10.

$$Gv(a,b,c) = \frac{a+b+c}{3}$$

Formula 10: The group value function

Within the group value function, the variable 'a' signifies the value the participant states out in
question (11). Similar to that, the variable 'b' signifies the value the participant states out in the
question (12), and the variable 'c' signifies the value the participant states out in the question
(13).

The first group is the one having a group value (Gv) of 4 or lower. Therefore, they can be described
as being open to admit mistakes, as being influenced by new information, and as being rational
and realistic when gathering information and facts. The second group is the one having a group
value above 4. They can be described as not being open to admit mistakes, as not being influenced
by new information, and as not being rational and realistic when gathering information and facts.
Therefore, the first group equals the characteristics of the members of the group (A) should rep-
resent. The other way around, the second group mentioned in this section equals the character-
istics of the members of the group (B). An overview of the process of determination of the group
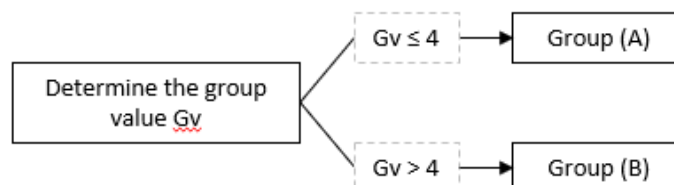membership can be seen in figure 7.



Figure 7: Determine the group membership

## 7.8   Results

In this paper, the focus of research is the impact of the loss aversion on the motivated confirmation bias. Concerning this, the individual value of loss aversion (LA) is the independent variable. Accordingly, the individual value of confirmation bias (CB) in the motivated form is the dependent variable. The relationship between the two values, LA and CB, will be shown in a value function. As there are two groups of participants according to the two hypotheses, there are two different value functions.

Therefore, in the first step, the participants will be divided according to their group membership. In the next step, the combination of the individual participants' loss aversion and confirmation bias will be marked in the graph. The value function in figure 8 shows the theoretical relation between the individual loss aversion and the confirmation bias of participants being a member of the group (A) when applying the hypothesis 1. The higher the value of loss aversion (LA), the lower the value of confirmation bias (CB).
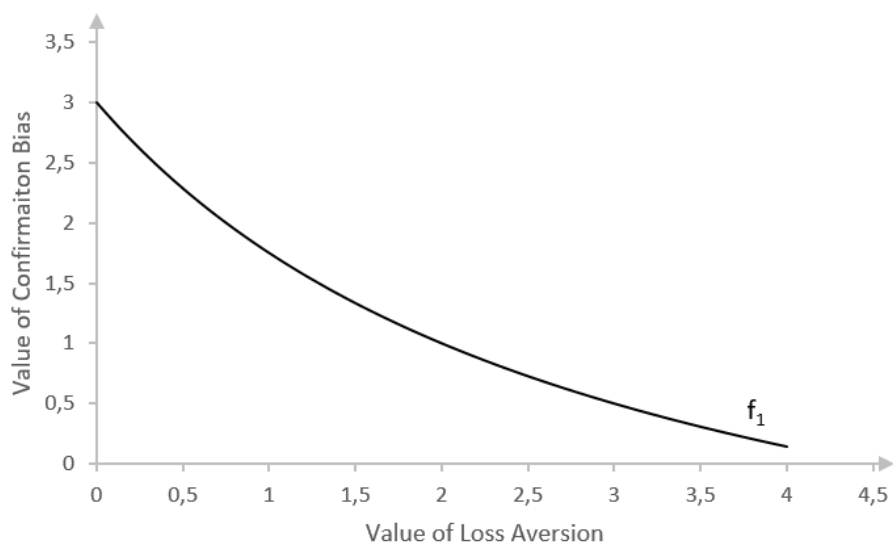


Figure 8: The theoretical relation between the individual loss aversion and the confirmation bias of participants being a member of the group (A)

Furthermore, figure 9 shows the theoretical relationship between the individual loss aversion and the confirmation bias of participants being a member of the group (B) when applying the hypothesis 2. The higher the value of loss aversion, the higher the value of confirmation bias.
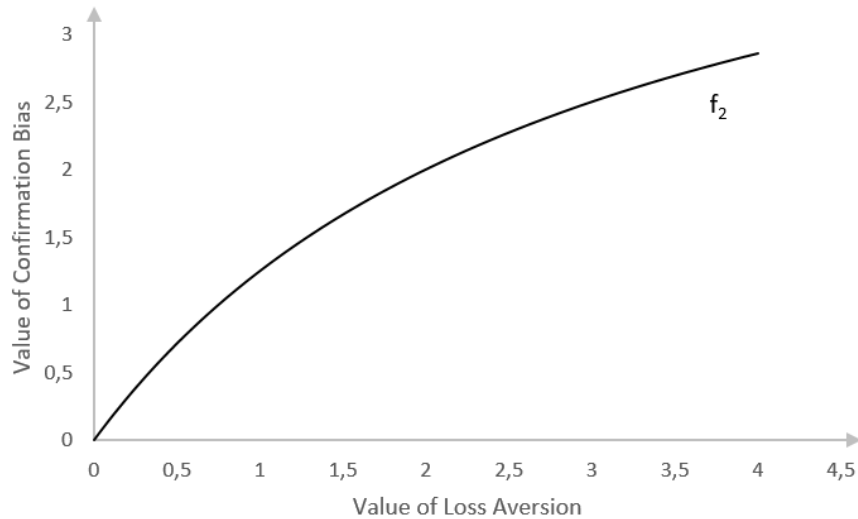
Figure 9: The theoretical relation between the individual loss aversion and the confirmation bias of participants being a member of the group (B)

In both value functions, there is a diminishing marginal utility assumed. This assumption is based on the general fact that changes loom larger in the first place than in the second. Furthermore, it is pointed out in this paper that the loss aversion is an unconscious bias. The participants might not be aware of the fact that they are biased by loss aversion. However, the higher the value of loss aversion gets, the higher is the probability that the participant is getting aware of the influence by the loss aversion. This might explain the diminishing marginal utility, as the participants are getting more aware of the influence the higher the loss aversion is, and they try to counteract. This counteracts might cause diminishing sensitivity. Therefore, the gradient of the value function $f_1$ reduces with its size and the gradient of the value function $f_2$ increases with its size.

The actual shape and characteristics of the curve will be figured out when the experiment is conducted. An overview of the hypotheses of this paper and the theoretical outcome can be seen in figure 10.
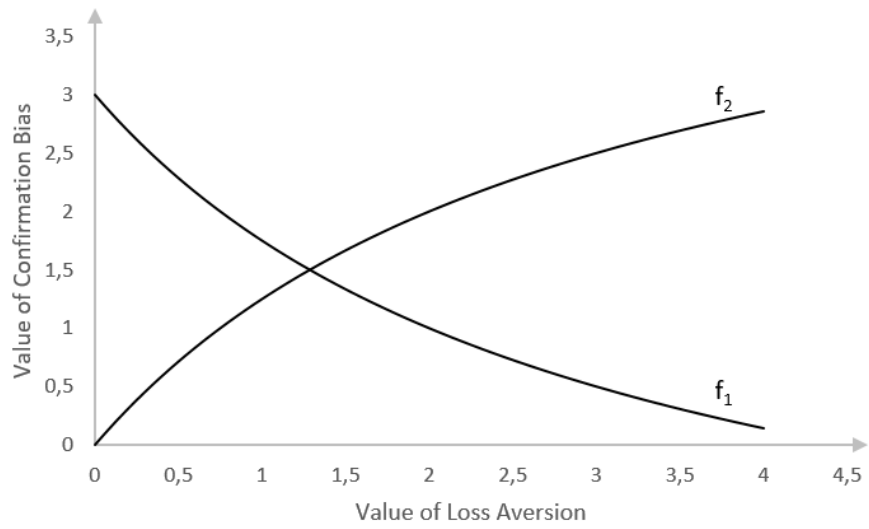
Figure 10: Overview of the theoretical outcome of the hypotheses

8    Discussion

Concerning the practical implementation, the experimental design, and the analysis of the results various adjustments might be necessary. First, when implementing the experiment, the mentioned confounding variables need to be adjusted. As many confounding variables depend on the experiment, there were only discussions over a few variables and how to minimize their effects. However, to ensure a high-quality outcome, the experimental design and setting has to be re-thought and, if necessary, adjusted. A general technique, which is used in this paper as well, is the randomisation. To this day, randomisation might be the best technique to reduce confounding variables. There are also online tools, which can be used to randomise such as randomizer.org.[73]

The measuring of the confirmation bias seems to need a big sample group. As the research subjects are minimised to only the described certain ones.  The others are still answering the rest of the questions and the individual loss aversion will still be determined. Therefore, further research with the participants, who not suit all the necessary criteria, should be considered. There should be a special focus on a bias that can be seen as the counterpart of the confirmation bias.

At the time this research paper was writing there had been no bias that can be described as the counterpart of the confirmation bias. However, this paper not only provides a method to measure the confirmation bias. It might be possible to modify the experiment to measure this unknown bias.

Furthermore, this paper provides the basis to research an additional biases. Those biases can be shown in the following scenario. The participant stated his hypothesis about entirely electric cars in question (3). After this, the participant does not receive any new information and therefore, the stated value in question (10) should not differentiate from the one in question (3). However, the participant is changing his hypothesis and states a different value in question (10). There are two possible scenarios. First, the participant changes the value in the confirming direction. This means, the participant increases the value in the positive sector or decreases the value in the negative sector. In this scenario, the participant is influenced by the information without it being new. Even though the participant might confirm the first stated hypothesis this phenomenon is not the confirmation bias. Second, the participant changes the value in the opposite direction of

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[73] ("Research Randomizer").

the first statement. This means, the participant decreases the value in the positive sector or increases the value in the negative sector. In this scenario, the participant evaluated the information irregular again, as there is no new information. Both biases could be researched further, especially as this paper already shows a basis, how to measure it.

In general, the experimental design should be reconsidered when implemented. A strong focus needs to be put into the design of the questionnaire. It should be up-to-date, contain relevant facts, and should always be trustworthy to ensure a high-quality outcome of the surveys. Additionally, when measuring the value of confirmation bias, there should be more information and facts than in this paper. This gives the opportunity to differentiate more between the levels of value.

To ensure the highest possible objectivity, reliability, and validity further adjustments might be considered. Therefore, it might be necessary to add a questionnaire concerning confounding variables such as the mood of the participant. Depending on the mood, humans tend to mistrust information or have a higher attentiveness.[74] Furthermore, as the experiments will not be implemented, there might be thoughts and explanations missing in this paper about facts or settings, that were considered as not relevant to be discussed detailed.

Fußnoten: Abstand auf 1 manuell ändern und Schrift auf Calibri 11 ändern- auch in Verzeichnissen

Literaturverzeichis um Internetquellen erweitern.

Formelnummern etc. überprüfen

Abkürzungsverzeichnis

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[74] Gerrig, Dörfler, and Roos (2016, pp. 458–468).

9    List of References

Baron, J., Beattie, J., & Hershey, J. C. (1988). Heuristics and biases in diagnostic reasoning. *Organizational Behavior and Human Decision Processes*, *42*, 88–110.

Becker, G. M., Degroot, M. H., & Marschak, J. (1964). Measuring utility by a single-response sequential method. *Behavioral Science*, *9*, 226–232.

Beyth-Marom, R., & Fischhoff, B. (1983). Diagnosticity and pseudodiagnosticity. *Journal of Personality and Social Psychology*, *45*, 1185–1195.

Blume, L. E., & Durlauf, S. N. (2017). *The New Palgrave dictionary of economics* (Continuously updated edition). [S.l.]: Palgrave Macmillan.

Bognanno, M. L., & Thaler, R. H. (1993). The Winner's Curse: Paradoxes and Anomalies of Economic Life. *Industrial and Labor Relations Review*, *47*, 145.

Bokhari, S., & Geltner, D. (2011). Loss Aversion and Anchoring in Commercial Real Estate Pricing: Empirical Evidence and Price Index Implications. *Real Estate Economics*, *39*, 635–670.

Bruner, J. S., Goodnow, J. J., & Austin, G. A. (1956). *A study of thinking* (9. [print.]). *Psychology*. New York: Wiley.

Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit (BMUB), www.bmub.bund.de. Wie umweltfreundlich sind Elektroautos? Retrieved from https://www.bmu.de/fileadmin/Daten_BMU/Download_PDF/Verkehr/emob_umweltbilanz_2017_bf.pdf

Campbell, J. D., & Fairey, P. (1985). Effects of self-esteem, hypothetical explanations, and verbalization of expectancies on future performance. *Journal of Personality and Social Psychology*, *48*, 1097–1111.

Casals, L. C., García, B. A., Aguesse, F., & Iturrondobeitia, A. (2017). Second life of electric vehicle batteries: relation between materials degradation and environmental impact. *The International Journal of Life Cycle Assessment*, *22*, 82–93. https://doi.org/10.1007/s11367-015-0918-3

Charness, G., Gneezy, U., & Kuhn, M. A. (2012). Experimental methods: Between-subject and within-subject design. *Journal of Economic Behavior & Organization*, *81*, 1–8. https://doi.org/10.1016/j.jebo.2011.08.009

Chlupsa, C. (2017). *Der Einfluss unbewusster Motive auf den Entscheidungsprozess: Wie implizite Codes Managemententscheidungen steuern*. Wiesbaden: Springer Gabler. Retrieved from http://dx.doi.org/10.1007/978-3-658-07230-8

Christensen, C. (1989). The psychophysics of spending. *Journal of Behavioral Decision Making*, *2*, 69–80.

Christoph Schneeweiß. (1991). *Planung*: Springer Berlin Heidelberg.

Coleman, J. S. (1990). *Foundations of Social Theory. Belknap Press Series*: Belknap Press of Harvard University Press.

Coursey, D. L., Hovis, J. L., & Schulze, W. D. (1987). The Disparity Between Willingness to Accept and Willingness to Pay Measures of Value. *The Quarterly Journal of Economics*, *102*, 679.

Elektromobilität. (2018). Retrieved from http://www.bafa.de/DE/Energie/Energieeffizienz/Elektromobilitaet/elektromobilitaet_node.html

Evans, J. S. (1989). *Bias in human reasoning: Causes and consequences. Essays in cognitive psychology*. Hove: Erlbaum.

Festinger, L. (1957). *A theory of cognitive dissonance*. Stanford: Stanford Univ. Press.

Flauger, J. (2018). Strommix in Deutschland: Erneuerbare Energien decken jetzt mehr als ein Drittel des deutschen Strombedarfs. Retrieved from https://www.handelsblatt.com/unternehmen/energie/strommix-in-deutschland-erneuerbare-energien-decken-jetzt-mehr-als-ein-drittel-des-deutschen-strombedarfs/22784884.html?ticket=ST-10090439-UyCUroGsTeT1zg6TvpyG-ap3

Friedman, M., & Savage, L. J. (1948). The utility analysis of choices involving risk. *Journal of Political Economy*, *56 (1948)*, 279–304.

Gächter, S., Johnson, E. J., & Herrmann, A. (2007). Individual-level loss aversion in riskless and risky choices. Retrieved from http://ftp.iza.org/dp2961.pdf

Gehalt.de. (2018). Gehaltsatlas 2018: In diesen Bundesländern verdienen Sie am besten. Retrieved from https://www.gehalt.de/news/gehaltsatlas-2018

George Caspar, H. (1968). *Elementarformen sozialen Verhaltens*: VS Verlag für Sozialwissenschaften.

Gerrig, R. J., Dörfler, T., & Roos, J. (2016). *Psychologie* ([20., aktualisierte und erweiterte Auflage]). *Always learning*. Hallbergmoos/Germany: Pearson. Retrieved from http://lib.myilibrary.com/ProductDetail.aspx?id=927254

Gierl, H., Helm, R., & Stumpp, S. (2001). Wertfunktion der Prospect-Theorie, Produktpräferenzen und Folgerungen für das Marketing. *Schmalenbachs Zeitschrift Für Betriebswirtschaftliche Forschung*, *53*, 559–588.

Grutters, J. P. C., Kessels, A. G. H., Dirksen, C. D., van Helvoort-Postulart, D., Anteunis, L. J. C., & Joore, M. A. (2008). Willingness to accept versus willingness to pay in a discrete choice experiment. *Value in Health : the Journal of the International Society for Pharmacoeconomics and Outcomes Research*, *11*, 1110–1119.

Hinrich Helms, Julius Jöhrens, Claudia Kämper, Jürgen Giegrich, Axel Liebich. Weiterentwicklung und vertiefte Analyse der Umweltbilanz von Elektrofahrzeugen. Retrieved from https://www.umweltbundesamt.de/sites/default/files/medien/378/publikationen/texte_27_2016_umweltbilanz_von_elektrofahrzeugen.pdf

Hussy, W., Schreier, M., & Echterhoff, G. (2013). *Forschungsmethoden in Psychologie und Sozialwissenschaften für Bachelor*. Berlin, Heidelberg: Springer Berlin Heidelberg.

Kahneman, D., & Tversky, A. (2000). *Choices, Values, and Frames*: Cambridge University Press. Retrieved from https://books.google.de/books?id=gfnZAQAAQBAJ

Kahneman, D. (2012). *Schnelles Denken, langsames Denken* (Vierundzwanzigste Auflage). München: Siedler.

Kahneman, D., Knetsch, J. L., & Thaler, R. H. (1990). Experimental Tests of the Endowment Effect and the Coase Theorem. *Journal of Political Economy*, *98*, 1325–1348.

Kahneman, D., Knetsch, J. L., & Thaler, R. H. (1991). Anomalies: the endowment effect, loss aversion, and status quo bias. *The Journal of Economic Perspectives : EP : a Journal of the American Economic Association*.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica : Journal of the Econometric Society, an Internat. Society for the Advancement of Economic Theory in Its Relation to Statistics and Mathematics*, *47*, 263–291.

Kast, B. (2011). *Wie der Bauch dem Kopf beim Denken hilft: Die Kraft der Intuition* (4 Aufl.). *Fischer: Vol. 17451*. Frankfurt am Main: Fischer Taschenbuch.

Keeney, R. L., & Raiffa, H. (1976). *Decisions with multiple objectives: Preferences and value tradeoffs. Wiley series in probability and mathematical statistics*. New York, NY: Wiley.

Kelley, H. D. (1950). The warm-cold variable in first impressions of persons. *Journal of Personality*, *18*, 431–439.

Klayman, J., & Ha, Y.-w. (1987). Confirmation, disconfirmation, and information in hypothesis testing. *Psychological Review*, *94*, 211–228.

Knetsch, J. L., & Sinden, J. A. (1984). Willingness to Pay and Compensation Demanded: Experimental Evidence of an Unexpected Disparity in Measures of Value. *The Quarterly Journal of Economics*, *99*, 507.

Koriat, A., Lichtenstein, S., & Fischhoff, B. (1980). Reasons for confidence. *Journal of Experimental Psychology: Human Learning & Memory*, *6*, 107–118.

Kraftfahrt-Bundesamt. (2018). Bestand an PKW am 1. Januar 2018 nach ausgewählten Kraftstoffarten. Retrieved from https://www.kba.de/DE/Statistik/Fahrzeuge/Bestand/Umwelt/2018_b_umwelt_dusl.html?nn=663524

Krüger, S. (2018). *Ökobilanzierung der Elektromobilität*. Retrieved from https://opus.ostfalia.de/files/935/Krüger_2018_Ökobilanz_Elektromobilität.pdf

Loewenstein, G., & Issacharoff, S. (1994). Source dependence in the valuation of objects. *Journal of Behavioral Decision Making*, *7*, 157–168.

Matlin, M. W., & Stang, D. J. (1978). *The Pollyanna principle: Selectivity in language, memory, and thought*. Cambridge.

Mynatt, C. R., Doherty, M. E., & Tweney, R. D. (1977). Confirmation Bias in a Simulated Research Environment: An Experimental Study of Scientific Inference. *Quarterly Journal of Experimental Psychology*, *29*, 85–95. https://doi.org/10.1080/00335557743000053

Neumann, J. von, & Morgenstern, O. (1944). *Theory of games and economic behavior*. Princeton: Princeton University Press.

Oppenheim, A. N. (2004). *Questionnaire design, interviewing and attitude measurement* (New ed., reprinted.). London: Continuum.

Prelec, D. (1998). The Probability Weighting Function. *Econometrica*, *66*, 497.

Pyszczynski, T., & Greenberg, J. (1987). Toward an Integration of Cognitive and Motivational Perspectives on Social Inference: A Biased Hypothesis-Testing Model. In L. Berkowitz (Ed.), *Advances in Experimental Social Psychology. Advances in experimental social psychology: Vol. 20* (Vol. 20, pp. 297–340). San Diego: Academic Press.

Raymond S. Nickerson. (1998). Confirmation Bias: A Ubiquitous Phenomen in Many Guises. *Review of General Psychology*, 175–220.

Research Randomizer. Retrieved from https://www.randomizer.org/

Ross, L. (1977). The Intuitive Psychologist And His Shortcomings: Distortions in the Attribution Process. In L. Berkowitz (Ed.), *Advances in Experimental Social Psychology. Advances in experimental social psychology* (Vol. 10, pp. 173–220). New York: Academic Press.

Samuelson, W., & Zeckhauser, R. (1988). Status quo bias in decision making. *Journal of Risk and Uncertainty*, *1*, 7–59.

Schmidt, U., & Traub, S. (2002). An experimental test of loss aversion. *Journal of Risk and Uncertainty : JRU*, *25*, 233–249.

Sedlak, M. Argumente pro und contra Elektroauto. Retrieved from https://sedl.at/Elektroauto/Argumente

Sherman, S. J., Zehner, K. S., Johnson, J., & Hirt, E. R. (1983). Social explanation: The role of timing, set, and recall on subjective likelihood estimates. *Journal of Personality and Social Psychology*, *44*, 1127–1143.

Thaler, R. (1980). Toward a positive theory of consumer choice. *Journal of Economic Behavior & Organization*, *1*, 39–60.

Thaler, R. H. (1985). Mental Accounting and Consumer Choice. *Marketing Science*, 199–214.

Thaler, R. H. (1999). Mental Accounting Matters. *Journal of Behavioral Decision Making*, 183–206.

Tversky, A., & Kahneman, D. (1974). Judgment under Uncertainty: Heuristics and Biases. *Science (New York, N.Y.)*, *185*, 1124–1131.

Tversky, A., & Kahneman, D. (1981). The framing of decisions and the psychology of choice. *Science (New York, N.Y.)*, *211*, 453–458.

Tversky, A., & Kahneman, D. (1991). Loss Aversion in Riskless Choice: A Reference-Dependent Model. *The Quarterly Journal of Economics*, *106*, 1039–1061.

Tversky, A., & Kahneman, D. (1992). Advances in Prospect Theory: Cumulative Representation of Uncertainty. *Journal of Risk and Uncertainty*, *5*, 297–323. Retrieved from https://EconPapers.repec.org/RePEc:kap:jrisku:v:5:y:1992:i:4:p:297-323

Umweltbundesamt Österreich, Fritz, D., Heinfellner, H., Lichtblau, G., Pölz, W., & Schodl, B. (2016). Ökobilanz alternativer Antriebe: Fokus Elektrofahrzeuge. Retrieved from http://www.umweltbundesamt.at/fileadmin/site/publikationen/REP0572.pdf

Viscusi, W. K., Magat, W. A., & Huber, J. (1987). An Investigation of the Rationality of Consumer Valuations of Multiple Health Risks. *The RAND Journal of Economics*, *18*, 465.

Zak, P. J., & Jensen, M. C. (2010). *Moral Markets: The Critical Role of Values in the Economy*. Princeton: Princeton University Press.

## 10 List of Appendencies

Determining the willingness to accept: The seller's questionnaire

In the following questionnaire, there is no right or wrong answer. Your response to each question should reflect your own preferences without any external influence. Like other parts of this survey, the following questions are part of scientific research on how consumer make economic choices. Please read the instructions carefully and feel free to ask the interviewer in case you have any questions or problems.

<div align="center">

CONGRATULATION!

You have just won the following model version of your new car.

You can keep it after this survey!

</div>

In case that you do not want to keep this model car, you have the option to sell it to the interviewer. Therefore, we would like you to mark the minimum acceptable price at which you are willing to sell the model car on the following page. Please make sure that you understand the below instructions.

In case your indicated lowest price of accepting the offer is **lower** than the offered price, you will receive the offered amount of money in exchange for the model car.

Figure 11: The seller's situation (1)

In case your indicated lowest price of accepting the offer is **higher** than the offered price, the car will not be sold to the interviewer.

Figure 12: The seller's situation (2)

The price at which the interviewer will offer you to buy the car will be randomly determined. The price will be between 0€ and 10€ and every price is equally likely to be determined. The scientific reason for this is that you cannot influence the price. Therefore, you have a higher incentive to state out the price of your true preference, which is acutely needed to assure high-quality research. It is not allowed to negotiate the price and you cannot change your choice after you made it.

| Price in € | Please make a cross in the checkbox whether you are ready or not to accept the offer for the car model. | |
|---|---|---|
| If the price is **0,0€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **0,5€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **1,0€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **1,5€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **2,0€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **2,5€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **3,0€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **3,5€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **4,0€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **4,5€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **5,0€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **5,5€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **6,0€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **6,5€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **7,0€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **7,5€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **8,0€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **8,5€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **9,0€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **9,5€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **10,0€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |

Table 4: The seller's decision template

Determining the willingness to pay: The buyer's questionnaire

In the following questionnaire, there is no right or wrong answer. Your response to each question should reflect your own preferences without any external influence. Like other parts of this survey, the following questions are part of a scientific research study on how consumer make economic choices. Please read the instructions carefully and feel free to ask the interviewer in case you have any questions or problems.

Unfortunately, you do not receive the following car model.

However, you can purchase it and keep it after this survey!

In case that you want to purchase this model car, you have the chance to buy it from the interviewer. Therefore, we would like you to mark the maximum acceptable price that you are willing to pay for the model car. Please make sure that you understand the following procedure.

In case your indicated highest price of paying for the model car is **lower** than the offered price, you will not receive the model car and keep your money.

Figure 13: The buyer's situation (1)

In case your indicated highest price of paying for the model car is **higher** than the offered price, you will receive the model car in exchange for the offered amount of money.

Figure 14: The buyer's situation (2)

The price at which the interviewer will offer you to sell the car will be randomly determined. The price will be between 0€ and 10€ and every price is equally likely to be determined. The scientific reason for this is that you cannot influence the price. Therefore, you have a higher incentive to state out the price of your true preference, which is acutely needed to assure high-quality research. It is not allowed to negotiate the price and you cannot change your choice after you made it.

| Price in € | Please make a cross in the checkbox whether you are ready or not to pay for the car model. | |
| --- | --- | --- |
| If the price is **0,0€** | ☐I am **ready** to pay | ☐I am **not ready** to pay |
| If the price is **0,5€** | ☐I am **ready** to pay | ☐I am **not ready** to pay |
| If the price is **1,0€** | ☐I am **ready** to pay | ☐I am **not ready** to pay |
| If the price is **1,5€** | ☐I am **ready** to pay | ☐I am **not ready** to pay |
| If the price is **2,0€** | ☐I am **ready** to pay | ☐I am **not ready** to pay |
| If the price is **2,5€** | ☐I am **ready** to pay | ☐I am **not ready** to pay |
| If the price is **3,0€** | ☐I am **ready** to pay | ☐I am **not ready** to pay |
| If the price is **3,5€** | ☐I am **ready** to pay | ☐I am **not ready** to pay |
| If the price is **4,0€** | ☐I am **ready** to pay | ☐I am **not ready** to pay |
| If the price is **4,5€** | ☐I am **ready** to pay | ☐I am **not ready** to pay |
| If the price is **5,0€** | ☐I am **ready** to pay | ☐I am **not ready** to pay |
| If the price is **5,5€** | ☐I am **ready** to pay | ☐I am **not ready** to pay |
| If the price is **6,0€** | ☐I am **ready** to pay | ☐I am **not ready** to pay |
| If the price is **6,5€** | ☐I am **ready** to pay | ☐I am **not ready** to pay |
| If the price is **7,0€** | ☐I am **ready** to pay | ☐I am **not ready** to pay |
| If the price is **7,5€** | ☐I am **ready** to pay | ☐I am **not ready** to pay |
| If the price is **8,0€** | ☐I am **ready** to pay | ☐I am **not ready** to pay |
| If the price is **8,5€** | ☐I am **ready** to pay | ☐I am **not ready** to pay |
| If the price is **9,0€** | ☐I am **ready** to pay | ☐I am **not ready** to pay |
| If the price is **9,5€** | ☐I am **ready** to pay | ☐I am **not ready** to pay |
| If the price is **10,0€** | ☐I am **ready** to pay | ☐I am **not ready** to pay |

Table 5: The buyer's decision template

Determining the willingness to accept: The chooser's questionnaire

In the following questionnaire, there is no right or wrong answer. Your response to each question should reflect your own preferences without any external influence. Like other parts of this survey, the following questions are part of a scientific research study on how consumer make economic choices. Please read the instructions carefully and feel free to ask the interviewer in case you have any questions or problems.

Unfortunately, you do not receive the following car model.
However, you have the possibility to either receive a compensation payment or the car model and keep it after this survey!

In case that you want to receive this model car, you have the chance to receive it from the interviewer. Therefore, we would like you to mark the maximum acceptable price which you are willing to accept receiving money instead of the model car. Please make sure that you understand the following procedure.

In case your indicated lowest price of accepting the offer is **lower** than the offered price, you will receive the offered amount of money instead of the model car.

Figure 15: The chooser's situation (1)

In case your indicated lowest price of accepting the offer is **higher** than the offered price, you will receive the model car instead of the offered amount of money.

Figure 16: The chooser' situation (2)

The price at which you will receive the money instead of the model car will be randomly determined. The price will be between 0€ and 10€ and every price is equally likely to be determined. The scientific reason for this is that you cannot influence the price. Therefore, you have a higher incentive to state out the price of your true preference, which is acutely needed to assure high-quality research. It is not allowed to negotiate the price and you cannot change your choice after you made it.

| Price in € | Please make a cross in the checkbox whether you are ready or not to accept the offer for the car model. | |
|---|---|---|
| If the price is **0,0€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **0,5€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **1,0€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **1,5€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **2,0€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **2,5€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **3,0€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **3,5€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **4,0€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **4,5€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **5,0€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **5,5€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **6,0€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **6,5€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **7,0€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **7,5€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **8,0€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **8,5€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **9,0€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **9,5€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |
| If the price is **10,0€** | ☐ I am **ready** to accept | ☐ I am **not ready** to accept |

Table 6: The chooser's decision template

Measuring the confirmation bias: The questionnaire

(1) Did the ecological performance of the car influence your decision?

&#9744;Yes &#9744;No

(2) Rank the following types of engine decreasing by their ecological performance, starting with the environmental-friendliest:

_ Gasoline

_ Diesel

_ Gasoline-Hybrid

_ Electric

_ Fuel cell.

(3) How environmental-friendly is an electric car in your opinion on the scale of 1 to 7 (1 = very environment-unfriendly, 7 = very environment-friendly)?

O1          O2          O3          O4          O5          O6          O7

(4) The professional disposal of entirely electric cars makes up more than 6% of the total energy expenditure. Research by the Austrian federal motor transport office in 2016 showed that electric cars have twice as much energy expenditure during the disposal process than comparable gasoline or diesel driven cars.[75] Even though the lifetime of the electric car's battery depends on divers' factors, it has to be replaced up to twice as often than conventional motors.[76]

Were you aware of these facts about the disposal process of electric cars?

&#9744;Yes &#9744;No

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[75] Umweltbundesamt Österreich et al. (2016).
[76] Krüger (2018).

(5) The battery of entirely electric cars might last 5 to 10 years. After this, there is the opportunity to reuse them. In their so-called second life cycle, which varies from 8 to 20 years, the batteries are used for example as energy stores.[77] The total energy expenditure of entirely electric cars seems to be almost 50% less than diesel driven cars, and over 60% less than gasoline driven cars.

Were you aware of the total energy expenditure and the second life cycle of the battery of electric cars?

☐Yes     ☐No

(6) There are more raw materials used in electric cars than in conventional driven cars. Because of the power unit, entirely electric cars need several additional components such as multiple vehicle electronics and additional cooling units. Different finite resources, which are not needed in conventional driven cars are used in electric cars as well.[78] Further developments might improve all types of engine.

Did you know of these facts about the use of materials in electric cars?

☐Yes     ☐No

(7) About 50% of the nitrogen oxide emission of electric cars occur during the process of electricity generation. The further development of renewable energy production might reduce this nitrogen oxide emission level by 50% within the year 2030.[79] In 2017, renewable energies make out about 36% of the produced energy in Germany.[80] The environmental-friendliness of electric cars might change from further developments. Owner of electric cars might use their own produced renewable energy to charge the battery.

Did you know these facts about the electricity used in electric cars?

☐Yes     ☐No

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[77] Casals, García, Aguesse, and Iturrondobeitia (2017).

[78] Hinrich Helms, Julius Jöhrens, Claudia Kämper, Jürgen Giegrich, Axel Liebich.

[79] Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit (BMUB), www.bmub.bund.de.

[80] Flauger (2018).

(8) Figure 6 shows the particle emission by types of engine in mg/km. Concerning the particle emission, diesel driven cars seem to have the lowest environment unfriendly value. On the other side, entirely electric cars seem to have the highest value with almost a 50% higher value of particulate emission than diesel driven cars. The production of electric cars produces already more particulate emission than gasoline and diesel-driven cars in total.
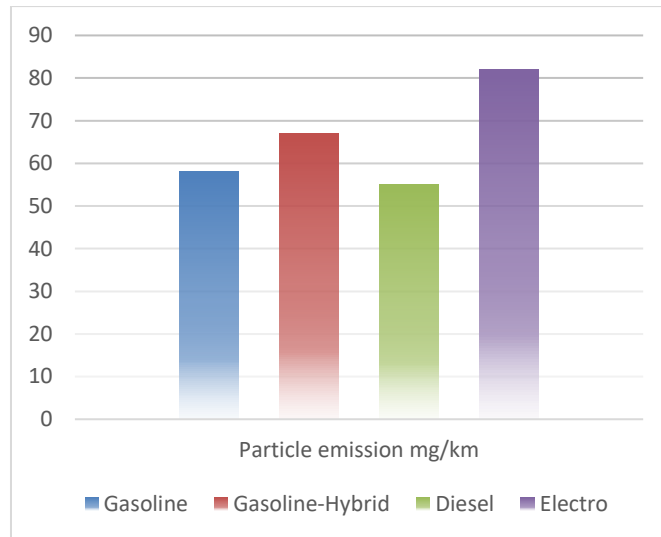


Figure 17: The particulate emission by types of engine in mg/km (UBA 2016)[81]

Did you know of the value of particulate emission of electric cars?

☐Yes        ☐No

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[81] Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit (BMUB), www.bmub.bund.de.

(9) Figure 7 shows the nitrogen oxide emission by types of engine in mg/km. Concerning the nitrogen oxide emission, entirely electric driven cars seem to have the lowest value. Diesel driven cars seem to have more than a 50% higher value than the electric cars. Over 50% of the nitrogen oxide emission of diesel-driven cars is emitted during the driving process. Whereas the entirely electric driven cars do not have any nitrogen oxide emission while driving.
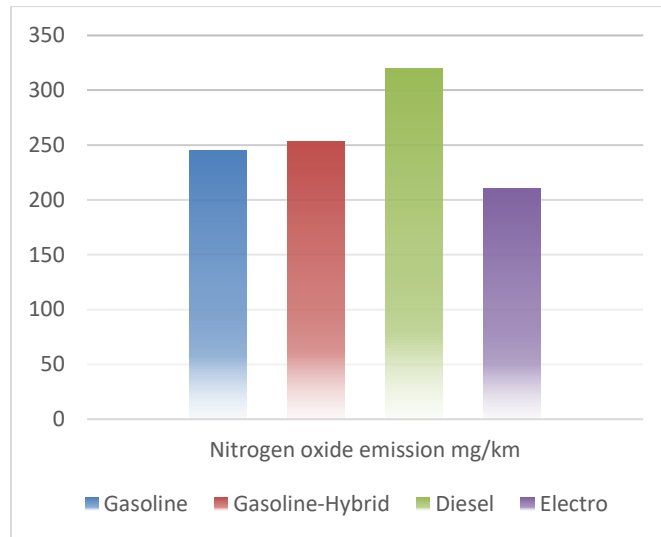


Figure 18: The nitrogen oxide emission by types of engine in mg/km (UBA 2016)[82]

Did you know of the value of nitrogen oxide emission of electric cars?

☐Yes        ☐No

(10) What is your opinion about the environmental-friendliness of electric cars on the scale of 1 to 7 (1 = very environment-unfriendly, 7 = very environment-friendly)?

O1          O2          O3          O4          O5          O6          O7

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[82] Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit (BMUB), www.bmub.bund.de.

Determine the individual curve: The questionnaire

(11) How open do you see yourself, concerning willingness to admit mistakes? (1 = I am always admitting mistakes immediately; 7 = I am never admitting mistakes)

O1          O2          O3          O4          O5          O6          O7

(12) How much does new information influence you, concerning existing beliefs? (1 = New information influence my existing believes completely; 7 = New information influence my existing believes not at all)

O1          O2          O3          O4          O5          O6          O7

(13) How rational and realistic do you gather information and facts? (1 = I always gather information and facts the exact same way, they are presented; 7 = I always gather information and facts the way I feel about them)

O1          O2          O3          O4          O5          O6          O7