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The effect of accountability on biases in the cultural heritage sector

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Abstract

In the cultural heritage sector there are a lot of complicated decision-making processes. There are a lot of factors involved in decisions that have to be made. This makes it likely that there are biases that have an effect on the final decisions. Previous literature has shown that accountability can reduce certain biases. This research tests if most people in the cultural heritage sector are susceptible to certain biases and how accountability affects these biases. Four biases were selected based on their relevance for the cultural heritage sector: confirmation bias, status quo bias, zero-risk bias, and sunk cost bias. A survey which measured the biases was held under people working in the cultural heritage sector. Binomial tests were done to test if most people were susceptible to biases. Fisher's exact tests and Mann-Whitney U tests were used to test if biases were distributed the same over a control group with low accountability and the treatment group with high accountability. Accountability was realized by making subjects justify their answers. It was found that most subjects were not susceptible to zero-risk bias and sunk cost bias. Some evidence was found that accountability can reduce zero-risk bias. Holding people accountable individually is recommended when there are zero-risk options involved. A recommendation for future research is to test the effect of accountability on the biases on a larger scale, this would lead to more powerful tests.

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Introduction

In 2019 the Boijmans van Beuningen museum in Rotterdam was closed for a big renovation and improvement project (Boijmans.nl, n.d.). The estimated cost of this project is €223,5 million and the museum is supposed to open again in 2026.

One aspect that will be improved by this project is the indoor climate of the museum. Regulating the indoor climate of a museum is important for the preservation of the (art) collection. However, for Boijmans van Beuningen, the preservation of the collection will be at the cost of the museum building. The museum building has a high architectural value. Therefore, a good balance has to be found between the preservation of the building and the art collection.

This is just one decision about the indoor climate that has to be made for the renovating project at Boijmans van Beuningen. There are many more complicated decisions that have to made. Another example is determining the temperature of the museum. This decision is among other things a trade-off between human comfort of the people visiting or working in the museum and the preservation of the art collection.

The cultural heritage sector faces a lot of complicated decisions as shown by the decisions that have to be made about the Boijmans van Beuningen museum. The complexity of these decisions also makes it that a lot of people with different work backgrounds are involved. This makes it very likely that there are biases that influence these decision-making processes. Furthermore, all factors that play a role in the decision-making process could bring their own biases, so in the cultural heritage sector biases could have a big effect on the final decisions made. This makes it important to know how biases affect decision-making and what can be done to debias the decision-makers.

Previous literature has shown that accountability in some cases can reduce decision errors (Simonson & Nye, 1992). Projects in the cultural heritage sector have a lot of decision-makers who have their own responsibilities. However, often only a small group or one person is responsible for the final decision. Decision-makers might not feel accountable for the final decision and can be more likely to make decision errors.

This research will look into certain biases that might affect decision-making processes in the cultural heritage sector and show how much certain decisions are affected by these biases. Furthermore, this research will test if accountability can debias decision-making processes in this sector.

The biases selected for this research are confirmation bias, status quo bias, zero-risk bias, and sunk cost bias. Confirmation bias was selected based on literature about group decision-making. Previous literature has shown that there is confirmation bias in group decisions (Schulz-Hardt et al., 2000).

Status quo bias was selected because it was mentioned by cultural heritage employees that people often stick to the status quo in the cultural heritage sector when making decisions. Zero-risk bias is relevant for the cultural heritage sector, because a lot of decisions in the cultural heritage sector involve risk, for example while deciding the indoor climate the risk of damage to the collection is always taken into account. Lastly, sunk cost bias was selected, for most big projects, decisions have to be made relating to sunk costs. So, this is an important bias to test.

To find out how accountability influences the decision-making biases in this sector, the research question is: *How does accountability influence the confirmation bias, status quo bias, zero-risk bias, and sunk cost bias in the cultural heritage sector?*

A survey was held under decision-makers in the cultural heritage sector. Specifically, under people that are involved in decisions about the indoor and outdoor climate in museums. The questions in the survey were all in a cultural heritage context. The survey was sent out in different countries across the world, so the sample contains respondents from a range of different countries.

The subjects of the survey were split into a control group and a treatment group. The treatment group had a higher accountability compared to the control group. Accountability was realised by making the treatment group justify their given answers. Furthermore, the questions were framed in a way to have that the treatment was given the deciding vote, while the control group just had a vote without specifying if it was deciding. All subjects were asked questions which measured the previously mentioned biases. The control and treatment group were compared to see if accountability influences the biases. Based on previous literature it is expected that most people are biased. Furthermore, it is expected that accountability will reduce biases in some cases.

To my knowledge, the effect of accountability on the zero-risk bias has not been tested. In general, if accountability decreases the biases, recommendations can be given to increase accountability in decision-making processes. This should be able to work in practice because accountability is realised in a simple way. Which means that this form of accountability should work and be realisable easily in practice.

To my knowledge, no research has been done before into biases in the cultural heritage sector. Furthermore, based on the identified biases, recommendations can be given about the decision-making process.

The rest of this paper is structured as follows: First, a literature review on decision-making and potential biases in the cultural heritage sector. Afterwards, the methods used are explained. Then an analysis of the data is done. Lastly, there is a discussion including the limitations and a conclusion.

Literature Review

Decision making process cultural heritage sector

Indoor and outdoor climate

The optimal climate differs for each museum (Ankersmit & Stappers, 2020). There are a lot of factors that play a role when deciding the indoor climate in museums. Three important factors that often contradict each other are the preservation of the collections of museums, the preservation of the building and the human comfort of the visitors.

Preservation

In the Netherlands, every museum has target values for temperature and relative humidity (Ankersmit & Stappers, 2020). These values are important for the preservation of the collections. If these values are not right it could lead to different kinds of degradation:

- If the relative humidity is too high, mold might grow on art pieces. This growing process can be accelerated by high temperature.
- Chemical degradation occurs when the temperature is high. A lower temperature can prevent chemical degradation. A rule of thumb for degradation is that if the temperature is decreased with 5^{o}C, the life expectancy of the art piece doubles.
- The last type of degradation caused by indoor climate is mechanical degradation. Changes in relative humidity can cause materials to shrink or swell. A way to prevent this from happening is by connecting the different materials in specific ways.

Often museums have art pieces on loan. These on loan art pieces have extremely strict requirements set by the owner about indoor climate. This is another factor that plays a role when making decisions about the indoor climate.

Visitors

The museum should also take human comfort into account when determining the indoor climate. The health, productivity, and experience of the people in the museum is also influenced by the climate (Ankersmit & Stappers, 2020). Humans normally prefer higher temperatures, while for the collection preservation often low temperatures are ideal. So, these factors contradict each other.

Laws and Guidelines

There are laws that have an impact on the climate decision. For example, in the Netherlands there is a law that demands a certain air quality (Ankersmit & Stappers, 2020).

Furthermore, there are guidelines about the indoor climate. In the Netherlands there are four recommended temperature and relative humidity profiles, which give target values.

How is the indoor climate determined?

In general, decision-making processes about the indoor climate are not a linear (Ankersmit & Stappers, 2020). When exploring possible solutions, new risks are found. These risks must be discussed again in that case. So, solutions are often discussed multiple times for everyone involved to completely understand the context.

Theoretically, the decision-making process follows the following seven steps:

1. Defining the requirements of the indoor climate for the whole museum. This contains determining the upper and lower limits of the temperature and/or relative humidity for the art collection, visitors/employees, and the museum building.

2. Determining for which areas of the museum these requirements do not hold.

3. Defining an adapted indoor climate requirement program. Starting over from step 1 for excluded areas based on step 2.

4. Combining all requirement programs.

5. Determining how the current indoor climate differs from the program.

6. If there is a big discrepancy between the programs, then the organizational, construction and installation solutions should be explored and considered by weighing the positives and negatives.

7. If the programs cannot be combined, then change the requirement program by repeating this process from step 1.

Decision makers

Because of the complexity of the indoor climate decision-making, there are a lot of people with different specializations that are typically involved and have an influence on the decision-making process. Ankersmit and Stappers (2020) mention the following roles and their responsibilities:

- The originator: Initiates the process and has a vision for the future of the museum, the use of the collection and collaboration with other heritage institutes, which is made explicit in the requirements program. Sets goals for the project and is responsible for the final decision.
- Manager of the collection: Is knowledgeable about the material aspects, the use and preservation aspects of the collection. Identifies the sensitivities of the collection and looks at potential consequences of the requirement programs on the preservation.
- Curator: Knows about the history of the collection, the provenance and meaning of individual objects. Knows which story they can tell and how to design the exhibitions to make them

accessible for visitors. Looks into the consequences of the requirement programs on the accessibility.

- Conservator: Has knowledge of the make and materials of the art pieces. Is responsible for providing the knowledge about the relation between the susceptibility and the risks of an incorrect indoor climate. Analyses the consequences of the requirement programs on the collection.
- Conservation scientist: An external advisor. Has knowledge of the degradation processes and is responsible for rationalizing the requirements and the preservation of the collection.
- Building physics specialist: External advisor who is specialized in building physics: air, moisture, and energy transfer between in- and outside. Is responsible for informing about building physics and thinking about possible solutions for the requirement programs related to building physics.
- Architect: Oversees and coordinates. Has knowledge of the building. Is responsible for knowing everything about the requirement program and the entire design of the project.
- Civil servant: Grants permits for procedures that change the museum buildings.
- Moderator: External and not involved with the project. Only responsibility is to moderate.

Accountability

So, decision-makers in the cultural heritage sector all have their own responsibilities. These responsibilities are related to their area of expertise. However, when it comes to the final decision only the originator(s) are accountable for making the right choice. So, most people that have an influence on the decision are not held accountable for the final decision.

Accountability can be important in decision making because, according to the literature, it reduces decision errors. Simonson and Nye (1992) found that accountability can reduce the sunk cost bias. They tested this by doing experiments where the control group was given low accountability for a task while the treatment group was given high accountability for the same task. Low accountability was realized by letting the subjects in the control group know that their answers were confidential, and they did not need to fill in a name. High accountability was realized by inviting the subjects in the treatment group to give an explanation and justification of their decisions to the researchers. The treatment group was less susceptible to sunk cost effects compared to the control group.

They also found evidence that accountability does not reduce decision errors when the correct answer was unknown and not available to the subject when they would process information more thoroughly. In other words, if the subject could not make a better decision by thinking more

thoroughly, accountability did not reduce decision errors. This indicates that accountability can lead to people thinking more thoroughly before they have to make decisions.

Accountability can also have a negative effect on decision making. Stewart et al. (1998) found that discussion bias could increase when a group is held accountable. Discussion bias occurs when groups discuss shared information instead of unshared information. This has a negative impact on decision making because less new information is exchanged. In the research by Stewart et al., groups with accountability focused more on irrelevant details compared to groups without accountability. Accountability was realized by letting the accountable groups know they would have an individual meeting with an interview panel about the group's decision afterwards.

Kroon et al. (1991) researched the differences between individual and collective accountability and their effect on groupthink. Groupthink can be defined as all kinds of mistakes in decision-making caused by a range of different factors. It can be viewed in two ways, either as collective avoidance or as collective overoptimism. There is collective avoidance in group decision-making when a group collectively avoids giving feedback on decisions or argue the drawbacks of a certain decision. This happens because the people in the group do not want to take individual accountability. Collective overoptimism happens when groups are not critical enough about possible opportunities. They overvalue certain projects because they want to be associated with successes. Which makes them more likely to choose projects of which others think that they would be a great success, without critically reviewing the option.

This research found that accountability can reduce groupthink in terms of collective avoidance. They also found that individual accountability reduces this type of groupthink more than collective accountability. This difference is explained because when there is collective accountability, individuals can avoid full accountability by "hiding in the crowd". For individual accountability, they are fully accountable. Both individual and collective accountability was realized by letting the subjects know the quality of their answers were observed and they would have to justify their decision. Furthermore, they were told they could get a higher grade, or they could earn extra money if they performed well. The difference between individual and collective accountability was realized in the following way. The subjects with individual accountability were not only told they would have to justify the group decision individually, furthermore they had to explain their contribution to the final decision and what the other groupmates contributed to the final decision. The subjects with collective accountability only were told to justify the group decision as a group afterwards.

A similar research by Kroon et al. (1992) found no difference between individual and collective accountability on groupthink. The way accountability was realized by letting the individual group

know they would individually have to justify the group decision and their own contribution to that decision, while the collective accountability group was told they had to justify their decisions as a group. This research did find that there are gender effects when it comes to accountability. Groups consisting of only men were affected more by accountability compared to groups consisting of females.

Biases

The four biases on which the effect of accountability will be tested are explained and it is discussed in more detail how accountability might affect these biases.

Confirmation bias

The first bias is confirmation bias. Confirmation bias is the searching, interpreting, or remembering of information in a way which systematically hinders the likelihood that a certain hypothesis will be rejected when the information supports the hypothesis (Oswald & Grosjean, 2004). For example, there are two options: project A and project B. When someone believes project A is the best project, they are more inclined to search for positives, interpret information more positively or remember information more positively when it comes to project A compared to project B. This makes it more likely they would choose or vote for project A, even when this is not optimal.

Important to note is that this happening unconsciously (Nickerson, 1998). So, the term confirmation bias is not used when for example a debater only argues the positives of something. This is a conscious decision while confirmation bias is about people accidentally accepting information that confirm their beliefs.

Prior research has shown that accountability might debias confirmation bias (Misra et al., 2019). This research under tax consultants had one subject group with low accountability and a group with high accountability. The group with low accountability had to solve a tax issue anonymously, while the high accountability group had to fill in information about their identity and attention was put that there was high pressure. In this research, it is implied that subjects with a strong accountability did more detailed information searches compared to subjects that had a weak accountability. This is in line with the previously mentioned research by Simonson & Nye (1992), which found that accountability appears to make people research information more thoroughly. More detailed information searches decrease the confirmation bias because less time is spent on confirming the hypothesis the person believes in and more time is spent on finding information that could lead to a rejection of the hypothesis.

Nickerson (1998) describes that confirmation bias has multiple forms. To model confirmation bias in a group decision context, Schulz-Hardt et al. (2000) use the preference for supporting information

over conflicting information in the decision-making process as the definition for confirmation bias, which is based on previous research on confirmation bias of individuals. The confirmation bias can happen before the decision has been made as well as when the decision is being made.

Before the research of Schulz-Hardt et al., only research had been done to confirmation bias on an individual level. Their research is about group decision-making, where the groups are divided into homogeneous and heterogeneous groups. These groups are homogeneous and heterogeneous when it comes to their opinion of a certain topic. The control group that is used consists of individuals.

In their research, they conduct three experiments. For the first experiment, they look at how much biased information searching influences the decision-making process, comparing homogeneous and heterogeneous groups of five with individuals. Biased information search happens when participants prefer requesting supporting information against conflicting information. The sample consists of 200 high school students.

They measure confirmation bias as the difference between the number of individuals/groups that chose supporting information and the number of individuals/groups that chose conflicting information. This is considered confirmation bias, because the participants request supporting information that supports their beliefs instead of requesting more useful information that might give other insights.

When they look at the individual control group, heterogeneous treatment group and the homogeneous treatment group, they find that there is confirmation bias for all groups. This indicates that there is confirmation bias for individual and group decision-making.

The confirmation bias for homogeneous groups was especially strong when compared to the heterogeneous group. The confirmation bias for heterogeneous groups with a minority of one participant was also bigger than the heterogeneous groups with a minority of two participants. This indicates that there is more confirmation bias for groups where more people share the same view/opinion.

The second experiment is similar to the first experiment. It uses another sample which consists of 57 male managers from banks and industrial companies. Because of the smaller sample size, there was no control group that consists of individuals. Furthermore, the groups only existed of three participants. This experiment shows the same result as the first experiment. Supportive information is preferred to conflicting information and the confirmation bias is higher for homogeneous groups compared to heterogeneous groups.

The last experiment is focused on testing if the homogeneous and heterogeneous are different, because of the group decision-making process. Just like in the previous experiments, the result was that for homogeneous groups the confirmation bias was higher. In other words, homogeneous groups are more likely to choose and discuss supportive information compared to heterogeneous groups.

To conclude, there can be confirmation bias in an individual context, but also in a group context. Therefore, it is likely that the cultural heritage sector is also affected by confirmation bias. Firstly, it will be tested if most people in the cultural heritage context are susceptible to confirmation bias:

Hypothesis 1: *Most subjects are susceptible to confirmation bias.*

Accountability might be a solution to reduce the bias. To test if this is the case, the second hypothesis is:

Hypothesis 2: *Subjects that are held accountable for their choices are less susceptible to confirmation bias compared to subjects that are not held accountable.*

Status quo bias

While talking to people in the cultural heritage sector, it was mentioned that decisions often were based on previous decisions. These previous decisions were not based on any research or were not researched in a long time. For example, the temperature of a museum is often based on an old status quo. This indicates that there might be better alternative options that are not taken into consideration while deciding. So, there appears to be a status quo bias that influences the decision outcome.

There is status quo bias when an individual or group disproportionally sticks with the status quo (Samuelson & Zeckhauser, 1988). So, the individual or group chooses the status quo while there are better options available. Samuelson & Zeckhauser divide the causes for status quo bias into three categories:

- *Rational decision making*

  A reason why people stick to the status quo is rational decision making. Often there are transaction costs involved when choosing an alternative to the status quo. When these transaction costs outweigh the efficiency gains, the status quo will be preferred.

  Another factor that can explain status quo bias is uncertainty. Even when there are no or little costs to switching, uncertainty can make people less interested in diverting from the status quo.

For example, when someone is satisfied with a certain product, they are less likely to switch to a different product that could be better.

- *Cognitive misperceptions*

Loss aversion is a cognitive misperception that impacts the status quo bias. When people see the status quo as their references point, they might have the irrational fear to lose utility compared to the reference point. They weigh losses heavier than gains, which makes it less likely from them to not choose the status quo.

Anchoring also influences the status quo bias. There is anchoring when a certain decision is chosen as a starting point and the following decision options are valued based on that certain decision. For example, when you see a product with a high price and afterwards you see a cheaper product, you are more likely to buy the cheaper product compared to a situation where you only see the cheaper product. This happens because you base the value of the cheaper product on the price of the expensive product. When the status quo is chosen as the starting point, anchoring influences the decision process.

- *Psychological commitment*

Sunk cost may cause people to stick to the status quo. There is sunk cost bias when someone still values costs for the status quo when they should not be relevant anymore in the decision-making process. For example, when money has already been invested into a project, continuing the project is preferred to abandoning it even when continuing costs more than abandoning. Previous investments can cause the status quo to be preferred while it is not the optimal choice.

Regret avoidance also influences the psychological commitment. If someone has negative feelings that come with regret, then the feelings will have an effect on decisions involving regret. Similar to loss aversion they set the status quo as the reference point. If someone would choose an alternative, they could regret the decision, so this will be taken into account when deciding between the status quo and the alternative. This is less the case if the individual sticks to the status quo because less regret is felt from inaction (sticking to the status quo) compared to making an active decision (choosing an alternative) (Kahneman & Tversky, 1982 in; Samuelson & Zeckhauser, 1988).

People like to have the feeling that they are in control of a situation. This can create an illusion of control, where someone thinks they are in control because they made a decision. People make different choices when there is a status quo compared to when there is no status quo. When they have chosen an option that becomes the status quo, they value that option higher than they

would have valued the same option when they did not pick the status quo themselves. For example, when there is a ticket lottery, an individual that is given one of the tickets randomly values the ticket on average lower than an individual that manually got to pick one of the tickets (Langer, 1983 in; Samuelson & Zeckhauser, 1988). The individual that picked one of the tickets manually has the illusion of control of the situation and values the ticket higher.

So, the status quo bias is caused by a lot of different factors that differ from rational choice models (Samuelson & Zeckhauser, 1988). Samuelson and Zeckhauser did controlled experiments using surveys where the respondents had to make decisions. Every question starts with a hypothetical situation which is followed by a multiple-choice question. The difference between the control and treatment group is that the hypothetical situation for the treatment group contains a status quo. After the survey, the decision made by both groups were compared. In these experiments they found that individuals stick to the status quo disproportionally.

The status quo bias differs for different groups of people. Burmeister and Schade (2007) find that status quo affects bankers more than it affects entrepreneurs or students. Furthermore, they find indirect evidence that there also are differences in status quo bias between different kind of entrepreneurs. So, the context and subject group also is important when measuring status quo bias.

The status quo bias is a hard bias to overcome. The only easy way according to Samuelson & Zeckhauser (1988) is to call on decision makers that they have to weigh all options evenly. Though, this does not solve all the problems of the bias.

Accountability can have an effect on status quo bias. When there are known audience preference, expected social norms or severe consequences are involved, in other words when there is an optimal choice according to the audience or an expected choice, then accountability can increase the status quo bias (Tetlock & Manstead, 1985 in; Messier Jr. et al., 2014; Lerner & Tetlock, 1995 in; Messier Jr. et al., 2014; Tetlock & Boettger, 1994 in; Messier Jr. et al., 2014). However, accountability can also reduce the status quo bias (Messier Jr. et al., 2014). Messier Jr. et al. found that when auditors were held accountable, the likelihood of them sticking to the status quo decreased. Accountability in this research was realized by letting the group with high accountability know they would have to justify their decision, while the low accountability group was not aware that they would have to justify their decision. So, accountability can negatively affect the status quo bias, but it can also have a positive effect on the status quo bias.

To conclude, for the cultural heritage sector it is likely that there is status quo bias. To see if this actually is the case, the third hypothesis is:

Hypothesis 3: *Subjects are affected by status quo bias.*

Furthermore, it is unknown if accountability will increase the status quo bias because there can be severe consequences in decision making processes. However, it can also be the case that accountability decreases the status quo bias. To test if and how accountability affects status quo bias, the fourth hypothesis is:

Hypothesis 4: *Subjects that are held accountable for their choices have a different susceptibility to status quo bias compared to subjects that are not held accountable.*

Zero-risk bias

The third bias is zero-risk bias. There is zero-risk bias when someone prefers reducing a risk to 0% over a bigger risk reduction of an equally or more important alternative (The Decision Lab, n.d.). In other words, the value of certainty is overweighed compared to the value of uncertainty. This happens because people find being in an uncertain situation discomforting, so they want to get out of that situation and therefore they give a higher value to being certain (Schneider et al., 2017).

This bias is relevant for the cultural heritage sector. As mentioned before, there are a lot of risk related problems involved when it comes to preserving the collection of the museum or the museum itself, so it is likely that the zero risk-bias plays a role.

Schneider et al. (2017) conducted four experiments with different task formats, decision types and decision domains. In all four experiments they found that zero-risk bias is present. Furthermore, they found that contextual factors have a big influence on zero risk bias. Firstly, more abstract tasks led to more zero-risk bias compared to more concrete tasks. Secondly, the decision domain effects the amount of zero risk bias present. It was found that the zero-risk bias was less present for gambling situations compared to social situations. Lastly, they found that choosing an option with zero-risk was deemed appropriate for objects, but not for persons when it comes to health scenarios. In a gambling situation when given two options, subjects were more likely to put all their resources towards one of the two options. While when it came to saving lives a significantly smaller number of subjects put all resources towards one person in need of help. This is among other things because of factors like fairness.

To my knowledge, no research has been done on the effect of accountability on the zero-risk bias. However, there has been research done on the effect of accountability on risk taking. Weigold & Schlenker (1991) found that self-proclaimed low risk takers would become more risk-averse when they were held accountable. While self-proclaimed high-risk takers did not change their behaviour significantly. Accountability was realised by letting the subjects justify the decisions they made. So,

accountability might decrease the zero-risk bias, because if the decision makers become more risk averse, they might want to reduce the bigger risk instead of choosing the zero-risk option. In other words, they would not fall for the zero-risk bias. To test if most people in the cultural heritage context are susceptible to the zero-risk bias, the fifth hypothesis is:

Hypothesis 5: *Most subjects are susceptible to zero-risk bias.*

Furthermore, as mentioned before, accountability can make people think more thoroughly. In a situation where there is the possibility for zero-risk bias, people might think more thoroughly and therefore do not choose the zero-risk option. So, it is expected that accountability can reduce the zero-risk bias in the cultural heritage sector. To test if accountability indeed reduces zero-risk bias, the sixth hypothesis is:

Hypothesis 6: *Subjects that are held accountable for their choices are less susceptible to zero-risk bias compared to subjects that are not held accountable.*

Sunk cost bias

The last bias is sunk cost bias. The sunk cost bias is the "greater tendency to continue an endeavor once an investment in money effort, or time has been made." (Arkes & Blumer, 1985, p. 124). Anecdotally, in the cultural heritage context this bias can appear when money and time has been invested into project A and the decision-makers do not want to switch to a better project B because of the invested money and time in project A.

People do not want to feel like they wasted time or money, so they want to justify themselves psychologically by valuing sunk costs to not feel like they wasted time, effort, or money (Arkes & Blumer, 1985). This makes not choosing the sunk cost option feel like a loss (thedecisionlab, n.d.). People are loss averse and therefore they may stick to the sunk cost option, so they do not feel like they lost something.

Arkes and Blumer did multiple experiments which showed that there was a sunk cost bias. The first experiment they did was made their subjects choose between two hypothetical trips. Trip A costed $100 and trip B costed $50. Both tickets were already bought, and it was common knowledge that trip B was preferred to trip A. Classic economic theory would predict that every subject would choose trip B, however the sunk cost of spending $100 on trip A made subjects choose differently. Furthermore, they did experiments with a control group that was not given a sunk cost and a treatment group with a sunk cost. In these experiments the treatment group made more decision errors compared to the control group. Decision errors in this research are defined as choosing the

sunk cost option. This is a decision error, because the sunk cost option is not the optimal choice for the subject.

Accountability can decrease decision errors when it comes to sunk costs according to previous literature (Simonson & Nye, 1992). Simonson and Nye found that when they gave people more accountability, that they were less likely to be negatively affected by the sunk cost bias. For their experiment they had a control group with a low accountability and a treatment group with a high accountability. Using similar questions as Arkes and Blumer (1985), they found that the treatment group was less effected by the sunk cost effect compared to the control group.

So, for the cultural heritage sector it is likely that there is sunk cost bias since it is there in different contexts. To test if this is the case, the seventh hypothesis is:

Hypothesis 7: Most subjects are susceptible to sunk cost bias.

It is also expected that accountability will decrease the sunk cost bias. To test if accountability indeed reduces sunk cost bias in the cultural heritage sector, the eighth hypothesis is:

Hypothesis 8: *Subjects that are held accountable for their choices are less susceptible to sunk cost bias compared to subjects that are not held accountable.*

Methods

A survey was done under people working in the cultural heritage sector, more specifically under people that work on indoor-climate related projects. The full survey can be seen in Appendix A. It contained a control group that had low accountability and a treatment group with high accountability. The questions in the survey were designed to measure the confirmation bias, status quo bias, zero-risk bias, and sunk cost bias. There were also some general questions asked to get an insight in the sample. Binomial tests were done to test if most of the subjects were susceptible to confirmation bias, zero-risk bias, and sunk cost bias. Fisher's exact tests were done to test the effect of accountability on the confirmation bias, zero-risk bias, and sunk cost bias. Mann-Whitney U tests were done to test if subjects were affected by status quo bias and to test what the effect of accountability is on the status quo bias.

All respondents were aware of the following. The data collected will only be used for this research, all given answers were anonymous and the respondents were able to quit the survey at any time.

Experimental design

An experimental between-subjects study was done based on the survey. Subjects were randomly assigned to either the control group or the treatment group. The control group had low accountability while the treatment group had high accountability. High accountability was realized by letting the subjects justify their answers of which they were aware while making their decision. Furthermore, for all biases except the confirmation bias the subjects were informed they got to make the final decision. While the low accountability control group only had a vote that could influence the final decision. The four biases and eight hypotheses were tested as follows:

Confirmation bias

The confirmation bias variable was based on Schulz-Hardt et al. (2000). They identify confirmation bias when subjects prefer supporting information over conflicting information. Furthermore, the questions used to measure this variable are based on Gertner (2016). Based on the literature it is expected that there is a confirmation bias.

To measure the confirmation bias, subjects first were given a situation where they would have to decide to add (more) insulation to a certain museum building or not. Some pros and cons were mentioned about adding insulation. The subjects were asked how likely it was that they would add insulation on a five-point Likert scale. Secondly, the subjects were given the opportunity to get more information about this situation. They could pick between an article about the benefits of good insulation in museums or an article about the importance of the architectural value of museum buildings.

The variable for confirmation bias equals zero if the subject preferred adding insulation for the first question and an article about the importance of the architectural value of museum buildings for the second question (conflicting information) or if they were not likely to add insulation and they chose the article about the benefits of insulation (conflicting information). The variable for confirmation bias equals one if they chose supporting information for the second question. If they were indifferent between adding insulation or not the variable was reported as missing.

To test if most subjects are susceptible to the confirmation bias, a binomial test with a P-value of 0.5 was done. This test also tested if subjects did not give random answers. Secondly, a Fisher's exact test was done to test if the confirmation bias is evenly distributed over the control and treatment group.

Status quo bias

The status quo bias variable was measured based on Samuelson & Zeckhauser (1988). For this bias, the control group was randomly split into two groups, both groups still had low accountability,

however for one group there was a status quo added into the question. The status quo added to the question contained that the current temperature of the museum was 20° C. The treatment group remained the same size and had high accountability and the status quo. The subjects were asked to choose a temperature between 16° C and 20° C for the galleries of a museum. They could pick the temperature to one decimal place. They were also given some pros and cons for both high and low temperatures.

Firstly, it was tested if subjects are affected by the status quo by comparing both control groups. A Mann-Whitney U test was done to test the difference of the median of the control group without the status quo and the median of the control group with the status quo.

Secondly, it was tested if status quo bias is different for the control group with the status quo compared to the treatment group. Another Mann-Whitney U test was done to test the difference between the median of the two groups.

Zero-risk bias

The variable used for zero-risk bias is based on Schneider et al. (2017). Classic economic theory predicts that there should be no zero-risk bias. However, based on the literature, it is expected that there will be zero-risk bias in this situation. Furthermore, it is expected that accountability reduces the zero-risk bias.

To measure the zero-risk bias, subjects were asked to use an intervention on two indoor climate projects: Project A and Project B. Both projects are equally important. Project A has a risk of failing of 30% while project B has a risk of failing of 5%. This intervention can reduce the risk of Project A to 20% and completely remove the risk of Project B. The zero-risk variable equals 0 if the subject decided to use the intervention on Project A and the variable equals 1 if the intervention was used on Project B.

To find out if most subjects are susceptible to zero-risk bias and if people did not fill in the survey randomly, a binomial test with a P-value of 0.5 was done. Secondly, a Fisher's exact test was done to test if the zero-risk bias is evenly distributed over the control group and treatment group.

Sunk cost bias

The question that measures sunk cost bias is based on Arkes & Blumer (1985). Based on the literature it is expected that people working in the indoor climate context are susceptible to sunk-cost bias. Based on Simonson and Nye (1992) it is expected that accountability will reduce the sunk-cost bias.

To measure the sunk cost bias variable, subjects were given a situation where they had to choose between two insulation projects. €1 Million has already been spent on Project A and the remaining cost to finish the project is €500,000. Project B is a better alternative compared to Project A. However, for Project B to succeed, the already installed insulation of Project A needs to be removed. The removal of the Project A and installation of Project B would cost a total €500,000. The estimated time for both projects is the same. If subjects chose to continue Project A the sunk cost variable equals 1 and if they chose Project B the variable equals 0.

Another binomial test with a P-value of 0.5 was done to test if most subjects are susceptible to sunk cost bias and if the questions were not filled in randomly. Furthermore, a Fisher's exact test was done to test if the sunk bias is evenly distributed over the control group and treatment group.

Assumptions

The binomial test has a few assumptions (Laerd statistics, n.d.). The response variable has to be a binary variable, which is the case. The variable can be a success or a failure, for the test used in this research, the biases can be specified as a success or a failure. The P-value remains constant. The P-value for this research is constant on 0.5. The observations are independent, this is highly likely. It is not expected that subjects interacted with each other. Lastly, the sample has to be representative of the population, since all subjects were working in the cultural heritage sector, it is expected that the sample is representative.

The Fisher's exact test also has a few assumptions (Statistic Solutions, n.d.). It assumes that random sampling is done, the respondents are not able to influence each other, and mutual exclusivity is assumed. All these assumptions hold for the tests, because random sampling was done, and it is very unlikely that subjects influenced each other. Mutual exclusivity holds since subjects were only able to answer the survey one time and were put in one group.

The Mann-Whitney U test has four assumptions (Laerd statistics, n.d.). It assumes that there is one dependent variable on a continuous or ordinal level. The temperature is a continuous dependent variable, so this assumption holds. The second assumption is that there is one independent variable that consists of two categorical and independent groups. This is the case for both tests, so this holds. The third assumption is independence. It is unlikely that the subjects interacted with each other, and subjects were only in one group. Lastly, the fourth assumption is about the shape of the distribution of the two independent groups. If the shape of the distribution is different the Mann-Whitney U test is used to test the differences in distribution, otherwise it is tested to test if there are differences between the medians. For both tests the shapes of the distribution are different (Appendix B), so the Mann-Whitney U test tests the difference in medians.

Sample

Sample size calculation

The effect sizes used to calculate the sample sizes for is based on Schneider et al. (2017). The expected effect size used is 0.3, calculated by taking the absolute differences of the proportions of the control and treatment group. Using α=0.05, a power of 0.8 and an allocation ratio of 1. For the binomial test a total sample size of at least 21 is required. For a one-sided Fisher's exact test Stata gives a total sample size of at least 82. A one-sided Mann-Whitney U test has a total sample size of at least 278. For the fourth hypothesis a two-sided Mann-Whitney U test requires a total sample size of at least 352.

Actual sample

The respondents were recruited by a survey link in an e-mail. The survey was sent out internationally to people working in the cultural heritage sector. They were encouraged to share the survey with colleagues. The survey was open from 21-6-2021 till 28-6-2021.

The total sample size consists of 44 subjects. 11 Respondents that did not complete all questions about the biases were removed from the sample. If people filled in an impossible age or if they filled in nonsense for the open questions, they would be removed. This was not the case. Which brings the total sample to 33 subjects.

Descriptive statistics

Table 1: Descriptive statistics: Age in years

Variable	Obs	Mean	Std.Dev.	Min	Max
Age	30	45.967	11.981	25	63

Table 2: Descriptive statistics: Gender

Gender	Freq.	Percent	Cum.
Male	12	37.50	37.50
Female	18	56.25	93.75
Prefer not to say	2	6.25	100.00

Table 3: Descriptive statistics: Country of residence

Country of Residence	Freq.	Percent	Cum.
Other	1	3.03	3.03
Austria	1	3.03	6.06

Canada	2	6.06	12.12
Denmark	17	51.52	63.64
France	3	9.09	72.73
Netherlands	2	6.06	78.79
Norway	2	6.06	84.85
South Korea	1	3.03	87.88
Sri Lanka	1	3.03	90.91
United Kingdom	1	3.03	93.94
United States	2	6.06	100.00

Table 4: Descriptive statistics: Role in the decision-making process

Role in decision-making process	Freq.	Percent	Cum.
Decision maker	3	9.09	9.09
Supervisor	1	3.03	12.12
Advisor	25	75.76	87.88
Advisor and Other	1	3.03	90.91
Other	3	9.09	100

The average age of the sample is around 46 years old (table 1). There were slightly more female respondents compared to male respondents (table 2). A bit more than half of the sample lives in Denmark, the other half of the sample come from a different range of countries across the world (table 3). A bit more than 75% of the sample are advisors in the cultural heritage sectors (table 4). The three responses that filled in Other were conservators two times and a curator one time.

Results

Confirmation bias

A binomial test was done to test if most subjects were susceptible to confirmation bias and to test if the questions were not filled in randomly.

Table 5: Binomial test of the confirmation bias

Variable	Observations	Observed k	Expected k	Assumed p	Observed p
ConfirmationBias	26	12	13	0.5	0.462

Using table 5, only 12 of the 26 subjects were susceptible to confirmation bias. The P-value of the binomial test which tested if most people were susceptible is 0.721. This P-value is bigger than 0.05,

so it cannot be concluded that most subjects were susceptible to confirmation bias. Given α=0.05. This test has a power of 0.08 with an effect size of 0.04 which was calculated as the absolute difference of the expected P-value 0.5 and the actual P-value.

The P-value of the two-sided test is 0.845. This is also bigger than 0.05, so it cannot be concluded that the answers were not filled in completely random. Using the same calculation of the effect size, the power is 0.0414 and an effect size of 0.0385. Given α=0.05

A Fisher's exact test was done to test if there was more confirmation bias in the control group compared to the treatment group.

Table 6: Distribution of Confirmation bias over the control and treatment group

	treatment		
ConfirmationBias	0	1	Total
0	5	9	14
1	7	5	12
Total	12	14	26

Using Table 6, the proportion of the treatment group that was susceptible to confirmation bias was smaller compared to the proportion of the control group. The one-sided Fisher's exact test gives a P-value of 0.224. This is bigger than 0.05, so the null hypothesis that the confirmation bias is evenly distributed over the control and treatment group cannot be rejected. The Fisher's exact test has a power of 0.20, with an effect size of 0.23, calculated by taking the absolute differences of the proportions of the control and treatment group. Given α=0.05.

Status quo bias

Table 7: Mann-Whitney U test of the chosen temperature in the control group with the status quo against the control group without the status quo.

Control status quo (1) vs Control no status quo (0)	Observations	Rank Sum	Expected
0	10	98	95
1	8	73	76
Total	18	171	171

The status quo was set high, so it is expected that the control group with the status quo has the higher median. Using table 7, this group indeed has a slightly higher median. The one-sided Mann-Whitney U test has a z-score of 0.286. Which gives a P-value of 0.387. The P-value is bigger than 0.05 so, this test is not significant on a 5% level. This means that the null hypothesis that the medians are the same cannot be rejected. The test has a power of 0.12. The effect size is 0.11, calculated by taking the absolute differences of the means of the two groups. Given α=0.05.

Table 8: Mann-Whitney U test of the chosen temperature in the treatment with status quo against the control group with the status quo.

Treatment(1) vs Control (0)	Observations	Rank Sum	Expected
0	8	94	96
1	15	182	180
Total	23	276	276

It was expected that accountability would reduce the bias, so it was expected that the median of the treatment group is lower since the status quo was set high. Based on table 8, the median of the treatment group is slightly higher compared to the control group. The two-sided Mann-Whitney gives a z-score of -0.132. This z-score gives a P-value of 0.895, which is bigger than 0.05. Therefore, this result is not significant and the null-hypothesis that the medians of the control group with the status quo and the treatment are different cannot be rejected. The test has a power of 0.05, an effect size of 0.00 calculated by taking the absolute differences of the means of the two groups and using α=0.05.

Zero-risk bias

To test if most subjects are susceptible to zero-risk bias and to test if the answers were not filled in completely randomly, a binomial test was done.

Table 9: Binomial test of the zero-risk bias

Variable	Observations	Observed k	Expected k	Assumed p	Observed p
ZeroRiskBias	33	9	16.5	0.5	0.273

Using table 9, only 9 of the 33 subjects were susceptible to zero-risk bias. Therefore, the P-value of the one-sided test where k is bigger than the expected k is 0.998. So, it cannot be concluded that most subjects are susceptible to zero-risk bias. Given α=0.05, the power of this test is 0.84. The effect size is 0.23, which was calculated as the absolute difference of the expected P-value 0.5 and the actual P-value.

The two-sided binomial test gives a P-value of 0.014. 0.014 is smaller than 0.05, this means that the answers were not filled in completely randomly. Furthermore, it shows a significant effect that most people are not susceptible to zero-risk bias. Given α=0.05, the power of this test is 0.73. With the same effect size as the one-sided test of 0.31.

A Fisher's exact test was done to test if the zero-risk bias is evenly distributed over the control and treatment group.

Table 10: Distribution of Zero-risk bias over the control and treatment group

	treatment		
ZeroRiskBias	0	1	Total
0	10	14	24
1	8	1	9
Total	18	15	33

Using table 10, the proportion of the zero-risk bias in the treatment group is lower than the proportion of zero-risk bias in the control group. The one-sided Fisher's exact test gives a P-value of 0.018. The P-value is smaller than 0.05, so the null hypothesis that zero-risk bias is evenly distributed over the control and treatment group is rejected. The alternative hypothesis that zero-risk bias is unevenly distributed is accepted. In other words, there is more zero-risk bias in the control group. This test has a power of 0.78. The effect size is 0.38, calculated by taking the absolute differences of the proportions of the control and treatment group, given α=0.05.

Sunk cost bias

Another binomial test was done to test if most subjects were susceptible to sunk cost bias and to test if the question was not filled in randomly.

Table 11: Binomial test of the sunk cost bias

Variable	Observations	Observed k	Expected k	Assumed p	Observed p
SunkCostBias	33	6	16.5	0.5	0.182

Using table 11, only 6 of the 33 were susceptible to sunk cost bias. So, more people were not susceptible to sunk cost bias. The P-value of the one-sided test where k is bigger than the expected k is 0.999. Given α=0.05, this test has a power of 0.99. The effect size was calculated as the absolute difference of the assumed and observed p, which is 0.32.

The two-sided binomial test has a P-value of 0.000. This means that it can be concluded that the answers were not filled in completely randomly. Furthermore, it is significant on a 1% level that most subjects are not susceptible to sunk cost bias. Given α=0.05, this test has a power of 0.97. The effect size remains 0.32.

A Fisher's exact test was done to test if the sunk cost bias is evenly distributed over the control and treatment group.

Table 12: Distribution of Sunk cost bias over the control and treatment group

	treatment		
SunkCostbias	0	1	Total
0	15	12	27
1	3	3	6
Total	18	15	33

Based on table 12, the proportion of the treatment group that is susceptible to sunk cost bias is smaller than the proportion of the control group. The one-sided Fisher's exact test gives a P-value of 0.577. This is bigger than 0.05, so the null hypothesis that the sunk cost bias is evenly distributed over the control and treatment group cannot be rejected. The power of the Fisher's exact test is 0.04. With an effect size of 0.03 calculated by taking the absolute differences of the proportions of the control and treatment group given α=0.05.

Discussion

The goals of this research have been to test if most people are affected by the confirmation bias, status quo bias, zero-risk bias, and sunk cost bias and how accountability affects the biases. It was tested if most people were susceptible to the biases. Furthermore, an experiment was done using a treatment and a control group. The treatment group had to make and justify their decisions in a cultural heritage context, while the control group only had to make the decisions without justifying them. A sample of 33 people working in the cultural heritage sector was used.

Based on the given answers it cannot be concluded that there is confirmation bias. It could be the case that the answers were filled in randomly based on the binomial test. This is not in line with Schulz-Hardt et al. (2000), in which it was predicted that there is confirmation bias in decision-making. Using a Fisher's exact test, no significant effect was found that accountability would debias the confirmation bias in the cultural heritage context. This is unexpected, previous research had shown that accountability can reduce confirmation bias (Misra et al., 2019), so a significant result was expected. A possible explanation for these unexpected results is the small sample size, which makes it hard to get significant results. The small sample size also caused a low power for the tests.

For the status quo bias firstly a Mann-Whitney U test was done which tested if there was status quo bias in the cultural heritage context. Against expectations, no evidence was found that there was status quo bias. This goes against Simonson & Zeckhauser (1988) on which it was predicted that there would be status quo bias. Using another Mann-Whitney U test, there was no significant effect found for an effect of accountability on status quo bias. The lack of evidence for both tests could be

because they had an even smaller sample size, which made it hard to find significant effects. This also partially caused a low power for the tests.

For zero-risk bias, the binomial test showed significant results that the subjects did not fill in their answers completely randomly. It also showed significant results that most subjects were not susceptible to zero-risk bias. So, it cannot be concluded that there is zero-risk bias. This is different than what was predicted based on Schneider et al. (2017). Furthermore, a Fisher's exact test was done which found a significant difference in distribution of zero-risk bias between the control and treatment group. The treatment group was less likely to be affected by the zero-risk bias. So, there is some evidence that accountability can debias the zero-risk bias. However, the power of the test was lower than 0.8 due to the small sample size, which is important to take into account.

Lastly, the binomial test on the sunk cost bias showed as well that the answers were not filled in completely randomly. Furthermore, the binomial test showed that most subjects are not susceptible to sunk cost bias. Which is different than what was predicted based on Arkes & Blumer (1985). The Fisher's exact test did not show significant effects that accountability debiases sunk cost bias. This is different than what the research by Simonson & Nye (1992) showed. They found that accountability could prevent decision error in terms of sunk cost bias. Again, the insignificant results could be because of the small sample size, which also caused a low power for the test.

Limitations

For the internal validity of this research, as mentioned before, the small sample size is the biggest limitation of this research. This made it hard to find significant effects and caused a low power for all the tests that were used. A bigger sample size is recommended for future research.

Another limitation of this research is that the biases were only measured based on one situation. It could be the case that these biases were not very relevant in the situations used for this research, but they could be more relevant or less relevant in other situations. It is hard to say if the biases will be there in every different situation. For future research I would recommend focussing on the effect of accountability on one specific bias. Then the effect of accountability on the bias can be tested in different situations in the cultural heritage sector and mediating factors could be identified. A similar survey as the one used in this research could be used to test this.

Furthermore, the hypothetical situations were simplified which has an effect on the external validity. The simplified situations were necessary for the survey to work. Decisions in the cultural heritage sector are often more complicated as seen in the literature review. This could mean that people working in the cultural heritage sector will behave differently in practice when it comes to the more complicated decisions. Future research could be a field research, looking into real problems and

seeing how accountability affect those problems or how biases affect those situations. This field research could have a similar design as this study. When a decision has to be made about a certain topic, the decision makers can be randomly assigned to a control and treatment group. The treatment has to justify their decisions to the person that makes the final decision, while the control group does not have to do this. Then the groups can be compared to see if they made different decisions.

Lastly, this research only tested if most subjects were susceptible to the biases. It is also possible that a minority of people are susceptible to a certain bias. This can still be relevant, because a minority of people being susceptible to a bias can still influence the final decision.

Conclusion

Main findings

Based on the results it cannot be concluded that there is confirmation bias, status quo bias, zero-risk bias, and sunk cost bias when it comes to decision-making in the cultural heritage sector. For the zero-risk bias and sunk cost bias it was found that most people were not susceptible to the biases. However, there was some evidence found that accountability can reduce the zero-risk bias.

To answer the research question: *How does accountability influence the confirmation bias, status quo bias, zero-risk bias and sunk cost bias in the cultural heritage sector?*, no significant effects on the effect of accountability on confirmation bias, status quo bias and sunk cost bias were found. This is likely due to the small sample size. Accountability does appear to have a debiasing effect on the zero-risk bias in the cultural heritage sector.

Practical implications

Based on this research, I would recommend holding decision-makers accountable on an individual level when there are zero-risk options involved. This can make the decision-makers think about the problem more thoroughly and make better decisions. Accountability can be realised by making the decision makers justify their decisions to the person/people that has to make the final decision. Even though this is a simple form of achieving accountability, this research showed that it can work.

Furthermore, accountability can be realised by also making the decision-makers partly accountable for the final decision. If they are held partly accountable for the final decision it could make them think more thoroughly about the advises they give to the person/people that make the final decision.

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Appendix A: Survey

Master Thesis Decision Making

Start of Block: Introduction

Thank you for participating in my survey!

For my internship at the Cultural Heritage Agency of the Netherlands and my master thesis, I am analyzing decision-making in the cultural heritage sector.

You will be asked questions about four scenario's where you need to make a decision.

The survey should only take a few minutes and there are no wrong answers.

The data will only be used for this research. All given answers are anonymous and cannot be traced back to you.

You can quit the survey at any time.

End of Block: Introduction

Start of Block: Treatment group

Question 1A: A museum has to decide whether or not to add (more) insulation to the museum building facade. The insulation will improve the preservation of the collection and will give more opportunities to loan art pieces from other museums. However, this will come at the cost of the museum building. The museum building is considered of high architectural value. Adding extra insulation would have a significant negative impact on the architectural

value. You get to vote on whether to add (more) insulation or not. How likely are you to vote for adding insulation?

- ○ Very unlikely (1)
- ○ Unlikely (2)
- ○ Neutral (3)
- ○ Likely (4)
- ○ Very Likely (5)

Question 1B: You get the opportunity to get more information about this topic. You only have time to read one of the following two articles, which one would you choose? Please clarify your choice in the open text box.

- ○ An article about the benefits of good insulation in museums (1)
- ○ An article about the importance of the architectural value of museum buildings (2)

Question 1C: Imagine you would have to justify your decision of question 1B in writing. How would you explain your decision?

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Question 2A: A museum is working on two indoor climate projects: project A and project B. Both projects are equally important.
The risk of project A failing is 30% and the risk of project B failing is 5%.
An intervention is developed that could be used on one of the two projects to reduce the risk.
Using the intervention on project A would decrease the risk of failure to 20% for Project A.
Using the intervention on project B would completely remove the risk of failure for Project B.
You get to make the final decision. For which project would you use the intervention? Please clarify your choice in the open text box.

- ○ Project A (1)
- ○ Project B (2)

Question 2B: Imagine you would have to justify your decision in writing. How would you explain your decision?

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Question 3A:
A museum is currently working on Project A.**Project A**: The museum has spent €1 million on insulation of the galleries so far. The remaining cost to finish this project is €500,000.
Project B: a better insulation alternative was found, which is better for the preservation of the collection and better for the human comfort. However, the previously installed insulation from Project A would have to be removed. The removal of the Project A insulation and installation of this alternative would cost a total €500,000.
The estimated time for both projects is the same.
You get to make the final decision. Would you continue project A or start project B? Please clarify your choice in the open text box.

- ○ Project A (1)
- ○ Project B (2)

Question 3B: Imagine you would have to justify your decision in writing. How would you explain your decision?

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Page Break

Question 4A: A museum has to decide the temperature specifications in the galleries for the upcoming years. The current temperature in the galleries is 20° C. The optimal temperature for this specific collection is 16° C, a higher temperature would negatively impact the preservation of this collection. The optimal temperature for visitors is 20° C. A lower temperature would result in more complaints about the human comfort.
You get to make the final decision on the temperature specifications. How high would you set the temperature? Please clarify your choice in the open text box.

	16	17	18	19	20
Temperature (°C) ()					

Question 4B: Imagine you would have to justify your decision in writing. How would you explain your decision?

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End of Block: Treatment group

Start of Block: Control group

Question 1A: A museum has to decide whether or not to add (more) insulation to the museum building facade. The insulation will improve the preservation of the collection and will give more opportunities to loan art pieces from other museums. However, this will come at the cost of the museum building. The museum building is considered of high architectural value. Adding extra insulation would have a significant negative impact on the architectural value. You get to vote on whether to add (more) insulation or not. How likely are you to vote for adding insulation?

- ○ Very unlikely (1)
- ○ Unlikely (2)
- ○ Neutral (3)
- ○ Likely (4)
- ○ Very Likely (5)

Question 1B: You get the opportunity to get more information about this topic. You only have time to read one of the following two articles, which one would you choose?

- ○ An article about the benefits of good insulation in museums (1)
- ○ An article about the importance of the architectural value of museum buildings (2)

Page Break

Question 2: A museum is working on two indoor climate projects: project A and project B. Both projects are equally important.
The risk of project A failing is 30% and the risk of project B failing is 5%.
An intervention is developed that could be used on one of the two projects to reduce the risk. Using the intervention on project A would decrease the risk of failure to 20% for Project A. Using the intervention on project B would completely remove the risk of failure for Project B. You get to vote for one of the projects. For which project would you use the intervention?

- ○ Project A (1)
- ○ Project B (2)

Page Break

Question 3:
A museum is currently working on Project A.**Project A:** The museum has spent €1 million on insulation of the galleries so far. The remaining cost to finish this project is €500,000.
Project B: A better insulation alternative was found, which is better for the preservation of the collection and better for the human comfort. However, the previously installed insulation from Project A would have to be removed. The removal of the Project A insulation and installation of this alternative would cost a total €500,000.
The estimated time for both projects is the same.
You get to vote on one of the projects. Would you vote to continue project A or start project B?

- ○ Project A (1)
- ○ Project B (2)

Page Break

Question 4: A museum has to decide on the temperature specifications in the galleries for the upcoming years. The optimal temperature for this specific collection is 16° C, a higher temperature would negatively impact the preservation of this collection. The optimal temperature for visitors is 20° C. A lower temperature would result in more complaints about the human comfort.
You get to give an advice on the temperature specifications. How high would you set the temperature?

	16	17	18	19	20
Temperature (°C) ()					

End of Block: Control group

Start of Block: Control group (treatment status quo)

Question 1A: A museum has to decide whether or not to add (more) insulation to the museum building facade. The insulation will improve the preservation of the collection and will give more opportunities to loan art pieces from other museums. However, this will come at the cost of the museum building. The museum building is considered of high architectural value. Adding extra insulation would have a significant negative impact on the architectural

value. You get to vote on whether to add (more) insulation or not. How likely are you to vote for adding insulation?

- ○ Very unlikely (1)
- ○ Unlikely (2)
- ○ Neutral (3)
- ○ Likely (4)
- ○ Very Likely (5)

Question 1B: You get the opportunity to get more information about this topic. You only have time to read one of the following two articles, which one would you choose?

- ○ An article about the benefits of good insulation in museums (1)
- ○ An article about the importance of the architectural value of museum buildings (2)

Page Break

Question 2: A museum is working on two indoor climate projects: project A and project B. Both projects are equally important.
The risk of project A failing is 30% and the risk of project B failing is 5%.
An intervention is developed that could be used on one of the two projects to reduce the risk.
Using the intervention on project A would decrease the risk of failure to 20% for Project A.
Using the intervention on project B would completely remove the risk of failure for Project B.
You get to vote for one of the projects. For which project would you use the intervention?

- ○ Project A (1)
- ○ Project B (2)

Page Break

Question 3:
A museum is currently working on Project A.**Project A:** The museum has spent €1 million on insulation of the galleries so far. The remaining cost to finish this project is €500,000.
Project B: A better insulation alternative was found, which is better for the preservation of

the collection and better for the human comfort. However, the previously installed insulation from Project A would have to be removed. The removal of the Project A insulation and installation of this alternative would cost a total €500,000.
The estimated time for both projects is the same.
You get to vote on one of the projects. Would you vote to continue project A or start project B?

- ○ Project A (1)
- ○ Project B (2)

Page Break

Question 4: A museum has to decide the temperature specifications in the galleries for the upcoming years. The current temperature in the galleries is 20° C. The optimal temperature for this specific collection is 16° C, a higher temperature would negatively impact the preservation of this collection. The optimal temperature for visitors is 20° C. A lower temperature would result in more complaints about the human comfort.

You get to give an advice on the temperature specifications. How high would you set the temperature?

	16	17	18	19	20
Temperature (°C) ()					

End of Block: Control group (treatment status quo)

Start of Block: Demographic questions

*

What is your age?

_____

What is your gender?

- ○ Male (1)
- ○ Female (2)
- ○ Non-binary / third gender (3)
- ○ Prefer not to say (4)

What is your country of residence?
Country (1)

▼ Else (1) ... Zimbabwe (113)

What is your role in decision making processes related to the indoor climate of museums?

- ☐ Decision maker (1)
- ☐ Supervisor (2)
- ☐ Advisor (3)
- ☐ Else: (4) _____

End of Block: Demographic questions

Appendix B: Histograms Mann-Whitney U test

Figure 1: Histogram of question 4; Control group no status quo and Control group with status quo

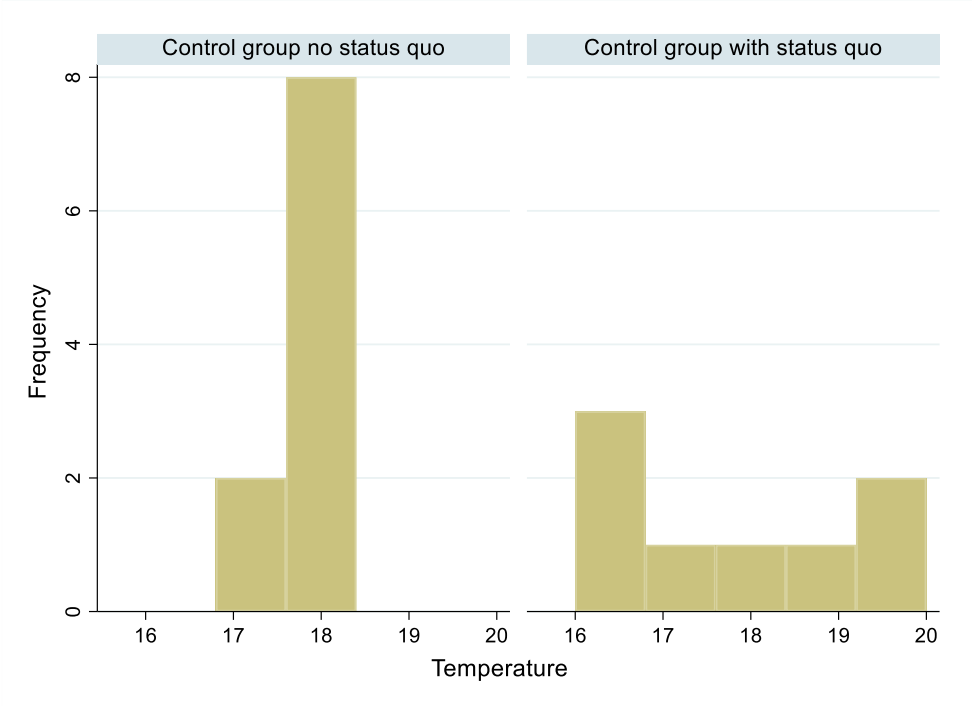

Figure 2: Histogram of question 4; Control group with status quo and Treatment group with status quo