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How to prevent a sinking ship: choice architecture as a means of reducing the sunk cost effect

Bachelor Thesis

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Abstract

The sunk cost effect is a famously discussed subject and has been known for many years, yet the issue is still prevalent in a real world setting. This paper advocates the use of choice architecture in order to mitigate the sunk cost effect on management. Existing literature has not yet examined the combination of these two fields, this paper marks the start for research on this relationship and calls upon further research on the subject. The goal of this paper is to raise awareness for the use of choice architecture in order to reduce the sunk cost effect on management. The paper specifically focuses on the framing aspect of choice architecture and introduces two new forms of framing; the uninterrupted and interrupted frames. The effects of these frames are evaluated by conducting a survey, though the results are minimal, they do indicate towards the possibilities, and warrant future research. Choice architecture allows for a wide array of uses, and correct application should improve the decision-making process and reduce the effect of biases caused by heuristics and bounded rationality. For management this should improve project decisions and reduce losses for organizations that would otherwise result from the sunk cost effect.

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Chapter 1

Introduction

Sunk cost can often lead to irrational behavior, potentially causing non-optimal decision making and resulting in less desirable outcomes. It is generally agreed upon that historic costs should not be considered when making a decision as only future costs and benefits are relevant (Bazerman and Moore, 2009). Yet studies have shown decisions get altered when introduced with sunk cost (e.g. Arkes and Blumer, 1985; Nevado, 2003; Roth et al., 2015). There are many possible psychological explanations for this effect such as the urge for self-justification or the unwillingness to ‘waste’ the investment, among many others. Managers may often find themselves in such situations, as they tend to be the ones to decide upon which project to undertake, if this project takes a turn for the worse they might be faced with a difficult decision, in which sunk cost might cloud their judgment. If this leads to a non-optimal decision, such as to continue with an undesirable project, it may result in negative consequences, not just for the manager but the organization as a whole. It is therefore highly relevant for organizations to try and reduce, or perhaps eliminate, the sunk cost effect, as this could mean preventing future losses and limiting risk.

The sunk cost effect has been known for over 30 years, yet the problem is still prevalent. No clear solution has been introduced and implemented; perhaps it is a symptom of its complicated nature. Parayre (1995) called it “one of the most persistent problems in decision making.” A possible way to tackle the sunk cost problem in organizations could be done by designing and optimizing choice architecture for managers. Choice architecture is a term first coined by Thaler and Sunstein (2008); they argued that by applying appropriate choice architecture for consumers, consumer decision making and overall welfare could be improved upon by reducing the effects of biases. Though they are more focused on the consumer side with how they make decisions on health and wealth, the same can be applied to managers. Management has to make plenty of decisions, the frame in which these decisions are available and presented, could theoretically be augmented to optimize the decision-making process and reduce biases, or in this case the sunk

cost effect.

This paper focuses on the relationship between choice architecture and the sunk cost effect, specifically on management personnel. How can choice architecture be used in order to reduce or eliminate the sunk cost effect on managers? Though choice architecture is a very broad term and has many uses, as such this paper will mostly cover one specific form of choice architecture, specifically it will introduce a new form of framing called the 'interrupted' frame. The goal of this paper is to create awareness for the use of choice architecture to combat the sunk cost effect on management. Up until now, the two subjects have merely been researched individually; the interesting relationship between the two has not yet been properly researched.

The paper is structured as follows; first, existing and relevant literature will be discussed, then this paper will build upon prior literature by expanding on a unified decision-making model, subsequently the hypothesis will be developed. In order to better evaluate the hypothesis a survey was conducted, of which the goal, methodology and results will be discussed. Following that, the limitations of this paper, improvements and other avenues for future research will also be covered, and finally everything will be tied together in the conclusion.

Chapter 2

Theoretical Framework

2.1 The sunk cost effect

Staw (1976, 1981) studied the escalation of commitment to a course of action and found that decisions resulting in negative outcomes would lead to an even higher commitment of resources into that same chosen action, all in an effort to potentially recoup their losses. He argues that personal responsibility and the need for self-justification are key factors that might explain this phenomenon. This type of behavior is not in line with rational choice theory; instead prospect theory (Kahneman and Tversky, 1979) is often taken as basis. In prospect theory a gain frame leads to risk aversion and a loss frame in turn leads to risk seeking behavior. This is often argued to be the case for the sunk cost effect; a person who has gone through an unsuccessful investment finds himself in a loss frame where further losses no longer have the same impact as before and instead comparable gains are valued higher. Image theory (Beach, 1990) also provides helpful distinction between types of decisions, which Garland and Conlon (1998) apply to the sunk cost effect. Specifically, they distinguish between utilization and progress decisions. Utilization decisions are essentially choices between alternatives with differing levels of sunk cost or the level of usage of an already acquired and paid for product or service. Progress decisions occur after a decision-maker has already invested into an initial project, thus incurred sunk cost, and then later acquires new information, which was previously unavailable, and has to now decide upon the continuation of the project. In the latter type, the sunk cost effect can be described as an escalation of commitment within a loss frame; where when an investment in money, effort or time has been made a greater tendency to continue an endeavor is manifested.

Arkes and Blumer (1985) conducted several experiments to test the sunk cost effect, they concluded that people emit irrational behavior when presented with sunk cost and have the tendency to throw good money after bad. They describe the desire not to appear wasteful as a psychological

justification for this type of behavior and find that having taken prior courses in economics does not lessen this effect. More recently, Roth et al. (2015) conducted a meta-analysis on the sunk cost effect and found clear evidence for the sunk cost effect; furthermore they too found that the decision-maker's background and familiarity with economic decision-making does not reduce this effect. They did however find a difference in the size of the sunk cost effect when it came to the different types of decisions with respect to time. For utilization decisions the more time in between the initial investment and the eventual consumption the lower the size of the sunk cost effect, arguing that people tend to mentally forget the pain of paying the more time passes. Whereas for progress decisions effect size increases with time, they argue that the time itself can be considered an investment and thus sunk cost. An increase in the amount of sunk cost subsequently increases the sunk cost effect (Nevado, 2003; Baliga and Ely, 2011). Considering the relationship between time and sunk cost, Baliga and Ely (2011) propose that sunk cost may be a helpful tool to coping with limited memory. The more time passes and new information arrives, a decision-maker may no longer remember all the reasons why he began the project in the first place. He may be missing out on information—which may very well still be relevant—as a result of his limited memory. The sunk cost in that case may provide additional information about future profits and help improve subsequent decisions, therefore simply completely ignoring all sunk cost may not be the best solution against the sunk cost effect, thus alternatives should also be considered. Not that ignoring sunk cost tends to always work anyways; often times, even people who specifically learned not to include sunk cost in their decision-making still get affected subconsciously.

2.2 Choice architecture

Research into the framing of decisions has shown that when the same problem is framed differently, preferences can be shifted, resulting in differing outcomes (Kahneman and Tversky, 1981, 1986; Kühberger, 1998). Framing has a wide array of uses, for example by stating the problem in a loss or gain frame a person's behavior towards risk can be altered, or even just by changing the wording of a problem a different decision might be made. In that sense, framing decisions regarding sunk cost problems in an optimal fashion, such that it would minimize the sunk cost effect, could benefit organizations and managers alike. Thaler and Sunstein (2008) suggested the use of choice architecture in order to 'nudge' consumers into the correct direction within a decision-making environment. Choice architecture is essentially the context in which choices are presented as well as the design of those choices, which means that framing and choice architecture are closely related. They argued that people are susceptible to biases and limited by their own bounded rationality, which is why choice architecture can be highly useful in order to optimize decisions. One example that is relevant in the case for sunk cost is the preference for the 'default' option, which represents

the path of least resistance. People facing important and difficult decisions may often choose to simply do nothing or continue as planned as per the ‘status quo bias’ (Samuelson and Zeckhauser, 1988).

Choice architecture is a form of ‘libertarian paternalism’ (Thaler and Sunstein, 2003), which is the idea that institutions can affect behavior and steer people in the right direction whilst maintaining the freedom of choice. Johnson et al. (2012) outline several tools available for a choice architect; they divide these tools into two categories: tools for structuring choice tasks and tools for describing choice options. Furthermore, they argue the use of defaults to be one of the most powerful tools available to the choice architect. Though Thaler and Sunstein’s (2008) work regarding choice architecture is mostly in the direction of optimizing consumer welfare and has consumers as the decision-makers, the same can be applied towards managers. Virine and Trumper (2013) do exactly that, although they call it ‘choice engineering’, and make a case for the use of choice architecture for project management as they too tend to be affected by common biases.

2.3 Debiasing

The sunk cost effect is essentially a behavioral trap that is closely related with several biases. For example, the previously mentioned status quo bias is one such bias, which is most likely positively correlated with the sunk cost effect. Then there is also the optimism bias, which causes people to be overly optimistic over their future; overestimating the likelihood of positive events and underestimating the likelihood of negative events (Sharot, 2011). In the case of the sunk cost effect a manager may overestimate the future prospects of the project even though current information indicates otherwise. Closely related is the overconfidence bias (Gilovich et al., 2002), wherein the manager may overestimate their own capabilities and assume they will be able to successfully complete the currently failing project. Another relevant bias to the sunk cost effect could very well be the anchoring bias, though this might be in contradiction to the previously mentioned effect of limited memory. The anchoring bias causes decision-makers to rely too heavily on initial pieces of information when making subsequent decisions (Gilovich et al., 2002). In the sunk cost effect on management this could be the initial information the manager has when initiating a project, this initial information would in this case be the ‘anchor’ and the manager could rely too heavily on it as opposed to more recently received information. Finally prospect theory’s loss aversion is another bias closely related with the sunk cost effect as previously explained. These are just a few relevant examples and though they are not the same as the sunk cost effect, they are most likely positively related, therefore it’s important to figure out a way to work around these biases and avoid the trap that is the sunk cost effect.

Managers have to cope with plenty of decisions throughout the day and in order to ease the decision-making procedure they tend to use heuristics during their decision-making processes. These heuristics as well as the managers' bounded rationality may result in biases, including the ones mentioned before; reducing these biases should reduce the sunk cost effect and improve decision-making. Hafenbrack et al. (2014) investigated the debiasing effect of meditation on the sunk cost effect; they found that increased mindfulness, as a result of meditation, reduced the tendency to allow prior costs to influence current decisions. Reduced accountability is also argued to have a debiasing effect; according to Mahlendorf (2015) increased 'allowance for failure' reduces project escalation. Gerling (2009) addresses the role of management accounting in debiasing in order to improve managerial decision-making. He recommends the use of feedback in order to learn from prior actions and reduce the effect of sunk cost in future environments, but this would require mistakes to already have been made due to the sunk cost effect. Even then, pride paired with the self-serving bias (Luft and Shields, 2010) would reduce the effect of learning from past mistakes, even if feedback is given, it may be disregarded. Instead choice architecture, and specifically framing, could potentially prevent the sunk cost effect from occurring in the first place.

To evaluate how exactly choice architecture can be applied within firms in order to reduce the sunk cost effect on managers, it would be helpful to look at a general model for behavioral decision-making and examine how the process can be altered. Laing et al. (2014) presented a unified model for researching behavioral economic decisions that incorporates sunk cost; they combine the behavioral theories of prospect theory and image theory to predict rational choice (expected utility theory). This model provides a useful framework which can be manipulated by adding or changing variables for testing the predicted outcomes. Specifically, this paper will use the sunk cost reference point and expand upon the framing by incorporating choice architecture, beyond the standard positive and negative frames from prospect theory.

Chapter 3

Hypothesis Development

Figure 3.1 presents a slightly modified version of Laing et al.'s (2014) model; the additions to the model are colored in red. Their model focuses on the two frames from prospect theory, the positive and negative frames. This paper acknowledges the framing effect of these frames and also adds two additional frames to examine, namely the 'uninterrupted' and 'interrupted' frames. The uninterrupted frame relates back (explicitly) to the progress decision; where a decision is made on an ongoing project and is thus framed as in progress, this can be viewed as the 'standard' frame for progress decisions. The interrupted frame however, puts the project in a momentary lull and provides the decision-maker with time to make up his or her mind during this temporary intermission. By doing this, the decision is no longer explicitly a progress decision; it is now a combination of both: part progress decision and part utilization decision. It is partly still a progress decision as it concerns a previously started project and now also partly a utilization decision as the choice is now whether to re-start the project or not, which can be viewed as a decision between (new) alternatives with differing sunk cost.

Recall the previously mentioned status quo bias that causes a preference for the path of least resistance. A choice architect could technically use this to his advantage and allocate a default to the preferable option, see for example the opt-out program for organ donations as opposed to opt-in (Johnson and Goldstein, 2004), or re-frame the decision and remove an undesirable default. In terms of the sunk cost effect, purchasing a product or investing into a project comes with the expectation of utilization for that product or progressing within that project and thus puts the decision-maker on a default path (Gilovich et al., 2002). This paired together with the difficulty of choosing an alternative caused by the desire not to appear wasteful and the need for self-justification may impose the default as the preferable option, even when it isn't optimal. From this it follows that the sunk cost effect could theoretically be reduced by re-framing the decision and re-allocating the default away from the choice with the sunk cost. Re-framing the decision in

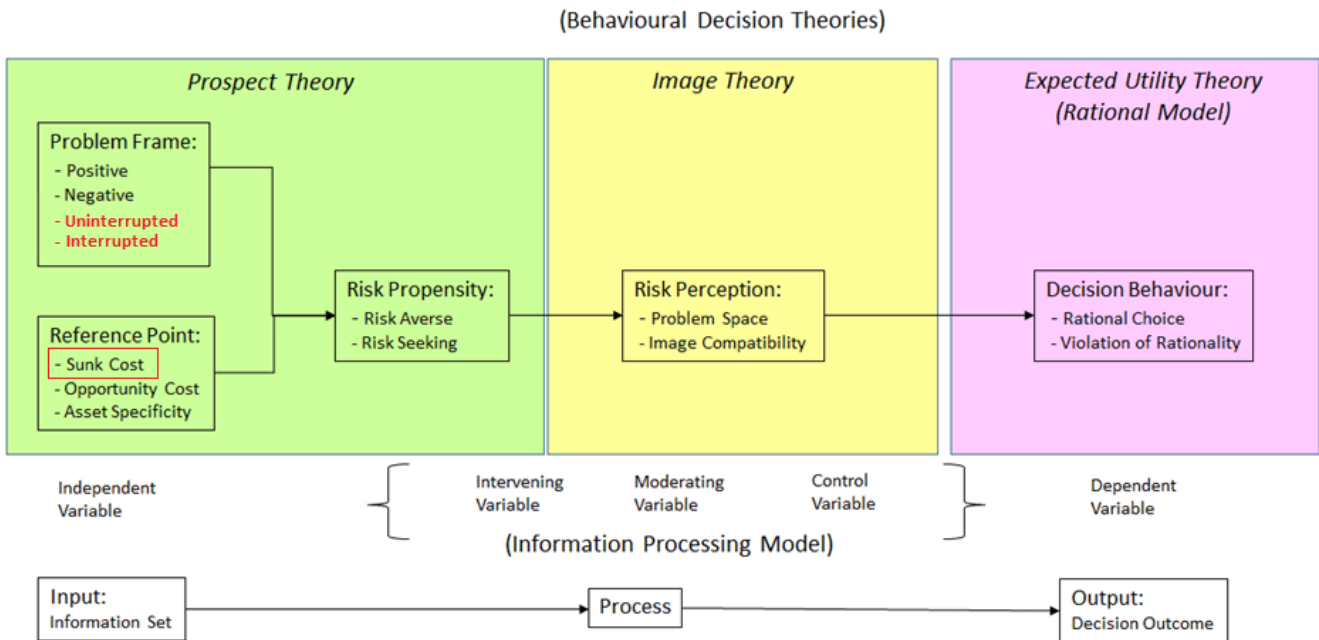


Figure 3.1: Unified Model for Researching Behavioral Economic Decisions (Laing et al., 2014) - A modified version, alterations presented in red.

an interrupted frame as opposed to an uninterrupted one could potentially achieve exactly that, as it may disrupt the initially formed expectation of utilization/progress.

This leads to the following hypothesis: *Re-framing the project continuation decision by temporarily halting the project will reduce the sunk cost effect on management.*

Consider the following situation; a manager initiated a project a while back, recently however new information has come to light and the project is no longer desirable, yet a fair amount has already been invested into it. It is a standard sunk cost situation, in which the manager now has to make a decision on the continuation of the project. In the present state the manager is in the uninterrupted frame, where he is exposed to several potential biases. The manager probably expected the project to continue and eventually come to completion, he may be overly optimistic over the future, or overconfident in his own abilities, or perhaps rely too heavily on initially received information. All of which, paired with his pride, need for self-justification, desire not to appear wasteful and ego; may fuel the sunk cost effect. These are all variables that differ between individual managers, some may be unable to see over their own pride and are fully confident in their own abilities to turn the project around, whereas others may be able to acknowledge the project as a failure and cut their losses. However, with the use of choice architecture it could be possible to, on average, lower these variables.

Management accountants or higher-ups, whichever are to be the choice architects, could introduce the manager into the interrupted frame. This could be done by halting their project for the

day, temporarily moving all (non-essential) labor elsewhere, or even just giving them the day off. The manager can then be given that day to decide whether to start the project back up again or proceed elsewhere. This would in a sense remove the default bias towards the choice of continuing, as the project is no longer on a railway track so to speak but has instead come to a halt. Thus the status quo bias has been reduced; moreover the optimism and overconfidence biases might also get reduced. By having another party, in this case their higher-ups or management accountants, having to step in, the manager's self-confidence and trust in the project may get lowered. Of course you don't want to unnecessarily demoralize your managers; a low confidence and pessimism are also undesirable traits. This effect all depends on the implementation, if it is done in a correct fashion, or perhaps becomes the standard, this effect could be lowered. Another effect that could potentially be achieved would be the 'de-anchoring' effect, by removing all other responsibilities and giving the manager the time to think clearly, the relative weight of the initial information may be reduced. This could be amplified by asking the manager to meditate during that time, which would increase his mindfulness and reduce the weight of prior costs as researched by Hafenbrack et al. (2014). Of course not everyone believes in meditation and one can hardly force meditation upon someone. Though the idea of how best to fill up the gap during the interrupted frame is open for discussion and left for future research as it won't explicitly be covered in this paper.

Chapter 4

Methodology

As already mentioned; this paper examines the relationship between choice architecture and the sunk cost effect, and argues that the first can be used to mitigate the latter. To examine how exactly this can be achieved, this paper focuses on a specific form of choice architecture. Though there are probably other ways in which choice architecture could be applied in order to achieve similar results, these alternatives are beyond the scope of this paper and instead left for future research on the subject. The focus in this paper lies on the, recently introduced, uninterrupted and interrupted frames and their effect on the sunk cost fallacy. As shown in figure 3.1, these frames are the input variables; they will have an effect on the decision-making process and in turn may alter the resulting decisions. The uninterrupted frame is the standard frame; it is assumed that project decisions are currently being made in this frame. In this current situation the sunk cost effect is present and may result in irrational decisions. The introduction of the interrupted frame into these choices will affect the decision-making process and probably have a debiasing effect, as argued in the previous chapter. This debiasing should result in a relatively lower weight being allocated to the sunk cost within the decision-making environment, and consequently reduce the amount of irrational decisions.

Literature from both the field of choice architecture and the field of the sunk cost effect were examined in order to provide sound arguments on the combination of the two fields. A lot of literature is available on the sunk cost effect, as it has been known and discussed for a long time now; the same applies to the framing of choices. Choice architecture on the other hand, originating from 2008, is still relatively new. As a result not a lot of literature on the subject is available, and the true extent and possibilities of choice architecture are still undiscovered. Unfortunately, no literature is available on the combination of the two fields even though this paper argues that choice architecture could provide a real solution to the sunk cost effect, which—despite the amount of research on the subject—is still prevalent. This is why the main goal of this paper is mostly to

raise awareness for future research on combining these two fields.

In order to answer the hypothesis and help examine whether applying choice architecture to battle the sunk cost effect warrants future research, an online survey was conducted. The survey specifically tests (a mild version of) the effect of the recently introduced interrupted frame on management decision-making when presented with sunk cost. The survey consists of a total of 8 questions¹; the first 5 questions are basic categorizing questions that ask the respondent's gender, age group, employment status, relevant education as well as their affinity with economics, business or management. The remaining 3 questions, which form the main part of the survey, consist in two different forms; a set of questions within the uninterrupted frame as well as a set within the interrupted frame. The respondents will randomly be assigned one of the two sets and never see the other. These 3 questions each present the respondent with a unique situation involving a project with sunk cost and the question on how to proceed given new negative information regarding that project. In the questions within the uninterrupted frame the decision-maker chooses simply whether to continue or cancel the relevant project. As for the questions in the interrupted frame; the decision-maker is told that as a result of the recent news, higher-ups have decided to halt the project for the day and given you that day to decide whether to start it back up again or quit the project. For these final 3 questions the respondents were also asked to explain their chosen action.

The survey was public and distributed over the internet, as such people from all over the world participated in the survey. In total 48 complete responses were collected. The goal of this survey is mostly to get an initial indication for future research, for which this type of survey and sample group suffice, ideally however, similar surveys and experiments are to be conducted in a controlled environment and with a larger sample group. There was a fair bit of variety between the people that participated in the survey, as indicated by the results² of the first five questions, 60% (40%) were male (female), more than half were between the ages of 18–29, coincidentally slightly more than half consist of students. The majority however, has not studied in the direction of economics, business or management, and the average self-proclaimed knowledge on the subjects on a scale of 0–100 falls around the 40.

The survey was structured in a way so that, with the given information one choice is always the rational one to make. If all respondents are fully rational, then the same decision should be made, regardless of the type of framing. However, it is generally acknowledged that people do not always act rationally, and the same should apply to the sample group. Though this irrationality is what allows the sunk cost effect to take place, it also allows for framing to be used to counteract its effect. In this survey an effort is made to try and push a part of the respondents in the right direction by applying the interrupted frame.

¹View Appendix B for the full survey setup

²View Appendix A for the survey results for questions 1–5

Chapter 5

Results

Each of the three main questions asked will be presented below; the majority of the questions are the same for both sample groups where only the final sentence or two differ along with the wording of the choices. The parts that differ will be indicated by their respective type of framing. Below the first of the three main questions is presented along with its results, this question contained the least specific (numerical) information regarding the future prospects of the project and as such required more of a ‘gut-feeling’ from the decision-maker.

You are a manager at Test Inc., a decent mid-sized company that produces technologically intensive medical instruments. 6 Months ago you initiated a project into the development for a new product, a surgical instrument that would allow for faster and lower risk surgeries. The product would require a period of 1 year for research and development with costs being approximately €1.000.000 during that period. Afterwards the product was estimated to sell well as it would be the first of its kind. However, recently new information has come to light that a competitor of yours, Rival Inc., has been developing a similar albeit slightly superior product and they are planning on releasing their product in 3 months. Although your project is on schedule it is not possible to release the product before 6 months, and entering the market 3 months after Rival Inc.’s slightly superior version has been released will most likely have a high negative effect on sales. It is no longer possible to delay and alter the product in order to have a quality advantage. Currently €500.000 of the estimated €1.000.000 has already been invested and can no longer be regained.

Uninterrupted frame: *Should you continue or cancel the project?*

Answer	Response	%
Continue the project	11	46%
Cancel the project	13	54%
Total	24	100%

Table 5.1: Survey results Q6 - uninterrupted frame

Interrupted frame: *As a result of the recent news higher-ups have halted your project for the day and given you until the end of the day to decide whether to start the project back up again or quit the project. What is your choice?*

Answer	Response	%
Start the project back up again	8	33%
Quit the project	16	67%
Total	24	100%

Table 5.2: Survey results Q6 - interrupted frame

The above situation puts the respondent in a manager's position where he is presented with a sunk cost problem. Although unlike the following questions there is no expected value that one could calculate in order to make the appropriate rational decision, it should still be clear which choice is the rational one with the given information. If the sunk cost is taken out of the equation and instead the question is asked whether you would initiate a new project with otherwise the same above information, one can assume that most people would not undertake such a project with a high negative outlook. But because of the inclusion of sunk cost people try to justify the continuation of the project in all kinds of ways.

In the uninterrupted frame 46% of the respondents were likely affected by the sunk cost effect and have taken the irrational decision as a result, in the interrupted frame this is only 33%. Though the difference isn't large, it is still something to consider. Apparently, in this specific case, fewer people were affected by the sunk cost effect in the interrupted frame, as hypothesized. Although the effect of framing was fairly small, it is to be expected as the framing itself was minimal, since only the final sentence and wording of the choices differed.

The next question, presented below, again confronts the decision-maker with a sunk cost problem. Though in this case the expected value of the project can be calculated¹, which falls below the remaining investment², as such there should be no rational excuse for not quitting the project. There is however a fair amount of sunk cost as well as the existence of a possibility of turning a profit. This may lead an agent to act in an irrational way, although the probability is low and thus most likely only risk-seekers would be willing to undertake such an action.

One year ago, you, as manager of a company, initiated a project that would have a development time of 2 years and a total cost of €10.000.000 during that period, before the product hits the market. Initially the product was estimated to have a value of €12.000.000 during its entire life cycle. However, recent changes in the market have changed the prospects of the product for the worse. There is now an 80% chance the product will only have a value of €3.000.000, or a 20% chance for the initial value of €12.000.000. So far, €5.000.000 out of the €10.000.000 has already been invested and cannot be regained even if the project is discontinued. The project still requires the remaining one year and €5.000.000 for completion.

Uninterrupted frame: *Should you continue or cancel the project?*

Answer	Response	%
Continue the project	5	21%
Cancel the project	19	79%
Total	24	100%

Table 5.3: Survey results Q7 - uninterrupted frame

Interrupted frame: *As a result of the recent news higher-ups have halted your project for the day and given you until the end of the day to decide whether to start the project back up again or quit the project. What is your choice?*

¹ $80\% * €3.000.000 + 20\% * €12.000.000 = €4.800.000$

² $€4.800.000 < €5.000.000$

Answer	Response	%
Start the project back up again	4	17%
Quit the project	20	83%
Total	24	100%

Table 5.4: Survey results Q7 - interrupted frame

The sunk cost effect is seemingly lower in this case compared to the first problem. In both frames only a small percentage of the people chose to continue the project. Most people either calculated the expected value or were turned off by the low chance of ‘winning’. The people that did continue or re-start the project are most likely risk-seekers with a high risk tolerance. The difference between the two frames is very low here, 21% and 17% choose to continue and re-start the project respectively. Though the sunk cost effect is once more lower in the interrupted frame, in this case the difference is nearly negligible. But it does allow for the idea that on a larger scale paired with a higher difference in framing a more pronounced effect could be realized.

The next and final question is similar to the previous in the sense that once again the expected value could be calculated and compared with the remaining required investment of the project. In this case however, not only does the described situation differ but so do the numbers. This time around the expected value³ is higher than the remaining investment⁴, meaning that the rational choice would be to continue/re-start the project. Moreover, this time around the probabilities of gaining or losing are an equal 50–50, so the respondent’s specific attitude towards risk has less of an effect. This particular question, in which the rational choice is not to discontinue the project with the sunk cost, was added in order to check for (1) respondents that are specifically trying to avoid the sunk cost trap, even if in actuality, sunk cost or not, the better decision would be to continue the project and (2) people with high risk aversion in general.

You are a manager at a high tech software company and last year you initiated a project into new and innovative grounds. For the first time the company is working on virtual reality software, the market is fresh and growing rapidly. However your project has recently run into difficulties. Originally the project was supposed to last 18 months and cost a total of €20.000.000. Now it seems that on top of this the project would require an additional 3 months and €2.000.000 before it is ready to hit the market. Furthermore, market forecasts have changed for the worse; the hardware it requires to run on is still in its infancy and the industry is having trouble

³ $50\% * €0 + 50\% * €24.000.000 = €12.000.000$

⁴ $€12.000.000 > €7.000.000$

developing the appropriate hardware. Initially the software was forecasted to have a total value of €30.000.000. Now however, due to the severe uncertainty within the market, there is a 50% chance that the software will be completely useless and thus have a value of €0 or a 50% chance that it will have a value of €24.000.000. So far the project has been ongoing for one year and €15.000.000 has already been spent.

Uninterrupted frame: *Should you continue or cancel the project?*

Answer	Response	%
Continue the project	19	79%
Cancel the project	5	21%
Total	24	100%

Table 5.5: Survey results Q8 - uninterrupted frame

Interrupted frame: *As a result of the recent news higher-ups have halted your project for the day and given you until the end of the day to decide whether to start the project back up again or quit the project. What is your choice?*

Answer	Response	%
Start the project back up again	17	71%
Quit the project	7	29%
Total	24	100%

Table 5.6: Survey results Q8 - interrupted frame

The majority of people did indeed make the rational choice, though a few still decided to discontinue the project. Perhaps this is because of the possibility that they would lose everything as the project would end up earning nothing. Although the expected value exceeds the remaining investment, the chance that your project will end up having a value of 0, as opposed to any other low notional amount, could deter people that are risk averse from continuing the project.

Once again there is a slight difference between the two versions of frames, again fewer people decided to re-start the project (71%) compared to the people that chose to continue the project (79%). Even though this time around that was actually the rational choice. Perhaps this means that the interrupted frame might reduce the willingness of a manager to continue a project regardless of its positive or negative prospects.

Chapter 6

Discussion and Limitations

Overall, the results show only a small difference between the interrupted and uninterrupted forms of framing, in each case the project was more often continued as opposed to restarted. There are several limitations to the conducted survey that may have limited the results. First of all, the respondents merely read though a bit of text describing a situation and make a decision based off of that; they are barely involved, therefore eliminating any form of feeling ‘personally responsible’. A cornerstone of the sunk cost effect is the feeling of being personally responsible for the relevant sunk cost. This leads to what is often described as the causing effects of the sunk cost fallacy, namely the need for self-justification as well as the desire to not appear wasteful. There is no need to justify oneself when that person does not feel personally responsible in the first place, furthermore, wasting resources is an entirely different matter when the person is responsible for those resources or not. In this case the respondents did not actually initially decide upon the projects that are discussed in the sunk cost problems, therefore the sense of personal responsibility is highly reduced. Besides that, the fact that most respondents have never studied within the field may cause them to be unable to relate to the manager described in each situation. Together, this has probably resulted in a lower sunk cost effect; in turn the observed framing effect will then also be low.

Secondly, the applied choice architecture was very minimalistic, as mentioned previously the only differences in framing were the final sentence and wording of the choices. It stands to reason that a minimalistic application of choice architecture will also have a minimal effect. Most importantly though, the interrupted framing does not work well solely in a textual environment, basically there was no actual ‘interruption’, in both versions of the questions the respondents made their decisions within the same amount of time and in the same situation. Having a project actually get halted for the day will undoubtedly have a larger effect on a person’s decision-making than if it is just one sentence of a text that states it.

Furthermore, there are no alternatives stated, it may not be entirely clear what would happen next if a respondent were to choose to quit the project. Whereas if the respondent chose to continue the project it would be clear what is getting worked on. Vermillion et al. (2015) argue that having a clear alternative in the decision is crucial in mitigating the sunk cost effect. Perhaps the addition of one or more alternatives would stimulate the effect of the interrupted framing.

Finally, the numbers and writing of the questions themselves have most likely influenced the respondent's decisions in other ways as well. For the first question this could be the fact that it concerns a medical product, this may cause some people to want to continue the project simply for the sake of 'doing good' by increasing supply on the medical market, as opposed to maximizing profit. Secondly some may perceive the monetary values to be low, specifically the amount of sunk cost, when compared with the other problems, though the fact that this question comes first might reduce that effect. For the second question, the percentages and values used may have an adverse effect. The fact 80% results in a loss and 20% in a win will turn most people that are not risk seekers towards discontinuing the project. Although in this case this was done intentionally so as to preserve an expected value below the remaining investment whilst still having the possibility to come out on top, it should still be noted that these numbers have an effect of their own. For the final question a 50-50 chance was used, so that this is no longer present, however in this question the expected value is higher than the remaining investment. For this final question though, there is the possibility that nothing is gained and all investment lost if the project is continued, which is a type of 'worst-case scenario' and could affect the decision. Furthermore, the fact that it concerns the new and 'hyped' virtual reality market may also affect the respondents' attitudes towards this problem. They may for example believe that virtual reality is the future and have that affect their decision instead of explicitly using the given information in the problem. The fact that these 3 questions are so different does not mean that it is necessarily bad, just that it makes it difficult to compare the results between these questions.

All of these limitations notwithstanding, the results do still point towards the possibilities of using this type of choice architecture in order to reduce the sunk cost effect. The very goal of this simple survey was, not to find clear evidence for the hypothesized effect, but merely to get an indication for the sake of future research, which is believed to be warranted. Choice architecture is a very interesting tool that has many uses, and it could very well be applied to reduce the sunk cost effect on managers and not only in the form examined in this paper. But in order to figure out exactly how organizations could implement and apply choice architecture optimally, and to what extent the sunk cost effect would be affected, further research into the subject would be required.

Though these limitations are all regarding the used survey, there are also limitations to the idea itself of applying this type of choice architecture; these should also be points of interest for future

research. For example, costs of actually halting a project should be considered, though if this leads to a better long term—as a result of having overcome the sunk cost effect—the benefits may outweigh the costs. More importantly though, it may have psychological effects on the manager or alter his relationship with his colleagues and subordinates. First of all, the manager whose project gets halted may feel that his authority has been undermined, his position amongst his colleagues may have changed for the worse, his subordinates may lose trust in him, his reputation may be damaged etc., there are many possible side effects that should be considered. Secondly, there is the case of signaling; by halting the project, the manager may perceive it as a signal that quitting the project is what his higher-ups want him to do and he might as well do so, even though it may not necessarily be the optimal decision. Such possible effects should be considered going forward.

Chapter 7

Future Research

Having discussed the theory behind applying choice architecture in order to combat the sunk cost effect, as well as the limitations of this paper's survey, further (empirical) research on the subject is warranted. Though there are many ways choice architecture could theoretically be used, and research into each would be interesting, this section will mainly discuss how research into the use of the interrupted framing and its effect on the sunk cost effect, as mainly discussed in this paper, could be improved in the future.

First and foremost, a survey is not the optimal way to test the effect of this type of choice architecture on the sunk cost effect; instead an experiment would be more appropriate. Long questions with a fair bit of text are not very suitable for surveys as they quickly dissuade respondents from continuing with the survey, as was the case in this survey where many quit once they reached the second page. But most importantly, an experiment would allow the participants to have more of a feeling of personal responsibility compared to when a survey is used. This can be attained by initially having the sample group simply choose between a set of project alternatives, for which they again are placed in the perspective of the manager. The choices have to be relatively equal in prospects, i.e. no one single project should stand out as the best choice. Which project is actually chosen is not important, only the fact that they put real thought and effort into the decision and thus form a certain 'personal attachment' to the chosen project. Then turn each of these chosen projects into standard sunk cost problems, where again a decision on the project's continuation is required, much alike the situations described in this paper. After a while, invite the same participants back and present them with these sunk cost problems, of course regarding their own chosen projects. Making sure to divide the sample group by half and test the difference between the interrupted and uninterrupted frames on the sunk cost effect. This time around the participants will actually have chosen the projects themselves and feel more responsible for the results; this may allow the difference between the two forms of framing to be better highlighted.

Of course in this scenario the feeling of interruption may not fully be there yet as the project is not actually being worked on in the experiment. Perhaps a more interesting experiment could be conducted on students and their school projects, if possible and without negatively affecting the students. For example, the students would choose their own subject on a certain school project, their sunk cost would be the time and effort put into that project, of course this would mean the monetary sunk cost is no longer prevalent. Then after a while, the teacher or project supervisor presses concerns on the future of the chosen subject and its potential and noting that maybe a different subject might be better, providing the student with the choice of continuation on the current subject, without making the choice compulsory. For one group of students they could be asked to think about it whilst still continuing work on their project, for another group of students they could be asked to stop work on the project for a while whilst they think about it. In this example of an experiment there is both a feeling of responsibility as well as an actual interruption, together this should significantly increase the potential effect. This type of experiment could be conducted within any other type of sunk cost related progress decisions, even though it is not necessarily in the realm of management, the implications are still relevant for managers as it could be argued that their decisions would be affected in a similar fashion.

There are many other ways to empirically test the effect of choice architecture on the sunk cost fallacy, the above described possibilities are one such way where personal responsibility is raised and the interrupted frame is more explicit. This creates a better distinction between the two types of frames, and will most likely allow for more significant results. As mentioned earlier there are also many other areas of choice architecture that haven't been covered in this particular paper. For example there are many different types of framing that could be applied, be it the positive and negative framing from prospect theory or other types of framing such as the discussed interrupted and uninterrupted framing. Outside of that there is the way in which information is presented to the manager, visualization of the process, having progress decisions be made by uninvolved managers, work atmosphere, and many others, all of which can depend on the choice architecture design, and may subsequently affect the sunk cost effect. As choice architecture has a wide array of uses, where optimal use may potentially be a solution for the sunk cost effect on managers, further research in the area, including the effect of applying the interrupted frame, should be both relevant and of importance for economists and psychologists alike.

Chapter 8

Conclusion

The goal of this paper was to raise awareness for the use of choice architecture as a means of reducing the sunk cost effect on managers. These two fields have not yet been properly combined in prior literature, and though the sunk cost effect has been discussed thoroughly, research has not been able to effectively reduce the sunk cost effect in a real world setting. This paper proposes choice architecture as a real and effective way of potentially dealing with the sunk cost effect on management. Choice architecture has many tools by which this could potentially be attained, this paper however, builds upon a unified decision-making model and focuses on two newly introduced forms of framing as its main tool of choice architecture. These are the uninterrupted and interrupted frames; this paper argues that correct implementation of the interrupted frame on a sunk cost problem will improve the decision-making process of the manager and reduce the sunk cost effect.

The effect of the interrupted frame was evaluated by conducting a simple survey, and though the results are minimal, which was argued to be a consequence of the minimalistic application of the framing, they do point in the direction of possible use, and warrant future research on the subject. The limitations, such as the lack of a feeling of personal responsibility, were discussed as well as how to improve upon them in the future. Though there are many things that should be considered when moving forward, the lack of research combining these two fields is something that should be worked on in the coming years. The interrupted and uninterrupted frames require more in-depth as well as empirical research to truly evaluate their effect on the sunk cost fallacy. Furthermore, other avenues of choice architecture, some of which this paper already mentioned, should also get investigated on whether they may be able to effectively reduce the sunk cost effect on management.

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Appendix A

Results Q1–5

Q1: What is your gender?

Answer	Response	%
Male	29	60%
Female	19	40%
Total	48	100%

Table A.1: Survey results Q1 - Gender

Q2: What is your age group?

Answer	Response	%
Under 18 years old	2	4%
18–21 years old	15	31%
22–29 years old	12	25%
30–39 years old	10	21%
40 years or older	9	19%
Total	48	100%

Table A.2: Survey results Q2 - Age group

Q3: What is your employment status?

Answer	Response	%
Student	25	52%
Employed	20	42%
Unemployed	2	4%
Retired	0	0%
Other, please specify:	1	2%
Total	48	100%

Table A.3: Survey results Q3 - Employment status

Q4: Have you studied or are you currently studying in the direction of Economics, Business or Management?

Answer	Response	%
Yes, I have	5	10%
Yes, I am currently doing so	8	17%
No	34	71%
Other, please specify:	1	2%
Total	48	100%

Table A.4: Survey results Q4 - Relevant education

Q5: How would you rate your own familiarity with the following fields?

Answer	Min Value	Max Value	Average Value	Standard Deviation	Responses
Economics	0.00	100.00	37.90	26.46	48
Business	0.00	100.00	37.40	25.75	48
Management	0.00	100.00	42.63	28.25	48

Table A.5: Survey results Q5 - Field familiarity

Appendix B

Survey setup¹

This survey is anonymous; the following questions only serve to properly contextualize the answers.

Please answer truthfully, and make sure to only check one box in each question.

Q1: What is your gender?

- Male
- Female

Q2: What is your age group?

- Under 18 years old
- 19–21 years old
- 22–29 years old
- 30–39 years old
- 40 years or older

Q3: What is your employment status?

- Student
- Employed
- Unemployed
- Retired
- Other, please specify: _____

Q4: Have you studied or are you currently studying in the direction of Economics, Business or Management?

- Yes, I have
- Yes, I am currently doing so
- No
- Other, please specify: _____

Q5: How would you rate your own familiarity with the following fields? Please fill in a number on a scale of 0 (know nothing about it) to 100 (know everything about it)

Economics _____

Business _____

Management _____

¹This is a print version, the survey itself was conducted online on the Qualtrics platform where the aesthetics and format differed slightly.

Please take your time to read and answer the following 3 questions to the best of your ability.

Q6: *You are a manager at Test Inc., a decent mid-sized company that produces technologically intensive medical instruments. 6 Months ago you initiated a project into the development for a new product, a surgical instrument that would allow for faster and lower risk surgeries. The product would require a period of 1 year for research and development with costs being approximately €1.000.000 during that period. Afterwards the product was estimated to sell well as it would be the first of its kind. However, recently new information has come to light that a competitor of yours, Rival Inc., has been developing a similar albeit slightly superior product and they are planning on releasing their product in 3 months. Although your project is on schedule it is not possible to release the product before 6 months, and entering the market 3 months after Rival Inc.s slightly superior version has been released will most likely have a high negative effect on sales. It is no longer possible to delay and alter the product in order to have a quality advantage. Currently €500.000 of the estimated €1.000.000 has already been invested and can no longer be regained. Should you continue with the project or cancel the project?*

- Continue the project
- Cancel the project

Please explain your chosen action below:

Q7: *One year ago, you, as manager of a company, initiated a project that would have a development time of 2 years and a total cost of €10.000.000 during that period, before the product hits the market. Initially the product was estimated to have a value of €12.000.000 during its entire life cycle. However, recent changes in the market have changed the prospects of the product for the worse. There is now an 80% chance the product will only have a value of €3.000.000, or a 20% chance for the initial value of €12.000.000. So far, €5.000.000 out of the €10.000.000 has already been invested and cannot be regained even if the project is discontinued. The project still requires the remaining one year and €5.000.000 for completion. Should you continue or cancel the project?*

- Continue the project
- Cancel the project

Please explain your chosen action below:

Q8: You are a manager at a high tech software company and last year you initiated a project into new and innovative grounds. For the first time the company is working on virtual reality software, the market is fresh and growing rapidly. However your project has recently run into difficulties. Originally the project was supposed to last 18 months and cost a total of €20.000.000. Now it seems that on top of this the project would require an additional 3 months and €2.000.000 before it is ready to hit the market. Furthermore, market forecasts have changed for the worse; the hardware it requires to run on is still in its infancy and the industry is having trouble developing the appropriate hardware. Initially the software was forecasted to have a total value of €30.000.000. Now however, due to the severe uncertainty within the market, there is a 50% chance that the software will be completely useless and thus have a value of €0 or a 50% chance that it will have a value of €24.000.000. So far the project has been ongoing for one year and €15.000.000 has already been spent. Should you continue or cancel the project?

- Continue the project
- Cancel the project

Please explain your chosen action below:

Please take your time to read and answer the following 3 questions to the best of your ability.

Q6: *You are a manager at Test Inc., a decent mid-sized company that produces technologically intensive medical instruments. 6 Months ago you initiated a project into the development for a new product, a surgical instrument that would allow for faster and lower risk surgeries. The product would require a period of 1 year for research and development with costs being approximately €1.000.000 during that period. Afterwards the product was estimated to sell well as it would be the first of its kind. However, recently new information has come to light that a competitor of yours, Rival Inc., has been developing a similar albeit slightly superior product and they are planning on releasing their product in 3 months. Although your project is on schedule it is not possible to release the product before 6 months, and entering the market 3 months after Rival Inc.s slightly superior version has been released will most likely have a high negative effect on sales. It is no longer possible to delay and alter the product in order to have a quality advantage. Currently €500.000 of the estimated €1.000.000 has already been invested and can no longer be regained. As a result of the recent news higher-ups have halted your project for the day and given you until the end of the day to decide whether to start the project back up again or quit the project. What is your choice?*

- Start the project back up again
- Quit the project

Please explain your chosen action below:

Q7: *One year ago, you, as manager of a company, initiated a project that would have a development time of 2 years and a total cost of €10.000.000 during that period, before the product hits the market. Initially the product was estimated to have a value of €12.000.000 during its entire life cycle. However, recent changes in the market have changed the prospects of the product for the worse. There is now an 80% chance the product will only have a value of €3.000.000, or a 20% chance for the initial value of €12.000.000. So far, €5.000.000 out of the €10.000.000 has already been invested and cannot be regained even if the project is discontinued. The project still requires the remaining one year and €5.000.000 for completion. As a result of the recent changes in prospects, higher-ups have halted the project for the day and given you until the end of the day to decide whether to start the project back up again or quit the project. What is your choice?*

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Please explain your chosen action below:

Q8: You are a manager at a high tech software company and last year you initiated a project into new and innovative grounds. For the first time the company is working on virtual reality software, the market is fresh and growing rapidly. However your project has recently run into difficulties. Originally the project was supposed to last 18 months and cost a total of €20.000.000. Now it seems that on top of this the project would require an additional 3 months and €2.000.000 before it is ready to hit the market. Furthermore, market forecasts have changed for the worse; the hardware it requires to run on is still in its infancy and the industry is having trouble developing the appropriate hardware. Initially the software was forecasted to have a total value of €30.000.000. Now however, due to the severe uncertainty within the market, there is a 50% chance that the software will be completely useless and thus have a value of €0 or a 50% chance that it will have a value of €24.000.000. So far the project has been ongoing for one year and €15.000.000 has already been spent. As a result of the recent changes in prospects, higher-ups have halted the project for the day and given you until the end of the day to decide whether to start the project back up again or quit the project. What is your choice?

- Start the project back up again
- Quit the project

Please explain your chosen action below: