Gordon Institute of Business Science
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The effect of reframing relative to intuition on decision quality in complex and unfamiliar tasks

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Abstract

This study responds to a call for research that recognised the role of reframing, as a third cognitive strategy in managerial decision-making, along with the often studied Type 1 and Type 2 decision processes in dual processing theory. Reframing as a cognitive strategy utilises both Type 1 non-conscious processing and Type 2 conscious processing. As a relatively new construct within behavioural decision-making the effectiveness of reframing as a cognitive strategy required further testing. This research therefore fulfilled the purpose, through an experimental research methodology to test the effectiveness of reframing, relative to intuition, within decision-making contexts of low familiarity and high complexity. Moreover, the study examined whether the type of intuition used by individuals interacts with the effectiveness of reframing relative to intuition. Although the theorised effect of reframing in decision quality of unfamiliar and complex decision tasks was well-motivated, the experiment did not find statistically significant support that reframing as a cognitive strategy is more effective that intuition in these contexts. Furthermore, the study did not find support that the different types of intuition used by individuals interacts with the effectiveness of reframing relative to intuition. The study, however, found that reframing has a positive coefficient relative to intuition as a baseline group. These findings offer behavioural decision-making researchers several new questions regarding the relative value of reframing as a cognitive strategy. Organisations are encouraged to develop a broad range of cognitive strategies to support effective decision-making, not limited to reframing or intuitive processes.

Keywords

Decision-making, dual-process theory of cognition, reframing, cognitive strategy, intuition, complexity.

Declaration

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Philosophy Corporate Strategy at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

28 November 2022

John Loubser

Name & Surname

Signature

Table of contents

Abstract i
Keywords i
Declaration ii
List of tables vi
List of figures vii
List of abbreviations and acronyms viii
Chapter 1: Introduction to the research problem 1
1.1. Background to the research problem 1
1.2. The research problem 2
1.2.1. Research problem one 4
1.2.2. Research problem two 5
1.3. Research questions 6
1.4. Research purpose and aims 8
1.5. Research contribution 8
1.6. Research scope 10
1.7. Conclusion 10
Chapter 2: Literature review 12
2.1. The dual-processing theory of cognition 13
2.1.1. Introduction to the dual processing theory of cognition 14
2.1.2. Type 1 Processing and intuition 16
2.1.3. Type 2 Processing and analytical reasoning 16
2.2. Reframing as a cognitive strategy 19
2.2.1. Introduction to reframing 20
2.2.2. Reframing and the dual processing theory of cognition 26
2.2.3. Disadvantages of reframing 30
2.3. Intuition 31
2.3.1. Introduction to intuition 32
2.3.2. Intuition compared to reframing 34
2.4. Decision quality 35
2.4.1. Decision quality measure 36
2.4.2. Decision quality analysis 36
2.5. Decision-making in highly complex situations with low familiarity 37
2.5.1. Complexity 38
2.5.2. Low familiarity 39
2.6. Conclusion 39
Chapter 3: Hypothesis and conceptual model 41

Chapter 4: Research methodology 44
4.1. Introduction and research paradigm 44
4.2. Research design 46
4.2.1. Unit and level of analysis 46
4.2.2. Population and sample 46
4.2.3. Sample size 48
4.2.4. Research instrument, Data Gathering and Research Quality 50
4.2.4.1. Step one 53
4.2.4.2. Step two 53
4.2.4.3. Step three 54
4.2.4.4. Step four 54
4.2.4.5. Step five 55
4.2.4.6. Step six 56
4.2.4.7. Step seven 59
4.2.4.8. Step eight 59
4.3. Data analysis overview 60
4.4. Limitations 61
4.5. Summary 61
Chapter 5: Results 63
5.1. Participants overview 63
5.2. Hypothesis testing 64
5.2.1. Hypothesis 1 65
5.2.2. Hypothesis 2 66
5.2.3. Hypothesis 3 67
5.2.4. Summary of hypotheses 68
5.3. Data analysis approach 69
5.3.1. Types of Intuition Scale 69
5.3.2. Decision quality 73
5.3.2.1. Low complexity 73
5.3.2.2. High complexity 76
5.4. Summary 82
Chapter 6: Discussion 83
6.1. Hypothesis 1 83
6.2. Hypothesis 2 86
6.3. Hypothesis 3 87
6.4. Summary 88
Chapter 7: Conclusion 90

7.1. Principal theoretical conclusions 91
7.2. Research contribution 92
7.3. Business relevance 93
7.4. Limitations of the research 93
7.5. Suggestions for further research 94
7.6. Concluding remarks 95
References 96
Appendices 104
Appendix A: Ethical clearance approval 104
Appendix B: Pilot survey feedback 112
Appendix C: Experimental vignettes 114
Appendix D: Types of Intuition Scale 126

List of tables

Table 1: Review on the literature of framing and reframing....24
Table 2: Hypotheses intersection....43
Table 3: Sample sizes in experiments....49
Table 4: Experimental vignette options (low and high complexity)....59
Table 5: Participant overview summary....64
Table 6: Hypotheses summary with reference to p-values....69
Table 7: Principal component analysis....70
Table 8: Question loading on the Types of Intuition Scale....71
Table 9: Participant classification according to component value....73
Table 10: Simple model for low complexity....74
Table 11: Code value predicted using Factor3....74
Table 12: Code value predicted using Intuition and Factor3....75
Table 13: Interaction term introduction to code value predicted using Intuition and Factor3....75
Table 14: Simple model for high complexity....76
Table 15: Simple model for high complexity with Intuition....77
Table 16: Simple model for high complexity with Intuition and interaction term....78
Table 17: Simple model for high complexity with Factor3....78
Table 18: Simple model for high complexity with Factor3 and interaction term....79
Table 19: ChoiceB against all three predictors....79
Table 20: Interaction between Complexity and Intuition....80
Table 21: Interaction between Factor3 and Intuition....80
Table 22: Complexity and Factor3....81
Table 23: Interaction between all three predictors....82

List of figures

Figure 1: Research problem intersection 3
Figure 2: Literature review roadmap 13
Figure 3: Stanovich's tri-partite model of the mind 18
Figure 4: Foundations of reframing as a cognitive strategy 28
Figure 5: Hypotheses intersection 43
Figure 6: Experiment flow 52

List of abbreviations and acronyms

A	Affective intuition
HA	Holistic intuition
HC	High complexity
I	Inferential intuition
LC	Low complexity
PC	Principal Component

Chapter 1: Introduction to the research problem

1.1. Background to the research problem

Effective decision-making is “the most important job of any executive” as better-quality decisions improve the performance of an organisation (Hammond et al., 2006, p. 118). While decision makers are generally quick to seek a solution within decision situations, typically utilising intuition or analytical reasoning (or combination of both), this is often premature as decision makers tend do so before understanding whether they have correctly diagnosed a problem (Evans & Stanovich, 2013; Kahneman, 2003; Wedell-Wedellsborg, 2017). This correct diagnosis is crucial as an understanding of the problem is central to effective decision-making within organisations (Powell et al., 2011).

Reframing, which can be defined as “deliberate attempts to reflect on and rethink the parameters and background assumptions underlying how one approaches a particular situation”, provides a practical solution to correctly diagnose a problem (Luoma & Martela, 2021, p. 2). This correct diagnosis is argued to lead to a better-quality decision within specific contexts which in turn improves the performance of an organisation (Laureiro-Martínez & Brusoni, 2018; Luoma & Martela, 2021; Wedell-Wedellsborg, 2017).

Wedell-Wedellsborg (2017) provides a practical illustration of the benefit of correctly diagnosing a problem. Suppose a decision maker is tasked with fixing the problem of a slow elevator in an office building that causes frustration to co-workers. An intuitive and obvious solution to this problem would be to make the elevator faster by upgrading it with a new faster elevator. This is a costly yet an effective solution to the problem. If the decision maker were, however, to reframe the problem as being the annoyance of waiting for the elevator an entire new possibility of more cost-effective solutions become apparent. This includes putting up mirrors or a television on the floors where most people wait for the elevator. This would make the waiting time less frustrating given the entertaining distraction (Luoma & Martela, 2021; Wedell-Wedellsborg, 2017).

From a theoretical perspective, the traditional view of decision-making has been that decision makers have at their disposal a choice of two cognitive strategies being intuition and analytical reasoning (Evans & Stanovich, 2013; Kahneman, 2003; Laureiro-MartÍnex & Brusoni, 2018; Luoma & Martela, 2021). These cognitive strategies are based on the dual process theory of cognition which distinguishes being Type 1 non-conscious

processing and Type 2 conscious processing (Kahneman, 2003; Luoma & Martela, 2021).

Luoma and Martela (2021), however, argue that that the dualistic view of cognitive strategies based on the dual process theory of cognition "masks a third cognitive strategy which is crucial to effective decision-making in the strategy context: reframing" (Luoma & Martela, 2021, p. 2). It is this dual process theory of cognition that provides the academic anchor for this research report as a study on the effectiveness of reframing will further advance an understanding of the cognitive strategies, and the effectiveness of such strategies, available under the dual process theory of cognition.

1.2. The research problem

The research problem can be separated into two distinct research problems. Research problem one is concerned with what the effectiveness of reframing as a cognitive strategy is. This research problem is informed by the call of Luoma and Martela (2021) to extend their work on the theoretical foundations of the cognitive strategy of reframing, by testing the effectiveness of reframing in simulated decision-making situations using experimental manipulations. Research problem two is concerned with the contexts in which reframing is argued to be more effective when compared to other cognitive strategies. More specifically, one of the propositions posited by Luoma and Martela (2021) is to test the effectiveness of reframing relative to intuition in contexts of high complexity and low familiarity. This context is aligned with calls by behavioural strategists to further develop an understanding of cognitive strategies and decision-making in complex situations (Borchardt et al., 2022; Luoma & Martela, 2021; Powell et al., 2011). The intersection of the two research problems is illustrated in Figure 1 below and further detailed in sections 1.2.1 and 1.2.2.

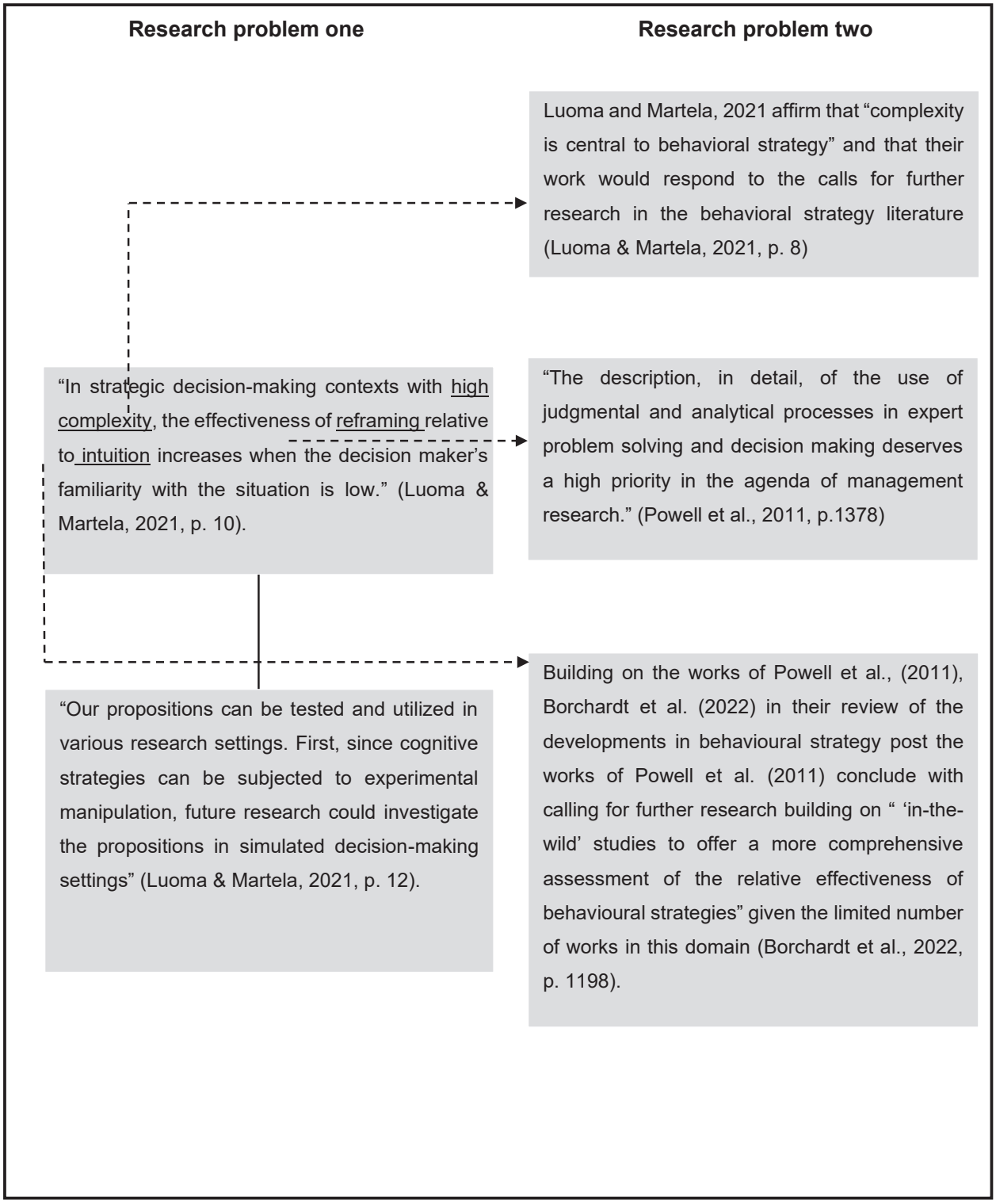

Figure 1: Research problem intersection
Source: Author

1.2.1. Research problem one

Reframing as a third cognitive strategy is a relatively new construct within strategic management and accordingly Luoma and Martela (2021) posit that the cognitive strategy of reframing is presently underdeveloped and there is accordingly a theoretical need to develop it further. This is because when compared to the utilisation of intuition in contexts of high complexity and low familiarity, reframing is argued to lead to better-quality decisions (Luoma & Martela, 2021).

Within the specific context of complexity and low familiarity, Luoma and Martela (2021) invite scholars to test, through experimental treatment, the proposition that "in strategic decision-making contexts with high complexity, the effectiveness of reframing relative to intuition increases when the decision maker's familiarity with the situation is low" (Luoma & Martela, 2021, p. 10).

While Luoma and Martela (2021) provide further propositions which posit that reframing can be more effective in leading to better-quality decisions when compared to intuition and analytical reasoning in specific contexts of ambiguity and high rate of change, *this research report will only seek to test the effectiveness of reframing in improving decision-quality relative to intuition within a context of high complexity and low familiarity*. This is given the second research problem which is to contribute to the literature on a behavioural strategy – a discipline which has not kept pace with behavioural movements in other disciplines and has received a call for further understanding by behavioural strategists, as further detailed in section 1.2.2 (Bolinger et al., 2022; Borchardt et al., 2022; Powell et al., 2011).

A short description of the key constructs in the proposition by Luoma and Martela (2021), which provides that reframing will be more effective than intuition in decision-making contexts that are highly complex and where there is low familiarity, are detailed immediately below (Luoma & Martela, 2021). While these constructs are analysed in Chapter 2 of this research report, a brief description is useful to contextualise this research problem and the research questions that follow in section 1.3. These key constructs also illustrate the intersection between research problem one and research problem two.

A highly complex situation can be characterised as a situation where a decision is based on numerous factors as well as the interaction of such factors amongst themselves. The

varying interdependency of the factors amongst themselves further play a role in the outcome of the decision made (Baumann et al., 2019; Luoma & Martela, 2021; Vasconcelos & Ramirez, 2011).

The effectiveness of reframing can be understood as reframing being more effective than intuition in improving decision quality (Luoma & Martela, 2021). Decision quality can in turn be understood as "the extent to which the decision attained its intended objectives" (Shepherd et al., 2021, p. 126). Familiarity can be understood as familiarity with a previous decision situation (Luoma & Martela, 2021).

Intuition can be defined as a cognitive process "based on automatic processes that rely on knowledge structures that are acquired by (different kinds of) learning and operating at least partially without people's awareness and result in feelings, signals, or interpretation" (Glöckner & Witteman, 2010, p. 5 - 6). Pretz et al. (2014) further distinguishes between three independent types of intuition: affective, holistic, and inferential intuition which are further detailed and analysed in section 2.3. The significance of cognitive strategies, which includes intuition, and decision-making in complex situations within the behavioural strategy literature informs research problem two which is detailed below.

1.2.2. Research problem two

The second research problem is concerned with the limited development of behavioural strategy. Behavioural strategy is a discipline which has been criticised for not keeping pace with behavioural movements in other disciplines such as psychology and economics. It has accordingly received a call for further research and understanding (Borchardt et al., 2022; Luoma & Martela, 2021; Powell et al., 2011).

Behavioural strategy is a discipline that is positioned within strategic management theory and seeks to apply cognitive and social psychology to obtain a realistic understanding about cognition, emotions, and social interactions. The overarching aim of behavioural strategy is to improve practical usefulness as well as the empirical integrity of strategic management theory (Powell et al., 2011). The development of behavioural strategy is therefore aligned with the greater emphasis in the field of strategic management on the micro-foundations that underpin strategic management theory and its practicality (Bolinger et al., 2022).

In one of the seminal works in behavioural strategy, Powell et al. (2011), argues that despite progress within this discipline a number of unresolved problems remain, and accordingly further research is called for within this discipline. This includes further research on problem solving and decision-making through the use of autonomous and analytical processes (Powell et al., 2011). Despite this call for further research Borchardt et al. (2022), in their review of the developments in behavioural strategy post the works of Powell et al. (2011), note the lack of development of behavioural strategy despite the call for further research by Powell et al. (2011) and conclude their review with another call for further research and understanding of the effectiveness of behavioural strategies in decision-making. This call for further research and understanding is not only informed by the limited number of works post the works by Powell et al. (2011), but also given the proven and practical value of behavioural strategy within private and public sectors (Borchardt et al., 2022).

Within the field of behavioural strategy cognitive strategies and decision-making in complex situations are specific constructs that have received a specific call for further understanding by behavioural strategists (Borchardt et al., 2022; Luoma & Martela, 2021; Powell et al., 2011). A greater understanding of decision-making is of paramount importance given that it is an antecedent to firm performance with better-quality decisions improving the performance of an organisation (Bolinger et al., 2022; Hammond et al., 2006, Wedell-Wedellsborg, 2017). This is also aligned with the primary goal of strategic management to understand the antecedents of firm performance (Bolinger et al., 2022).

In summary of the background to the research problems detailed above, the research problems can be summarised as (i) a lack of sufficient theoretical knowledge regarding the effectiveness of reframing as a cognitive strategy in contexts of high complexity and low familiarity, as well as (ii) a lack of development of behavioural strategy relative to behavioural developments in other disciplines. This research report intends to respond to these research problems as detailed in the research questions and aims below.

1.3. Research questions

Given the business and theoretical needs for further theoretical development on the effectiveness of a reframing as a cognitive strategy and a lack of development of behavioural strategy, the following three research questions are formulated:

RQ1: Is reframing more effective than intuition in a highly complex strategic decision-making situation where a decision maker's familiarity with a situation is low?

RQ1 is informed by Luoma and Martela's (2021) proposition which posits that reframing will be more effective than intuition in highly complex decision-making contexts where the decision makers familiarity with the decision-making context is low (Luoma & Martela, 2021). Luoma and Martela (2021) call for this proposition to be tested through experimental manipulation which is why this proposition is formulated as a research question.

RQ2: Does the effectiveness of reframing relative to intuition increase as the complexity of a strategic decision-making situation increases, where a decision maker's familiarity with a situation is low?

RQ2 is informed by the same proposition as detailed in RQ1 but seeks to understand whether complexity as a variable is related to an increase in the effectiveness of reframing relative to intuition. As will be detailed in section 2.5.1, when the complexity of a decision-making context increases there is further scope for errors in reasoning and biases (Laureiro-MartÍnex and Brusoni, 2018; Luoma & Martela, 2021). Reframing, as detailed in section 2.2, counters such errors in reasoning and biases (Luoma & Martela, 2021). RQ2 is therefore concerned with whether reframing is more effective than intuition as the complexity of a decision situation increases.

RQ3: Does the effectiveness of reframing relative to intuition depend on the type of intuition that is used in a highly complex decision-making situation where a decision maker's familiarity with a situation is low?

RQ3 is informed by the distinction between affective intuition, holistic intuition, and inferential intuition as three different and distinct types of intuition (Pretz et al., 2014) as well as the proposition by Luoma and Martela (2021) under RQ1. While Luoma and Martela (2021) do not distinguish between the different types of intuition in positing that reframing will be more effective than intuition in contexts of high complexity and low familiarity, Pretz et al. (2014) and Pretz (2011) demonstrate how different intuitive processes lead to different outcomes in terms of decision quality (Pretz et al., 2014; Pretz, 2011). It is therefore feasible that the

type of intuition used by decision makers will interact with the effectiveness of reframing relative to intuition as detailed in RQ1 and RQ2.

1.4. Research purpose and aims

From the research questions detailed above, the ultimate purpose of this research report is to understand whether reframing, as a cognitive strategy, will lead to a better-quality decision relative to intuition within the contexts of high complexity and low familiarity. This will respond to both research problems detailed in section 1.2. The research aims that flow from this purpose are discussed below.

The first research aim is to respond to the invitation by Luoma and Martela (2021) and test the proposition that “in strategic decision-making contexts with high complexity, the effectiveness of reframing relative to intuition increases when the decision maker’s familiarity with the situation is low” (Luoma & Martela, 2021, p. 10). This research aim is aligned with research problem one and research problem two as identified in section 1.2.1 and section 1.2.2.

The second research aim is to analyse the effectiveness of affective, holistic, and inferential intuition on decision quality in contexts of high complexity and low familiarity. These different types of intuition are argued by Pretz et al. (2014) to lead to different outcomes in terms of decision quality. The second research aim is related to the purpose as it provides an understanding on whether the effectiveness of reframing, as a cognitive strategy, relative to intuition depends on the type of intuition that is used. This research aim is further aligned with research problem two as identified in in section 1.2.2.

Each of the research aims detailed above further respond to the call by behavioural strategists to contribute to this discipline by focusing on the core constructs of cognitive strategies, such as intuition, and decision-making in complex situations (Borchardt et al., 2022; Luoma & Martela, 2021; Powell et al., 2011). This is the third research aim of this research report.

1.5. Research contribution

The purpose of this research is to understand whether reframing, as a cognitive strategy, will lead to a better-quality decision relative to intuition within the contexts of high complexity and low familiarity.

This research reports seeks to contribute to the literature on the dual processing theory of cognition (Evans, 2019; Evans & Stanovich, 2013; Kahneman, 2003; Laureiro-MartÍnex & Brusoni, 2018; Luoma & Martela, 2021). This will be achieved by studying the effectiveness of reframing (as a cognitive strategy) relative to intuition (as a cognitive strategy) on decision quality in contexts of high complexity and low familiarity (Baumann et al., 2019; Luoma & Martela, 2021; Pretz et al., 2014 Vasconcelos & Ramirez, 2011). In doing so the research report also contributes to the behavioural strategy literature by responding to the call from behavioural strategists to further develop this discipline (Borchardt et al., 2022; Luoma & Martela, 2021; Powell et al., 2011).

In contributing to the literature on the dual processing theory of cognition, this research report will also adopt an experimental research methodology to answer the hypotheses detailed in Chapter 3 which are informed by the research questions detailed in section 1.3. This is aligned with the first research problem which is to respond to the call by Luoma and Martela (2021) to test their propositions through experimental manipulation. It is also aligned with the second research problem to further develop behavioural strategy which development has been identified as benefiting from experimental approaches (Bolinger et al., 2022). As will be detailed in Chapter 4, the research questions are well suited to an experimental research methodology given that experiments are a useful mechanism for isolating causal relationships and are referred to as the ‘gold standard’ for understanding cause and effect relationships (Bell et al., 2019; Bolinger et al., 2022).

From a practical perspective, the research report contributes to decision-making techniques and strategies that decision makers can employ within their organisations. More specifically, the research report provides a greater understanding of the cognitive strategy of reframing that can be employed by decision makers. While the research report will have a focus on whether reframing as a cognitive strategy is more effective than intuition in contexts of high complexity and low familiarity; the process of reframing (as informed by the cognitive strategy of reframing) can be used in a variety of other settings to correctly diagnose a problem (Luoma & Martela, 2021; Wedell-Wedellsborg, 2017). This correct diagnosis is crucial as an understanding of the problem is central to effective decision-making within organisations that determines its performance (Hammond et al., 2006; Powell et al., 2011).

1.6. Research scope

The research scope was centred on the effectiveness of cognitive strategies in decision-making as utilised by decision makers within South African corporates. The rationale for this is outlined in section 4.2.2. The scope of the research is to focus on the effectiveness of reframing, as a cognitive strategy, on decision quality relative to intuition, as a cognitive strategy within the context of high complexity and low familiarity.

The research scope does not include a study on the effectiveness of reframing, as a cognitive strategy, on decision-making relative to other cognitive strategies such as analytical reasoning. The research scope further excludes a study on the effectiveness of reframing and intuition in contexts of ambiguity and high rates of change which are further contexts where refarming is argued to be more effective that intuition or analytical reasoning (Luoma & Martela, 2021). This is given that the research report seeks to contribute to the literature on behavioural strategy by focusing on the core constructs of cognitive strategies, such as intuition, and decision-making in complex situations (Borchardt et al., 2022; Luoma & Martela, 2021; Powell et al., 2011).

1.7. Conclusion

This research report ultimately seeks to investigate and explain, within the context of high complexity and low familiarity, the following:

(i) whether there is a stronger causal relationship between reframing and effective decision-making as opposed to intuition and effective decision-making;

(ii) whether the abovementioned causal relationship is dependent on the level of complexity of the decision-making situation; and

(iii) whether the effectiveness of reframing on decision quality relative to intuition depends on the type of intuition that is used.

In answering these research questions, the research study will adopt an experimental research methodology which in line with calls from management scholars as further outlined in Chapter 4 (Bolinger et al., 2022; Luoma & Martela, 2021). In analysing and empirically testing the hypotheses informed by the research questions, the research study seeks to contribute to literature on dual processing theories of cognition which is the academic anchor for this study (Luoma & Martela, 2021). A further understanding of

the dual processing theories of cognition and the cognitive strategies that flow from such dual process theories, is important from a business perspective given that better-quality decisions ultimately drive the performance of an organisation (Wedell-Wedellsborg, 2017).

The subsequent chapters are divided into the literature review (Chapter 2), the hypotheses (Chapter 3), the research methodology (Chapter 4), results (Chapter 5), a discussion on the results (Chapter 6) and the conclusion (Chapter 7). Appendices are included to supplement Chapter 4 and Chapter 5.

Chapter 2: Literature review

The purpose of this research report is to understand whether reframing, as a cognitive strategy, will lead to a better-quality decision relative to intuition within the contexts of high complexity and low familiarity. This purpose responds to the research problems detailed in section 1.2. The purpose of the research report also informs the following three research aims:

(i) The first research aim is to respond to invitation by Luoma and Martela (2021) and test the proposition that "in strategic decision-making contexts with high complexity, the effectiveness of reframing relative to intuition increases when the decision maker's familiarity with the situation is low" (Luoma & Martela, 2021, p. 10).

(ii) The second research aim is to analyse the effectiveness of affective, holistic, and inferential intuition on decision quality in contexts of high complexity and low familiarity (Pretz et al., 2014).

(iii) The third research aim is to respond to the call by behavioural strategists to contribute to this discipline by focusing on the core constructs of cognitive strategies, such as intuition, and decision-making in complex situations (Borchardt et al., 2022; Luoma & Martela, 2021; Powell et al., 2011).

In response to the purpose as well as the three research aims of this research report, the literature review will focus on analysing:

(i) the academic anchor of the dual processing theory of cognition;

(ii) the key constructs of reframing, intuition, and decision quality which are the independent and dependent variables of the experimental design detailed in Chapter 4, and

(iii) the contexts of complexity and low familiarity which are the contexts in which the key constructs will be empirically tested.

Figure 2 provides an illustration of these topics and a roadmap of how these topics that will be analysed in this Chapter 2.

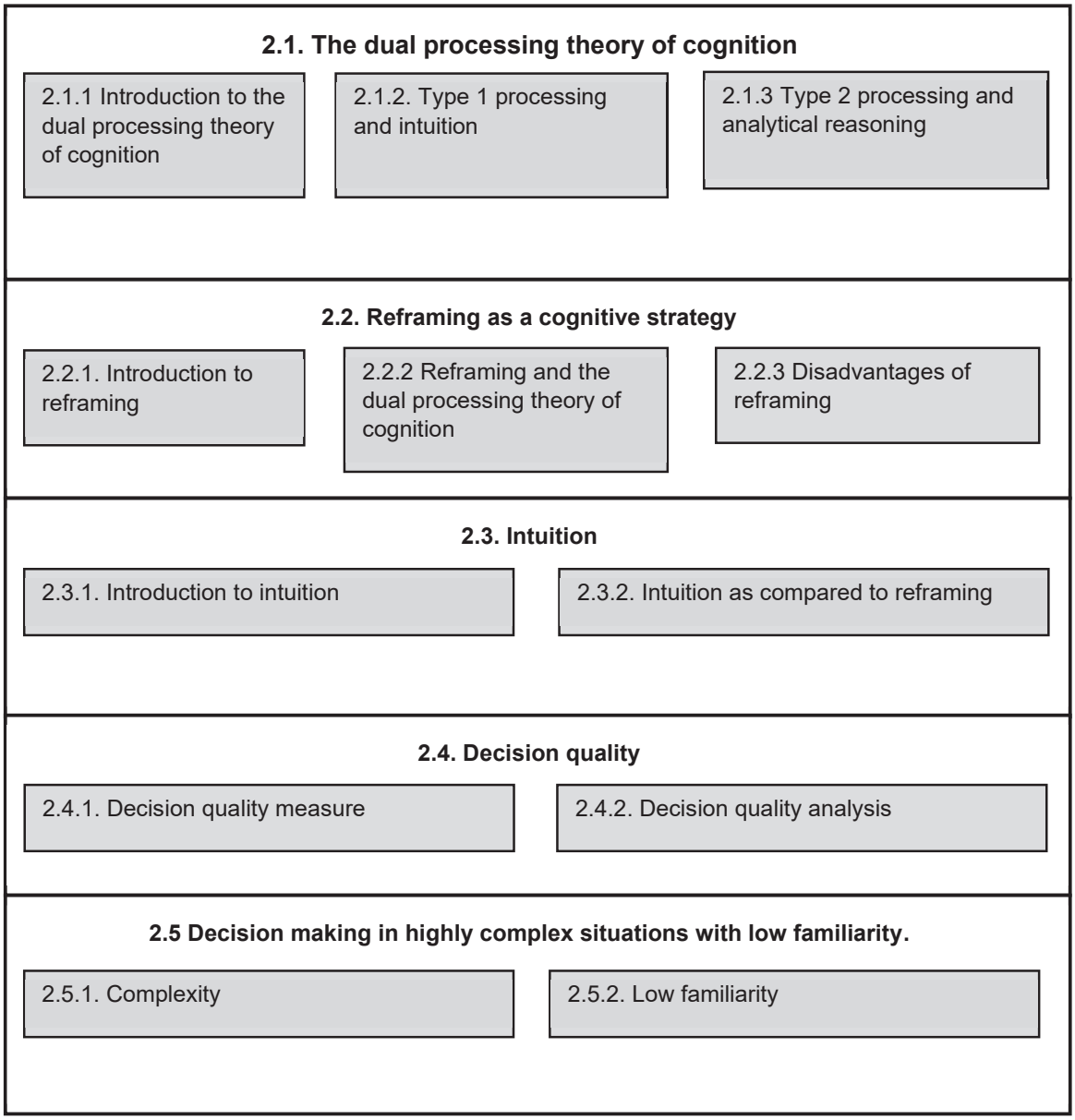

Figure 2: Literature review roadmap
Source Author

2.1. The dual-processing theory of cognition

The followings sections critically discuss the dual processing theory of cognition which is the academic anchor for this research report. The section will start with an introduction to the dual processing theory of cognition as well as critically discuss and analyse the criticisms of the dual processing theory of cognition. This is followed by a critical discussion of Type 1 processing and Type 2 processing as well as the cognitive strategies that can be employed by utilising Type 1 processing and Type 2 processing.

The critical discussions and analysis are relevant as the cognitive strategy of reframing, as analysed in section 2.2, will detail how reframing is based on Type 1 processing and Type 2 processing (Luoma & Martela, 2021).

2.1.1. Introduction to the dual processing theory of cognition

The academic anchor of this study is the dual processing theory of cognition which distinguishes between the two types of thinking: autonomous processing termed Type 1 processing and non-autonomous processing termed Type 2 processing (Evans & Stanovich, 2013; Kahneman, 2003; Kahneman, 2011; Luoma & Martela, 2021). The choice on what cognitive strategy (such as intuition, analytical reasoning, or reframing) to employ is dependent on this dual processing theory of cognition (Hodgkinson & Sadler-Smith, 2018; Laureiro-Martínex & Brusoni, 2018; Luoma & Martela, 2021).

Type 1 processing and Type 2 processing are akin to System 1 and System 2 thinking and are often used interchangeably (Hodgkinson & Sadler-Smith, 2018; Laureiro-Martínex & Brusoni, 2018; Luoma & Martela, 2021). This research report, however, adopts the terminology of Type 1 processing and Type 2 processing given that Systems 1 and System 2 thinking suggests that the different types of processing use different neurological systems. As that there is no neurological evidence that suggests that different types of thinking and processing use different neurological systems, the terms Type 1 processing and Type 2 processing are more accurate (Laureiro-Martínex & Brusoni, 2018).

This above classification is important as it responds to the criticism that the dual processing theory of cognition is subject to multiple and vague definitions (Evans & Stanovich, 2013). This is identified as being problematic given that each descriptor of the dual processing theories of cognition, such as System 1 and System 2, have their own semantic meaning which creates vagueness in accurately defining what the dual processing theory of cognition entails (Evans, 2019; Evans & Stanovich, 2013; Luoma & Martela, 2021). The description of Type 1 processing and Type 2 processing as types of thinking in this research report is therefore aligned with creating accuracy in how the dual processing theory of cognition is defined.

Another often cited criticism of the dual processing theory of cognition, is that cognitive strategies employed by decision makers are clustered as being based on either Type 1 processing or Type 2 processing (Evans & Stanovich, 2013; Klauer & Kellen, 2011;

Luoma & Martela, 2021). This dualistic classification of a cognitive strategy being based on either Type 1 processing or Type 2 processing is problematic as, as is argued in section 2.2, a cognitive strategy such as reframing utilises both Type 1 processing as well as Type 2 processing (Luoma & Martela, 2021).

The above view is shared by Evans (2019) who argues that cognitive strategies that are employed by decision makers are based on Type 1, Type 2 and Type 3 processing. In describing what Type 3 processing entails, Evans (2019) provides a narrower definition of Type 1 processing as being autonomous but being accompanied with a feeling that such autonomous response is correct based on working memory (Evans, 2019). Where such autonomous responses are not accompanied with a feeling of correctness or based on working memory, they are classified as Type 3 processing. According to Evans (2019), Type 3 processing would be responsible for a decision maker choosing to adopt Type 2 processing as it operates on a higher regulatory state that determines whether Type 1 or Type 2 processing should be employed (Evans, 2019).

The importance of Evans' (2019) work is that it affirms that a dualistic classification of cognitive strategies based on Type 1 or Type 2 processing is problematic, as it is arguable that decision makers can engage in Type 3 processing. Accordingly, decision makers are not limited to only two cognitive strategies (Evans, 2019). This is aligned with Luoma and Martela (2021) who agree that a dualistic classification of cognitive strategies is problematic as cognitive strategies, such as reframing, can employ Type 1 and Type 2 processing.

Notwithstanding the work of Evans (2019), it is accepted that the distinction between the dual processing theory of cognition which distinguishes between at least Type 1 processing and Type 2 processing, is supported by evidence in cognitive sciences and is regarded as being an accurate distinction of the cognitive process's individuals possess. This dualistic distinction, however, does not translate to a similar dualistic distinction between cognitive strategies based on Type 1 processing and Type 2 processing (Evans & Stanovich, 2013; Laureiro-MartÍnex & Brusoni, 2018; Luoma & Martela, 2021). The work of Evans (2019) furthermore affirms that this dualistic distinction of cognitive strategies is not accurate albeit for a different reason that there is another form of processing, being Type 3 processing, that is available to decision makers.

As reframing is considered in this research report from the perspective as a cognitive strategy that is based on the dual process theory of cognition, the research report does not adopt the distinction between Type 1, Type 2 and Type 3 processing and rather adopts the dualistic distinction between Type 1 and Type 2 processing. The reason for this is that, as demonstrated above, the works of Luoma and Martela (2021) and Evans (2019) are aligned in that they both share the view that a dualistic view of cognitive strategies is not accurate. An analysis of the relevance of Type 1, Type 2 and Type 3 processing is therefore not relevant to the purpose and aims of this research report which focuses on the cognitive strategy of reframing. Furthermore, the dualistic distinction between Type 1 and Type 2 processing is well reported and supported by evidence and accordingly adopting this distinction would not be inaccurate (Evans & Stanovich, 2013; Laureiro-Martínex & Brusoni, 2018; Luoma & Martela, 2021). Type 1 and Type 2 processing as well as their concomitant strategies are therefore critically discussed in turn below.

2.1.2. Type 1 Processing and intuition

Type 1 processing can be described as ‘fast’ and operating automatically with minimal effort and control (Evans & Stanovich, 2013; Kahneman, 2003; Kahneman, 2011; Laureiro-Martínex & Brusoni, 2018; Luoma & Martela, 2021). The operations of Type 1 are done at a level where an agent is not aware of it and can be referred to as intuition as this is the dominant form of processing when adopted as a cognitive strategy (Kahneman, 2011; Luoma & Martela, 2021).

Relying on intuition as a cognitive strategy involves a decision-maker giving considerable weight to their intuition in making a choice despite analytical reasoning, based on Type 2 processing, recommending a different choice (Luoma & Martela, 2021). The benefit of Type 1 processing is that it requires minimal cognitive processing. The disadvantages of Type 1 processing are errors in reasoning and cognitive biases (Laureiro-Martínex and Brusoni, 2018; Luoma & Martela, 2021). Intuition as a cognitive strategy is further analysed in section 2.3 of this research report.

2.1.3. Type 2 Processing and analytical reasoning

Type 2 processing can be described as ‘slow’ and in contrast to Type 1 processing as it is intentional, effortful, and consciously monitored (Evans & Stanovich, 2013; Kahneman, 2003; Laureiro-Martínex & Brusoni, 2018; Luoma & Martela, 2021). Type 2 processing

can be referred to as analytical reasoning as this is the dominant form of processing when adopted as a cognitive strategy (Luoma & Martela, 2021). Relying on analytical reasoning as a cognitive strategy involves a decision maker consciously deducing what the appropriate decision is considering the decision-making situation (Evans & Stanovich, 2013; Luoma & Martela, 2021).

Type 2 processing can further be divided into two levels: algorithmic thinking and reflective thinking (Evans & Stanovich, 2013; Luoma & Martela, 2021). Either algorithmic or reflective thinking, or a combination of both, are utilised when analytical reasoning is adopted as a cognitive strategy (Luoma & Martela, 2021).

Algorithmic processing refers to the correct processing of rules to arrive at an outcome. It is based on the ability of the brain to perform explicit processing based on rules that are informed by working memory (Evans & Stanovich, 2013; Evans, 2019). This form of processing is successful when the relevant parameters of a decision-making situation are well defined, and the quality of a decision is based on the use of the correct reasoning in arriving at a decision (Evans & Stanovich, 2013; Luoma & Martela, 2021).

Given that algorithmic thinking does not involve the challenging of the parameters of a decision situation, but rather focuses on making a decision based on the correct rules of processing, it is not used in the process of reframing when adopted as a cognitive strategy (Luoma & Martela, 2021). In contrast to algorithmic processing, reflective Type 2 processing is used when reframing is adopted as a cognitive strategy (Luoma & Martela, 2021).

Reflective Type 2 processing refers to the thinking dispositions of individuals which informs how an individual approaches a decision situation. Reflective Type 2 processing involves identifying the relevant parameters and information of a decision-making situation as a first step, followed by the use of relevant thinking dispositions and rules of reasoning within the decision-making context (Evans & Stanovich, 2013; Luoma & Martela, 2021).

Reflective Type 2 processing is therefore similar to Type 3 processing identified by Evans (2019) as it operates on a higher regulatory state that informs how an individual approaches a decision situation. Reflective Type 2 processing also utilises algorithmic processing in the sense that once the relevant parameters and information of a decision-making situation is defined through the first utilisation of reflective Type 2 processing,

algorithmic processing in the form of reasoning and rules of processing are utilised to make a decision (Evans & Stanovich, 2013; Kahneman, 2003; Laureiro-Martínex & Brusoni, 2018; Luoma & Martela, 2021). This distinction and interaction between algorithmic processing, reflective processing and intuition is illustrated in Figure 3 below.

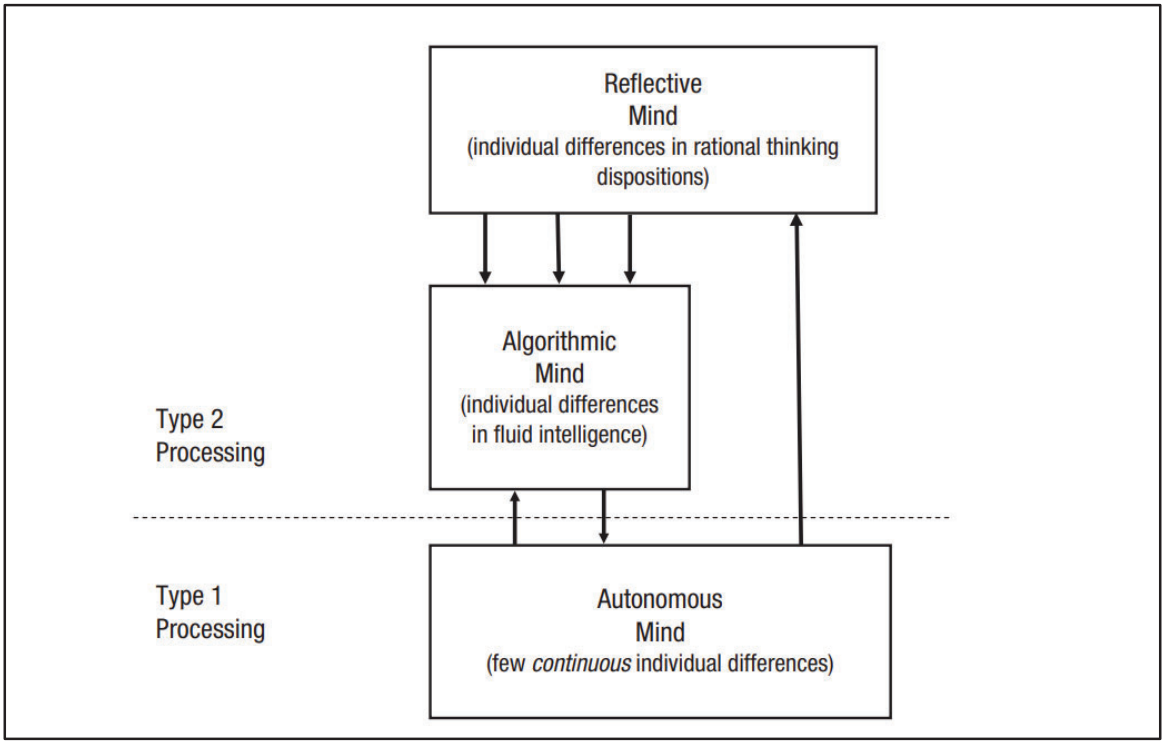

Figure 3: Stanovich's tri-partite model of the mind
Reprinted from "Dual-Process Theories of Higher Cognition: Advancing the Debate" by J. B. T. Evans, K. E. Stanovich, 2013, *Perspectives of Psychological Science, 8(3)*, p. 230. Copywrite 2018 by SAGE.

The above tri-partite model of the mind illustrates the intersection between Type 1 processing as well as algorithmic Type 2 processing and reflective Type 2 processing (Evans & Stanovich, 2013; Stanovich, 2012). Algorithmic Type 2 processing is displayed above autonomous Type 1 processing and is separated by a dotted line. Reflective Type 2 processing is in turn displayed above reflective Type 2 processing. This 'ranking' is with the intention of illustrating that while algorithmic Type 2 processing can override autonomous Type 1 processing, this overriding is initiated by a higher level of control which is reflective Type 2 processing (Evans & Stanovich, 2013; Stanovich, 2012).

The ability of algorithmic Type 2 processing to override autonomous Type 1 processing is illustrated by the arrows between the text boxes marked 'Algorithmic Mind' and 'Autonomous Mind'. The arrow between the text boxes marked 'Autonomous Mind' and

‘Reflective Mind’ in turn illustrate that the higher level of control of reflective Type 2 processing is informed by pre-attentive processes such as the subconscious accumulation of information that informs thinking dispositions (Stanovich, 2012).

The higher level of control that initiates this ability to override is illustrated by the arrows between the text boxes marked ‘Reflective Mind’ and ‘Algorithmic Mind’. (Stanovich, 2012). It is therefore useful to think of reflective Type 2 processing as taking a ‘step back’ and considering the parameters of a decision-making situation before deciding on a response (Evans & Stanovich, 2013; Stanovich, 2012).

The distinction between Type 1 processing, algorithmic Type 2 processing and reflective Type 2 processing as illustrated in Figure 3, is of relevance to this this research report as it provides the basis for the cognitive strategy of reframing (Evans & Stanovich, 2013; Stanovich, 2012; Luoma & Martela, 2021). The distinction between algorithmic and reflective Type 2 processing identifies reflective Type 2 processing as the form of processing that is used to challenge intuitive responses to a decision. Reframing as a cognitive strategy, which relies on this reflective Type 2 processing to override intuition as a cognitive strategy employed through Type 1 processing, is critically discussed below (Luoma & Martela, 2021).

2.2. Reframing as a cognitive strategy

The followings sections critically discuss reframing as a cognitive strategy based on the dual processing theory of cognition. The first section critically discusses the concept of reframing as a cognitive strategy is and provides an overview on the literature on framing and reframing. The first section also analyses how the literature on framing and reframing intersects with the works of Luoma and Martela (2021) whose works focus on the cognitive strategy of reframing.

The second section critically reviews the process of reframing from the perspective of Type 1 processing, algorithmic Type 2 processing and reflective Type 2 processing. This section shows how the dual processing theory of cognition detailed in section 2.1, is related to the cognitive strategy of reframing.

The third section is dedicated to an analysis of the disadvantages of reframing and responds to these disadvantages. These responses inform why this research report

seeks to understand the effectiveness of reframing as a cognitive strategy as compared to intuition as a cognitive strategy which is critically discussed in section 2.3.

2.2.1. Introduction to reframing

Based on the works of Porac and Tschang's (2013) as well as Lejarraga and Pindard-Lejarraga (2020), Luoma and Martela (2021) define the process of reframing as a deliberate attempt to rethink as well as reflect on the background assumptions and the parameters of a decision-making situation (Luoma & Martela, 2021). Luoma and Martela (2021) further define the cognitive strategy of reframing as a strategy whereby a decision maker recognises their intuitive responses to a decision situation but consciously, through utilising reflective Type 2 processing, challenges such intuitive responses to ascertain whether they are a correct response (Luoma & Martela, 2021).

The benefit of reframing is that it allows decision makers to challenge assumptions previously held but which are fallible, identify errors in their thought process as well as identity new options based on factors or an interdependency of factors not previously considered in a decision-making situation (Hodgkinson et al.,1999; Luoma & Martela, 2021). In doing so decision-making is argued as being improved (Hodgkinson et al.,1999; Hodgkinson et al.,2002; Luoma & Martela, 2021; Wedell-Wedellsborg, 2017).

Reframing is not a new concept to strategic management and its strategic importance and benefits have been well documented (Hodgkinson et al., 1999; Hodgkinson et al., 2002; Laureiro-MartÍnex & Brusoni, 2018; Luoma & Martela, 2021). Research on reframing has historically been approached from one of two streams. The first stream is focused on how cognitive frames and the framing of biases influence decision-making and managerial judgement which ultimately determines organisation actions (Luoma & Martela, 2021). The second is focused on group-based and organisational level influences on the framing of a matter under review (Luoma & Martela, 2021).

Luoma and Martela (2021) in reviewing the streams of research detailed above, note that the cognitive process of reframing as a strategy has not been examined in detail within the strategic management literature (Luoma & Martela, 2021). This observation is aligned with the work of Cornelissen and Werner (2014) who, in their review of the literature on framing, identify that the streams within reframing literature can be separated into a micro level where an individual decision maker is the unit of behaviour, and a meso level where collective decision makers are the unit of behaviour (Cornelissen

& Werner, 2014). Cornelissen and Werner (2014) further identify that the cognitive process of reframing presents significant opportunities for further research which is aligned with the observation by Luoma and Martela (2021) (Cornelissen & Werner, 2014).

An overview of the selected works within the two streams of research identified by Luoma and Martela (2021) is detailed below. The distinction between an analysis of reframing from a micro and a meso level map neatly into this distinction with the micro level being part of research stream one and the meso level being part of research stream two. This research, as outlined in Table 1 below, however, goes further and identifies literature on the cognitive strategy of reframing that is not identified by Luoma and Martela (2021). This is identified under the heading ‘Research stream three’ in the table below and is further analysed in section 2.2.3 to demonstrate how the literature within the third stream is aligned with and also differentiated with the works of Luoma and Martela (2021).

Author	Key Finding
Research stream one	
Laureiro-Martínex and Brusoni (2018)	Focus their study on the ability of decision makers to adapt their cognitive processes when faced with different problems. This adaptation is termed cognitive flexibility and, building on the existence of framing biases as identified by Hodgkinson et al. (1999) and Hodgkinson et al. (2002), is argued to overcome the negative effect of framing errors as different theories of cognition can be 'switched' between to improve decision-making.
Abatecola et al. (2018)	Decision makers are influenced by options depending on how the decisions are framed. This is because this framing produces perceptions of risk that "influence the decision makers' affective states and their search strategies" (Abatecola et al., 2018, p. 418).
Dong et al. (2016)	Illustrates how abductive reasoning and deductive analysis within design research can be utilised to produce a greater array of cognitive frames that could lead to a better decision within a decision-making situation.
Cornelissen and Werner (2014)	Provide an overview on how framing bias and cognitive frames influence decision-making and are influenced by priming, language, gestures as well as cultural norms.
Benner and Trispas (2012)	Find that, within the digital camera industry, that affiliation with the industry prior to digital camera technology influences the framing of a new product market.
Hodgkinson et al. (2002)	In response to a critique by Wright and Goodwin (2002), Hodgkinson et al. (2002) support their claim that framing bias exists within complex strategic decisions and be overcome by casual mapping by evidencing the ecological validity of their findings.

Hodgkinson et al. (1999)	Identify that a framing bias exists within complex strategic decisions but can be overcome through casual mapping of a decision-making situation which is a mechanism that induces effortful thought prior to making a decision.
Sieck and Yates (1997)	Adopting an experimental research methodology, Sieck and Yates (1997) observe that when decision makers are provided with a comprehensive overview of the reason for the decision (termed exposition) the negative effects of framing is reduced.

Research stream two

Abatecola et al. (2018)	In a group setting, the probability of framing biases occurring is decreased given that "collaborative decision rules" allow for a more rational decision-making process with less chance for individual biases occurring (Abatecola et al., 2018, p. 418).
Jacobides et al. (2016)	Review how framing contests – whereby individuals in an organisation advocate for their ideas to be adopted in new developments – are informed by decision makers acting rationally in pursuing their own interests. These framing contests influence how decisions makers are influenced as well as influence other decision makers.
Werner and Cornelissen (2014)	Analyse how a framing bias can be influenced or mitigated through rhetoric that directs and guides a cognitive frame.
Beckert (2010)	Illustrate how cognitive frames are an antecedent to explanations of economic outcomes as "institutions are defined as intersubjectively shared meanings and thereby become almost indistinguishable from cognitive frame" (Beckert, 2010, p. 607)
Kaplan (2008)	Analyses cognitive frames of actors within a decision-making situation and described how these actors engaged in framing practices to ensure decisions are made in their favour.

Research stream three	
Mukherjee et al. (2020)	Examine how scenarios research enables decision makers to reframe their current situations by developing plausible future contexts which are intended to re-perceive the cognitive frames of decision makers.

Table 1: Review on the literature of framing and reframing
Source: Author

Following a critical review of the works detailed in Table 1 above, a common theme is the saliency of the work of Hodgkinson et al. (1999) and Hodgkinson et al. (2002) which has recently been extended by Laureiro-Martínex and Brusoni (2018). Accordingly, a further critical discussion on how these works relate to the cognitive strategy of reframing is provided below.

Hodgkinson et al. (1999), in two experimental investigations, identify that a framing bias – a bias that occurs when decisions are influenced by the way in which options or information are presented as opposed to the information itself – is an influential factor that exists in complex strategic decisions. This bias is ultimately based on systematic errors in thought patterns or thinking that are identified as being a disadvantage of utilising Type 1 processing (Hodgkinson et al., 1999; Hodgkinson & Sadler-Smith, 2018; Laureiro-Martínex & Brusoni, 2018).

A bias is therefore a flawed response to decision-making situation given an error in thought patterns or thinking by decision makers (Wilke & Mata, 2012). This error in a thought process or thinking, which can be observed as a bias, is argued to be capable of rectification through the use of reframing as detailed further below in this section 2.2.1 (Hodgkinson et al., 1999; Hodgkinson et al., 2002; Hodgkinson & Sadler-Smith, 2018; Laureiro-Martínex & Brusoni, 2018; Luoma & Martela, 2021).

In their seminal work, Hodgkinson et al. (1999) and Hodgkinson et al. (2002) further identify that framing effects can be minimised through effortful thought prior to selecting a course of action (Hodgkinson et al., 1999). This view persists in more recent literature. For instance, Laureiro-Martínex and Brusoni (2018) reference the works of Hodgkinson et al. (1999) in illustrating that framing occurs when decision makers are faced with a complex strategic decision-making and how adapting a different processing style is a

useful mechanism to counter the effects of errors in framing and allow for a better understanding of a problem (which will in turn improve the quality of a decision). The works of Laureiro-Martínex and Brusoni (2018) further focus on the cognitive flexibility in switching between Type 1 processing and Type 2 processing as required by certain decision-making situations.

While Hodgkinson et al. (1999), Hodgkinson et al. (2002) as well as Laureiro-Martínex and Brusoni (2018) do not reference reframing as a cognitive strategy, it is important to note that these works pre-date the work of Luoma and Martela (2021). Luoma and Martela (2021) specifically seek to further develop the cognitive strategy of reframing which is informed by the above cited works on framing and reframing. This is a research gap identified by Luoma and Martela (2021) who note that the previous works on framing has not been considered within the theoretical framework of the dual-processing theory of cognition (Luoma & Martela, 2021).

The mechanisms described by Hodgkinson et al. (1999), Hodgkinson et al. (2002) as well as Laureiro-Martínex and Brusoni (2018) are argued to be aligned with the cognitive strategy of reframing. More specifically the effortful thought before selecting a course of action, as noted by Hodgkinson et al. (1999) and Hodgkinson et al. (2002), is a deliberate thought process whereby a consideration of how information and options are presented involve thinking about the parameters of the decision-making situation and identifying whether there are any errors in thought that are based on how information or options are presented. This is aligned with the process of reframing defined by Luoma and Martela as a purposeful attempt to rethink and reflect on the background assumptions as well as the parameters of a decision situation that underpins how a decision maker approaches a decision situation (Luoma & Martela, 2021).

In addition, the process of adapting different processing styles to avoid errors in thinking and to ensure a better understanding of a problem, as noted by Laureiro-Martínex and Brusoni (2018), is aligned with the cognitive strategy of reframing which requires decision makers to recognise but go beyond intuitive and algorithmic Type 2 processing and also rely on reflective Type 2 processing (Luoma & Martela, 2021). The cognitive strategy of reframing therefore involves the adoption of Type 1 processing as well as both algorithmic and reflective Type 2 processing (Laureiro-Martínex & Brusoni, 2018; Luoma & Martela, 2021). The process of reframing as a cognitive strategy from the perspective of this Type 1 processing as well as algorithmic and reflective Type 2 is detailed in section 2.2.2 below.

The above analysis is important to this research report as it positions the question on the effectiveness of reframing, as detailed in research questions one to three, from the perspective of reframing as a cognitive strategy. The theoretical basis for considering the effectiveness of reframing as a cognitive strategy is further informed by literature. More specifically the works of Luoma and Martela (2021) and Cornelissen and Werner (2014) demonstrate that the cognitive process of reframing as a strategy has not been examined in detail. This view is justified as shown in Table 1 as well as through an analysis of the works of Hodgkinson et al. (1999), Hodgkinson et al. (2002) as well as Laureiro-MartÍnex and Brusoni (2018). The analysis of the works of Hodgkinson et al. (1999), Hodgkinson et al. (2002) as well as Laureiro-MartÍnex and Brusoni (2018) further demonstrates that a consideration of reframing as a cognitive strategy is not a departure of these works but is rather aligned with these works and extends the understanding of reframing.

2.2.2. Reframing and the dual processing theory of cognition

Reframing is underpinned by the dual process theory of cognition and is comparable to certain components of both intuition and analytical reasoning and is not a cognitive strategy that is independent from intuition and analytical reasoning (Luoma and Martela, 2021). Reframing is comparable to Type 1 processing as the questioning of intuitive responses and the background assumptions are preceded by first making an intuitive choice which is akin to Type 1 processing (Luoma & Martela, 2021). Questioning whether the background assumptions and intuitive responses are correct or whether there are any flaws in this process relies on the reflective Type 2 processing disposition of considering whether the best decision is made given the parameters (Evans & Stanovich, 2013; Stanovich, 2012; Luoma & Martela, 2021).

It is important to note that when used during a process of reframing, reflective Type 2 processing is first utilised in considering whether the parameters of the decision situation are correct as opposed to making a decision based on the parameters. Once the correct parameters have been identified, reflective Type 2 processing (which encompasses algorithmic processing) is then used again to make the best decision in the decision situation (Dijksterhuis & Stick, 2016; Luoma & Martela, 2021).

The first utilisation of reflective Type 2 processing is akin to the use of effortful thought as described by Hodgkinson et al. (1999). The effortful thought is used to identify whether

there are any biases – including framing biases – when Type 1 processing is utilised. The ability to switch from Type 1 processing to Type 2 processing to counter the effects of framing errors is a form of cognitive flexibility as identified by Laureiro-MartÍnex and Brusoni (2018).

The actual process of reframing when used as a cognitive strategy can be done in one of two manners. Firstly, a decision maker can consciously undertake to reframe an issue within a decision-making situation (Luoma & Martela, 2021). This is similar to the process identified by Hodgkinson et al. (1999) and Hodgkinson et al. (2002), whereby a deliberate thought process is undertaken to consider how information and options are presented; challenging the parameters of a decision-making situation; and identifying whether there are any errors in thought that are based on how information or options are presented. The second manner in which reframing when used as a cognitive strategy can be done is to postpone a decision and allow for a period of incubation (Luoma & Martela, 2021). This is to allow an opportunity for non-conscious processing. Incubation is regarded as being an effective mechanism to improve decision-making (Luoma & Martela, 2021; Sio & Ormerod, 2009).

It is useful to illustrate the foundations of the cognitive strategy of reframing as well as its relation to previous works on framing and techniques to overcome errors in framing as discussed in sections 2.2.1 and 2.2.2. This is illustrated in Figure 4 below.

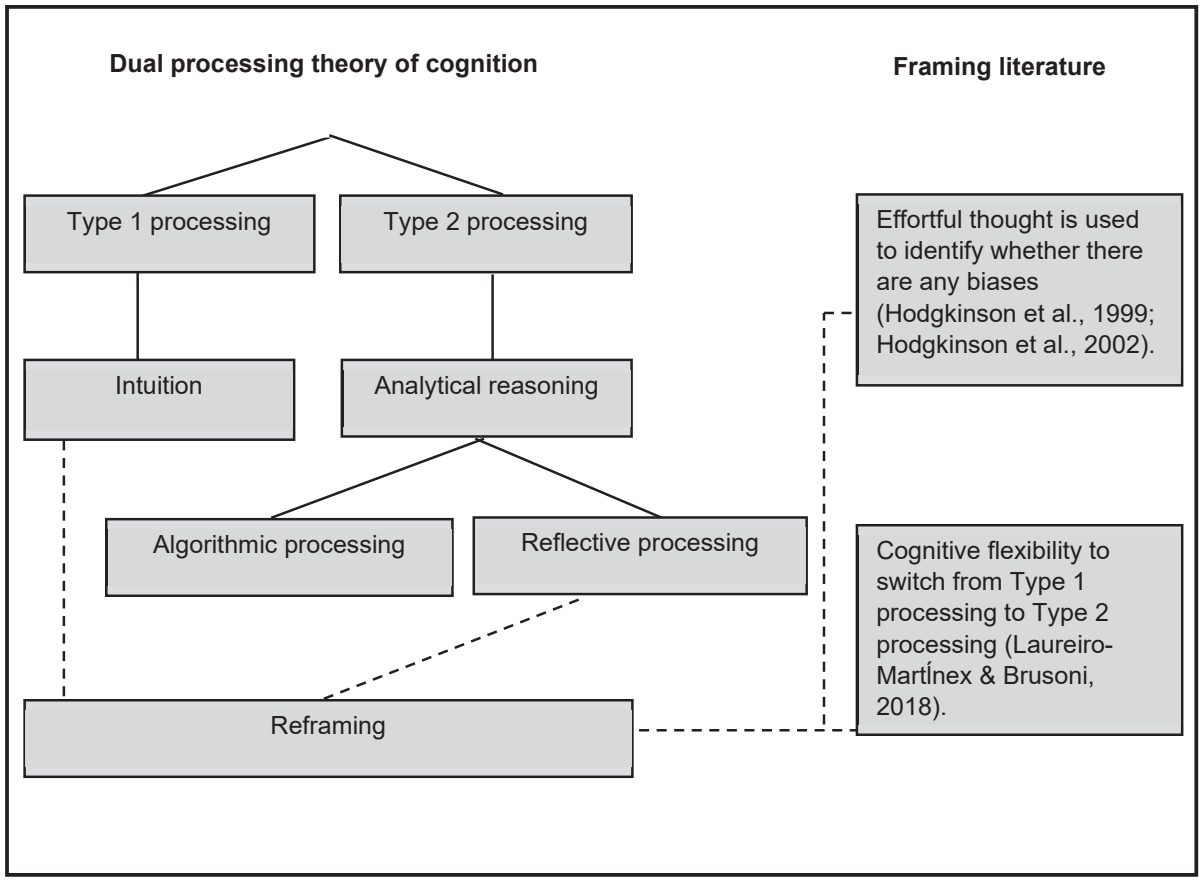

Figure 4: Foundations of reframing as a cognitive strategy
Source: Author

Figure 4 illustrates how reframing relies on intuition which is done by identifying the intuitive choice made as shown by the dotted line connecting the 'Intuition' and 'Reframing' text box (Luoma & Martela, 2021). This intuitive choice is then challenged through the use of reflective Type 2 processing as shown by the dotted line between the 'Reframing' and 'Reflective processing' text boxes (Dijksterhuis & Stick, 2016; Luoma & Martela, 2021). Reflective processing together with algorithmic processing are types of analytical reasoning which relies on Type 2 processing. Intuition in turn relies on Type 1 processing (Dijksterhuis & Stick, 2016; Luoma & Martela, 2021). Both Type 1 and Type 2 processing is based on the dual processing theory of cognition (Luoma & Martela, 2021). The dotted lines between the 'Reframing' text box and the two text boxes under the heading framing literature shows how the salient works of Hodgkinson et al. (1999) and Hodgkinson et al. (2002), as extended by Laureiro-Martínex and Brusoni (2018), intersects with the concept of reframing as a cognitive strategy.

As detailed in section 2.2.1 reframing is not a new topic in strategy and has been used to understand a variety of topics including biases in uncertain decisions and to explore when social interactions that utilise reframing can overcome suboptimal decisions. (Abatecola et al., 2018; Cornelissen & Werner, 2014; Hodgkinson et al., 1999; Hodgkinson et al., 2002; Laureiro-MartÍnex & Brusoni, 2018; Luoma & Martela, 2021). The cognitive process of reframing as a strategy, however, has not been examined in detail within the strategic management literature (Luoma & Martela, 2021).

One of the few exceptions to the above is the examination by Mukherjee et al. (2020) which responds to the invitation from Ramirez and Wilkinson (2016) to provide an examination on the process of cognitive reframing. Mukherjee et al. (2020) responds to this invitation by examining how scenarios research enables decision makers to reframe their current situations by developing plausible future contexts which are intended to re-perceive the cognitive frames of decision makers (Mukherjee et al., 2020). The outcome of their study is practical in nature as it describes a method, based on a scenarios research approach, that can be utilised as a successful method of reframing. The examination by Mukherjee et al. (2020) is not referenced Luoma and Martela (2021) and is accordingly analysed below.

The examination by Mukherjee et al. (2020) complements the work by Luoma and Martela (2021) as it supports the argument that reframing can be used to identify errors in the background assumptions of a decision maker in a decision situation.

The examination by Mukherjee et al. (2020) is contrasted to the work of Luoma and Martela (2021) in that Luoma and Martela (2021) propose a concept of reframing as a third cognitive strategy that invites further empirical testing to determine its efficacy in certain contexts. While the work of Mukherjee et al. (2020) does indeed examine the process of cognitive reframing, their work is very much focused on how cognitive reframing can be implemented through a scenarios research approach. Their work does not determine the efficacy of reframing (Mukherjee et al., 2020).

The work of Mukherjee et al. (2020) is further contrasted to the works of Luoma and Martela (2021) as Mukherjee et al. (2020) apply their scenarios research approach to a context of uncertainty which is not one of the contexts noted by Luoma and Martela (2021). The findings by Mukherjee et al. (2020) could, however, be investigated to see whether it applies to contexts of ambiguity, which has similarity with the concepts of uncertainty (Luoma & Martela, 2021), as well as whether a scenarios-based approach

could be used in the contexts noted by Luoma and Martela (2021). This is not considered in this research report but is noted as an avenue for further research in section 7.5.

The above analysis critically discusses the process of reframing as informed by the dual process theory of cognition which is the academic anchor of this research report. The analysis is important given, as shown above in this section 2.2.2 and in section 2.2.1, that a consideration of the process of reframing from the perspective of a cognitive strategy has not been considered in great detail (Cornelissen & Werner, 2014; Luoma & Martela, 2021).

The only notable exception to the above is the works of Mukherjee et al. (2020) which complements the works of Luoma and Martela (2021) by arguing that reframing can be used to identify errors in the background assumptions of a decision maker in a decision situation. The contrast between the works of Mukherjee et al. (2020) and Luoma and Martela (2021) is, however, of relevance as the research questions detailed in 1.3 considers the effectiveness of reframing in contexts of low familiarity and high complexity as opposed to uncertainty which is the context in which Mukherjee et al. (2020) consider the effectiveness of reframing. The disadvantages of reframing as a cognitive strategy are critically discussed below.

2.2.3. Disadvantages of reframing

While reframing is argued to be a better cognitive strategy when utilised in certain contexts, it would be remiss not to mention the disadvantages of reframing which relate to timing and efficacy. Both the first and second disadvantage are problematic as quick and correct managerial decisions are desirable for an organisation (Luan et al., 2019).

The first disadvantage is that the process of reframing is likely to be a lengthier process than utilising either intuition or analytical reasoning. In particular the process of reframing through a period of incubation, as opposed to the deliberate undertaking of a reframing process, is time consuming and can take up to a few days with no guarantee that an optimal decision being reached (Luoma & Martela, 2021).

In response to the first disadvantage and limitation, it is important to note that a decision maker has a meta-level choice on the process of reframing they would like to adopt (Luoma & Martela, 2021). For time critical decisions, decision makers could therefore choose to adopt a deliberate thought process to consider how information and options

are presented; challenge the parameters of a decision-making situation; and identify whether there are any errors in thought that are based on how information or options are presented (Laureiro-MartÍnex & Brusoni, 2018; Luoma & Martela, 2021). Expressed otherwise, they could choose to use the process of reframing that utilises a deliberate thought process as opposed to a process that involves a period of incubation.

In addition, the work of Mukherjee et al. (2020) provides a practical solution on how a scenarios research approach enables decision makers to adopt reframing as a cognitive strategy. This framework, and further frameworks that may be developed, allows for a practical solution to the disadvantage of reframing being a lengthier process.

The second disadvantage is the uncertainty regarding the efficacy of reframing in achieving its intended outcomes of decision quality when compared to using intuition or analytical reasoning (Luoma & Martela, 2021). In response to this second disadvantage and limitation, the proposed study will seek to understand whether reframing leads to a better-quality decision when compared to intuition. This is aligned with the research questions detailed in section 1.3 which seek to question the effectiveness of reframing relative to intuition. The reason for this is that Luoma and Martela (2021) argue that reframing leads to better decision when compared to intuition given that reframing allows for a questioning of the background assumptions and intuitive responses as well as the relevant parameters of a decision situation. This questioning of background assumptions, intuitive responses and parameters of a decision situation allows an opportunity to identify any errors in reasoning and cognitive biases that could occur when intuition is used as a cognitive strategy (Khaneman, 2003; Luoma & Martela, 2021). Intuition as a cognitive strategy based on the dual process theory of cognition, is critically discussed in section 2.3 below.

2.3. Intuition

Intuition is the dominant form of processing when Type 1 processing is adopted as a cognitive strategy (Kahneman, 2011; Luoma & Martela, 2021). Intuition is further an independent variable of the experiment design detailed in Chapter 4. This section accordingly critically discusses the literature on intuition. Section 2.3.1 provides an overview and critically discusses salient literature on intuition. Section 2.3.2 compares intuition to reframing and analyses why reframing is argued to lead to a better quality of

decisions in contexts of high complexity and low familiarity which are analysed in sections 2.4 and 2.5 respectively.

2.3.1. Introduction to intuition

Intuition is based on Type 1 processing and while there are varying interpretations of intuition, Glöckner and Witteman (2010), analyse these various interpretations in defining intuition as being “based on automatic processes that rely on knowledge structures that are acquired by (different kinds of) learning and operating at least partially without people’s awareness and result in feelings, signals, or interpretation” (Glöckner & Witteman, 2010, p. 5 - 6).

Glöckner and Witteman (2010) further distinguishing between four types of intuition: associative intuition, matching intuition, accumulative intuition, and constructive intuition. Associative intuition is a simple learning-retrieval process and is based on associative learnings and retrieval of a previous successful behavioural choice. Matching intuition is an exemplar learning-retrieval process and is based on the acquisition of exemplars and the retrieval of such exemplars that can be compared to a current decision situation. Accumulative intuition is based on memory traces from associative and matching intuitions. Lastly, constructive intuition is similar to accumulative intuition but differs in that the process of constructive intuition uses mental representations in forming consistent interpretations applicable to a decision situation (Glöckner & Witteman, 2010; Pretz et al., 2014).

The four types of intuition noted by Glöckner and Witteman (2010) above is relevant as Pretz et al. (2014) extend the work of Glöckner and Witteman (2010) and provides a Types of Intuition Scale that can be used to test the type of intuition used by participants to test research RQ3.

Pretz et al. (2014) distinguishes between three types of intuition: affective, holistic, and inferential intuition which are shown to be independent of each other. As will be demonstrated further below, the distinction between the three types of intuition as identified by Pretz et al. (2014) is justified as a measure to identify the types of intuition.

Affective intuition is akin to associative intuition in that affective intuition judgments are primarily based on emotional reactions to a specific decision situation (Pretz et al., 2014). An example of affective intuition is when a decision maker has a ‘feeling’ about what the

right response to a decision-making situation is. Such ‘feeling’ is often not capable of being expressed or rationally justified but generally provides a decision maker with a sense of certainty (Pretz & Totz, 2007). While it has been argued that affective intuition includes emotion and affect, affect is generally recognised as being a correlate of affective intuition and not a component of it (Pretz & Totz, 2007).

Holistic intuition is akin to accumulative intuition in that holistic intuition is based on a qualitatively non-analytical processes whereby decisions are made by holistically integrating various and diverse cues (Pretz et al., 2014). Holistic intuition is done on a subconscious level and involves decision makers within a decision-making situation making a decision based on internal and external stimuli or cues (Julmi, 2019; Pretz & Totz, 2007; Pretz et al., 2014).

Inferential intuition is akin to constructive intuition as it is based on inferences that have become automatic through the practice of an analytical decision-making process conducted numerous times in the past (Pretz et al., 2014). An example of inferential intuition would be driving a car. At first when starting to drive the process would be analytical with a focus on acceleration, breaking and gear changing but after a while this process will become automatic to drivers.

In measuring the type of intuition Pretz et al. (2014) develop and validate a Types of Intuition Scale (TIntS) which provides a valid measure of three independent types of intuition: affective, holistic, and inferential intuition. Cronbach’s alpha for affective, holistic, and inferential intuition are .76, .74 and .79 respectively (Pretz et al., 2014). The work of Pretz et al. (2014) appears to respond to the call Ackinci and Sadler-Smith (2012) who call for further analysis on the work of Glöckner and Witteman (2010) to “explore the relationships between the disaggregated processes of intuiting” given that the types of intuition identified by Glöckner and Witteman’s (2010) appear to overlap with each other (Ackinci & Sadler-Smith, 2012, p. 31).

Given the extension of Glöckner and Witteman’s (2010) study by Pretz et al. (2014), the experimental design detailed in Chapter 4 will adopt the three types of independent intuition identified by Pretz et al. (2014). By identifying the type of intuition that is used, this research report will be able to test whether the effectiveness of reframing depends on the type of intuition that is used when measuring decision quality.

Given that affective, holistic, and inferential intuition are shown to be independent types of intuition, it is of interest to consider whether the type of intuition that is used has an effect on decision quality and in turn whether the effectiveness of reframing on decision quality depends on the type of intuition that is used (Pretz et al., 2014). While this is not analysed by Luoma and Martela (2021), it is argued to be relevant to the proposed study as the three different types of intuition are based on different processes and lead to different outcomes in terms of decision quality (Pretz et al., 2014; Pretz, 2011).

2.3.2. Intuition compared to reframing

This section critically reviews intuition as compared to reframing. This is important as the research questions detailed in 1.3 seek to compare the effectiveness of reframing relative to intuition.

While the benefit of intuition, as a cognitive strategy based on Type 1 processing, is that it requires minimal cognitive processing its disadvantages are errors in reasoning and cognitive biases (Laureiro-MartÍnex and Brusoni, 2018; Luoma & Martela, 2021). The reason for these errors in reasoning and biases are that they are based on heuristic principles, informed by past experiences, which do not always take into account all relevant factors and parameters of a decision-making situation (Kahneman, 2003). Relying on intuition as a cognitive strategy will not always lead to errors in reasoning and cognitive biases it is, rather, a disadvantage in the sense that it is more likely to lead to errors in reasoning and cognitive biases when compared to the cognitive strategies of analytical reasoning and, as argued by Luoma and Martela (2021), reframing.

Reframing is argued to lead to better decision when compared to intuition given that reframing allows for a questioning of the background assumptions and intuitive responses as well as the relevant parameters of a decision situation. This allows an opportunity to identify any errors in reasoning and cognitive biases that could occur when intuition is used as a cognitive strategy (Khaneman, 2003; Luoma & Martela, 2021).

It is important to note that intuition can be effective in contexts of high ambiguity and complexity – where the decision maker has the necessary experiential basis (Luoma & Martela, 2021; Pretz et al., 2011). This effectiveness, however, of relying on intuition within this context is generally adequate but is not a guarantee that an optimal decision is made (Luoma & Martela, 2021, p.10). In addition, the use of intuition within these

contexts could gradually be creating problems that are only identified later in time (Luoma & Martela, 2021; Rahmandad & Repenning, 2016).

Within contexts of high familiarity, however, intuition is argued by Luoma and Martela (2021) to be more effective than reframing as a cognitive strategy. Although not canvassed by Luoma and Martela (2021) this study adopts the viewpoint that this would only be the case where the parameters of a decision-making situation are well defined and the quality of a decision is only based on the use of the correct reasoning in arriving at a situation. This would obviate the need for reflective Type 2 processing – a process identified in section 2.2.2 as being a component of reframing as a cognitive strategy – which considers whether the best decision is made given the parameters (Evans & Stanovich, 2013; Luoma & Martela, 2021).

Notwithstanding the above, the proposition by Luoma and Martela (2021) is to understand the effectiveness of reframing compared to intuition in contexts of high complexity and low familiarity. What constitutes low familiarity is critically discussed in section 2.5.2 and informs the context of the experimental research methodology.

Ultimately, the benefit of using refarming as a cognitive strategy in contexts of high complexity and low familiarity is that it leads to a better decision given that a decision maker ‘takes a step back’ and allows themselves an opportunity to consider whether there are any parameters or information that they have erroneously considered or not identified (Luoma & Martela, 2021). The measure of what a better decision is can be obtained by understanding the quality of a decision. This key construct is critically discussed in section 2.4 below.

2.4. Decision quality

The followings sections delve into an understanding of decision quality and how it can be measured by reference to the work of Amason (1996). As decision-quality is the primary outcome variable of this study as further detailed in Chapter 4 a critical review of decision quality is required. Section 2.4.1 describes the decision quality measure as posited by Amason (1996). This decision quality measure is then analysed in section 2.4.2.

2.4.1. Decision quality measure

When comparing intuition with reframing, the effectiveness of each cognitive strategy within a specific context is determined by looking at the effectiveness of a decision which can be measured by looking at the quality of the decision made (Luoma & Martela, 2021). Decision quality in turn can be defined as “the extent to which the decision attained its intended objectives” (Amason, 1996; Shepherd et al., 2021, p. 126). This definition is aligned with the works of Laureiro-MartÍnex and Brusoni (2018) who note the effectiveness of a decision is dependent on the extent to which such a decision achieves its desired objectives.

With the above definition in mind, it is possible to measure the quality of a decision by determining the correlation between three measures being: the decision relative to its intent, the effect of the decision on organizational performance and generally the overall quality of the decision (Amason, 1996; Shepherd et al., 2021; Thanos, 2022). This research report and the experimental research design detailed in Chapter 4 will, however, measure the quality of a decision by only analysing the first two measures of (i) the decision relative to its intent, as well as (ii) the effect of the decision on organizational performance. The reason for this requires a critical review of the work of Amason (1996) which is done below.

2.4.2. Decision quality analysis

The reason for the approach detailed in section 2.4.1 requires an overview of the decision quality measure as introduced by Amason (1996), as further referenced and extended by Shepherd et al. (2021) and Thanos (2022). The decision quality measure introduced by Amason (1996) was positioned as being perceptual in nature and adopted qualitative research methodology with data gathered through interviews. In these interviews participants were asked to rate their own decisions and that of other members.

The rationale for adopting the above approach was that an objective measure to measure a single decision was hard to isolate in Amason’s (1996) study. More specifically, Amason (1996) identified that a decision may be classified as good or bad depending on context and to measure these decisions on the same objective scale would accordingly not be an accurate measure of the quality of a decision. The rating of decisions by other participants was therefore a mechanism to introduce a rating of a decision within a specific context (Amason, 1996).

The key distinction between Amason's (1996) study and the experimental research design detailed in Chapter 4, is that Amason (1996) focused on decisions that had already been made. This necessitated a perceptual measure so that the context in which a decision was made, was considered. As the experimental research design detailed in Chapter 4 has the benefit of designing the decision-making situation and defining what the parameters are to measure the quality of a decision, there is no need for a perceptual measure. More specifically, the decision-making situation, introduced through an experimental vignette, has a parameter which is communicated to participants in the decision-making situation – they are required to make a decision that has the greatest monetary payoffs for a fictional organisation. This is the intent of the decision with the outcome of the choice determining the effect on organisational performance (Amason, 1996).

In summary the experimental research design detailed in Chapter 4 is contrasted to Amason's (1996) study as an objective measure will be used to measure decision quality. There is accordingly no need for decisions to be rated by other participants as there are two parameters used to determine the quality of the decision made. This measurement of decision quality provides an objective measure to compare the effectiveness of reframing against the three types of intuition on decision quality within the contexts of high complexity and low familiarity - which are critically discussed in section 2.5 below.

2.5. Decision-making in highly complex situations with low familiarity

As detailed in Chapter 1, the objective of this study is to examine decision quality within highly complex situations where the decision maker also has low familiarity with the decision situation. This echoes the types of decisions that upper echelon decision-makers encounter (Hammond et al., 2006). The following sections deal with the remaining two constructs which inform the research questions detailed in 1.3, namely complexity and low familiarity. Section 2.5.1 critically discusses complex decision-making situations. Section 2.5.2 provides a critical overview of what constitutes low familiarity. The context of low familiarity will not be analysed in this section given that this was done in section 2.3.2.

2.5.1. Complexity

Complex situations can be characterised as situations where the best decision is based on numerous factors as well as the interaction of such factors amongst themselves (Luoma & Martela, 2021; Vasconcelos & Ramirez, 2011). Extending the understanding by Vasconcelos and Ramirez (2011), Baumann et al. (2019) note that the interaction of factors also varies in terms of their interdependency on other factors which in turn creates a multitude of decisions. An optimal choice therefore requires a decision maker to make a set of choices that mutually reinforce one another (Baumann et al., 2019; Luoma & Martela, 2021; Vasconcelos & Ramirez, 2011).

It is worth noting that Luoma and Martela (2021) reference the work of Levinthal (1997) in defining what constitutes complexity and do not seek to extend the understanding. Baumann et al. (2019) also base their review on the work of Levinthal (1997) in identifying themes in simulation studies. Utilising the work of Baumann et al. (2019) is therefore submitted as complementing the high complexity situations noted by Luoma and Martela (2021) and therefore allows for a greater understanding of such a complex situation.

Strategic decision-making situations with high complexity, as noted in the proposition by Luoma and Martela (2021) detailed in section 1.2.1, can therefore be understood as situations where various decisions can be made given not only all the factors that need to be considered in making such a decision, but also given the interdependency of the factors on each other (Baumann et al., 2019). It is within this context that reframing is likely to lead to better decisions when compared to intuition given that reframing allows for a questioning of the background assumptions and intuitive responses as well as the relevant parameters of a decision situation (Luoma & Martela, 2021).

As increased complexity creates further scope for errors in reasoning and biases given that there is a larger number of factors and interactions between these factors, the effectiveness of reframing is likely to increase when compared to intuition as the complexity of a decision situation increases (Luoma & Martela, 2021). The experiment methodology noted in Chapter 4 of this research report seeks to create such a situation through two complex tasks, with differing complexity, that require a decision to be made based on various factors and the interaction of such factors amongst themselves. The decision-making situation will also be within the context of low familiarity which was critically discussed in section 2.3.2 and is further analysed immediately below.

2.5.2. Low familiarity

Familiarity can be understood as familiarity with a previous decision situation (Luoma & Martela, 2021). Luoma and Martela (2021) further posit that reframing can be more effective as a cognitive strategy in complex environments where a decision maker is unfamiliar with a situation. This given that familiarity with a problem is required for intuition to be an effective cognitive strategy (Glöckner & Witteman, 2010; Luoma & Martela, 2021; Pretz et al., 2014).

The above aligns with the types of intuition identified by Pretz et al. (2014), as well as Glöckner and Witteman (2010), which all rely on some form of evidence accumulation, which evidence accumulation creates familiarity, in making an intuitive response.

Ultimately, the benefit of reframing in unfamiliar scenarios is that the decision maker takes a step back, challenges their assumptions of intuition and looks at the parameters of a decision. The robust nature of reframing suggests that it will be better suited for decision environments that appear new to the decision maker (Luoma & Martela, 2021). It is for this reason that the research problem and questions, are considered within the context of low familiarly.

2.6. Conclusion

The literature review analysed the literature on (i) the academic anchor of the dual processing theory of cognition; (ii) the key constructs of reframing, intuition, and decision quality, and (iii) the contexts of complexity and low familiarity.

In reviewing the literature is submitted that there is a stronger causal relationship between reframing, as a cognitive strategy, and effective decision-making as opposed to intuition, as a cognitive strategy, and effective decision-making in contexts of high complexity and low familiarity. Reframing and intuition are both cognitive strategies based on the dual processing theory of cognition as was critically discussed in section 2.1. This effectiveness of reframing and intuition as cognitive strategies in specific contexts was critically discussed in sections 2.2 and 2.3 and it was argued that reframing is more effective than intuition in contexts of high complexity and low familiarity. This context of high complexity and low familiarity was critically discussed in section 2.5 and

section 2.3.2 in part. The measure of effectiveness of a decision was detailed in section 2.4 to be based on decision quality.

In addition, it is further submitted that the causal relationship detailed above, within the same context of low familiarity, is dependent on the level of complexity of the decision-making situation and the type of intuition that is used. The reason why the casual relationship is argued to be dependent on the level of complexity is because, as critically discussed in section 2.5.1, as the complexity of a decision-making situation in increases, the effectiveness of reframing as a cognitive strategy when compared to intuition as a cognitive strategy is argued to increase. The reason why the casual relationship is argued to be dependant on the type of intuition used is because the type of intuition used by a decision maker have different effects on decision quality as was critically discussed in section 2.3.1.

The above summary accordingly allows for the testing of three hypothesis which are detailed in Chapter 3.

Chapter 3: Hypothesis and conceptual model

The literature review in Chapter 2 provides the theoretical basis for the view that there is a stronger causal relationship between reframing, as a cognitive strategy, and effective decision-making; as opposed to intuition, as a cognitive strategy and effective decision-making, in contexts of high complexity and low familiarity (Evans, 2019; Evans & Stanovich, 2013; Kahneman, 2003; Laureiro-Martínex & Brusoni, 2018; Luoma & Martela, 2021). In addition, it is further submitted that this causal relationship, within the same context of low familiarity, is dependent on the level of complexity of the decision-making situation and the type of intuition that is used (Baumann et al., 2019; Luoma & Martela, 2021; Vasconcelos & Ramirez, 2011). Accordingly, the following three hypotheses are set:

Hypothesis 1: Compared to intuition, reframing leads to a better-quality decision in a highly complex and unfamiliar decision-making situations.

Hypothesis 1 is informed by the proposition by Luoma and Martela (2021) that in the contexts of high complexity and low familiarity, reframing as a cognitive strategy is more effective than intuition. The effectiveness of reframing relative to intuition can be understood as reframing being more effective than intuition in improving decision quality (Amason, 1996; Luoma & Martela, 2021). As detailed in section 2.4, the quality of a decision can be measured by determining the decision relative to its intent, as well as the effect of the decision on organizational performance (Amason, 1996; Shepherd et al., 2021; Thanos, 2022). The context of low familiarity is relevant to the hypothesis as familiarity with a problem is required for intuition, as opposed to reframing, to be an effective cognitive strategy (Glöckner & Witteman, 2010; Luoma & Martela, 2021; Pretz et al., 2014).

Hypothesis 2: Compared to intuition, reframing leads to a better-quality decision as the complexity of a task increases in low familiarity situations.

Hypothesis 2 is informed by the same propositions as detailed in hypothesis 1 as well as the proposition that increased complexity creates further scope for errors in reasoning and biases given that there is a larger number of factors and interactions between these factors (Baumann et al., 2019; Luoma & Martela, 2021; Vasconcelos & Ramirez, 2011). As reframing is more effective than intuition given the increase in errors in reasoning and biases (which increase is created by increased complexity) reframing is posited as being

more effective than intuition as the complexity of a decision-making situation increases (Luoma & Martela, 2021).

Hypothesis 3: The effectiveness of reframing relative to intuition in highly complex and low familiarity situations, depends on the type of intuition used.

Hypothesis 3 is informed by the same proposition as detailed in hypothesis 1 as well as the distinction between the three types of intuition: affective, holistic, and inferential intuition which are shown to be independent of each other (Pretz et al., 2014). As different types of intuitive processes lead to different outcomes in terms of decision quality, the type of intuition used should interact with the level of effectiveness between reframing and intuition (Pretz et al., 2014; Pretz, 2011).

The hypotheses are illustrated in Figure 5 and further detailed in Table 2 below.

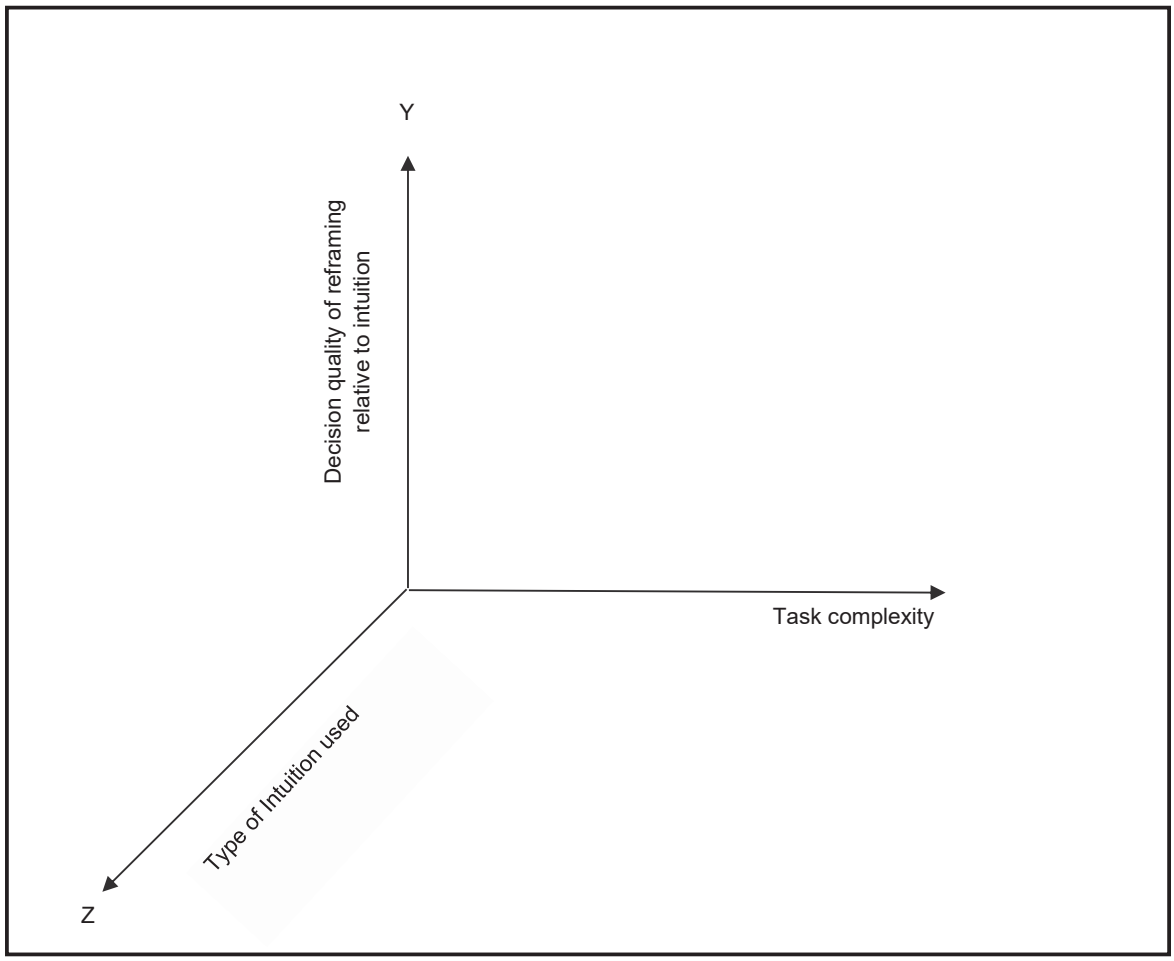

Figure 5: Hypotheses intersection
Source: Author

Hypotheses	Measure (in context of constant low familiarity)
H1	Is the coordinate greater than 0 on Y axis?
H2	Does the coordinate on the Y axis increase as task complexity, measured on the X axis, increases?
H3:	What is the coordinate on the X, Y and Z axis relative to the types of intuition used – being affective, holistic, and inferential intuition.

Table 2: Hypotheses intersection
Sources: Author

Chapter 4: Research methodology

The research questions of the proposed study were to understand (i) whether there is a stronger causal relationship between reframing and effective decision-making as opposed to intuition and effective decision-making; (ii) whether the causal relationship noted in (i) is dependent on the level of complexity of the decision-making situation, and (iii) whether the effectiveness of reframing on decision quality relative to intuition depends on the type of intuition that is used.

The first research aim that flows from the research questions is to respond to the invitation by Luoma and Martela (2021) and test the proposition that "in strategic decision-making contexts with high complexity, the effectiveness of reframing relative to intuition increases when the decision maker's familiarity with the situation is low" (Luoma & Martela, 2021, p. 10). The second research aim is to analyse the effectiveness of affective, holistic, and inferential intuition on decision quality in contexts of high complexity and low familiarity. The third research aim is to respond to the call by behavioural strategists to contribute to this discipline by focusing on the core constructs of cognitive strategies, such as intuition, and decision-making in complex situations (Borchardt et al., 2022; Luoma & Martela, 2021; Powell et al., 2011)

The purpose of this Chapter 4 is to describe the research methodology and design that was used to respond to the research questions and the research aims detailed above. Chapter 4 starts with a discussion on the research methodology and paradigm in section 4.1. This is followed by detailing the research methodology employed in section 4.2. Section 4.3 provides an overview of the data analysis method employed in Chapter 5. Section 4.4 deals with the limitation of the research design and is followed by a summary of this Chapter 4 in section 4.5.

4.1. Introduction and research paradigm

Experiments are a useful mechanism for isolating causal relationships and is often referred to as the 'gold standard' for understanding cause and effect relationships (Bolinger et al., 2022). This is given the high internal validity of experimental methodologies as the variables that determine cause and effect relationships are capable of isolation. The isolation of such variables within experiments allows for theories underpinned by cause and effect to be tested with certainty and precision (Bolinger et al., 2022).

Accordingly, an experimental design and methodology was adopted to empirically test the research questions as well as gather primary data (Bell et al., 2019; Bolinger et al., 2022). An experimental methodology and design are further aligned with the three research aims of this research report as detailed below.

With refence to the first research aim, Luoma and Martela (2021) specifically call for their propositions to be tested through experimental manipulation. Adopting an experimental research design and methodology is further aligned with the third research aim given that experiments are identified as being a useful methodology to understand the micro-foundations of strategic management as well as behavioural strategy (Bolinger et al., 2022).

While Luoma and Martela (2021) do not distinguish between the different types of intuition in positing that reframing will be more effective than intuition in contexts of high complexity and low familiarity, cognitive strategies such as intuition and decision-making in complex situations have received a call for further understanding by behavioural strategists (Borchardt et al., 2022; Luoma & Martela, 2021; Powell et al., 2011). Given that experiments are identified as being a useful methodology to understand the micro-foundations of strategic management as well as behavioural strategy, the testing of the second research aim through an experimental research design is justified (Bolinger et al., 2022).

Experimental research designs can either employ a quantitative or qualitative research strategy. As the research questions will be making quantitative comparisons between the effectiveness of reframing relative to intuition and the various types of intuition on decision quality, the proposed design will be quantitative in nature (Bell et al., 2019).

The quantitative method is aligned with the epistemological position of positivism which invites quantitative research methods that collects numerical data to ultimately measure the relationships between social phenomena (Bell et al., 2019). In terms of an ontological position, positivism is characterised as an objectivist ontological position which posits that social phenomena exist objectively and are external to observers. As positivism is based on an objective reality, the most appropriate manner of data gathering is through observation or measurement. This measurement can in turn be achieved through experiments (Bell et al., 2019).

4.2. Research design

The followings sections describe the research design that was employed. Section 4.2.1 describes the unit and level of analysis. This is followed by a description of the population and sample in section 4.2.2. Section 4.2.3 is dedicated to an analysis of the sample size of the study with reference to other experiments conducted in management literature. Section 4.2.4 details the research instrument used to gather data.

4.2.1. Unit and level of analysis

The level of analysis was an individual in a complex decision-making situation as it was this individual decision-making that the hypotheses detailed in Chapter 3 was aimed at understanding (Bell et al., 2019). The unit of analysis was the strategic decision made by the decision maker in the experiment (Bell et al., 2019). This is aligned to the basic unit of behaviour that was investigated by Luoma and Martela (2021).

4.2.2. Population and sample

The population for the research was decision makers within South African corporates. This was driven by the need for accessibility of respondents as well as the importance of effective decision-making for organisations as detailed in section 1.5 (Bell et al., 2019; Hammond et al., 2006; Wedell-Wedellsborg, 2017).

There was no sampling frame for this population. Accordingly, convenience sampling as a form of purposive, non-probability sampling, was used to source appropriate participants (Bell et al., 2019). While probability sampling is preferred as it reduces the probability of a sampling error, it was not possible to do so in this research report (Bell et al., 2019). This is owing to the absence of a credible database of decision makers within South African corporates that have four or more years of managerial experience and are not investment or financial officers within manufacturing industries. Accordingly, a purposive, non-probability, sampling method was employed.

The criteria of the participants needing to have four of more year of managerial experience who were not investment or financial officers within the manufacturing industry was, however, a form of criteria sampling (Palinkas et al., 2015). The benefit of this technique was that participants who met the criteria detailed above, could be deemed an information rich class given their experience in strategic decision-making

situations (Laureiro-Martínez & Brusoni, 2018; Palinkas et al., 2015). The three criteria used in the criteria sampling are detailed below.

The first criteria to take part in the experiment was that participants had to be working within a South African corporation. This was to ensure that the participants were part of the population (Bell et al., 2019).

The second criteria was that participants had to have four or more years or managerial experience. This was informed by the experiment conducted by Laureiro-Martínez and Brusoni (2018) who, in one of their sampling criteria, required participants to have four or more years or managerial experience as such participants were likely to have adequate cognitive ability.

The third criteria were that participants could not take part in the experiment if they were investment or financial officers within manufacturing industries. This was to reduce the likelihood of participants having familiarity with the research instrument (Laureiro-Martínez & Brusoni, 2018; Luoma & Martel, 2021). As the research questions were required to be tested within the context of low familiarity, this criterion was included (Luoma & Martela, 2021).

The criteria detailed above were all introduced within the research design as detailed in section 4.2.4. The method used to find participants that met these criteria is detailed below.

To ensure a level of triangulation in the convenience sample, three methods that target different groups within the population and to create a more representative sample was adopted. This was important as a criticism of convenience sampling is that it is hard to generalize findings where a sample is taken from a set of participants that are similar to each other within the sample, but not representative of the population as a whole. A common example of this is managers studying the same degree (Bell et al., 2019).

The first method to target different groups within the population was to invite individuals within the professional network of the researcher, who were not students at the Gordon Institute of Business Science, to take part in the research study. The second method was to invite students at the Gordon Institute of Business Science to take part in the research study. The third method was to adopt a snowball sampling technique whereby potential

participants were asked to circulate the link to the experiment to other potential participants who met the criteria for participation detailed above (Bell et al., 2019).

The above section detailed the population and sample of the experiment as was informed by criteria sampling and further detailed how participants were targeted to take part in the experiment. Prior to a description on the research design employed it is, however, important to first provide an overview of the required sample size for the experiment.

4.2.3. Sample size

In calculating the sample size, the "rule of thumb calculation" of 30 x (the number of dependent variables + the number of levels) was used (Bolinger et al., 2022, p. 83). The dependent variable of the experiment was only decision quality. The number of levels were two which were low complexity and high complexity as detailed further in section 4.2.4.5. The sample size was therefore required to be no less than 60 which was calculated as 30 (1 x 2).

To ensure a level of confidence in the sample size calculation, experiments conducted within strategy research was reviewed. This was to ensure that the sample size of the experiment conducted was adequate. Table 3 below, provides an overview of sample sizes in a selection of studies that adopted an experimental research methodology.

Author	**Sample participants and size**	**Number of variables**	**Journal and Scopus ranking**
Shea & Hawn (2019)	88 students	Two (amount as well as favourability if feedback and whether the pen they bought a pen they tested)	Academy of Management Journal 99%)
Laureiro-Martínez & Brusoni (2018)	49 strategic decision makers	Two (type of processing and performance)	Strategic Management Journal (96%)

Tong, Reuer, Tyler, & Zhang (2015)	84 executives	Three (Divestiture attractiveness, joint venture and preference for joint venture attractiveness versus divestiture).	Strategic Management Journal (96%)
Lovallo, Clarke, & Camerer (2012)	33 private equity employees	One (value of inside forecasts over outside forecasts).	Strategic Management Journal (96%)
Gary & Wood (2011)	63 MBA students	One (cumulative profit as a proxy for performance)	Strategic Management Journal (96%)
Bardolet, Fox, & Lovallo (2011)	64 executive MBA students	One (fund allocation)	Strategic Management Journal (96%)
Amaldoss & Jain (2002)	36 students	Three (payoffs, winning frequency and frequency of investing all capital)	Management Science (88%)

Table 3: Sample sizes in experiments
Based on "Experiments in strategy research: A critical review and future research opportunities" by M. T. Bolinger, M. A. Josefy, R. Stevenson, M. A. Hitt, 2022, *Journal of Management*, *48*(1), p. 71 – 73. Copywrite 2022 by Sage.

Table 3 provides an overview of sample sizes and the number of dependent variables in studies that conducted an experiment. The journal in which such research was reported is also detailed to illustrate the repute of the experiment. Table 3 does not, however, detail the number of levels of the experiments reported due to the limited reporting of this. This, however, was not a concern as from a calculation of the sample size based on the reported number of variables and assuming only one level for the experiments reported above, it could be inferred that 60 participants for one variable and two levels was an adequate sample when compared to the experiments detailed in Table 3.

4.2.4. Research instrument, Data Gathering and Research Quality

The research instrument used to obtain the necessary data was an Experimental Vignette Methodology (Aguinis & Bradley, 2014). This type of experiment methodology is useful as it combines the benefit of laboratory experiments, being high internal validity, with the benefit of field experiments, being high external validity (Jahn et al., 2020). An Experimental Vignette Methodology involves presenting participants with a realistic scenario to determine dependent variables such as behaviours or decisions (Aguinis & Bradley, 2014).

Prior to the data being gathered, ethical approval was obtained by the Gordon Institute of Business Science's Research Ethics Committee. Ethical clearance was received on 27 June 2022 and is attached as Appendix A. The Ethics Clearance Application form indicated the methodology that was used in the experiment and included the experimental vignette. Further it was confirmed that no names of participants would be requested, that only aggregated information would be reported and finally that data would be stored without identifiers. The data gathered from the experiment complied with all these requirements.

Once ethical clearance was received, the experiment was designed using an experiment builder as detailed in section 4.2.4.1. This was finalised on the 13th of August 2022 and links to the experiment was sent to four participants, who were not part of the final experiment, as part of a pilot study. The pilot study was important for two reasons. Firstly, it needed to be identified that participants understood the experiment and could navigate the experiment online. Secondly, it was important to ensure that the data gathered from the experiment was capable of use to test the hypothesis detailed in Chapter 3.

The feedback from the four participants, which is detailed in Appendix B was used to refine the experiment. Importantly, there were no concerns that the pilot study participants were unable to understand the steps to complete the experiment. The only comments were regarding numbering issues and to ease readability of options posed after the experimental vignetted (as detailed in section 4.2.4.6).

The data that was gathered was furthermore capable of use in testing the hypothesis which was the second reason for the pilot study. In line with the ethical clearance application, the identity of participants was recorded without identifiers as a random and unique seven figure participants identity number was provided. As no names or other

identifiers were requested from participants, this identity number could not be traced back to a specific participant. Using this identity number, the experiment builder and the software behind it could track what groups the participants were randomly assigned to as well as what options they had made after reading the experimental vignette as well as their responses on the Type of Intuition Scale. This data was capable of being extracted into Excel which was in turn analysed in R studio.

The research design, that incorporated the above, is best illustrated by detailing the systematic approach that the research design followed. Figure 6 provides such an illustration of the steps taken and is followed by a detailed explanation of these steps.

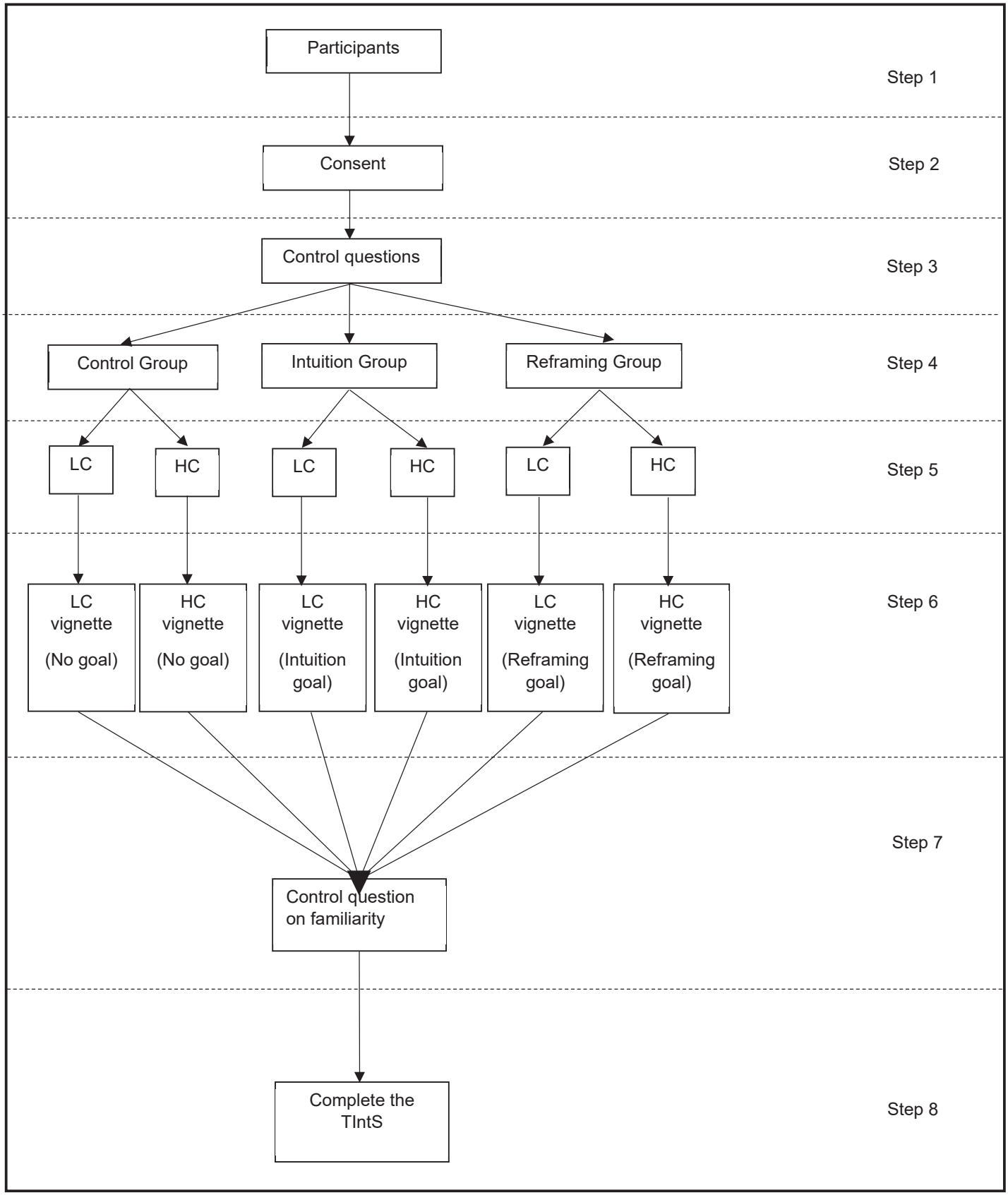

Figure 6: Experiment flow
Source: Author

4.2.4.1. Step one

As the first step, once ethical clearance was received and the pilot study had been completed (and the experiment was refined accordingly), participants who met the criteria detailed in section 4.2.2 above were invited to voluntarily take part in the proposed study. Once participants agreed that they would like to take part in the study, a link to the Gorilla experiment was sent to participants.

Gorilla is an online experiment builder that has been designed as a robust and reliable platform where researchers can create experiments, using java script, capable of being conducted online by participants on a device of their choice and at a time that suits them. Gorilla has been utilised to create experiments in a wide variety of domains including cross-lingual priming as well as cognitive tests and the gamification thereof. As of January 2019, Gorilla was used in over 400 academic institutions (Anwyl-Irvine et al., 2020).

Given the capability of Gorilla to accurately capture the data required to test the hypotheses detailed Chapter 3, it was selected as the research tool to create the experiment. The ability to accurately capture the date required to test the hypotheses was confirmed by the pilot study as detailed in section 4.2.4.

4.2.4.2. Step two

Once participants accessed the link to the experiment, they were first asked to provide their consent to taking part in the experiment and were informed that they were free to stop the experiment at any time. The design of the experiment on Gorilla allowed participants to do so and informed the researcher when they left the experiment. As soon as participants agreed to take part in the experiment they were provided with a unique, non-identifiable, identification number.

A unique identification was important as it allowed participants to be identified in terms of what groups they were randomly assigned too and what type of intuition they displayed in terms of the type of intuition scale developed by Pretz et al. (2014). This allowed hypothesis 3 to be tested once the type of intuition used by participants as gathered in step 8, as detailed in section 4.2.4.8, was obtained. Hypothesis 3 posits that the effectiveness of reframing relative to intuition in highly complex and low familiarity situations, depends on the type of intuition used.

4.2.4.3. Step three

Once participants had provided their consent to take part in the experiment, they were asked whether they had four or more years of managerial experience as well as whether they were currently a financial or investment officer within the manufacturing industry. While participants were informed of these criteria prior to being sent the link to the experiment, an extra control was built in to ensure that participants met the criteria.

If participants indicated that they did not have four or more years of managerial experience or were a financial or investment officer in the manufacturing industry, they were asked to close the experiment after responding to the control questions.

4.2.4.4. Step four

Once participants had provided their consent to take part in the experiment, they were randomly assigned by the Gorilla experiment builder to one of three groups with the same conditions. This random assignment was important as it improved the internal validity of the experiment (Bell et al., 2019).

The three groups were separated into a control group, an intuition group and a reframing group. The introduction of the control group was to ensure that the manipulation of the independent variables of decision-making through the use of intuition or reframing as a cognitive strategy actually had an effect on decision quality (Bell et al., 2019).

The separation into three groups was important as it allowed hypothesis 1 to tested. Hypothesis 1 posits that compared to intuition, reframing leads to a better-quality decision in a highly complex and unfamiliar decision-making situations. By determining the effectiveness of the decision between the intuition and reframing group, hypothesis 1 could be tested by comparing the quality of the decision of the reframing and the intuition groups (Bell et al., 2019).

In terms of assignment of participants, The Gorilla experiment builder was pre-set with an allocator function to have 20% assigned to the control group and 40% assigned to the intuition group and 40% assigned to the reframing group.

4.2.4.5. Step five

Once participants were separated into the control, intuition or reframing group, they were randomly exposed to a condition of a low complexity decision task experimental vignette or a high complexity decision task experimental vignette. The vignette was unique as it was designed by the researcher. This was to ensure that there would be low familiarity with the vignette. As detailed in Chapter 3, all three of the hypotheses were tested in contexts of low familiarity so this was an important consideration in the research design.

This random assignment into 2 subgroups per group as detailed above, was important as it allowed hypothesis 2 to be tested. Hypothesis 2 posits that compared to intuition, reframing leads to a better-quality decision as the complexity of a task increases in low familiarity situations. The detailed experimental vignettes are included in appendix C of this research report. The changes between the experimental vignettes in appendix C have been italicised for ease of review with a summary of the experimental vignette provided below.

Both the low complexity as well as the high complexity vignette were based on a fictional company MTP Technologies (Pty) Ltd ("MTP") that was faced with a decision to invest in technology or export their products. The product was tube cathodes for large scale x-ray generators for use in mining operations The participants were given the role of a chief investment officer who was responsible for strategic investment decisions that would increase the profits of MTP. It was important that the role was clearly defined, as the decision quality was measured on how close the decision met its intended objections (Amason, 1996). The vignette also introduced a conflicting value that the participants had to consider – they were advised that the chief executive officer of MTP believed that investment in technology was the correct option. This was of relevance to the participants as the chief investment officer was hoping to become the chief executive officer and knew that aligning his or her views with the chief executive officer, would increase the probability of becoming the next CEO.

The low complexity and the high complexity vignette differed in that the high complexity experimental vignette introduced a second conflicting value. The chief investment officer in the high complexity vignette was an environmentalist and knew that exporting products would result in it being used in environmentally unsustainable mining practices. To ensure that a decision was not based on an inference by participants that exporting

products to jurisdictions that have environmentally unstainable mining practices, it was made clear to participants that this was not illegal.

Both the low complexity and the high complexity experimental vignettes were high in complexity. They were termed low complexity and high complexity for ease of convention only. The complexity of the low complexity group was introduced through the various factors to consider in the decision-making situation and the interplay between such factors as well as the conflict between values and the intended objective of the decision required (to maximise profits). Complexity was further introduced through negatively framing one of the choices, as detailed under step 5, which is a feature of a complex situation (Hodgkinson et al., 1999).

The complexity of the high complexity group had the same complexities as the low complexity experimental vignette but introduced a second conflicting value to the intended objective of the decision of maximising profits. This second conflicting value was introduced through the chief investment officer being an environmentalist who was aware that exporting the products meant that it would be used in environmentally unsustainable practices to the intended objective of the decision.

There where accordingly six groups within the experiment; a low and high complexity control group, a low and high complexity intuition group and a low and high complexity reframing group. In terms of assignment of participants, The Gorilla experiment builder was pre-set with an allocator function to have participants randomly assigned to either the low or high complexity vignette with a probability of 50% of being assigned to either the low complexity or the high complexity sub-group.

4.2.4.6. Step six

As the sixth step, after participants had read the experimental vignette, they were presented with options based on the vignette they had just read. For the control group, intuition group and reframing groups participants were asked to make a choice of two options if they were in the low complexity group or a choice of three options if they were in the high complexity group.

Participants in the intuition group (for both the low and high complexity experimental vignettes) as well as the reframing group (for both the low and high complexity experimental vignettes) were further given a goal of utilising a cognitive strategy of

intuition or reframing. The introduction of this goal was based on the work of Bos et al. (2018) where participants in the experiment by Bos et al. (2018) where given a goal of using unconscious thought as a thinking disposition. For the control group, no goal was given and participants where simply asked to make a choice between two options (for the low complexity experimental vignette) or three options (for the high complexity experimental vignette).

For the intuition group, participants were given the goal at the beginning of the vignette and just before the options were presented to make a choice based on their 'gut' feel on what feels like the best option. This gut feel is aligned with using intuition which is based on making a choice based on 'gut' feel (Kahneman, 2011).

For the reframing group participants were given the goal at the beginning of the vignette and just before the options were presented to make a choice by considering what the criteria are for making the best decision within the specified context as well as identifying any intuitive response they have and considering whether there are any flaws in this intuitive response. This process is aligned with the cognitive strategy and process of reframing as identified by Luoma and Martela (2021), as further detailed in section 2.2.2, which involves a decision maker questioning their intuitive responses made and challenging the background assumptions of a decision-making situation (Luoma & Martela, 2021).

The options in the low complexity and the high complexity experimental vignette are detailed below in Table 4, together with the expected payoffs and ranking of the choice. The expected payoffs were important as it allowed for an objective measure to measure decision quality (Amason, 1996). As detailed in section 2.4.1 this was important as there was no subjective measure of decision quality. The quality of the decision was based on whether the decision met its intended objectives (which as the chief investment officer was to maximise profits) which could be measured objectively through calculating the payoffs.

Low complexity

	Options	Payoff	Ranking
Option 1	Allocating a budget to the product development team within South Africa and not attempting to export the tube cathodes overseas. Credible market research indicates that this initiative will certainly lead to profits of R25 million. This will increase your chances of becoming the next CEO of MTP.	25	2
Option 2	Halting the allocation of a budget to the product development team and rather utilising the budget to accelerate the export of products to other countries. Credible market research indicates that this initiative will lead to profits of target level of R40 million with a probability of 40% and profits of R20 million with a probability of 60%. This will not increase your chances of becoming the next CEO of MTP.	40(0.4) + (20) (0.6) =28	1

High complexity

	Options	Payoff	Ranking
Option 1	Allocating a budget to the product development team within South Africa and not attempting to export the tube cathodes overseas. Credible market research indicates that this initiative will certainly lead to profits of R25 million. This will increase your chances of becoming the next CEO of MTP	25	2

Option 2	Halting the allocation of a budget to the product development team and rather utilising the budget to accelerate the export of products to other countries. Credible market research indicates that this initiative will lead to profits of target level of R40 million with a probability of 40% and profits of R20 million with a probability of 60%. You are however aware that – 25% of the exports which will be to countries that have less stringent environmental laws. This will not increase your chances of becoming the next CEO of MTP.	40(0.4) + (20) (0.6) =28	1
Option 3	Adopting option 2 and allocating a budget of R5 million to the external affairs department of MTP to lobby for stricter environmental laws in the countries that have less stringent environmental laws.	[40(0.4) + (20) (0.6)] -5 = 23	3

Table 4: Experimental vignette options (low and high complexity)
Source: Author

4.2.4.7. Step seven

As the seventh step, after participants had made their choices based on the experimental vignette, they moved to a new screen where they were asked whether they had any familiarity with the experimental vignette they were exposed too. If they answered yes, they were asked to please explain what caused the familiarity. Only one participant indicated that they had familiarity and explained their reasoning as having been a financial officer that worked in the leisure industry, they had been exposed to choices for expansion. As this response did not indicate familiarity with the experimental vignette, they were included in the data gathered.

4.2.4.8. Step eight

As the final step, all participants in the experimental groups were asked to answer the questions on intuition types based on the Types of Intuition Scale as developed by Pretz

et al. (2014). This was a Likert scale that consisted of 24 items. The Types of Intuition Scale is attached as Appendix D. It was important to gather the type of intuition used by participants as this allowed Hypothesis 3 to be tested which posits that the type of intuition used in low familiarity situations interacts with the effectiveness of reframing to influence decision quality.

While the scale that was originally developed by Pretz et al. (2014) consisted of 29 items, the Types of Intuition Scale used in the experiment removed “Holistic-Big Picture items” which consisted of five items. This was based on the work of Pretz et al. (2014) who determined that the “Holistic-Abstract Scale” is a more valid measure of holistic intuition (Pretz et al., 2014, p. 564). Pretz et al. (2014) further deems such removal justifiable and encourage researchers to rather use the “Holistic-Abstract Scale” given that it is a more valid version to test holistic intuition.

4.3. Data analysis overview

The data received from participants who completed the study was analysed using three different techniques. These techniques and the justification for why they were used are detailed below.

The data received as part of step 6, as detailed in section 4.2.4.6, was analysed according to whether a participant was in the low complexity or the high complexity groups. The low complexity groups had two possible options. As the responses were binary, logistic regression was used. The high complexity groups had three possible options and accordingly multinomial regression was used. This analysis allowed hypothesis 1, which posits that compared to intuition; reframing leads to a better-quality decision in a highly complex and unfamiliar decision-making situations, to be tested.

To test hypothesis 2, which posits that compared to intuition; reframing leads to a better-quality decision as the complexity of a task increases in low familiarity situations, an additional code value (which coded whether the best decision was made in the low complexity groups or high complexity groups) was introduced. This allowed complexity to be used as a predictor in the low complexity and high complexity groups.

To test hypothesis 3, which posits that the effectiveness of reframing relative to intuition in highly complex and low familiarity situations; depends on the type of intuition used, was analysed by performing a principal component analysis. The principal component

analysis was done on the 24 questions that was included in the Types of Intuition Scale with the intention of identifying the variables, being the type of intuition, that are the composite indicators of components within the Types of Intuition Scale (Bhattacherjee, 2012; Pretz et al., 2014). The identification of the type of intuition used by participants was then used as a predictor in the low complexity and high complexity groups.

The analysis above was further interpreted with the limitations of the experimental research methodology employed in mind which is detailed in section 4.4 below.

4.4. Limitations

The research was limited in three extents. The limitations are detailed below, and the data received from the experiment, was interpreted with these limitations in mind.

The first limitation is that the research conducted assumed that decision makers have the necessary cognitive capability to control the cognitive strategy they wish to employ (Lejarrraga & Pinnard-Lejarraga, 2020; Luoma & Martela, 2021). The research conducted, however, attempted to circumvent this by adopting the sampling approach of Laureiro-Martínez and Brusoni (2018) who required participants to have four of more years of managerial experience as such participants were likely to have adequate cognitive ability. Nevertheless, the research did not test the cognitive capability of participants.

The second limitation is that the experimental vignette was based on only one scenario. This limited the ability to further manipulate the independent variables. The result is that some of the responses captured may be biased given factors within the experimental vignette (Aguinis & Bradley, 2014).

A third limitation is that only one experiment was done and the results of only that experiment was analysed. As the he Experimental Vignette Methodology is regarded as being capable of producing more stable results from repeated Experimental Vignette Methodology applications, this was a limitation of the experiment (Schmidt et at., 2022).

4.5. Summary

This Chapter 4 provided an overview of the research methodology employed. An experimental design and methodology was adopted for three reasons. Firstly, the

hypotheses noted in Chapter 3 seek to understand a cause an effect relationship which are best understood through experiments as experiments are regarded as being the 'gold standard' to understand cause and effect relationships (Bolinger et al., 2022). Secondly, Luoma and Martela (2021) specifically call for their propositions to be tested through experimental manipulation. Thirdly, experiments are identified as being a useful methodology to understand the micro-foundations of strategic management as well as behavioural strategy (Bolinger et al., 2022). These three reasons are aligned with the research aims detailed in section 1.4.

This Chapter 4 further detailed the research design employed in section 4.2. In doing so an overview was provided of the unit and level of analysis as well as the population and sample. Regarding the sample size, it was argued why a sample size of 67 was sufficient for an experiment by reference to relevant literature. Section 4.2.4 provided a systematic overview of how the experiment was designed and implemented to ensure that credible data could be gathered. The analysis of this data is detailed in Chapter 5 below.

Chapter 5: Results

To test the hypothesis detailed in Chapter 3, the data that was required to be captured was the decision made by participants in their respective groups as well as the type of intuition used by participants (Pretz et al., 2014).

Altogether there were six groups with a low complexity and high complexity control group, intuition group and reframing group. For the low complexity groups, the decision made between the two options was captured. For the high complexity groups, the decision made between the three options was captured. The type of intuition used by participants was captured and analysed using the Types of Intuition Scale (Pretz et al, 2014).

Chapter 5 presents the findings from the data collected and the analysis done. Section 5.1 starts with an overview of the number of participants and exclusions in each of the six groups detailed above. This is followed by section 5.2 which provides a systematic overview of how the hypothesis were tested. Section 5.3 details the data analysis approach that was adopted to test the hypothesis. Section 5.4 provides a summary of the findings in this Chapter 5.

5.1. Participants overview

In total, 81 participants started the experiment. Of these 81 participants 16 did not complete the entire experiment. The breakdown of the participants and the groups they were randomly allocated to as well as the stage of exclusions are detailed in Table 4.1 below. The steps are the sequential steps of the experiment as illustrated in Figure 6 under section 4.2.4.

Steps	Number of participants	Exclusions
Step 1 Link sent to and accepted by participants	81	2
Step 2 Consent	79	0
Step 3 Sampling criteria questions	79	0

Step 4 Random assignment into one of six groups	79	0
Step 5 Exposure to vignette	79	0
Step 6 Choices made after reading the vignette	72	7
Control Group – low complexity	10	1
Control Group – high complexity	9	0
Intuition Group – low complexity	16	2
Intuition Group – high complexity	14	0
Reframing Group – low complexity	15	1
Reframing Group – high complexity	15	3
Step 7 Familiarity check	72	3
Step 8 Completion of the Types of Intuition Scale (Pretz et al., 2014)	69	2
Final sample size	**67**	**16**

Table 5: Participant overview summary
Source: Author

The required sample size as calculated using the "rule of thumb calculation" and a review of experiments within strategy research, as detailed in section 4.2.3, was 60 (Bolinger et al., 2022, p. 83). The total sample size of 67 was therefore sufficient.

5.2. Hypothesis testing

The hypotheses detailed in Chapter 3 were tested using the data received from the experiment and was analysed on R Studio. This section 5.2 provides a systematic overview of the hypotheses that were tested and provides an overview of the specific statistical tests that were utilised. Section 5.2.4 provides a summary of the results of the

hypotheses tested. The specific models used to test the hypotheses as detailed in this section 5.2 are included as tables in section 5.3.

5.2.1. Hypothesis 1

Hypothesis 1 posited that compared to intuition, reframing leads to a better-quality decision in a highly complex and unfamiliar decision-making situations.

Hypothesis 1 was tested by analysing the data received from participants in the low complexity and the high complexity groups. The low complexity groups had two possible options. As the responses were binary, logistic regression was used. The high complexity groups had three possible options and multinomial regression was accordingly used.

Hypothesis 1 was tested using the models which is produced in Table 13 and Table 19. Both Table 13 and 19 are reproduced below for ease of reference.

Coefficients*:	**Estimate**	**Std Error**	**Z value**	**Pr(>|z|)**
(Intercept)	-0.6931	0.7071	-0.980	0.327
IntuitionControl	1.3863	1.4142	0.980	0.327
IntuitionReframing	1.2040	1.0165	1.184	0.236
Factor3HA	18.0552	4612.2020	0.004	0.997
Factor3I	-0.4055	1.3540	-0.299	0.765
IntuitionControl:Factor3HA	-37.3145	7988.5683	-0.005	0.996
IntuitionReframing:Factor3HA	NA	NA	NA	NA
IntuitionControl:Factor3I	0.4055	2.1985	0.184	0.854
IntuitionReframing:Factor3I	-18.6714	3765.8475	-0.005	0.996

Note: glm(formula = Code ~ Intuition * Factor3, family = "binomial", data = low). Dispersion parameter for binomial family taken to be 1. Null deviance is 45.475 on 32 degrees of freedom and residual deviance is 34.179 on 25 degrees of freedom. Akaike information criterion of 50.179. Number of Fisher Scoring Iterations is 17.
*1 not defined because of singularities

Table 13: Interaction term introduction to code value predicted using Intuition and Factor3
Source: Author

Coefficients:	Estimate	Std Error	Z value	Pr(>|z|)
(Intercept)	-0.7975	0.6202	-1.286	0.19851
ComplexityHigh	-2.3064	0.7412	-3.112	0.00186 **
IntuitionControl	0.9735	0.8875	1.097	0.27272
IntuitionReframing	1.6078	0.7750	2.075	0.03802 *
Factor3HA	-0.5992	1.0208	-0.587	0.55721
Factor3I	-0.6489	0.7614	-0.852	0.39413

Note: glm(formula = ChoiceB ~ Complexity + Intuition + Factor3, family = "binomial", data = data1). Dispersion parameter for binomial family taken to be 1. Null deviance is 77.977 on 66 degrees of freedom and residual deviance is 60.336 on 61 degrees of freedom. Akaike information criterion of 72.336. Number of Fisher Scoring Iterations is 5.
* Signif. codes: 0 *** 0.001 ** 0.01 * 0.05 '.' 0.1 ' ' 1

Table 19: ChoiceB against all three predictors
Source: Author

From the above it can be concluded that at a 5% significance level, hypothesis 1 was not supported as the p-value is not equal to or below 0.05 in Table 13 and Table 19 (Clark et al, 2021).

5.2.2. Hypothesis 2

Hypothesis 2 posited that compared to intuition, reframing leads to a better-quality decision as the complexity of a task increases in low familiarity situations.

Hypotheses 2 was tested by introducing an additional code value. This code value was assigned to whether the best decision was made in the low complexity groups or high complexity groups. This allowed complexity to be used as a predictor in the low complexity and high complexity groups which were produced as a combined model which included both low and high complexity. This is included in Table 20 which is reproduced below for ease of reference.

Coefficients:	Estimate	Std Error	Z value	Pr(>|z|)
(Intercept)	-0.5780	0.6340	-0.912	0.362
ComplexityHigh	-18.7382	2948.6201	-0.006	0.995
IntuitionControl	1.3135	1.0221	1.285	0.199
IntuitionReframing	1.0046	0.8490	1.183	0.237
Factor3HA	-0.4633	1.0724	-0.432	0.666
Factor3I	-0.8633	0.7578	-1.139	0.255
ComplexityHigh:IntuitionControl	-1.4241	4631.4567	0.000	1.000
ComplexityHigh:IntuitionReframing	17.5399	2948.6202	0.006	0.995

Note: glm(formula = ChoiceB ~ Complexity * Intuition + Factor3, family = "binomial", data = data1). Dispersion parameter for binomial family taken to be 1. Null deviance is 77.977 on 66 degrees of freedom and residual deviance is 55.660 on 59 degrees of freedom. Akaike information criterion of 71.66. Number of Fisher Scoring Iterations is 18.
* Signif. codes: 0 *** 0.001 ** 0.01 * 0.05 '.' 0.1 ' ' 1

Table 20: Interaction between Complexity and Intuition
Source: Author

As none of the interaction terms used in the models were statistically significant, given that no p-value was less than or equal to 0.05, hypothesis 2 was not supported (Clark et al, 2021).

5.2.3. Hypothesis 3

Hypothesis 3 posited that the effectiveness of reframing relative to intuition in highly complex and low familiarity situations, depends on the type of intuition used.

Hypothesis 3 was tested by looking at the interaction terms between the intuition groups as introduced in the models in both the low complexity and high complexity analysis which is illustrated in the combined model in Table 21 which is reproduced below for ease of reference.

Coefficients:	Estimate	Std Error	Z value	Pr(>|z|)
(Intercept)	-0.8644	0.6848	-1.262	0.20686
ComplexityHigh	-2.1350	0.7912	-2.698	0.00697 **
IntuitionControl	0.7605	1.1348	0.670	0.50277
IntuitionReframing	1.7497	0.9294	1.883	0.05975
Factor3HA	-15.5667	3261.3194	-0.005	0.99619
Factor3I	-0.3288	1.3185	-0.249	0.80307
IntuitionControl:Factor3HA	-1.6324	4417.7981	0.000	0.99971
IntuitionReframing:Factor3HA	15.7488	3261.3197	0.005	0.99615
IntuitionControl:Factor3I	1.1258	2.0252	0.556	0.57826
IntuitionReframing:Factor3I	-1.5216	1.8504	-0.822	0.41088

Note: glm(formula = ChoiceB ~ Complexity + Intuition * Factor3, family = "binomial", data = data1). Dispersion parameter for binomial family taken to be 1. Null deviance is 77.977 on 66 degrees of freedom and residual deviance is 55.862 on 57 degrees of freedom. Akaike information criterion of 75.862. Number of Fisher Scoring Iterations is 17.
* Signif. codes: 0 *** 0.001 ** 0.01 * 0.05 '.' 0.1 ' ' 1

Table 21: Interaction between Factor3 and Intuition
Source: Author

As none of the interaction terms used in the models were statistically significant, given that no p-value was less than or equal to 0.05, hypothesis 3 was not supported (Clark et al, 2021).

5.2.4. Summary of hypotheses

The salient p-values and the results of the hypotheses tested are provided in Table 6 below.

Hypothesis	p-value	Table reference	conclusion
Hypothesis 1: Compared to intuition, reframing leads to a better-quality decision in a highly complex and unfamiliar decision-making situations	0.236 (LC) 0.038 (HC)	Table 13 Table 19	Not supported
Hypothesis 2: Compared to intuition, reframing leads to a better-quality decision as the	0.995 0.995	Table 20	Not supported

complexity of a task increases in low familiarity situations.			
Hypothesis 3: The effectiveness of reframing relative to intuition in highly complex and low familiarity situations, depends on the type of intuition used.	0.996 (factor3) 0.803 (factorHA) 0.996 (factor I) 0.410 (interaction)	Table 21	Not supported

Table 6: Hypotheses summary with reference to p-values
Source: Author

An overview on the systematic approach used to test the hypotheses summarised in Table 6 above is detailed further in section 5.3 below.

5.3. Data analysis approach

Section 5.3.1 starts with an analysis of the type of intuition used by participants by reference to the Types of Intuition Scale and principal component analysis (Bhattacherjee, 2012; Pretz et al., 2014). This was analysed first as the principal components, being the type of intuition used by participants, was utilised in the models for low complexity and high complexity. The low complexity and high complexity models are detailed in sections 5.3.2.1 and 5.3.2.2 respectively under the heading of decision quality.

5.3.1. Types of Intuition Scale

The data received from the 67 participants after completing the Types of Intuition Scale was analysed to classify the type of intuition used by participants (Pretz et al., 2014). This was done by performing a principal component analysis on the 24 questions that was included in the Types of Intuition Scale with the intention of identifying the variables, being the type of intuition, that are the composite indicators of components within the Types of Intuition Scale (Bhattacherjee, 2012; Pretz et al., 2014). Analysing the data in this manner produced the results in Table 7 below.

	Standard deviation	Proportion of Variance	Cumulative Proportion
PC1	2.18	0.27	0.27
PC2	1.49	0.12	0.39
PC3	1.24	0.09	0.47
PC4	1.07	0.06	0.54
PC5	1.04	0.06	0.60
PC6	0.91	0.05	0.64
PC7	0.86	0.04	0.69
PC8	0.81	0.04	0.72
PC9	0.78	0.03	0.76
PC10	0.75	0.03	0.79
PC11	0.72	0.03	0.82
PC12	0.71	0.03	0.84
PC13	0.66	0.03	0.87
PC14	0.63	0.02	0.89
PC15	0.60	0.02	0.91
PC16	0.57	0.02	0.93
PC17	0.53	0.02	0.94
PC18	0.51	0.01	0.96
PC19	0.45	0.01	0.97
PC20	0.42	0.01	0.98
PC21	0.38	0.01	0.99
PC22	0.31	0.01	0.99
PC23	0.28	0.004	0.996
PC24	0.24	0.003	1.00

Table 7: Principal component analysis
Source: Author

From the above analysis only 48% of the total cumulative variation in the data captured in the Types of Intuition Scale. How each question loaded onto each component is illustrated in Table 8 below.

Principal Component	Question
Affective intuition (PC1)	2, 7, 11, 12, 13, 15, 17, 24
Inferential intuition (PC 2)	1, 3, 4, 5, 8, 10 16 18 19 22 23
Holistic Intuition (PC 3)	6, 9, 14, 20, 21

Table 8: Question loading on the Types of Intuition Scale
Source: Author

From the above the type of intuition used by each participant can be classified by identifying the component with the largest magnitude (positive or negative) which would be representative of that participant (Bhattacherjee, 2012; Pretz et al., 2014). This is illustrated in Table 9 below. This classification is required as it allows hypothesis 3 to be tested by identifying the type of intuition used by participants in the intuition and reframing groups.

Participant	Group	PC1	PC2	PC3	Factor3
1	Control (LC)	1,151	0,515	1,042	A
2	Control (LC)	-3,768	1,295	-0,056	A
3	Control (LC)	-0,727	1,455	-0,849	I
4	Control (LC)	0,213	0,565	-0,341	I
5	Control (LC)	0,375	0,898	1,461	HA
6	Control (LC)	-1,284	-0,167	-0,881	A
7	Control (LC)	-1,967	2,647	-0,143	I
8	Control (HC)	4,528	2,672	0,589	A
9	Control (HC)	-3,849	-0,407	1,217	A
10	Control (HC)	0,276	-0,516	2,111	HA
11	Control (HC)	-1,494	-1,167	-1,152	A
12	Control (HC)	-0,117	-0,044	-0,343	HA
13	Control (HC)	4,639	0,403	0,774	A
14	Control (HC)	-0,284	0,593	0,979	HA
15	Control (HC)	-4,544	0,990	0,028	A
16	Control (HC)	0,501	-0,420	-0,153	A
17	Intuition (LC)	-2,562	-1,198	0,141	A
18	Intuition (LC)	1,600	-0,594	-1,520	A
19	Intuition (LC)	0,675	-0,276	-0,362	A
20	Intuition (LC)	-1,109	-0,621	0,014	A

21	Intuition (LC)	1,647	0,369	-0,379	A
22	Intuition (LC)	2,341	1,369	-0,731	A
23	Intuition (LC)	1,136	-0,075	0,015	A
24	Intuition (LC)	-2,660	-2,241	0,301	A
25	Intuition (LC)	1,811	-3,804	-1,846	I
26	Intuition (LC)	-0,808	-1,097	-0,863	I
27	Intuition (LC)	4,571	-0,771	1,012	A
28	Intuition (LC)	0,084	-1,683	-0,140	I
29	Intuition (LC)	0,101	3,244	0,796	I
30	Intuition (HC)	0,871	-3,005	-0,079	I
31	Intuition (HC)	2,384	1,592	-0,289	A
32	Intuition (HC)	1,966	-0,075	0,198	A
33	Intuition (HC)	3,100	0,544	0,688	A
34	Intuition (HC)	0,511	-1,351	1,465	HA
35	Intuition (HC)	2,014	-2,504	-0,045	I
36	Intuition (HC)	-0,058	1,398	5,701	HA
37	Intuition (HC)	2,898	2,045	-0,030	A
38	Intuition (HC)	-2,482	-1,601	-0,293	A
39	Intuition (HC)	-0,905	-0,086	-1,157	HA
40	Intuition (HC)	-1,371	-0,049	-0,809	A
41	Intuition (HC)	-1,259	-0,589	-0,556	A
42	Intuition (HC)	0,384	-0,241	-0,546	HA
43	Reframing (LC)	-1,998	1,765	-2,380	HA
44	Reframing (LC)	1,935	-0,917	-0,427	A
45	Reframing (LC)	1,802	-0,156	0,253	A
46	Reframing (LC)	-1,512	-3,298	-0,436	I
47	Reframing (LC)	-4,114	-0,077	0,169	A
48	Reframing (LC)	2,466	-0,763	2,162	A
49	Reframing (LC)	-2,301	2,678	0,001	I
50	Reframing (LC)	-1,330	1,004	0,815	A
51	Reframing (LC)	2,017	1,866	-1,290	A
52	Reframing (LC)	-0,321	0,491	0,782	HA
53	Reframing (LC)	-3,211	-0,471	-0,101	A
54	Reframing (LC)	3,634	0,365	-1,213	A
55	Reframing (LC)	0,773	-1,242	0,117	I
56	Reframing (HC)	-3,937	-1,175	-0,298	A

57	Reframing (HC)	1,502	-0,558	0,915	A
58	Reframing (HC)	0,371	-0,578	-0,514	I
59	Reframing (HC)	1,253	-1,584	-1,906	HA
60	Reframing (HC)	2,140	-0,870	0,610	A
61	Reframing (HC)	1,080	0,824	0,895	A
62	Reframing (HC)	-0,186	1,216	0,955	I
63	Reframing (HC)	-1,385	2,690	-0,190	I
64	Reframing (HC)	-2,734	-0,416	1,037	A
65	Reframing (HC)	-1,760	-1,348	2,821	HA
66	Reframing (HC)	-2,868	2,957	-2,933	I
67	Reframing (HC)	0,707	0,617	-0,170	A

Table 9: Participant classification according to component value
Source: Author

5.3.2. Decision quality

The quality of the decision was considered from the perspective of low complexity and high complexity. The data analysis for this is detailed below.

5.3.2.1. Low complexity

The low complexity groups were faced with a task that was high in complexity as detailed in section 4.2.4.5. By way of a summary the complexity was introduced through the various factors to consider in the decision-making situation, the interplay between such factors as well as the conflict between values and the intended objective of the decision required (to maximise profits). The group was termed low complexity for ease of reference.

For low complexity there were two possible options. As the responses were binary, logistic regression was accordingly used. In the low complexity models the code value for a decision was either coded as 1 or 2 with a value of 2 being the best option in terms of decision quality. Intuition is the base *Intuition* value as hypothesis 1 was to test the effectiveness of reframing compared to intuition. Expressed otherwise, the *Intuition* group was made up of whether participants were in the control, intuition or reframing group but was termed *Intuition* as this was the base value. The baseline *Factor3* is the affective intuition.

Coefficients:	Estimate	Std Error	Z value	Pr(>|z|)
(Intercept)	-0.8109	0.6009	-1.349	0.177
IntuitionControl	1.0986	0.9718	1.130	0.258
IntuitionReframing	0.9651	0.8189	1.178	0.239

Note: glm(formula = Code ~ Intuition, family = "binomial", data = low). Dispersion parameter for binomial family taken to be 1. Null deviance is 45.475 on 32 degrees of freedom and residual deviance is 43.554 on 30 degrees of freedom. Akaike information criterion of 49.554. Number of Fisher Scoring Iterations is 4.

Table 10: Simple model for low complexity
Source: Author

In the above model the code was predicted using *Intuition*. The coefficient for the base *Intuition* level is not shown as it was included in the intercept. The coefficients of the other levels of *Intuition* are given relative to the base group/value. In interpreting the above, a positive coefficient is seen as an improvement from moving from the base group to that coefficient's group. The last column shows the p-values associated to the coefficients in the model with none of them being below 0.05 which means that that the findings in the above table cannot be supported.

Following an analysis of the above model, the decision quality was predicted using *Factor3* which was the component that the participants loaded onto in the model illustrated in Table 9. For *Factor3,* the baseline value is affective intuition (A).

Coefficients:	Estimate	Std Error	Z value	Pr(>|z|)
(Intercept)	2.091e-16	4.472e-01	0.000	1.000
Factor3HA	6.931e-01	1.304e+00	0.532	0.595
Factor3I	-8.473e-01	8.223e-01	-1.030	0.303

Note: glm(formula = Code ~ Factor3, family = "binomial", data = low). Dispersion parameter for binomial family taken to be 1. Null deviance is 45.475 on 32 degrees of freedom and residual deviance is 43.762 on 30 degrees of freedom. Akaike information criterion of 49.762. Number of Fisher Scoring Iterations is 4.

Table 11: Code value predicted using Factor3
Source: Author

The results from model in Table 10 and 11 were then combined to predict the decision quality, using *Intuition* and *Factor3* as predictors.

Coefficients:	Estimate	Std Error	Z value	Pr(>|z|)
(Intercept)	-0.5463	0.6408	-0.852	0.394
IntuitionControl	1.2497	1.0441	1.197	0.231
IntuitionReframing	0.8961	0.8613	1.040	0.298
Factor3HA	0.2303	1.3596	0.169	0.866
Factor3I	-1.0053	0.8737	-1.151	0.250

Note: glm(formula = Code ~ Intuition + Factor3, family = “binomial”, data = low). Dispersion parameter for binomial family taken to be 1. Null deviance is 45.475 on 32 degrees of freedom and residual deviance 41.942 on 28 degrees of freedom. Akaike information criterion of 51.942. Number of Fisher Scoring Iterations is 4.

Table 12: Code value predicted using Intuition and Factor3
Source: Author

The model used in Table 12 uses both predictors in the model. As this could be a reason why no statistically significant coefficients were observed, as the p-value was not less than or equal to 0.05, it was required to ascertain whether there was an interaction effect between the two predictors that the model did not account for. An interaction term was accordingly introduced in the model illustrated in Table 13 below.

Coefficients*:	Estimate	Std Error	Z value	Pr(>|z|)
(Intercept)	-0.6931	0.7071	-0.980	0.327
IntuitionControl	1.3863	1.4142	0.980	0.327
IntuitionReframing	1.2040	1.0165	1.184	0.236
Factor3HA	18.0552	4612.2020	0.004	0.997
Factor3I	-0.4055	1.3540	-0.299	0.765
IntuitionControl:Factor3HA	-37.3145	7988.5683	-0.005	0.996
IntuitionReframing:Factor3HA	NA	NA	NA	NA
IntuitionControl:Factor3I	0.4055	2.1985	0.184	0.854
IntuitionReframing:Factor3I	-18.6714	3765.8475	-0.005	0.996

Note: glm(formula = Code ~ Intuition * Factor3, family = "binomial", data = low). Dispersion parameter for binomial family taken to be 1. Null deviance is 45.475 on 32 degrees of freedom and residual deviance is 34.179 on 25 degrees of freedom. Akaike information criterion of 50.179. Number of Fisher Scoring Iterations is 17.
*1 not defined because of singularities

Table 13: Interaction term introduction to code value predicted using Intuition and Factor3
Source: Author

Notwithstanding the introduction of an interaction term, there were no statistically significant coefficients. It is also work noting that Table 13 contains a finding of ‘NA’. The

reason for this is because there were no participants in the low complexity intuition group that had a HA type of intuition.

From the above four models and tables, it can be concluded that for a highly complex task, in the low complexity groups, there are no predictors that show a statistically significant effect on decision quality.

5.3.2.2. High complexity

The high complexity groups were faced with a task that was higher in complexity than the low complexity group as detailed in section 4.2.4.5. By way of a summary the complexity of the high complexity group had the same complexities as the low complexity experimental vignette but introduced a second conflicting value to the intended objective of the decision of maximising profits. This second conflicting value was introduced through the chief investment officer being an environmentalist who was aware that exporting the products meant that it would be used in environmentally unsustainable practices to the intended objective of the decision.

For high complexity, there was three possible options. Multinomial regression was accordingly used. In the high complexity models the value for decision quality was either coded as 1, 2 or 3 with a code value of 2 being the best option followed by option 1 and then option 3. Intuition is the base *Intuition* value and affective intuition is the base *Factor3* value. As the responses available for the code value was dependent on complexity, *ChoiceB* was created which codes the best option as 1 and 0 otherwise. This allowed complexity to be used as a predictor which could be used to test hypothesis 2.

Coefficients:	**Estimate**	**Std Error**	**Z value**	**Pr(>|z|)**
(Intercept)	-0.1823	0.3496	-0.522	0.60201
ComplexityHigh	-2.1531	0.6984	-3.083	0.00205

Note: glm(formula = ChoiceB ~ Complexity, family = "binomial", data = data1). Dispersion parameter for binomial family taken to be 1. Null deviance is 77.977 on 66 degrees of freedom and residual deviance is 65.768 on 65 degrees of freedom. Akaike information criterion of 69.768. Number of Fisher Scoring Iterations is 5.

Table 14: Simple model for high complexity
Source: Author

From the above table, it is observed that the p-value for high complexity (0.00205) is much lower than 0.05. The coefficient is furthermore negative which shows that increasing the complexity from low to high reduces the probability of selecting the best option. Moreover, this relationship is statistically significant. Following the above, *Intuition* was added to the model illustrated in Table 14 above, as shown in Table 15 below.

Coefficients:	**Estimate**	**Std Error**	**Z value**	**Pr(>|z|)**
(Intercept)	-0.9890	0.5852	-1.690	0.09104
ComplexityHigh	-2.2821	0.7277	-3.136	0.00171 **
IntuitionControl	0.8536	0.8675	0.984	0.32516
IntuitionReframing	1.5285	0.7537	2.028	0.04257 *

Note: glm(formula = ChoiceB ~ Complexity + Intuition, family = "binomial", data = data1). Dispersion parameter for binomial family taken to be 1. Null deviance is 77.977 on 66 degrees of freedom and residual deviance is 61.256 on 63 degrees of freedom. Akaike information criterion of 69.256. Number of Fisher Scoring Iterations is 5.
* Signif. codes: 0 *** 0.001 ** 0.01 * 0.05 '.' 0.1 ' ' 1

Table 15: Simple model for high complexity with Intuition
Source: Author

In the above Table 15, the same observations are made about complexity as with the model illustrated in Table 14. It is observed that *Intuition* has a significant coefficient and as predicted it is reframing. While the p-value is not less than or equal to 0.05, the relationship for reframing is consistent with the previous models as it has a positive coefficient, suggesting that moving from intuition to reframing can improve the probability of selecting the best decision. Given the close proximity of the p-value to 0.05, an interaction term was included in the model illustrated in Table 16 below.

Coefficients:	Estimate	Std Error	Z value	Pr(>|z|)
(Intercept)	-0.8109	0.6009	-1.349	0.177
ComplexityHigh	-18.7551	2982.6266	-0.006	0.995
IntuitionControl	1.0986	0.9718	1.130	0.258
IntuitionReframing	0.9651	0.8189	1.178	0.239
ComplexityHigh:IntuitionControl	-1.0986	4663.2530	0.000	1.000
ComplexityHigh:IntuitionReframing	17.5024	2982.6267	0.006	0.995

Note: glm(formula = ChoiceB ~ Complexity * Intuition, family = "binomial", data = data1). Dispersion parameter for binomial family taken to be 1. Null deviance is 77.977 on 66 degrees of freedom and residual deviance is 57.050 on 61 degrees of freedom. Akaike information criterion of 69.05. Number of Fisher Scoring Iterations is 18.

Table 16: Simple model for high complexity with Intuition and interaction term
Source: Author

From the above, it is observed that following the introduction of an interaction term no relationships show statistical significance. *Factor3* was accordingly added to the model depicted in Table 14.

Coefficients:	Estimate	Std Error	Z value	Pr(>|z|)
(Intercept)	0.01315	0.42765	0.031	0.97547
ComplexityHigh	-2.19051	0.71977	-3.043	0.00234 **
Factor3HA	-0.28804	0.94507	-0.305	0.76053
Factor3I	-0.57158	0.73075	-0.782	0.43411

Note: glm(formula = ChoiceB ~ Complexity + Factor3, family = "binomial", data = data1). Dispersion parameter for binomial family taken to be 1. Null deviance is 77.977 on 66 degrees of freedom and residual deviance is 65.116 on 63 degrees of freedom. Akaike information criterion of 73.116. Number of Fisher Scoring Iterations is 5.
* Signif. codes: 0 *** 0.001 ** 0.01 * 0.05 '.' 0.1 ' ' 1

Table 17: Simple model for high complexity with Factor3
Source: Author

As complexity shows significance but *Factor3* shows no significance, an interaction term is added to the model depicted in Table 18 below.

Coefficients:	Estimate	Std Error	Z value	Pr(>|z|)
(Intercept)	4.133e-16	4.472e-01	0.000	1.000
ComplexityHigh	-2.140e+00	8.711e-01	-2.457	0.014 *
Factor3HA	6.931e-01	1.304e+00	0.532	0.595
Factor3I	-8.473e-01	8.223e-01	-1.030	0.303
ComplexityHigh:Factor3HA	1.712e+01	2.174e+03	-0.008	0.994
ComplexityHigh:Factor3I	1.378e+00	1.560e+00	0.883	0.377

Note: glm(formula = ChoiceB ~ Complexity * Factor3, family = "binomial", data = data1). Dispersion parameter for binomial family taken to be 1. Null deviance is 77.977 on 66 degrees of freedom and residual deviance is 61.956 on 61 degrees of freedom. Akaike information criterion of 73.956. Number of Fisher Scoring Iterations is 17.
* Signif. codes: 0 *** 0.001 ** 0.01 * 0.05 '.' 0.1 ' ' 1

Table 18: Simple model for high complexity with Factor3 and interaction term
Source: Author

Even though complexity has a slightly higher p-value, it is still statistically significant in the model depicted in Table 15. *Factor3* still shows no significance. As a next step, *ChoiceB* was therefore modelled against all three predictors.

Coefficients:	Estimate	Std Error	Z value	Pr(>|z|)
(Intercept)	-0.7975	0.6202	-1.286	0.19851
ComplexityHigh	-2.3064	0.7412	-3.112	0.00186 **
IntuitionControl	0.9735	0.8875	1.097	0.27272
IntuitionReframing	1.6078	0.7750	2.075	0.03802 *
Factor3HA	-0.5992	1.0208	-0.587	0.55721
Factor3I	-0.6489	0.7614	-0.852	0.39413

Note: glm(formula = ChoiceB ~ Complexity + Intuition + Factor3, family = "binomial", data = data1). Dispersion parameter for binomial family taken to be 1. Null deviance is 77.977 on 66 degrees of freedom and residual deviance is 60.336 on 61 degrees of freedom. Akaike information criterion of 72.336. Number of Fisher Scoring Iterations is 5.
* Signif. codes: 0 *** 0.001 ** 0.01 * 0.05 '.' 0.1 ' ' 1

Table 19: ChoiceB against all three predictors
Source: Author

The models continue to show that there is a significant negative relationship between high complexity and selecting the best decision option. This also shows the significance of reframing relative to intuition. For the sake of completeness, combinations of interaction effects are included in the models depicted in Tables 20 to Table 23 below.

Coefficients:	Estimate	Std Error	Z value	Pr(>|z|)
(Intercept)	-0.5780	0.6340	-0.912	0.362
ComplexityHigh	-18.7382	2948.6201	-0.006	0.995
IntuitionControl	1.3135	1.0221	1.285	0.199
IntuitionReframing	1.0046	0.8490	1.183	0.237
Factor3HA	-0.4633	1.0724	-0.432	0.666
Factor3I	-0.8633	0.7578	-1.139	0.255
ComplexityHigh:IntuitionControl	-1.4241	4631.4567	0.000	1.000
ComplexityHigh:IntuitionReframing	17.5399	2948.6202	0.006	0.995

Note: glm(formula = ChoiceB ~ Complexity * Intuition + Factor3, family = "binomial", data = data1). Dispersion parameter for binomial family taken to be 1. Null deviance is 77.977 on 66 degrees of freedom and residual deviance is 55.660 on 59 degrees of freedom. Akaike information criterion of 71.66. Number of Fisher Scoring Iterations is 18.
* Signif. codes: 0 *** 0.001 ** 0.01 * 0.05 '.' 0.1 ' ' 1

Table 20: Interaction between Complexity and Intuition
Source: Author

Coefficients:	Estimate	Std Error	Z value	Pr(>|z|)
(Intercept)	-0.8644	0.6848	-1.262	0.20686
ComplexityHigh	-2.1350	0.7912	-2.698	0.00697 **
IntuitionControl	0.7605	1.1348	0.670	0.50277
IntuitionReframing	1.7497	0.9294	1.883	0.05975
Factor3HA	-15.5667	3261.3194	-0.005	0.99619
Factor3I	-0.3288	1.3185	-0.249	0.80307
IntuitionControl:Factor3HA	-1.6324	4417.7981	0.000	0.99971
IntuitionReframing:Factor3HA	15.7488	3261.3197	0.005	0.99615
IntuitionControl:Factor3I	1.1258	2.0252	0.556	0.57826
IntuitionReframing:Factor3I	-1.5216	1.8504	-0.822	0.41088

Note: glm(formula = ChoiceB ~ Complexity + Intuition * Factor3, family = "binomial", data = data1). Dispersion parameter for binomial family taken to be 1. Null deviance is 77.977 on 66 degrees of freedom and residual deviance is 55.862 on 57 degrees of freedom. Akaike information criterion of 75.862. Number of Fisher Scoring Iterations is 17.
* Signif. codes: 0 *** 0.001 ** 0.01 * 0.05 '.' 0.1 ' ' 1

Table 21: Interaction between Factor3 and Intuition
Source: Author

Coefficients:	Estimate	Std Error	Z value	Pr(>|z|)
(Intercept)	-0.7318	0.6274	-1.166	0.2435
ComplexityHigh	-2.3229	0.9183	-2.529	0.0114 *
Factor3HA	0.1325	1.3591	0.097	0.9224
Factor3I	-0.9301	0.8731	-1.065	0.2867
IntuitionControl	0.9994	0.9278	1.077	0.2814
IntuitionReframing	1.4496	0.7895	1.836	0.0663
ComplexityHigh:Factor3HA	-16.4061	2100.0839	-0.008	0.9938
ComplexityHigh:Factor3I	1.2643	1.6541	0.764	0.4447

Note: glm(formula = ChoiceB ~ Complexity * Factor3 + Intuition, family = "binomial", data = data1). Dispersion parameter for binomial family taken to be 1. Null deviance is 77.977 on 66 degrees of freedom and residual deviance is 58.216 on 59 degrees of freedom. Akaike information criterion of 74.216. Number of Fisher Scoring Iterations is 17.
* Signif. codes: 0 *** 0.001 ** 0.01 * 0.05 '.' 0.1 ' ' 1

Table 22: Complexity and Factor3
Source: Author

Coefficients+:	Estimate	Std Error	Z value	Pr(>|z|)
(Intercept)	-0.6931	0.7071	-0.980	0.327
ComplexityHigh	-18.8729	4064.6349	-0.005	0.996
Factor3HA	37.9282	12691.8183	0.003	0.998
Factor3I	-0.4055	1.3540	-0.299	0.765
IntuitionControl	1.3863	1.4142	0.980	0.327
IntuitionReframing	1.2040	1.0165	1.184	0.236
ComplexityHigh:Factor3HA	-37.9282	10754.0130	0.004	0.997
ComplexityHigh:Factor3I	0.4055	8622.3927	0.000	1.000
ComplexityHigh:IntuitionControl	-1.3863	5982.9807	0.000	1.000
ComplexityHigh:IntuitionReframing	17.6689	4064.6351	0.004	0.997
Factor3HA:IntuitionControl	-58.1874	16635.2351	-0.003	0.997
Factor3I:IntuitionControl	0.4055	2.1985	0.184	0.854
Factor3HA:IntuitionReframing	-18.8729	10161.5872	-0.002	0.999
Factor3I:IntuitionReframing	-19.6714	6208.8325	-0.003	0.997
ComplexityHigh:Factor3HA:IntuitionControl	58.1874	17003.5876	0.003	0.997

ComplexityHigh:Factor3I:IntuitionControl	NA	NA	NA	NA
ComplexityHigh:Factor3HA:IntuitionReframing	NA	NA	NA	NA
ComplexityHigh:Factor3I:IntuitionReframing	19.2660	10625.2179	0.002	0.999

Note: glm(formula = ChoiceB ~ Complexity * Factor3 * Intuition, family = "binomial", data = data1). Dispersion parameter for binomial family taken to be 1. Null deviance is 77.977 on 66 degrees of freedom and residual deviance is 46.316 on 51 degrees of freedom. Akaike information criterion of 78.316. Number of Fisher Scoring Iterations is 18.
* Signif. codes: 0 *** 0.001 ** 0.01 * 0.05 '.' 0.1 ' ' 1
+ 2 not defined because of singularities

Table 23: Interaction between all three predictors
Source: Author

5.4. Summary

Based on all the models, there only seems to be one consistently (statistically) significant relationship and that is between *ChoiceB* and *Complexity* which means that as a complexity as the decision-making situation increases, the odds of selecting the best options decrease. This is further analysed in section 6.1 below.

Ultimately, however, none of the models detailed in this Chapter 5 were able to support any of the three hypotheses detailed in Chapter 3. The possible reasons for this are discussed in Chapter 6 with further suggestions for research detailed in section 7.5 as based on the possible reasons.

Chapter 6: Discussion

This Chapter 6 discusses the results of the data analysis in Chapter 5 with relevance to the literature detailed in Chapter 2. As none of the three hypotheses was supported in the data analysis; this chapter is concerned with the reasons, as informed by relevant literature and the data analysis conducted in Chapter 5, as to why this is the case. In doing so this Chapter 6 is separated into four sections. The first three sections deal with the hypotheses individually. The fourth section provides a summary of this Chapter 6.

6.1. Hypothesis 1

Hypothesis 1 posited that compared to intuition, reframing leads to a better-quality decision in a highly complex and unfamiliar decision-making situations

Hypothesis 1 was informed by the proposition by Luoma and Martela (2021) that in the contexts of high complexity and low familiarity, reframing as a cognitive strategy is more effective than intuition. Reframing is argued to lead to better decision when compared to intuition given that reframing allows for a questioning of the background assumptions and intuitive responses as well as the relevant parameters of a decision situation. This allows an opportunity to identify any errors in reasoning and cognitive biases that could occur when intuition is used as a cognitive strategy (Khaneman, 2003; Luoma & Martela, 2021).

The effectiveness of reframing relative to intuition was understood as reframing being more effective than intuition in improving decision quality (Amason, 1996; Luoma & Martela, 2021). The quality of a decision was in turn measured by determining the decision relative to its intent, as well as the effect of the decision on organizational performance (Amason, 1996; Shepherd et al., 2021; Thanos, 2022). The context of low familiarity was relevant to this hypothesis as familiarity with a problem is required for intuition, as opposed to reframing, to be an effective cognitive strategy (Glöckner & Witteman, 2010; Luoma & Martela, 2021; Pretz et al., 2014).

While hypothesis 1 was not supported in the low complexity and high complexity groups as detailed in sections 5.3.2.1 and 5.3.2.2, it is worthwhile noting that the models illustrated in Tables 10, 11 and 13, as presented in section 5.3.2.1, show that there is a significant negative relationship between high complexity and selecting the best decision option. The models used and illustrated in the Tables 14 and 15, as presented in section

5.3.2.2, show that reframing has a positive coefficient relative to intuition as the baseline group. Accordingly, if the coefficients were statistically significant it would therefore be possible to expect that being in the reframing group would on average increase the probability of selecting a better option than if intuition were used.

While it is important to stress that the p-values in the high complexity group do not support the hypothesis, a large sample size could be employed to study the effectiveness of reframing relative to intuition in contexts of high complexity where the high complexity is introduced at a level similar to that in the high complexity experimental vignette. As the experiment conducted in this research report had the required sample size with reference to the “rule of thumb calculation” (Bolinger et al., 2022, p. 83) and a review of experiments within strategy research, as detailed in section 4.2.3, a larger sample size to test the hypothesis within the context detailed in this paragraph is identified and discussed in Chapter 7 as an avenue for further research.

Returning to why hypothesis 1 was not supported, two reasons are identified as potential explanations. Firstly, the experiment could have benefited from being conducted as a laboratory experiment. Secondly, it may be that the complexity in the experimental vignette was not great enough. These two reasons are detailed in turn below.

In their review of experimental work within the field of strategic management, Bolinger et al. (2022) analyse the contexts of experiments and identify that laboratory experiments are typically used for studies of a cognitive nature. As reframing is based on the dual processing theory of cognition, the experiment conducted in this research report was indeed cognitive in nature. The reason why laboratory experiments are useful for studies of a cognitive nature is that it invites effective priming to bring forth cognitive states such as employing a cognitive strategy of intuition or reframing (Bolinger et al., 2022; Mueller et al., 2018).

In the experiment conducted in this research report, participants in the intuition group as well as the reframing group were given a goal of utilising a cognitive strategy of intuition or reframing. This was aligned with the work of Bos et al. (2018) where participants in the experiment by Bos et al. (2018) were given a goal of using unconscious thought, as a cognitive state, as a thinking disposition.

Given the benefit of laboratory experiments to bring forth cognitive states the experiment may have benefited from firstly inducing participants to bring forth cognitive states such

as intuition or reframing (Mueller et al., 2018). This is relevant as Type 3 processing may have been utilised by participants. As critically discussed in section 2.1.1, Evans (2019) argues that cognitive strategies that are employed by decision makers are based on Type 1, Type 2 and Type 3 processing. Type 3 processing is an autonomous response that is not accompanied by a feeling of correctness or based on working memory. Where such an autonomous response is accompanied by a feeling of correctness or based on working memory, it is Type 1 processing which is more narrowly defined by Evans (2019) when compared to the works of Kahneman (2003), Kahneman (2011) as well as Luoma and Martela (2021). A laboratory experiment could have circumvented this potential by better priming participants to use intuition or reframing as cognitive strategies (Bolinger et al., 2022; Mueller et al., 2018).

In addition, a laboratory experiment would allow for better oversight on whether participants are indeed using intuition or reframing. More specifically, as the experimental vignettes were based on payoffs that could be calculated using analytical reasoning this could be controlled. This is important as under conditions of low familiarity and high complexity, analytical reasoning is a cognitive strategy more effective that reframing (Luoma & Martela, 2021). As the propositions by Luoma and Martela (2021) do not posit that reframing will be more effective than analytical reasoning in contexts of high complexity and low familiarity, it would have been useful to ensure that participants did not use analytical reasoning which could be achieved through observation and potentially an interview post the experiment.

Returning to the second reason why hypothesis 1 was not supported, it may be that the complexity of the decision-making situation introduced in both the low complexity and high complexity experimental vignette, was not complex enough.

A decision-making situation with high complexity can be understood as a situation where various decisions can be made given not only all the factors that need to be considered in making such a decision, but also given the interdependency of the factors on each other (Baumann et al., 2019; Luoma & Martela, 2021). Reframing was argued as being more effective than intuition given that reframing allows for a questioning of the background assumptions and intuitive responses as well as the relevant parameters of a decision situation (Luoma & Martela, 2021). Such questioning of background assumptions and intuitive responses would counteract errors in reasoning and biases that are disadvantages of intuition (Khaneman, 2003; Laureiro-Martínex & Brusoni, 2018; Luoma & Martela, 2021).

The introduction of additional options in the experimental vignette that interact with each other would have increased the complexity of the decision-making situation in the experimental vignette. Within a laboratory experiment setting, participants could also be asked for the reasons for their decisions. This would eliminate any data that was based on a guess by participants.

In summary, while hypothesis 1 was not supported there is merit in arguing that a larger sample size should have been used to test the hypothesis. In addition, the hypothesis would benefit from being tested in a laboratory experiment context where an experimental vignette with greater complexity (as introduced by more options) is provided and the reasons for the decision by participants is questioned.

6.2. Hypothesis 2

Hypothesis 2 posited that compared to intuition, reframing leads to a better-quality decision as the complexity of a task increases in low familiarity situations.

Hypothesis 2 was informed by the same propositions as detailed in hypothesis 1 as well as the proposition that increased complexity creates further scope for errors in reasoning and biases given that there is a larger number of factors and interactions between these factors (Baumann et al., 2019; Luoma & Martela, 2021; Vasconcelos & Ramirez, 2011).

As detailed in section 6.1, reframing was argued as being more effective than intuition in as the complexity of a decision-making situation increases (Luoma & Martela, 2021). This is given that as the complexity of a decision-making situation increase the probability of errors in reasoning and biases, which are disadvantages of intuition, would increase (Khaneman, 2003; Laureiro-MartÍnex & Brusoni, 2018; Luoma & Martela, 2021).

While hypothesis 2 was not supported in the low complexity and high complexity groups as detailed in sections 5.3.2.1 and 5.3.2.2, it is worthwhile noting as with hypothesis 1 that the models illustrated in Tables 10, 11 and 13 show that there is a significant negative relationship between high complexity and selecting the best decision option. As is also the case with hypothesis 1, the models used and illustrated in the Tables 14 and 15 in section 5.3.2.2, show that reframing has a positive coefficient relative to intuition as the baseline group. Accordingly, if the coefficients were statistically significant it would therefore be possible to expect that being in the reframing group would on average increase the probability of selecting a better option than if intuition were used.

Nevertheless, hypothesis 2 was not supported but would benefit from the same changes to the experimental vignette suggested in hypothesis 1. This includes adopting a larger sample size and testing the hypothesis in a laboratory experiment context. The only difference from the suggested changes to hypothesis 1 would be that at least two, but ideally more than two, experimental vignettes with differing complexity would need to be utilised.

6.3. Hypothesis 3

Hypothesis 3 posited that the effectiveness of reframing relative to intuition in highly complex and low familiarity situations, depends on the type of intuition used.

Hypothesis 3 was informed by the same proposition as detailed in hypothesis 1 as well as the distinction between the three types of intuition: affective, holistic, and inferential intuition (Pretz et al., 2014). As these three types of intuition are independent types of intuition that lead to different outcomes in terms of decision quality it was posited that the effectiveness of reframing relative to intuition would depend on the type of intuition used (Pretz et al., 2014).

Hypothesis 3 was not supported as the interaction terms between the intuition groups as introduced in the models in both the low complexity and high complexity analysis as detailed in sections 5.3.2.1 and 5.3.2.2, did not present any statistically significant coefficients.

In critically analysing why hypothesis 3 was not supported, it is useful to return to the process of reframing as a cognitive strategy. As detailed in section 2.1.3 and illustrated in Figure 3, the process of reframing utilises reflective Type 2 processing to override intuition as a cognitive strategy employed through Type 1 processing (Evans & Stanovich, 2013; Stanovich, 2012). Reflective Type 2 processing is therefore the form of processing that is used to challenge intuitive responses to a decision that arise when Type 1 processing is utilised (Luoma & Martela, 2021).

With the above distinction in mind, it may have been useful to alter the research design to further subdivide the decisions made by participants in the intuition groups according to the type of intuition that participants in the intuition group displayed. This would have allowed for a comparison on the decision quality of participants in the reframing group to

three intuition groups classified according to affective, holistic, and inferential intuition (Pretz et al., 2014).

Given that the cognitive process of reframing overrides intuition through the utilisation of reflective Type 2 processing, the correct use of reframing as a cognitive strategy would not depend on the type of intuition used by participants. This is because such intuition would be overridden through the use of reframing as a cognitive strategy (Evans & Stanovich, 2013; Luoma & Martela, 2021; Stanovich, 2012).

To achieve the above, the research design would further have to be altered to increase the sample size of the intuition groups. As there would be three levels to the type of intuition, the sample size for the intuition group would have to be no less than 90 although ideally more to ensure that there are at least 30 participants in each intuition group. This calculation is based on the “rule of thumb calculation” of 30 x (the number of dependent variables + the number of levels) (Bolinger et al., 2022, p. 83).

6.4. Summary

While all three hypotheses were not supported it would be remiss to argue that reframing is not an effective cognitive strategy when compared to intuition as a cognitive strategy in contexts of high complexity and low familiarity (Luoma & Martela, 2021). It would also be remis to argue that the type of intuition used by individuals does not interact with the level of effectiveness of reframing as a cognitive strategy relative to intuition as a cognitive strategy in contexts of high complexity and low familiarity (Luoma & Martela, 2021; Pretz et al., 2014). There are two primary reasons for this.

Firstly, as detailed in sections 6.1 to 6.3, the experimental design and methodology adopted could have been refined to better test the hypotheses. This is supported by both literature and the findings in Chapter 5.

Secondly, reframing as a cognitive strategy is a relatively new construct (Luoma & Martela, 2021). Luoma and Martela (2021) in reviewing the streams of research on reframing, note that the cognitive process of reframing as a strategy has not been examined in detail within the strategic management literature (Luoma & Martela, 2021). This observation is aligned with the work of Cornelissen and Werner (2014) who identify that the cognitive process of reframing presents significant opportunities for further research (Cornelissen & Werner, 2014). A review of the works on Google Scholar that

cite the work of Luoma and Martela (2021) indicate that, as of 20 November 2022, the work of Luoma and Martela (2021) has been cited 14 times. None of these 14 works, however, test the effectiveness of reframing as a cognitive strategy as called for by Luoma and Martela (2021). There is accordingly great scope for future research on the effectiveness of reframing as a cognitive strategy as detailed in Chapter 7.

Chapter 7: Conclusion

The purpose of this Chapter 7 is to provide a summary of the research conducted in this research report and to highlight conclusions detailed in Chapter 6. This informs the principal theoretical conclusions in section 7.1, the research contribution detailed in section 7.2, the relevance of the research report for business in section 7.3, the limitations of the research conducted in section 7.4, the suggestions for further research in section 7.5 and finally the concluding remarks in section 7.6. Prior to a discussion on the above mentioned sections it is, however, useful to summarise the salient themes of this research report.

The academic anchor this research report was the dual processing theory of cognition that distinguishes between Type 1 and Type 2 processing (Evans & Stanovich, 2013; Kahneman, 2003; Kahneman, 2011; Luoma & Martela, 2021). The choice on what cognitive strategy, such as intuition or analytical reasoning, to employ was shown to dependent on this dual processing theory of cognition (Hodgkinson & Sadler-Smith, 2018; Laureiro-MartÍnex & Brusoni, 2018; Luoma & Martela, 2021). It was, however, argued that this dualistic distinction of processing does not necessarily translate into a dualistic distinction between cognitive strategies (Evans, 2019; Evans & Stanovich, 2013; Laureiro-MartÍnex & Brusoni, 2018; Luoma & Martela, 2021). Luoma and Martela (2021) specifically argue that the cognitive strategy of reframing utilises both Type 1 and Type 2 processing.

This research reported provided an overview of reframing as a cognitive strategy which has received limited attention to date and served as a research gap (Luoma & Martela, 2021). This research report further critically discussed reframing as cognitive strategy with reference to the dual processing theory of cognition and previous literature of reframing and framing as a process. This was followed by a critical analysis of intuition as a cognitive strategy; the effectiveness of which could be compared to reframing. The effectiveness between the cognitive strategy of intuition and reframing was argued as being capable of measurement by looking at decision quality (Amason, 1996). More specifically the effectiveness of reframing relative to intuition was considered within the context of high complexity and familiarity (Luoma & Martela, 2021). The type of intuition used by individuals was also considered to ascertain whether the type of intuition used by individuals would interact with the effectiveness of reframing relative to intuition (Pretz et al., 2014).

The effectiveness of reframing relative to intuition within the context of high complexity and low familiarity was tested using an experimental research methodology. The experiment was designed using an Experimental Vignette Methodology (Aguinis & Bradley, 2014).

In analysing the results from the experiment, none of the three hypotheses detailed in Chapter 3 were supported. The possible reasons for this were discussed in Chapter 6. With the above context in mind, section 7.1 now provides an overview of the principal theoretical conclusions of this research report.

7.1. Principal theoretical conclusions

The results of the statistical analysis done in Chapter 5 and discussed in Chapter 6, showed that the following hypotheses were not supported:

Hypothesis 1: Compared to intuition, reframing leads to a better-quality decision in a highly complex and unfamiliar decision-making situations;

Hypothesis 2: Compared to intuition, reframing leads to a better-quality decision as the complexity of a task increases in low familiarity situations; and

Hypothesis 3: The effectiveness of reframing relative to intuition in highly complex and low familiarity situations, depends on the type of intuition used.

Given that the hypotheses detailed above were not supported it cannot be concluded within the context of high complexity and low familiarity that (i) there is a stronger causal relationship between reframing and effective decision-making as opposed to intuition and effective decision-making, (ii) that the abovementioned causal relationship is dependent on the level of complexity of the decision-making situation, and (iii) that the effectiveness of reframing on decision quality relative to intuition depends on the type of intuition that is used. The above was what the research report sought to investigate and explain as detailed in Chapter 1 and summarised in section 1.7.

Notwithstanding the above, Tables 10, 11 and 13 in section 5.3.2.1 as discussed in section 6.1 and 6.2, however, showed that there is a significant negative relationship between high complexity and selecting the best decision option. Tables 14 and 15 in section 5.3.2.2 as discussed in section 6.1 and 6.2, illustrated that reframing has a

positive coefficient relative to intuition as a baseline group. Accordingly, if the coefficients were statistically significant it would be possible to expect that being in the reframing group would on average increase the probability of selecting a better option than if intuition were used. This possible relationship is noted as a suggestion for further research in section 7.5

7.2. Research contribution

This research reports contributed to the literature on the dual processing theory of cognition by studying the effectiveness of reframing, as a cognitive strategy, on decision-making as well as intuition, also as a cognitive strategy, in contexts of high complexity and low familiarity (Evans, 2019; Evans & Stanovich, 2013; Laureiro-MartÍnex & Brusoni, 2018; Luoma & Martela, 2021). Reframing and intuition are cognitive strategies that employ Type 1 and Type 2 processing which are based on the dual processing theory of cognition (Khaneman, 2003; Luoma & Martela, 2021). Whether increased complexity or the type of intuition used by individuals moderated or interacted with the effectiveness of reframing relative to intuition in contexts of high complexity and low familiarity was also considered.

In testing whether reframing was more effective that intuition as well as whether the effectiveness of reframing relative to intuition was dependent on the complexity of the task or the type of intuition used by participants, it was concluded that these propositions could not be supported. The research contribution is, however, that these propositions are capable of further testing as detailed in section 7.5.

The research report also contributed to the behavioural strategy literature by responding to the call from behavioural strategists to further develop this discipline by further analysing cognitive strategies, such as intuition, and decision-making in complex situations (Borchardt et al., 2022; Luoma & Martela, 2021; Powell et al., 2011).

The research report further contributed to the dual processing theory of cognition and behavioural strategy literature by testing the hypotheses detailed in Chapter 3 through experimental manipulation. This was intentional given the specific calls to test the effectiveness of reframing, which is based on the dual processing theory of cognition, through experimental manipulation as well as the call by behavioural strategists to contribute to behavioural strategy through experimental approaches (Bolinger et al., 2022; Borchardt et al., 2022; Luoma & Martela, 2021; Powell et al., 2011).

7.3. Business relevance

From a business perspective, the research report contributed to an understanding of decision-making techniques and strategies that decision makers can employ within their organisations. More specifically, the research report provided a greater understanding of the cognitive strategy of reframing that can be employed by decision makers. It also showed that there are various forms of intuition that can be used by decision makers in decision-making situations.

Despite the hypotheses detailed in Chapter 3 not being supported, the process of reframing (as informed by the cognitive strategy of reframing) can be used in a variety of other settings within business to correctly diagnose a problem (Luoma & Martela, 2021; Wedell-Wedellsborg, 2017). This is as reframing is not a new concept to strategic management (as opposed to reframing as a cognitive strategy which is a relatively new construct) and is a concept whose strategic importance and benefits is well documented (Hodgkinson et al., 1999; Hodgkinson et al., 2002; Laureiro-MartÍnex & Brusoni, 2018; Luoma & Martela, 2021). Section 2.2.1 provided an overview of such settings and studies that demonstrate the strategic importance and benefits of reframing as a process.

7.4. Limitations of the research

The research was limited in three extents as identified in Chapter 6 and are discussed in turn below.

The first limitation is that the research conducted assumed that decision makers have the necessary cognitive capability to control the cognitive strategy they wish to employ (Lejarrraga & Pinnard-Lejarraga, 2020; Luoma & Martela, 2021). While Lejarrraga and Pinnard-Lejarraga (2020) argue that it is possible for decision makers to control the cognitive strategy they wish to employ, the was not tested and analysed in the experiment conducted.

The second limitation is that the experimental vignette was based on only one scenario which limited the ability to further manipulate the independent variables. The result is that some of the responses captured may be biased given factors within the experimental vignette (Aguinis & Bradley, 2014).

The third limitation is that only one experiment was done and the results of only that experiment was analysed. The Experimental Vignette Methodology is capable of producing more stable results from repeated Experimental Vignette Methodology applications (Schmidt et at., 2022).

The avenues for further research, some of which are informed by the limitations detailed above are discussed in section 7.5 below.

7.5. Suggestions for further research

There are two avenues for further research that have been identified. The first avenue is related to a refinement of the experimental research methodology. The second is related to the work of Mukherjee et al. (2020). Both of these suggestions are discussed in turn below.

In response to the first avenue, as detailed in section 5.2, the experiment conducted would benefit from four modifications. Firstly, the experiment would likely benefit from being a laboratory experiment as opposed to an online experiment. Secondly, the complexity of the experimental vignettes used in such a laboratory experiment would benefit from increased complexity. Thirdly, the experiment would benefit from multiple experimental vignettes as opposed to just one as this would produce more stable results (Schmidt et at., 2022). Finally, the sample size for any intuition groups in an experiment that tests hypothesis 3 should be larger and should not consist of less than 90 participants (although ideally more). This would ensure that there are enough participants in each of the affective, holistic abstract, and inferential intuition groups.

In response to the second avenue, as detailed in section 2.2.2, Mukherjee et al. (2020) responds to the invitation from Ramirez and Wilkinson (2016) to provide an examination on the process of cognitive reframing. Mukherjee et al. (2020) responds to this invitation by examining how scenarios research enables decision makers to reframe their current situations by developing plausible future contexts which are intended to re-perceive the cognitive frames of decision makers (Mukherjee et al., 2020). While the work by Mukherjee et al. (2020) is contrasted to some degree to the work of Luoma and Martela (2021), Mukherjee et al. (2020) do examine the process of cognitive reframing which is not noted or referenced by Luoma and Martela (2021).

While Mukherjee et al. (2020) apply their scenarios research approach to a context of uncertainty, which is not a context identified by Luoma and Martela (2021), there is similarity between the constructs of uncertainty and ambiguity (Luoma & Martela, 2021). Luoma and Martela (2021) do provide a proposition that within contexts of high ambiguity, reframing can be more effective than intuition where a decision makers familiarity with a situation is low. The reason why this is noted as an area for further potential research is that Mukherjee et al. (2020) examine the process of cognitive framing – an area of research that Luoma and Martela (2021) argue has received little attention. This was not considered in this research report given the specific research aims of this report as detailed in section 1.4.

7.6. Concluding remarks

While the hypotheses detailed in Chapter 3 were not supported it would be remiss to conclude that reframing as a cognitive strategy should receive little attention going forward. Ultimately, it remains a relatively new construct within the strategic management and dual processing theory literature. As of 20 November 2022, the work of Luoma and Martela (2021) has been cited 14 times according to Google Scholar. None of these 14 works, however, test the effectiveness of reframing as a cognitive strategy as called for by Luoma and Martela (2021). There is accordingly great scope for future research on the effectiveness of reframing as a cognitive strategy.

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Appendices

Appendix A: Ethical clearance approval

GIBS ETHICAL CLEARANCE APPLICATION FORM 2021/22

RESEARCH PROJECT INFORMATION

NAME:	[redacted]
STUDENT NUMBER:	21751553
PHONE NUMBER:	
E-MAIL ADDRESS:	21751553@mygibs.co.za
PROPOSED TITLE OF STUDY:	Decision quality in complex contexts - decisions makers unfamiliar with the problem - more effective to use cogntive strategy of reframing rather than intuition.
RESEARCH SUPERVISOR:	Charlene Lew
E-MAIL OF SUPERVISOR:	Lewc@gibs.co.za
RESEARCH CO-SUPERVISOR	
E-MAIL OF CO-SUPERVISOR	

The purpose of this Research Ethics process is to ensure that all research conducted under the auspices of GIBS is done so in an ethical manner, in accordance with the University's policy and in such a way that **the rights of all stakeholders** associated with the research are protected.

In order for the GIBS Research Ethics Committee to assess your application, you are required to submit a **description of your Research Methodology** that must contain sufficient detail to ensure that the required steps have been taken to achieve this purpose, in the research design, data collection, analysis and storage of data used in the conduct of this research.

Please indicate the nature of the output your research is aimed at producing (mark one box only):

- ☐ ABP Applied Business Project
- ☑ MBA/MPhil Research Report
- ☐ MBA Project Publish Article
- ☐ MBA Teaching Case Study
- ☐ MBA Entrepreneurship Stream Portfolio
- ☐ MBA Consulting Stream Portfolio/MBA Health Stream
- ☐ GIBS Faculty/Research Associate/Staff member or others undertaking research under the GIBS affiliation

GIBS Ethics Policy distinguishes between FOUR main types of data and THREE main types of methodology. Please complete the table for ALL the data types that you plan to use. Note that all applications must be accompanied by a description of the methodology to be used in the study. Initial all sections that apply to your research

GIBS ETHICAL CLEARANCE APPLICATION FORM 2021/22

Section of form and type of data or methodology		Attachments – including methodology chapter (please mark that they are included)	
A	**Pre-existing personal records of human subjects,** e.g. performance reviews	☐	Methodology section of proposal
		☐	Description of the nature of the records to be used
		☐	Signed permission letter from appropriately authorised person in the organisation to use the data
B	**New data solicited from human subjects,** e.g. through interviews or surveys	☑	Methodology section of proposal
		☑	Informed consent statement attach proforma (separate for qualitative data collection; as part of survey questionnaire for quantitative data collection)
		☑	Interview guide / survey questionnaire / pre-existing proprietary test instrument / description of intervention
		☑	IF pre-existing proprietary test instrument, letter of permission from the owner/copyright holder (e.g. the MBTI)
C	**Public non-human data,** e.g. World Bank or other databases (no letter needed)	☐	Methodology section of proposal
		☐	Explanation of the nature of the data, how you will source it and how you will use it
D	**Private Organisation-specific non-human data,** e.g. financial statements, marketing or safety records	☐	Methodology section of proposal
		☐	Explanation of the nature of the data, how you will source it and how you will use it
		☐	Permission letter from the owner/organisation to use the data
E	**Indicate which methodology** you will be using. Choose one only	☐	Qualitative
		☑	Quantitative
		☐	Mixed methods

GIBS ETHICAL CLEARANCE APPLICATION FORM 2021/22

SECTION A. PRE-EXISTING PERSONAL RECORDS OF HUMAN SUBJECTS

1. Specify the nature of records and how they will be used

2. Confirm that permission has been obtained from an appropriately authorised person to study and report on these records.
Remember to attach permission letter(s).

☐ I confirm

3. Provide the name and job title of the person in the organisation who has authorised the use of the records.

Name: Job Title:

4. How will **confidentiality** (when the identity of the respondent is known to the researcher e.g. when data collection is via interviews) and/or **anonymity** (when the identity of the interviewer is not known to the researcher e.g. when data collection is via surveys) of the respondents and their data be assured?
Mark all that apply – ensure this is included in your methodology chapter.

☐ No names will be requested

☐ No names will be reported

☐ Data will be stored without identifiers

☐ Only aggregated information will be provided

☐ Other. Please specify

SECTION B. NEW DATA OBTAINED FROM HUMAN SUBJECTS

5. Does the nature of your research require you to collect data from respondents who constitute a 'vulnerable population' (defined as those who are particularly susceptible to coercion or undue influence or who have difficulty giving free and informed consent to being the subjects of research)

☑ No

☐ Yes.
IF yes, explain the nature of the population and what measures will be put in place done to reduce or minimise this vulnerability. Ensure this is included in your methodology chapter.

6. Please confirm that no incentive is to be offered to respondents to participate in the study.

☑ I confirm

7. Mark the applicable box(es) to identify the proposed procedure(s) to be carried out to obtain data.

☐ Interview guide Attach if applicable

☑ Survey questionnaire Attach if applicable

☑ Pre-existing proprietary test instrument, e.g. MBTI Attach if applicable
IF a pre-existing proprietary test instrument is used, confirm that permission has been obtained to use it.

☑

I confirm
Remember to attach permission letter(s) to use proprietary test instrument/s from an appropriately authorised person.

☑ • Intervention, e.g. training or experiment Describe in full in methodology chapter

8. Confirm that the data gathering is accompanied by a consent statement.

☑ I confirm

9. Where is the consent statement found?

☑ As part of the survey questionnaire, if quantitative data collection, in the introduction section of the questionnaire.

☐ As a separate document, if qualitative data collection, remember to attach.

10. Is there a risk that the respondents may not fully understand the nature of the study, or instructions or questions, or their rights as a result of language barriers between themselves and the researcher?

☑ No, there is not a risk

☐ Yes, there is a risk.
IF yes, how will the subjects' full comprehension of the content of the research, including giving consent, be ensured? Please specify, and include in methodology chapter

11. Do any respondents risk possible harm or disadvantage (e.g. financial, legal, reputational or social) by participating in the research?

☑ No

☐ Yes.
IF yes, explain what types of risk and what is done to minimise and mitigate those risks and include in methodology chapter.

12. Are there any aspects of the research about which subjects are not to be informed?

☑ No

☐ Yes.
IF yes, explain why, and how subjects will be debriefed, and include in methodology chapter.

13. Will the audio or video recorded data be transcribed and/or translated by an independent transcriber and/or translator?

☑ No

☐ Yes.
If yes, confirm that the transcriber and/or translator will be required to sign a non-disclosure agreement to protect the respondent's confidentiality, and include in methodology chapter

☐ I confirm. Remember to attach a pro-forma non-disclosure agreement

14. How will **confidentiality** (when the identity of the respondent is known to the researcher e.g. when data collection is via interviews) and/or **anonymity** (when the identity of the interviewer is not known to the researcher e.g. when data collection is via surveys) of the respondents and their data be assured? Include in methodology chapter

☑ No names will be requested, relevant when the identity of the respondent is not known to the researcher

- ☐ No names of individuals or organisations will be reported, relevant when the identity of the respondent is known to the researcher
- ☑ Only aggregated information will be reported
- ☑ Data will be stored without identifiers
- ☐ Other. Please specify

15. Is the topic of your research and the nature of the interview or survey questions about one or more particular organisations or to be conducted within one or more particular organisations?

- ☑ No
- ☐ Yes. If yes, confirm that appropriately authorised person/s have provided written permission for you to conduct this research
- ☐ I confirm. Remember to attach signed permission letter/s

SECTION C. PUBLIC NON-HUMAN DATA

16. Specify the nature of records to be used: Explain how they will be selected, where the data will be sourced and how the data will be used, and include in methodology chapter:

17. Confirm that this pre-existing non-human data is in the public domain, is legally accessible and is free of any copyright.

- ☐ I confirm

GIBS ETHICAL CLEARANCE APPLICATION FORM 2021/22

SECTION D. PRIVATE ORGANISATION-SPECIFIC NON-HUMAN DATA

18. Specify the nature of records (e.g. financial reports, marketing reports or safety records) and how they will be used.

19. Confirm that permission has been obtained to study and report on these records.

☐ I confirm. Remember to attach a signed permission letter(s).

20. Provide the name and job title of the person in the organisation who has authorised the use of the records.

Name: Job Title:

21. Do companies risk possible harm or disadvantage (e.g. financial, legal, reputational or social) by participating in the research?

☐ No

☐ Yes. Explain what types of risk and what is done to minimise and mitigate those risks. Include explanation in methodology chapter

22. How will **confidentiality** (when the identity of the respondent is known to the researcher e.g. when data collection is via interviews) and/or **anonymity** (when the identity of the interviewer is not known to the researcher e.g. when data collection is via surveys) of the respondents and their data be assured? Include in methodology chapter

☐ No names will be requested, relevant when the identity of the respondent is not known to the researcher

☐ No names of individuals or organisations will be reported, relevant when the identity of the respondent is known to the researcher

☐ • Only aggregated information will be reported

☐ • Data will be stored without identifiers

☐ Other. Please specify

GIBS ETHICAL CLEARANCE APPLICATION FORM 2021/22

ALL APPLICANTS MUST COMPLETE SECTIONS E AND F

E. CONFIDENTIALITY OF RESEARCH REPORT SUBMITTED FOR EXAMINATION OR PUBLICATION

23. Please select the relevant option relating to the confidentiality of the research report you will submit for examination:

☑ Free access, i.e. report not embargoed

☐ No access for a period of two years after research report is submitted for examination
Note that in exceptional circumstances, GIBS, being the copyright holder of the published research, may consent to an embargo of the report submitted for examination for a period of no more than two years. If you wish to apply for such an embargo, please provide reasons for this in a separate attachment.

☐ No access under any circumstance for an undetermined period.
A letter of permission from the Vice- principal: Research and Postgraduate Studies at the University of Pretoria must be obtained prior to making this application – and attached to this application for ethical clearance.

F. DATA STORAGE AND DISSEMINATION OF RESEARCH REPORT SUBMITTED FOR EXAMINATION

24. Please conform that you will use appropriate methods to ensure your data is safely stored in an accessible format for a minimum period of 10 years

☑ I confirm

25. Confirm that the details of your data storage method are set out in your attached methodology chapter

☑ I confirm

26. It is a goal of GIBS to make research available as broadly as possible. Mark the boxes below for the medium/media in which you do NOT wish results to be made available.

Academic dissemination	**Popular dissemination**
☐ Research report	☐ TV
☐ Scientific article	☐ Radio
☐ Conference paper	☐ Lay article
☐ Book	☐ Podcast
	☐ Book

Provide reasons for any limitation on publication marked above

27. Confirm that the consent obtained reason from participant in the research is aligned with the extent of dissemination, specified in question 26. For example, consent if you are planning to use the research to launch a consulting career will be more comprehensive than in the case of research that is intended only for a scientific audience.

☑ I confirm

28. IF you wish to describe any other information which may be of value to the committee in reviewing your application

☑ No

☐ Yes. Provide details in a separate sheet attached to this application

GIBS ETHICAL CLEARANCE APPLICATION FORM 2021/22

G. APPROVALS FOR/OF THIS APPLICATION

When the applicant is a student of GIBS, the applicant must please ensure that the supervisor and co-supervisor (where relevant) has signed the form before submission

STUDENT RESEARCHER/APPLICANT:

29. I affirm that all relevant information has been provided in this form and its attachments and that all statements made are correct.

Student Researcher's Name in capital letters:	[redacted]
Date:	27 Jun 2022
Supervisor Name in capital letters:	CHARLENE LEW
Date:	27 Jun 2022
Co-supervisor Name in capital letters:	
Date:	27 Jun 2022

Note: GIBS shall do everything in its power to protect the personal information supplied herein, in accordance to its company privacy policies as well the Protection of Personal Information Act, 2013. Access to all of the above provided personal information is restricted, only employees who need the information to perform a specific job are granted access to this information.

Decision:

Approved

REC comments:

well done on a well prepared ethics application. The research framework is an interesting one. Good luck with your research.

Date: 27 Jun 2022

Appendix B: Pilot survey feedback

Pilot study participant number	Feedback
Participant 1	"In the case study I was asked to make a choice between two options but three were presented"
Participants 2	"There was a lot of information that was bolded and underlined which made readability challenging"
Participant 3	"There were three options, but the instruction was to choose between 2 options"
Participant 4	"1. Any chance of increasing the font size? I'm wearing my glasses and it is on the big screen" " 2. Your instructions are difficult. • Parameters to making best decision – can you simplify this please. • It's a multi-faceted instruction. Break it down into bullets Maybe something like: Your goal is to make the best decision intuitively. (less is more. There is lots of reading to do)." "3. I recommend you break your options into bullets as well. This is complex reading. OPTION 1

	- Allocating a budget to the product development team within South Africa - No attempting to export the tube cathodes overseas. - Credible market research indicates that this initiative will certainly lead to profits of R25 million. - This will increase your chances of becoming the next CEO of MTP. (we call each of these bullets decision cues. Separate the decision cues)" "4. Instead of did you have any familiarity with the previous case – have you ever dealt with similar decisions?"

Appendix C: Experimental vignettes

Control Group: low complexity Experimental Vignette

Instructions

Please read the hypothetical case study below*. Once you have read the case study you will be asked to choose between one of the two options presented*.

Case Study

You are the chief investment officer of MTP Technologies (Pty) Ltd (MTP). MTP is a manufacturer and distributor of tube cathodes for large scale x-ray generators for use in mining operations. In the past 5 years, MTP has been faced with increasing competition from the domestic South African market with other entities producing similar products to the point of market saturation. A longer-term threat to the sustainability of MTP and its products is the increase in technological developments related to the production of tube cathodes within the South African market.

MTP are considering whether to invest in the technological investments of MTP or to start exporting their products to other countries.

As the chief investment officer, you are responsible for strategic investment decisions that will increase the profits of MTP. The CEO of MTP, a well-respected and highly rated individual, has let you know that she feels strongly that technological investments are the way to go. You are also aware that the CEO will retire next year and that aligning yourself to her views, will increase your chances of becoming the CEO – a position you are actively working towards.

Based on the above you are now faced with one of two choices within this decision context.

Option 1:

- Allocating a budget to the product development team within South Africa and not attempting to export the tube cathodes overseas.
- Credible market research indicates that this initiative will certainly lead to profits of R25 million.
- This will increase your chances of becoming the next CEO of MTP.

Option 2:

- Halting the allocation of a budget to the product development team and rather utilising the budget to accelerate the export of products to other countries.
- Credible market research indicates that this initiative will lead to profits of target level of R40 million with a probability of 40% and profits of R20 million with a probability of 60%.
- This will not increase your chances of becoming the next CEO of MTP.

Control Group: high complexity Experimental Vignette

Instructions

Please read the hypothetical case study below. *Once you have read the case study you will be asked to choose between one of three options presented.*

Case Study

You are the chief investment officer of MTP Technologies (Pty) Ltd (MTP). MTP is a manufacturer and distributor of tube cathodes for large scale x-ray generators for use in mining operations. In the past 5 years, MTP has been faced with increasing competition from the domestic South African market with other entities producing similar products to the point of market saturation. A longer-term threat to the sustainability of MTP and its products is the increase in technological developments related to the production of tube cathodes within the South African market.

MTP are considering whether to invest in the technological investments of MTP or to start exporting their products to other countries. You understand that some of the countries that will import the products do not have as stringent environmental laws as South Africa. Thus, while there are no legal restrictions on exporting tube cathodes, you know that some of the corporations that will acquire the tube cathodes in export markets, will use the cathodes in environmentally unsustainable mining practices within their countries. You are an environmentalist and actively campaign from stronger global environmental laws.

As the chief investment officer, you are responsible for strategic investment decisions that will increase the profits of MTP. The CEO of MTP, a well-respected and highly rated individual, has let you know that she feels strongly that technological investments are the way to go. You are also aware that the CEO will retire next year and that aligning yourself to her views, will increase your chances of becoming the CEO – a position you are actively working towards.

Based on the above you are now faced with one of three choices within this decision context.

Option 1:

- Allocating a budget to the product development team within South Africa and not attempting to export the tube cathodes overseas.
- Credible market research indicates that this initiative will certainly lead to profits of R25 million.
- This will increase your chances of becoming the next CEO of MTP.

Option 2:

- Halting the allocation of a budget to the product development team and utilising the budget to accelerate the export of products to other countries.
- Credible market research indicates that this initiative will lead to profits of target level of R40 million with a probability of 40% and profits of R20 million with a probability of 60%.
- You are aware that 25% of the exports which will be to countries that have less stringent environmental laws.

Option 3:

- Adopting option 2; and
- Allocating a budget of R5 million to the external affairs department of MTP to lobby for stricter environmental laws in the countries that have less stringent environmental laws.

Intuition Group: low complexity Experimental Vignette

Instructions

Please read the hypothetical case study below. *Once you have read the case study you will be asked to choose between one of the two options presented*.*Your goal is to choose between one of the two options presented using your gut feel on what feels like the best option.*

Case Study

You are the chief investment officer of MTP Technologies (Pty) Ltd (MTP). MTP is a manufacturer and distributor of tube cathodes for large scale x-ray generators for use in mining operations. In the past 5 years, MTP has been faced with increasing competition from the domestic South African market with other entities producing similar products to the point of market saturation. A longer-term threat to the sustainability of MTP and its products is the increase in technological developments related to the production of tube cathodes within the South African market.

MTP are considering whether to invest in the technological investments of MTP or to start exporting their products to other countries.

As the chief investment officer, you are responsible for strategic investment decisions that will increase the profits of MTP. The CEO of MTP, a well-respected and highly rated individual, has let you know that she feels strongly that technological investments are the way to go. You are also aware that the CEO will retire next year and that aligning yourself to her views, will increase your chances of becoming the CEO – a position you are actively working towards.

Based on the above you are now faced with one of two choices within this decision context. *As a reminder, your goal is to choose between one of the two options presented using your gut feel on what feels like the best option.*

Option 1:

- Allocating a budget to the product development team within South Africa and not attempting to export the tube cathodes overseas.
- Credible market research indicates that this initiative will certainly lead to profits of R25 million.

- This will increase your chances of becoming the next CEO of MTP.

Option 2:

- Halting the allocation of a budget to the product development team and rather utilising the budget to accelerate the export of products to other countries.
- Credible market research indicates that this initiative will lead to profits of target level of R40 million with a probability of 40% and profits of R20 million with a probability of 60%.
- This will not increase your chances of becoming the next CEO of MTP.

Intuition Group: high complexity Experimental Vignette

Instructions

Please read the hypothetical case study below. *Once you have read the case study you will be asked to choose between one of the three options presented. Your goal is to choose between one of the three options presented using your gut feel on what feels like the best option.*

Case Study

You are the chief investment officer of MTP Technologies (Pty) Ltd (MTP). MTP is a manufacturer and distributor of tube cathodes for large scale x-ray generators for use in mining operations. In the past 5 years, MTP has been faced with increasing competition from the domestic South African market with other entities producing similar products to the point of market saturation. A longer-term threat to the sustainability of MTP and its products is the increase in technological developments related to the production of tube cathodes within the South African market.

MTP are considering whether to invest in the technological investments of MTP or to start exporting their products to other countries. You understand that some of the countries that will import the products do not have as stringent environmental laws as South Africa. Thus, while there are no legal restrictions on exporting tube cathodes, you know that some of the corporations that will acquire the tube cathodes in export markets, will use the cathodes in environmentally unsustainable mining practices within their countries. You are an environmentalist and actively campaign from stronger global environmental laws.

As the chief investment officer, you are responsible for strategic investment decisions that will increase the profits of MTP. The CEO of MTP, a well-respected and highly rated individual, has let you know that she feels strongly that technological investments are the way to go. You are also aware that the CEO will retire next year and that aligning yourself to her views, will increase your chances of becoming the CEO – a position you are actively working towards.

Based on the above you are now faced with one of three choices within this decision context. As a reminder, your goal is to choose between one of the three options presented using your gut feel on what feels like the best option.

Option 1:

- Allocating a budget to the product development team within South Africa and not attempting to export the tube cathodes overseas.
- Credible market research indicates that this initiative will certainly lead to profits of R25 million.
- This will increase your chances of becoming the next CEO of MTP.

Option 2:

- Halting the allocation of a budget to the product development team and utilising the budget to accelerate the export of products to other countries.
- Credible market research indicates that this initiative will lead to profits of target level of R40 million with a probability of 40% and profits of R20 million with a probability of 60%.
- You are aware that 25% of the exports which will be to countries that have less stringent environmental laws.

Option 3:

- Adopting option 2; and
- Allocating a budget of R5 million to the external affairs department of MTP to lobby for stricter environmental laws in the countries that have less stringent environmental laws.

Reframing Group: low complexity Experimental Vignette

Instructions

Please read the hypothetical case study below. *Once you have read the case study you will be asked to choose between one of the two options presented.*

Your goal is to choose between one of the two options presented by:

- *Considering what the criteria are for making the best decision within the specified context; and*
- *Identifying any intuitive response you have and considering whether there are any flaws in this intuitive response*.

Case Study

You are the chief investment officer of MTP Technologies (Pty) Ltd (MTP). MTP is a manufacturer and distributor of tube cathodes for large scale x-ray generators for use in mining operations. In the past 5 years, MTP has been faced with increasing competition from the domestic South African market with other entities producing similar products to the point of market saturation. A longer-term threat to the sustainability of MTP and its products is the increase in technological developments related to the production of tube cathodes within the South African market.

MTP are considering whether to invest in the technological investments of MTP or to start exporting their products to other countries.

As the chief investment officer, you are responsible for strategic investment decisions that will increase the profits of MTP. The CEO of MTP, a well-respected and highly rated individual, has let you know that she feels strongly that technological investments are the way to go. You are also aware that the CEO will retire next year and that aligning yourself to her views, will increase your chances of becoming the CEO – a position you are actively working towards.

Based on the above you are now faced with the two choices below within this decision context. As a reminder, your goal is to choose between one of the two options presented by:

- *Considering what the criteria are for making the best decision within the specified context; and*
- *Identifying any intuitive response you have and considering whether there are any flaws in this intuitive response.*

Option 1:

- Allocating a budget to the product development team within South Africa and not attempting to export the tube cathodes overseas.
- Credible market research indicates that this initiative will certainly lead to profits of R25 million.
- This will increase your chances of becoming the next CEO of MTP.

Option 2:

- Halting the allocation of a budget to the product development team and rather utilising the budget to accelerate the export of products to other countries.
- Credible market research indicates that this initiative will lead to profits of target level of R40 million with a probability of 40% and profits of R20 million with a probability of 60%.
- This will not increase your chances of becoming the next CEO of MTP.

Reframing Group: high complexity Experimental Vignette

Instructions

Please read the hypothetical case study below. *Once you have read the case study you will be asked to choose between one of the three options presented.*

Your goal is to choose between one of the three options presented by:

- *Considering what the criteria are for making the best decision within the specified context; and*
- *Identifying any intuitive response you have and considering whether there are any flaws in this intuitive response.*

Case Study

You are the chief investment officer of MTP Technologies (Pty) Ltd (MTP). MTP is a manufacturer and distributor of tube cathodes for large scale x-ray generators for use in mining operations. In the past 5 years, MTP has been faced with increasing competition from the domestic South African market with other entities producing similar products to the point of market saturation. A longer-term threat to the sustainability of MTP and its products is the increase in technological developments related to the production of tube cathodes within the South African market.

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- *Considering what the criteria are for making the best decision within the specified context; and*
- *Identifying any intuitive response you have and considering whether there are any flaws in this intuitive response.*

Option 1:

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- Credible market research indicates that this initiative will certainly lead to profits of R25 million.
- This will increase your chances of becoming the next CEO of MTP.

Option 2:

- Halting the allocation of a budget to the product development team and utilising the budget to accelerate the export of products to other countries.
- Credible market research indicates that this initiative will lead to profits of target level of R40 million with a probability of 40% and profits of R20 million with a probability of 60%.
- You are aware that 25% of the exports which will be to countries that have less stringent environmental laws.

Option 3:

- Adopting option 2; and
- Allocating a budget of R5 million to the external affairs department of MTP to lobby for stricter environmental laws in the countries that have less stringent environmental laws.

Appendix D: Types of Intuition Scale

1	2	3	4	5
Definitely false	Mostly false	Undecided (neither true nor false)	Mostly true	Definitely true

1. I trust my intuitions, especially in familiar situations. (I)
2. I prefer to use my emotional hunches to deal with a problem, rather than thinking about it. (A)
3. Familiar problems can often be solved intuitively. (I)
4. There is a logical justification for most of my intuitive judgments. (I)
5. I rarely allow my emotional reactions to override logic. (R) (A)
6. My approach to problem solving relies heavily on my past experience. (I)a
7. I tend to use my heart as a guide for my actions. (A)
8. My intuitions come to me very quickly. (I)
9. I would rather think in terms of theories than facts. (HA)
10. My intuitions are based on my experience. (I)
11. I often make decisions based on my gut feelings, even when the decision is contrary to objective information. (A)
12. When making decisions, I value my feelings and hunches just as much as I value facts. (A)a
13. I believe in trusting my hunches. (A)
14. When I have experience or knowledge about a problem, I trust my intuitions. (I)a
15. I prefer concrete facts over abstract theories. (R) (HA)
16. When making a quick decision in my area of expertise, I can justify the decision logically. (I)
17. I generally don't depend on my feelings to help me make decisions. (R) (A)
18. I've had enough experience to know what I need to do most of the time without trying to figure it out from scratch every time. (I)a
19. If I have to, I can usually give reasons for my intuitions. (I)
20. I prefer to follow my head rather than my heart. (R) (A)
21. I enjoy thinking in abstract terms. (HA)
22. I rarely trust my intuition in my area of expertise. (R) (I)

23. When I make intuitive decisions, I can usually explain the logic behind my decision. (I)
24. It is foolish to base important decisions on feelings. (R) (A)

Note. Retrieved from “Development and Validation of a New Measure of Intuition: The Types of Intuition Scale” by Pretz, J. E., Brookings, J. B., Carlson, L. A., Humbert, T. K., Roy, M., Jones, M., & Memmert, D, 2014, Journal of Behavioural Decision-making, 27(4), p. 456. Copyright 2014 by John Wiley & Sons, Ltd.