

**Behavioural Insights Team**

**A review of optimism bias, planning fallacy, sunk cost bias and groupthink in project delivery and organisational decision making**

**Accompanying**

**An Exploration of Behavioural Biases in Project Delivery at the Department for Transport**

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## Introduction

This literature review provides an overview of three common cognitive biases in the context of project delivery and organisational judgment and decision making. The first, optimism bias, refers to the fact that we tend to overweight our odds of success, and under-weight our chances of failure, or of negative events happening to us. Planning fallacy can be considered a specific variant of optimism bias and describes the tendency to optimistically plan project timescales and resources and to overlook project risks. The second, sunk cost bias, refers to the fact that we are often influenced by past, sunk, costs which are irretrievable and have no bearing on future outcomes but which continue to distort our decisions. The third, groupthink, describes the ways in which group dynamics, and in particular social influence, may skew our judgment and decisions, often towards a more conformist, and less deliberative or questioning viewpoint.

This literature review is in support of a project commissioned by the Department for Transport (DfT), in which the Behavioural Insights Team (BIT) have been tasked with exploring the prevalence of these common biases in the planning and delivery of national transport projects, and developing a range of potential interventions. These three biases have been selected as the focus of the project due to the perception that they may be present, to some degree, within the current departmental project management and governance processes, and due to the relative wealth of existing research from which to draw.

## How we make decisions and judgements

In order to frame the discussion of optimism bias, planning fallacy, sunk cost bias and groupthink, it is first worth considering some fundamental aspects of the way we make judgements and decisions under risk and uncertainty. We briefly summarise the predominant behavioural/psychological approaches to decision-making in this section.

The concept of **bounded rationality** suggests that people use a simplified model of reality to make judgements.<sup>1</sup> It postulates that in decision making, our rationality is not as perfect as described by the classical economic model of rational agents, but is limited by the information we have available to us, time constraints and finite cognitive capacity. Like any decision maker, government departments and project management teams do not have the time or resources to fully understand the complexities of project decisions, nor the ability to fully explore alternative options.<sup>2</sup> As such, administrative behaviour consists of 'satisficing', choosing a course of action which is good enough and which allows progress.<sup>3</sup>

Beyond the limitations imposed by bounded rationality, there is also much evidence demonstrating that we are subject to a range of '**cognitive biases**' – systematic deviations from the economic model of rational decision making which can lead us to make judgments and decisions which are not always in our best interest. These models are not merely a simplification of rational models, and go beyond

mental shortcuts due to time, knowledge or cognitive resource constraints, but identify a range of distinct psychological factors which influence the decision making process in predictable ways.<sup>4</sup>

This 'biases and heuristics' account of decision making arises from a 'dual process' model of cognition, perhaps the most famous interpretation of which is Nobel Laureate Daniel Kahneman's 'System 1 and System 2 thinking'.<sup>5</sup> System 1 describes a fast and automatic process requiring little control or concerted thought, for example called upon when taking a familiar commute to work. System 2 is more deliberative and analytical, requiring concerted effort, for example called upon when planning a complex journey to a foreign country. The main insight is that System 1, which draws upon a variety of heuristics (mental rules of thumb), social influence, intuition and emotion, is used a lot more than we commonly acknowledge, even in situations that ostensibly demand careful consideration. System 2, the more 'rational' mode of thought, is often used to post-rationalise instincts and rapid judgments made using System 1, rather than to analyse a situation objectively from the ground-up.

### Are biases irrational?

There is a longstanding debate in academia as to whether cognitive biases identified in the field of behavioural economics are in fact 'irrational' - a term which implies judgement of inferiority compared to a more rational economic mode of thought. Throughout this report we use the term 'bias' in line with mainstream behavioural literature, though we note that many cognitive biases are in fact highly efficient decision-making tools.<sup>6</sup> Such biases have evolved to allow us to make judgments which are mostly right, most of the time. They have arisen in an environment where cognitive attention is at a premium, giving us fast-and-frugal tools to remove uncertainty and navigate complexity without overwhelming our cognitive bandwidth (limited mental capacity).

As well as increasing cognitive efficiency, some psychological biases may be beneficial to us in other regards. For example, self-serving bias (the tendency to attribute positive events and qualities to our own doing, but negative events to unavoidable external factors), is beneficial to our psyche and thus benefits our day-to-day lives, but is not designed for accuracy, and so can be detrimental to our ability to objectively appraise a situation.<sup>7</sup>

Regardless of their advantages and disadvantages, the empirical evidence shows that these cognitive 'biases' do exist in a predictable manner, and tend to trip us up in some contexts where a more deliberative, analytical and detached mentality is needed, such as when planning a complex project.

## Optimism bias and the planning fallacy

### Definitions

- Optimism bias is a cognitive bias leading people to think they are more likely to succeed, or are less at risk of failure or of experiencing a negative event, than they really are.
- DfT also refer to the 'application of optimism bias' to describe their process of correcting for project overspends by applying cost uplifts.

We have used the term optimism bias in line with mainstream academic literature, as per the first definition above.

Optimism bias manifests in many ways, for example people tend to falsely believe they are less at risk of falling victim to crime than other people, and smokers believe they are less at risk of lung cancer than other smokers.<sup>8</sup> In the context of project management this leads to consistent over-estimation of success and benefit realisation, and under-estimation of cost and time resources.<sup>9</sup> Much of the miscalculation leading to project over-runs and over-spends occurs during the project planning phase,<sup>10,11</sup> and so in this context the bias is commonly termed the *planning fallacy*.<sup>12</sup>

Planning is a process of defining our intentions and objectives and quantifying the resources required to get there. By definition, set-backs and over-spends do not form part of these intentions and objectives, and so naturally tend to be poorly accounted for. There are also a range of psychological phenomena, including confirmation bias, self-serving bias, an illusion of control, and a tendency to mis-estimate the probabilities of events, all of which can exacerbate our optimistic approach to planning. We discuss each of these contributing factors below.

### How prevalent is the planning fallacy?

One large study has shown that one-third of managers of new businesses estimate the probability of failure as zero, with 81 percent perceiving their odds of success as at least 7 out of 10.<sup>13</sup> In reality, the department of Business Innovation and Skills report that of the 400,000 new businesses set up 2012, 20% failed within the first year, and around 50% were expected to fail by 2015.<sup>14</sup> Some estimates suggest that up to 80% of new businesses fail within 18 months, suggesting over-optimism is widespread among business leaders.<sup>15</sup>

The empirical evidence supporting planning fallacy is plentiful. Many studies and meta-analyses of project portfolios demonstrate that planners tend to overestimate the probability of the successful completion of a project and underestimate the probability of negative events, overspends and set-backs.<sup>16,17,18,19,20,21,22,23</sup> Moreover, this occurs even when knowing that the majority of similar projects have over-run.<sup>24</sup>

Transport infrastructure projects seem particularly susceptible to optimistic planning, with one meta-analysis concluding that 9 out of 10 projects have cost overruns. Based on a sample of 258 transport projects around the world, actual costs were on average 28 percent higher than estimated. Rail

projects incurred the highest cost overruns, with an average cost-overrun of 44.7 percent. This was followed by fixed-linked projects which averaged a 33.8 percent cost-overrun, and roads with a 20.4 percent cost-overrun.<sup>25</sup>

The research tends to focus most strongly on cost over-runs, though schedule over-runs are also prevalent (and are related, with both stemming from over-optimistic planning and a failure to sufficiently account for set-backs). A review of transport projects in Indiana suggests time over-runs are less prevalent than cost over-runs (with 55% of projects having cost over-runs, and 12% having time over-runs), though where delays do happen, they can be severe: the average delay across all projects was 115 days.<sup>26</sup>

A review of large public procurement over the 20 years to 2002 in the United Kingdom demonstrated that there is a historic tendency for project estimates to be highly optimistic.<sup>27</sup> Table 1 summarises the average optimism biases found in the study, which is expressed as a percentage difference between the original estimate and the final outcome. The following table summarises the percentage over-run (works duration), over-spend (capital and operating expenditures) and under-delivery of benefits for all types of publicly procured projects.

**Table 1.** Recorded average optimism biases for traditional procurement (%)

Works Duration	Capital Expenditure	Operating Expenditure	Benefits Shortfall
17	47	41	2

Source: MacDonald (2002, p. 1)

### Causes of optimism bias and the planning fallacy

A major cause of the planning fallacy is that people rarely take into account their own past experiences with similar tasks, instead focussing on the future expected outcomes.<sup>28</sup> Decision makers take an **inside view** of a project rather than considering the outcomes of previous projects.<sup>29,30,31</sup> They also tend to **anchor** future outcomes on plans and available scenarios of success, rather than past results, which leads to overly optimistic predictions.<sup>32</sup> These tendencies are underpinned by a number of psychological factors, outlined below.

### Self-serving biases

A range of biases exist which tend to give people inflated perceptions of themselves, beneficial to the ego, but not conducive to the accurate appraisal of facts and risks. These are collectively known as **self-serving biases**. For example managers have been shown to be prone to 'self-serving reinterpretations of reality', with a meta-analysis of the literature showing that managers often misperceive facts which are important for assessing market performance.<sup>33</sup> They also tend to take credit for good outcomes, but

blame circumstance when bad things happen. This is a case of **attribution error**, and contributes to decision makers' optimism when planning projects.<sup>34</sup>

The **self-enhancement** motivation (rooted in a deep-set need to feel positively about ourselves) explains why people tend to hold unrealistically positive view of themselves.<sup>35</sup> This pervasive psychological trait is revealed in the fact that the majority of us think ourselves to be more intelligent than average, better drivers than average, and so on (the majority of people being better than average is not possible in a normally distributed population).<sup>36</sup> This is sometimes referred to as **illusory superiority**,<sup>37</sup> and such wishful thinking can result in unrealistic optimism.<sup>38</sup>

The flip side of self-enhancement bias (which is concerned with feeling good about oneself), is **self-presentation bias**, or **impression management**: the desire to project a positive image to others. We want others to regard us highly, and so we often overstate our abilities. Taken to the extreme, impression management includes tactics such as boasting, flattery and ingratiation, though the process is not necessarily conscious, with subtler levels of exaggeration and overstatement of abilities being common in a lot of social interaction.<sup>39</sup>

### Illusion of control

Planners are affected by an **illusion of control** over uncontrollable events, leading them to underestimate the risk of unforeseeable or unavoidable set-backs.<sup>40</sup> We also constantly underestimate how unpredictable the future is, failing to account for 'unknown unknowns'. The illusion of control, along with optimism bias, attribution error and illusory superiority, are all examples of 'positive illusions' – wishful beliefs about the world and our agency within it. These are, like many of the biases discussed here, deep-rooted features of our psychology: traits which are beneficial to our psyches and which motivate us to shape our environments, but which have not evolved for accurate forecasting. Fritz Heider proposed that humans' motivation to control their environment is one of the core tenets of our human nature, whilst others have argued that these positive illusions are critical for fostering good mental health.<sup>41</sup> Indeed, depressed individuals have been shown to be less susceptible to the illusion of control.<sup>42</sup>

The illusion of control perhaps underlies the fact that those more deeply involved in a project are more optimistic about its outcomes compared to those less involved.<sup>43</sup> The illusion of control has been empirically studied in business environments, in particular in stock traders, though not specifically in project management. A study involving the City of London's investment banks required traders to punch an array of keys to raise the price of an artificial stock. They were told there would be some random fluctuation in price, but the keys would have an impact. In fact, the keys made no difference, though traders' ratings of their own performance demonstrated an illusion of control. Moreover, those individuals demonstrating greater illusion of control scored lower on company scorings of analytical ability, risk management, and contribution to profits.<sup>44</sup> The effect has also been shown to be greater in competitive and stressful environments, with implications for the way project managers should be incentivised toward success.<sup>35</sup>

It has also been shown that feedback which emphasises success rather than failure increases the illusion of control.<sup>45</sup> There is a link here to self-serving or attribution bias: feedback emphasising success will naturally cause us to feel more in control (since we tend to take credit for successes, putting them down to our control), but feedback which emphasises failure will naturally cause us to ascribe a lack of personal control (since we tend to blame unavoidable circumstance, or other people, for failures). The design of feedback during and after projects is therefore of clear importance.

### Confirmation bias

The **confirmation bias** leads planners to seek out, focus on and remember information which supports their existing worldview – for many, this worldview is a projection of competence and success.<sup>46</sup> This has the potential to apply both to past projects (a tendency to selectively recall successes over failures), during current projects (ongoing feedback and progress will be interpreted selectively and unevenly), and when planning new projects (information on alternatives will be skewed to confirm to prior beliefs).<sup>47</sup>

There are three key mechanisms underlying confirmation bias: our search for information is biased, our interpretation of information is biased, and our recollection of information is biased.

Firstly, we are inherently unscientific in our tendency to seek information which confirms our hypotheses (the exact opposite of the scientific method which only aims to disprove hypotheses). This notion of ‘positive searching’ is captured in the parable of the black swan – if we believe all swans to be white, searching for more white swans can never prove nor disprove this theory. Instead we should search for a black swan, since finding one is the only way to truly test our belief. The scientific method has been designed to do this. However, we are poor intuitive scientists: every time we do see a proverbial white swan our belief that all swans are white strengthens, whilst we rarely bother to search for a black swan. Amongst project managers this manifests as a tendency to phrase questions to receive an affirmative answer that supports our existing beliefs, and looking for consequences that would arise if our beliefs are true, but not to look for consequences that would arise if they are false.<sup>48 49</sup>

Secondly, ambiguous or complex information (as much information often is), will often be selectively interpreted to conform to an existing world view. Studies have shown that groups of people with differing prior beliefs tend to interpret the same piece of evidence very differently. For example, in one study people divided into two groups dependent upon their views on capital punishment both rated a technical scientific article on the subject as supporting their viewpoint.<sup>50</sup>

Thirdly, when recalling information our memory is highly selective. The cognitive mechanisms underlying this process are not so well understood. For example, Schema Theory, a theory describing the way in which we organise and categorise information, suggests experiences which conform to expectations will be easier to store and recall, supporting the notion of confirmatory or selective memory recall leading to confirmation bias.<sup>51</sup> Conversely, some argue that surprising or contradictory information should in fact be easier to remember.<sup>52</sup>



Regardless of the underlying cognitive mechanisms, what is clear is that our memories are not mere data repositories, but involve processes for building life narratives and ascribing meaning to events. As such, memories will become part of those narratives and may be distorted to fit with the broader world-view we have come to adopt.<sup>53</sup> This is a psychological process for reducing **cognitive dissonance** (the psychological discomfort associated with holding contradictory beliefs, and our innate tendency to reduce that dissonance to create a 'tidier' understanding of the world).<sup>54</sup> In the context of project management, this suggests that those identifying as a competent and professional manager with distort their recollection of past events to conform with this self-image.

### Perception of risk

Decision-makers tend to make decisions one at a time and also fail to take into account **pooled-risks**. That is, people may account for individual risks, which may be small, but fail to appreciate the cumulative risk of something going awry is high, and as such risk predictions are overly timid.<sup>55,56</sup> This is partly because humans have a poor conception of probability.<sup>57</sup> People often view chance as a self-correcting process, where a deviation in one direction resulting in failure or success increases the likelihood of a deviation in the opposite direction in order to achieve an equilibrium. This can lead to the belief that past events impact the probability of future events, such as three 'heads' in a row increasing the chance of a 'tails' on the fourth coin-toss.<sup>58</sup> It can also affect the assessment of cumulative risk in project management, since a high risk of one setback may lead to the perception of a lower risk of another.

Related to our perception of cumulative risk is the **conjunctive and disjunctive events bias**. Research has shown that if several events all need to occur to result in a certain outcome, we over-estimate the probability of that happening. The inverse is also true – if only one event from many need to happen, we under-estimate the probability of that happening.<sup>59</sup> For example, in a succession of five tasks, if each has a 90% chance of success, the chance of overall success is just 59% ( $0.9^5$ ). We are generally poor at estimating these compound multiplications, a common factor in poor financial decisions when taking out long-term loans.<sup>60</sup>

### Post-decision rationalisation

**Post-decision rationalisation**, or **choice-supportive bias**, is the tendency to retrospectively rationalise a decision. For example, if a person chooses A over B, even if the decision involved many trade-offs with no clear preference, that person would tend to retrospectively ignore or downplay the faults of their choice, but exaggerate the benefits.<sup>61</sup> This is a good example of our tendency to form attitudes based on our behaviour (rather than our attitudes determining our behaviour, as we might intuitively expect). In essence, we have chosen A, therefore we believe A must be better than B, lest we must admit (to ourselves) making a bad decision, leading to post-decision regret.<sup>62</sup> This is at least partly rooted in the need to reduce cognitive dissonance, since to simultaneously hold the belief that we chose A, and that B is better, is psychologically unpleasant. We therefore distort our view of the world to reduce this dissonance, coming to believe that A is in fact the better choice.<sup>63</sup>

This bias may arise whenever a decision is made which forgoes an alternative choice. Such situations occur frequently in project management. This leads to over-optimistic planning since once we have made a choice, we are motivated to support that choice by retroactively amplifying evidence which supports it and downplaying evidence which questions it.<sup>64</sup> Post-decision rationalisation is also a key cause of sunk-cost fallacy, discussed later.

### How to overcome optimism bias and the planning fallacy

Reflecting upon the underlying psychological mechanisms described above, there are some natural implications for improving project management and planning, though very little has been empirically tested. The following are therefore mostly well-founded suggestions rather than proven methods.

For example, self-enhancement bias, and the related biases of illusory superiority and attribution error fundamentally relate to perceptions of ourselves. Confirmation bias and the illusion of control are also introspective in nature. When making the same judgments about other people, we do not exhibit the same biases. In fact, we sometimes err on the pessimistic side. There may therefore be a lot of value in playing **devil's advocate**, since having someone separate from the project calculate the required resources and risks may help overcome the root causes of these biases.

In tackling the illusion of control there is also an important role for **well-designed feedback**. We know that feedback emphasising success can exacerbate the illusion of control, whereas feedback emphasising failure may help overcome it, though this is likely to depend upon the reasons for failure. The specific nature of this feedback may also be tailored to different project stages, for example during project planning it may be most beneficial to highlight failures or setbacks on previous projects to help those risks and lack of personal control become more salient.

Each of these suggestions is poorly supported by the empirical literature, though well supported by the established theory. We therefore expand on these ideas later in our suggested interventions.

**Reference class forecasting** has proven to be more accurate than conventional forecasting for generating estimates for projects. The process requires planners to predict future outcomes by comparing to previous similar situations. It forces project managers to take an outside view of the project overcoming some of the cognitive biases identified above. The process compares the current project with the statistical distribution of outcomes of similar projects. This approach can be used to help tackle overspends and schedule overruns.

The HM Treasury's *Green Book on Appraisal and Evaluation in Central Government* already requires appraisers to make explicit adjustments when planning a project to account for optimism bias (specifically regarding costs, though the same process could apply to schedule overruns). Data from previous or similar projects is used as a starting point and reasonable benchmark to increase cost estimates and decrease or delay benefit estimates.

In 2004, the Department for Transport adopted reference class forecasting to deal with optimism bias leading to overspends in transport planning. The approach has been to segment projects into

categories (e.g. rail, IT...) and plot distributions of historic overspends, from which a percentage uplift can be generated at a given risk level (e.g. if 70% of projects over-spent by 50% or less, a 50% uplift in budget applied at the outset should equate to a 70% chance of remaining within the uplifted budget).

However, there are a number of disadvantages to this approach. Fundamentally, it is a ‘fudge factor’, aiming to correct the budgets but not tackling the root causes of optimism bias or planning fallacy. Secondly, in order to plot a meaningful distribution of overspends, data is needed on many projects. This is lacking for some project types meaning the distribution of data is far from smooth, and as such the recommended uplift will either be very wide and unusable (e.g. ‘between 6% and 200%’), or misleadingly specific (e.g. a 37% uplift may be recommended to ensure a maximum 20% risk of overspend, belying the fact that 37% was derived from very noisy data). Thirdly, this approach may result in large contingency reserves being set unnecessarily, since it is a one-size-fits-all approach which does not identify and remove the underlying causes of bias which may exist in some projects but not others. Fourthly, it is plausible that any money allocated to the project will be spent, since there is no longer an incentive to remain within the original unadjusted budget. Overall departmental efficiency and value-for-money may therefore suffer.

DfT have recently reviewed their approach to optimism bias, with a range of measures being considered which aim to tailor the uplift to specific projects (reducing the risk of unnecessary or inadequate increases in budget) and which fundamentally improve the accuracy of estimates (and thus remove the need to apply an uplift).

In a laboratory experiment, the use of **implementation intentions** led to more realistic completion predictions and a significant reduction in optimism bias in task-completion predictions. Implementation intentions are concrete actions plans that specify how, when and where someone intends to act.<sup>65</sup> However, the use of implementation intentions has not been tested on large-scale projects involving multiple stakeholders and stages like those undertaken by DfT.

**Performance benchmarking** has been extensively used in the health, education and financial sectors to collect and disseminate information of the past performance of companies upon which to base procurement decisions. However, an international review of its use in infrastructure projects suggests that the benchmarking of government contractors’ performance on its own does not reduce the prevalence of optimism bias in infrastructure projects.<sup>66</sup>

Another possible solution is to simply think about why a project might fail<sup>67</sup>, for example using a **pre-mortem**.<sup>68</sup> Drawing on prospective hindsight, a pre-mortem requires decision makers and project teams to imagine their project has failed and to work backwards to imagine all the reasons why the project would have failed. Experiments show that people consider more causal pathways when contemplating an imaginary past failure compared with fore-sighting. Imagining that the event has already occurred can improve a person’s ability to correctly identify reasons for future outcomes by 30 percent.<sup>69</sup> It can also be used to help overcome **groupthink** (described below), by fostering a structured and more critical discussion on project risks.

It has been shown that **segmentation of project plans**, from large tasks into multiple smaller sub-task, leads to higher, and more accurate, estimations of cost and time resources. This is a result of our tendency to overlook some aspects of a task, and to underestimate the cumulative resources needed for many small tasks. Explicitly listing all sub-tasks helps us to quantify these elements more accurately.<sup>70</sup> However, this does increase the workload for project planners.

Finally, there is scope to improve DfT's current approach to optimism bias, and to apply this to optimistic scheduling as well as costing. To do this effectively much more data is required to build up a picture of historic project delays, and as such there would be value in DfT expanding its evidence base on project forecasts, delays, outputs and outcomes.

## Groupthink and group polarisation

**Groupthink** refers to people's tendency to be influenced by the opinions and actions of others when operating within a group. Group thinking can lead to a "deterioration of mental efficiency, reality testing [*questioning and testing beliefs against reality*], and moral judgment."<sup>71</sup> Most commonly, groupthink refers to the emergence of a middle-ground, non-contentious viewpoint, arising because people are wary of challenging others' views or of creating conflict.<sup>72,73</sup> Group members can be more concerned with reaching a consensus view than with reaching the best view, and because of the lack of questioning, groupthink can also lead to overconfidence in the decision.<sup>74</sup>

Another way in which group dynamics can influence decision making is through **group polarisation**, referring to the tendency for people in groups to reach opinions which are more extreme than they would express as individuals.<sup>75</sup> This situation can arise because, in the safety of like-minded people, moderate views are reinforced and strengthened, whilst more extreme or taboo views become acceptable. Accordingly the group consensus can veer towards a more extreme view than would arise if averaging the pre-existing opinions of the group members.

A third possible outcome is fragmentation of the group into two or more factions with **diverging viewpoints**. Each faction becomes more extreme in its view as a way of differentiating themselves from the opposing members, or as a tactic of exaggeration to swing the perceived middle ground towards their viewpoint.

To summarise, there are at least three possible outcomes all deriving from the fact that group dynamics distort our opinions through processes of social influence. It is rarely possible to predict in which direction the group members' viewpoints will skew, but in each case the group's decision may be suboptimal since it diverges from a more deliberative, critical and balanced appraisal of the situation:

1. Conformity towards a middle-ground, non-contentious view, due to the desire for consensus and conflict avoidance.
2. Conformity towards a more extreme view, due to the reinforcement, normalisation and strengthening of individual opinions in a group of like-minded people.
3. Divergence of opinions into two or more groups due to the desire to differentiate oneself from an opposing view or due to tactical exaggeration.

## How prevalent is groupthink?

Groupthink has been studied in a range of contexts, including in political, military, judicial and corporate decision making. Groupthink has also been documented in a range of government projects.<sup>76,77,78</sup> It often occurs when there is high group cohesion, a strong and directive leader, and a sense of urgency.<sup>79</sup>

Group discussion also affects optimism biases for time estimation. Experiments have shown that groups (more than individuals) tend to focus on factors that promote the successful completion of a

task, and this focus on success enhances a group's optimistic outlook.<sup>80</sup> This may also be rooted in the group dynamic promoting a positive 'we can do it' attitude.

### The benefits of groups

Group decisions are not always inferior to those of individuals. Individuals tend to have one perspective on a situation and are rarely in possession of all the relevant information. Aggregating multiple viewpoints can therefore lead to a more balanced decision, though this is dependent upon the group working well, having good information dispersed among its members, and allowing all perspectives to be heard and considered.

The notion of 'the wisdom of crowds' describes how the aggregate of many individual estimates is often more accurate than any one individual's estimate. The classic account is of Francis Galton's (1822-1911) observation at a country fair in which the crowd, on average, accurately guessed the weight of an ox (guessing 1197 pounds, with the true weight being 1198 pounds). No individual guesses were close to this figure, including those from experts.

However, the key insight here is that the crowd members were not influencing each other – they were providing individual estimates, with the accuracy arising when aggregating those individual views. Conversely, when groups make a decision collectively, some opinions tend to be suppressed whilst others are strengthened or exaggerated, therefore failing to harness the aggregate wisdom of crowds.

### What are the causes of groupthink?

#### The dual-process theory of social influence

Humans are inherently social animals, and we are constantly influencing and being influenced by those we come into contact with. The dominant account of social influence is the dual-process theory of **normative social influence** and **informational social influence**.<sup>81</sup> Under normative influence (sometimes called **compliance**) we conform to the group, not because our views are changed, but because we want to fit in, to avoid embarrassment, conflict or social exclusion. This force is more powerful than we might like to admit: the classic 'line judgment studies' demonstrated that we feel pressured into incorrectly answering a very simple visual task, simply because everyone else is.<sup>82</sup>

Informational social influence, commonly called **social proof**, or **internalisation**, refers to the fact that our beliefs and opinions are genuinely changed by the beliefs and opinions of those around us. The consensus view is often correct, or close enough, and so we have evolved the useful heuristic (mental rule-of-thumb) of using social comparison to inform our beliefs about the state of the world.<sup>83</sup>

The effects of social proof are strongest when the information is ambiguous or incomplete, giving us little first-hand knowledge to go on other than other people's beliefs. For example, one of the earliest

social psychology experiments involved projecting a spot of light on a screen in a dark room.<sup>84</sup> This was a visual illusion, since with no fixed reference point the light appears to move (although it does not). Asked how far the dot was moving, individual estimates varied widely (from 20cm to 80cm). Tested in groups, their views converged on a common estimate. This experiment explains the formation of informational social norms, and whilst this example may be abstract, the effect arises frequently in day-to-day life: we often adopt the views of our peers, friends and family;<sup>85</sup> customer reviews on products such as wine can over-rule our own first-hand experience;<sup>86</sup> and panic is contagious (as is calmness) because we use the behaviour of others to inform an appropriate response to an emergency.<sup>87</sup> In the boardroom, business estimates and strategic decisions are equally susceptible to this convergence of views, though this is not to say that all people always conform to a group consensus.

In the context of corporate groupthink, both forms of social influence can play a part: normative influence, through the desire to cooperate and reach consensus, may suppress contrarian views. This may be particularly prevalent in the presence of dominant leadership where the motive to avoid embarrassment or conflict is most strong. Informational influence, particularly in the presence of a respected peer whom one expects to agree with, or when faced by a clear majority of people presenting a common viewpoint, can distort our own beliefs.

### Identification and self-presentation

Some theorists have also proposed **identification** as a third mechanism of social influence, describing our tendency to do as others do because we identify with them or want to be like them. Specifically, this occurs “when an individual accepts influence because he wants to establish or maintain a satisfying self-defining relationship to another person or group.”<sup>88</sup> Moreover, individuals may conform to the expectations or stereotypes associated with a social role.<sup>89</sup> Commonly this applies to social roles with strong stereotypes such as nurses, soldiers, and police officers for whom the perception of their profession plays a large part in their personal identity; though it would plausibly apply to managers and leaders who also strive to present a particular persona (and to those around them who are influenced by that persona). This is related to the **self-presentational motivations** discussed in the context of optimism bias. We may match our self-presentation to the audience’s expectations or to paint a positive picture of ourselves.<sup>90</sup> For example, group members exaggerate their optimism and suppress pessimism in order to demonstrate strong leadership, a ‘can-do attitude’ or commitment to a project.<sup>91</sup> Other group members may then follow suit, motivated to also fit that social role.

Whichever underlying mechanisms are at play, the result of social influence in the workplace is that groups can fail to identify and appropriately aggregate the full variety of views in the group.<sup>92</sup>



### Bounded awareness in groups

Bounded awareness refers to the fact that groups often overlook important information during a decision-making process due to becoming overly focussed. Focus narrows awareness leading to oversight of peripheral issues and alternative views. The paradox is that groups are created to share information, but often end up focussing on the common information that all already know. This may be due to the positive reinforcement enjoyed by those who express views which are the widely agreed with. Other information known by individuals but not shared is less likely to influence the ultimate decision. Common examples of bounded awareness include oversight of changes to the market once a programme is underway, with all team members focussed too intently on delivering the objective without recognising that the business context is changing around them. This may be particularly problematic if changes are gradual and therefore easily missed.<sup>93</sup>

### Cascade effects

The effects of groupthink can often compound since group members may not correct the errors made by others or challenge their views, instead amplifying these errors. **Cascade effects** lead group members to follow on from the statements made by others, regardless of whether these statements lead the group in a good or bad direction.<sup>94</sup> The ordering of viewpoints is therefore critical, since those viewpoints expressed first may set the direction of conversation, and it becomes harder to express a contrarian opinion if many other people have already agreed on a different perspective.

### Groups can worsen our individual biases

As discussed within the context of optimism bias, we have a tendency to selectively search for, interpret and recall information which adheres to our existing worldview (confirmation bias), often causing us to post-rationalise decisions by ignoring information which puts those decisions in doubt. For example, studies have shown that people under respond to negative news, but update estimates based on positive news,<sup>95,96</sup> resulting in a ratcheting effect of optimism. Individually, we are susceptible to these biases and are very good at post-rationalising our decisions. This process is essentially one of wishful thinking, or delusion, ignoring that which we'd rather not be true. However in the group context this process of wishful thinking is made even easier when other people are also agreeing with us, potentially leading to **group delusion**. A group which fails to question assumptions or highlight contrarian views may therefore worsen many of our individual biases, and can result in the spread of 'wilful ignorance' throughout an organisation (though this term perhaps implies the process to be more conscious than it is).<sup>97</sup>

### How to overcome groupthink

There are very few studies testing interventions to overcome groupthink.<sup>98,99</sup> A good understanding of the theory, discussed above, allows us to isolate some of the causes of groupthink and to propose possible solutions. The social scientist Irvin Janis, who coined the term groupthink, does exactly this and recommends the following:



- ◆ Leaders should not express an opinion when assigning tasks to a group and should be absent from many of the meetings to avoid influencing the outcome. As discussed previously, the starting point of a discussion may set the course of subsequent debate, and so strong leadership making their opinions known at the outset can be particularly leading.
- ◆ Managers should set up a number of independent groups to plan and evaluate a project, under the direction of different leaders. These groups should then come together to reconcile their differences. This fragmentation of large groups increases the chance of capturing multiple viewpoints which have individually been discussed and developed in (smaller) groups.
- ◆ Group members should be encouraged to discuss problems with trusted people outside the group and report back to the group. Outside experts should also be invited to meetings to discuss problems and challenge core assumptions. Specifically instructing people to challenge the emerging consensus can be helpful since clear instruction makes it safe to do so; removing many of the forces of normative influence, such as the desire to avoid conflict, to reach consensus or to avoid embarrassment.
- ◆ Each member of a group should be assigned the role of critical evaluator and encouraged to freely air objections. One group member should also be assigned the role of devil's advocate.

Janis also proposed **second-chance meetings** as a tool to mitigate groupthink. They provide an opportunity to challenge the group consensus. Once a preliminary decision has been reached, a meeting is held where group members are required to express or restate all their residual doubts about the project and the decision. This gives group members a chance to reflect on the decision.<sup>100</sup>

A separate **red team** can also be established to challenge a group's assumptions and plans, providing independent critical thought to improve decision making (performing a devil's advocate role). Red teaming is a tool often used in the military and intelligence communities, to assess the assumptions, alternative options, vulnerabilities, limitations and risks of a decision.<sup>101</sup> The strategy challenges group conformity and ensures that dissenting ideas are generated.

Another strategy is to ask all group members to **pre-commit** to a viewpoint before coming to a meeting. Individuals are asked to write down their initial answers to the issues being discussed at the meeting. This helps group members to establish their own independent ideas prior to group discussion. The strategy is designed to mitigate against the informational signals and social pressures that pull a group toward conformity.<sup>102</sup>

Leveraging **anonymous feedback** is another tool to overcome groupthink, since anonymisation is another way of overcoming the forces of normative social influence (embarrassment, fear of conflict etc.). Group members are given cards to identify issues or generate solutions anonymously. If these need to be prioritised, 'dot voting' is a method to anonymously decide prioritise issues. Individual team members are allowed to vote in private for a certain number of the ideas generated and receive the corresponding number of dots to allocate accordingly. The ideas are then ranked by the number of votes they receive.<sup>103</sup>

## Sunk cost fallacy

The sunk cost fallacy is a cognitive bias which results in backward-looking decision making. It leads to erroneous decisions being made based on project costs that have already been incurred, cannot be recovered and have no impact on future outcomes. In traditional microeconomic theory, a decision maker would only account for prospective (future) costs. Accounting for sunk (past and irretrievable) costs could be irrational because it does not equate to assessing a decision solely on its own merits.<sup>104</sup> However, empirical evidence shows that most of us do allow sunk costs to influence future decisions.

By way of fictional example, a manager may have used ('sunk') £40,000 of a £100,000 project. The project may be going badly or a change in circumstance may have rendered the output of the project less worthwhile. The cost of completing the project may also have increased by £20,000. Two options therefore present themselves: cancel the project and achieve nothing, or spend another £80,000 and achieve completion of the project. The decision should therefore depend upon whether the future project outcome is worth paying £80,000 for. The £40,000 is spent regardless of the choice made, so should not influence the forward-looking decision. In reality, however, that £40,000 will influence most people's decisions.

In essence, sunk cost bias risks causing decision makers to throw good money after bad or fail to recognise the point at which escalating costs are no longer justified. This can lead to project cost overruns, continuing to invest in projects that cannot be recovered, and missed opportunities which would have been better served by diverting the limited resources.<sup>105,106</sup> A commonly cited transport example of the sunk cost fallacy is the Concorde project. Having 'gone too far to quit', the British and French Governments continued to fund the development of Concorde even once it became apparent that there was no longer any economic case for its development.<sup>107</sup>

## What are the causes of the sunk cost fallacy?

### Post-decision rationalisation, and cognitive dissonance

The sunk cost fallacy is rooted in the desire to not appear wasteful.<sup>108</sup> By committing additional resources, decision makers attempt to justify their original decision and prior expenditure. Research has shown that decision makers commit the greatest amount of resources to existing investments when they are personally responsible for their negative consequences: it is harder to admit a poor decision when we are personally responsible for it, and therefore we are more strongly motivated to justify that decision.<sup>109,110</sup> Research also shows that actors who have incurred a sunk cost increase their estimate of how likely their project will succeed compared to estimates by those who had not incurred a sunk cost.<sup>111</sup> In this way sunk cost bias is linked to optimism bias, whereby sunk costs lead us to be more optimistic about a project's success (the belief that a project might fail becomes harder to accept once investment has been made).<sup>112</sup>

The underlying psychological mechanism which motivates us to post-rationalise choices and to escalate our commitment to decisions is cognitive dissonance, and an analogy can be made with Leon Festinger's original study on the subject: The social psychologist studied a small UFO-religious cult who predicted a forthcoming apocalypse.<sup>113</sup> When the event did not occur, most observers predicted the members would be forced to admit the inaccuracy of their beliefs, but in fact their beliefs strengthened, justified by even more far-fetched rationalisations. Whilst the context of this study is unusual and may seem distant from the boardroom, the key insight is that we strive for a consistent narrative, but tend to take the path of least psychological resistance. For the believers, faced with no apocalypse, it was easier to distort their views of reality yet further and to post-rationalise the apparent contradiction, than it was to admit their beliefs had been false all along. Moreover, this account shows us that the stronger the evidence that a belief or decision was wrong, the more fanatical the commitment to that belief must be (and the more detached from reality the supporting arguments) in order to sustain it.

For most professional managers, the extent of this psychological phenomena is far milder, but the essence is the same: rather than admit the project has failed, and that some of the decisions made were ill-informed, a manager may latch onto questionable justifications (and truly come to believe them) in order to defend their prior actions. In the process of doing this their belief in the project may strengthen, with more resources being committed. Like most psychological traits, there is great individual variation in people's propensity for post-rationalisation and denial, with some more willing than others to change their beliefs in response to new evidence.

### Status-quo bias

The sunk cost fallacy is also related to the **status-quo bias**, describing our tendency to stick to a current course of action.<sup>114</sup> This is partly explained by the fact that it is harder to justify a change of course than it is to justify the status quo (in part due to post-rationalisation and cognitive dissonance, as above). Status quo bias is also rooted in the fact that it is simply more effort to change course. Furthermore, different options are rarely made salient: once we have committed to a course of action, often foregoing alternatives, those alternatives tend to be put out of mind and are rarely reconsidered.

### Loss aversion and prospect theory

Any changes from the status quo may be seen as a loss,<sup>115,116</sup> something we tend to avoid due to our inherent **loss-aversion**.<sup>117</sup> Loss aversion describes the insight that a given loss is felt more strongly than an equivalent gain, and we are therefore more motivated to avoid losses than we are to pursue gains. Subsequently, loss aversion may discourage decision-makers from making a change, even when a change is in their interest: continuing a project based on sunk costs can enable managers to avoid losses, even if only in the short-term.

Loss aversion can be explained by **Prospect theory**, which in turn sheds further light on our propensity to continue adding funds to sunk costs.<sup>118</sup> The model states that people make decisions based on the relative value of losses and gains rather than the absolute outcome. After a substantial unsuccessful

investment has been made (and we are therefore in a state of negative value) continued losses result in a relatively modest decrease in perceived value, whereas comparable gains result in a larger increase in value.<sup>119</sup> Our preferences have therefore reversed, and contrary to loss aversion we are now more positively affected by a gain than we are negatively affected by an equivalent loss. We therefore become more risk-seeking when we are down on resources, willing to take chances for the possibility of significant improvements. This is an 'all or nothing attitude' common in gamblers down to their last few chips. This may encourage project managers who have sunk significant costs to 'throw good money after bad' in a more risky attempt to save the project.

### How to overcome the sunk cost fallacy

Again, there are very few empirical studies testing interventions designed to overcome this cognitive bias, though there are promising strategies which can be reasonably inferred from an understanding of the psychological mechanisms.

Anecdotally, **deliberately focussing only on the present and future, and ignoring the past**, may help overcome sunk cost bias. As if waking up with amnesia, with no knowledge of how you got to the current situation, and no attachment to the money or time that has been spent, the question becomes 'are the future rewards worth the future costs?' For a project that progresses as planned, the answer should always be 'yes', since the rewards of completing the project remain the same, but the remaining future costs are lower than they were at the beginning of the project. However, if the future costs have inflated to the extent they are no longer justified by the outcome, or the outcome has diminished such that it no longer justifies the costs, then the project should be aborted. Note that this approach does not preclude putting additional money into a project, since the future rewards may justify the future cost even if the budget has over-run.

Given the role of cognitive dissonance, which leads project managers toward wishful thinking and post-rationalisation of decisions, there may also be a benefit to inviting an outside view, or **devil's advocate**, to provide a less psychologically-invested perspective on the continued value of the project.

### Conclusion

An occasional misconception in behavioural economics is that people are subject to dozens, if not hundreds, of discrete cognitive biases. When viewed from the perspective of traditional economics this may seem reasonable, with each bias representing a new and distinct deviation from the classical micro-economic account of human behaviour. However, a more psychological approach reveals that many biases are underpinned by shared psychological mechanisms, with a few common themes emerging.

For example, one common theme is the desire to feel positively about ourselves, which underpins numerous self-serving biases including attribution error, illusory superiority, impression management and self-enhancement, and these in turn explain aspects of optimism bias, planning fallacy, sunk-cost

bias and groupthink. A second theme common to the biases discussed here is our aversion to cognitive dissonance and the need to maintain a consistent world-view, which manifest through confirmation bias, denial and wishful thinking, which are also contributing factors to optimism bias, planning fallacy, and sunk cost bias. A third fundamental theme of this literature review is our propensity to be influenced by other people, both because they represent an often-valid source of information (so we tend to believe them), and because we want to fit in (so we tend to copy them).

These biases not only share some common causes, but also interact with each other. For example optimism bias is in part a causal component of sunk cost bias; our optimism in a project encourages us to stick with it in the face of escalating costs. The reverse is also true; our attachment to sunk costs causes us to be more desperate in our belief that a project will succeed, exacerbating optimism bias. Similarly, Groupthink has the potential to interact with both optimism bias and sunk cost bias since the decision-making scenarios where each may appear are often among groups.

In sum, cognitive biases are rarely distinct or isolated deviations from our otherwise economically rational brains, but generally reflect common and deep-rooted psychological traits. This has implications for the way in which we try to overcome these biases.

Broadly there are two possible approaches to developing solutions - the aspirin or the antibiotic. The aspirin may soothe the symptoms but do little to cure the underlying ailment, and in this way is analogous to the optimism bias uplift employed by DfT and others. Such an approach deals with the consequences of optimism bias (the overspends and over-runs), and may be very effective in doing so, but does little to stop optimism bias from occurring in the first place. The alternative approach - the antibiotic - aims to stop the bias from occurring by prompting decision makers to think differently, or by putting processes in place which tackle to root cause of the problem. This approach benefits from a deeper understanding of the underlying psychological mechanisms, rather than simply the consequences, of the biases. This is the rationale for the style of this literature review which explores the underlying psychology in some depth.

Another justification for delving into the psychological mechanisms is that there is very little empirical evidence on what works. Whilst the theoretical and experimental literature is vast, very little of this tests the impact of interventions designed to overcome these biases. In developing our own solutions it is therefore necessary to reasonably infer what might work, which can only be done from a thorough understanding of what is happening behaviourally and psychologically.

In developing possible solutions, the fact that many of the biases are underpinned by common psychological traits may act to our advantage. For example, the self-serving biases which contribute, at least partially, to optimism bias, planning fallacy, sunk-cost bias and groupthink, are inherently introspective in nature and generally don't apply to our opinions of other people. A degree of separation from the project, or a third-party acting as devil's advocate, is therefore an approach which tackles multiple aspects of the problem. This devil's advocacy may help over-come optimism bias by allowing a project plan to be created unmarred by an illusion of control or over-confidence in ability and

it may also help tackle sunk-cost bias by inviting critique from someone who is not personally invested or responsible for the sunk costs. In addition, it may help overcome groupthink by providing a process to prompt contrarian views which would otherwise be suppressed by group dynamics and social influence. Other solutions may be more process-driven and designed to nudge people out of their natural thought processes, such as prompting a critique of a project through pre-mortems or decision trees. Other solutions still may aim to harness our psychology, rather than try to overcome it, for example using the influence of social networks to disseminate lessons learnt. With very little evidence of these possible solutions being tried or tested, there is great scope to develop this work further.

## Endnotes

- <sup>1</sup> Simon, H. A. (1957). *Models of man; social and rational*. New York: John Wiley & Sons.
- <sup>2</sup> National Audit Office (2013) *Over-optimism in government projects*, London: HM Government.
- <sup>3</sup> Simon, H. A. (1947). *Administrative Behavior: A study of decision-making processes in administrative organization*. New York: Macmillan.
- <sup>4</sup> Ariely, D. (2008) *Predictably Irrational: The hidden forces which shape our decisions*. New York: HarperCollins.
- <sup>5</sup> Kahneman, D. (2011), *Thinking, Fast and Slow*, Penguin, London.
- <sup>6</sup> Gigerenzer, G. (2008). *Gut feelings: Short cuts to better decision making*. London: Penguin.
- <sup>7</sup> Krueger, J. (1998). Enhancement bias in description of self and others. *Personality and Social Psychology Bulletin*, 24, 505-516.
- <sup>8</sup> Chapin, J., & Coleman, G. (2009). Optimistic bias: what you think, what you know, or whom you know?. *North American Journal of Psychology*, 11(1), 121-132
- <sup>9</sup> MacDonald, M. (2002). *Review of large public procurement in the UK*. London: HM Treasury.
- <sup>10</sup> McCray, G. E., Purvis, R. L., & McCray, C. G. (2002). Project management under uncertainty: The impact of heuristics and biases. *Project Management Journal*, 33(1), 39-61.
- <sup>11</sup> Pickrell, D. H. (1992). A desire named streetcar fantasy and fact in rail transit planning. *Journal of the American Planning Association*, 58(2), 158-176.
- <sup>12</sup> Kahneman, D. & Tversky, A. (1979), 'Intuition prediction: Biases and corrective procedures', *Management Science*, 12, 313-27
- <sup>13</sup> Cooper, A. C., Woo, C. Y., & Dunkelberg, W. C. (1988). Entrepreneurs' perceived chances for success. *Journal of business venturing*, 3(2), 97-108.
- <sup>14</sup> Willman, C. (2013) *Business Start-ups... why do so many fail?* retrieved from <http://www.businesszone.co.uk/community-voice/blogs/colin-willman/business-start-upswhy-do-so-many-fail>
- <sup>15</sup> Wagner, E. T. (2013) *Five Reasons 8 Out of 10 Businesses Fail* retrieved from <http://www.forbes.com/sites/ericwagner/2013/09/12/five-reasons-8-out-of-10-businesses-fail/#579894db5e3c>
- <sup>16</sup> Bain, R. (2009). Error and optimism bias in toll road traffic forecasts. *Transportation*, 36(5), 469-482.
- <sup>17</sup> Cunha, J. A., Viglioni, T., Thomaz, J., & Moura, H. (2014, November). Project Management in Light of Cognitive Biases: A Public Sector IT Organization Case. In *European Conference on Management, Leadership & Governance* (p. 50). Academic Conferences International Limited.
- <sup>18</sup> Flyvbjerg, B. (2005). *Policy and planning for large infrastructure projects: problems, causes, cures* (Vol. 3781). Washington, D.C: World Bank Publications.
- <sup>19</sup> Flyvbjerg, B. (2008). Curbing optimism bias and strategic misrepresentation in planning: Reference class forecasting in practice. *European planning studies*, 16(1), 3-21.
- <sup>20</sup> MacDonald, M. (2002). *Review of large public procurement in the UK*. London: HM Treasury.
- <sup>21</sup> Mackie, P., & Preston, J. (1998). Twenty-one sources of error and bias in transport project appraisal. *Transport policy*, 5(1), 1-7.
- <sup>22</sup> Pickrell, D. H. (1992). A desire named streetcar fantasy and fact in rail transit planning. *Journal of the American Planning Association*, 58(2), 158-176
- <sup>23</sup> Virine, L. & Trumper, V. (2009) *Project Decisions: The Art and Science*. Vienna, VA: Management Concepts.
- <sup>24</sup> Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica: Journal of the Econometric Society*, 263-291.
- <sup>25</sup> Flyvbjerg, B, Skamris Holm, MK & Buhl, SL 2002, 'Underestimating costs in public works projects: Error or lie?', American Planning Association. *Journal of the American Planning Association*, vol. 68, no. 3, pp. 279-95.
- <sup>26</sup> Bordat C, Labi, S, Sinha, K (INDOT Research) (2004). An analysis of cost overruns and time delays of INDOT projects. Publication Number: FHWA/IN/JTRP-2004/7, SPR-2811
- <sup>27</sup> MacDonald, M 2002, *Review of Large Public Procurement in the UK*, HM Treasury, London.
- <sup>28</sup> Buehler, R., Griffin, D., & Ross, M. (1994). Exploring the "planning fallacy": Why people underestimate their task completion times. *Journal of personality and social psychology*, 67(3), 366.
- <sup>29</sup> Flyvbjerg, B. (2013). Quality control and due diligence in project management: Getting decisions right by taking the outside view. *International Journal of Project Management*, 31(5), 760-774.



- <sup>30</sup> Kahneman, D. (1994). *New challenges to the rationality assumption. Journal of Institutional and Theoretical Economics*, 150(1), 18-36.
- <sup>31</sup> Kahneman, D. & Tversky, A. (1979), 'Intuition prediction: Biases and corrective procedures', *Management Science*, 12, 313-27
- <sup>32</sup> Kahneman, D., & Lovallo, D. (1993). Timid choices and bold forecasts: A cognitive perspective on risk taking. *Management Science*, 39(1), 17-31.
- <sup>33</sup> Engel, C. (2010). The behaviour of corporate actors: How much can we learn from the experimental literature?. *Journal of Institutional Economics*, 6(04), 445-475.
- <sup>34</sup> Jones, E. E., & Harris, V. A. (1967). The attribution of attitudes. *Journal of experimental social psychology*, 3(1), 1-24.
- <sup>35</sup> Beaugregard, K. S., & Dunning, D. (1998). Turning up the contrast: self-enhancement motives prompt egocentric contrast effects in social judgments. *Journal of personality and social psychology*, 74(3), 606-621.
- <sup>36</sup> McCormick, I. A., Walkey, F. H., & Green, D. E. (1986). Comparative perceptions of driver ability—a confirmation and expansion. *Accident Analysis & Prevention*, 18(3), 205-208.
- <sup>37</sup> Hoorens, V. (1993). Self-enhancement and superiority biases in social comparison. *European review of social psychology*, 4(1), 113-139.
- <sup>38</sup> Alicke, M. D., & Sedikides, C. (2010). Self-enhancement and self-protection: Historical overview and conceptual framework. New York: The Guilford Press, 1-22
- <sup>39</sup> Goffman, E. (1959). *The presentation of everyday life*. New York: Doubleday
- <sup>40</sup> Presson, P. K., & Benassi, V. A. (1996). Illusion of control: A meta-analytic review. *Journal of Social Behavior and Personality*, 11(3), 493.
- <sup>41</sup> Taylor, S. E., & Brown, J. D. (1988). Illusion and well-being: a social psychological perspective on mental health. *Psychological bulletin*, 103(2), 193-210.
- <sup>42</sup> Thompson, S. C. (1999). Illusions of control how we overestimate our personal influence. *Current Directions in Psychological Science*, 8(6), 187-190.
- <sup>43</sup> Tyebjee, T. T. (1987). Behavioral biases in new product forecasting. *International Journal of Forecasting*, 3(3), 393-404.
- <sup>44</sup> Fenton-O'Creavy, M., Nicholson, N., Soane, E., & Willman, P. (2003). Trading on illusions: Unrealistic perceptions of control and trading performance. *Journal of Occupational and Organizational Psychology*, 76(1), 53-68.
- <sup>45</sup> Thompson, S. C. (1999). Illusions of control how we overestimate our personal influence. *Current Directions in Psychological Science*, 8(6), 187-190.
- <sup>46</sup> Kahneman, D. (2011) *Thinking, Fast and Slow*. Penguin, London.
- <sup>47</sup> Nickerson, R. S. (1998). Confirmation bias: A ubiquitous phenomenon in many guises. *Review of general psychology*, 2(2), 175-220
- <sup>48</sup> Baron, J. (2000), *Thinking and deciding*. New York: Cambridge University Press
- <sup>49</sup> Nickerson, R. S. (1998). Confirmation bias: A ubiquitous phenomenon in many guises. *Review of general psychology*, 2(2), 175-220
- <sup>50</sup> Lord, C. G., Ross, L., & Lepper, M. R. (1979). Biased assimilation and attitude polarization: The effects of prior theories on subsequently considered evidence. *Journal of personality and social psychology*, 37(11), 2098-2109.
- <sup>51</sup> Rumelhart, D.E. (1980), 'Schemata: the building blocks of cognition', in Spiro, R.J., Bruce, B.C, & Brewer, W. F., (eds), *Theoretical Issues in Reading Comprehension: Perspectives from Cognitive Psychology, Linguistics, Artificial Intelligence, and Education*. Hillsdale, NJ: Lawrence Erlbaum, 33-58.
- <sup>52</sup> Oswald, M., Grosjean, S. (2004), Confirmation Bias, in Pohl, R. F., *Cognitive Illusions: A Handbook on Fallacies and Biases in Thinking, Judgement and Memory*, Hove, UK: Psychology Press, 79–96
- <sup>53</sup> Kleider, H. M., Pezdek, K., Goldinger, S. D., & Kirk, A. (2008). Schema-driven source misattribution errors: remembering the expected from a witnessed event. *Applied Cognitive Psychology*, 22(1), 1-20.
- <sup>54</sup> Festinger, L. (1957), *A Theory of Cognitive Dissonance*. Palo Alto, CA: Stanford University Press.
- <sup>55</sup> Cantarelli, C. C., Flyvbjerg, B., Molin, E. J., & Van Wee, B. (2010). Cost overruns in large-scale transportation infrastructure projects: explanations and their theoretical embeddedness. *European Journal of Transport Infrastructure Research*, 10(1), 5-18.
- <sup>56</sup> Kahneman, D. & Lovallo, D. (1993), Timid Choices and Bold Forecasts: A Cognitive Perspective on Risk Taking, *Management Science*, 39(1), 17-31.
- <sup>57</sup> Bazerman, M. H. (2002), *Judgement in Managerial Decision Making*. New York: John Wiley & Sons.
- <sup>58</sup> Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *science*, 185(4157), 1124-1131.
- <sup>59</sup> Bazerman, M. H. (2002), *Judgement in Managerial Decision Making*. New York: John Wiley & Sons.
- <sup>60</sup> Karlan, D., Ratan, A. L., & Zinman, J. (2014). Savings by and for the Poor: A Research Review and Agenda. *Review of Income and Wealth*, 60(1), 36-78.
- <sup>61</sup> Lee, S. W., & Schwarz, N. (2010). Washing away postdecisional dissonance. *Science*, 328(5979), 709-709.
- <sup>62</sup> Rosenzweig, E., & Gilovich, T. (2012). Buyer's remorse or missed opportunity? Differential regrets for material and experiential purchases. *Journal of personality and social psychology*, 102(2), 215.



- <sup>63</sup> Brehm, J. W. (1956). Postdecision changes in the desirability of alternatives. *The Journal of Abnormal and Social Psychology*, 52(3), 384.
- <sup>64</sup> Cooper, A. C., Woo, C. Y., & Dunkelberg, W. C. (1988). Entrepreneurs' perceived chances for success. *Journal of business venturing*, 3(2), 97-108.
- <sup>65</sup> Koole, S., & van't Spijker, M. (2000). Overcoming the planning fallacy through willpower: effects of implementation intentions on actual and predicted task-completion times. *European Journal of Social Psychology*, 30(6), 873-888.
- <sup>66</sup> Siemiatycki, M. (2010), 'Managing Optimism Biases in the Delivery of Large-Infrastructure Projects: A Corporate Performance Benchmarking Approach', *The European Journal of Transport and Infrastructure Research*, 10(1), 30-41.
- <sup>67</sup> Soll, J. B., Milkman, K. L., & Payne, J. W. (2014). A user's guide to debiasing in Keren, G., & Wu, G. (Eds.). (2015). *The Wiley Blackwell Handbook of Judgment and Decision Making*. 903-23.
- <sup>68</sup> Klein, G. (2007). Performing a project premortem. *Harvard Business Review*, 85(9), 18-19.
- <sup>69</sup> Mitchell, D. J., Edward Russo, J., & Pennington, N. (1989). Back to the future: Temporal perspective in the explanation of events. *Journal of Behavioral Decision Making*, 2(1), 25-38.
- <sup>70</sup> Forsyth, D. K., & Burt, C. D. (2008). Allocating time to future tasks: The effect of task segmentation on planning fallacy bias. *Memory & cognition*, 36(4), 791-798.
- <sup>71</sup> Janis, I. L. (1972). *Victims of groupthink; a psychological study of foreign-policy decisions and fiascoes*. Boston: Houghton, Mifflin. 9
- <sup>72</sup> HM Government (2016) *Understanding the Behavioural Drivers of Organisational Decision-Making Rapid Evidence Assessment*. London: HM Government.
- <sup>73</sup> McCauley, C. (1998). Group dynamics in Janis's theory of groupthink: Backward and forward. *Organizational behavior and human decision processes*, 73(2), 142-162.
- <sup>74</sup> Virine & Trumper (2009) *Project Decisions: The Art and Science*. Vienna, VA: Management Concepts.
- <sup>75</sup> Isenberg, D. J. (1986). Group polarization: A critical review and meta-analysis. *Journal of personality and social psychology*, 50(6), 1141-1151
- <sup>76</sup> Janis, I. L. (1982). *Groupthink: Psychological studies of policy decisions and fiascoes (Vol. 349)*. Boston: Houghton Mifflin.
- <sup>77</sup> King, A., & Crewe, I. (2014). *The blunders of our governments*. London: Oneworld Publications.
- <sup>78</sup> Janis, I. L. (1972). *Victims of groupthink; a psychological study of foreign-policy decisions and fiascoes*. Boston: Houghton, Mifflin.
- <sup>79</sup> Kerr, N. L., Tindale, R. S. (2004) 'Group Performance and Decision Making', *Annual Review of Psychology*, 55, 623-55
- <sup>80</sup> Buehler, R., Messervey, D., & Griffin, D. (2005). Collaborative planning and prediction: Does group discussion affect optimistic biases in time estimation?. *Organizational Behavior and Human Decision Processes*, 97(1), 47-63.
- <sup>81</sup> Deutsch, M., & Gerard, H. B. (1955). A study of normative and informational social influences upon individual judgment. *The Journal of abnormal and social psychology*, 51(3), 629.
- <sup>82</sup> Asch, S. E. (1951). Effects of group pressure upon the modification and distortion of judgments. *Groups, leadership, and men*. S, 222-236.
- <sup>83</sup> Cialdini, R. B. (2001). Harnessing the science of persuasion. *Harvard Business Review*, 79(9), 72-81.
- <sup>84</sup> Sherif, M. (1935). A study of some social factors in perception. *Archives of Psychology (Columbia University)*. 27(187)
- <sup>85</sup> Salganik, M. J., Dodds, P. S., & Watts, D. J. (2006). Experimental study of inequality and unpredictability in an artificial cultural market. *science*, 311(5762), 854-856.
- <sup>86</sup> Wooten, D. B., & Reed, A. (1998). Informational influence and the ambiguity of product experience: Order effects on the weighting of evidence. *Journal of consumer psychology*, 7(1), 79-99.
- <sup>87</sup> Latané, B., & Darley, J. M. (1969). Bystander "Apathy". *American Scientist*, 57(2), 244-268.
- <sup>88</sup> Kelman, H. C. (1958). Compliance, identification, and internalization: Three processes of attitude change. *Journal of conflict resolution*. 63
- <sup>89</sup> Haney, C., Banks, W. C., & Zimbardo, P. G. (1973). A study of prisoners and guards in a simulated prison. *Naval Research Reviews*, 30, 4-17
- <sup>90</sup> Baumeister, R. F., & Hutton, D. G. (1987). Self-presentation theory: Self-construction and audience pleasing. In *Theories of group behavior*. New York: Springer. 71-87.
- <sup>91</sup> Kahneman, D., & Lovallo, D. (1993). Timid choices and bold forecasts: A cognitive perspective on risk taking. *Management science*, 39(1), 17-31.
- <sup>92</sup> Sunstein, C. R., & Hastie, R. (2015). *Wiser: Getting beyond groupthink to make groups smarter*. Boston: Harvard Business Press.
- <sup>93</sup> Bazerman, M. H. (2002), *Judgement in Managerial Decision Making*. New York: John Wiley & Sons.
- <sup>94</sup> Bazerman, M. H. (2002), *Judgement in Managerial Decision Making*. New York: John Wiley & Sons.
- <sup>95</sup> Eil, D., & Rao, J. M. (2011). The good news-bad news effect: asymmetric processing of objective information about yourself. *American Economic Journal: Microeconomics*, 3(2), 114-138.
- <sup>96</sup> Mobius, M. M., Niederle, M., Niehaus, P., & Rosenblat, T. S. (2011), *Managing Self-Confidence: Theory and Experimental Evidence*, Research Center for Behavioral Economics. Boston: Reserve Bank of Boston.

- <sup>97</sup> Bénabou, R. (2013), Groupthink: Collective Delusions in Organizations and Markets, *Review of Economic Studies*, 80(2), 429-62.
- <sup>98</sup> Paul't Hart. (1991). Irving L. Janis' victims of groupthink. *Political Psychology*, 247-278.
- <sup>99</sup> HM Government (2016). Understanding the Behavioural Drivers of Organisational Decision-Making Rapid Evidence Assessment, HM Government, London.
- <sup>100</sup> University of Foreign Military and Cultural Studies (UFMCS), (2014). GroupThink Mitigation Guide, University of Foreign Military and Cultural Studies, Fort Leavenworth.
- <sup>101</sup> Ministry of Defence, (2013). Red Teaming Guide, HM Government, London.
- <sup>102</sup> UFMCS, (2014). GroupThink Mitigation Guide, University of Foreign Military and Cultural Studies, Fort Leavenworth.
- <sup>103</sup> UFMCS, (2014). GroupThink Mitigation Guide, University of Foreign Military and Cultural Studies, Fort Leavenworth.
- <sup>104</sup> Thaler, R. (1980). Toward a positive theory of consumer choice. *Journal of Economic Behavior & Organization*, 1(1), 39-60.
- <sup>105</sup> Arkes, H. R., & Blumer, C. (1985). The psychology of sunk cost. *Organizational behavior and human decision processes*, 35(1), 124-140.
- <sup>106</sup> Virine, L., & Trumper, M. (2009). *Project decisions: The art and science*. Management Concepts Inc..
- <sup>107</sup> Colman, A. M. (2015). *A dictionary of psychology*. Oxford University Press, USA.
- <sup>108</sup> Arkes, H. R., & Blumer, C. (1985). The psychology of sunk cost. *Organizational behavior and human decision processes*, 35(1), 124-140.
- <sup>109</sup> Bazerman, M. H., Giuliano, T., & Appelman, A. (1984). Escalation of commitment in individual and group decision making. *Organizational behavior and human performance*, 33(2), 141-152.
- <sup>110</sup> Staw, B. M. (1976). Knee-deep in the big muddy: A study of escalating commitment to a chosen course of action. *Organizational behavior and human performance*, 16(1), 27-44.
- <sup>111</sup> Arkes, H. R., & Blumer, C. (1985). The psychology of sunk cost. *Organizational behavior and human decision processes*, 35(1), 124-140.
- <sup>112</sup> Meyer, W. G. (2014). The effect of optimism bias on the decision to terminate failing projects. *Project Management Journal*, 45(4), 7-20.
- <sup>113</sup> Festinger, L., Riecken, H. W., & Schachter, S. (1956). When prophecy fails: A social and psychological study of a modern group that predicted the end of the world.
- <sup>114</sup> Kahneman, D., Knetsch, J. L., & Thaler, R. H. (1991). Anomalies: The endowment effect, loss aversion, and status quo bias. *The journal of economic perspectives*, 5(1), 193-206.
- <sup>115</sup> Anderson, J. (2010). *Nudge: Improving Decisions about Health, Wealth, and Happiness*, Richard H. Thaler and Cass R. Sunstein. Yale University Press, 2008. x+ 293 pages. [Paperback edition, Penguin, 2009, 320 pages.]. *Economics and Philosophy*, 26(03), 369-376.
- <sup>116</sup> Samuelson, W., & Zeckhauser, R. (1988). Status quo bias in decision making. *Journal of risk and uncertainty*, 1(1), 7-59.
- <sup>117</sup> Kahneman, D., & Tversky, A. (1984). Choices, values, and frames. *American psychologist*, 39(4), 341.
- <sup>118</sup> Kahneman, D., & Tversky, A. (1979b). Prospect theory: An analysis of decision under risk. *Econometrica: Journal of the Econometric Society*, 263-291.
- <sup>119</sup> Tversky, A., & Kahneman, D. (1992). Advances in prospect theory: Cumulative representation of uncertainty. *Journal of Risk and uncertainty*, 5(4), 297-323.