Cognitive Biases as an Explanation for Classic Mistakes in Information Technology

Timothy Adams

University of South Florida

Abstract

Although a strong and detailed body of project management knowledge exits, information technology projects continue to experience high rates of failure. Over a decade ago some IT project mistakes were identified that were known to occur so often and with such predictable results that they were cataloged as ‘Classic Mistakes’. Unfortunately, rather than learn to avoid these mistakes, we not only continue to commit them, but have added more. While there are many possible reasons that these problems persist, this paper looks to the field of behavioral economics and literature about biases in human cognition to explain them.

Classic Mistakes, Cognitive Biases, and Project Management

The Information Technology (IT) industry is no stranger to pessimism when it comes to project success. According to a recent study only 32% of information technology projects succeed, while 44% of projects are challenged, and 24% fail[1] (Standish Group International, 2009). The 24% failure rate ranks as the highest in over a decade, and challenged projects, those that were delivered but suffered cost or schedule inflation, report average cost overruns of 54% and average time overruns of 79%.

In Rapid Development: Taming Wild Software Schedules, Steve McConnell (1996) identified 36 mistakes that are made so often, and across so many IT projects that they should be both predictable and preventable. He termed these 'classic mistakes'. While one might think that knowledge of these "predictable and preventable" mistakes would reduce their occurrence, when the list of mistakes was revisited in 2007, several new ones were actually added to it, bringing the total number up to 42.

So, with over 60 years of industry experience developing these IT projects and well over a decade of knowledge of mistakes so common that they could be considered classics, why do we still have trouble delivering successful projects?

We have a well-defined body of knowledge to help us both plan projects and control their execution in the Project Management Institute's (PMI) *A Guide to the Project Management Body of Knowledge* (PMBOK© Guide) (2013), so we are neither lacking in project management methods nor controls. However, there is an assumption in the approach taken by the PMBOK© Guide that project leaders will follow a rational and consistent approach to project management and decision making (Shore, 2008).

[1] Project success is defined as being delivered on time, on budget, and with all required features and functions, whereas project failure is defined as being cancelled prior to delivery or being delivered and never used.

Behavioral economics emerged as a discipline in the latter half of the 20th century, founded in part on the work of Daniel Kahneman, who received a Nobel Prize in 2002 for his contributions to the field. Much of Kahneman's work focuses on the cognitive factors come in to play in decision making, and how those factors can create biases in our judgments. The results of these biases are decisions and actions that are often a departure from purely rational and logical behaviors (Kahneman, 2011).

Recently, behavioral economics has emerged as a field with a lot of potential to be a platform for intradisciplinary information systems research (Goes, 2013). This paper will attempt to use concepts from the field of behavioral economics to explain some of the trouble that IT projects experience. It will examine of the classic mistakes defined by McConnell to determine which are the most prevalent in projects and which have the most impact on those projects. It will then review the literature for examples of how some of the concepts of behavioral economics, particularly biased judgments, can manifest themselves in IT project management, leading to the commission of those mistakes. The paper will conclude by offering some best practices for project management to lessen the occurrence and the impacts of these mistakes, hopefully contributing to project success.

The Classic Mistakes

The 42 classic mistakes mentioned earlier can be broken down into four general categories: people, process, product, and technology related mistakes (McConnell, 1996). People related mistakes have to do with personnel; how they work and work together. Process mistakes are related to planning and implementation and the way these can hinder a project. Product and technology mistakes relate to what is being built and what tools are being used to build it, respectively. Similarly, IT project risks can be grouped into three categories: people risks,

process risks, and product risks (Kappelman, McKeeman, & Zhang, 2006). Since IT projects almost never fail on product related risks (Kappelman et al., 2006), this paper will focus exclusively on the people and process related mistakes. Fortunately, these are these categories requiring the most decisions and judgments, and so they should also yield the most examples of cognitive biases.

Classic Mistakes Today

Between June and July of 2007, Construx Software conducted a survey of the software industry to determine how often classic mistakes occur and what impact they have on a project. Participants were provided with a list of the classic mistakes and asked to rate each one based on both its frequency of occurrence "in the last three years or the last five projects, whichever is shorter" and its impact on the project in terms of severity. Of the more than 500 respondents to the survey, 77% listed 'Overly Optimistic Schedules' as occurring more than 50% of the time, with an average rate of occurrence at 60-70%, putting it in first place (Construx Software, 2008). Overly optimistic schedules also ranked high for severity, coming in third on that scale at a 78% response rate and being considered to have a serious impact on projects.

The mistake considered most severe was 'Unrealistic Expectations'. It scored an 83% response rate and was also considered to have a serious impact on projects (Construx Software, 2008). Unrealistic expectations also held the number two spot in terms of frequency, with 73% of respondents reporting that it occurred more than half the time, at an average rate of 60-70%. For the top ten most frequent and most severe classic mistakes reported by Construx Software, see Table 1 and Table 2, respectively.

We will begin by looking at these two mistakes in more detail.

Overly Optimistic Schedules and Unrealistic Expectations

McConnell (1996) describes 'Overly Optimistic Schedules' as follows: "The challenges faced by someone building a three-month application are quite different than the challenges faced by someone building a one-year application. Setting an overly optimistic schedule sets a project up for failure by underscoping the project, undermining effective planning, and abbreviating critical upstream development activities such as requirements analysis and design. It also puts excessive pressure on developers, which hurts developer morale and productivity." It is considered a process related mistake. It can occur when either the amount of time and effort required to complete a project are underestimated, or when insufficient time and effort are dedicated to performing those estimates in the first place. Either way, the end result is a project in peril because not enough time has been allocated to complete it.

'Unrealistic Expectations' are described as: "One of the most common causes of friction between developers and their customers or managers is unrealistic expectations (which is probably just human nature). Sometimes project managers or developers ask for trouble by getting project approval based on optimistic estimates. A Standish Group survey listed realistic expectations as one of the top five factors needed to ensure the success of an in-house business-software project." (McConnell, 1996). Considered to be a people related mistake, unrealistic expectations can be actively created by project team members through overly optimistic estimates, or passively encouraged by them through poor expectations management.

The fact that the two most common and most serious classic mistakes made by the IT industry today are a process related and a people related mistake, supports our decision to focus on these two areas. It should also be noted that these two mistakes are related. The description of unrealistic expectations indicates that they are often built on optimistic estimates from project managers or developers. This will include optimistic estimates of schedules, although it will by

no means be limited to such. Seeing the relationship between these two mistakes, it makes sense at this point, to introduce a third, and final, mistake: "Confusing Estimates with Targets."

Confusing Estimates with Targets

The first thing to note about this mistake is that it was not included in the original list of 36. It was added in 2007 and is described as follows: "Some organizations set schedules based purely on the desirability of business targets without also creating analytically-derived cost or schedule estimates. While target setting is not bad in and of itself, some organizations actually refer to the target as the 'estimate,' which lends it an unwarranted and misleading authenticity as a foundation for creating plans, schedules, and commitments." (Construx Software, 2007).

Confusing estimates with targets also made the top 10 lists for mistake frequency and severity , taking the number 9 spot with a 65% response rate and average occurrence of 55-65%, and falling out at number 8 on the severity list with a 71% response rate and serious impact (Construx Software, 2007). While making the top ten in both categories makes this an interesting mistake in its own right, it is included here primarily because of its relationship to the other two mistakes we are considering. By definition, confusing estimates with targets will lead to overly optimistic schedules. Also, confusing a target for an estimate is likely to create unrealistic expectations that the target will be met without having done any estimates to see if that is likely or, in some cases, even possible.

With these three classic mistakes identified as current, frequent, and problematic we can begin looking at both how and why they manifest themselves in IT project management. Since this paper will focus on behavioral explanations to answer these questions, we first need some background on cognitive biases, and heuristics.

Cognitive Biases and Heuristics

In 1974, two researchers, Amos Tversky, and Daniel Kahneman published an article, "Judgment Under Uncertainty: Heuristics and Biases", that explored the nature of intuitive thinking. They found that when people were asked to assess the likelihood of uncertain events, rather than applying purely logic based mathematical reasoning, they instead turned to a limited number of heuristics. These heuristics are the simple rules we use to solve problems and perform tasks. They are substitutes for the more complex problem. Because they are short-cuts, heuristics provide adequate, but often flawed, answers to the original problem, resulting in biased judgments (Kahneman, 2011). These biases inform the field of behavioral economics when it looks to study the cognitive factors that affect the way people assign values to objects and make decisions about how to manage those values.

While the field of behavioral economics is deep and many cognitive biases exist, we will consider only a few and investigate how they relate to our classic mistakes. The biases we will investigate are: the planning fallacy, the overconfidence effect, and the anchoring effect.

The Planning Fallacy

The planning fallacy is the tendency for people to underestimate how long a task will take, especially when they have experience with similar tasks that would give them empirical evidence to the contrary (Kahneman, 2011). More broadly, it stems from the conviction people have that a current project will go as well as planned even though other similar projects have failed to fulfill their planned outcomes (Buehler, Griffin, & Peetz, 2010).

The psychological mechanism underlying the planning fallacy is explained in terms of an inside versus an outside view of a situation (Buehler et al., 2010). People involved with a project tend to focus on the qualities of the tasks composing those projects, neglecting information about the outcomes of similar projects that have already been completed. Even when presented with

this outside information, project team members taking inside views fail to incorporate it into their estimates for their projects (Buehler et al., 2010). An inside view focuses on singular information: specific tasks that might lead to a longer or shorter completion time, whereas the outside view focuses on distributional information, or how the current task fits into the set of related tasks. Ignoring or underweighting this distributional information is considered to be the major source of error in estimating (Flyvbjerg, 2006).

The Overconfidence Effect

Overconfidence is the tendency people have to express a level of confidence in an opinion or a decision that is unsupported by any available evidence (Shore, 2008). Interestingly enough, when estimating, the level of confidence that people tend to show in their estimates appear to be related more to the amount of time they spent forming those estimates than in any objective measure of their accuracy.

Kahneman attributes the overconfidence effect to a cognitive illusion called 'what you see is all there is' (2011). He claims that neither the quantity nor the quality of the available evidence actually contribute to subjective confidence, but that confidence is instead built on the quality of the narrative that can be created from the readily available information. Effectively, we fail to allow for the possibility that some important information may be missing and are overconfident in the things we know.

Anchoring and Adjustment Bias

The anchoring effect is considered to be one of the most robust and reliable phenomena of experimental psychology. It has been demonstrated across a wide array of domains and is explained as follows: when people are given a problem to solve and an initial estimate for that solution, their final answers will be close to that original estimate (Kahneman, 2011).

Something known as adjustment bias is tightly coupled to the anchoring effect and, to some extent, helps to explain it. It is believe that we solve problems by making an initial estimate based on a simplified scenario, and then try to adjust that estimate based on more detail (Kahneman, 2011). However, we tend to adjust our initial estimates inadequately, hence staying close to them. This failure to adequately adjust from our initial estimates is what is referred to as adjustment bias.

Biases and Classic Mistakes in Project Management

We can begin putting everything together by first, looking at the classic mistakes we are examining: overly optimistic schedules, unrealistic expectations, and confusing estimates with targets, and then considering our cognitive biases: the planning fallacy, overconfidence, and anchoring and adjustment. Some clear relationships exist between them.

One could first argue that the continued existence of classic mistakes could be considered a consequence of the planning fallacy. By definition, each of these mistakes has been demonstrated to be common and to have a negative effect on project outcome, which meets our planning fallacy requirement that we have both the experience and evidence to anticipate a negative outcome. Still these mistakes continue to be made. Since we can assume that very few people are actively choosing to put their projects in peril, we must conclude that these mistakes are made under the belief that they will be successful. Obviously this has not proven to be the case.

Additionally, while the planning fallacy is not a necessary condition for overly optimistic schedules, it is a sufficient condition. One facet of the planning fallacy is underestimating the amount of time and effort a project will take. This will lead directly to overly optimistic schedules.

The same type of relationship can be seen to exist between unrealistic expectations and overconfidence. Having a high level of confidence in an aspect of a project does not have to be bad. However, having a high level of confidence in an aspect of a project while neglecting to consider all of the available evidence and whether and significant evidence may be missing will certainly create unrealistic expectations.

Confusing estimates with targets is a little more complicated. In this case, the anchoring effect could be considered a necessary condition, but not a sufficient one. By definition, this mistake occurs when organizations begin to use business targets in place of estimates in their projects. The anchoring and related adjustment bias tells us that in the absence of empirical or calculated estimates having these initial targets will create anchors for any intuitive estimates. It will subsequently be difficult to adjust these anchors reflect the true nature of the project.

Fortunately some research has been done in this area, so we do not have to rely strictly on logic and conjecture to make a point. We will also see that the relationships above are not the only ways that these biases and mistakes manifest themselves in projects.

Research Review

Planning Fallacy

Flyvbjerg found that project managers are inclined to take and inside view when planning new projects (2012). Costs and benefits of major projects have also generally been found to be inaccurate and biased in an overly optimistic way (Flyvbjerg, 2012). This manifestation of the planning fallacy is likely to underestimate the costs being incurred in new projects and to overestimate the potential benefits from those projects. This is likely to create unrealistic expectations for the project during the planning phase.

In a review of 25 articles pulled from engineering and management science literature regarding time estimation, 17 of the studies reported a tendency to underestimate the time required for project completion, 2 studies reported an equal amount of under and overestimation of time required, and the remaining 6 reported a tendency to overestimate tasks (Halkjelsvik, & Jørgensen, 2012). However, these studies were further characterized as field studies, lab studies, or surveys. The lab studies involved tasks performed explicitly for research, often in controlled settings, the field studies included natural observation and field experiments, and the surveys were studies where project managers and software developers reported actual time and estimation errors in retrospect. All 7 survey experiments reported time underestimation. The results of these surveys indicate an underestimation of the effort required for tasks and are an example of the planning fallacy in real IT projects leading to overly optimistic schedules.

Anchoring

McCray et al. found that one of the ways that anchoring manifests itself during the planning phase of projects is in the overall project indicators, such as likelihood of project completion on schedule (2002). Projects tend to be completed in phases, so these estimates tend to be made for each phase and used to calculate a total. However, even when the estimates for each individual phase are accurate, in total they can create an anchor for overall project success that can be quite different from the actual calculation of that success (statistics being conceptually difficult to grasp for many). Anchoring on inaccurate estimates for project completion leads to unrealistic expectations.

Overconfidence

When an existing project plan is familiar and resources are aligning according to that plan, project managers are unlikely to step back and evaluate the project when early signs of trouble

arise (McCray et al., 2002). In these situations project managers feel overly confident that the project can be kept on track. Unfortunately these unrealistic expectations are often unmet.

Similarly, an examination of a case study of the Denver Airport Baggage Handling system revealed other impacts of overconfidence on a project (Shore, 2008). Evidence was found indicating that a major project stakeholder insisted on having a more complicated baggage handling system and that the contractor for that system insisted on implementing it despite some trouble on the project. These attitudes were interpreted as overconfidence, a blind support for the project without ever considering the feasibility of the project to begin with. This is another case of unrealistic expectations arising out of overconfidence.

Conclusions and Recommendations

We have examined the ways that cognitive biases and heuristics affect IT project management and play a role in the continued commissions of classic mistakes on those projects. There does appear to be some evidence supporting the idea that common cognitive biases such as the planning fallacy, the overconfidence effect, and the anchoring effect provide a behavioral explanation for why these mistakes keep occurring, despite good project management practices and previous knowledge of the mistakes.

The question that remains is: can anything be done about it? While more research needs to be done, a few guidelines can help minimize the impact of these biases. The following two recommended best practices are a good start:

1. Always use objective data (McCray et al., 2002). By collecting data to support decisions and analyzing the quality of that data, overconfidence can be avoided. While anchoring may not be avoidable, good evidence will at least help to develop better estimates on which to anchor.

2. Take the outside view (Flyvbjerg, 2012). One solution to both the planning fallacy is for estimators to use base rates and distributional information regarding the amount of work done on other projects to estimate the amount of work to be done on their projects.

Following these two simple rules is a first step towards better project estimates, more realistic expectations, and estimates that are independent from business targets.

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Table 1

Classic Mistakes Most Frequently Reported to Occur Almost Always or Often (Construx Software, 2008)

Rank	Classic Mistake	Frequency of Response	Frequency of Occurence
1	Overly optimistic schedules	77%	60-70%
2	Unrealistic expectations	73%	60-70%
3	Excessive multi-taksing	71%	60-70%
4	Shortchanged quality assurance	70%	60-70%
5	Noisy, crowded offices	69%	55-65%
6	Feature creep	69%	55-65%
7	Wishful thinking	68%	55-65%
8	Insufficient risk management	68%	55-65%
9	Confusing estimates with targets	65%	55-65%
10	Omitting necessary tasks from estimates	61%	50-60%

Table 2

Classic Mistakes Most Frequently Reported to Produce Catastrophic or Serious Consequences When They Occur (Construx Software, 2008)

Rank	Classic Mistake	Frequency of Response	Average Impact
1	Unrealistic expectations	83%	Serious
2	Weak personnel	78%	Serious
3	Overly optimistic schedules	78%	Serious
4	Wishful thinking	76%	Serious
5	Shortchanged quality assurance	72%	Serious
6	Inadequate design	72%	Serious
7	Lack of project sponsorship	71%	Serious
8	Confusing estimates with targets	71%	Serious
9	Excessive multi-taksing	71%	Serious
10	Lack of user involvement	70%	Serious