Heuristics and Biases in Project Management

The following is not a comprehensive list, but it includes the most relevant heuristics and biases that apply to project management. Some psychological effects mentioned in this book, such as the creativity block, are not included to avoid repetition. If you glance through the list from time to time, it will refresh your memory and give you some ideas about how you should think while you manage your projects.

The discipline of psychology helps us look at our actions from a different point of view. When we showed this list to managers who were not familiar with cognitive biases, most recognized the mental pitfalls that had tripped them up in the past. We hope this list will help you avoid some of these pitfalls.

It is difficult to come up with definitive classifications for heuristics and biases in project management. Many biases are related to each other and may affect our behavior in different ways. Nevertheless, we have grouped all the biases into a few logical categories. Within each category, the biases are presented in alphabetical order. A few fundamental psychological concepts, such as selection perception, and some heuristics have a number of biases associated with them.

**BEHAVIORAL BIASES AND BIASES RELATED TO PERCEPTION**

**Ascription of Causality** – The tendency to ascribe causation even when the evidence suggests only correlation. Managers may think that a project succeeded because they created and managed a risk list. Correlations between a project’s success rate and the presence of a risk list is not enough to conclude that a risk list led to the positive result.

**Bias Blind Spot** – The tendency not to see your own cognitive biases (Pronin, Lin, and Ross 2002). Even if people know their own cognitive biases, they do not compensate for them. Knowledge of this bias is important for project management training and education.

**Biased Covariation Assessment** – The tendency not to examine all the possible outcomes when making a judgment regarding a correlation or an asso-
ciation. We may focus on only one or two possibilities, while ignoring the rest. This bias affects a project manager’s ability to analyze correlation and causation in a project.

**Choice-Supportive Bias** – The tendency to remember positive attributes as having been part of the chosen option rather than of the rejected option. For example, research participants were asked to make a choice between two options. Later, in a memory test, participants were given a list of positive and negative features. Positive features were more likely to be attributed to the chosen option, and negative features are more likely to be attributed to the rejected option (Mather and Johnson 2000). This bias is related to the selection of project alternatives and reviews of the results of decision analysis.

**Congruence Bias** – A bias that occurs due to a decision-maker’s reliance on direct testing of a given hypothesis while neglecting indirect testing. Because of this bias, decision-makers are often unable to consider alternative hypotheses. This bias is related to generation and evaluation of creative project alternatives.

**Disconfirmation Bias** – The tendency for decision-makers to extend critical scrutiny to information that contradicts their prior beliefs (Lord, Ross, and Lepper 1979). This bias is also related to the confirmation bias.

**Elimination-by-Aspect Heuristic** – A heuristic in which people eliminate a potential choice from a plurality of choices if it does not satisfy certain conditions (Tversky 1972). It manifests itself when project managers select project alternatives based on multiple criteria.

**Escalating Commitment** – The tendency to invest resources in failing projects with a very small chance of recovery (Mccray, Purvis, and Mccray 2002). This behavioral trap is related to the sunk-cost effect.

**Experiential Limitations** – Inability or unwillingness to look beyond the scope of past experiences or rejection of the unfamiliar. This bias serves as a creativity block when project managers may discard good ideas because they do not fit into a familiar pattern.

**Failure to Consider Alternatives** – A tendency to evaluate and consider only a single course of action. It occurs when project managers attempt to reduce efforts during the evaluation of alternatives. It is often the result of sufficient information about one particular suggested course of action and insufficient information about alternatives. This bias is related to the congruence bias.

**Focusing Effect** – A bias that occurs when decision-makers place too much importance on one aspect of an event or process. For example, a software
project manager believes the software’s quality is associated only with the number of software defects. In reality, the notion of software quality, in addition to the quality of the software code, involves the quality of the documentation, user interface, packaging, and support.

**Hyperbolic Discounting** – The tendency to prefer smaller payoffs to larger payoffs when the smaller payoffs come sooner in time than the larger. For instance, a project manager may prefer a $500,000 NPV project now to one with a $1 million NPV several years from now. However, given the choice of the same $500,000 NPV project five years from now and the $1 million NPV six years from now, project managers would choose $1 million in six years (Chung and Herrnstein 1967).

**Illusion of Control** – The tendency of decision-makers to believe they can control or influence outcomes over which they have no influence. For example, when rolling dice in craps, people tend to throw stronger for high numbers and softer for low numbers. Sometimes project managers plan projects under the assumption that they can control most processes, which in reality they cannot.

**Inconsistency** – The inability or unwillingness to apply the same decision criteria in similar situations. Consistency is one of the fundamental principles of the project decision analysis process.

**Inertia** – An unwillingness to change thought patterns that we have used in the past in the face of new circumstances. Project managers often follow the same practices in a new environment, such as project size, industry, organizational structure, and so on. In many cases, this can be inappropriate and lead to problems.

**Invisible Correlations** – The inability to see correlations because they are not expected to be related. In project management this inability is often related to a correlation between an individual’s motivation, beliefs, experience, and preferences and project results.

**Impact Bias** – The tendency of a decision-maker to believe that if a negative event occurs, it takes longer to recover emotionally from the event than it actually does. In project management it is related to the analysis of risk impacts.

**Information Bias** – The tendency to seek information even when it cannot affect a decision. In organizations, management sometimes requires more reports and analysis than necessary. Value-of-information analysis will help to mitigate a negative effect of this bias.
Lexicographic Heuristic – The tendency of people to apply the following process to make a choice between alternatives strategies: (a) rank the order attributes; (b) select the option rated highest on the most important attribute; (c) if a tie, go to the next attribute (Tversky 1969). This heuristic is called lexicographic because a similar algorithm is used to order words in dictionaries. The heuristic manifests itself when project managers select project alternatives based on multiple criteria.

Omission Bias – The tendency to judge potentially harmful actions as worse than equally harmful inactions (omissions). Project managers may believe that new product development is riskier than continuing to maintain an existing product that is losing sales, even if the costs of both project alternatives are the same.

Outcome Bias – The tendency to evaluate a decision by its final outcome instead of the quality of the decision at the time it was made. If a decision results in a negative outcome, this does not mean that decision was wrong, because the decision was made based on the best possible information at the time. This bias manifests itself in the review of project decisions.

Planning Fallacy – The tendency to underestimate the duration of project activities. Project managers may eliminate factors that they perceive are not related to the project. Moreover, they may discount multiple improbable high-impact risks because each one is so unlikely to happen. The planning fallacy is one of the fundamental biases related to estimations in project management.

Post-Purchase Rationalization – A bias that occurs when people have invested a lot of time, money, or effort in something and try to convince themselves that the expenditure must have been worth it. It may affect the analysis of projects during reviews.

Biases related to Prospect Theory:

- **Endowment Effect** – The tendency of decision-makers to place a higher value on objects they own than on objects they do not. It explains why people rarely exchange a product they have already purchased for a better product. It can manifest in project management in choices related to replacing existing products, tools, and services (Kahneman, Knetsch, and Thaler 1990).

- **Loss Aversion** – The tendency of decision-makers to prefer avoiding losses versus acquiring gains. In project management it is associated with risk aversion and risk tolerance when decision-makers evaluate possible project gains and loses.
Appendix B: Heuristics and Biases in Project Management

- **Pseudocertainty Effect** – The inclination to make risk-averse choices if the expected outcome is positive, but make risk-seeking choices to avoid negative outcomes (Tversky and Kahneman 1981; Slovic, Fischhoff, and Lichtenstein 1982). Actual choices can be affected by simply reframing the descriptions of the outcomes. Project managers will prefer to take a risk and buy a component if they receive a free unit for every three purchased instead of buying all four components with a 25% discount.

- **Zero-Risk Bias** (related to the *certainty effect*) – The preference for reducing a small risk to zero over a greater reduction in a larger risk. Individuals may prefer small benefits that are certain to large ones that are uncertain. Project managers sometimes prefer to avoid a small risk completely rather than significantly mitigate a larger one.

**Recognition Heuristic** – When making a judgment between two items when only one of the items is recognized, the recognized item will be considered to have a higher criterion value (Goldstein and Gigerenzer 1999). This heuristic manifests itself when project managers select project alternatives based on multiple criteria.

**Repetition Bias** - A willingness to believe what we have been told most often and by the greatest number of different sources. Repetition bias is related to the *exposure-memory effect* and can lead to wrong assessments of business situations in project management.

**Selective Perception** – The tendency for expectations to affect perception. Sometimes selective perception is referred to as “What I see is what I want to see.” There are several biases related to selective perception:

- **Confirmation Bias** – The tendency of decision-makers to seek out and assign more weight to evidence that confirms a hypothesis, and to ignore or give less weight to evidence that could discount the hypothesis. This can lead to statistical errors (Watson 1960). This bias is related to estimations and evaluations of alternatives in project management.

- **Premature Termination of Search for Evidence** – The tendency to accept the first alternative that looks like it might work.

- **Professional Viewpoint Effect** – The tendency to look at things according to the conventions of a decision-maker’s profession, forgetting any broader point of view. For example, project management professionals may not fully apply methodologies and tools that originated from operations research.
- **Selective Search of Evidence** – The tendency to gather facts that support certain conclusions while disregarding other facts that support different conclusions.

**Similarity Heuristic** – Relates to how people make judgments based on similarity. Thinking by similarity is one of the fundamental mental strategies of project managers, who usually analyze project issues by comparing these issues with previously corrected problems. Over time, a project manager’s past experiences will allow his or her use of the similarity heuristic to be highly effective, quickly choosing the corrective actions that will likely reveal the problem’s source. Similar approaches are used by software programmers, doctors, police investigators, and other professionals.

**Source Credibility Bias** – The tendency to reject information if there is a bias against the person, organization, or group that is the source of the information. The opposite effect is the tendency to accept information uncritically from trusted sources. In project management it can lead to a *sampling bias*, when too much faith is placed in certain information while other information is rejected (Skinner 1999).

**Status Quo Bias** – The inclination of decision-makers to like things to stay relatively the same (Samuelson and Zeckhauser 1988). This bias is similar to the *omission bias* and is related to the *endowment effect*. It explains why ineffective project management procedures often are not changed and why outdated technology is not replaced.

**Student Syndrome** – The tendency of people to wait until a deadline is near to start to fully apply themselves to a task (Goldratt 1997). The bias is named after the way students tend to put off doing their papers until the night before they are due. The bias is related to estimation of project activity duration. A similar effect is *Parkinson’s Law*, which states that the demand upon a resource always expands to match the supply of the resource (Parkinson 1996). Particularly, work expands to fill the time available for its completion. Is also strongly related to procrastination.

**Sunk-Cost Effect** – The tendency to make a choice considering the cost that has already been incurred and cannot be recovered (sunk cost). Sunk costs affect the decisions due to the loss-aversion effect. Sunk costs may cause cost overruns and may also lead to investment in a project that now has no value. This effect is related to the escalating commitment bias.

**Wishful Thinking** – The formation of beliefs and decision-making according to what might be pleasing to imagine instead of by appealing to evidence or applying rationality. For example, a project manager often makes estimates based on positive results he or she wants to achieve instead of what is possible to achieve. Wishful thinking is related to the *optimism bias*.
BIASES IN ESTIMATION OF PROBABILITY AND BELIEF

Ambiguity Effect – The tendency to prefer options with known probabilities and to avoid options in which missing information makes the probability seem unknown (Ellsberg 1961). In project management it is important to collect information for all selected alternatives.

Anchoring Heuristic – The tendency to rely on one trait or piece of information when making decisions. The following are biases related to the anchoring heuristic:

- Insufficient Adjustment – The tendency of decision-makers to “anchor” on a current value and make insufficient adjustments for future effects. In project management this bias often manifests itself in the estimation of uncertainties. A project manager often does not allow sufficient adjustment after making three-point estimates of an activity’s duration or cost.

- Overconfidence in Estimation of Probabilities – A tendency to provide overly optimistic estimates of uncertain events. Decision-makers tend to set the ranges of probability too low and remain overconfident that these ranges will include true values. Overconfidence is most likely after a series of project successes, and it can lead to risk-taking.

- Overestimating the Probability of Conjunctive Events – If an event is composed of a number of elementary events, the probability of the elementary events should be multiplied to come up with the probability of a main event. For example, the probability of task completion is 80%. If the project consists of three tasks, the probability of project completion will be (0.8 * 0.8 * 0.8), or 51.2%. People tend to overestimate the probability of the main event because the probability of elementary events serves as an anchor.

Availability Heuristic – The tendency to make judgments about the probability of events occurring by how easily these events are brought to mind. The following are biases related to the availability heuristic:

- Ease of Recall Not Associated with Probability – The tendency of people to recall events that are unusual or rare, vivid, or associated with other events such as major issues, successes, or failures. As a result, assessment of probabilities for project risks can be wrong.

- Illusory Correlations – The tendency to overestimate the frequency in which two events occur together. In project management the bias manifests itself in the analysis of relationships between two or more
parameters—for example, whether the geographic location of a supplier is related to the quality of its products.

**Optimism Bias** – The tendency to be overly optimistic about the outcome of planned actions. This bias manifests itself in project planning and forecasting. Project managers often overestimate the probability of successful project completion and underestimate the probability of negative events. The optimism bias is also related to wishful thinking.

**Representativeness Heuristic** – A heuristic according to which people estimate probability by judging how representative the object, person, or event is of a certain category, group, or process. Following are biases related to the representativeness heuristic:

- **Conjunction Fallacy** – An unwanted appeal to more detailed scenarios. This fallacy can lead to a “preference for details.” If, for example, a project manager must select one project from a number of proposals, he or she may tend to pick those proposals with the most detail, even though they may not have the best chance of success (McCray, Purvis, and McCray 2002).

- **Gambler’s Fallacy** – The belief that a successful outcome is due after a run of bad luck (Tversky and Kahneman 1971). In project management, corrective actions as a response to certain issues and problems are often not taken because project managers believe that the situation will improve itself.

- **Ignoring Base-Rate Frequencies** – The tendency of people to ignore prior statistical information (base-rate frequencies) when making assessments about probabilities. In project management this bias can manifest itself in the estimation of probabilities and forecasting. For example, what is the probability that a new component from a supplier is defective? Project managers can make estimates based on recent testing where most components were defective. However, they may ignore the fact that historically 99% of the components from this supplier have been problem-free.

- **Ignoring Regression to Mean** – The tendency to expect extreme events to be followed by similar extreme events. In reality, extreme events most likely will be followed by an extreme in the opposite way or an average event. Project managers should not expect extraordinary performances from a team or individuals for every project because of the regression to mean, or the tendency to be average.
SOCIAL AND GROUP BIASES

Attribution Biases – Biases that affect attribution, or the way we determine who or what was responsible for an event or action. Understanding of attribution biases is important for project human resource management. Attribution biases include:

- **Egocentric Bias** – The tendency of people to claim more responsibility for the results of a joint action than an outside observer would.

- **Fundamental Attribution Error (Correspondence Bias or Overattribution Effect)** – The tendency of people to overemphasize personality-based explanations for behaviors observed in others while underemphasizing the role and power of situational influences on the same behavior (Heider 1958; Jones and Harris 1967). People tend to judge what a person does based more on what “kind” of person he or she is than on the social and environmental forces at work on that person.

- **False Consensus Effect** – The tendency of decision-makers to overestimate the degree to which others agree with them. If members of a group reach a consensus and it is not disputed, they tend to believe that everybody thinks the same way (Ross, Greene, and House 1977). Therefore, if nobody expresses a contrary opinion in a team meeting, project managers will believe that everybody agrees on the course of action.

- **Self-Serving Bias** – The tendency to claim responsibility for successes rather than failures. The self-serving bias results in the better-than-average effect and overconfidence. For example, project managers of a successfully completed project might say, “I did it because I am very experienced.” Project managers of a failed project might say, “The clients did not provide good specifications, and we did not have the necessary resources.”

- **Outgroup Homogeneity Bias** – People see members of their own group as being relatively more varied than members of other groups.

- **Self-Fulfilling Prophecy** – A prediction that, once made, actually causes itself to become true. In other words, a false statement may lead people to take actions that will ultimately result in fulfillment of the prophecy (Merton 1968). For example, a project manager expresses a concern that resources are not sufficient for the project. When resources are not given to him, he perceives all problems with the project as a result of limited resources. In J.K. Rowling’s *Harry Potter and the Order of the Phoenix*, a prophecy was made shortly before Harry Potter’s
birth that the one with the power to destroy Voldemort would be born shortly. To protect himself, Voldemort attempted to kill Harry Potter while he was an infant, but his curse backfired on him, transferring some of his powers to Harry. In fact, this power transfer is a response to the prophecy. The prophecy was only “true” because Voldemort believed it.

- **Trait-Ascription Bias** – The tendency of people to view themselves as relatively variable in terms of emotion, personality, and behavior while viewing others as much more predictable. This may be because people are able to observe and understand themselves better than others. This bias may lead to stereotypes and prejudice. The bias manifests itself in project team communication. This bias is similar to outgroup homogeneity bias on the group level.

**Bandwagon Effect (Groupthink)** – The tendency to do (or believe) things because many other people do (or believe) the same. The effect manifests itself in project teams when project managers and team members are reluctant to express different points of view.

**Ingroup Bias** – The tendency of people to give preferential treatment to people they perceive to be members of their own groups (Tajfel 1982), even if the group they share is random or arbitrary (such as having the same birthday). Ingroup bias is an important factor related to communication within project teams.

**Polarization Effect** – The tendency for group discussions to lead to amplified preferences or inclinations of group members. If a project team member already has an opinion about a certain issue (e.g., new product design), as a result of the meeting he or she may have a much stronger opinion about this issue. People on both sides can move farther apart, or polarize, when they are presented with the same mixed evidence (Lord, Ross, and Lepper 1979).

**MEMORY BIASES AND EFFECTS**

**Context Effect** – Memory is dependent on context of the environment. Out-of-context memories are more difficult to retrieve than in-context memories. For example, recall time and accuracy for a project-related memory will be lower when a manager is at home, and vice versa.

**Generation Effect** – People will recall information better if it is generated rather than simply read. If a project manager experienced a certain issue and actually dealt with it, he or she will remember it better than if he or she just read about it. The generation effect can be a strategy for learning (Jacoby 1978).
Exposure Effect – People can express an undue liking for things merely because they are familiar with them. The more often we read about a certain method or principle, the more we like it. This effect is used in the advertisement industry. For example, a project manager may like certain project management software just because it is advertised more often in an industry journal.

Hindsight Bias (the “I Knew It All Along” effect) – The tendency to see past events as being more predictable than they actually were. The possible explanation of this bias is that events that actually occur are easier to recall than possible outcomes that did not occur. This bias manifests in the review of project decisions.

False Memory – A memory of an event that did not happen or a distortion of an event that did occur, as influenced by externally corroborated facts. Often, project managers simply forget important information and lessons learned.

Misinformation Effect – A memory bias that occurs when misinformation affects people’s reports of their own memory. If people read an inaccurate report about a project and are asked to recall their own experience about the project, the report will distort their memory about the project (Roediger, Meade, and Bergman 2001).

Picture Superiority Effect – Concepts and ideas are more likely to be remembered if they are presented as pictures rather than as words (Paivio 1971; 1986). This effect is important for presentation and interpretation of project information, e.g., the results of project decision analysis.

Peak-End Rule – The heuristic according to which people judge their past experiences almost entirely on how they were experienced at their peak (pleasant or unpleasant) and how they ended. Other information is discarded, including net pleasantness or unpleasantness and how long the experience lasted. In project management this heuristic is important in project reviews because project stakeholders may not remember all necessary project details (Kahneman 1999).

Zeigarnik Effect – Project managers may remember tasks in progress better than recently completed tasks (Zeigarnik 1967).