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Managing the Unexpected with Earned Schedule

By Robert Van De Velde

Abstract

Project managers spend much of their time dealing with the unexpected. When project managers are blind-sided by an unexpected event, they commonly ascribe the miss to a lack of diligence or experience. They think that such failures could be avoided with additional attention, practice, or education. Recent research indicates that the problem is much deeper and is not amenable to such corrective action. A different approach is required.

Advances in Earned Value Methodology, in particular, Earned Schedule, fill in the gap. They provide new mathematical and statistical methods for forecasting project behaviour. The forecasts are effective tools for exposing otherwise unanticipated problems early in the project life cycle, thus enabling project managers to detect and address them while there is still time to respond.

This paper starts by briefly describing the real reason that project managers miss unexpected events and the implications for project management. Then, the focus shifts to Earned Schedule and techniques for managing the unexpected.

Invisible Events

In a remarkable series of experiments over the past decade, researchers identified limits on our innate ability to detect unexpected events. The original experiment was based on a curious video that has become widely known via the Internet (to view it, click here: [U of Illinois Video 1999 1min 22sec](#)). In the video, there are six players standing in a circle, dressed alternately in black and white t-shirts. The players in white pass a basketball to other players in white. The players in black pass another basketball to those in black. Observers are asked to count the number of passes between players in white. While the balls are passed around, someone in a gorilla suit walks through the action, pausing in the middle to thump its chest. Many observers report the correct number of passes, but, amazingly, about half of the observers miss the gorilla (Simons and Chabris 1999). Subsequent experiments confirmed these results.

In a recent variation on the experiment (to view it, click here: [U of Illinois Video 2010 1min 42sec](#)), other unexpected events were added to the scenario: one of the players in black leaves the scene, and the background curtain changes colour from red to gold. All of the observers who had previously heard about the experiment notice the gorilla. Observers still unaware of the experiment again fail to notice the gorilla about half the time. More striking, few observers in either group identify the other unexpected events. Over 80% of the subjects across the two groups fail to notice that a player left or that the curtain colour changed (Chabris 2010).

Not only do we often miss the unexpected, but we miss the unexpected even when we expect it.

Project Management Implications

Projects involve far more than simple visual perception. They are complex amalgams of perception, memory, reasoning, and decision making. The experiments, however, are still relevant. “[They are] not just limited to visual attention but [apply] equally to all of our senses and even to broader patterns in the world around us” (Chabris and Simons 2010). The experiments reveal that all of us, including project managers, operate within fundamental cognitive limitations.

When project managers miss unexpected events, they generally believe that something exceptional has happened: a breakdown of attention, training, or experience. The research points in a different direction. It suggests that the failure to see unexpected events is the result of systemic constraints. If so, project managers cannot erase the limits; they can only recognize, accept, and accommodate them. How can project managers defend their projects against such intrinsic limitations?

Accommodating Cognitive Limitations

The researchers recommend a psychological defense: healthy self-doubt. Fight limits of attention, knowledge, and judgment, they say, by questioning your intuitions, admitting your cognitive weaknesses, and being open to the input of knowledgeable peers. That is good advice, but there are more potent weapons in the project manager’s arsenal—in particular, numbers. Numbers provide an independent view of what is occurring, an objectivity that brings into view otherwise invisible threats.

What project managers need is a standard set of objective metrics, based on a solid theoretical foundation, refined by extensive research and practice, and supported by tools. Earned Value Methodology meets all of these needs. Especially relevant are the

forecasting techniques encompassed by the methodology. The forecasts use historical information as the basis for trend analysis. By predicting future behaviour of the project, the forecasts illuminate potential problems, often well before they would otherwise be visible.

An example illustrates how Earned Value can be used to manage the unexpected.

Earned Value Prerequisites

Vijay is managing a large technology project. The tasks in his schedule accurately reflect the project deliverables, their sequence, and their timing. The work effort allocated to each task represents a fair estimate. Vijay has assigned a resource to each task and has allotted at least a nominal rate to each of the resources. He has stockpiled all the data he needs to generate Earned Value numbers.

Vijay mobilizes the data by calculating the value of each task. In projects of any size, the calculations are automated either via spreadsheet or directly through a scheduling tool. Planned Value is the work estimate times the rate for the resource assigned to the task. Earned Value is the Planned Value times the percent complete for the task. Finally, there is Earned Schedule, a measure of the time earned on the project.

In a pioneering article a few years ago, Walt Lipke defined Earned Schedule as the sum of all the time periods during which the cumulative Earned Value is less than or equal to the cumulative Planned Value (Lipke 2003, Van De Velde 2007).¹ Forecasting based on Earned Schedule has been shown to be superior to other Earned Value forecasting techniques (Lipke 2008a). Consequently, the remainder of the illustration focuses on Earned Schedule.

Initial Warning of the Unexpected

Vijay's project started in January and is scheduled to finish by the end of October. Although he experienced problems early in the project, Vijay sorted them out and believes that things are going well. What do the numbers say?

Figure 1 shows the relationship between the time that should have been earned on the project and the time that has actually been earned. Once calculated, the Earned Schedule is compared with the baseline duration of the project. If the cumulative Earned Schedule is less than the cumulative Baseline Schedule, the schedule is behind; if the cumulative

¹ For further explanation of Lipke's work, see my article in a previous issue of *PMWorldToday*: [Time Is Up](#).

Earned Schedule is greater than the cumulative Baseline Schedule, the schedule is ahead. The relationship is easy to see in a graph.²

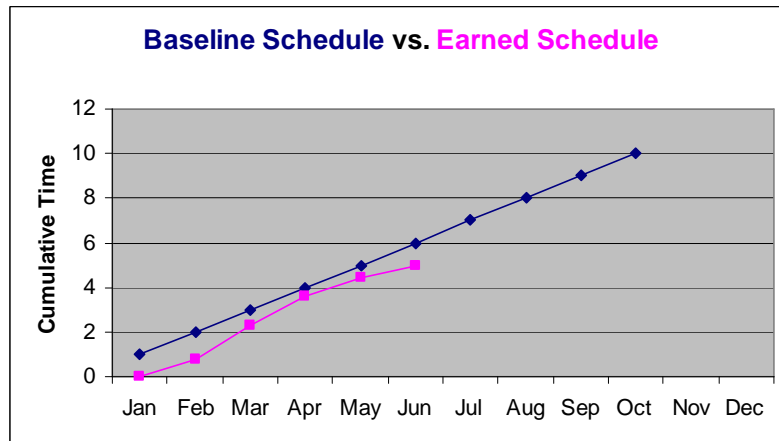


Figure 1

During the first two months of the project, productivity ran below expectation. By March, productivity had improved, and the gap began to close. Now, in June, the gap has reopened. Vijay’s intuition is wrong: there is a problem. But, is it serious? Again, the numbers give us an answer.

Sizing Unexpected Impacts

The Schedule Performance Index (time) measures the ratio between the Earned Schedule and the Actual Time. The ratio indicates how well the schedule is performing: above 1, it is performing well; below 1, it is performing poorly. Based on the level of performance, the duration of the project can be forecasted—it is the Planned Duration divided by the Index (Henderson 2004). Unfortunately, Vijay’s project is performing poorly. Calculations show that its Index is .824, and the nominal forecast is December 31st, well after the October 31st planned end date.

Once calculated over a period of time, the Index values can be subjected to statistical analysis (Lipke 2009). Such analysis reveals that, given a particular probability, say 90%, values for the Index lay within a certain range. Using that range, upper and lower bounds can be forecast for how long the project will take. The upper bound represents the “worst

² All the graphs in the article were produced from [ProjectFlightDeck’s Project Performance Analyzer](#) using the data in Figure 7-1, Lipke 2009.

case” scenario for the duration of the project, and the lower bound represents the “best case” scenario. Here are the forecasts for Vijay’s project.

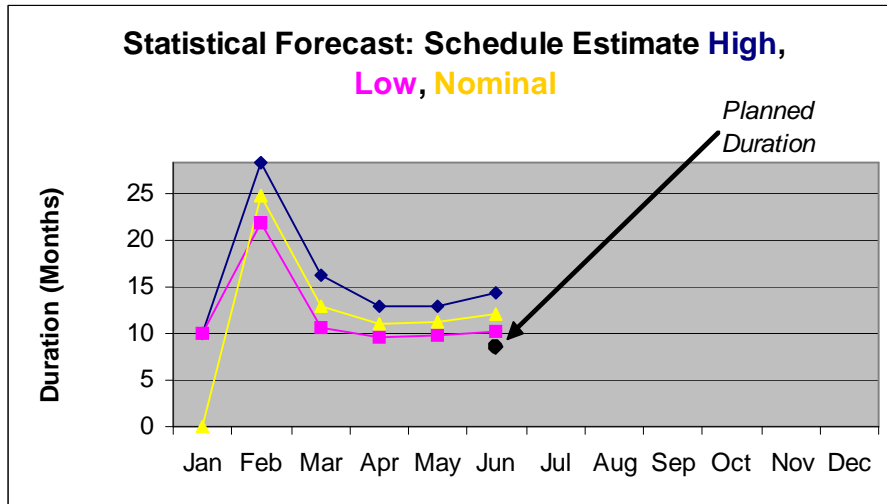


Figure 2

Statistical analysis shows that the best case for Vijay’s project is completion within 10.3 months. Vijay’s plan, however, is based on delivery in 9.9 months. Given that the worst case scenario is 14.4 months and the nominal forecast is 12.0 months, the numbers show that the problem is serious. Even in the best case, Vijay will probably miss his commitment, and he may well miss it by a significant amount. Nonetheless, the project might still be recoverable. The numbers tell Vijay if the project is still viable.

Identifying Unrecoverable Events

Some of Lipke’s most recent research explores the “point of no return” for a project (Lipke 2008b). Lipke examines the traditional Earned Value metric known as the “To Complete Performance Index”. By applying calculus to the rate of change in the “To Complete” Index value, Lipke shows that once the threshold value of 1.1 is exceeded, a project is out of control. There is little chance that it can be recovered. Applying the mathematics to Vijay’s situation, we get the following result.

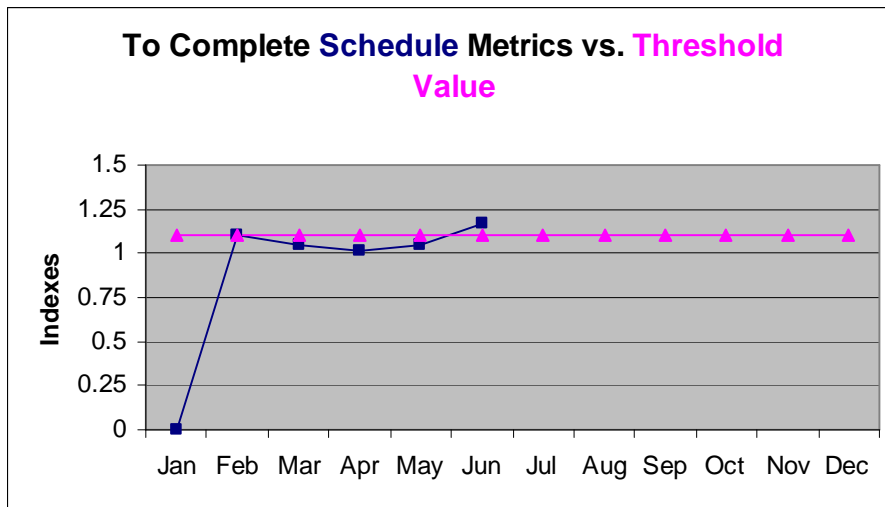


Figure 3

The value of the “To Complete” metric has edged above the 1.1 threshold. The project is therefore not recoverable within the current schedule, and re-negotiation is required. On a positive note, the problem is visible to Vijay in June, well before the planned end date in October. It is easier to deal with the unexpected if you see it early.

Managing Projects within Limits

Psychological research presents a compelling case for limits on our ability to detect unexpected events. The limits affect project managers, putting their projects at risk. The use of systematic, objective measures such as Earned Schedule enables project managers to flush out and fight the “invisible gorillas” that would otherwise endanger their projects.

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