How engineers learn from failure (or we're a weird bunch!)

Sean Brady examines how engineers learn from failure and discovers that frustration is key.

Introduction

For many months now we've talked about the importance of learning from failure. And of course what we're really talking about is learning from other people's failures. But how easy is it to learn from failures when we're personally involved? Do the negative emotions they generate act as an impetus to embrace learning, or do they instead cloud our learning and replace objectivity with subjectivity? Or do we simply want to move on from failure and put it behind us, with the process of learning being relegated to a secondary consideration?

The answers to these sorts of questions are, as you'd expect, not nearly as straightforward as we'd like, but we can gain some insight from work carried out by Dean Shepherd and his team at Indiana University, USA. The team was interested in how negative emotions from project failures or terminations impacted individuals directly involved in the project. Do these negative emotions affect the individual's ability to move on from the project and break their bond with it? Does termination affect their commitment to the company and can they effectively apply themselves to new projects? Shepherd's team also wanted to explore whether negative emotions affected an individual's ability to learn the lessons of why the project failed and was terminated. Or were these lessons simply lost?

Shepherd conducted the study on research scientists, and found that the emotions the scientists experienced when a project failed or was terminated were very powerful and could interfere with learning. But it was when the team selected engineers for their next study that things got interesting. They found that engineers dealt with failure in quite a different way to the scientists. We engineers do tend to think of ourselves as being a little different – Shepherd and his team were about to discover just how big this difference was.

Scientists

The team's research began with research scientists from different research institutes in Germany[1]. They interviewed the scientists, discussed recently terminated projects, how the scientists felt about them, what they learned, and what they would do differently next time around. They even returned to participants at later dates to ascertain whether their feelings had changed over time and whether or not more time for reflection had given them more insight into what went wrong.

Previous studies had found that many research scientists experience feelings of distress due to project termination. Many had committed to projects on a personal level, and the loss of time and energy that went into the terminated projects upset them. For many, these projects had become part of their identity, and without them some scientists questioned who they were.

Shepherd's research was comprehensive, and we can only cover a number of the key findings. Some are predictable, some are surprising. The study found that, as a result of these feelings of distress, many scientists felt less committed to the company's goals. The good news was, however, that distance from the failed project – in terms of time – did indeed heal wounds, and resulted in an opportunity for reflection and learning.

Engineers

The team then embarked on a new study to examine how the timing of project termination affected learning[2]. Do we learn more when a failing project is nipped in the bud quickly, or is it better for the project to drag out slowly, with the whole project team being subjected to what is known as 'creeping death'? Conventional wisdom – from the perspective of the individual doing the terminating – argues in favour of the speedy termination of failing projects. The logic goes something like this: put measurement parameters in place to measure project success; if the project is failing, try and assess why; and if the issues cannot be fixed, then terminate it. The key advantage of this approach is the ability to reassign internal resources (namely, people) from the failing project to other more favourable projects.

Shepherd's team wanted to understand whether this same wisdom applied to the individuals working on the project, as opposed to the individuals doing the terminating. Does quick termination give the individuals involved in the project the opportunity to learn what went wrong and allow them to articulate what they would do differently next time? Truly understanding these lessons, which can then be applied by individuals to new projects, has obvious benefits for the organisation as a whole. And for this study the team turned their attention to engineers. They selected research and development engineers from across four divisions in an international company. Eight failed projects were examined, and engineers were interviewed, generally in person, over a significant period of time to ascertain how they responded to the failed projects.

It is here that things got very interesting. Shepherd's team found that the engineers, unlike the scientists in the previous study, generally did not experience negative emotions when their project was terminated – as long as the termination occurred in a timely manner. (We will return to projects that experienced creeping death shortly.) Of all the engineers interviewed, only a few were upset. For example, one engineer was moved on to a new project they considered
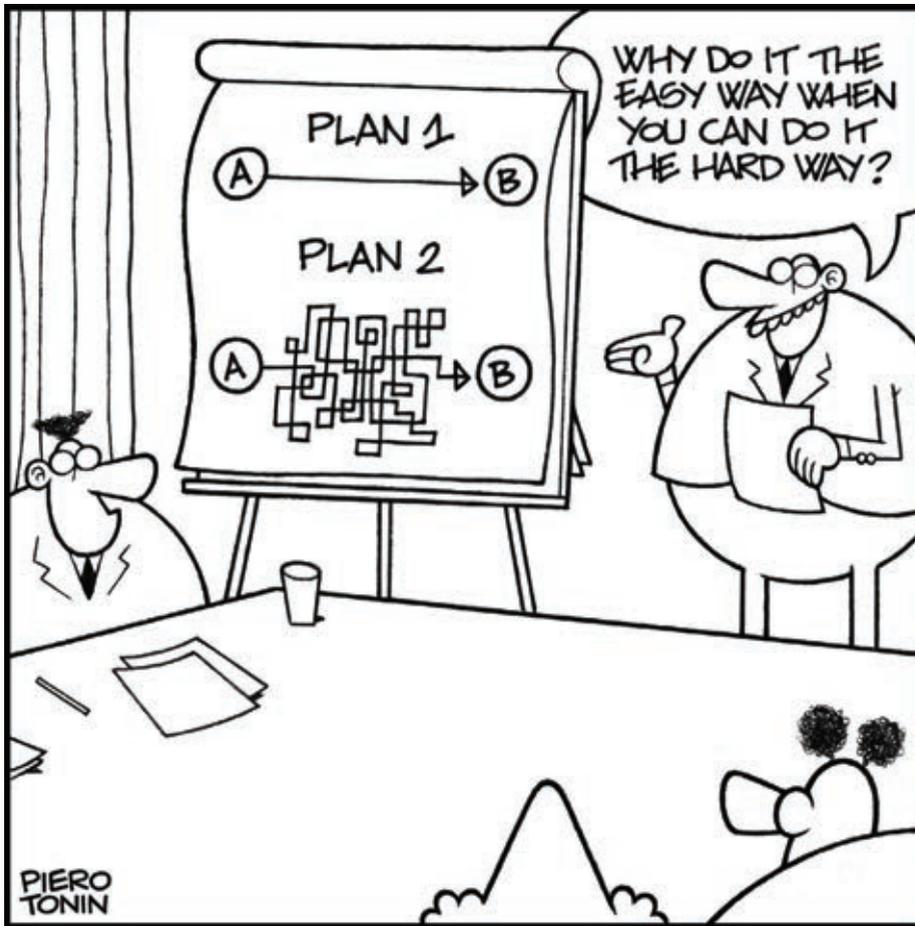
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Figure 1
Is the process more important than the outcome for engineers?

For the scientists, their negative emotions compromised their learning ability. But for the engineers involved in failing projects that were terminated quickly, the lack of negative emotions – because they were redeployed to new projects – also compromised their learning. These engineers had neither the time nor the inclination to learn the lessons from the previous failure – they were already focused on the new engineering challenges they faced.

However, the engineers caught in the projects experiencing creeping death experienced negative emotions born out of the frustration of not being able to move on to new projects. While these negative emotions interfered with the scientists' learning, they actually drove the engineers' learning. Out of frustration these engineers strove to understand why their projects were failing. This search for understanding essentially became the engineers' new project. For those involved in creeping death projects, the engineers said they had understood so much more about why their projects failed, and how they were able to take this learning and apply it to future projects. The time provided by creeping death, along with the negative emotions it generated, provided the necessary conditions for effective learning. Such reflection did not occur when the engineer was simply redeployed.

There is an entertaining line that goes something like "good decisions are a result of experience, but experience is the result of poor decisions". In the light of this research we can tweak the line to read that "experience is the result of poor decisions, coupled with pain and time for reflection". It appears that for engineers like ourselves, some pain is indeed gain. We really are a weird bunch.

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technically beneath them, and one was forced to relocate to a new continent. But these negative emotions were a result of what transpired after the termination, rather than the termination itself.

So why did the engineers not get upset by project termination in the same way as the scientists? Shepherd's team found that the scientists were upset because their project outcomes were not achieved, but the engineers responded differently. They only became upset when they were unable to continue applying the engineering process and contributing to the organisation's engineering challenges. In other words, engineers involved in failing projects that were terminated in a timely manner were quickly redeployed to new projects, which allowed them to continue applying the engineering process. With the new project came a new technical challenge, minimal negative emotions, and thus satisfaction. Shepherd coins the term the 'engineering mindset' to describe such behaviour.

Conversely, when engineers were involved in failing projects where termination was delayed, negative emotions did occur. But these negative emotions were not the result of the termination itself, but a failure to terminate in a timely manner, which resulted in them being unable to redeploy their engineering talents to more worthwhile projects. Instead, they had to work in an environment where they knew what they were doing was a waste of time and ultimately futile. The inability to apply the engineering process and meaningfully contribute is what caused the distress.

Extrapolating this finding to structural engineers suggests that we engineers place more importance on the process of engineering than on the outcomes it produces. I will leave it to you to decide whether such an extrapolation is reasonable, but I'm sure the idea that the engineering process can become more important than the engineering outcome is something we have all seen in action in design offices and on sites around the world (Figure 1).

Effective learning
So, to minimise negative emotions for engineers, this research tells us we should terminate failing projects quickly. But there is a sting in the tail – minimising the negative emotions also minimises our ability to learn.

REFERENCES:

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2) Shepherd D. A., Patzelt H., Williams T. A. and Warnecke D. (2014) 'How does project termination impact project team members? Rapid termination, "creeping death", and learning from failure', *J. Manage. Stud.*, 51 (4), pp. 513–546