False Positive

The term false positive is frequently used in medicine to describe an undesirable and potentially dangerous condition, namely, a test result indicates the presence of something that really isn't there, as is highlighted in the table below. In the extreme, the consequences of treating a patient for a condition they do not have can be deadly. Fortunately, it is a very rare event in medicine, but what about business and technology?

Test result	Actual condition
True	True
False	False
True	False
False	True

Testing, evaluating and experimenting are essential components in the development of any new process or technology. An idea is just an idea, until we can confirm it by testing. Furthermore, as part of the scientific method, we should anticipate the results of our experiment before we perform it.

When the test results are not consistent with our predictions, we clearly need to understand and explain the discrepancy. Much time and effort will be spent to resolve the conflict because it is often a direct challenge to our fundamental understanding of our technology.

In stark contrast, when the experimental data agree with our predictions, there is no discrepancy to resolve and less time is spent reviewing the data. We take the test results as validation of our basic ideas. We proceed on the assumption that our fundamental understanding is correct. This is when the trouble can start.

The notion that we could perform an experiment where our predictions and our data agree, yet one or more of our underlying assumptions are flawed, is extremely difficult for most people to accept, especially about their own work. Yet it happens more often than we imagine. It is difficult to recognize, making it hard to rectify, particularly when our first test gives a false positive.

Example One

Management at a company just starting to make NdFeB alloy in the mid 1980's was convinced that they could produce a quality product by melting the alloy in air, instead of using more expensive furnaces with controlled atmospheres. Chemical analysis of the alloy showed they hit the target composition and customer response to the first sample was positive. The process was scaled-up, based on this lone piece of encouraging feedback.

As time went by, the replies from other potential customers were not positive. They complained about the large amounts of oxygen and nitrogen present in the alloy, especially compared to materials available from other suppliers. Surely something was wrong, management reasoned, after all the initial feedback was positive.

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After a year of work, the company completely abandoned the product, unable to gain and keep a single customer, destroying their credibility with any potential customer in the process. Unfortunately, they were saddled with a large inventory of unusable product and had no idea on how to handle it. In hindsight, it was clear that their first attempt at making alloy this way was only marginally acceptable in the marketplace. But as customers became more sophisticated, they needed and demanded alloys with less oxygen and nitrogen, something readily available from other suppliers and impossible to do melting alloys in air.

Example Two

After a flawed cost analysis, assuming unrealistically high yields, management thought that they could save a substantial amount of money by making their own $SmCo_5$ alloy, rather than buying it from their regular supplier.

After the first trial through production went particularly well, management considered the new material a complete success. The new alloy was judged just as good as the supplier's material. Seeing no reason for the good results not to continue, they immediately cut off their supplier completely and returned their entire inventory for credit.

As more batches were processed, two points became clearer about the new material. First, the homemade alloy was more difficult to process. It was less tolerant of ordinary process variations, requiring more attention as it moved through production. Second, the cost difference between the two approaches was not nearly as great as had been originally assumed. Once the true yield of the new process was calculated, the two processes were about the same in cost.

This scenario continued for several months, spurred on by the initial success and the hope that the yields would improve eventually. In the meantime, shipments to customers dropped off, as the throughput of the process was stifled by the new substandard material.

The project was finally abandoned. The success of the first run was never duplicated. Humbly, management returned to their original supplier to reestablish business with them. It took several additional months to recover fully, to eliminate the backlog of customer orders and repair the damaged relationship with their supplier.

Looking back, the project was ill advised. Sometimes it is easy to look at another manufacturing process and conclude it must be easy and profitable. Often this happens when the subtleties of a process are overlooked. Cutting off the supplier abruptly compounded the problem. A gradual or partial replacement would have done less damage.

How can you avoid the trap caused by a false positive? First, never base a big decision on the results of just one trial. Second, seek an unbiased second opinion. Our review of your project may be all you need to put things in better perspective.

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