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SUNK SUB: LOOKING UNDER THE HOOD

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We don't see things as they are. We see them as we are. (Anaïs Nin)

Abstract

At first glance, the catastrophic implosion of OceanGate's Titan submersible in June 2023 looks like a tragic accident. It is terribly sad, but the disaster was due entirely to human failure, hence preventable. To ensure that similar calamities never happen again, we must reveal the hidden patterns that led to the needless deaths of the five people on board. They are the same crash factors that derail 65% of all projects, big and small. They are neither technical nor financial; they are human. And they are likely to be ignored once again. This article distinguishes at least three hidden patterns of failure: first, a *woke* or political correctness bias; second, groupthink and the silencing of dissenters; and third, overconfidence coupled with impatience. The article then zooms out from the particular Titan case to projects in general: Are its findings applicable to all major and megaprojects? The short answer is yes, they can. The dozens of biases that have been identified in the literature can be categorized in three groups: individual, group, and decision biases. The article gives one example from each group. If these crash factors were systematically revealed in projects, billions in taxpayer moneys could be saved, not to speak of human lives.

Keywords: OceanGate, submersible, megaprojects, culture, ethics, leadership, management

Introduction

People the world over watched with bated breath for days after the OceanGate submersible named Titan (based on the Titanic shipwreck its crew ventured down to explore) went missing off the coast of Newfoundland. Then, on 18 June 2023, the US Coast Guard was forced to confirm the worst fears: A debris field in the North Atlantic made it inevitable that Titan had suffered a "catastrophic implosion" (a violent collapse inward), instantly killing all five passengers on board.

We mourn the company's founder and CEO Stockton Rush, who was piloting the Titan. The British billionaire and explorer Hamish Harding, 58. Pakistani-born businessman Shahzada Dawood, 48, and his 19-year-old son, Suleman, both British citizens. And French oceanographer and renowned Titanic expert Paul-Henri Nargeolet, 77, who had visited the wreck dozens of times.

When a submarine hull collapses, it moves inward at about 2,414 km/h—or 671 meters per second, Dave Corley, a former US nuclear submarine officer, told the BBC. The time required for complete collapse is about one millisecond, or one thousandth of a second. The air inside a sub has a high concentration of hydrocarbon vapors. When the hull collapses, the air auto-ignites and an explosion follows the initial rapid implosion, Corley said. Human bodies incinerate and are turned to ash and dust instantly. So according to Corley, at least the five men on board did not have to suffer.

A tragic accident?

No, not tragic. Tragedy implies *force majeure*. This catastrophe was human-made, and preventable. Will the investigation go deep enough to reveal the hidden crash factors? U.S.

authorities announced an investigation, which will in all probability focus on the submersible's carbon-fiber midsection. The pressure vessels of deep vehicles like the Titan are normally constructed from a robust metal such as titanium and shaped in a sphere, to spread the immense pressure equally around the passenger compartment. To fit more people inside, the OceanGate sub instead adopted a cylindrical shape, with a carbon fiber tube inserted between two titanium end caps. Carbon fiber is very tough—it is used to build aeroplane wings and racing cars. We don't know why the midsection imploded.

But those are symptoms. What will likely go unnoticed are the hidden crash factors that led to the disaster. Whether we call them mindset or blind spots, hidden neural patterns or simply culture (Sathe, 1985; Zweifel, 2012): This happens routinely in companies as well as in major and megaprojects. And that is the real tragedy: It is blind spots that derail strategies and cost lives (Vyas & Doughty, 2017; Vyas &Zweifel, 2022). Looking under the hood, as it were, three distinct patterns of failure can be seen.

Hidden Failure Pattern #1: "No 50-Year-Old White Guys"

One hidden crash factor is evident from the OceanGate founder and CEO: Stockton Rush refused to hire "50-year-old white guys" like other submarine companies because he wanted his team to be young and "inspirational."

"When I started the business, one of the things you'll find, there are other sub operators out there but they typically have gentlemen who are ex-military submariners and you'll see a whole bunch of 50-year-old white guys," Rush had told *Teledyne Marine* in August 2020.

"I wanted our team to be younger, to be inspirational and I'm not going to inspire a 16-year-old to go pursue marine technology but a 25-year-old, you know, who's a sub pilot or a platform operator or one of our techs can be inspirational," Rush continued. "So we've really tried to to get very intelligent, motivated, younger individuals involved because we're doing things that are completely new."

Oceangate hired "inspirational" and inexperienced young people instead of "50-year-old white guys" who knew what they were doing. A deadly mix of political correctness, a desire to be hip, and woke ideology trumped quality and safety.

Hidden Failure Pattern #2: Silencing Whistleblowers

Here is a second hidden pattern: Former OceanGate director of marine operations David Lochridge—one of those "50-year-old white guys" who were not "inspirational" enough—had been fired by Rush in 2018 after he blew the whistle on OceanGate by raising safety concerns over their first-of-a-kind carbon fiber hull and other systems. As *TechCrunch* reported, David Lochridge was terminated in January 2018 after presenting a scathing quality control report on the vessel to OceanGate's senior management, including Rush.

According to a court filing by Lochridge later in 2018, the preamble to his OceanGate Cyclops 2 Quality Control Inspection Report on 18 January 2018 read: "Now is the time to properly address items that may pose a safety risk to personnel. Verbal communication of the key items I have addressed in my attached document have been dismissed on several occasions, so I feel now I must make this report so there is an official record in place." (Oceangate Inc v. David Lochridge And Carole Reid Lochridge, 2018).

The report detailed "numerous issues that posed serious safety concerns," according to the filing, including Lochridge's worry that "visible flaws" in the carbon fiber supplied to OceanGate raised the risk of small flaws expanding into larger tears during "pressure cycling" (significant pressure changes the submersible would experience as it was to make its way to and from the deep ocean floor.) Lochridge noted that a previously tested scale model of the hull had "prevalent flaws."

Carbon fiber composites can be stronger and lighter than steel, making a submersible naturally buoyant. But they can also be prone to sudden failure under stress. The hull Lochridge wrote about was made by Spencer Composites, the only company to have previously made a carbon fiber hull for a manned submersible.

Lochridge recommended non-destructive testing of the Titan's hull to ensure a "solid and safe product." The filing stated that Lochridge was told such testing was impossible, and that OceanGate would instead rely on its much-touted acoustic monitoring system. The company claimed this technology, developed in-house, uses acoustic sensors to listen for the tell-tale sounds of carbon fibers in the hull that might be deteriorating. These sensors supposedly permit "early warning detection for the pilot with enough time to arrest the descent and safely return to surface."

Lochridge, however, worried in the lawsuit that the system would not reveal flaws until the vessel was descending, and then might only provide "milliseconds" of warning before a catastrophic implosion.

Hidden Failure Pattern #3: Hush-Hush or Rush-Rush?

The 2018 filing also claimed that hazardous flammable materials were being used inside the submersible. For these reasons, Lochridge strongly encouraged OceanGate to have a classification agency, such as the American Bureau of Shipping, inspect and certify the Titan sub.

A day after filing his report, Lochridge was summoned to a meeting with Rush and the company's human resources, engineering, and operations directors. There, the filing states, he was informed that the manufacturer of the Titan's forward viewport would certify the vessel to a depth of only 1,300 meters, due to OceanGate's experimental design. The filing states that OceanGate refused to pay for the manufacturer to build a viewport that would meet the Titan's intended depth of 4,000 meters. The Titanic lies about 3,800 meters below the surface.

At the end of the meeting, after saying that he would not authorize any manned tests of Titan without a scan of the hull, Lochridge was fired and escorted from the building. He claimed he was discharged in retaliation for being a whistleblower, and made his filing after OceanGate sued him in federal court in Seattle in June 2018. OceanGate accused him of sharing confidential information with two individuals, as well as with the Occupational Safety and Health Administration (OSHA). In the lawsuit, OceanGate characterized Lochridge's report as false and accused him of committing fraud by fabricating a reason to be fired.

TechCrunch reported that "the lawsuit was settled in November 2018" and "neither OceanGate nor Lochridge responded to requests for comment." A routine OSHA inspection of OceanGate in 2021 had found only three minor workplace safety violations, resulting in no financial penalties.

Months after Lochridge's dismissal, the company blogged its reasons for not having Titan certified by the American Bureau of Shipping or a similar organization. "The vast majority of marine (and aviation) accidents are a result of operator error, not mechanical failure," it reads. "As a result, simply focusing on classing the vessel does not address the operational risks. Maintaining high-level operational safety requires constant, committed effort and a focused corporate culture—two things that OceanGate takes very seriously and that are not assessed during classification."

In 2019, Rush said in an interview: "There hasn't been an injury in the commercial sub industry in over 35 years. It's obscenely safe, because they have all these regulations. But it also hasn't innovated or grown—because they have all these regulations."

Following Lochridge's departure, the Titan was tested safely on increasingly deep dives, including to 4,000 meters in the Bahamas. But one of Lochridge's concerns would soon

be borne out. In 2020, Rush admitted in another interview that the Titan's hull "showed signs of cyclic fatigue." Because of this, the hull's depth rating had been reduced to 3,000 meters. "Not enough to get to the Titanic," Rush conceded.

In 2020 and 2021, the Titan's hull was either repaired or rebuilt by two Washington state companies, Electroimpact and Janicki Industries, that largely work in aerospace. In late 2021, the Titan made its first trip down to the wreck of the Titanic.

Spencer Composites said the Titan was not using its carbon fiber hull on its last, deadly dive. Presumably, apart from the hull work, one source familiar with the company told *TechCrunch* that not much with Titan had changed since 2018.

Cognitive Distortions

Daniel Kahneman was the first Nobel laureate for economics who was not an economist by training. Kahneman is a psychologist who was one of the founding fathers of behavioral economics with his legendary collaborator Amos Tversky. The bottom line: what happens in our minds and brains, not least our beliefs and biases, directly impacts the success or failure of any endeavor—including, unfortunately, of the OceanGate sub. Cognitive distortions run rampant in all projects, more often than not with equally disastrous results: a full 65% of megaprojects go over time, over budget, or otherwise fail to reach their objectives.

The aim here is not to provide a complete list of biases, which would go far beyond the scope of this article. We can distinguish three levels of bias (see Fig. 1 below): first, individual; second, group or social; and third, decision.

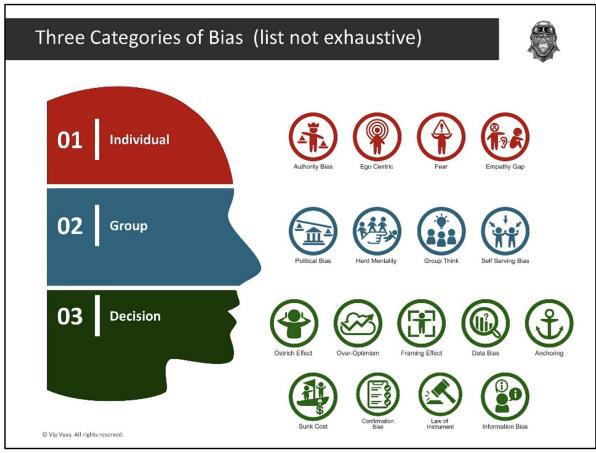


Fig. 1: Categories of Bias (list not exhaustive). Source: Vyas &Zweifel, 2022.

1. "I" = Self-oriented biases that act systematically upon us individually, both inside and outside our projects. Examples are fear, ego-centricity, or lack of empathy.

- 2. "We" = Group and social biases that affect our collaborations, teams, and organizations. Examples are groupthink, herd mentality, or political bias.
- 3. "It" = Decision-making biases that condition our ability to evaluate information, assess situations effectively, make high-quality decisions, and perform with cognitive flexibility when circumstances change. Examples are confirmation bias, optimism bias, or sunk cost bias.

"I" or Individual: Authority Bias--Leader Knows Best

The ability of those who are (or are seen to be) in positions of authority to exert influence and control others was demonstrated in the 1960s in a well-known study by Stanley Milgram. (Milgram, 1963). In particular, Milgram was interested in understanding how people are obedient and follow orders, even if it means inflicting harm on other people. The experiment and its results regarding social influence were alarming. The experiment involved placing ads in newspapers to recruit participants from various backgrounds. Candidates were told that the research goal was to study the effects of punishment on learning, and participants would either be "teachers" or "learners." In fact the process was rigged so that all participants ended up being teachers. Each participant, the "teacher," and the "learner" (the latter played by an actor) were taken into a room where a screen separated both so the participant couldn't see the "learner." The person in authority was played by a third person on the participant's side, providing the instructions.

The core of the experiment involved each participant asking the "learner" a series of questions. Every time the "learner" got a question wrong, the person in authority instructed the participant to "punish" the "learner" by turning a dial and administering electric shocks. (In reality, the actor playing the "learner" simply played pre-recorded screams whenever the voltage increased.)

The experiment found, shockingly, that a very high proportion of subjects fully, albeit some of them reluctantly (and some with "nervous laughter"), obeyed the instructions. Had the fake electric shocks been real, they would have killed each of the "learners."

Of course, not all people in authority harbor evil intent or instruct people to harm others. But hierarchy does have an unintended side-effect: Those below the top of the organization chart tend to seek guidance and affirmation for their actions and take the path of least resistance. In other words, they obey.

Great leaders foster environments where direct reports can openly and freely discuss risks, give bad news, and put issues on the table. By contrast, poor leaders enhance a climate of fear and anxiety where dissent is crushed. The result is a project where any bad news is filtered heavily as it travels from the field and up the organizational hierarchy.

You might object, "But don't nice guys finish last? Don't you have to be tough to get anything done? Didn't Jack Welch succeed by sacking the 10% lowest performers each year? Didn't that climate of fear spur people to perform at their best?"

The answer is, yes, for a while perhaps, but the performance won't last. And it will depend on one strong personality. The management theorist Jim Collins described this in *Good to Great* as "a pattern we found in every unsustained comparison: a spectacular rise under a tyrannical disciplinarian, followed by an equally spectacular decline when the disciplinarian stepped away, leaving behind no enduring culture of discipline."

A typical example was Rubbermaid —the U.S. manufacturer of countless household products such as trashcans, closets, laundry baskets, and step stools- under the helm of Stanley Gault, who was accused of being a tyrant and quipped in response, "Yes, but I'm a sincere tyrant." The result: Rubbermaid rose dramatically under Gault—it beat the market 3.6 to 1, and its stock rose an impressive 25 percent each year—but after he left, it lost 59 percent of its value relative to the market before being bought out by Newell. (Collins, 2001, pp. 130-133).

"We" or Social: Groupthink

"How could we have been so stupid?" President John F. Kennedy asked after he and, his close group of advisors had blundered into the Bay of Pigs invasion. Clearly the problem was not stupidity, since the advisors were among the most intellectually talented minds in the history of U.S. government. So if stupidity was not the explanation, what was? Social psychologist Irving L. Janis's answer: group dynamics (Janis, 1972). Janis was the first to use Groupthink as a term in his analysis of U.S. policymaking. Groupthink is a cognitive bias that encourages people to desire harmony or conformity within a group. In many cases, people will set aside their own personal beliefs to adopt the opinion of the rest of the group. Groupthink can occur when there is a time constraint and individuals put aside personal doubts so a project can move forward. Groups, teams or organizations can suppress diversity and dissent, resulting in dysfunctional decision making. This happens when we take the path of least resistance, conforming our behaviors or beliefs to those of the group we belong to.

Think about the last time you were part of a group. Perhaps it was during a work meeting or a project. Imagine that you had a deadline to meet and some difficult problems to solve. Someone proposed an idea that you thought was rather misguided, but the majority agreed it was the best solution. Did you make your opinion known, or did you cast it aside to go along with the majority? Let me guess: you chose the latter? That was an instance of groupthink, sometimes also referred to as Herd Mentality.

Importantly, groupthink can also occur when one member of the group dominates the decision-making process, thus leading others to follow in their footsteps. It is a similar phenomenon to the Bandwagon Effect.

Level 3, Decision Bias: Over-Optimism

Overconfidence results from a false, exaggerated belief in one's own (or sometimes others') ability to produce results. It convinces us that we are better than we really are. For example, 73% of drivers in the United States consider themselves better-than-average drivers—a logical impossibility. This means that at least 23 percent of drivers (the delta between half and those 73%) are overconfident. Men are even more full (or is the word "even fuller"?) of themselves: Not less than 80% (four-fifths) of male drivers say they are better-than-average drivers. With some 229 million licensed drivers (not counting an additional estimated 11 percent of drivers without a license) on the roads, at least 52 million of them think they drive better than they really do. The consequences of such overconfidence are dire: In 2022, over 42,000 deaths in the United States were through car accidents alone. (Worldwide, the figure is 1.3 million people annually.)

Optimism bias is dangerous not only in traffic but also in projects, where success depends on accurate estimates for completing all the works and tasks that make up the project. Megaproject expert Bent Flyvbjerg found that optimism bias has a systematic, detrimental impact on projects. His extensive research showed how optimism bias, and inaccurate forecasting that stems from it, regularly hamper large-scale infrastructure projects, whether in building rail, bridges, tunnels, or roads. (Flyvbjerg, 2008, 2023). Flyvbjerg's conclusions: Many project managers cook the books or lie outright to make their projects or companies look better than they really are. Project owners might inflate the benefits of a project while understating the costs.

According to historians, we are hardly the first generation whose megaprojects suffer from over-optimism—already Alexander the Great did. In the 4th century, before the common era, the ancient king of Macedon proposed building a series of ziggurats. Alexander also wished to make a road from Egypt to the Pillars of Hercules and circumnavigate the African continent. And rumor has it that a plan was drawn up for an entire town to be carved into the

side of a mountain, in the shape of a massive Alexandrian hand (of course). None of these grand designs ever materialized.

Then there was Napoleon's Channel Tunnel. By 1802, Napoleon Bonaparte had ordered a feasibility study for a tunnel that would allow him to invade Britain. The engineers found that the megaproject would suffer from a giant difference in sea level and subsequent high costs. Napoleon did not like to hear that and ordered a second report, which ignored and/or falsified the evidence. A toxic mix of prestige, nationalism, imperialism, and megalomania led the French leader, not unlike some would-be Napoleons today, to condone hiding inconvenient facts when they did not suit his ambitions.

In fact there were several failed plans for an English-French Channel tunnel before the Chunnel finally came to fruition. It had first been suggested in 1751 by Nicolas Desmaret, then after 1802, it was again designed by French engineer Aimé Thomé de Gamond. Another attempt, this time a joint Franco-British venture presided over by British Member of Parliament Colonel Beaumont, went to the digging stage and was slated to complete by 1880, but was abandoned after one mile of digging because of logistical and political reasons issues plaguing it. Yet another tunnel was proposed in 1919 by British Prime Minister Lloyd George, but the French government swiftly dismissed the idea.

Optimism bias continues to this day. Kahneman revealed a systematic fallacy in planning and decision-making: People underestimate the costs, completion times, and risks of planned actions; in contrast, they overestimate the benefits of the very same actions. This would later be known as "the planning fallacy." (Kahneman, 2011; Kahneman & Tversky, 1979; Kahneman & Lovallo, 1993).

Biases Save Bandwidth

Biases do serve a useful purpose. We know by now that only a fraction of the signals we receive actually lands into our consciousness; our brain is much too small for processing all the visual stimuli that come its way. It's an almost incomprehensible number of inputs: 11 billion bits. Is that, you might ask, 11 billion bits per year, per month, per week? No, *per second*. And that's only the information coming in through the eyes, not the other four senses—hearing, smelling, tasting, or touching.

Given that tsunami of incoming signals every second of every day, the brain has to prioritize. It emphasizes only a small part of those 11 billion bits that come in through the eyes (not to mention the other senses) and ignores the rest. Our brain is constantly filtering out information not relevant to our survival. To accomplish this herculean task, it uses shortcuts. The brain says, "Ah—I've seen this before, I already know this" and equates new experiences with experiences in the past. "Ah, she's saying the same thing she said last week…" "Friend or foe…" "Good or bad…" "I like this, I hate that…" We do this 24 hours a day, nonstop, every moment, with every encounter.

For example, when managers interview job candidates, 60 percent of interviewers have made up their mind about the candidate within 15 minutes, and 30 percent of interviewers even within 5 minutes. (Frieder et al., 2015). Worse, when you see a political candidate on TV or the Web, your brain makes a snap judgment before consciously deciding whether to vote for that politician. A 2005 study showed Princeton students photos of candidates from the last three Congressional races. As each pair of candidates came up on the computer screen, students had to judge quickly which candidate looked more competent. It turned out that students picked the actual winner almost 70 percent of the time.

Before we even blink our eyes, our brain has decided whether we want to hire, date, hate, or make friends with the person we just met. And then the brain registers only the evidence that supports its prior snap judgment.

Since our perception of reality is "systematically biased", as Daniel Kahneman and Amos Tversky put it, it's hardly surprising that our performance is constrained by our mental models based on our database of past experiences. According to British neuroscientist Richard Gregory, 90% of what we see is projected from our memory. Only 10% is added by fresh input from our sensory organs. This projected memory distorts what we see and influences how we deal with problems and issues as they arise. It can significantly impact performance, especially in dealing with complex challenges that require innovative ideas depending on the brain's ability to form new neural connections.

Conclusion

A full 65% of major and megaprojects fail in three ways: by going over budget, by going over time, or by otherwise missing their objectives. The catastrophic implosion of the OceanGate Titan submersible was only the latest and most dramatic example. Projects crash not for technical, operational or financial reasons—the root causes are human.

If we peer into the black box of the Titan disaster, we find at least three crash factors that will likely be ignored by investigators: first, political correctness at the expense of quality; second, silencing whistleblowers at the expense of open debate; and third, a rush to market at the expense of safety.

If we generalize these findings to all major and megaprojects, we can categorize all cognitive biases into individual, group, and decision biases. Examples for each bias, respectively, are authority bias (in short, our place in the hierarchy distorts the picture), groupthink (our social desires distort the picture), and optimism bias (our planning fallacy distorts the picture).

It is not too late to shine the spotlight on the hidden patterns of failure, not only in the Titan sub and OceanGate, but in all megaprojects. This is a matter not only of saving billions in taxpayer moneys, but of life and death.

Thomas D. Zweifel is the author, with Vip Vyas, of *Gorilla in the Cockpit: Breaking the Hidden Patterns of Project Failure and the System for Success*.

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¹ "Americans are dangerously overconfident in their driving skills--but they're about to get a harsh reality check, *Business Insider*, 25 January 2018.

ii Gregory, R. (1998:5): "... a major contribution of stored knowledge to perception is consistent with the recently discovered richness of downgoing pathways in brain anatomy. Some 80% of fibres to the lateral geniculate nucleus relay station come downwards from the cortex, and only about 20% from the retinas. [See Sillito, A. (1995). Chemical Soup: Where and How Drugs May Influence Visual Perception, in *The Artful Eye*. Oxford: Oxford University Press, pp. 291-306.]"