Chapter 3: Thought and Calculation

When a father goes to prepare for his son's birthday, he shops for eggs, water, oil, a box, a can of frosting and some candles. In his mind is the idea of a cake with candles blazing, set in front of his child. Then the focus of every eye in the room, the child glows with joy while the birthday song is sung.

The link between the unbaked ingredients and the moment the candles are blown out is the father's confidence in his capacity to convert money into ingredients, and then to execute the recipe instructions to produce a cake.

If I asked him "Why?", he'd respond "Because I love my son." And I might stare into space for a moment, until I realized that he didn't understand. I meant, "Why do you have that confidence?"

And, of course, his control over that process is almost trivial, as compared to the farmers that cultivate, plant, tend and harvest the wheat; or the generations of chefs that learned to mix chocolate, ground grain, oil, water and baking soda to produce batter, followed by culinary engineers that refined the processing and combining of cacao, flour and sugar to produce the finest chocolate powder with the smoothest flavor; or the package designers that developed an easy-open plastic bag that preserves the ingredients through transport and weeks on the shelf – the goal of each of those parties being to reduce the uncertainty in the final product to ensure the most reliable outcome of baking.

That reliability arises from a process of calculation. Not just narrowly mathematical calculation, but the persistent application of intelligence to create a reliable process for accomplishing an intended result. In our story, the end result is to relieve the father/baker of almost all calculation, allowing him to appreciate the subtle and unexpected satisfactions of fatherhood.

There's a deep lesson here, about material excellence and spiritual satisfaction, but we won't focus on that – yet.

Consider instead the farmer. If asked "Why?", what would he say? Would he think of the man baking the cake? Of course not. His concerns lie elsewhere, with irrigation, fertilizer, bank loans and tractor pulls.

The Sociology of Explanation

Our explanations depend upon our place in the process, which in turn depends upon our social status and personal qualities. What is important to our peace of mind, however, is that our explanations connect our desires to behaviors that allow us to relate successfully to our community. The farmer survives and enjoys his hobbies because he produces wheat that is used in baked goods.

Sometimes those explanations are comfortingly close to concrete reality. The farmer can see his wheat growing; the father needs to wait only hours until his experience is realized. But what about the man neurotically asking "Why?" What about the scientist?

When Einstein was asked why he became a scientist, he recalled an uncle teaching him algebra by leading him on a hunt for the mysterious 'x'. The analogy bears elaboration. The scientist does enter into a protected preserve – a preserve of ideas developed, refined and winnowed over thousands of years. The generous complexity of the world poses a daunting challenge to the individual scientist; significant progress can be made only through institutions that educate researchers, organize their work and conserve the insights gained. Since that work often does not yield practical significance for tens or hundreds of years, the scientist requires support for his efforts through private endowment or governmental funding.

The balance of funding has changed dramatically over time. Considering the life of Galileo, we learn that he had very little time to devote to his studies of the cosmos. Much of his intellectual effort was concerned with his sponsors' civil projects, teaching and his vineyard. Einstein, conversely, spent his latter years at a "think tank." Galileo's ideas were considered so dangerous that the Church spent hundreds of years trying to prevent their distribution to the public at large. Einstein's most powerful idea, the equivalence of matter and energy, ended up being translated into a bomb that changed the nature of warfare, but few people can explain the idea itself – they know it as '$E = mc^2$'.

Somewhere during the intervening years, the conversations held between scientists became incomprehensible to all except their fellow specialists.

Consensus and Institutions

Would the farmer bake a cake for his daughter? You bet he would. In fact, the baking industry depends upon it. Entire industries count on the conventions that people bake cakes for their children, buy them cards, and decorate their living rooms with balloons and crepe-paper.

Consensus is the underpinning of modern economies. In the four decades after WWII ended, the savings and loans industry suppressed interest differentials, allowing the American middle class to finance college tuitions and retirement with their mortgage interest. When Ronald Reagan "freed" the money tied up in the Savings and Loan industry for investment in "higher yield" opportunities, the Savings and Loans diversified. After those failed "opportunities" were bailed out (to the tune of $500 billion) by the American taxpayer, the S&L industry was bought up by the banking industry. Since then, interest rate spreads have increased, with savings accounts yielding scant percentages, and credit card rates running anywhere from 10 to 30%. Many college graduates now leave school saddled with debts around $50,000, and most young families are simply priced out of the housing market. At the same time, America has experienced the greatest transfer of wealth from the working man to the ultra-rich in the history of the nation.

The consensus that held prior to the Reagan era was that the working class should have a safe haven for their investments. That consensus supported the institutions of the single-home family, the savings and loan industry, and pay-as-you-go colleges. Those institutions have been undermined by the "deregulation" of the industry. The "Greed is Good" and "Trickle Down" principles of economics held that transferring savings into the control of "sophisticated" fund managers would yield greater market efficiencies and growth in the economy. The results are clear. Whatever benefits were generated accrued to the rich.

This case history illustrates the dangerous consequences of radical and unmanaged change in consensus. Why was the change so easy to foist upon the American public? The public trusted Reagan as a leader, and was not sophisticated enough to analyze the consequences of the policy change. Sadly, neither was Reagan himself. In his Presidential Library, outside Air Force One hall, a plaque explains how T. Boone Pickens and others convinced Reagan that money should be "free", just as the people of Eastern Europe should be free. I can almost hear Marx and Lenin wailing sarcastically from their graves: "Woe to the dollars that suffered under the tyranny of the S&L industry! And how happy that they have now voted with their feet and taken haven with the oligarchy!"

Now, the story of the S&L industry is concrete and relatively immediate to people of the nation. We can therefore focus our analysis and reach some kind of root-cause sense of how forces were organized to create different outcomes in the two eras. What correspondences might we find in the sociology of physics over the last 60 years?

After WWII, the military-political elites of America had quite concrete reasons to believe that physicists were an impressive and geopolitically significant sub-population. They designed big bombs! There was every reason to protect and corral that population in research institutes and national laboratories.

This occasioned a renaissance in the physical sciences, spear-headed by the accelerator laboratories. Under the proposition that we had better understand what might be hidden inside the atom, ever larger accelerator facilities were built, topping out at CERN near Geneva, Switzerland, with a price tag running beyond $10 billion for facilities and operations.

Unfortunately, around 1990 it began to become increasingly obvious that there was little of practical significance to be expected from the physics that was being exposed. The accelerators of the 60's were too large to carry on an airplane, and those of the 70's began to exceed the capacity of large naval vessels. The frequency of interesting events dropped precipitously in a kind of inverse Moore's Law, and the coherency of those events grew smaller and smaller. The practical outcome appeared literally to be heat, rather than light.

About this time, the strategy for supporting academic study of fundamental physics became far more refined. First, advanced study in particle physics was beyond any but the smartest students. The graduate programs served as a self-selection filter for the world's best and least worldly minds. Secondly, the construction and operation of the research facilities became a plum for governmental delegations. As prices ran through the $100 million and towards the $1 billion mark, design and fabrication were distributed across states and nations, creating diversified political support for the projects. Finally, as physicists worked towards a Grand Unified Theory and a history of the universe, expectation grew that if only a few more generations of accelerators were built, a complete understanding of physics would be achieved, allowing Humanity to resolve questions of ultimate origins and the basis for spirituality.

For the political elites understand spirituality very well, although they may choose not to share their experience with the public at large. They know that something is missing from the physics that is taught in our universities. They are dissatisfied that analysis of their experience is dealt

with only in scripture and mystical texts.

So, when the NSF representative spoke at LLNL, he observed that nobody in Congress wanted to talk about quarks, super-symmetry or dark matter. They wanted to know what happened at the beginning of the universe, and what physicists expected to happen at the end. They wanted to know whether they could continue to count on calculation, or might expect the intervention of a higher hand to guide humanity through the crises that loom at the beginning of the 21st century.

Unfortunately, when the NSF representative summarized his collected list of "crazy ideas", you can believe that none of them was actually very crazy. Anything truly "crazy" – for instance, something that suggested we had to reconsider the Big Bang, learn new methods for calculating particle dynamics, or (worse) that suggested we have already discovered everything we needed to know – could have endangered billions of dollars in research funding. If the consensus that supported that funding evaporated, the community might never again wield the political clout to generate the funding that would allow them to complete their exploration of established ideas! Worse, they might even lose operating funds at existing research institutes, forcing mature scientists to develop new programs at an age where such transitions are extremely difficult.

Conservation and Liberation

Now, financial managers in the 80's may have had similar motivations. America's industrial economy seemed to be failing. Industrial managers seemed to lack the sophistication to move upstream into value-added niche markets, and labor seemed to lack the necessary flexibility. Financial services seemed to be the way out, and the huge capital assets of the S&L industry may have been seen as a resource for generating wealth that could stabilize the economy for the next generation.

The fundamental lesson, then, is not one of political manipulation by elites. It is the ancient balance between conservation and liberation. Conservatives believe that institutions are incredibly hard to create. The natural tendency for populations in distress is to reallocate resources to ensure personal survival, resulting in the collapse of institutions, and the loss of the ideas and processes they support. For that reason, conservatives tend to treat the general public as barbarians, and believe that the common man shouldn't be allowed real power until he can prove that he has a better way of doing things.

Liberals, on the other hand, believe that institutions have a natural tendency to develop self-serving elites. Coddled in their protective cocoon, these elites lose touch with the reality experienced by the population that supports them. The elites use their access to government and investors to develop consensus that the greater good would be served by allocating more resources to their programs. When the size of the organization exceeds the management capacities of its leaders, the institution ceases to adapt to social need, and becomes simply a self-supporting system for generating funding.

Under those circumstances, arguments exist for "liberating" resources from institutions. For much of history (until the end of the 20th century), the "liberation" process was violent. In fact, violence as a means of institutional reorganization has subsided only in the developed nations. It remains a plague in the rest of the world. The promise and challenge of democracy is to

demonstrate a less destructive means for accomplishing change.

As illustrated by the history of the Savings and Loan, the most disappointing outcome of the analysis of mature democracies is that the thought that motivates civic responsibility does not seem to penetrate deeply into our calculation of personal benefit. If the merits of responsibility could be propagated more powerfully, we might have greater hope for the stability of our democracies, and the evolutionary potential of more primitive cultures.

As for the scientists, in recent days their role has been to act as a warning bell. Humanity seems to be at a tipping point in history. We are undermining the stability of the global systems that support life itself, and the only basis we have for organizing a response are the calculations of super-computers running simulations that attempt to predict the future of ecosystems and economies. Since the alarm was first sounded two decades ago, it has become clear that our institutions are incapable of responding effectively to the impending crisis.

We have reached the limits of calculation, and our thought struggles to evolve. The inevitable outcome would appear to be rebellion. Obviously, there will be resistance from conservatives. This chapter, while it may seem out of place, has surveyed the landscape to prepare the reader for the establishment's counter-assaults to the ideas presented here.