特集：挑戦

徒手空拳の技術
Empty-handed Technology

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Abstract

The selection of such an unusual title for this paper is not because the author is a former sports freak. It is because of a desire to emphasize his belief that engineers should constantly train themselves to be able to tackle problems empty-handed when necessary, i.e., without the aid of technical tools.

Lately this author has found himself frequently forgetting people's names. This is because he is definitely gaining the strength of age. But, this is not the only reason. He is also forgetting how to write certain Chinese "Kanji" characters and gradually losing the ability to do calculations in his head.

Quite a while ago, when cheap electronic calculators first became available there was an episode of a popular comic series from the 1960s that had the following scene: An elementary school teacher asked one of her students to solve a math problem. The student did the calculation on a calculator he had hidden under his desk and when he computed the answer, he told it to the teacher with an innocent face. Meanwhile, the teacher had been calculating the answer on her calculator hidden behind her desk. When she saw that the answer was correct, she told the student, "Very good."   It is believed that the author already had an awareness at the time that due to the invention and use of such convenient devices, people were actually becoming less intelligent.

In 2003, shortly after the author started working on Yamaha's MotoGP challenge, he had a nine-hour long lay-over in Birmingham Airport, on the way back home from the British GP at the Donnington Circuit. The airport was in a state of confusion due to the fact that many flights were either late or cancelled.

The cause of all this confusion was a failure in the computer system. All the flight control operations were dependant on the computer system and when it failed the result was complete chaos. The author remembers his feelings of anger and hopelessness watching the airport workers running around, seemingly without reason, in their confusion. If America's Southwest Airline had been flying in and out of Birmingham, then perhaps the confusion would have been solved right away. Southwest Airlines is one of the most profitable airlines in the industry. The author is told that Southwest also has one of the highest levels of information technology（IT）in the airline business. It also happens to have a very simple mileage program that doesn't require any complicated calculation of miles. If you fly with Southwest Airlines eight times in one year

you automatically receive a coupon for one free flight. That is how simple it is. Also, there are no different seating classifications and no reserved seating, thus when enough tickets are sold to fill the plane, it flies. This policy insures that, except for an occurrence of mechanical trouble, there are no flight delays. The reason for the company's high reputation in the IT area is probably because of the standardization and simplification of the software they use. However, at the same time, they use work processes that can be carried out completely without IT when necessary. In other words, they seem to have refined their systems to the point that, even though they have excellent IT, in most cases they don't even need to use it.

Today's personal computers have amazing performance. It seems that today's PCs have already surpassed the performance of yesterday's super computers. As long as you are running the right software, today anyone can make complex technical calculations or run high-level simulations with relative ease. These are truly convenient times we live in. On the other hand, the complexity we have developed is so hard to understand that when problems occur they are very difficult to repair. Also, no matter how sophisticated a simulation may be, it usually will not be of much use unless the engineers also have the ability to apply their intuition to the problem. It is interesting to note that if one is able to simplify these complicated system simulations down to a small number of degrees of freedom, so that one is able to use intuition, then it is often possible to calculate things manually without using a computer at all. This is the strategy being used by Southwest Airlines.

In the racing world, you never know what is going to happen next. It is often the case that things one has worked scrupulously to prepare suddenly become useless or irrelevant. These are the moments when intuition and gut feelings become important. The intuition referred to here is, of course, not simple guesswork. It must be a feeling resulting from mature knowledge and sound judgments. These judgments must be based on a thorough understanding of physical principles and realities, and on having a good grasp upon and daily practice in the use of these principles. The author believes that an engineer must at least have the skills to design something based only on Newton's second law ($F=ma$) and Hooke's Law ($F=kx$) and must be able to apply the least-squares method to the results of experimental tests. These are the skills that this author takes the liberty of calling "Empty-handed Technology."

To prevent the aging of one's mind, a person should prepare for crisis management at times when there are no computers available, and also be able to use a computer with true skill. In other words, there is a need to always polish one's "Empty-handed Technology" skills.

いきなり意味不明の表題になっているのは、何も筆者が体育会系出身だから、という訳ではありません。技術の道具を使えない場合でも、素手で戦えるように、日頃から技術者として鍛錬を積む必要性があることを端的に表現したかったからです。

　最近、筆者はいとも簡単に人の名前を忘れるようになりました。確実に老人力がついてきたためです。しかし、漢字を書けなくなったり、暗算ができなくなっているのは、このためだけではありません。その昔、安価な電卓が普及し始めた昭和後期頃の漫画に、こんなシーンがありました。小学校の教室で先生がある計算問題を出したところ、指名された生徒はちゃっかり机の下に隠してある電卓で計算した後、何食わぬ顔で、「答えは○×です。」と答えます。先生も、質問している間に、机の下の電卓で計算していて、「良くできました。」と褒めています。この漫画の作者は、すでにこの時、人間が便利な道具を手にすることによって、実はだんだん利口ではなくなっていくことを見抜いていたのではないでしょうか。

　2003年に筆者がモトGPに挑戦を始めてまもなく、イギリスはドニントンでのレースの帰路、バーミンガム空港で9時間も足止めを余儀なくされたことがあります。多くの飛行機が遅れたり、キャンセルになったりで、空港内は騒然となりました。原因はコンピューターの故障です。飛行機の運航すべてをコンピューターに頼っているために、一度これが故障すると大混乱になります。この混乱状態で働く空港スタッフたちの対応のまずさには、腹立たしさと同時に失望を感じたことを覚えています。おそらく、ここにアメリカのサウスウェスト航空が就航していれば、すぐに問題は解決したことでしょう。

　サウスウェスト航空は、航空業界No.1の利益率を誇る会社です。また、IT（Information Technology）レベルでも業界No.1といわれています。ところが、この会社のマイレージプログラムは、ややこしいマイル計算をしません。年に8回飛ぶと1回のタダ券がもらえるようになっているだけです。また、席にクラス分けがなく、指定席もないので、切符のもぎりで定員になると飛行機は飛んでいきます。機材がトラブルを起こさない限り、遅れることはありません。ITで名高い会社である理由は、ソフトウェアの標準化と単純化が進んでいるからだそうですが、そもそも、ITを使わなくてもちゃんと仕事ができるようになっていて、儲かるような仕組みになっています。要するに、伝家の宝刀を持ちながら、抜く必要がないところまでワザを極めているということでしょう。

　現代のパソコンの性能の高さには目を見張るものがあります。かつてのスーパーコンピューターの能力を超えてしまったかのようです。パソコンと適切なソフトウェアさえあれば、誰でも複雑な技術計算や高度なシミュレーションを利用できるようになりました。誠に便利な時代です。しかし、複雑なものは理解しにくい上に、一度トラブルを起こすと修理も難しくなります。また、どんなに高度なシミュレーションも技術者の直感が働かないものは、あまり役に立たないようです。面白いことに、複雑なシステムも単純化を進めて直感が働くレベルまで自由度を縮退していくと、コンピューターを使わなくても手計算でも何とかなるようになります。これはサウスウェスト航空の手口と同じです。

　レースの現場では何が起こるか分かりません。周到に準備したものが一瞬にして使えなくなることも、よくあります。こういう場面では直感が大きくものを言います。ただ、ここでいう直感とは、単なる山勘ではなく、理論と実際をよく勉強し、理解して、日ごろから修練を積むことにより醸成された知識と判断力でなければなりません。少なくとも、ニュートンの第2法則（$F=ma$）と、フックの法則（$F=kx$）だけで設計ができ

るワザと、最小二乗法で実験ができるワザを習得していなければならないと思っています。これらのワザを、筆者は勝手に徒手空拳の技術と呼んでみたのです。

　頭の老化を防止するために、また、コンピューターを使えない時の危機管理として、さらにはコンピューターを本当に上手に使うためにも、徒手空拳の技術を磨く必要があると思っています。

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