

# Preface

The progress of engineering is remarkable. Their primary efforts today, however, are paid to develop better methods or tools for realizing high-quality products. But if we look back, engineering started because we were motivated to create something that could not be obtained from nature and to make our dreams come true.

As Herbert Simon pointed out, rationality is bounded. With increasing number of variables, the problem becomes extremely difficult to solve due to growing computational complexity. Therefore, we cannot optimize in an open world as we did in a closed world. So, Simon proposed Satisficing (Satisfy+Suffice). Satisficing is nothing other than emotional satisfaction. Thus, the rapidly growing complexity of systems calls for emotional engineering approach.

Another important point is that engineering today is final product-based. However, it should be emphasized that not only products, but processes also create values. Abraham Maslow placed self-actualization on the top of the hierarchy of human needs. Humans would like to demonstrate how capable they are. Let us take mountain climbing, for example. If we would like to get to the top of the mountain, then we can ask a helicopter to take us there. But mountain climbers find a difficult route to the top and they challenge. In fact, challenge is the core and mainspring of all human activities.

But current engineering forgot such desires of ours. Even if mountain climbers cannot make it to the top, they would be satisfied if they can move ahead and get closer to the top. Indeed, they could not achieve their goal, but they succeeded in demonstrating their capabilities by moving ahead, although it might be a small step. This gives them a feeling of fulfillment and achievement. They can challenge next time, and they can keep on dreaming. In fact, when they succeed, they will find a more difficult route next time. They would like to keep on challenging. This satisfies another need of humans to grow, which is pointed out by Edward Deci and Richard Ryan. Thus, getting to the top (product, result) is not what they really want. They would like to enjoy the processes of getting there. Consideration of such process values is lacking in today's engineering. Engineers today are looking for a vehicle to take us to the goal with less efforts. But we must remember efforts yield values. The more efforts are needed, the more value is created.

Motivation and emotion share their etymology. They came from the same Latin word *movere* (= move). Thus, motivation and emotion constitute the following cycle: Cognition (Perception) => Motivation => Decision Making => Action => Emotion. This cycle is repeated in our daily life.

Current engineering focuses their primary attention to the latter part. It proposes new ideas or tools to make our action more efficient. It is goal-oriented or product-focused. But if we remember self-actualization is the highest need of humans, we must pay more attention to the earlier stages, i.e., How do we perceive and how we are getting motivated. In fact, the most important goal of engineering tomorrow will be how we can develop satisfaction. We have been discussing productivity until today, but tomorrow what we should discuss is the degree of satisfaction. What engineers tomorrow must develop is satisfaction. Product-based engineering is quickly fading away.

Additive Manufacturing and 3D Printing (AM3D) are getting wide attention these days. But most of the discussion about them remains still in the traditional framework of product development. Regrettably, how they can produce process values is rarely discussed. But as Maker demonstrates, people would like to actualize themselves. AM3D brings to us the opportunities of feeling fulfillment and achievement.

To accelerate our move toward satisfaction engineering, first we must make clear and understand motivation. In fact, the same environment and situation are perceived differently from person to person. Current engineering discusses environments and situations objectively. But what motivates us are subjective environments and situations. The same environment and situation motivates us in a very different manner from person to person. Therefore, understanding motivation is a crucial step toward satisfaction engineering.

This book contains researches from many different perspectives. To understand motivation, we need to have a broader and more multi-dimensional perspective. It is strongly hoped that this book contributes to understanding the importance of motivation and helps us move ahead toward satisfaction engineering, i.e., engineering tomorrow.

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