An interview with Paolo Galluzzi

From craftsman to philosopher: the development of engineering as a profession

Q.: Part of the idea behind *The Art of Invention* is that the technical worker gained a new and higher status during the Renaissance, as an artist-engineer. How would you characterize the earlier status of technicians during the Middle Ages, before that new profession was invented?

PG: The situation of the technical worker before the 15th century can be defined as marginal. Engineers--an uncommon word then--were generally anonymous. Beautiful buildings were made during the Middle Ages, but you don't even know the names of the builders, which is a clear sign that their social role was considered marginal.

Another way to gauge the status of technicians is through the classification of disciplines in the Middle Ages. The basic school curriculum covered seven liberal arts. Four of these, called the *quadrivium*, were considered to be higher, and three, called the *trivium*, were lower. The intellectual disciplines of the *quadrivium*--arithmetic, geometry, astronomy, and music--were held to be superior. The disciplines of the *trivium*--grammar, dialectic, and rhetoric--were inferior. Still at a lower level were mechanical arts. This was both an intellectual and a social distinction. Being trained only in mechanical arts meant you were someone who worked with your hands, someone who was fit only to be directed by someone else who was better educated. We still have a trace of that distinction in our language, in the words "trivial" and "mechanical." The social distinction of the medieval corporation survives in our use of those terms.

Q: How did engineers in the Renaissance rise above that subordinate status?

PG: A process started at the end of the 14th century in which people gained ground by using their hands and their brains together. By their success in building things, they gave evidence of the importance of the
Of course, this development was also evidence of a political and social change. The 13th century had been a period of the accumulation of capital in cities such as Florence and Siena through industry and trade. Through the textile industry, they gained an enormous amount of money. That accumulation is the key to understanding how they came to be so beautiful. For two centuries after the 14th century, Florence and Siena exploited the enormous financial power they had gained.

In this situation, where lots of investments become possible, people begin to see themselves as occupying an advanced position. And in an advanced place, people develop a taste for novelty. They don't want something that's been done before. They want to invest in innovation, because that's their image of themselves. They are innovative in their own field of finance, and so they patronize talented people who can offer something new. By hiring a Filippo Brunelleschi to build the dome of Florence's cathedral, on the promise that it would be something unprecedented, these patrons showed the world that they were unique and could make their city unique.

Brunelleschi was the first figure to give evidence of this process. Unlike the builders of medieval times, he was not unknown. He signed his work. In fact, he is buried in the cathedral, with an epitaph that compares him to the legendary builder of ancient times, Daedalus. The century from Brunelleschi to Leonardo is the period of development of this new figure, the artist-engineer.

Q: How would you sum up that century of development?

PG: The artist-engineers become cultivated people. They start studying. They strive to learn Latin and theoretical mathematics. They come to occupy official positions in the courts. They lose the poor image of their earlier colleagues. With Leonardo, they arrive at the status of philosophers--which is the end of the metamorphosis from the trivial craftsman to the philosopher.

Leonardo dies, according to legend, in the arms of the most powerful monarch in Europe, Francis I. Whether the story is true doesn't matter so much as the fact that the story could be told at all. Only after a century of metamorphosis of the craftsman into the philosopher could such a story be told. This was a tremendous change, both intellectually and socially.
Q: What defined this new personality, the artist-engineer?

PG: First, he did not receive formal training. Although there were a few exceptions, the artist-engineer was generally self-taught to a great degree. Second, he was good at drawing, which he used as a tool for understanding machines, for designing them, and for conveying his ideas to other people. Third, he was involved in both artistic activities--painting, sculpture, architectural drawing--and in purely technical operations--military engineering, architecture, hydraulics, transportation, practical mechanics, and many other applications, depending on the needs of the patron. This type of intellectual had existed in antiquity. But then, after the fall of the Roman Empire, the artist-engineer-author had disappeared for a thousand years. That's why the artist-engineers of the Renaissance compared themselves to the figures of the Golden Age of antiquity. Like the literary figures and philosophers of the time, they were influenced by the humanist movement, and they shared the goal of being compared to the heroes of the past. Just as poets sought to be compared to Horace, the artist-engineers wanted to be compared to Daedalus, Vitruvius, and Archimedes.

Q: To what extent was this development confined to Italy, and to what extent did it take place elsewhere in Europe?

PG: This kind of multidisciplinary intellectual--active in both artistic and technological pursuits, despite a general lack of formal training--first reappeared in Europe in the geographic center of Italy, Tuscany. But almost immediately, the artist-engineers spread out through the peninsula. The King of Naples, the Duke of Milan, the Duke of Urbino, the officers of the Republic of Venice began hiring these people and paying them well. So did Francis I in France, who employed not only Leonardo, but also Benvenuto Cellini and Fra Giocondo, the builder of the Pont-Neuf in Paris. Soon the Italian artist-engineers were working throughout Europe, in England, in Holland, in Spain. All of the military engineering of the 16th century--the fortifications to protect cities and camps from bombardment, the weapons, the transports--came from Italian sources.

So Brunelleschi, the Sienese engineers, and Leonardo were important not only in themselves but also for their contributions to shaping a new profession. "Engineer" is not a word you find in the 14th century. It enters the
vocabulary around the middle of the 15th century and becomes widely used only in the time of Leonardo. "Ingeniarius Ducalis" is Leonardo's official title in Milan--the Duke's Maker of Ingenious Devices--and "Ingeniarius et Architectus" is his title when he follows Cesare Borgia, the natural son of Pope Alexander VI, into the military campaign in central Italy. This profession didn't exist before. There had been only anonymous laborers, who put one stone on top of the other under the direction of someone else. Now these people imagine the project, design it, manage the team that carries out the construction, and become famous for their combination of skill and knowledge. When Leonardo dies, he dies as an intellectual.

3 of 6

[ Contents of the interview | Italiano ]