

HISTORY OF INNOVATION

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In the chronology of social development, when human beings started to acquire assets, competitive desires evolved—a desire to have more, a desire to have something better, a desire to have things that make life easier. When these desires became strong enough, they transformed into a need or necessity, and as the old cliché goes, “necessity is the mother of all inventions.” Historically, knowledge was limited to a few. However, in today’s knowledge age, where information is shared widely, future innovation will result from individual and collaborative discoveries at an increasingly faster rate. Studies show that innovation is built on past knowledge and continuous experimentation. Rather than accepting it as an ad-hoc process with unknown outcomes, innovation can be developed into a structured process and a more predictable system.

Innovation has always been a part of mankind. Since the discovery of fire by rubbing two stones together, humans have been innovating. Innovation is probably the oldest known process; in other words, innovation is an extension of a person’s creativity. We have always used our innate skills to create many new things and to help mankind.

Imagine when the human evolved and discovered fire. What was the knowledge level then based on what we know today? What was the level of excitement at the discovery of fire? As people gain new understanding by trial and error, they transform it into new knowledge and then use that knowledge to gain new understanding, discover more unknowns, and

become even more curious. Thus the cycle of experimentation, knowledge, and innovation continually repeats. The outcome of the knowledge-experience cycle has led to continual creativity and innovation.

HISTORY AND EVOLUTION OF KNOWLEDGE: FROM STONE DAGGERS TO METAL

Before discovering fire, humans discovered simple rocks that could be used as tools. Getting ideas from human or animal teeth, a thought of a dagger could have arisen, and so daggers of stone were made. A dagger provided protection from animals and probably was used as a tool to prepare cold food which was then warmed by the sun's heat. Daggers could easily have evolved into knives and spears. These tools could be used to tame animals or even for hand-to-hand fighting.

Humans discovered fire more than 50,000 years ago. Fire, which could be very destructive if not controlled, could be a great friend when controlled. The discovery of fire led to further human knowledge, as the fire could be used for making tools, keeping humans warm, keeping animals away, cooking meals, lighting dark caves, or even melting ice. Therefore, the discovery of fire could be considered a great breakthrough in human evolution because it was critical for survival.

How could the early humans or hominids get an idea about fire? They must have observed fire caused by lightning, or sun heat, or volcanic eruptions. They could have even observed fire while throwing rocks which produced sparks when they hit other rocks. The discovery of fire led to humans thinking about how to use fire and how to protect themselves from it.

Thousands of years later, humans did invent the bow. The idea of a bow could have come from tree branches loaded with fruit. In thunderstorms or high winds, tree branches often throw their fruit far away. The tree branches may have been the catalyst for the invention of slings for throwing rocks, and slings led to bows to launch arrow-like spears. The arrow could be considered an evolution of spears adapted to work with bows for throwing longer distances.

The discovery of daggers, knives, fire and bows and arrows may have led to the preparation of warm meals. Warm meals resulted in warmer bodies and may have led to the need for clothes to satisfy the demand for warmth. Clothes made out of grass and roots evolved to clothes made of animal skins with the help of a needle. Therefore, the discovery of the needle was a breakthrough. The early needles were like a hook to stitch two pieces of skin or fabric to replace the series of knots previously used to put two pieces together. The knots could have been discovered from natural entanglements of long string-like objects, or even tree branches or bushes.

Early civilization appears to be based on the seven metals, as the remaining known metals were discovered since the 13th century. The seven metals are gold, copper, silver, lead, tin, iron and mercury. Early tools and weapons were made of copper, which was discovered around 4000 BC, and tin and iron were discovered around 1500 BC. The discovery of copper was more significant, as the first set of tools, implements and weapons were made of copper. Early applications of copper were made with hammer and chisel.

Copper smelting was probably learned while throwing copper waste into fire. The first copper-smelted artifacts were found in the form of rings, bracelets, chisels, and weapons about 500 years after the discovery of copper. By the 17th century, an additional five metals were isolated, which are platinum, antimony, bismuth, zinc, and arsenic. By this time, metallurgy was a well-developed discipline. Post 17th century discovery of metals accelerated as twelve new metals were discovered in the 18th century.

HISTORY AND EVOLUTION OF KNOWLEDGE: LANGUAGE, NUMERALS AND ART

Panini (6th century BC), an Indian mathematician, developed a theory of phonetics, phonology, and morphology, and provided formal production rules and definitions describing Sanskrit grammar in his treatise called *Asthadhyayi*. Basic elements such as vowels and consonants, and parts of speech such as nouns and verbs, were placed in classes. The construction of

compound words and sentences was elaborated through ordered rules operating on underlying structures in a manner similar to formal language theory.

In the modern world, around the 12th century, Raymundus Lullus invented the logical machine, *Ars Combinatoria*, in a deep crisis of communication. Lullus started a revolution of formalistic thinking to produce declarations in a mechanical manner. He founded the concept of organizational thinking by constructing a paper-machine to combine language and geometrical figures (represented by signs and letters) for capturing various declarations the human mind could conceive. It consisted of three circular paper disks that were fixed on an axis on which they could be turned for producing possible combinations of letters and symbols, thus leading to the development of deciphering signs, creating organized thoughts and the processes of decoding and encoding. In other words, language was born out of graphic representations of signs and studying their associated patterns.

Language evolved based on natural sounds and representations as well as circumstantial human body expressions (i.e., pain, anger or joy). Physical gestures led to oral expressions. Humans have evolved upright teeth, small mouths to make sounds, intricate muscles in lips, a very flexible tongue, and a resonating larynx. The desire to express personal feelings led to communication or the interactive language, and describing natural phenomena led to the development of transactional language or communicating observations, knowledge, or skills. This transactional language led to the development of a written form of language. In other words, written language must have evolved from the spoken word, pictograms, syllabic writing, and alphabetic writing.

In India, the decimal system existed in the pre-1000 BC era and migrated to the Middle East through the translation of Indian literature. Even though the Indian-Arab numerals had been in existence in 300 BC, the use of numerals began to grow in Spain in 900 AD. Leonardo Fibonacci introduced the Indian-Arabic numerals to Europe in 1200 AD. However, it was not until the 15th century that the European tradesmen, bookkeepers, and surveyors started using Arabic numbers instead of Roman numerals.