9A MORE ON CREATIVITY

Engineering Creativity

Creativity is defined as the ability to develop new and original ideas, possibilities, and solutions. It often involves the discovery of new patterns, connections, and relationships. It is often a major factor in engineering design.

Following are some of the features of engineering design creativity;

1- Engineering creativity is more methodological and systematic then the artistic creativity. It is important to classify the technologically possible design alternatives, and not to omit any probable design before the final evaluation for a choice. Tools like functional decomposition and design tree help the designers to develop all the possible alternative designs in a systematic manner.

2- Engineering creativity depends on the scope of the available elements (building stones) of a product. The larger the number of machine elements that a designer can access, it is more likely to develop the best possible design…

3- Engineering creativity is largely dependent on the designers' own educational background and own personal experience. A designer with a good experience on say; hydraulics will have naturally a tendency to design using hydraulic components. Similarly one cannot expect a designer without any experience in microprocessor technology to develop an intelligent machine with software control. [1]

Creativity in the Bible

Consider the following out –of-the-box solutions:

- God's creation of the Universe- "ex nihilo"
- Adam – gave each animal an original name
- Creativity in the developing culture –art, crafts
- Jacob- creative in a negative way-a crafty swindler
- Plagues in Egypt and parting of the Red Sea
- Manna to feed the Israelites in the wilderness
- Gideon's victory with jars and torches (God's creative idea)
- Joshua's victory over Jericho with marches and trumpets (God's creative idea)
- David's victory over Goliath with a sling and stone
- Nathan's creative story for King David
- Solomon's creative solution for the contested baby
- Solomon's creativity in laying out Jerusalem (2 Kings, Eccl.2)

- Creativity in Solomon's temple
- Elijah's contest with priests of Baal
- Inspired creativity of the prophets
- "Creative alternatives" of Daniel
- Jesus' incarnation
- Uniqueness and power of Jesus' parables and miracles
- Jesus' resurrection
- Images in the book of Revelation
- God's New Creation (Revelation)

In Matthew 21 and 22 Jesus interacts with His opponents (Pharisees, Sadducees, Scribal lawyers) with a brilliant creative approach: Leveling the playing field: [2]

"You can ask Me anything- but then I get to ask you a question.":

"Who gave you this authority?"

"The baptism of John- from God or from men?"

"We can't answer."

Later-

"Is it right to pay taxes to Caesar?"

"Whose picture is on the coin?"

"Whose wife will she be in the resurrection?"

"Haven't you read where God says He is the God of Abraham, Isaac and Jacob?"

Now I'll ask you-

"If David calls the Messiah (the Christ) Lord, how is He also His son?"

Matthew 22:46 – "And no man was able to answer him a word, neither did any man from that day forth dare to ask him any more questions."

Theology of Creativity

A brief theology of creativity [3]

1. God is a creative God.
   Just look at creation.
2. Jesus modeled creativity.

He taught with parables and linked His miracles to His lessons, always unique for the audience at hand

3. The Spirit empowers us to be creative.

Connor writes:

God invented creativity. He thought it up. It was his idea. Creativity is part of who God is. The fifth word in the Bible is 'created' – "In the beginning God created *... (Gen.1:1)" God started the creative ball rolling and it has been rolling ever since.*

Think of creation – God created the entire universe out of nothing. He formed all original things (like an inventor or manufacturer). What an incredible designer he is! There is nothing bland, boring or predictable about God's world. Think of things such as:

- *Color – we have three primary colors with up to 10 million different hues that a human eye can see.*
- *Texture – rough, smooth and everything in between.*
- *Shape and form - so many varieties.*
- *Movement – wind, water, animals (bird, cheetah, elephant, snake)*
- *Sound – a thunderstorm, the crashing of the waves of the ocean or the sound of a bird*
- *Seasons – winter, spring, summer, autumn.*
- *Human personality – unique finger prints for 6 billion people, no boring predictable clones!* [4]

The entire Trinity was involved in creation:

(P.B.) Paulus points out that group creativity entails idea generation, selection, and execution. It is through both divergent and convergent thinking that ideas emerge with fluency (large numbers), flexibility (variance), originality (uniqueness), and elaboration (building on each other). It takes little effort to examine the beauty of creation surrounding the world today and see that every one of these characteristics occurred through God's handiwork in Genesis 1. There were perhaps no official Tinitarian brainstorming sessions, but the very reflection of mutual submission seen in the Trinity reveals a relationship of idea generation (God the Father), selection (the Spirit), and execution (the Word) that effectively demonstrated resulting fluency, flexibility, originality, and elaboration. [5]

Creativity may be a large part of being made in God's image:

Our faith in God rests on our belief that God is the Creator — the Uncreated Creator. As people interested in the power of creativity, we know deeply that we were created, are created, in the first place. And we believe we were created in the image of God.

I suspect that to be made in the image of God has to do with our ability to be rational, to be stewards of the earth, to represent God to each other. Called into covenant with God, the covenant could be read this way: I set before you life and death. Choose to create life, choose to

create goodness, choose to create the beautiful, and choose to create the truth through the art of your actions." [6]

Human Creativity

What is at the core of all human creative activity? It is the perceiving of often odd and striking likenesses, the relating of like things in unexpected ways to form a new unity that was never before noticed. The artist's or the scientist's imagination creates by perceiving a likeness between a number of things that at first sight appear to have no measurable relation, and it recognizes in them a new kind of unity, a new universe, that can be handled with power as if it existed independently, and whose power is operative in the world of things that can be observed and measured. Both artist and scientist are really explorers who discover a unity of new likenesses that maintains its independent existence due to the activity of the Divine Creator, Maker of Heaven and Earth. Thus any human creator, in a real sense, is "thinking God's thoughts after Him." ...

New Technologies are a result of a human creativity that owes its existence to man bearing God's image. Faith is a central component of all such creativity; the creativity that can bring about beneficial new technologies thrives when embedded in a God-given matrix of basic presuppositions about God, man, and the world.

Human creativity in its widest context further supports this thesis that beauty is an essential component of all creative efforts. Beauty is commonly associated with the creative activities of artists; but other areas of human creativity are also marked by beauty, modern science being an example. Beauty is an essential component of scientific theory formulation; "notions of elegance and economy, especially as expressed in mathematical form have frequently proved valuable guides to a better understanding of the physical world. It is a recognized technique in elementary particle physics to seek theories which are compact and mathematically beautiful, in the expectation that they will then prove to be the ones realized in nature. This is a striking fact." (Quoting John Polkinghorne) [7]

Some principles of creativity

Gerard Puccio [8] distinguishes between problems that are heuristic (open-ended) which require a truly creative solution and those which are algorithmic (closed –ended) which might have a formulaic solution. In engineering we distinguish between true design problems and the analysis problems of Circuits or Statics. True design problems may have an enormous number of solutions, and we may need to optimize some particular property (cost, for example).

Stages in creative problem-solving involve [9]

- Clarification of the problem
- Transformation of the problem (identifying potential ideas and crafting then into workable solutions)
- Implementation of the solution

(The approach is very similar to key steps in engineering design.)

Creative people always dream of "what ifs." They have a vison. They always feel free to think beyond what is obvious or state-of-the art. They have the ability to conceptualize-to use the power of their education and experiences to go beyond them, rather than to let them act as constraining boundaries. [10]

Attempts to measure creativity have typically focused on a given challenge and

- Number of solutions generated
- Uniqueness of the solutions
- Feasibility of the solutions.

Roadblocks to creativity include:

- Negative attitude ("I'm just not creative.")
- Time limitations
- Stress
- Lack of rest
- Fears of trying new ideas
- "Paradigm blindness" (inability to consider any other rearrangement)
- Rejecting ideas before fully exploring them

Most people can increase their creative capacity by taking some basic steps:

- Identify and eliminate roadblocks to creativity
- Study the techniques of creative thinking
- Practice divergent (generate many possible solutions) and convergent (select the most promising solution) thinking
- Give yourself time to relax and be imaginative
- Read widely; learn in new areas
- Keep a journal of new ideas
- Generate problems and consider solutions
- Solve puzzles
- Explore alterations of designs or objects: expand, contract, invert, rotate,…
- Explore creative outlets: Try writing stories, composing music, drawing scenes

Tim Keller mentions three Biblical doctrines (underlying truths) that fuel creativity [11]:

1. Creation itself

God created out of nothing and created us in His image. Being creative is then part of who we are, part of who we are meant to be. Tolkein has developed a theory of "subcreation."
No other specifically worldview enables creativity.

2. The Word –God speaks
   God has given commands and guiding principles which give us boundary conditions without destroying our freedom. Every area of art and design has rules and norms.
3. Grace
   Beyond the major commands in the New Testament we are not given a lot of specifics about how we should live. God gives us freedom and grace to be creative within the bounds of loving the Lord and the others around us.

In the book *Zero to One* Peter Thiel talks about innovation and the sad lack of recent innovation. Our colleague Matthew Henry has said that Christians should be the most creative people on earth. [12]

We are to be imitators of God. We are created in his image and likeness (Gen.1:27). We are to be like him. This means we are designed to be creative too! You have a unique contribution to make. When we look at who God is and what he has done, we have a good reason to be creative – to sing, to write, to paint, or whatever – to express our love and adoration for him. See what you're doing as a 'work of art' – displaying God's glory… Let's unleash our creative potential and use it to communicate the most compelling message ever given to humanity. Creativity is not an option for the church; it is a biblical mandate that flows from the very character of God. [13]

Why aren't we more creative?

- There is a human tendency to laziness.
- Many are convinced that they aren't naturally creative.
- Creativity/innovation doesn't seem "spiritual" (dualism again).
- Many expect the earth and all human development to be destroyed soon.

Innovation

Closely linked to creativity is the idea of innovation. Innovation is the transforming of an idea into a practical reality, usually in the form of a product, a process, or a service. Innovation results in value for both the customer and the company and is the key to industrial growth.

> *(I)magination is not just a feature of the arts; it is a feature of human life itself. Without imagination, without experimentation, without openness to new questions and new possibilities, there can be no science and no technology. We are not challenging God when we do this, at least not when we do it in humility and faith. We are not stealing fire*

from the gods. We are taking up our responsibility before God to shape what he has placed in our hands. [14]

Wilson outlines a theology of innovation: [15]

1. *As children of God, God invites us into a collaborative relationship, where we produce things that heal and build creation.*
2. *God gives us a creative vision of the future, which are ideas to make something and build culture the way God intends, and the capacity to act on them. (Num 13)*
3. *As we adopt God's vision for creation, we begin to discover our calling to help create the world the way it is meant to be.*
4. *We call these visions a calling. They form a proper understanding of vocation. (1 Sam 3)*
5. *We can call the results of our creative efforts innovation, which produces artifacts called technology that benefits others.*
6. *The result of our creative work produces growth and flourishing.*
7. *The beauty, truth and goodness of these works gives glory to God and helps build a redeemed culture, which Jesus calls the "kingdom of heaven." (Rev 21)*
8. *The potential of our creative efforts is remarkably described by Jesus as "greater" than works he did in his earthly ministry.*

Importance of innovation

According to Connor [16],

1. "In a period of rapid change, the only ones who survive are those who innovate and create change." [Peter Drucker]
2. Without creativity, there would be no progress, and we would be forever repeating the same patterns." [Edward de Bono]
3. **.** *"Intelligent people are always open to new ideas; in fact, they look for them."* [Proverbs 18:15. NLT]

In the book *Prisoners of Hope* [17] innovation expert Lanny Vincent describes how innovation fuels the imagination of many engineers, providing them with "lift," much like moving air provides lift for an airplane wing. Using the OT account of David and Goliath Vincent likens Saul's armor to the old ways, Goliath to the obstacle, and David's approach to the innovative engineer.

In real engineering practice

- We may exercise faith
- We may encounter giants
- We may have to go it alone

Faith is simply trust, and Christian faith is trust in the goodness of God, in the death and resurrected life of Christ to rescue us. It is based upon God's word, God's actions in the past, and all of the evidence available to us. It is anything but a blind leap in the dark.

Yet, life is an adventure, because we can't physically see God, and we don't know what events will come into our lives in the future.

Does engineering involve faith? Yes, when the engineer goes from theory and design to implementation. We trust in the physical laws and the knowledge of what worked in the past, but we are never guaranteed the outcome. We may neglect some effect, underestimate a value, or even miscalculate results. Many designs require a few iterations to get to the final version.

I am convinced that God can inspire engineers with creative ideas for new technologies and devices to help mankind. Earthmoving equipment designer R.G. LeTourneau often sensed that God had provided the idea for solutions he needed in answer to prayer. Wilson Greatbatch realized that the solution to many lethal conduction blockages in the heart was something akin to a metronome or a basic oscillator circuit, producing square pulses, resulting in his invention of the cardiac pacemaker. [18]

David and Goliath and Innovation

Lanny Vincent's *Prisoners of Hope: How Engineers and Others Get Lift for Innovating* studies the Biblical account of David and Goliath (I Sam. 17) for lessons in engineering innovation ("the unplanned collisions of experiences and possibility"), likening acts of faith to forces an airfoil producing lift. With David defined as the innovator, Vincent identifies these elements of the story:

- Atmosphere of uncertainty and threat
- Overcoming the fear
- Positioning
- Analogous experience
- Permission to try (and permission to fail)
- Passion and motivation
- Conceptual innovation

The "faith" that propels and energizes innovators to rise above fears has these patterns [19]:

1. Awe and wonder for discovery
2. Inspiration and appreciation for invention
3. Forgiveness and persistence for—
4. Submission and for—
5. Acceptance and gratitude for the integration
6. Innovation in daily life

Entrepreneurship

While many engineers become experienced designers, relatively few actually succeed in commercializing their own designs. The entrepreneur takes a product from concept to prototype to market.

Steve VanderLeest, who has experience in starting companies, stresses the importance of entrepreneurs:

> *Entrepreneurship is the discipline and art of innovation – creating new products, new businesses, new organizations, new approaches. The word itself derives from the French verb entreprendre which means*
> *—to begin‖ or —to undertake‖. Engineering is also the discipline and art of innovation – creating new products, new approaches, and new processes. Both the entrepreneur and the engineer focus on practical application of ideas and inventions. Such similarities in focus and goals lead many engineers to become entrepreneurs. It is not uncommon to find engineers running large businesses. For example, the most frequent undergraduate degree for CEOs of the S&P top 500 corporations is engineering (accounting for 23% of the CEO undergrad degrees, followed by Economics at 13%). Even more engineers are found in entrepreneurial enterprises related to technology (which itself accounts for a large number of businesses):*
> *—About two-thirds of the technical entrepreneurs have degrees in engineering, 30 percent in science, and 3 percent in other fields.* [20]

What skills are needed in addition to design ability?

- Creativity
- Knowledge of the market (What do people need? What will then public buy?)
- Some business basics and business sense
- Ability to accept (inconclusive results)
- Flexibility
- Some capacity for risk-taking (reasoned risk taking that doesn't put someone's life in danger or destroys a family's income.)
- Ability to accept failure until success is achieved

Based on material by Chewning [21], VanderLeest [22] offers these principles for a Christian entrepreneur:

- Love for neighbor
- Honesty
- Caring
- Divine gifting
- Stewardship
- Planning for good while trusting in God

Conclusions

How should we approach the area of creativity?

- Glorify God for His creativity
- Celebrate creativity
- Enhance your own creativity

Creativity is not necessarily a special calling or gift from God to the few, it is a natural expression of the fact that we are created in the image of God, who is the Creator. It is His thumbprint on our souls, a part of His signature. The real question is, "How will I live out this fingerprint of God on my life?" [23]

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