11D THE TWO CULTURES

In 1959 scientist-novelist C.P. Snow published an essay entitled "The Two Cultures". [1] In his article he argued that scientists and experts in the arts (or scientific intellectuals and literary intellectuals) not only think differently but can't even communicate about their work.

A good many times I have been present at gatherings of people who, by the standards of the traditional culture, are thought highly educated and who have with considerable gusto been expressing their incredulity at the illiteracy of scientists. Once or twice I have been provoked and have asked the company how many of them could describe the, Second Law of Thermodynamics, the law of entropy. The response was cold: it was also negative. Yet I was asking something which is about the scientific equivalent of: 'Have you read a work of Shakespeare's?'

I now believe that if I had asked an even simpler question — such as, What do you mean by mass, or acceleration, which is the scientific equivalent of saying, 'Can you read?' — not more than one in ten of the highly educated would have felt that I was speaking the same language. So the great edifice of modern physics goes up, and 1 the majority of the cleverest people in the western world have about as much insight into it as their Neolithic ancestors would have had. [2]

Largely a critique of the British educational system, the essay rang true with many readers and has prompted dozens of responses. We easily see a disparity between the "techies" and the "fuzzies" in the university setting (Appendix 2A). Science needs the humanities, and those in the arts should have some measure of "technical literacy." Snow later proposed the development of a "Third Culture," one that was able to bridge the two.

Writers are still trying to explain the causes for the split that Snow observed.

Good reasons exist for this phenomenon. In the first place, while we bemoan the lack of good science teaching in our public schools (the vast majority of middle school physical science and math teachers, for example, do not have a science degree), scientific illiteracy is not a major impediment to success in business, politics and the arts. At the university level, science is too often seen as something needed merely to fulfill a requirement and then to be dispensed with. To be fair, the same is often the case for humanities courses for science and engineering majors, but the big difference is that these students cannot help but be bombarded by literature, music and art elsewhere as a part of the pop culture that permeates daily life. And what's more, individuals often proudly proclaim that science isn't their thing, almost as a badge of honor to indicate their cultural bent. [3]

John Olson, a liberal arts professor, places the problem source on STEM education: [4]

In the large educational institutions of the 21st Century, STEM subjects are emphasized more than the arts. Science, technology, engineering, and mathematics have a 'higher' reputation in society than the arts due to the wealth and status it brings to individuals. In public universities and colleges, the science and engineering programs on the campuses are far more abundant in resources in comparison to the departments within the arts. This false stigma and bias must be wiped from society in order to form a bridge between C.P. Snow's two cultures, science and the arts. Literature and history need more funding, and the professions comprised within these two subject must be seen as an equivalent to those of science.

Few educated people understand the details of physics. Many technical people are uninterested in classical literature. This is not an issue of worldview: there are theists and naturalists on both sides.

Atheist Lawrence Krauss predictably blames faith for the divide: [5]

Snow did not rail against religion, but ignorance. As the moderator in my panel finally understood after an hour of discussion, the only vague notions of God that may be compatible with science ensure that God is essentially irrelevant to both our understanding of nature and our actions based on it. Until we are willing to accept the world the way it is, without miracles that all empirical evidence argues against, without myths that distort our comprehension of nature, we are unlikely to bridge the divide between science and culture and, more important, we are unlikely to be fully ready to address the urgent technical challenges facing humanity.

Finneran writes of his hope for an interdisciplinary approach to science:

The advantage of having scholars from other disciplines look at science is that they don't look at it the same way that scientists do. Within science there is a growing awareness of interdisciplinary studies. Chemistry can make a contribution to physics or biology because chemists do not approach problems in the same way. Of course, a chemist can go only so far without the help of a physicist or biologist. This is what should also be happening in cultural studies of science.

The best work will come when scientists and nonscientists work cooperatively to develop ideas that incorporate a working knowledge of science as it is practiced today with a sophisticated understanding of modern intellectual directions. As Wilson notes, experts in all disciplines suffer from too narrow a focus. The movement toward interdisciplinary work among the sciences should be extended to include the humanities. [6]

Finneran, K., "The Two Cultures Revisited." *Issues in Science and Technology* 14, no. 3 (Spring 1998).

Today we see evidence of the development of subcultures within these cultures. Computer scientists communicate with one another, geneticists talk mostly within their group, theoretical physicists talk mostly with one another, and so the list increases with thousands of subcultures apparent within the culture of science. Similar patterns of communication exist in communications between nonscientists… C. P. Snow's lament and theme is important- it is dangerous to have cultures that will not or cannot communicate. [7]

If the split is visibly present between those in the natural sciences and those in the arts, it is even more visible between engineers and those in the humanities.

This was the summary of William Wulf's remarks on C.P. Snow (Wulf was president of NAE at that point): [8]

The cultural divides have not narrowed... The problem is now worse. He said his colleagues understand the words of the other culture, but not what the person is saying. He spends a lot of time interpreting between the two cultures. Although he resonates to Snow's premise, he does not pretend to understand all the cultures to which he has been exposed.

Mr. Wulf said he does not know how many cultures there are. Using the simple math of three numbers, one, two, and infinity, he said there are more than two. Each culture has a stereotype of itself and others, particularly one with which each contrasts itself. Each characterizes itself as being on the top of the heap. Business people assume they live in the 'real world' while academics live in an 'ivory tower.' Scientists do 'pure research,' and at one time prided themselves that the problems on which they worked could not have any practical use. Applied science is for second-rate minds. Academics live the 'life of the mind' and see only massive greed in the private sector. The one he hates the most: philosophers call themselves 'thinkers,' with troubling implications for the rest of us.

For as long as Mr. Wulf can remember, people have talked about the importance of interdisciplinary work. Einstein spoke of a time when all new discoveries would come from the interstices. What Wulf sees at the interstices is the development of new specialties that quickly develop their own identities, norms, and barriers.

Some have suggested that engineering is actually the "new liberal arts," since the background of engineers is among the broadest in the academy: math, physics, chemistry, engineering sciences, engineering design, technical specialty, composition, literature, history, plus exposure to economics, ethics, project planning, and teamwork.

The idea of engineering as the "new liberal arts" comes from at least the 1950s. If the phrase's connotation is limited to maximizing one's chances of securing a job after undergraduate, then said connotation is appropriate. Prior to the Industrial Revolution, the Liberal Arts man was the most valuable type of man to society and obtaining a Liberal Arts education allowed man to secure a prestigious position in said society.

After the Industrial Revolution, there was greater need for specialists to handle the ever more complex systems being invented, developed, etc. Thus, technical disciplines, and especially engineering, became more valuable to business…The trade-off is that, increasingly, engineers have to specialize more and more and that leaves less and less room for the humanities education so badly needed in our current world. [9]

Michael Griffin of NASA expressed this concern:

C.P. Snow believed that mutual comprehension and appreciation between the arts and the sciences, which had existed in earlier times, had been erased by his time. He did not find a means to restore it. I sometimes think that the gap between synthesis and analysis in engineering is as wide as that between the arts and the sciences of Snow's "two cultures". But the fact remains that designers simply do not think or work in the same way as analysts, and this does on occasion produce a certain cognitive dissonance. When it occurs in the context of a complex system development, catastrophe is a likely result. [10]

Griffin suggests that System(s) Engineering is the needed bridge: [11]

System engineering is the link which has evolved between the art and science of engineering. The system engineer designs little or nothing of the finished product; rather, he seeks a balanced design in the face of opposing interests and interlocking constraints. The system engineer is not an analyst; rather, he focuses analytical resources upon those assessments deemed to be particularly important, from among the universe of possible analyses which might be performed, but whose completion would not necessarily best inform the final design. There is an art to knowing where to probe and what to pass by, and every system engineer knows it.

Do engineers need the humanities? Absolutely, and they are a part, although often a small part of every curriculum via the General Education requirements of the university. The case is typically made that Liberal arts supply general knowledge about the world, develop rational and critical thinking skills, help engineers to see the "big picture" in any project, and help students to understand humanity. Real design involves more than just the technical solution, but also the human user and the business aspects. Olin University and Harvey Mudd College have emphasized the development of the symmetrical "T-shaped engineer," having both general breadth and technical depth.

Figures

At the same time, many engineers would argue that liberal arts must be included, but not at the expense of technical subject matter.

Often engineers approaching retirement finally find some leisure time to read, discover history and the classics, and wish they had read more widely in college. They become cheerleaders for more arts in the curriculum. They tend to forget, however, that needed a strong foundation in technical material to launch their careers and simply did not appreciate liberal arts courses as students.

Samuel Florman ("In Search of the Civilized Engineer") expresses both sides of the argument. Engineers are civilized and civilizers, "but not as civilized as they might be." [12]

I am nevertheless convinced that the quality of our technology, and consequently the quality of our lives would be improved by the liberal enrichment of engineering education, by the

broadening of horizons, the deepening of cultural awareness-in short, by the civilizing –of engineers…

Of course, as a number of engineering professors have told me, they view it as their duty to produce, not Renaissance men and women, but the large numbers of competent engineers that have traditionally made our nation's technology the envy of the world. If American innovation, quality control, and productivity have declined, most engineering educators do not see the humanities as the source of potential improvement. [13]

Christian Responses

Charles Adams, in proposing the initial engineering curriculum for Dordt University commented on the observations of C. P. Snow:

The coherence between the aesthetic and logical aspects of reality has been lost. One result in our culture is the ugliness, both in appearance and function, of many of our modern technological products…

An engineer without an understanding of history and philosophy is just as rootless and impaired in his life and calling as other persons who lack that understanding, regardless of their profession. Without the ability to read widely or communicate meaningfully in speaking and writing, or without an aesthetic sensitivity, an engineer is reduced to little more than a calculating machine…

Given the principles of unity, coherence, and interrelatedness in creation, the term "liberal arts" may never lead us in the direction of two cultures as described by C. P. Snow. The humanities may never be understood in opposition to the science, to the extent that meaningful communication cannot occur between scholars in those two general fields. Art may not be divorced from technics. While admitting and recognizing the diversity in creation, even to the extent of defending the mutual irreducibility of its various modal aspect, we must never lose sight of the interwovenness of creation. [14]

Gaylen Byken of Calvin College wrote: [15]

Early in the seventeenth century Izaak Walton, an Englishman, wrote an enchanting book entitled The Compleat Angler. This book is now read mostly by graduate students of English literature or by fanatical trout fishermen who recognize the book as one of the first and premier works of angling literature. Walton wrote about fishing, mostly for trout in the chalk streams of Devonshire -- a pastoral setting where fishing was not just one activity on a list of recreational habits in a busy life, but where fishing became angling…The book was "compleat" in that Walton covered the sport thoroughly, but mainly in that he presented a holistic picture of a sweet, gentle, patient life peacefully passed in a rural and innocent Arcadia…For Walton, personal philosophical development would always take precedence over the results oriented pragmatism of our age…

(Following Walton's idea) a "compleat ingineer" seeks to integrate all aspects of his or her life; is a person who has, to paraphrase the poet, Robert Frost, made his avocation his vocation. Such a person delights in his or her God-given ability to apply the rigor of scientific training with the

dance of creativity in order to think deeply about problems whose solutions are not just benign, but beneficial to fellow travellers. As Christians, any time we talk about "completeness," we feel a deep theological resonance. From the great narrative of the Fall and the Redemption, we know that sin has distorted our lives, separated us from our Creator. We know that we are not whole. We feel our fallen incompleteness. We seek wholeness, an inner feeling that our lives will be complete, that our minds will find peace from our estrangement, our alienation. These are powerful human longings that will not be fully satisfied in this life. But in the striving after wholeness, in our efforts to become "compleat," I believe the route takes us past the foot of the cross of Jesus Christ and past his empty tomb.

Conclusion

The Christian university is in the ideal position to overcome the problem of the Two Cultures by providing these elements:

- Bible courses and courses on the Christian worldview (A student will develop greater value for human life, ethical behavior, and the environment from Bible-theology courses than from literature courses.)
- Integration of faith and learning
- Ongoing dialogue between engineering faculty and faculty in the liberal arts
- Appreciation for the liberal arts component of the curriculum
- Problems presented in context, whenever possible
- Interdisciplinary projects and teams

References

1. Snow, C.P., "The Two Cultures," the Rede Lecture, Cambridge University Press, 1959.
2. Ibid.
3. Krauss, L. M., "An Update on C. P. Snow's "Two Cultures,"" *Scientific American*, 2009 https://www.scientificamerican.com/article/an-update-on-cp-snows-two-cultures/
4. Olson, J., "Bridging the Two Cultures," https://web.colby.edu/st112a-fall18/2018/10/10/bridging-the-two-cultures/
5. Krauss, op. cit.
6. Finneran, K., "The Two Cultures Revisited." *Issues in Science and Technology* 14, no. 3 (Spring 1998).
7. Chappell, D. and Cook, D., *Not Just Science*, Zondervan, 2005, p. 69.
8. Wulf, W., "Snow's Two Cultures Revisited From an Engineer's Perspective," 2015,

https://pswscience.org/meeting/snows-two-cultures-revisited-from-an-engineers-perspective/

9. Enginox comments, “Is Engineering the New Liberal Arts Degree?” https://talk.collegeconfidential.com/t/is-engineering-the-new-liberal-arts-degree/956478/5
10. Griffin, M., “System Engineering and the ‘Two Cultures’ of Engineering,” NASA Boeing Lecture, Purdue University, 28 March 2007, https://www.nasa.gov/pdf/173108main_mg_purdue_20070328.pdf
11. Ibid.
12. Florman, S., “In Search of the Civilized Engineer”, *Engineering Education*, Dec. 1987, p. 162-163.
13. Ibid.
14. Adams, C., Engineering in Reformed Perspective, *Pro Rege* 9 (September): 9-21.
15. Byken , G., “The Compleat Ingineer,” CEEC 1