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Strong Words – The Creative Writing of Engineers

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Abstract

A number of contemporary engineers who have authored books of poetry, award-winning short fiction, highly-acclaimed creative non-fiction, and best-selling novels are introduced. Their thoughts on engineering, engineering education, the engineering workplace and technical and creative writing are presented. Implications for engineering education and creativity are discussed. Keywords: engineering communication, engineer writers, creative writing

Introduction

Many employer surveys have indicated that communication skills, both oral and written, are critical to an engineer's success [1,2]. Evidence that these skills are being developed by engineering students is an important element of the Engineering Criteria 2000 requirements used by the Accreditation Board for Engineering and Technology (ABET) in evaluating engineering academic programs [3]. To ensure that their graduates possess the expected communication proficiency, colleges and universities offer technical writing and professional communication courses focused on the needs of their engineering students or include writing and communication instruction as an integral part of the technical and professional coursework as students progress through the engineering curriculum.

Still, it is not unusual to hear that many engineers still can't write or communicate effectively [4,5]. To remedy this many companies contract with communication consultants and training firms for short programs in effective writing for their technical employees [6]. And, for customer documentation and other important information products, companies employ skilled technical writers or contract with professional technical writers as a cost-effective method of ensuring clear, professional communication.

Information content is of primary importance in the written products, such as reports, presentations, proposals, procedures and specifications, normally generated by engineers. But the successful creation of documents

within these genres requires an understanding of language and substantial skill with its purposeful use. That understanding and skill is also demanded of literary writers, the creators of novels, short stories, poetry and works of creative non-fiction. In most of these forms the information content is of considerably lesser importance than literary concerns such as the unfolding of a storyline or generating particular emotional responses with the words and their arrangement.

While the transfer of some informational content may have importance, many of these highly creative information products are designed to entertain or stimulate readers and provide insight into aspects of our human experience. The communication goals and approaches that the writers and poets who create these literary products take to their audiences vary considerably from those normally expected in technical documentation and the more prosaic information products engineers might be expected to produce. But, to achieve success both the engineering writer and the literary writer must have solid understandings of language and the process of using it to communicate effectively.

Thus it should be expected that some engineers, experienced in the creation of technical documents, would try their hand at other writing forms, including those considered creative in nature. A number of these engineers, in fact, proved to be quite proficient in the use of language for creative purposes and were able to garner large readerships, win literary awards, and in some cases gain a degree of fame.

The most notable engineer who turned to writing is Fyodor Dostoevsky. The famed Russian novelist studied engineering at the St. Petersburg Academy of Military Engineering before writing classic novels like *Crime and Punishment* and *The Idiot* [7]. Other engineer-writers include Nevil Shute, an English novelist best known for the apocalyptic *On the Beach*, who was honored as a fellow of the Royal Aeronautical Society for his accomplishments in the design of aircraft technology, L. Sprague DeCamp, an accomplished science fiction author who graduated in engineering from Cal Tech, Robert Musil, an Austrian novelist and engineer who was

nominated for a Nobel Prize in Literature, and Robert Heinlein, one of America's most famous writers of science fiction who graduated from the Naval Academy and worked as a civilian engineer during the Second World War [8,9,10,11].

Other well known writers such as Robert Louis Stevenson, Eric Ambler, and Kurt Vonnegut pursued engineering studies but failed to complete a degree. And the great American novelist Norman Mailer earned a Bachelor of Science in Aeronautical Engineering from Harvard but never worked in the field [12,13,14,15].

Methodology

A number of contemporary American writers of fiction and poetry studied and worked as engineers, many of them still making contributions as teachers, researchers and consultants. To learn more about these engineering writers and their experiences, several of these contemporary poets, novelists, and writers of short stories and creative non-fiction were contacted and interviewed. The selected writers all had written or edited at least one book that had been released by an established publisher and reviewed in the press; none were self-published.

The interviews were conducted in person, over the telephone and through exchanges of e-mail correspondence. In each case it was attempted to learn the background of the writer/engineer, their experiences in engineering school, their experiences in the workplace and their thoughts on both creative writing and workplace writing. The goal was to see how their engineering training and experiences had affected the strong skills they have displayed in the use of language in their literary work.

The Engineer Writers

A dozen writers were interviewed in this manner. In the paragraphs that follow each will be introduced with a brief biography. Subsequently, a preliminary sampling of their comments on engineering education, technical communication, and writing will be compared.

Gene Wolfe

Gene Wolfe was inducted into the Science Fiction Hall of Fame in a ceremony held last year in Seattle. The author of more than 25 novels and short story collections, Wolfe is one of science fiction and fantasy writing's most revered authors. He has twice won Nebula awards, for the novel *The Claw of the Goniliator* and the novella *The Death of Doctor Island*, and is best known for novels like *The Book of the Short Sun*, *The Wizard*, and *Soldier of the Mist* [16,17,18,19,20].

Wolfe studied mechanical engineering at Texas A&M College, but quit after two years and served in the army as a combat infantryman during the Korean Conflict. He returned to complete a degree in mechanical engineering at the University of Houston and entered the workforce as a development engineer for Proctor and Gamble, primarily designing production equipment for the company's wide variety of product lines. He was the primary designer for the cooking unit that was used to introduce the Pringles brand of potato chips.

Wolfe left Proctor and Gamble to take a job as an editor for *Plant Engineering*, a trade publication, and was, among other things, the magazine's robotics editor. He retired in 1986 and was able to write full time.

Karl Iagnemma

Karl Iagnemma's first novel, *The Expeditions*, was released earlier this year [21]. His first book of short stories, *On the Nature of Human Romantic Interaction*, was highly praised when it was published in 2003 and caught Hollywood's attention where it is now being developed as a feature film [22]. Iagnemma's short stories have won the Paris Review Discovery Award and the Playboy College Fiction contest and appeared in numerous literary publications.

Iagnemma earned a BS degree in Mechanical Engineering from the University of Michigan and a MS and PhD in Mechanical Engineering from MIT. He is noted for his work developing algorithms to control the motion of wheeled robots that are used for planetary exploration and medical surgery. He is a principal research scientist at MIT where he supervises post-doctoral fellows in the Department of Mechanical Engineering's robotics laboratory and recently was a visiting researcher at the National Technological Institute of Athens in Greece.

Aileen Schumacher

Aileen Schumacher's second novel, *Framework for Death*, was nominated for an Anthony Award, an important honor for mystery writers awarded each year at the Bouchercon World Mystery Convention [23]. She has written four novels that feature a feisty female protagonist who happens to be a structural engineer. In the books, the engineer must use her technical expertise to assist law enforcement in the solution of a mystery.

Schumacher was studying biology at New Mexico State University when an accident while working with some laboratory equipment piqued her interest in the world of technology. She completed her bachelor of science degree in Biology but turned to engineering when she entered graduate school and earned a Master of

Science in Civil Engineering from New Mexico State. She worked on numerous civil engineering projects and, with her husband, served as principal of a Florida engineering and consulting firm doing road, storm drain, bridge and other structural projects.

George Saunders

In 2006 George Saunders received a MacArthur Foundation Fellowship grant, often called the “genius” award, for his work as a writer of satiric and often hilarious short stories. He has published five volumes of short fiction and released a collection of his non-fiction, *The Braindead Megaphone*, in 2007 [24]. His work has been described as whacky and subversive and compared to the barbed humor of Mark Twain.

Saunders studied at the Colorado School of Mines and received a degree in geophysical engineering. He worked for a petro-chemical firm doing exploration in Indonesia and the Far East before becoming ill and returning to the United States. He then earned a MA in writing from Syracuse University, and worked as a technical writer for a New York environmental firm. He currently is on the faculty at Syracuse University.

Richard Gabriel

Richard Gabriel has written one book of poetry, *Drive On*, and has conscientiously written a new poem every day for the past eight years [25]. He received a MFA in poetry from Warren Wilson College and his poetry has appeared in various journals and poetry magazines. Gabriel has written extensively about the writing process and is an advocate of using a writers’ workshop approach in teaching programming and software design.

Gabriel received his PhD from Stanford University and was a founder of Lucid, Inc., a software company that was started in 1984. He was a “distinguished engineer” at Sun Microsystems from 1998 to 2007 and currently holds the same title at IBM Research.

Brad Henderson

Brad Henderson is a poet who is a frequent participant in poetry events held in the Sacramento area and regularly contributes to the San Francisco Writers Conference. He has published a novel, *Drums*, and a book of poetry, *Split Stock* [26,27]. *Drums* won the Phi Kappa Phi award when Henderson attended the University of Southern California where he received a Master of Professional Writing (MPW) degree. His poems have been widely published in literary journals and he has several book projects in work.

Henderson graduated from California State Polytechnic University with a mechanical engineering degree and was

employed by the Parker Hannifin Corporation where he designed fluid control devices. He later did technical training for Hewlett Packard and currently is on the faculty of the University of California at Davis.

Marissa Martinez

Marissa C. Martinez is a poet and writer whose work has appeared in literary magazines and anthologies. She was co-editor of *The Lesbian’s Health Book* and regularly attends writing conferences to stimulate her writing. In addition to poetry, she is working on a collection of memoirs centered on her experiences as a student [28].

Martinez received her degree from MIT with specializations in engineering and humanities. She has worked in software engineering for several firms and was a group manager doing product development and testing at Microsoft. While there she was honored with a diversity award at the Hispanic Engineer National Achievement Awards Conference. Martinez currently is principal program manager at SupplyScape, a Boston area firm specializing in supply chain management for the pharmaceutical industry.

Stewart O’Nan

Stewart O’Nan has written 10 novels, including *The Good Wife*, *A Prayer for the Dying*, and *Last Night at the Lobster* [29,30,31]. His first novel, *Snow Angels*, was made into a motion picture that was shown at the Sundance Film Festival and premiered in Los Angeles in 2008 [32]. Granta magazine cited O’Nan as one of the country’s top young novelists and his writing has won the Drue Heinz Literature Prize and the Pirate’s Alley Faulkner Prize. He received an MFA in writing from Cornell University.

O’Nan graduated from Boston University with a degree in aeronautical engineering. He went to work for the Grumman Corporation where he did fatigue testing of aircraft metallic parts as well as other mechanical tests for four years.

Henry Petroski

Henry Petroski is the author of 14 books of non-fiction, including *The Pencil: A History of Design and Circumstance*, *Success Through Failure: The Paradox of Design*, and *The Book on the Bookshelf* [33,34,35]. His most recent volume was released in 2007, *The Toothpick: Technology and Culture* [36]. As a young man Petroski wrote poetry and some of his poems were published in the prestigious journal *Poetry* but it was his later articles and books about the practice of engineering that caused him to be called the “poet laureate of engineering.”

Petroski received his PhD in applied mechanics from the University of Illinois at Urbana-Champaign and worked at the Argonne National Laboratory. He is a fellow of the American Society of Civil Engineers, a member of the National Academy of Engineering and has been on the faculty at Duke University since 1980.

Nick Arvin

Nick Arvin's first novel, *Articles of War*, received a Rosenthal Family Foundation award from the American Academy of Arts and Letters for "considerable literary achievement" in 2006 [37]. That book, a story of a GI's strange odyssey during World War Two, also received the Colorado Book Award as best book of the year and the Boyd Award from the American Library Association as best military novel of the year. Arvin received an MFA from the University of Iowa and his first book of short stories, *Into the Electric Eden*, won widespread praise [38].

Arvin graduated in mechanical engineering from the University of Michigan and went on to earn a Master of Science degree in ME specializing in thermodynamics and fluid mechanics at Stanford University. He went to work for the Ford Motor Company and rotated through various engineering positions. Later, he worked as a forensics engineer in Denver and currently works part-time in power plant design for the Harris Group.

David Poyer

David Poyer is a best-selling author whose most recent book, *Korea Strait*, was released in 2007 [39]. He has written 27 novels, including a popular series about the modern U.S. Navy, a series about the adventures of an undersea diver, a series of historical novels about the Federal and Confederate navies during the American Civil War, and another series about conflicts and murder in a fictional county set in northwestern Pennsylvania. Poyer is on the faculty of the graduate writing program at Wilkes University in Pennsylvania.

Poyer graduated from the U.S. Naval Academy at Annapolis, what a character in one of his novels refers to as the "best engineering school in the country", and started his career installing a missile system aboard a frigate. Later, as a civilian, he did submarine design and other engineering work at Newport News Naval Shipyard. He retired from the navy in 1999 holding the rank of Captain.

Homer Hickam

Homer Hickam's memoir *Rocket Boys* was a best seller in 1998 and reached the screen as the movie

October Skies [40]. That story told of the rocket launching exploits of a coal miner's young son. It was followed by eight more books, including a science fiction novel, three novels about a coast guardsman's adventures in the Second World War, and, most recently, *The Red Helmet*, a novel about contemporary coal mining in West Virginia [41].

Hickam received a degree in industrial engineering from Virginia Polytechnic Institute. After military service in Vietnam, Hickam went to work as a civilian engineer for the U.S. Army Missile Command, primarily working on computer systems in this country and Germany. Later he was employed by NASA where, among other assignments, he trained astronauts to properly operate and perform their onboard science experiments.

Views on Engineering Education

These writers, successful as creators of fiction, non-fiction and poetry, were educated as engineers. (The one exception is Richard Gabriel, the distinguished engineer at Sun and IBM research, who earned his degrees in mathematics and computer science.) Although they studied at different educational institutions, at different times and within different engineering specializations, they all shared the rigors of coursework in the sciences, applied mathematics and engineering fundamentals required in engineering programs.

Most of them enjoyed their engineering education. Wolfe, Petroski and Poyer all recall doing well in engineering core classes like statics, dynamics, and strength of materials. Poyer likened the problems posed in some of those classes to geometry, a branch of mathematics wherein he was able to excel. Arvin liked the more theoretical aspects of engineering, especially fluid dynamics. "The Navier Stokes equations," he said. "It doesn't get any more abstract than that." Henderson loved his engineering education, comparing the experience to a video game, and particularly enjoyed a senior design class where his group did a project for FMC in San Jose, California. "That was the first time we got a problem where the problem statement didn't look like it came out of a textbook," he recalled. "It was kind of clumsy. There were things missing. We had to make assumptions. It pushed us out of our comfort zone."

Several discovered that the approach to education used in engineering is somewhat different than what they had experienced in other studies. Schumacher came to realize that success in her engineering classes didn't rely on memorization as it had in most of her undergraduate biology classes and, instead, demanded that students have the ability to apply learned principles to problem-solving. Martinez had a similar experience. "It had always been easy for me in high school because the stuff is fed to you

as opposed to you having to think and figure things out on your own,” she said. “I found the tests problematic, of being able to match what I knew with what was being asked all the time.”

The rigors of engineering caused more than a few problems. Saunders found difficult going in his first years of engineering school. “I learned that a person could try as hard as they wanted, and make huge strides, shock themselves with how much they had learned and still get a C. That was sort of stunning,” he said. Wolfe and Poyer had similar difficulties. “I did well in math through elementary calculus – and hit the wall after that,” Wolfe recalled. “There was something I couldn’t grasp, and I never even found out what it was.” Higher level engineering classes that required calculus were challenges for Poyer. “Calculus,” Poyer said, “was my *pons asinorum*.” Even Petroski, who started in mechanical engineering, had some difficulties. “Thermodynamics I couldn’t understand,” Petroski recalled. “Controls, I didn’t understand. I still have problems understanding them.”

Many of them squeezed writing classes into their engineering programs. Martinez’s humanities concentration was in technical writing. Poyer took at creative writing class at Annapolis. Arvin squeezed in writing workshop classes at both Michigan and Stanford. Henderson minored in English. Iagnemma’s graduate program at MIT required a minor and he chose fiction, taking writing classes at MIT and Harvard. One of the professors on his advisory committee approved the minor, thinking the subject was “friction.”

Others began to test their wings as writers while in college. Wolfe’s first published stories appeared in a Texas A&M literary journal and Petroski began writing poems in graduate school. Hickam became a columnist for the Virginia Tech student newspaper. “I got to be a min-celebrity on campus since everyone on campus liked to read my stuff,” he recalled. “This was great reinforcement for my writing!”

Views on Writing in the Workplace

As engineers, these writers also encountered the need for workplace communication. Arvin recalls a time when he was working at Ford where he dropped a 12 page report on his manager’s desk. The manager picked it up, began red-penciling it and condensed the entire package into a one-page memoranda with bullet points. “I think that was the most memorable experience I had in learning or beginning to learn how you have to sort of compress information in that environment,” he said. “In a lot of ways it is very similar to fiction writing in that you want to be as efficient with your information as possible.”

Gabriel first honed his skills writing e-mails. “I started doing lots and lots of email,” he recalled. “I am one of the people who has been using e-mail on the net since 1972, if you can imagine that.” In the late 1980’s he wrote a paper in completely idiomatic English and presented it at a conference. “My peers looked at it and said, oh, you can’t publish this because it is too down home. It is too plain-spoken. It’s in normal spoken English, it’s not formal stuff.” He did it anyway. “It was fairly successful and I started to get on the kick of trying to teach the computer science world that it is ok to loosen up and be less formal.”

“I do think that the writing I do as an engineer is good practice for fiction writing,” Iagnemma said. “Any kind of writing is good practice I think as long as you are doing it seriously and trying to achieve the purpose that is intended for. In technical writing that purpose is always clarity, being as clear as possible. I don’t think there is an art to it but there is certainly a craft to it.... There is not a lot of room for fuzziness in my fiction, so the technical writing is actually very good practice for that. I try to convince my students that cutting words, getting the sentence down, is essential, actually counts, because it allows a reader to read a paragraph, a sentence or a page with less fatigue and understand your ideas more clearly.”

Martinez has worked with a lot of engineers and laughs at the idea that some of them are poor writers. “There might be some intentional incompetence involved there,” she said. “If you prove you can’t do it, you are not asked to do it.” As a software engineer she writes specifications, user documents, test plans and marketing documentation. She approaches this type of writing differently than her poetry. “It is about a technical product. I don’t use as much emotion in the technical writing. But you have to have good sentence structure and active verbs. That is still important.”

Poyer wrote numerous technical documents as part of his engineering career, including reports for the U.S. Senate and the military’s highest commands. “I have always done a lot of that. What engineers don’t realize, I think, is that they have to do a lot of writing in their careers,” he said. “You really can’t escape it because you have to communicate your findings and produce written reports, manuals and evaluations and all sorts of written things, especially for the Navy.”

Saunders worked as a technical writer for a pharmaceutical company and then an environmental firm. “I loved it,” he said. “I tell you, I learned so much doing that about clarity and reduction and all those kind of things. I had the false idea, I think, that literary writing was over here and literary writing was puffy and better and evocative. But then when I started writing reports, they did not want anything extra. They really didn’t want anything extra. So you learn to be direct. If you are trying to prove A, say as little as you can to prove A.

Take out everything that isn't essential. To do that every day, for eight hours a day, was fantastic. It just became second nature."

O'Nan had to document the tests that he performed while working in the aerospace industry. "I wrote results reports for Grumman and these were shipped to the Navy or NASA," he said. "Big thick buggers. You weren't supposed to mention yourself, or any humans, really, so I had to learn how to use the active voice without making it seem like these test articles were breaking themselves. Made me look hard at sentences and how they worked. Also taught me the value of economy and tables."

"One of my greatest strengths as an engineer was my ability to write cogently, simply, and with precision," said Homer Hickam. "I often observed instances when my fellow engineers -often much better engineers than I- were unable to properly describe their ideas and projects, either in writing or in a variety of formal and informal presentations. It is absolutely essential that an engineer be able to communicate. Even now, writing is the best way to accomplish this. It is why I have strongly urged American engineering schools to stress English, literature, and writing studies in their curriculum."

Views on Writing and Engineering

These writers have differing views of the impact that their engineering educations and experiences have had on their writing. Some see a direct relationship. Others admit the possibility of a correlation. And some doubt that having been in engineering has had any effect upon their writing.

Iagnemma

"If you kind of map out engineering and writing you would think the nearest you would get in the engineering domain to writing would be mechanical design," Karl Iagnemma suggested. "I think you could make a strong argument it is the most purely creative aspect of engineering. I think you can draw pretty close parallels between the mechanical design process, a good designer's process, and the story writer's process."

O'Nan

"I think the biggest influence engineering has had on my writing is the continual insistence on comparing what I'm thinking about to how the real world actually works," said Stewart O'Nan. "What would REALLY happen? What I've just written or am about to write can't just sound good, it has to pass a reality test, even if what I'm writing is Gothic fantasy or pulp. In engineering, you make several tries at a solution that will hold up to the laws of

the real world, and when you find one, you test it. Unlike the theoretical sciences, you can't just assume things - forces- are equal to zero. Engineers learn early that numbers lie. As a writer, you need to get to the point where you understand that words lie. Something can sound wonderful and perfect and in truth be wrong or even absurd. The danger of a finely tooled prose surface is that it may hide or contain nothing or even falsehood. So I hope my training has taught me to break that pretty surface open and really see what's there."

Henderson

"The pedagogy of English is different from the pedagogy of engineering education," said Brad Henderson. "Profoundly. In the world today, in the post 60s educational world, it is in vogue to pass over the fundamentals and launch students at a very early age into the holistic writing process. The idea is that the fundamentals of how to write a sentence will be absorbed by little insights and little on demand discussions with teachers about nouns and verbs and at some point in time the light will go on and everything will come together. Well, sadly, that rarely happens.

"It is particularly bothersome to the engineering mind, because the engineering mind knows that process just isn't going to work." Henderson continues. "At the very get go. So the engineering mind is desperately wanting somebody to sit down and share with it the fundamentals, first. The other thing the engineering mind craves is whenever something is evaluated, the engineering mind yearns to know what the evaluation criteria are. There is a lot of evaluation in the letters where the evaluation criteria are highly obscure, vague, if defined at all. So there is not strong logic in a lot of good writing. Unfortunately."

Martinez

"I know I have these particular tools and skills. When I am focused on the engineering side, when I am focused on design, even things as mundane as project management stuff, I know I have these skills at my disposal. I don't really think about what I use. I have an end result that I want to aim for and I sort of pull things in and sort of keep going to get me there," said Marissa Martinez.

"The same thing happens from a writing standpoint, especially in poetry. Certainly from a poetry standpoint it has to do with what I envision, what I want to be doing in the poem. I think about the emotional response that I want to have happen at the end of the poem and I maneuver myself there through what I am writing. I don't think about: Do I need to have these things rhyme or do I need to put a simile here. I don't think in those terms. I think about here is the end place I want to get to, here is

where I am starting. I pull things in and built the poem to get there.”

She does the same thing in her readings, striving for a public response to her words and the images and emotions they convey. “Engineers don’t care about the emotion, they care about the thing. If you can work on what that thing is and focus on is it working or is it not, you can extract the emotion out of the equation of that interaction.”

Gabriel

“There is a difference, I think, between pure problem solving and the creative end of things, both in engineering and in art,” said Richard Gabriel. The difference seems to be with problem solving there is a higher emphasis on using principles, looking at existing solutions to similar problems, analytics, sort of researchy type of things.

“If you are trying to get some piece of software to interact in a particular way with a data base, for example, and you have some performance problems, there are some tools you can throw at that. There are solutions other people have done. Some of the tools include performance measurement, looking at page faults, looking at how the code is structured. If you are doing pure engineering, there are often tables you can look at or formulas that help you sort of get a sense of what is going on, you can sort of explore the space that way. Then you can zero in on some solutions pretty quickly.

“In the art world, for example with poetry, if you have got a stanza that sounds very nice but happens to be ungrammatical or you accidentally wrote it in the wrong tense you have to problem solve your way out of that. That involves, if you are worried about rhythm for example, changing the tense which is going to change the rhythm, maybe. There you have to look at some alternates in the wording. You might have to go to a dictionary or thesaurus. If you are inspired by a particular poet, you can go and see how they did things so that this other tense did not screw up the rhythm.

“On the creative side, the key appears to be to be able to let go of your sort of rational side for a little bit and think of wild possibilities. Try to imagine if there weren’t any constraints of software, if we weren’t using Java or c++ or Lisp, what is the code we would like to write. Pretend there is a language and see where you can go. Or imagine wild structures.

“On the pure engineering side what would it be like if there was no possibility of support, how would we actually support something when there is nothing underneath to support it with. You eventually come up with cantilevers and things like that. I think there is this continuum that goes in between the two (engineering and writing) where you have to let go and rein back in and then let go again. I think the interesting connection could

be that this ability to go back and forth can be taught and learned.” To take advantage of this connection, Gabriel has advocated the use of writers’ workshop techniques in software programming education.

Hickam

“Probably the most technical book I ever wrote was *Back to the Moon*, a novel that fell into the techno-thriller genre,” said Homer Hickam. “Here, I blended skills as a literate engineer with those of the fiction writer. Whenever I wrote about anything that had to do with science or engineering, even when it was a vastly complex subject, I simplified it until even a grade schooler could understand it. This I confess I also did with my bosses at NASA, not because they were not capable engineers, but they simply didn’t have the time to plunge into a great deal of technical esoterica. In this regard, the smart novelist and the smart technical writer/engineer have at least some commonality.”

Poyer

David Poyer uses flow charts, tables and matrices to plan and organize his novels, ensuring that the characters he uses and their actions are clear to his readers. He sees these as engineering tools but feels that literary writing is a clear departure from engineering practice. “In engineering you do things to the standard of best professional practice. You do things that have been done before. You apply certain well understood rules. You do it with great attention and sometimes a little flare but basically you are following a cookbook. In art, as opposed to craft, you can’t follow the cookbook. Now, first, you have to know the cookbook cold so you can do anything that you have to do no matter how uninspired you feel, you can still do it. Now, art takes it a step further and does it in a way that hasn’t been done before. I try to do that,” Poyer said, noting that in each of his books he has employed some approach to the writing that is different than that found in his other books.

Petroski

In one of his books, Henry Petroski compared the writing process to that of bridge building. The design and creation of a written piece follows a very similar path as does an engineered product. “I am just doing a different kind of engineering,” Petroski said. “That is what it is. I have often described my books as pieces of engineering. I definitely feel that because: What is an engineering design? You start with a concept. You have to flesh it out. That is what you are doing when you are writing, at least what I am doing when I write.”

Schumacher

Aileen Schumacher finds comparisons between the writing and the engineering process to be apt but notes that criticism of her creative writing cuts far more personally than questions about her engineering designs. "If somebody looks at a design and they say that is a stupid place to put an entrance, it certainly is not as devastating as their looking at a manuscript and saying that is a two-dimensional character. That is stilted dialogue. This plot really sucks," she said. "Criticism I think really cuts to the bone when applied to your fiction because you have created everything, it is not just a matter of not having strung facts together the best way that you could."

Saunders

George Saunders found similarities between his technical writing and the process that led to his short stories. "You are making something incrementally better every day. As you arrange it and rearrange it and cut it, you start to see an internal logic you hadn't seen before. That is satisfying. As you read it you can tell whether a text is drawing you in or not. Therefore, if it is your text, you can modify it. As long as you have an opinion, there is hope. So, if you look at the work that you have done and it makes you sick to your stomach, that's a good thing. Your opinion is working and therefore you know how to fix it. As long as you hold up your heroes' work in your mind as a model, yours will always be deficient but there is a factor, you can make yours incrementally better. And it is very encouraging to just think, to know you don't have to be Dickens right out of the gate, you just have to be yourself and feel the flaws in your own work, then you can tweek it and as you move it incrementally you will see further opportunities, and that is really all you have to do. You don't have to worry about anything other than that."

Arvin

"People are always wanting to say, well I am a much more rational writer, I approach it in more analytical ways than I would if I wasn't an engineer," Nick Arvin said. "That might be true. It is really very hard to separate out. You don't have a reference point for what kind of writer you would be if you hadn't been an engineer. I think I tend to approach writing in a relatively analytical way, I do a lot of revisions, and I have a sort of mental process of trying to analyze what the problems are in a story but I think maybe every writer does that. Maybe I am overly analytical or maybe not. If I am, is that because I am a

more analytical person or because I have a background in engineering. Did I go into engineering because I am an analytical person?"

Discussion

Two aspects of this study merit additional study and consideration. One is the role that engineer-writers such as those interviewed for this study might play in engineering education. The second is the nature of the relationship between engineering, writing and creativity.

Engineering Literature-A Potential Course

The success of so many engineers within the literary world seems quite notable and is not widely known. The writing prowess of these writers, and of many other engineer-writers who have not been included here, if better known might cause other engineers to be less intimidated by the writing that they must accomplish in the workplace. The awareness of these engineer-writers and their work could cause engineers to be less intimidated by the demands of written communication and see it as a natural extension of their engineering efforts rather than a separate and alien craft.

It is also possible that poetry, short stories, novels and creative non-fiction created by engineers could provide an attractive means of bringing an understanding and appreciation of literature to engineering students. If literature classes were offered that focused on the works of engineers, or works by and about engineers, students might approach the required readings with far more openness than they would for more classical works or works reflecting contemporary literary trends. Knowing the writing to have come from kindred spirits, engineering students could be more receptive to appreciating the creative and skillful use of language and the literary genres the works represent. It would seem that a literature course based entirely on work by engineers could answer broad-based general education requirements in literature and stimulate technology students to read and enjoy contemporary literature and, perhaps, even try their own hand at creating it in the future.

Connections: Writing-Engineering-Creativity

Interviews with a number of writers have revealed varying opinions as to the manner in which their engineering experiences have affected their use of language in the creation of novels, stories, poems and other creative works. Some see clear links between the processes of writing and those used in various aspects of engineering study and practice. They liken their literary output to industrial products and note that as they write,

they design, test, and redesign based on the test results, just as they would with a new piece of technology. Most acknowledge having to work with constraints and deal with failure in their writing, just as they would in an engineering experience.

One questioned whether the analytic approach he brings to his writing is more a result of him being an analytic thinker, quite independent of his engineering training and employment. Some saw the creative writing as simply an extension of their workplace writing or technical writing. One was surprised that the creativity often expected in engineering practice hadn't led to more creative writers than it has. Others wondered if their profession has played any more role in their writing than that of countless lawyers, teachers, law enforcement officers, medical doctors, teachers and others who became writers or turned to writing as a creative outlet.

All of the selected engineers found they had a strong ability to use words and language for creative purposes. As with most creative activities, no single clear cut route seems to have led these men and women from the world of engineering to that of literature.

Continued study and analysis of these and other engineer writers is expected to provide additional insights on the paths that connect creativity, engineering, and the written word.

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Note: All comments are from interviews (personal, telephone and e-mail) conducted with the noted engineer-writers during the period July 20, 2006 to March 1, 2008

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