SIGEVOLution

newsletter of the ACM Special Interest Group on Genetic and Evolutionary Computation

Volume 8
Issue 2

Photograph from the Santa Fe Institute

in this issue

tributes to
John Henry
Holland
1929 - 2015

EDITORIAL

This issue of SIGEVOLution is dedicated to the memory of **John Holland**, inventor of Genetic Algorithms, who sadly passed away on August 9th 2015. John's work will have touched all of us working in the field of Evolutionary Computing in some way big or small, from the PhD student just beginning to those who began work in the field at its inception. It was reading his book "Adaptation in Natural Artificial Systems" while I was an MSc student in 1994 that inspired me to go on to do first a Master's project and then a PhD in the area and I'm sure the same goes for so many other people reading this.

It is clearly impossible to do justice to such a figure in the few short pages of this newsletter. My grateful thanks go to **Una-May O-Reilly** who has been hugely helpful in suggesting names and collecting material for this issue. We have tried to pay tribute by gathering together contributions from many of those who worked directly with John during his long and rich career. In addition, we have interviews and contributions from several of his former graduate students, people who were inspired by his classes, and those that went on to work with him. The newsletter also highlights some of the tributes that were paid in various forms of the media, including a radio programme, a recent book published to celebrate his 85th birthday, and a look back to an interview with him published in the SIGEVO newsletter in 2008. Interviews and contributions are presented here in no particular order.

What ever you are currently working on in the broad, diverse and flourishing field of Evolutionary Computing today, it is doubtless underpinned by John's original ideas - I hope that you enjoy reading these insights into John the man and the scientist who paved the way for us!

Wishing you a Happy New Year and a successful 2016.

Emma Hart

CFP - GECCO 2016: 25th Int. Conf. on Genetic Algorithms and 21st Annual Conf. on Genetic Programming

July 20 - 24, Denver, Colorado, USA

Abstract Deadline: January 27, 2016
Submission of Full Papers: February 3, 2016

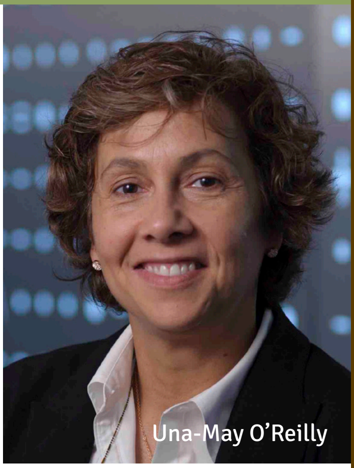
The GECCO 2016 Program Committee invites the submission of technical papers describing your best work in genetic and evolutionary computation. Abstracts need to be submitted by January 27, 2016. Full papers are due by the non-extensible deadline of February 3, 2016.

Each paper submitted to GECCO will be rigorously evaluated in a double-blind review process. The evaluation is on a per-track basis, ensuring high interest and expertise of the reviewers. Review criteria include significance of the work, technical soundness, novelty, clarity, writing quality, and sufficiency of information to permit replication, if applicable. All accepted papers will be published in the ACM Digital Library.

Researchers are invited to submit abstracts of their work recently published in top-tier conferences and journals to the Hot Off the Press track. Contributions will be selected based on quality and interest to the GECCO community.

Full details here: http://www.sigevo.org/gecco-2016/papers.html

Una-May O'Reilly


Una-May O'Reilly

The world was so fortunate to have such a wonderful man. He was a brilliant and bold thinker of enormous impact. John's ideas on complexity and, within them on evolutionary computation, might arguably have been articulated in advance of the technical capabilities needed to fully explore their foundations, implications and potential. That kind of scientific vision is hallmark of a great thinker. For GAs and GP, we're only now, in isolated cases, exploring computation at a scale large enough to realize some of the facets of complexity he so clearly abstracted and described in such an inspiring way.

I'm still awed by the reception I received from John the first time we met. It was at SFI, I was a green PhD student from a lesser-known university and in awe of his work. I was ready for a powerful man, so full of self-importance that I would be ignored. To the contrary, he welcomed me warmly and showed boundless intellectual enthusiasm for my (very modest) ideas and (likely sophomoric) insights into GAs and GP. He was friendly and encouraging and had an easy laugh. The ease with which he could be approached provided me with an example that everyone should emulate.

I always enjoyed meeting him and telling him something new from my research. He would offer me some new finding in exchange and we had so much fun with the swap.

We will all miss him! He was a special human.

***Una-May O'Reilly**, graduate student, 1993-1995, Santa Fe Institute, currently SIGEVO Vice-Chair, co-founder of Women@ GECCO, recipient of EvoStar Award for Outstanding Achievements in Evolutionary Computation in Europe (2013). Founder and co-leader of Any Scale Learning for All research group, MIT Computer Science and Artificial Intelligence Lab.*

Any Scale Learning for All research group: http://groups.csail.mit.edu/ALFA
Una-May O'Reilly: http://people.csail.mit.edu/unamay/

Celebrating John H. Holland: An Interdisciplinary Life

Big Beacon radio brought together three of Holland's former students, hosting a lively conversation that celebrated John the man, as well as his interdisciplinary approach to research and teaching:

- **Erik Goodman,** Director of the Beacon Center,
- **John R. Koza,** inventor of genetic programming, and
- **Dave Goldberg,** host of Big Beacon Radio,

shared their remembrances of John Holland and ways in which John's interdisciplinary vision begs broad and full enactment.

First broadcast on October 19th, and hosted by David E. Goldberg, the episode can be downloaded using the links below:

http://cdn.voiceamerica.com/business/011554/goldberg101915.mp3 (mp3)
https://itunes.apple.com/us/podcast/big-beacon-radio/id990814297?mt=2 (iTunes)

Change is coming to higher education like a freight train, but transforming higher education is challenging, full of risks and opportunities for educators, students, workers, and employers, alike. Big Beacon Radio, Transforming Higher Education, with Dave Goldberg, helps you explore and understand the latest news and views.

Melanie Mitchell


Melanie Mitchell

In 1984 I came to graduate school at Michigan to work with **Doug Hofstadter**. I didn't know anything about the CS department. It was my great luck that I ended up taking John Holland's class "Adaptation in Natural and Artificial Systems". The class completely changed my perspective on what computer science was (and should) be about. As fellow grad student **Chris Langton** put it, John's view was that "The proper role of computer science is the study of computation writ large across all of nature." This idea, and John's development of it during the class, was a great epiphany for me that shaped my future career and all of my thinking about science in general. John became my co-advisor at Michigan, and did so much to support and encourage me in my work. He let me know when I had done enough for my Ph.D. (and told me it was time to get my "union card," as he called it). He recommended me for the Michigan Society of Fellows, and then invited me to join the famous BACH group during my fellowship. He also invited me to visit SFI, first for a summer, and then asked me to direct SFI's Adaptive Computation program. This led to my faculty appointment at (and hopefully life-long engagement with) the Institute. I was fortunate to became one of John's close-knit group of former Ph.D. students, all of us, including John, meeting every now and then to talk about everyone's research projects and to speculate on big questions. Our last meeting was in Fall, 2014. John, in spite of his illness, was in great spirits, and regaled us with his new ideas and enthusiasms. In addition to his great intellect, John was perhaps the most enthusiastic, cheerful, and *lively* person I've ever known. I'll miss him greatly.

***Melanie Mitchell** is Professor of Computer Science at Portland State University, and External Professor and Member of the Science Board at the Santa Fe Institute. Melanie directs the Santa Fe Institute's Complexity Explorer project, which offers online courses and other educational resources related to the field of complex systems.*

Complexity Explorer Project: http://www.complexityexplorer.org/

This is reproduced with permission from the comments posted on the obituary that appeared on the Santa Fe Institute website on Aug 10th: http://www.santafe.edu/news/item/in-memoriam-john-holland/

CFP - PPSN 2016: 14th International Conference on Parallel Problem Solving from Nature

PPSN 2016 will be held in **Edinburgh**, Scotland, UK, **17-21 September 2016**.

This biennial meeting brings together researchers and practitioners in the field of Natural Computing: the study of computational systems inspired by nature, including biological, ecological, physical, chemical, and social systems. This is a fast-growing interdisciplinary field, featuring a range of techniques and methods for dealing with large, complex, and dynamic problems with various sources of potential uncertainties.

PPSN 2016 will showcase a wide range of topics in Natural Computing including, but not restricted to: Evolutionary Computation, Artificial Neural Networks, Artificial Life, Swarm Intelligence, Artificial Immune Systems, Self-Organising Systems, Emergent Behaviours, Molecular Computing, Evolutionary Robotics, Evolvable Hardware and Applications to Real-World Problems. PPSN 2016 will also feature workshops and tutorials covering advanced and fundamental topics in the field of Natural Computing.

Paper submission deadline: April 4, 2016

Keynote speakers:
Susan Stepney - University of York, UK
Josh Bongard - University of Vermont, USA
Katie Bentley - Harvard Medical School, USA

PPSN 2016
September 17-21st 2016, Edinburgh, Scotland

Full details here:
http://www.ppsn2016.org/conference/call-for-papers

Erik Goodman


Erik Goodman

John's passing is very sad for me, and I extend my deepest sympathies to his family, friends and colleagues who enjoyed his marvellous spirit.

John completely altered my academic path when I took his adaptive systems class in 1969. Although GA's were not yet named, John had fully developed the ideas, proved a schema theorem, invented classifier systems, and thought a great deal about complex adaptive systems. His ideas were infectious, and I took his second adaptive systems course. He got me a fellowship in the Logic of Computers Group (in the Ouimet Building). **Art Burks** was the director and John the associate director, but John's spirit propelled us. He taught and advised this group, but also instilled by his example a sense of joy and playfulness in everything we did. Lunchtime meant playing Go, the strategy game at which John excelled and was well-ranked. He would spot us MANY stones and still beat us easily, but we learned about both strategy and tactics, great topics for budding young AI students! And Space War! Logic had two computers in the basement--an IBM 1800 and a DEC PDP-7 with a "337" display, custom-interfaced by a Logic student. The interface took 8 18-bit PDP-7 words and converted them to/from 9 16-bit IBM 1800 words, so the IBM's disk drive could serve the PDP-7, which had only a paper tape reader. On that, **Dan Frantz** implemented an early video game--Space War--a more advanced version than the earliest PDP-1 game at MIT. Many of us in Logic got into the code and enhanced it further. Dan was #1 at this game with orbiting ships and gravity-affected missiles, but #2 was John Holland. We spent many exciting hours playing Space War with John and each other. Sessions playing Consensus, the electoral college board game invented by John's student **John Koza**, were also popular. Holland DELIBERATELY made Logic a fun place to work, and one where everyone felt free to test their crazy ideas on each other.

With characteristic unselfishness, John appointed his recently graduated Ph.D., **Bernie Ziegler**, as my Ph.D. advisor, helping Bernie launch his career. I used a GA (not named that yet, of course) to solve for 40 real parameters of a model of E. coli growth, and I'm afraid we broke some of John's early "rules" about GA's, since we didn't use a bit string and binary mutation, but rather Gaussian mutation on discretized reals. But John allowed me to run almost continuously on the IBM 1800, and after a year of checkpoint/ restart running (ONE run), I finished the Ph.D. (1972).

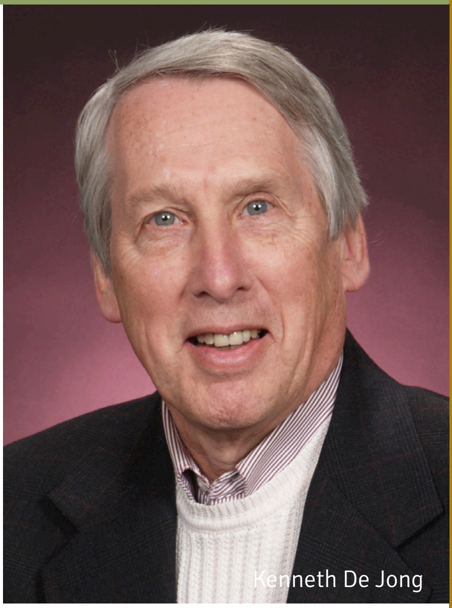
A goal of mine in directing two centers has been to emulate John and make them fun places for students to play and to learn from each other, as in Logic. A few years ago, John invited me to CSCS to give a seminar about our work in BEACON Center, and he was delighted when I told him how strongly I was trying to model BEACON's atmosphere on his example at Logic of Computers. Our education of BEACON grad students seeks to prepare then in the same multidisciplinary way that John had implemented in the Computer and Communication Sciences program at UM in the 1960's and '70's.

John was truly a national treasure--not only because of his ever-flowing fountain of ideas, but also because of his eagerness to share his inspiration with others. He was a giant, and we shall all be poorer for his loss.

Let's do our best to keep alive his ideas and his passion for seeing these ideas put to work in many different environments.

Erik Goodman *is a professor of Electrical and Computer Engineering and of Mechanical Engineering and of Computer Science and Engineering at Michigan State University. He is the director of BEACON: An NSF Center for the Study of Evolution in Action, headquartered at MSU http://beacon-center.org/. He also co-directs MSU's Genetic Algorithms Research and Applications Group (GARAGe).*

Kenneth De Jong



Kenneth De Jong

The sense of which individuals have had a major impact on one's life sharpens as one gets older. In my case there is no doubt that **John Holland** has had the strongest influence on my academic and professional life. As a graduate student in Computer Science at the University of Michigan in the late 1960s, I enrolled in Holland's Adaptive Systems course and was immediately infected by his innovative ideas, his boundless enthusiasm, and his interdisciplinary perspective. That was the first step in a life-long journey that included:

- my Ph.D. thesis that extended and hardened Holland's early adaptive systems ideas into useful algorithms for dealing with difficult optimization problems in computer science and engineering.
- my academic life as a computer science professor continuing to extend these ideas to heuristic search and machine learning, as well as inspiring a new generation of Ph.D. students.
- my professional involvement in related activities such as ICGA, FOGA, SIGEVO, and the founding editor-in-chief of the Evolutionary Computation journal.
- my leadership role at GMU's Krasnow Institute, a sister institute to the Santa Fe Institute.

Just a brief look at John Holland's long list of Ph.D. students makes it clear that I am only one of many that could compose a personal note similar to mine, and have also gone on to make a significant impact on the fields of computer science and engineering. The list is too long to cover in detail, but it is worth highlighting a few:

- **Edgar Codd**: the inventor of relational databases and a Turing Award recipient.
- **Bernard Ziegler**: a pioneer in the theory of modeling and simulation, past SCS president, ECE professor and center director at the University of Arizona.
- **Gul Agha**: developer of the Actor model of concurrent computation, former EiC of ACM Computing Surveys, CS professor at UIUC.
- **Chris Langton**: an early pioneer in artificial life and agent-based modeling.
- **Tomosso Toffoli:** an early pioneer in cellular automata and artificial life, ECE professor at Boston University.

If we think of Holland's students as his academic children, his impact on computer science and engineering extends well beyond them through an ever-expanding family tree of grandchildren and great-grandchildren. It's difficult to get an accurate count, but a rough estimate of at least ten of Holland's Ph.D. students active in academia, each producing 10-15 Ph.D. students of their own gives one a clear sense of the breadth of his impact. And, of course, a number of these grandchildren are now producing their own Ph.D. students.

In addition to his impact on and through specific individuals, Holland's innovative adaptive systems ideas continue to shape the fields of computer science and engineering in more general ways. His early ideas about genetic adaptive systems led to a class of genetic algorithms that continue to play an important role in the broader field of evolutionary computation, a field that has grown and matured in the past two decades to include a variety of respected journals, conferences with typical attendance figures of 400+, and an ever increasing number of books.

His early adaptive systems ideas also included innovative ideas about machine learning, articulated as a "Learning Classifier System", that continues to play an important role in the reinforcement learning community. Both his work on classifier systems and genetic algorithms reflect the "bio-inspired" aspect of Holland's contributions. Today, that theme has matured into the field of

"Natural Computation" that takes a broader perspective than Evolutionary Computation and is having a similar impact on computer science and engineering.

Perhaps the most under-appreciated aspect of Holland's contributions comes from his firm belief that innovation occurs on the boundaries of disciplines. This is perhaps best reflected in his early involvement in establishing the Santa Fe Institute and his contributions to our understanding of complex adaptive systems. The important notions of emergence and agent-based modeling of complex systems have been fundamentally shaped by Holland's adaptive systems ideas. His influence continues today because of his active participation in the Santa Fe Institute, the Krasnow Institute at George Mason University, and a variety of complex systems programs around the world.

It's difficult to know where to stop documenting Holland's impact. I hope my brief summary is sufficient to convey the fact that his life-long work has made major contributions of lasting importance both to me personally and to science and engineering in general. He will be missed!

__Kenneth A. De Jong__ received his Ph.D. in computer science from the University of Michigan in 1975. He joined George Mason University in 1984, and is currently a Professor of Computer Science, head of the Evolutionary Computation Laboratory, and associate director of the Krasnow Institute. He is the founding editor-in-chief of the journal Evolutionary Computation (MIT Press), and a member of the board of ACM SIGEVO.

An Interview With John Holland

From the SIGEVO newsletter, August 2008

Lashon B. Booker, Mitre Corporation, interviewed John Holland in August 2008. SIGEVO published the interview as a series of questions and answers in which John talks about a range of topics

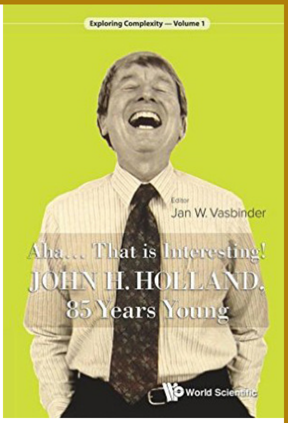
He begins by describing his early childhood and the experiences that shaped his passion for science, moving forward onto the topics in the field that still excite him today. Find out what topics still excite him today and what he considers as the big open questions that need to be addressed in Evolutionary Computing. If you are a PhD student, then should check out his recipe for successfully completing your PhD!

The original article can be accessed from the ACM Digital Library at:

http://dl.acm.org/citation.cfm?id=1562109

Aha..... That is Interesting!: John Holland, 85 Years Young (Exploring Complexity)

edited by Jan Fasbiner



This book published in celebration of John's 85th birthday, collects together stories that highlight aspects of the creation of complexity science that will most likely not be found in the books on John's works. The stories and anecdotes about his quests, his collaborators, and his friends, show his incredible mind, his boyish curiosity and explorative energy, his philosophy of life, his enormous hospitality and natural inclination to make friends. Stories were collected through personal invitations to a range of people who were asked to contribute a short story, that only they could write. The 10 chapters provide a fascinating insight into the life of a remarkable man.

http://www.amazon.com/Aha-That-Interesting-Exploring-Complexity/dp/9814619868

Scott Page


Scott Page

On Aug. 9, 2015, we lost John Holland, computer scientist, psychologist, and complexity scientist. John defined new areas of research and tools for exploring them. Along the way, he made significant contributions in a startlingly unusual range of fields. He gave us new ways to solve problems and changed how many of us think, literally.

More traditional obituaries list his awards, positions, and publications. Here I would like to take a moment to describe my impressions of the intellectual contributions of a rare cross-disciplinary genius—a term I use sparingly but that truly applies here.

Holland began graduate school at Michigan in the field of philosophy, but his interests in signal processing and algorithmic computation moved him into the as-yet-undefined field of computer science.

He became a student of **Arthur Burks**, who himself had helped **John von Neumann** build and design one of the original all-purpose electronic digital computers, the iconic ENIAC. This intellectual history played a central role in Holland's intellectual development.

Von Neumann introduced the idea of self-reproducing cellular automata: computer programs capable of making copies of themselves. He had proven that any such automata must contain a set of instructions that are then copied to the offspring. In other words, von Neumman had proven that something like DNA must exist–and had done so before Crick and Watson discovered DNA's structure.

Holland was fascinated with von Neumann's "creatures" and began wrestling with the challenge and potential of algorithmic analogs of natural processes. He was not alone. Many pioneers in computer science saw computers as a metaphor for the brain. Holland did as well, but his original contribution was to view computation through a far more general lens. He saw collections of computational entities as potentially representing any complex adaptive system, whether that might be the brain, ant colonies, or cities.

His pursuit became a field. In brief, "complex adaptive systems" refer to diverse interacting adaptive parts that are capable of emergent collective behavior. The term emergence, to quote Nobel-winning physicist **Phil Anderson's** influential article, captures those instances where "more is different." Computation in the brain is an example of emergence. So is the collective behavior of an ant colony. To borrow physicist **John Wheeler's** turn of phrase, Holland was interested in understanding "it from bit.'"

In 1962, Holland wrote a sort paper titled "Outline for a Logical Theory of Adaptive Systems." In this paper, which foreshadows his seminal later work, Holland observed that an adaptive environment can be modeled as a population of problems and that many of these problems were high dimensional and complex. To solve these larger problems, systems would need to somehow self-construct subproblems that, when solved, would point to the solution of larger problems–not an easy task.

In 1975, Holland offered up more than an outline. He released a seminal work, "Adaptation in Natural and Artificial Systems." Dense, challenging, and thought-provoking, the work has left a lasting imprint in computer science, operations research, biology, ecology, psychology, economics, political science, and philosophy of science. Most notably, the book introduced the world to perhaps Holland's greatest contribution, and certainly his most prominent: genetic algorithms. Like many moments of genius, Holland's idea in retrospect seems obvious. He used evolution as a metaphor for an algorithm that could be used to solve problems, and in doing so defined the field of evolutionary computation. The genetic algorithm consists of three steps:

Step 1: Create a population of random solutions to a problem and represent them as binary strings. Think of each potential solution as an individual and as the binary representation of its DNA.

Step 2: Think of the problem to be solved as a fitness function that assigns a numerical value to each proposed solution.

Step 3: Repeatedly apply genetic mechanisms: reproduction of the more fit, genetic crossover (sexual recombination), mutation, and inversion to the strings to create a new population to create more fit individuals.

Holland's genetic algorithms computationally implement an analog of genetic evolution, where survival of the fittest means that better solutions reproduce more often. As an algorithm, evolution worked. Over the past 40 years, genetic algorithms have proven to be an effective general purpose optimization procedure

Equally important, within the algorithmic representation, Holland could prove analytic results. His Schema Theorem revealed how evolution solves problems by locating solutions to parts of the problem (what he called schema), reproducing those through survival of the fittest, and then recombining them through sexual recombination.

As substantial as their impact within optimization, genetic algorithms may have made an even larger contribution to modeling. They have been used to represent ecosystems, competing firms, political parties, collections of individuals, and even competing ideas within an individual.

In sum, Holland had not only mimicked evolution on a computer, he'd developed a powerhouse algorithm, and provided a framework within which scientists could derive analytic results that have deepened our understanding of how evolution works and helped identify conditions when evolution may get stuck in the shallows and miseries.

He had only begun.

In that same book (yes, the same book), Holland defined a general purpose problem algorithm called Learning Classifier Systems. These consisted of a population of if-then rules that passed messages back and forth. In a Classifier System, the if-then rules evolved using a genetic algorithm and the fitness of each rule emerged naturally in the model via what Holland called a bucket brigade algorithm. This algorithm within an algorithm offered a solution to the conundrum he had identified earlier: enabling fitnesses for solutions to subproblems to emerge in the process of solving the larger problem.

Classifier systems were capable of learning sophisticated tasks. They could play checkers. They could operate a pipeline

Not surprisingly, Holland found a community of people interested in applying his algorithmic models to the brain. Along with psychologists **Richard Nisbett** and **Keith Holyoak** and philosopher **Paul Thagard**, Holland undertook a multi-year, cross-disciplinary study induction – the process of inferring the general from the particular. Their contribution, published as "Induction Processes of Inference, Learning, and Discovery," offered a general rule-based system that again linked the natural (the brain) and the artificial (computers) Their system, a version of classifier systems, assumes a set of competing rules. At any one moment, a single rule is activated and sends a message. The rule that responds to that message is chosen according to the rule's past usefulness and how closely the conditions of the rule match the message.

In demonstrating how sequences of these messages can produce inductive reasoning, Holland and coauthors made an early and seminal contribution to what has become the field of Cognitive Science. At the time, this was a loose collection of computer scientists, mathematicians, psychologists, and philosophers trying to make analytic headway into understanding cognition.

In the 1990s Holland helped to define the field of Complex Systems, characterizing both its boundaries and frontiers. To the very end, John continued to play with ideas in his unique joyful, mischievous, generous way.

We miss him. We will continue to explore, examine, and expand the ideas he so eloquently shared.

Scott Page *is the Leonid Hurwicz Collegiate Professor of Complex Systems, Political Science, and Economics at the University of Michigan and an external faculty member at the Santa Fe Institute.*

Reprinted from the Washington Post:
https://www.washingtonpost.com/blogs/monkey-cage/wp/2015/08/19/goodbye-to-the-genius-who-changed-the-way-we-think-and-you-didnt-know-even-know-it/

3 Lessons I Learned from John H. Holland - David E. Goldberg


David E. Goldberg

Complexity science pioneer **John H. Holland** passed away on Sunday, 9 August 2015 (here). Those of us who got to work with him were blessed, and, like so many of his other students, my life was irrevocably altered by working with him. To remember John, I'd simply like to tell the story of how I met him, and three things I learned from him that had roots in that first encounter.

Meeting John
It was the fall of 1980, and I had returned to Michigan to get a PhD in Civil Engineering. Prior to returning to school, I worked writing and installing real-time pipeline simulation software in oil and gas pipeline systems, and I had the realization that long-distance gas pipeline operators "drive" pipelines like you or I drive a car, so I returned to school with dreamy visions of doing artificial intelligence; I signed up for the standard CS course on Artificial Intelligence, went to class, and found a sign on the door saying that the course was cancelled.

In seeing the sign, all I could think was that my dreams of doing AI and pipelines were being crushed by the cruel fates of class scheduling. I looked through the course catalog searching for a class replacement and I came across a course called Introduction to Adaptive Systems, CCS 524, taught by someone named J. Holland. It wasn't exactly what I was looking for, but it was the best game in town, so I signed up and went to class.

I arrived in the classroom, and standing at the front was an energetic and youngish looking prof. He said the class didn't have any exams, it had one term paper/project on any subject, and two course books. One book was something called Adaptation in Natural and Artificial Systems, a text written by the instructor himself in 1975. The second book was a collection of papers published in 1963, Computers & Thought. I couldn't help wondering at the time whether there hadn't been anything more interesting published in AI than a 17-year old collection of papers, but I reserved further judgment until I could get the books.

The youngish prof put on his glasses and started talking about what sounded to me like a randomly selected and unrelated series of subjects: genetics, economics, automata theory, schemata, Samuel's checker player, some strange construction he called a classifier system. I didn't understand what this had to do with "real AI" or adaptive systems, but the prof seemed earnest enough, and there was a deep confidence about him. Nonetheless, I couldn't fathom how any of this might lead to a dissertation in Civil Engineering.

This first experience was perplexing enough, and I thought matters couldn't get any worse, but I was wrong! I went to the bookstore, got the two texts, and took them home. The collection of papers was dreadfully old and outdated, it had no working code, and it even even smelled bad—musty and old—like a flooded basement after the water recedes.

And the author's book. Yikes!! It was filled with equations that didn't relate to anything I had experienced in my equation-filled engineering education, and it moved from what at the time seemed like disparate topic to topic with what appeared to be reckless abandon.

What had I gotten myself into?
But, I stayed with the course, wrote a dissertation applying genetic algorithms and classifier systems to gas pipeline control, and had the privilege of learning from and working with one of the early masters of modern complex systems.

3 Lessons I Learned from John
I love telling this story because of the serendipity and intellectual tension of the first encounter. As I reflect back, one of the puzzlers is why I stuck with the course; it met none of my prior expectations, and yet I stayed. Of course, I am glad I did. Doing so changed the course of my life, but what was it that kept me coming back for more?

I think I stayed, in part, because I had an intuitive sense of some of the great lessons in store by working with John. Here, I'd like to summarize three of those lessons.

Lesson #1: Tell Great, Coherent Stories
One reason I stayed with the course is because John was a great teller of science stories. Sometimes his equations were hard to follow, but I always got his story, and it was the coherence of his narrative that convinced me that his stuff could be made to work.

Since that time, my work as an engineer, scientist, and now as a leadership coach has led me to think of stories as the central way in which human beings approach complexity. Stories contain, time and spatial relationships, causality relationships, intentionality relationships, clues regarding ontological modes & epistemic certainties and uncertainties, all in a compact representation with the possibility of pointers to other stories as well as visual and mathematical representations. I couldn't have had a better introduction to the importance of great narrative in a scientific context than listening to John.

Lesson #2: Have the Courage to Jump Long
One of the puzzles for me in meeting John was getting used to his bringing insight from so many different fields. He did it so effortlessly and naturally, yet for a young engineer it was bewildering to see someone jump outside of his own discipline with such confidence, always bringing back so many useful things.

Since that first day in class in 1980, university life has become marginally more interdisciplinary, but students of John smile knowingly at each other when others talk about interdisciplinary work. John taught a kind of extreme courage to go wherever you need to go in the interest of doing good work. Rarely do you see it done with such grace and aplomb as by John, but many of us touched by his example are better able to jump longer and further afield than we otherwise would have without his leadership and example.

Lesson #3: Trust Yourself & Others
I think another thing that kept me in class during those first days and weeks when I was still full of doubt and skepticism was John's demeanor. He was completely at ease and quietly confident about the things he was saying, and it wasn't arrogance. It was what coaches might call "leadership presence." He was connected with us in class. You trusted what he was saying even if you didn't fully understand it, and he was curious about our questions and reservations. It was attractive in a way that was and is hard to describe.

This attitude carried over to the way he "managed" us as his PhD students. Basically, he trusted us to figure things out. He would listen carefully to our results, he would ask a few questions, but he rarely was directive about what should be done next. At the time, I think I wished for a little more advice. In hindsight, I am grateful he did things as he did.

The Last Time I Saw John
I last saw and spoke with John in early 2013 in Singapore at an event at Nanyang Technological University (NTU) commemorating his 85th birthday. I was in Singapore on other business and traveled across town to listen to John lecture on portions of his 2012 book, Signals & Boundaries. The vibrancy of his storytelling, the courage of his long jumping, and his presence & trust came through as before; and this particular talk sent me off on a weeklong reflection regarding the concept of lever points in ways that felt familiarly like reflections so many years earlier.

During a break, I pulled John aside, and I was moved to tell him how much he had meant to my life, and how grateful I was for having been his student. He smiled and moved on to a pressing appointment. Thinking back about that last encounter, he didn't seem that much different than the youngish looking prof I met 35 years ago. And maybe in that final observation is another lesson for us all.

***David E. Goldberg** is best known for his work on genetic algorithms and his first book Genetic Algorithms in Search, Optimization, and Machine Learning (1989). Today, he is a trained leadership coach (Georgetown University) and president of ThreeJoy Associates, Inc., a coaching, training, and change leadership consulting firm in Douglas, Michigan. He resigned his tenure and a distinguished professorship in 2010 to work full time for the transformation of higher education. He can be reached at deg@threejoy.com.*

This is an abbreviated and modified version of a piece that appeared in Aha... that Is Interesting, a book of short papers honoring John on the occasion of his 85th birthday.

About this newsletter

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Suggestions: If you have a suggestion about how to improve the newsletter, please send us an email

Contributions will be reviewed by members of the newsletter board.

We accept contributions in LATEX, MS Word, and plain text.

Enquiries about submissions and contributions can be emailed to editor@sigevolution.org

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