The Web's Awake

An Introduction to the Field of Web Science and the Concept of Web Life

Philip Tetlow

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For VeeVon, Dude, and Kidder

“You’re really not going to like it,” observed Deep Thought.
“Tell us!”
“All right,” said Deep Thought. “The Answer to the Great Question . . . .”
“Yes . . . !”
“Of Life, the Universe and Everything . . .” said Deep Thought.
“Yes . . . !”
“Is . . .” said Deep Thought, and paused.
“Yes . . . !”
“Is . . .”
“Yes . . . !!!”
“Forty-two,” said Deep Thought, with infinite majesty and calm.

—Douglas Adams, *The Hitch Hiker’s Guide to the Galaxy*

Contents

Foreword

Like most members, when I joined the W3C's (World Wide Web Consortium) working groups, I was pleasantly surprised. Not only did I find the dedicated group of skilled professionals I was expecting, but I also found an eclectic community of genuinely warm and imaginative individuals, all passionate about their work and the Web technologies to which they contribute. For them, novel yet rigorous thinking is the norm, and strong debate is an integral part of that thinking process. It leads to that rarest of things; a body of opinion independent of the daily squabbles of academia and business life.

It was during a W3C meeting in Bristol (UK) in 2003 that I first came across Phil Tetlow, and it was his propensity for lateral thinking that attracted me. During the course of that meeting we came to discuss many topics including the application of new Semantic Web technologies, a conversation that extended well beyond the close of proceedings. I can remember us both eventually standing on a rather cold station platform, waiting to catch our respective trains back home and yet still bouncing crazy ideas off each other. It was then that I suggested starting some work on applying Semantic Web technologies to the general field of Software Engineering, a somewhat radical proposition at the time. Upon hearing my thoughts, Phil's eyes glazed over for a few seconds as he considered the implications of my suggestion, he then smiled and nodded, and a pact was struck. Not only were we going to try and do something different and challenging, but it was obvious that a friendship had been formed that would prove rewarding from that day forward.

Unlike many of those involved with Web standards, Phil's experience does not lie solely within the confines of software construction or academic research. His years of consulting have instilled in him a pragmatic understanding of many other areas such as systems' architecture and the social drivers behind modern-day technologies. Not only does he have an interest in nurturing the raw materials behind modern-day software, but he also carries considerable experience from the "coal face," actually implementing these to architect some of the largest and most complex computer systems in existence today.

Because of this it came as little surprise to me to hear that he had been working on this book for some time. He has often voiced his frustrations with contemporary thinking on software with me, and I can fully understand why his desire to seek out best practice eventually led him to the door of the W3C and his excitement for the Web. What I find stimulating is that it was while within this community that the fi-

nal threads of his ideas came together and he eventually found a way through the story he wanted to tell here.

The Web's Awake hence draws from a diverse background, pulling together a number of ideas centered on the general notion complex systems, independent of whether modern technology is involved or not. This naturally brings with it more subject matter dealing with aspects such as systems' dynamics and a variety of patterns and theories undying complex phenomena. Undoubtedly where the book distinguishes itself is in its comparison between the most complex software-based system known today (in other words the World Wide Web) and the absolute pinnacle of complex systems, life itself. Through this can be found an illuminating collection of thoughts that are bound to put the reader in a reflective mood and stir up deliberation. It is a testament to Phil's tenacity, curiosity, and integrity that such a wide ranging yet cohesive argument has been formed at all.

I know that in piecing together this work he has compared notes with some of the most authoritative minds on the planet and pushed himself well beyond his comfort zone many times to fill gaps in his reasoning as they appeared. For me this makes *The Web's Awake* both novel and informative, an off-the-wall interpretation of a number of interlinked snippets for which many Computer Scientists secretly harbor a fascination. There are other books that cover similar ground, but I am not aware of any that take such a unique perspective or specifically concentrate on the Web as the core subject matter. I know of several who have been waiting for this book to surface for some time. Now that it has finally appeared, I am sure that their wait will be rewarded many times over.

It is interesting to note that I prepared the final version of this foreword, just after attending the 5th International Semantic Web Conference (Athens, Georgia, 2006). As part of the proceedings, Phil and I, together with other colleagues from the W3C Best Practice and Deployment Working Group, successfully coordinated the International Workshop on Semantic Web Enabled Software Engineering—our second organization of such an event. Given the great numbers who took time out to attend and their overwhelmingly positive response, we are all undoubtedly in for a fascinating and fun ride in the years ahead. Welcome aboard.

JEFF Z. PAN

Department of Computing Science,
The University of Aberdeen, Scotland
World Wide Web Consortium Member

Preface

From the very birth of computer science the quest to find technology that even approximates to the salient qualities of life has proved to be somewhat of a hunt for elusive treasure. If we add to this pursuit the potential to unearth some new forms of intelligence along the way, then the prize involved quickly transforms into the magnetic mother lode of all Geekdom; no wonder it has been such a popular target for fiction writers and quasi scientists over the years.

In some respects this golden chalice has been its own worst enemy, regularly poisoning its reputation through the compounded effect of published half-truths. So why should anyone in their right mind want to join such a search knowing full well that the odds of finding a fresh and serious pathway to the truth were slim? Indeed this is a question I have asked myself often, overly appreciating that many a great mind has failed along the way before me. Why should I, even with a strong technical background and a great deal of experience, want to stick my pin in the map now? The answer is simple; I have never really deliberately sought out such treasure and there is no such map of which I know. When I first set out on my personal quest for enlightenment, I had much less provocative adventures in mind. It is merely a coincidence that the path I have taken to quell my curiosity has led me across some rather unexpectedly fertile and interesting ground.

My primary interests originally lay with the construction of large and somewhat mundane data processing systems, some distance away from the swirling vortex of life studies. Nevertheless, in my search to understand the intricacies of more and more complex computer systems, I have found myself powerless to resist the philosophical attraction of such subject matter and have been slowly pulled in over the years. On my way I have become increasingly amazed, for instance, that we still commonly construct computer systems, especially complex computer systems, using methods and patterns different from those chosen by nature in the fashioning of its own solutions. Over some time this has led me to believe that we still have a number of irreconcilable disparities in our general understanding of, and the way that we go about, the very business of computing at a number of levels, even if those who pioneered the Information Technology revolution had different ideas and were more in tune with nature's own objectives.

As a case in point, few who profess to be computer experts appreciate that computation is a concept independent of any particular physical medium, and in such respects the very Universe itself can be seen to compute. Perhaps this is the reason why we have not taken more than a few leaves out of Nature's cookbook thus far.

But this is surely a no-brainer, so have we been making some fundamental mistakes? Unlikely, I've always thought, given mans' intellectual success rate over recent millennia. Such contradictions have intrigued me deeply for some time, so consequently I set off to find some answers for myself almost 20 years ago. At first, like most, I was unsuccessful, but then, little by little, I began to realize the error of my ways; I was looking in the wrong place. I was down amongst the weeds when the real answers lay all around me.

Books about computers, bits, bytes, and the raw nuts and bolts of technology are often dry and boring, and I hate most of them with a passion. Taken at face value, they offer little more than a thin veneer, unwittingly concealing a richer treasure of far greater connected truths beneath. Books about Nature, the Universe, and complexities of life, on the other hand, have an inbuilt advantage, drawing from a never-ending well of fascination and mystery. They constantly taunt the reader, reminding them of mankind's inherent inability to truly comprehend the world in which we live. But this does not necessarily mean to say that computation or the properties of modern digital technology are any less magical or any less natural. Society's quintessential notion of its modern digital existence is one in which technology plays a role of pervasively connected enablement, at the same time being divorced of any tangible connection to the real world itself. We quite happily accept that today's computers can capably juggle everyday abstract concepts such as e-mail for us, but are somewhat less comfortable with any idea of them working in ways that even approximate to our own familiar worldly understandings. Computers may be able to control the machinery needed to make a perfect cup of coffee, for instance, but we consider the idea that they might be able to actually understand our desire for caffeine with disdain and disbelief. This is a step too far, but for whom, them or us?

Ever since the days of my earliest memories, my overriding view of the world has been one of awe and wonderment. For me, appreciation of the complex natural beauty of the Universe has always come easily, even if the understanding that accompanies it has required much more effort. Even so, combining such appreciation and learning has always been a pleasure, a release, a fascination, a property of my very identity. But my enthusiasm has not always been free-flowing. Like so many aspiring scholars interested in science and technology, during the education of my youth my head was filled with classical, Newtonian views of the world that contradicted my heartfelt instinct for how things "really were." What I was being taught was obviously right, but it somehow felt so wrong, incomplete somehow. How could the inexorable complex splendor surrounding us be described in the same types of formulae used to make clear the forced regularity of a mechanical clock? This was ludicrous, but was, nevertheless, the story of mainstream science's choosing, or so the educational system that outlined my curriculum thought, and to fight against it proved a frustrating and confining task.

For some time I succumbed to the system and, even though my inborn talents demonstrated themselves to be more artistic than scientific, my tenacious interest in technology won out and I conformed to the task at hand. I learned of basic scientific practice and gained an appreciation for simplified understandings. I learned to accept the limits of natural human cognition and I watched the constant upward march of Information Technology with much excitement, because I knew that one day

soon it would enable us to look at our surroundings in different ways, ways closer to nature's scales and preferences, ways greater and grander than we have ever been capable of achieving before. Even so, the timing of my studies further worked against me and it was only after many years of aimless investigation that I learned of others also interested in the same perspectives as myself. Far more talented individuals than I were already working hard in fresh fields of mathematics and science, equipped with the new tools provided by the computer age. At first they were considered as crackpots, over-ambitious academics playing with crazy ideas, but gradually their findings started to gel, and recognized disciplines such as Chaos, Complexity, and Network Theory were born. These were all branches sprouting off one central theme, a theme that would become known as connectionism to some, systems theory to others, and nonlinear dynamics to yet more and that would still hide under numerous other pseudonyms in just about every field of modern scientific endeavor.

So I suppose it was no coincidence that in the last year of my undergraduate studies my random meanderings through the literature bore fruit and I stumbled upon a book by Sir Tony Hoare. The first passage in *Communicating Sequential Processes* reads, "Forget for a while about computers and computer programming, and think instead about objects in the world around us, which act and interact with us and with each other in accordance with some characteristic pattern of behaviour" [32], and the very moment I read this original insight a light went on somewhere in my subconscious. I had found the start of the thread I was looking for, a thread I hoped would tie together a number of intuitions, instincts almost, from both the natural and digital world that I felt were connected. What really surprised me was that others were thinking the same way too. Stuart Kauffman, one of the most respected researchers in complex systems theory, sums up this feeling far more eloquently that I ever could, stating his personal search for greater truths as aspiring to a "self-consistent big picture that ties everything together, from the origin of life as a self-organised system, to the emergence of spontaneous order in genomic regulatory systems, to the emergence of systems that are able to adapt, to nonequilibrium price formation which optimizes trade amongst organizations, to this unknown analogy of the second law of thermodynamics. It is all one picture. I really feel it is."

Many books have been written on the complexities of the natural world and the interplay between modern technology and the Universe's periodic cycles. Many more have been written on our current understanding of "life" and the prerequisites needed for its emergence. Such books collate ideas from a wide range of disciplines, but few, if any, directly relate such ideas to the single most powerful and prevalent computer technology in existence today. This is the World Wide Web, the ever-growing maelstrom of information muscle structure strung over the bones of the global Internet.

There is little doubt that the Web is having a profound effect on our personal and social existence, pulling down the barriers of time and distance and placing unequalled opportunities to access information at the fingertips of everyday people. This has attracted many authors who have attempted to categorize just what is actually going on, but few have looked at the characteristics of the Web from the perspective of holistic complexity and growth. Why is the Web evolving in the way

that it is? What does the Web actually look like now and what will it look like in the future? Is "evolution" even the right word to use to describe its progression? These are all questions that have been relevant for some time, but which have appeared to be taboos in all but the most open-minded of circles. In truth a new science is needed to help address such questions, a science that combines the empirical strength of the material classics while still embracing the synthetic expression granted by the abstract worlds of computing. This is a science that must account for the atomic components of the Web all the way up to the phenomena presented by its totality. This is Web Science and from its birth should rightly come a new collection of understandings, not least of which should be some clarity on the idea of Web Life.

In the spirit of true heresy, I have hence ploughed through the jungle of works related to the various types of question asked here. In doing so, I have been exceptionally fortunate: My professional life has brought me in touch with many of the best minds in the world—first, through my employment as a Technical Architect at IBM and, second, through my membership of The World Wide Web Consortium (W3C) on IBM's behalf. Both privileges have opened many an unexpected door, and I have never been shy to grasp at opportunities and question those who might possess important answers. As such, I have been honored to meet and philosophize with a number of world experts along the way, really enjoying their company and gaining much valuable experience from the vantage point of true giants' shoulders. This has enabled me to pull together a number of ideas and conclusions from a patchwork of original, consistent, and acknowledged findings that all point to a conclusion (a finding that might currently be somewhat unorthodox in parts) that the Web is emerging as a truly natural entity.

This book attempts to lay out the case for such a conclusion, hopefully coherently stringing together observations and findings from a number of diverse fields. In parts I have deliberately borrowed writings from other writers, particularly through excellent references like www.wikipedia.org and M. Mitchell Waldrop's excellent book on complexity [67]. But this has been for no other reason than the original author(s) convey the concepts concerned far better than I ever could. This is a liberty I trust you will allow me to take, for I sincerely hope that, to quote Stuart Kauffman directly, "sometimes outsiders can make serious contributions" [52]. [1] In so doing, I also respectfully acknowledge the danger that "sometimes outsiders just make damned fools of themselves [52]." Even so, I believe that this is a risk worth taking, considering that the collection of material covered paints a provocative and compelling emergent picture, a picture of the Web as a truly natural entity, an infant alone in a cradle of its own folded reality, a child dependent on mankind for its very existence, nourishment, and upbringing.

If the evidence is correct, even in part, then it obviously brings profound responsibilities for society as well as some huge consequences for the ways that we run and organize our personal and collective lives. Most outcomes of the Web's development will undoubtedly be beneficial for us in the long term, but some will inescapably be detrimental. Many might say that this is obvious, a "natural" consequence not worth raising a fuss over. My point is exactly that. That the Web's

[1]Whever possible, every effort has been made to reference source materials as accurately as possible.

evolution is precisely an act of nature and by recognizing this fact we can surely utilize it for our betterment. Some have called such arguments visionary, some have called them idiotic, and some, like Sir Tim Berners-Lee, the father of the Web, have even lightheartedly commented that material of this type may be part of a wider conspiracy. Personally I have always preferred to side with the idiots, but I nevertheless feel flattered that many appear to take such thinking seriously.

But just how serious is the material presented and how should one interpret it? To paraphrase the great physicist Richard Feynman, he used to say that there were two types of scientist in the world; the Babylonians and the Greeks. By this he was referring to the opposing philosophies of those ancient civilizations. The Babylonians made Western civilization's first great strides in understanding numbers and equations and in geometry. Yet it was the later Greeks—in particular, Thales, Pythagoras, and Euclid—whom we credit with inventing mathematics. This is because Babylonians cared only whether or not a method of calculation worked—that is, adequately described a real physical situation—and not whether it was exact or fitted into any greater logical system. Thales and his Greek followers, on the other hand, first grasped the idea of theorem and proof and required that for a statement to be considered wholly true, it had to be an exact logical consequence of a system of explicit stated axioms or assumptions. To put it simply, the Babylonians focused on the phenomena, whereas the Greeks focused on the underlying order [31].

I, like the illustrious Feynman, consider myself to be a Babylonian, but freely appreciate that both approaches have merit and can be powerful. The Greek approach brings with it the full force of the logical machinery of mathematics. Philosophers and scientists of this inclination are often guided by the mathematical beauty of their developing theories, and this has led to many beautiful applications of mathematics. The Babylonian approach allows a certain freedom of imagination and frees you to follow your instinct or intuition, your "gut feeling" about nature, without worrying about rigor and justification. This aesthetic has also led to great triumphs, triumphs of intuition and "physical reasoning"—that is, reasoning based principally on the observation and interpretation of phenomena, and not driven by mathematics in the first instance. In fact, those employing this kind of thinking sometimes violate the formal rules surrounding their chosen subject, or even invent strange and unproven formulae or systems of their own based on their own understanding or interpretation of the manifestation they are studying. In some cases this has left mainstream science to follow behind, either justifying such novel ideas or investigating why their unwarranted use gives pretty accurate answers anyway.

Much of the content of this book has been structured in such a way. Several old, yet well-founded, ideas have been collected and repositioned within the new context of Web Life. The outcome of such an exercise may prove to be significant over time if subject to rigorous and proper examination, or be found to be just another misguided attempt to explain the unexplainable. Either way there is sufficient evidence on which to face the jury on behalf of our new found defendant.

In reading this book I must, however, offer both an apology and some advice to the reader, because in its writing I have unfortunately had to reach a compromise. There is a warning included too. This is not a work that aspires to be a politically, morally, or religiously correct text, nor is it necessarily aligned with any particular

philosophical or religious school of thought. It is merely a personal interpretation of a rather large collection of strongly interlinked facts and findings from a wide range of sources and research areas. These range from quantum mechanics, through general systems and complexity theory, and on to the social sciences, a daunting spectrum to be sure, but one that is nonetheless necessary to do justice to this fascinating subject.

I have always believed that the concept of the Web as a living thing should be intelligible and appealing to as wide an audience as possible. For this reason I have deliberately tried not to write this book as an academic work. Instead I have chosen to use common language and phrases wherever possible. Even so, there are some reasonably complex and abstract areas that need to be covered before the complete case for a living Web can be fully presented. Therefore I must advise that this book may well be both too light in parts for the serious academic and too deep for those with merely a casual interest. For those wanting a general understanding of Web Science and Web Life, I suggest that they may wish to bypass the detail contained between Chapters 3 and 7, but for those looking for a deeper appreciation, this material may prove crutial. Regardless, at the end of the day, my primary aim in producing this work has been to provide a compelling and enjoyable read, so I hope you find the story as enthralling and thought-provoking as I still do.

Anyone wanting to keep abreast of developments, or who might also care to contribute to new understandings, can visit my website (www.thewebsawake.com). There you will find a blog of my musings and a forum where you can freely partake in open debate.

PHILIP TETLOW

Stockton on Tees, England
January 2007

Acknowledgments

First I must credit the unquestionably brilliant work of the late Professor Richard Feynman, Professor Stuart Kauffman, Professor Douglas R. Hofstadter, Professor Brian Arthur, Professor John Holland, Professor Christopher Langton, Professor Richard Dawkins, Professor Roger Penrose, Professor John Kleinberg, M. Mitchell Waldrop, Kevin Kelly, Dr. Philip Ball, and Dr. Holger Knublauch; I have drawn extensively from their groundbreaking and insightful work in this book. Next I must thank my colleagues Richard Hopkins, Derek Duerden, Kevin Jenkins, Brad Jones, David Conlon and Bruce Anderson of IBM, my good friend Craig Gannon, and Dr. Jeff Pan, Evan Wallace, Dr. Daniel Oberle, Alistair Miles, and Tom Croucher, all members of the World Wide Web Consortium (W3C), for listening to my constant jabbering and crazy ideas. At times I am sure that I have been insufferable. I must also thank Grady Booch and Bob Lojek from IBM, Professors Barrie Thompson and John Tait of Sunderland University, and Professor Keith Boddy, formerly of Newcastle University, because they have certainly been my mentors in this endeavour, although they may not have realized it. Finally I must thank my father, Dr. Alan Tetlow, because I have undoubtedly led him down a long and tortuous path. That he has chosen to follow me every step of the way is truly the mark of a great man and an even greater parent.

P. T.

Prologue

Undoubtedly the World Wide Web has provided a collection of technologies that is having a profound effect on mankind. Like the wheel, the plow, and steam power before it, it is a proving a truly differentiating tool in our world, changing the very ways in which we interact with each other, our surroundings, and our socioeconomic systems. But, unlike the great technologies that have come before it, the Web is different. Why? Because its phenomenal growth and complexity are starting to outstrip our capability to control it directly, making it impossible for us to grasp its completeness in one go. It may quite literally be taking on a life of its own. A set of emergent characteristics and behaviors are now starting to appear that we have not programmed individually. These are apparently starting to increase in number and strength, leading some to believe that the Web not only has its own life, but may also now be worthy of being considered a living organism in its own right; a new posthuman species consisting of just one isolated member.

Many have worked on the concept of emergent properties within highly complex systems, concentrating heavily on the underlying mechanics concerned. Few, however, have studied the fundamentals involved from a sociotechnical perspective. In short, the virtual anatomy of the Web remains relatively uninvestigated. This book therefore attempts to seriously explore this apparent gap, citing a number of provocative, yet objective, similarities from studies relating to both real world and digital systems. By referencing material from a broad range of fields, it presents a collage of interlinked facts, assertions, and coincidences which boldly point to a Web with a powerful potential for life.

This is not a book of definitive answers or rigorous proofs. It is a book about connections, new perspectives, immutable patterns, and the bewildering properties of complex, entangled systems. When Sir Tim Berners-Lee, the inventor of the Web, discussed its first draft at the World Wide Web Consortium's (W3C) Plenary Session in 2005, he lightheartedly referred to it as a conspiracy in the spirit of Dan Brown's best selling novel *The Da Vinci Code.* Maybe he is right, maybe he is wrong, but one thing is for sure: Herein can be found an alluring story well worth personal scrutiny.

CHAPTER 1

The Web and Life

> The story so far: In the beginning the Universe was created. This has made a lot of people very angry and has been widely regarded as a bad move.
>
> —*Douglas Adams, The Restaurant at the End of the Universe*

INTRODUCTION

In some corner of a bland, ambiguous office somewhere in the world today, there is a high likelihood that the following scenario will play out. A young and rather attractive clerk will wander over to the office's token computer technician and ask, "So . . . Why do they call you a geek?" most likely as a bet from some fellow worker. Our technician will be unflustered by this question, having encountered it several times before in their unremarkable career. Nevertheless, they will still raise their head from their coffee-stained keyboard, smile and reply sincerely, "Because I talk to my computer as if it's my best friend." The clerk will never speak to the technician again.

This scene may appear to be an unrealistic and cruel caricature, but for many of those involved in the Information Technology industry it holds much truth. Scores of individuals have followed a career in computing inspired entirely by the expectation that, perhaps one day, they might be able to interact with machines as if they were alive. Whole sections of the industry openly aspire to it, with Artificial Intelligence gurus rushing from their closets to freely foretell a brave new world just over the horizon. But this world has never appeared and we are still faced with the reality of computer systems as lifeless and unnatural creations. Or are we?

A few facts are beyond question. Today, one particular example of combined computational power has emerged on a scale and power far greater than any individual or organized collective could have ever hoped to ascertain or understand in the past. This is the World Wide Web, or "Web" for short, and its unparalleled power is growing steadily by the second. Its growth is almost scary. Widespread use of the Web did not really begin until around 1995, when studies accounted for around 16 million users. By 2001 this figure had grown to over 400 million, and some estimates now predict that it should have topped 1 billion by 2005 and will surpass 2 billion by 2010 [80]—around one-third of the world's population by most common accounts. Couple the fact that the Web is well on its way to absorbing significant

portions of mankind's joint knowledge with the raw processing power that is inherent to its technical infrastructure and a social machine the likes of which we have never experienced before is plain. As Gustavo Cardoso, professor of information and communication sciences at ISCTE, Lisbon, said in 1998, "We are in the presence of a new notion of space where physical and virtual influence each other, laying the ground for the emergence of new forms of socialisation, new lifestyles and new forms of social organisation." Some have even referred to the Web as a higher level of human consciousness, a post-human [40] existence with its own independent cognitive capabilities and conscience, a "Metaman" [1] if you will, emerging from unapparent macroevolutionary processes.

A sizable and controversial claim without a doubt. Surely no form of man-made technology could, or should, ever be considered in the same vein as life itself. Perhaps not, but there are certainly a number of apparent similarities between the type of highly complex computer systems we see today and both the development and composition of many real-world systems that natural science has chosen to classify under the heading of "life." In short, and this point is key, a number of reoccurring patterns and themes appear prevalent across both real and virtual worlds. "When a pattern recurs in different systems which bear no obvious relationship to one another, we must suspect a common causative principle, one which can be understood in the most general terms without reference to the specifics of this or that case [80]." To take one brief example, binary characteristics linked to a significant number of macro and micro natural systems have been a matter of well-proven scientific fact for some time. In particular, they are recognized to play a key role in the state transitions surrounding many of the complex systems directly related to the idea of organism. Such characteristics are also fundamental to both macro and micro control in the digital systems world, but until relatively recently these have not been investigated under the same light as their evidently similar real-world twins. It is this duality of pervasion across real and digital worlds that makes binary systems both influential and enthralling. As a recurring theme that appears in the most unexpected of guises, there is much evidence in our Universe to point to the true power of two.

At this point in our understanding there is a need to be careful, however. It is important to emphasize the term *similarity* and not confuse it with the absolute understanding of proven equivalence. Even so, by indulging the creative license granted by established prior work, it should be remembered that mankind has made many great leaps by initially recognizing similarity alone. First comes imagination, inspiration, and recognition, then speculation, investigation, and ultimately proof or disproof. Some ideas are reeled into our minds wrapped up in facts, and some burst upon us naked without the slightest evidence that they could be true but with all the conviction they are. The ideas of the latter sort are the more difficult to displace [21]. Currently, we may well be somewhere between imagination and investigation when considering ideas of life through technologies like the Web, but if one accepts this position and allows a certain level of trust in the proven research of recent decades, then at the very least a highly compelling and provocative case can be presented for others to later validate properly. Many of the observations in the pages to