What is the measure of a life when it is gone? A newspaper obit? A magazine story? A potted television biography? How shall we capture the essence of that life? A list of accomplishments? Highlights and lowlights? Interviews with family, friends, colleagues, and critics? A womb-to-tomb narrative? And if that life was an epochal-shaping life, how is a contemporary biographer to put that life in perspective before the epoch is over?

What tools should we use? Oral history interviews? Demographic and statistical data? Document analysis? What fields should we consult? Psychology? Sociology? Cultural history? Does the measure of a life depend as much on who is doing the measuring as it does on the measured life itself? Can we even get to the true core of a person? Can there be a science of biography?

Narrative Biography

Humans are storytelling animals. Our greatest stories are about ourselves, our lives, and how they play out within the larger context of culture and history. From Moses to Michener, narrative has been the vehicle of biography for three millennia. Thus, my aim is not to tear down the citadel but to build upon it. In considering how narrative biographies are constructed I thought of Barbara Tuchman—one of our era’s most eloquent storytellers—and the frustration she experienced in facing the vast panorama of human variability and apparent contradictions in her attempt to generalize about the Middle Ages (1978, xvii):

Contradictions, however, are part of life, not merely a matter of conflicting evidence. I would ask the reader to expect contradictions, not uniformity. No aspect of society, no habit, custom, movement, development, is without cross-currents. Starving peasants in novels live alongside prosperous peasants in featherbeds. Children are neglected and children are loved. Knights talk of honor and turn brigand. Amid depopulation and disaster, extravagance and splendor were never more extreme. No age is tidy or ma de of whole cloth, and none is a more checkered fabric than the Middle Ages.

No life is tidy or made of whole cloth, and few form a more checkered fabric than Carl Sagan’s. Science writers Keay Davidson and William Poundstone have done a remarkable job of getting their minds around such a larger-than-life figure, given that both conducted their interviews, gathered their materials, and produced elegantly written narratives in the two and a half years since Sagan’s death on December 20, 1996.

I read Davidson’s book first during a summer houseboat vacation in August, 1999. I had schlepped half a dozen books to read but started with the bound galleys of Carl Sagan: A Life and never got to the others because I couldn’t put it down. It’s a great read, revealing Carl’s life to be even grander than I thought. Yet Davidson pulls no punches in this “warts and all” portrayal of the great cosmic visionary. Poundstone’s Carl Sagan: A Life in the Cosmos will be favored by those who prefer its easy-to-get-around style of short subtitled sections that take the reader along a time/subject line of Sagan’s life.

Although some reviewers have disputed some of the claims and charges made by the biographers (see, for example, Chris Chyba’s review in Nature), based on my personal knowledge of and research on Carl Sagan, I think both authors got the story right in its basics and captured the man in his essence. And if you can keep a dry eye during the death bed scene with Carl, Annie, his children and friends (the essence of which appears under Ann’s name as an epilogue to Billions and Billions), and Annie’s final words to her beloved Carl, and his to her and his children, I’ll personally refund your money for the book. I tried to read the final scene out loud to my wife but couldn’t get through it. The humanization of Carl Sagan makes him an even greater man than he was in myth and legend.

But the problem of all narrative biography (and here I do not fault either author for not writing their biography I would have written) is in determining whether a particular action, a quote from a speech, an excerpt from a book, or a description of one’s subject by a colleague or friend represents a passing fancy or a deep interest, a whim or a passion, a long-term personality trait or a short-term temporal state (trait v. state theory in personality psychology).

Was Sagan a tender-minded liberal or a tough-minded careerist? Was he a feminist or a misogynist? Was he really obsessed with the possibility of extraterrestrial intelligence, or was this just a flighty avocation that happened to generate a lot of media attention? Was he a scientist of the first rank or merely a media-savvy popularizer? How can we tell? It is easy to start off with a hunch and then comb through books, papers, notebooks, diaries, interview notes, and the like, pick out the quotes that best support the hypothesis, and draw the anticipated conclusion. In statistics this is called “mining the data.” In cognitive psychology it’s termed “confirmation bias,” a powerful explanatory concept that accounts for many human thinking foibles where we tend to focus on information that confirms what we already
believe and ignore disconfirming evidence (Nickerson, 1998). Or as I like to say about psychic readings, we remember the hits and forget the misses.

Toward a Scientific Biography

How can we avoid the confirmation bias in writing biography? One way is to apply the tools of the social sciences. Fortunately for any would-be scientific biographer, Sagan’s curriculum vitae (c.v.) is, to say the least, comprehensive. Weighing in at 4.5 pounds, it totals 265 single-spaced typed pages. An analysis of it allows us to answer certain questions and to test specific hypothesis.

For example, how productive a career did Sagan have? Figure 1 presents his 293 advisory groups, professorships and lectureships, and professional societies by type. Figure 2 displays Sagan’s 89 fellowships, awards, and prizes by type, offering insight into what he was most recognized for by society and his professional colleagues: first and foremost as a humanitarian and science popularizer, next for his scientific research, and last for his scientific writing (but one was the Pulitzer).

Such data alone, however, tells us little without a context. Was Sagan a world class scientist or a mediocre scientist and a world-class popularizer? Since he was rejected by the National Academy of Science, the most prestigious scientific organization in America, I thought it would be instructive to compare Sagan’s statistics to those of the average NAS member. Unfortunately such comparative data are not available. But even by NAS standards Sagan was no ordinary scientist, so I decided to compare him to a handful of scientists who represent the crème de la crème: Jared Diamond, Stephen Jay Gould, Ernst Mayr, and E. O. Wilson.

Figure 3 shows Carl’s honorary degrees in comparison: Gould’s 41 towers above the rest, but Sagan’s 23 is nestled firmly between Wilson and Mayr (although Ernst was quick to point out that his “are from the very best universities, the cream of the crop, such as Oxford, Cambridge, Harvard, Yale, and Bologna, the world’s oldest university”). Diamond’s single honorary doctorate actually helps us understand the meaning of the others. Honorary doctorates are one of several means of keeping score for driven careerists. Of these five, in my opinion Diamond is the most modest and unassuming. As he told me: “I only have one because they don’t mean that much to me and they take time away from my family.”

Sagan’s book production is also telling—in totality, in content, and in comparison. Figure 4 shows Sagan’s 31 books by content, indicating his primary professional interest in planetary science (from his first book in 1961, The Atmospheres of Mars and Venus with W. W. Kellogg, to Pale Blue Dot in 1994), as well as his pioneering efforts in the exotic science of exobiology and the (at the time) mildly radical SETI (from the classic Intelligent Life in the Universe with I.S. Shklovskii to Contact). Under general science I included such books as Cosmos and The Demon-Haunted World, and under the category of evolution fall The Dragons of Eden and Shadows of Forgotten Ancestors, co-authored with Ann Druyan and considered by Davidson to be his greatest work (because of her influence). But Sagan’s most controversial books dealt with the topics of nuclear winter, disarmament, and the environment, especially A Path Where No Man Thought with Richard Turco.

Figure 5 shows that Sagan’s book productivity was the highest in my comparison group, outgenerating Mayr by 10 in 35 fewer years, Wilson by eight in 10 fewer years, Gould by 11 in only five more years, and Diamond by 22 in the same time frame. Interestingly, for all his alleged arrogance Sagan has the highest ratio of co-authorships and co-editships of this elite group (eight of those 15 co-authored books had four or more authors or were large group collaborations, artificially inflating his book total but demonstrating his ability and willingness to work with others).

In Figures 6, 7, and 8 we get to the meat of Sagan’s c.v.—scientific output by content and in comparison. Figure 6 presents a content analysis I conducted on Sagan’s 500 published scientific papers, revealing that planetary science was by far and away his greatest professional interest, with two-thirds more than all other papers combined. Nevertheless, nearly a third (31.6%) of the total were in the (then) controversial field of exobiology, and another 9% in such career-hampering fields as SETI and nuclear winter. To many scientists, these washed out Sagan’s remarkable 67 (13.4%) papers that appeared in the prestigious journals Science (37) and Nature (30). By comparison, Diamond had 13 in Science, 128 in Nature (with 120 of them as his regular “News and Views” column), and through 1996 Gould had 45 articles total published in Science and Nature.

Edward Teller was the most publicly vitriolic critic, sputtering to Davidson “Who was Carl Sagan? He was a nobody! He never did anything worthwhile. I shouldn’t talk with you. You waste your time writing a book about a nobody.” Even though Teller had his own agenda, he was not alone in such criticisms. Many have claimed that Sagan was little more than a popularizer, forcing us to accept a crude binary taxonomy where one is either a scientist or a popularizer, but never both. These critics strengthen their case by citing Sagan’s inability to get tenure at Harvard, or the National Academy of Science’s rejection of his bid for membership. When asked by David Swift to characterize Sagan’s role as a SETI pioneer
Melvin Calvin put it bluntly (1990, 129): “He’s a publicist.” Philip Morrison said of Sagan “I don’t think he’s actually done very much directly bearing on the technical problems,” but that “There’s no doubt that he’s had an impressive impact on the public about the whole question” (42). When I asked my colleagues to describe Sagan’s “strengths and weaknesses as a scientist,” one astronomer wrote: “I don’t think about Carl Sagan’s strengths and weaknesses as a scientist. I think of him as the most successful mass media promoter of science yet. Some of his own research, public pronouncements, and priorities were compromised by his personal vision and style, but that is how it is in science.”

Can we scientifically assess the relative value of Sagan’s scientific contribution versus his popularization? We can. And we can make quantitative comparisons to other world-class scientists. In Figures 7, 8, and 9 we see Sagan’s overall scientific production and annual rate of publication comparable to my select eminent group (in Figures 7 and 8 Sagan’s total and average do not include abstracts, which the others did not include in their c.v.’s). The data speak for themselves: by quality and quantity Sagan stands toe to toe with these giants of science. Note that had Sagan lived to Mayr’s age of 95, his total would have been 751 articles. If Diamond continues at his present pace to 95, his lifetime total will top out at 1,004, bettered only by Gould who, if he makes it to 95, will peak at 1,219. Gould’s figures include his 288 essay columns in Natural History.)

Figure 9 shows that with the exception of a dip during the years Cosmos was under production in the late 1970s (and a subsequent messy divorce), Sagan’s scientific productivity has never wavered. In fact, he turned out more than a scientific paper per month from 1983 until his death in 1996, during the off-the-chart years of media exposure and popular writing. (Note: included in these 1,380, so labeled in his c.v. as “General Works, Interviews, Speeches, Policy Analyzes, Book Reviews, Television Writing, etc.” are articles written not by Sagan or even about Sagan, but by journalists who interviewed Sagan, along with others for an article on a subject of which Sagan was an expert. No one in my comparison group has anything comparable in their c.v.)

What Sagan was most famous for, and what got him in the biggest trouble with the academic establishment, was his Brobdingnagian outpouring of popular articles and interviews. For Figure 10 I conducted an eye-blurring content analysis of all 1,380 items, revealing that public and professional perceptions of Sagan as the ET go-to guy were not misdirected, with SETI and space exploration topping the list. The number two most popular subject, interestingly and tellingly for this analysis, was Sagan himself, with no less than 263 interviews and profiles of the man (and many with his wife and professional collaborator Ann Druyan).

Was Sagan politically and socially liberal? The data give us an unequivocal answer: one third of everything he wrote or said was on nuclear war, nuclear winter, environmental destruction, women’s rights, reproductive rights, social freedoms, free speech, and the like (and this figure does not include Op Ed pieces, which were not given titles in the c.v.).

But in looking beyond the raw data one finds a definite tension in Sagan between his liberal/feminist ideals and his career ambitions. Although he was already a social activist in his early 20s, according to his first two wives Sagan was no liberal or feminist in the home. As Davidson described it: “Sagan’s liberalism, while sincere, had an abstract aspect; it was the clever, witty, after-dinner-speaker liberalism of Adlai Stevenson, not the passionate, heart-wrenching, take-to-the-streets liberalism of Martin Luther King Jr. Like so many aloof intellectuals, the young Sagan seemed to think in terms of People rather than people, of Humanity rather than humans.” (113). Margulis recalled that Sagan “never changed a diaper in his life, he never cleared the table of his dishes, he never washed the dishes. … He needed ten thousand people to be raving about him all the time. I was just one young woman, trying to go to school and take care of kids and run a household. Every distraction he considered personal” (121). To be fair to Carl, however, it should be noted that after his death Margulis admitted to Druyan that she had been unfair in the marriage (a fact I confirmed with Lynn, but who also explained this was long after the marriage had gone sour for other reasons), possibly making Sagan’s lack of household egalitarianism, in conjunction with the cultural expectations of that time for men to be excused from such domestic duties, a little more understandable.

As a consequence, the marriage disintegrated. In a response emblematic of a man so committed to science and rationality as to not see its boundaries, Sagan tried to persuade her to come back through what Davidson called “a very Saganish sales pitch—big on career, tongue-tied on love.” Margulis recounted the breakup: “We were walking on the street and he told me how I was crazy because he was such an important person, and he was going to be much more important, and that I was really married to a fantastic guy and I was crazy to even think about leaving” (Davidson, 140). More than anyone else Ann Druyan showed Sagan that you have to live the principles, not just talk about them, especially in the home. Even here, however, my wife Kim (to whom I read much of Davidson’s biography aloud while we were driving), pointed out that it is much easier for one to be a liberal and a feminist later in life when one is established and well off, where day to day chores can be hired done, when careers are flourishing and the children are grown. Sagan’s first son with Margulis, Dorion, wrote Sagan a contentious letter to point out what he perceived to be hypocrisy (summarized by Davidson, Dorion is speaking, reflecting as well the pain of being largely abandoned by his then excessively careerist father):

“His understanding of markets, which I had been studying, was simplistic. I remember being up at the Ritz Carlton...with his friends and his new wife [Annie]. Top floor of the Ritz Carlton, getting all kinds of perks—and they were going on about the virtues of communism. And
that’s classic champagne socialism, you know?” Dorion wrote his dad a letter implying that his left-leaning economic views were hypocritical—a letter that was, Dorion admits, a pretext for his own inner hurts. “In the letter I said stuff like, ‘You say that we should have an equal allotment of wealth….Okay, why don’t we cap [the maximum allowable wealth] at your earnings last year and we call the unit ‘one sagan,’ and nobody can make more than one sagan. While we’re doing it, let’s cap the number of books that anybody can write” (395).

Along similar lines Poundstone properly nuances Sagan’s conflicting feelings about, and attitudes toward, homosexuality. When Dorion was in high school he befriended a gay classmate, triggering Sagan to sit him down for a lecture explaining that homosexuality was not how a species can propagate itself. Nevertheless, Poundstone gainsays Dorion’s stories (and we would do well to remember that, however understandable, Dorion still harbors a fair amount of ill will toward his father that may cloud his judgment) with examples of how Carl’s closest scientific collaborator, Jim Pollack, was openly gay; how Carl came to the defense of Pollack’s lover in a problem with obtaining treatment at the university health service emergency room, and that “in no visible way did Pollack’s homosexuality impede Sagan’s long and productive collaboration with him” (89).

What made Sagan a pioneer in the search for extraterrestrial intelligence? To attempt an answer to this question Figure 11 presents data I culled from David Swift’s 1990 book SETI Pioneers. Not surprising, none believed that UFO sightings represent actual visitation by extraterrestrials. Equally unsurprising was their universal agreement that extraterrestrial intelligences (ETIs) probably exist somewhere in the cosmos (why else would they be involved in SETI?) I included these columns because, although interest in and the study of exobiology and the possibility of ETIs is certainly not mainstream science, then or now, it is nowhere near as fringe as belief in UFOs. In a way, SETI is elitist, UFOs populist; SETI is highbrow, UFOs lowbrow; SETI is dominated by Ph.D. astronomers, physicists, and mathematicians, UFOs are predominantly the domain of non-credentialed amateurs. As revolutions go, SETI is on the conservative side. This observation will become important when we turn to the role of personality in science.

Swift asked each of the SETI pioneers about their parents’ religiosity, but oddly did not ask about their own beliefs. Nevertheless, I was able to glean most of that information from the interviews—enough to make the generalization that most were raised in a religious household but that not one believes in anything like the traditional Judeo-Christian God (although I am missing some data). What is the significance of this observation? Astronomer Frank Drake, ostensively the SETI pioneer if there was one (and creator of the infamous “Drake equation” for computing the probability of ETIs), who was raised “Very strong Baptist. Sunday school every Sunday,” made this observation: “A strong influence on me, and I think on a lot of SETI people, was the extensive exposure to fundamentalist religion. You find when you ask people who have been active in SETI that there seems to be that thread. They were either exposed or bombarded with fundamentalist religion. So to some extent it is a reaction to firm religious upbringing” (Swift, 57). Similarly, John Kraus recalled: “We were very strong churchgoers, members of the Methodist church. I was brought up in a very religious atmosphere…there was never any thought of conflict between science and religion in my thinking or in my upbringing. Science and religion were simply both seeking ultimate truth but using different ways of going at it” (236).

But there were exceptions. Melvin Calvin’s parents were Russian Jews who “didn’t keep any religious practices. When I grew up I was without religion; a-religious, not anti-religious” (123). And Bernard Oliver’s parents “belonged to no orthodox church of any sort. I think my father had been christened a Congregationalist by his mother when he was very little, but he never went to church; it didn’t interest him. My mother, however, had this strong interest—a philosophical interest, let’s say, in life: what was life? And she believed that there was a soul. And the reason was that material things were far too gross to in any way hold this marvelous quality called life.”

Does religion play a role in attitudes toward ETIs? Philip Morrison gave his considered opinion (28): “Well, it might, but I think that it’s just one of the permissive routes; it isn’t an essential factor. My parents were Jewish. Their beliefs were conventional but not very deep. They belonged to the Jewish community; they went to services infrequently, on special occasions—funerals and high holidays” (28).

One might speculate that SETI, as a highbrow, elitist revolution, contains within it quasi-religious and spiritual overtones, in the sense that these scientists, while not believing in God, do believe in ETIs, uniformly portrayed as higher intelligences who, having survived what might be a tendency in species toward self-destruction once advanced technologies are created, must also be morally superior. To the extent that religion involves belief in and hope for transcendence or transcendent beings, SETI is a high-cultural form of religion, and UFOs a low-cultural form of religion.

Melvin Calvin said as much about the impact of first contact: “It would have a marked effect. It’s such a broad, major subject of concern to everyone, no matter where they are, that I think people would listen. It’s like introducing a new religion, I suppose, and having it picked up by a lot of people” (135). Philip Morrison compared it to the Copernican Revolution: “Up till now a great many people have the happy view that we are unique, the green footstool of creation, and that there is nothing else like us.” Discovering ETIs “will have an impact over the long run comparable to the notion that the Earth is not the center of the Solar System” (47). And Bernard Oliver returned to the problem his mother posed (105): “My mother was involved in quasi-religious or metaphysical things. The question is really, ‘Is life a negligible and extremely rare phenomenon in the universe—intelligent life, that is—or is it so prevalent that the universe can be considered to be somewhat efficient in producing it?’ …life could, in the course of time, become an important force in the late evolution of the universe. I can
imagine, though I can’t tell you how, that this life, in a network of communication, could form a sort of super-consciousness throughout the galaxy that, in ways we can’t foresee now, might modify the history of it.”

Although Sagan did not believe in God, he nevertheless said this about SETI’s importance (Swift, 219): “It touches deeply into myth, folklore, religion, mythology; and every human culture in some way or another has wondered about that type of question. It’s one of the most basic questions there is.” In fact, in Sagan’s novel/film Contact, described by Keay Davidson as “one of the most religious science-fiction tales ever written” (350), Ellie discovers that pi—the ratio of the circumference of a circle to its diameter—is numerically encoded in the cosmos and this is proof that a super-intelligence designed the universe (1986, 430-431):

The universe was made on purpose, the circle said. In whatever galaxy you happen to find yourself, you take the circumference of a circle, divide it by its diameter, measure closely enough, and uncover a miracle—another circle, drawn kilometers downstream of the decimal point. In the fabric of space and in the nature of matter, as in a great work of art, there is, written small, the artist’s signature. Standing over humans, gods, and demons, subsuming Caretakers and Tunnel builders, there is an intelligence that antedates the universe.

Sagan’s Essential Tension

The left column in Figure 11 presents the birth orders and sibship size of each of the SETI pioneers. Swift identified an apparent overabundance of firstborns in his population, including Sagan. But is it a statistically significant overabundance? Swift did not test for this, but U.C. Berkeley social scientist Frank Sulloway and I did, applying what is known as the Greenwood-Yule rule for expected number of firstborns. For the SETI pioneers eight is the expected number of firstborns based on the number of siblings they had, but 12 is the observed number. This difference (four) is statistically significant at the .05 level of confidence.

<table>
<thead>
<tr>
<th>Name</th>
<th>Birth Order/Sibship Size</th>
<th>Religious Upbringing</th>
<th>Religious Attitudes</th>
<th>Belief in ETI</th>
<th>Belief in UFOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Billingham</td>
<td>1/2</td>
<td>Church of England</td>
<td>Nonbeliever</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Bracewell</td>
<td>1/2</td>
<td>Anglican Orthodox</td>
<td>Nonbeliever</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Calvin</td>
<td>1/2</td>
<td>Jewish</td>
<td>Nonbeliever</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Cocconi</td>
<td>2/2 (older sister)</td>
<td>?</td>
<td>?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Drake</td>
<td>1/3</td>
<td>Baptist</td>
<td>Nonbeliever</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Dyson</td>
<td>2/2 (older sister)</td>
<td>Church of England</td>
<td>Nonbeliever</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Kardashev</td>
<td>1/2</td>
<td>None (parents died young)</td>
<td>?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Kraus</td>
<td>2/2 (older sister)</td>
<td>Strong Methodist</td>
<td>Believer?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Morrison</td>
<td>1/2</td>
<td>Jewish</td>
<td>Nonbeliever</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Oliver</td>
<td>Only</td>
<td>Nondenominational</td>
<td>Atheist</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>SAGAN</td>
<td>1/2</td>
<td>JEWISH</td>
<td>Nonbeliever</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>Sakurai</td>
<td>2/7</td>
<td>?</td>
<td>?</td>
<td>Yes</td>
<td>Unlikely</td>
</tr>
<tr>
<td>Seeger</td>
<td>1/7</td>
<td>?</td>
<td>?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Shklovskii</td>
<td>1/2</td>
<td>Jewish</td>
<td>?</td>
<td>Yes/No</td>
<td>No</td>
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<tr>
<td>Tarter</td>
<td>Only</td>
<td>Protestant/Presbyterian</td>
<td>Nonbeliever</td>
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<td>*</td>
</tr>
<tr>
<td>Troitskii</td>
<td>1/3</td>
<td>?</td>
<td>?</td>
<td>Yes</td>
<td>**</td>
</tr>
</tbody>
</table>

(*) Unlikely/Unexplained
(**) Unexplained/Possible

What does this significant number of firstborns mean? In Sulloway’s book Born to Rebel (1996, 73) he presents a summary of 196 controlled birth-order findings classified according to what are known as the “Big Five” personality dimensions:

- Conscientiousness: Firstborns are more responsible, achievement oriented, organized, and planful.
- Agreeableness: Laterborns are more easygoing, cooperative, and popular.
- Openness to Experience: Firstborns are more conforming, traditional, and closely identified with parents.
- Extroversion: Firstborns are more extroverted, assertive, and likely to exhibit leadership.
- Neuroticism/Emotional instability: Firstborns are more jealous, anxious, neurotic, fearful, and likely to affiliate under stress.

To measure Sagan’s personality Sulloway and I requested a number of his family members, friends, and colleagues to rate him on a standardized Big Five personality inventory of 40 descriptive adjectives using a 9-step scale. For example: I See Carl Sagan as Someone Who...
Most consistent with his firstborn status was Sagan’s exceptionally high ranking on conscientiousness (ambitiousness, orderliness, dutifulness) and his strikingly low ranking on agreeableness (tender-mindedness, easy-goingness, modesty). Extroversion and Neuroticism were nondescript, but Sagan’s Openness to Experience (preference for novelty, variety, adventurousness) was nearly off the scale, significantly higher than what one would expect from a firstborn. (See McCrae and Costa, 1987, 1990 on the “Big 5.”) How can we reconcile this disparity? In Sulloway’s family dynamics model he reveals a number of variables that shape personality (1996, 213):

- **Social Attitudes:** “People who are socially liberal are more open to radical change.” As we saw in Figure 9 for his publications and interviews about social issues, Sagan was extremely liberal.
- **Parental Social Attitudes:** “People having liberal parents tend to be liberal and hence to support radical change.” According to his biographers, Sagan’s parents were both socially liberal. Plus, members of many minority groups (Jewish in Sagan’s case) tend to support liberal causes and are more open to experience.
- **Personal Influences:** “Mentoring and friendship influence the adoption of radical ideas.” As a graduate student at the University of Chicago Sagan befriended Joshua Lederberg, whom Keay Davidson calls “the godfather of exobiology,” the meeting of which launched “the most high-profile dynamic duo of the early days of exobiology, the science of extraterrestrial life.” Sagan also worked closely with Nobel laureate H. J. Muller, and in 1976 wrote Lederberg: “If not for the encouragement by H. J. Muller and yourself, I might not have had the courage to seriously pursue what later has come to be called exobiology.” As Davidson described it: “The older scientist did more than talk; he escorted Sagan into the corridors of power.” Lederberg characterized the relationship as such: “I was often his protector and defender from folks who thought he was wild. He had a lot of offbeat ideas. They were always at some level not illogical, and some of them could prove to be right; and I would point out [to others] the value of listening closely to someone who has that degree of rigor and imagination at the same time” (89).

Sagan’s high conscientiousness occasionally clashed with his high openness. Lederberg recalls: “He didn’t stick to things very long. I think part of his reputation for not being ‘solid’ has less to do with lack of rigor on any one item than that he didn’t build a body of work on one particular topic. His interests were so catholic” (Davidson, 90-91). Actually this is what Sulloway’s family dynamics model predicts. Sagan’s openness to experience led him to gamble on a number of revolutionary ideas, but his conscientiousness prevented him from taking these ideas too far into crankdom.

If we view SETI as high culture and UFOs as low culture, then we should not be surprised to see a personality like Sagan’s support the former and reject the latter. This is the “essential tension” described by Thomas Kuhn (1977) in his apt distinction between normal science and revolutionary science, between tradition and change. Science is normally conservative, yet to progress it must occasionally relinquish ground to revolutionaries who have built enough of a foundation to grab a foothold. Sagan was masterful at balancing that essential tension, as he noted (in a quote that serves as the epigram for my book Why People Believe Weird Things, from a 1967 lecture he gave in Pasadena on “The Burden of Skepticism”):

> It seems to me what is called for is an exquisite balance between two conflicting needs: the most skeptical scrutiny of all hypotheses that are served up to us and at the same time a great openness to new ideas. If you are only skeptical, then no new ideas make it through to you. On the other hand, if you are open to the point of gullibility and have not an ounce of skeptical sense in you, then you cannot distinguish useful ideas from the worthless ones. If all ideas have equal validity then you are lost, because then it seems to me, no ideas have any validity at all.

To this context, in a 1998 study (Shermer, 1999) Sulloway and I found that openness was significantly correlated with lower levels of religiosity ($r=-.14$, $p<.0001$) and higher levels of religious doubt ($r=.18$, $p<.0001$). Moreover, openness was significantly correlated with change in religiosity, with higher openness scores being associated with lowered piety with increasing age ($r=.09$, $p<.01$), as well as with lower rates of church attendance ($r=-.11$, $p<.01$). Not surprisingly, we also found a strong correlation between openness and political liberalism ($r=.28$, $p<.0001$). These findings gel with Sagan’s personality and attitudes toward SETI and religion, where he was a passionate believer in the former and a skeptic of the latter.
tendencies, and when they are in conflict we see such seemingly paradoxical behavior. We square it by recognizing Sagan's essential tension: between high conscientiousness and high openness to experience. No one is all of one personality trait all of the time. These traits have often suspected that science held the same emotional position in his mind as religion has for others. He treated science virtually as his religion. He had an almost messianic passion for science. I have often suspected that science held the same emotional position in his mind as religion has for others. He used his verbal skills to help him accomplish much more than most people could have, by dictating whenever possible. He kept two secretaries working full-time just transcribing his tapes. Some of the most interesting observations of Carl's personality I received came from e-mail conversations with Ann Druyan. Although he had no belief in God whatsoever, and considered most of the tenets of religion a tissue of illusions, Ann set the record straight on how important Sagan's Jewish heritage was to him (in part, countering the suggestion by his biographers that Sagan hid his Jewishness in the interest of career ambitions): Carl was always completely out front about being Jewish. (And believed that his face was a gloriously unsubtle declaration of his origins.) It was his primary cultural identity. All three of his wives were Jewish, each wedding presided over by a rabbi. Our homes, replete with menorahs, yearly seders, etc. identifiably so. One of Carl's few unrealized lifelong goals was the writing of a new Haggadah. His conversation was dotted with Yiddish words and phrases. A check of his remarkable vita will reveal that he was repeatedly honored by Jewish organizations, and went to considerable effort when he was gravely ill to be included in a Life magazine book and feature on American Jews of distinction. Sulloway has shown that firstborns are more parent-identified, and Sagan's biographers go on at length about his adoring and dominating mother. Ann shows that the relationship with his father was no less special: To live with Carl and his father, Sam, was to witness the most tender and unambivalent father/son relationship I have ever known. I never once saw Carl be disrespectful or even slightly testy with his garment cutter father, or with mine. He adored Sam and tried his best to be as much like him as he could. As a tough-minded firstborn, Sagan preferred right over nice, putting conscientiousness above agreeableness, as Ann recalled: Carl never participated in anything so shabby or short-sighted as the desire to pass for something other than he was. See his refusal to absolve Werner von Braun, one who presumably a Carl neutered of his Jewishness would have otherwise lionized. I believe Carl was the only major figure in that community to take him on in print and even more courageously, in Huntsville. And Carl hired Frank Kameny, a man who couldn't get a job because he was the first declared homosexual to sue the Federal government over his dismissal stemming from his sexual preference. As for Carl 'the driven careerist,' if it was careerism that motivated him, surely he wouldn't have turned down three dinner invitations to the Reagan White House. That's like landing on Boardwalk for careerists. No, this was the man who routinely turned down invitations to dine with the rich and powerful and curry their favor. Instead, he's the guy who schleps to the inner city kindergartens and citizenship inductions and jury duty. No careerist would have resigned from the Air Force Science Advisory Board and surrendered his top security clearance in protest over the Vietnam War. He would have played the game at Harvard, and believe me, if that's what he wanted to do, he would have done it brilliantly. I never knew him once to keep his mouth shut about a matter of principle when it was in his self-interest. How do we square Carl as 'the driven careerist' with his consistent lifelong pattern of choosing a course that would be problematic for his career?

We square it by recognizing Sagan's essential tension: between high conscientiousness and high openness to experience. No one is all of one personality trait all of the time. These traits are tendencies, and when they are in conflict we see such seemingly paradoxical behavior.
But the paradox is resolved when put into the context of this personality dynamics model.

But enough analysis. Humans are storytelling animals. Not only was Carl the preeminent scientific storyteller of our time, his life right up to the end was heroic in the best Homeric mode, as Ann expressed it to me so poetically: “Even facing death and excruciating physical torture, Carl remained heroically rational. His samurai-like conduct, his grace throughout his harrowing two year illness and three bone marrow transplants—two years on the rack—is a demonstration of the authenticity of his perspective and character.”

How fleeting is our tenure on Earth, Carl might have said. We must make the most of it. Sagan certainly did. To quote George Bailey’s guardian angel, Clarence Oddbody, from It’s a Wonderful Life: “Strange, isn’t it? Each man’s life touches so many other lives, and when he isn’t around he leaves an awful hole, doesn’t he?”

Whether Carl’s life is measured qualitatively (through narrative biography) or quantitatively (through scientific biography), he really had a wonderful life.

Bibliography